NASA

National Aeronautics and
Space Administration

Budget Estimates

FISCAL YEAR **1982**

Volume III

Research and Program Management

Special Analyses

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1982 ESTIMATES

VOLUME III

TABLE OF CONTENTS

RESEARCH AND PROGRAM MANAGEMENT

RESEARCH AND
PROGRAM
MANAGEMENT

SUMMARY
INFORMATION

RESEARCH AND PROGRAM MANAGEMENT

FISCAL YEAR 1982 ESTIMATES

GENERAL STATEMENT

The Research and Program Management appropriation funds 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 objectives in aeronautical and space research. Objectives of the efforts funded by the Research and Program Management appropriation are to (1) provide the technical and management capability of the civil service staff needed to conduct the full range of programs for which NASA is responsible, (2) maintain facilities and laboratories in a state of operational capability and manage their 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 FY 1982, an appropriation of $1,136,300,000 is requested.

More than 22,600 civil service personnel at ten installations and Headquarters are funded by the Research and Program Management appropriation. This civil service workforce is NASA's most important resource, the strength on which the future of space and aeronautics research activities depend. Seventy-two percent of the Research and Program Managment appropriation is needed to provide for salaries and related costs of this civil service workforce. About two percent is for travel which is vital 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 successfully the NASA installations and to accomplish efficiently and effectively NASA's approved missions.

Each of the ten NASA installations are assigned certain principal roles of fundamental importance in meeting NASA's overall program goals. These roles reflect the intrinsic competence of the installations on the basis of demonstrated capabilities and capacities. They are summarized as follows:

Johnson Space Center: Principal roles are management of the integrated Space Shuttle program and the Orbiter development project; astronaut and mission specialist selection and training; Space Shuttle mission planning, operation and control; and application of remote sensing to agricultural assessments and other Earth resources uses.

Kennedy Space Center: Principal roles are the launch of Space Shuttle development and test flights; preparation for the operational phase of the Space Transportation System; and the launch of payloads on expendable launch vehicles.

Marshall Space Flight Center: Principal roles are management of the Space Shuttle main engine, solid rocket booster and external tank projects; management of NASA's development activities on the Spacelab and Inertial Upper Stage projects; management of large automated spacecraft projects such as the Space Telescope; experiments in materials processing in space; and solar heating and cooling technology development and verification for the Department of Energy.

National Space Technology Laboratories: Principal roles are the support of Space Shuttle engine development and testing; regional Earth resources research and technology transfer; and support functions for other Government agencies located there.

Goddard Space Flight Center: Principal roles are the development and operation of Earth orbital flight experiments and automated spacecraft to conduct scientific investigations and demonstrate practical applications; the management of the tracking and data acquisition activities for Earth orbital missions; and management of the Delta launch vehicle program.

Wallops Flight Center: Principal roles are management and launch of sounding rockets and balloons; and operation of an instrumented flight range for aeronautical and space research.

Ames Research Center: Principal roles are short haul aircraft and rotorcraft systems technology, computational fluid dynamics, planetary probes, and life sciences.

Dryden Flight Research Center: Principal roles are aeronautical flight testing, research and operations, as well as providing the primary landing site for Space Shuttle orbital test flights and a contingency landing site for operational missions.

Langley Research Center: Principal roles are long haul aircraft systems technology, emphasizing fuel conservation, safety and environmental effects; aerospace structures technology; environmental quality monitoring by remote sensing; and advanced space systems technology.

Lewis Research Center: Principal roles are aeronautical and space propulsion technology; space communications research and technology; space and terrestrial energy systems research and technology; and management of the Centaur expendable launch vehicle program.

The 1982 budget provides the necessary resources to apply these in-house capabilities to appropriate program activities. Detailed data on funding requirements is provided in the section on each installation. A summary description of, and the funding required by functional category, are as follows:

1. Personnel and Related Costs ($820,342,000): Includes salaries and benefits for NASA permanent and temporary civil service people, and for personnel of other Government agencies detailed to NASA. This category also includes supporting personnel 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 ($26,292,000): Includes the cost of transportation, per diem, and other associated expenses required for the direction, coordination and management of all NASA program activities; for contract management; for flight mission support; for travel to overseas development, launch and tracking sites; for meetings and technical seminars; and for relocation.

3. Facilities Services ($157,890,000): Includes rental of real property; the cost of maintenance, repair and related activities; engineering; custodial services; minor modifications and alterations; and utilities services.

4. Technical Services ($51,611,000): Includes the cost of general purpose automatic data processing for management activities; the dissemination of scientific and technical information derived from the research and development programs; education and informational programs; shops and other essential technical services.

5. Management and Operations Support ($80,165,000): Includes the cost of administrative communications; printing and reproduction; administrative supplies; general purpose materials and equipment; transportation of equipment and supplies; medical services and other support.

SUMMARY OF THE BUDGET PLAN BY FUNCTION

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
	(Thousands of Dollars)			
Personnel and Related Costs	750,995	770,991	805,082	820,342
Travel	18,843	20,825	20,825	26,292
Facilities Services	114,573	122,434	136,747	157,890
Technical Services	43,670	46,532	48,705	51,611
Management and Operations Support	67,887	72,372	70,041	80,165
Total	995,968	1,033,154	1,081,400	1,136,300

SUMMARY OF CHANGES FROM THE 1981 BUDGET ESTIMATE TO THE 1981 CURRENT ESTIMATE

The changes that have occurred in NASA's Research and Program Management plans in the past year are summarized as follows:

A net increase in the total level of the R&PM plan of $48,246,000 which reflects the budget amendment, the reduction in the appropriation request through Congressional action, the effect of civil service pay raises in 1981, and the partial absorption of such cost increases in 1981.

(In thousands of dollars)

1981 Budget estimate	1,047,154
Presidential action (Budget amendment - March 1980)	-14,000
Amended 1981 Budget estimate	1,033,154
Congressional action	-3,154
1981 Appropriation	1,030,000
Increased pay costs effective October 1980, pursuant to Executive Order 12248	59,202
Partial absorption of increased pay costs through savings in personnel costs	-7,802
1981 Current estimate	1,081,400

BASIS OF THE 1982 ESTIMATE

The budget estimate for 1982 of $1,136,300,000, an increase of $54,900,000 over the current 1981 plan, provides for the personnel and related costs for 22,713 full-time permanent employees; the minimum level of travel required to support agency missions; anticipated rate increases in support contracts and utilities; the increased costs of supplies, materials and equipment; and a partial restoration of the level of basic services that were temporarily reduced in 1981 to accommodate unanticipated rate increases and shuttle support requirements. The Research and Program Management appropriation request for 1982, by functional category, is summarized as follows:

1. Personnel and Related Costs ($820,342,000): The 1982 estimate for Personnel and Related Costs is based on 22,713 permanent full-time civil service employees. The increase in funding of $15,260,000 from the current 1981 plan to the 1982 plan results from the full year effect of the 1981 pay raise and the net of within grade and career advances and turnover savings.

2. Travel ($26,292,000): The 1982 estimate represents an increase over the current 1981 plan of $5,467,000. The increase is required to meet 1982 program milestones and other programmatic and institutional management needs and is primarily due to increased air fares and per diem rates. The travel of civil service personnel to contractor plants, launch and tracking sites, technical meetings and seminars for the accomplishment and coordination of technical matters is absolutely essential to the achievement of success in the conduct of NASA's research and development programs. The level of travel proposed for FY 1982 is the bare minimum needed to carry out the Agency's missions, especially in view of the artificially low level available in FY 1981 resulting from increases in per diem rates and air fares for which no increase has been provided in the amount for travel. Although the estimated level of travel activity in FY 1982 is greater than the FY 1981 current estimate, it is still about 3.5% below the FY 1980 actual level.

3. Facilities Services ($157,890,000): The 1982 estimate, representing an increase of $21,143,000 over the 1981 current plan, covers anticipated contractor and purchased utility rate increases; increased costs of supplies, materials and equipment; additional contractor effort; the partial restoration of basic services at several Centers, including maintenance activities which were temporarily reduced in 1981 to accommodate unanticipated rate increases and shuttle support requirements.

4. Technical Services ($51,611,000): The $2,906,000 increase in 1982 partially covers anticipated contractor rate increases as well as increased costs of supplies, materials and equipment in this category.

5. Management and Operations ($80,165,000): The $10,124,000 increase in this category is needed to provide for the increased costs of supplies, materials and equipment, and anticipated escalation of contract rates. The replacement of one small administrative aircraft is included in this function.

In summary, the FY 1982 budget requirement of $1,136,300,000 is to provide for a civil service workforce of 22,713 permanent positions and to support the activities at ten NASA installations and Headquarters, consistent with the research and development and construction of facilities program plans.

A supplemental appropriation of $51,400,000 is required in FY 1981 to partially meet the additional costs resulting from approved civil service pay raises.

DETAIL OF CONTENTS BY FUNCTION

The content of each functional category is explained in greater detail in this section, and the specific requirements for each installation are covered in their representative sections in this volume.

PERSONNEL AND BELATED 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 part of the functional category. As noted above, the 1982 funds will provide for 22,713 full-time permanent employees.

b. Other Than Full-Time Permanent Positions: This category includes the salaries of NASA's nonpermanent 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 awards.

2. Benefits: In addition to compensation, NASA makes an employer's contribution to personnel benefits as authorized and required by law. These benefits include contributions to the Civil Service Retirement Fund, employees' life and health insurance, and social security contributions for nonpermanent personnel. Payments for severance pay are made to former employees involuntarily separated through no fault of their own.

B. SUPPORTING COSTS:

1. Transfer of Personnel: Relocation costs, such as the expenses of selling and buying a home, and the movement and storage of household goods are provided under this category.

2. Office of Personnel Management Services: The Office of Personnel Management is reimbursed for certain 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 consist of courses offered by other Government agencies, and the remainder provides for training through nongovernment sources.

TRAVEL

A. Program Travel:

The largest part of travel is for direction, coordination and management of program activities. The complexity of the programs involved and the geographical distribution of NASA Installations and contractors and subcontractors throughout the entire United States impose the requirement 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 this purpose is directly related to both the number and complexity of the launches.

B. Scientific and Technical Development Travel:

Travel to scientific and technical meetings and seminars permits employees engaged in research and development to participate at both Government-sponsored and nongovernment-sponsored seminars. 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. Many of the Government-sponsored meetings are working panels convened to solve certain problems for the benefit of the Government.

C. Management Operations Travel:

Management and operations travel includes travel 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 or research advisory committees; and initial duty station, permanent change of assignment, and other family travel expenses.

FACILITIES SKRVICES

A. Rental of Real Property:

Rental of real property includes the rental of building space directly by NASA or through the General Services Administration to meet offsite office, warehousing, and other requirements which cannot otherwise be provided for in existing buildings at the NASA Installations. 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 for which NASA must provide rental payments to the General Services Administration in accordance with P.L. 92-313. Also included in this item is the rental of trailers required to accommodate special short-term needs.

B. Maintenance and Related Activities:

Maintenance and related activities includes the recurring day-to-day maintenance of facilities (grounds, buildings, structures, etc.) and equipment which is 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 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 case of equipment, related maintenance and other services are reflected for office, shop, laboratory and other facilities equipment as well as administrative intercommunications and television monitoring equipment.

C. 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; light fixture replacement; and laundry and dry cleaning of facility-related items.

D. 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 operating costs of the utility plants and systems and the cost of plant maintenance.

TECHNICAL SERVICES

A. Automatic Data Processing:

1. 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 appropriation.

2. Operations: Operations services include programming, computer operations and related services. Institutional-type applications include payroll, personnel data, logistics, and procurement records and reports.

B. Scientific and Technical Information and Educational Programs:

1. Libraries: The technical libraries are established to provide Installation staffs with books, periodicals, technical reports and other documentation.

2. 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 communications media. Assistance to the mass communications media includes the assembly and exposition of newsworthy material in support of requests, and takes such form as press kits, news releases, television and radio information tapes and clips, and feature material.

C. Shop Support and Services:

Shop support and services include general fabrications shops, reliability and quality assurance activities, safety, photographic services, graphics, and audio visual material.

MANAGEMENT AND OPERATIONS

A. Administrative Communications:

Included in this category are costs of leased lines, long distance tolls, teletype services, and local telephone service.

B. Printing and Reproduction:

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

C. 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 are also in this category.

D. 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; operation of photocopy equipment; chart and related art work; and postage.

DISTRIBUTION OF PERMANENT POSITIONS BY INSTALLATION

Installation	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
Johnson Space Center	3. 469	3. 494	3. 489	3. 489
Kennedy Space Center	2. 191	2. 201	2. 201	2. 201
Marshall Space Flight Center	3. 561	3. 561	3. 561	3. 561
National Space Technology Laboratories	103	103	103	103
Goddard Space Flight Center	3. 444	3. 440	3. 444	3. 444
Wallops Flight Center	395	395	395	395
Ames Research Center	1. 658	1. 658	1. 658	1. 658
Dryden Flight Research Center	461	461	461	461
Langley Research Center	2. 980	2. 980	2. 980	2. 980
Lewis Research Center	2. 835	2. 835	2. 835	2. 835
Headquarters	1. 516	1. 585	1. 586	1. 586
Total. Permanent Positions	22. 613	22. 713	22. 713	22. 713

SUMMARY OF BUDGET PLAN BY INSTALLATION

(Thousands of Dollars)

Johnson Space Center	164. 664	168. 433	174. 254	180. 411
Kennedy Space Center	133. 189	139. 232	152. 084	162. 960
Marshall Space Flight Center	155. 893	158. 304	165. 119	171. 150
National Space Technology Laboratories	4. 906	5. 042	5. 566	5. 624
Goddard Space Flight Center	133. 475	137. 575	143. 719	151. 605
Wallops Flight Center	17. 685	18. 697	20. 366	20. 414
Ames Research Center	67. 374	70. 550	73. 849	77. 921
Dryden Flight Research Center	20. 408	21. 386	22. 587	23. 767
Langley Research Center	113. 982	117. 605	123. 000	127. 620
Lewis Research Center	94. 842	100. 056	101. 425	108. 036
Headquarters	89. 550	96. 274	99. 431	106. 792
Total	995. 968	1. 033. 154	1. 081. 400	1. 136. 300

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1982 ESTIMATES

RESEARCH AND PROGRAM MANAGEMENT

DISTRIBUTION OF PERMANENT POSITIONS BY PROGRAM

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
SPACE TRANSPORTATION SYSTEMS	6.505	6.490	6.544	6.578
Space Shuttle	4.848	3.894	4.602	3.712
Space Flight Operations	1.326	2.280	1.601	2.598
Expendable Launch Vehicles	331	316	341	268
SPACE SCIENCE	2.290	2.069	2.252	2.173
Physics and Astronomy	1.792	1.568	1.758	1.688
Planetary Exploration	239	226	232	220
Life Sciences	259	275	262	265
SPACE AND TERRESTRIAL APPLICATIONS	1.984	2.202	2.074	2.110
Space Applications	1.891	2.115	1.986	2.020
Technology Utilization	93	87	88	90
AERONAUTICS AND SPACE TECHNOLOGY	5.687	5.773	5.680	5.704
Aeronautical Research and Technology	3.745	3.772	3.759	3.762
Space Research and Technology	1.408	1.382	1.395	1.432
Energy Technology	534	619	526	510
SPACE TRACKING AND DATA SYSTEMS	768	724	753	741
Tracking and Data Acquisition	768	724	753	741
Subtotal. Direct Positions	17.234	17.258	17.303	17.306
Center Management and Operations Support Positions	5.379	5.455	5.410	5.407
Total. Permanent Positions	22.613	22.713	22.713	22.713

(Thousands of Dollars)

FUNCTION	Total NASA	Johnson Space Center	Kennedy Space Center	Marshall Space Flight Center	National Space Technology Laboratories	Goddard Space Flight Center	Wallops Flight Center	Ames Research Center	Dryden Flight Research Center	Langley Research Center	Lewis Research Center	Headquarters
Personnel and Related Costs												
1980 Actual.....	750,995	123,259	73,581	124,572	3,343	112,996	11,386	55,722	15,080	92,891	79,387	58,778
1981 Budget.....	779,991	128,612	76,554	127,967	3,444	115,638	11,440	57,113	15,142	95,782	84,262	64,037
1981 Budget Amend	770,991											
1981 Current.....	805,082	132,655	82,496	132,366	3,716	120,231	12,187	59,043	16,329	98,490	83,886	63,683
1982 Estimate....	820,342	133,289	84,491	133,256	3,749	123,242	12,360	60,377	16,475	99,853	87,772	65,478
Travel												
1980 Actual.....	18,843	3,602	1,800	2,621	121	2,476	281	1,332	365	1,992	1,066	3,187
1981 Budget.....	20,825	4,035	2,255	2,982	147	2,712	347	1,446	400	2,021	1,244	3,236
1981 Budget Amend	20,825											
1981 Current.....	20,825	4,056	2,070	2,956	162	2,677	326	1,417	375	2,051	1,108	3,627
1982 Estimate.....	26,292	5,045	2,985	3,698	407	3,385	407	1,798	523	2,540	1,555	3,949
Facilities Services												
1980 Actual.....	114,573	17,916	33,431	12,716	1,118	8,772	3,654	6,183	2,786	11,580	10,627	5,790
1981 Budget.....	124,971	18,385	34,198	12,881	1,286	11,816	3,771	8,736	3,150	12,537	12,307	5,904
1981 Budget Amend	122,434											
1981 Current.....	136,747	18,384	43,200	14,634	668	11,383	4,056	8,455	3,130	14,170	12,884	5,783
1982 Estimate.....	157,890	22,602	48,156	16,273	611	14,574	4,609	10,541	3,572	15,870	14,756	6,326
Technical Services												
1980 Actual.....	43,670	7,529	7,387	6,507	70	3,111	631	981	458	1,328	817	14,851
1981 Budget.....	47,496	7,529	7,611	6,687	43	3,076	963	924	789	2,453	1,043	16,378
1981 Budget Amend	46,532											
1981 Current.....	48,705	7,332	8,418	6,104	121	2,917	591	1.528	534	2,446	997	17,717
1982 Estimate....	51,611	5,556	8.888	6,832	140	2,932	1,139	1,576	890	2.747	969	19,942
Management and Operations												
1980 Actual.....	67,887	12,358	16,990	9,477	254	6,120	1,733	3,156	1.719	6,191	2,945	6,944
1981 Budget.....	73,871	12,127	20,767	9,860	188	6,093	2,456	3,250	2,200	6,352	2,504	8,074
1981 Budget Amend	72,372											
1981 Current.....	70,041	11,827	15,900	9,059	899	6,511	3,206	3,406	2,219	5,843	2,550	8,621
1982 Estimate....	80,165	13,919	18,440	11,091	717	7,472	1,899	3,629	2,307	6,610	2,984	11,097
TOTAL												
1980 Actual.....	995,968	164,664	133,189	155,893	4,906	133,475	17,685	67,374	20,408	113,982	94,842	89,550
1981 Budget.....	1,047,154	170,688	141,385	160,377	5,108	139,335	18,977	71,469	21,681	119,145	101,360	97,629
1981 Budget Amend	1,033,154	168,433	139,232	158,304	5,042	137,575	18,697	70,550	21,386	117,605	100,056	96,274
1981 Current.....	1,081,400	174,254	152,084	165,119	5,566	143,719	20,366	73,849	22,587	123,000	101,425	99,431
1982 Estimate....	1,136,300	180,411	162,960	171,150	5,624	151,605	20,414	77,921	23,767	127,620	108,036	106,792

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; purchase (for replacement only, of one aircraft. for which partial payment may be made by exchange of at least one existing administrative aircraft and such other existing aircraft as may be considered appropriate), hire, maintenance and operation of administrative aircraft; purchase (not to exceed [thirty-six] ***twenty-four*** for replacement only) and hire of passenger motor vehicles: and maintenance and repair of real and personal property. and not in excess of 875,000 per project for construction of new facilities and additions to existing facilities. repairs, and rehabilitation and modification of facilities; [$1,030,000,000] *$1,136,300,000*: *Provided*. That contracts mag 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 **623,000** 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. *(42 U.S.C. 2451, et seq.; Department of Housing and Urban Development—Independent Agencies Appropriation Act, 1981: additional authorizing legislation to be proposed.)*

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

RESEARCH AND PROGRAM MANAGEMENT

Program and Financing (in thousands of dollars)

Identification code 80-0103-0-1-999

		Budget plan			Costs and obligations		
		1980 actual	1981 est.	1982 est.	1980 actual	1981 est	1982 est
	Program by activities:						
	Direct program:						
	1. Space transportation systems	407,021	451,800	477,300	410,299	451,800	477,300
	2. Scientific investigations in space	135,240	137,700	140,600	135,945	137,700	140,600
	3. Space and terrestrial applications	116,856	126,000	137,700	115,322	126,000	137,700
	4. Space research and technology	74,389	79,400	82,800	74,809	79,400	82.800
	5. Aeronautical research and technology	188,996	208,300	217,400	189,662	208,300	217,400
	6. Energy technology	28,381	28,700	30,300	28,467	28,700	30,300
	7. Supporting activity	45,085	49,500	50.200	45,342	49,500	50,200
	Total direct program	995.968	1,081,480	1,136,300	999,846	1,081,400	1,136,300
	Reimbursable program:						
	1. Space transportation systems	12,332	16,290	16,060	12,307	16,290	16,060
	2. Scientific investigations in space	112	250	250	123	250	250
	3. Space and terrestrial applications	3,501	3,420	4,180	3,487	3,420	4,180
	5. Aeronautical research and technology	488	510	530	492	510	530
	6. Energy technology	16,353	16,910	17,550	16,286	16,910	17,550
	7. Supporting activity	8,370	12,620	13,430	8.328	12,620	13,430
	Total reimbursable program	41,156	50,000	52,000	41,023	50,000	52,000
	Total program costs, funded[1]	1,037,124	1,131,400	1,188,300	1,040,869	1,131,400	1,188,300
	Change in selected resources (undelivered orders)				−3,745		
10.00	Total	1,037,124	1,131,400	1,188,300	1,037,124	1,131,400	1,188,300
	Financing:						
	Offsetting collections from:						
11.00	Federal funds				−34,698	−35,121	−36,793
14.00	Non-Federal sources				−6,458	−14,879	−15,207
25.00	Unobligated balance lapsing				218		
39.00	**Budget authority**				**996,186**	**1,081,400**	**1,136,300**
	Budget authority:						
40.00	**Appropriation**				**996,186**	**1,030,000**	**1,136,300**
44.20	**Supplemental for civilian pay raises**					**51,400**	
	Relation of obligations to outlays:						
71.00	Obligations incurred, net				995,968	1,081,400	1,136,300
72.40	Obligated balance, start of year				80,798	65,101	71,101
74.40	Obligated balance, end of year				−65,101	−71,101	−74,101
77.00	Adjustments in expired accounts				−1,785		
90.00	Outlays, excluding pay raise supplemental				1,009,880	1,025,600	1,131,700
91.20	Outlays from civilian pay raise supplemental					49,800	1,600

[1] Includes capital investment as follows: 1980, $5,793 thousand. 1981, $5,801 thousand; 1982, $6,540 thousand

INSTALLATION
JUSTIFICATION

JOHNSON
SPACE CENTER

RESEARCH AND PROGRAM **MANAGEMENT**

FISCAL YEAR **1982 ESTIMATES**

LYNDON B. JOHNSON SPACE CENTER

DESCRIPTION

The Lyndon B. Johnson Space Center is located approximately 20 miles southeast of downtown Houston, Texas. Total NASA-owned land at the Houston site consists of 1,620 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 Lyndon B. Johnson Space Center, including fixed assets in progress and contractor-held facilities at various locations and the White Sands Test Facility, as of September 30, 1980, was $904,979,000.

CENT ROLES AND MISSIONS

The Johnson Space Center (JSC) was established in November 1961, in response to the need for NASA to designate a primary 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. It was necessary to focus this responsibility in a Federal laboratory since the Government was to be the customer, consumer and facility owner of an activity which was viewed as possessing considerable risk and much uncertainty because of the total lack of previous experience. This need continued as the Nation proceeded towards more ambitious undertakings such as the Apollo program, the Skylab program, the Apollo-Soyuz Test Project and the current Space Shuttle program. To meet this responsibility, JSC has developed unique areas of recognized technical excellence within the civil service staff and facilities of superior merit; that is, major technical facilities which constitute a National resource. The principal and supporting roles are:

PRINCIPAL

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

Space Shuttle - development of the Orbiter and lead Center for management of the Shuttle system. Providing sustaining engineering and logistic support for Space Transportation System (STS) hardware.

Includes Shuttle configuration management, Shuttle sustaining engineering and Orbiter operational procurement.

Advanced Missions - focus is on orbital systems and advanced transportation systems.

Environmental and Crew Support Systems - develop and demonstrate Environmental Control and Life Support Subsystems (EC/LSS) and Extravehicular Activity (EVA) systems suitable for the space transportation systems and other advanced needs.

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

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.

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

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 operations and medical experiments.

Spacelab Payloads - development of Spacelab life sciences research capability through common operating research equipment development. Define, develop and integrate inflight biomedical experiments. Provide for the integration of dedicated life science Spacelab experiments and integration for human studies experiments.

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

Resource Observations - provide a discipline base for resource observations applications, including airborne techniques and space-based flight sensors. Current emphasis includes the application of Landsat and other data to agricultural crop forecasting.

SUPPORTING

Technology Experiments in Space - management of Orbiter experiments program. Definition and development of experiments in areas consistent with other JSC space roles.

Energy Systems - conduct Satellite Power Systems definition activities.

SUMMARY OF [illegible] CES [illegible]U

Funding Plan By Function

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
I. Personnel and Related Costs	123,259	128,612	132,655	133,289
II. Travel	3,602	4,035	4,056	5,045
III. Facilities Services	17,916	18,385	18,384	22,602
IV. Technical Services	7,529	7,529	7,332	5,556
V. Management and Operations	12,358	12,127	11,827	13,919
1981 Budget Amendment	---	-2,255	---	---
Total, fund requirements	164,664	168,433	174,254	180,411

Distribution of Permanent Positions by Program

Direct Positions

Space Transportation Systems and Operations	2,545	2,542	2,567	2,564
Space shuttle	2,123	1,563	2,004	1,536
Space flight operations	422	979	563	1,028

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
Space Science	147	152	149	152
Planetary exploration	44	40	43	43
Life sciences	103	112	106	109
Space and Terrestrial Applications	193	214	194	196
Space applications	189	209	190	192
Technology utilization	4	5	4	4
Aeronautics and Space Technology	36	46	37	38
Aeronautical research and technology	4	a	5	5
Space research and technology	24	20	24	25
Energy technology	a	18	8	a
Subtotal. direct positions	2. 921	2. 954	2. 947	2. 950
Center Management and Operations Support Positions	548	540	542	539
Total. permanent positions	3. 469	3. 494	3. 489	3. 489

PROGRAM DESCRIPTION

	Permanent Positions (Civil Service)
SPACE SHUTTLE.....	1,536

The 1982 staffing provides for continuation of design, development, test and evaluation activities to support a schedule consistent with the major program milestones including the first manned orbital flight and the subsequent orbital flight tests. Activities will continue consistent with a phased delivery of the total Orbiter fleet. Procurement of necessary initial flight and ground support equipment will be continued.

The Space Shuttle Program Office of JSC has program management responsibility for program control, overall systems engineering, and Space Shuttle system integration. The Space Shuttle Program Office provides management of the "Lead Center" functions as related to the Space Shuttle program and the overall systems management and integration of all elements of the program. The Space Shuttle Orbiter Project Office provides overall management of the design, development, test and production of the Orbiter system. This includes management of various elements of the total Orbiter system (e.g., structures, propulsion, power, avionics, etc.) and to lower elements within the subsystems.

To adequately 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 systems. General capabilty and performance criteria are established for special areas of consideration such as electro-magnetic compatibility and lightning protection. For proper systems operations, systems performance data and operational information are prepared such as operational data books, mission requirement documents, etc.

Although major Shuttle flight system elements have been individually managed through designated Shuttle element project offices and related provisioning contractors, a relatively large quantity of supporting equipment is supplied to the program through other elements of JSC. Examples of such equipment are: extravehicular mobility unit, portable oxygen system, closed circuit television, survival radio sets, dosimetry, crew equipment, photographic camera systems, and bioinstrumentation. Each represents a multitude of engineering, management, and evaluation activities. These include definition of requirements, establishment of contracts, management of contractor projects, evaluation of design and performance, and

provisioning of equipment in a certified "ready for use" configuration. Mission use of equipment also requires on-site processing for preparation and related reconditioning for sequential missions.

Since the Orbiter represents an integrated complex of technical and engineering disciplines, specific test, evaluation and analysis 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, design definition, performance evaluation, and breadboard testing for communications and tracking systems ground testing; providing expertise in guidance, navigation, control, instrumentation and electrical power distribution; management and operation of environmental test chambers; analysis, evaluation and component testing of the Orbiter hydraulics system, auxiliary power unit, orbital maneuvering system components, reaction control engine performance, reaction control system engine valve leak detection techniques and development of initiator firing units; analysis and laboratory testing for vehicle attachment and separation systems; design analysis of total Shuttle systems, Shuttle/payload interface design, crew station evaluation and design, Shuttle airlock design evaluation, etc.; 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 provide the Shuttle pilots and crew with the total assessment and command capability necessary to manage, fly and operate the vehicle. Because of the criticality of this system, very close attention is given to the identification of performance requirements, systems design, 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 controls, solid rocket booster control and recovery interface, power and control, and external tank propellant control and instrumentation.

Avionics and software testing and checkout in the Electronics Systems Test Laboratory and the Shuttle Avionics Integration Laboratory effectively supported the Approach and Landing Test (ALT) effort and will continue through Orbital Flight Testing (OFT) and into the operations era. Their purpose is to verify the functional performance of the Shuttle Integrated Avionics System, validate the system design, and verify compatibility of the various radio frequency communication links.

For OFT crew training, the Orbiter Aeroflight Simulator (OAS) was upgraded to the Orbiter 102 configuration to become the second crew station (motion base) in the Shuttle Mission Simulator (SMS) complex. The fixed base is the other crew station, and final systems delivery occurred in 1980. This complex is the primary flight crew training facility and is supplemented by a number of part task trainers and specialized training devices. Involved in simulator operations are the simulator readiness tests, operation of the simulators during training exercises, documentation of abnormal operations identified in the simulator performance or configuration, and correcting problems and system malfunctions. In addition, design and program modifications must be implemented to maintain configuration with Orbiter vehicle modifications and Shuttle program changes. The Mission Control Center (MCC) update involves the management of the design, development, integration, and testing of all MCC software required to support the OFT program. This includes modifications to old programs, new or replacement programs, their integration in the MCC, and integration of the MCC software and hardware. Shuttle Orbital Flight Test requirements pose a major design change to the MCC software and require new programs for telemetry, command, tracking, and communications.

Orbital 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 mission control center and network systems requirements, and operations input to the planning for the selection and operation of Shuttle OFT payloads.

Specific OFT flight planning activity encompasses the flight design, flight analysis, and software activities. The flight design tasks include: developing nominal and contingency profiles on a preflight basis; supporting the crew training simulations; and development of flight techniques for OFT. Specific OFT flight design products include conceptual flight profiles and operational flight profiles which are issued at launch minus twelve and three months, respectively, for each flight. The OFT 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 located in the erasable memory (mission-to-mission changes) is developed from the flight design process for incorporation into the Orbiter software and MCC systems.

Orbiter Software Development provides software required for the Shuttle Orbiter Avionics (onboard) general purpose computers. This task involves the generation of the specifications; the design, development, code and test; and integration and verification of the primary avionics software systems which are loaded into the onboard computers. These computers are used for crew training in the Shuttle Mission Simulator and for the actual space flight mission. In addition, this task provides software for Orbiter vehicle tests conducted at the Shuttle launch sites (Kennedy Space Center and the Western Space and Missile Center) and in the Shuttle Avionics Integration Laboratory.

	Permanent Positions (Civil Service)
SPACE FLIGHT OPERATIONS	1,028

Support of the Spacelab development effort at the Johnson Space Center 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 crew training in conjunction with flight hardware and the development and operation of Shuttle/Spacelab simulators and trainers, as well as Spacelab support software resident in the Orbiter general purpose computer.

The MCC is being upgraded for the STS Operations programs (STS-5 and subsequent) to support high flight density and secured DOD operations, and is being augmented with a Payload Operations Central Center (POCC) to support attached payloads. Design and implementation necessary for this upgrade includes the display, control, data handling and interface, communications, and computer hardware/software systems which are being replaced, modified, and/or supplemented. The STS operations upgrade will provide mission support for up to three Orbiters simultaneously (two in flight and one on pad or simulation), and ability to separate a secure data string for DOD Shuttle mission support. The POCC augmentation will provide Command and Control support for up to six attached payload flights per year.

Reconfiguration tools (hardware and software systems) to permit support of the high flight rate of the 1980's will be implemented in the Shuttle Mission Simulator (SMS) 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 will require 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 will continuously be made to keep up with changes to the Orbiters.

Orbiter avionics software development in the STS Operations area will provide for payload support. This will include general capabilities for Spacelab, Inertial Upper Stage (IUS), and Spinning Solid Upper Stage (SSUS), with flexibility available to implement specific payload requirements as optional services.

In addition, the task will provide for rapid handling of mission-to-mission software changes (flight dependent data in erasable 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 placed on software tools and the associated automatic data processing equipment hardware which now comprise the Software Development Laboratory and the transition of support into a Software Production Facility.

Flight design for operations 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 will include 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. As in OFT, the software activities for operational flights also include the continued development, definition, and verification support of the guidance, targeting, and navigation systems software requirements in the Orbiter and MCC. Software changes for Orbiter improvements will upgrade vehicle capabilities and performance.

The advanced programs objective is to provide technical as well as programmatic data for the definition and evaluation of potential future space programs and systems. In support of these activities, advanced studies are conducted to obtain significant performance and reliability improvements, reduce future program risks and development costs through the effective use of new technologies, and examine concepts and techniques which can reduce STS operations costs and mission turnaround times. In 1981, the advanced studies effort will assess the technology maturity for a Space Operations Center and examine innovative design concepts which would allow modular development of such a center. A Satellite Services Systems Analysis will be conducted to survey capabilities of proposed equipment to enhance deployment, retrieval, and servicing of payloads. Technology developments in support of Power Extension Package definition and development will be completed. Engineering and supporting studies will be conducted for all of these major disciplines.

	Permanent Positions (Civil Service)
PLANETARY EXPLORATION	43

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 must make an active contribution to our knowledge of the compositions, structures and evolutionary histories of the solid bodies of the solar system. Therefore, 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 is an important role for the geoscience group which is involved in extensive cooperation with the planetary science community.

	Permanent Positions (Civil Service)
LIFE SCIENCES	109

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. The scientific activities are to define, develop and integrate biomedical experiments for life sciences payloads. Additionally, these experiments are designed to utilize the space environment to accomplish medical and biological research.

The medical activities provide for medical contingencies in flight involving onboard health services, training for crewmen, ground-based medical support and medical evaluation of proposed crew members. These objectives are supportive of the Center's responsibility for assuring astronaut health and safety, both during flight and on the ground. The accomplishment of these objectives requires a well defined and continuing program that incorporates medical research, operations, laboratory support and clinical medicine.

The bioengineering activities provide integration of dedicated life sciences Spacelab experiments and integration for human experiments. To this end, experiments will be selected, and experiment hardware development will be initiated. JSC has mission management responsibility for the Office of Life Sciences payloads, which includes integration of equipment to the pallet, integrating the payload into the Orbiter, and real-time mission support while in orbit.

SPACE APPLICATIONS	*192*

The resource observations discipline is divided into two major areas: technology development and applications projects, and flight projects. JSC's responsibility entails the conduct and implementation of major tasks in each of these areas:

Technology development and applications projects use remotely-sensed data for agricultural crop identification, crop acreage and yield estimation, forest mapping and inventory, soil moisture measurement, and vegetation cover monitoring. Studies of data systems and techniques associated with these and other applications are also being conducted.

Flight projects responsibilities at JSC include the airborne instrumentation research project and Shuttle payload instrument development. The Large Format Stereo Camera is being developed for flight on the Shuttle. Responding to airborne measurement requirements generated by NASA research and cooperative

programs with the Departments of Agriculture, Interior, Defense, Commerce, and Energy, and various state agencies, JSC develops and implements an aircraft support plan. Involved is the testing, maintenance, and operation of a wide variety of remote sensors which provide data to investigators. Three aircraft, capable of data acquisition from 500 to 63,000 feet, are operated: a Lockheed C-130, a General Dynamics WB-57F, and a Bell 206B helicopter. They are maintained at nearby Ellington Air Force Base.

	Permanent Positions (Civil Service)
TECHNOLOGY UTILIZATION	4

The Technology Utilization program transfers new knowledge and innovative technology resulting from NASA's research and development programs for application in industry, medicine and important public sector areas such as urban development. The Technical Planning Office at JSC provides program office direction for the Technology Utilization program at JSC and provides engineering support to analyze the feasibility of applying space technology to ground-based operations, such as: telecare, feeding the elderly, and the bioisolation garment.

AERONAUTICAL RESEARCH AND TECHNOLOGY	5

The Center is continuing its efforts in fire testing aircraft fuselage sections fabricated with newly developed materials. This project provides the aircraft industry with test data and results of flammability tests on fuselage components based on full-scale fire testing. In addition, JSC is evaluating the Electro-mechanical Flight Control concept as an eventual replacement for aircraft hydraulic systems. *Also,* fiber optical systems are being examined to develop a stand-alone optical multiplexer/demultiplexer component capable of bidirectional, full duplex operation with sixteen channels.

SPACE RESEARCH AND TECHNOLOGY	25

Systems and design studies are being performed to: develop technology, fabricate and test a Synthetic Aperture Imaging Radar (SAIR); research fuel cell and electrolysis cell technology to demonstrate suitability to large orbital energy conversion and storage requirements; identify viable propulsion system designs and propellant alternatives which could replace hydrazine fuel in a second-generation Shuttle auxiliary propulsion system; collect data, using the Shuttle Development Flight Instrumentation, that will augment the research and technology base for future transportation systems design; and develop an instrumentation package which will provide flight mechanics data for the determination of aerodynamic coefficients from Orbiter flight data.

	Permanent Positions (Civil Service)
ENERGY TECHNOLOGY	8

Engineering manpower will be used for Space Solar Power Systems definition studies and research and development on instrumentation for monitoring nuclear waste isolation.

CENTER MANAGEMENT AND OPERATIONS SUPPORT	539

Center Management and Operations Support is defined as that support or service being provided to all JSC organizations which cannot be directly identified to a specific benefiting program or project. The civil service personnel involved are:

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

Management Support - Includes a wide range of activity categorized as business management support for programs and functional organizations for the entire Center. Specific functions include resource and budget management, program control, contracting and procurement, personnel management, property management, financial management, resource control, and management systems and analyses.

Operations Support - This is a broad spectrum of activity that is required to maintain and operate facilities, buildings, and equipment and provide the normal housekeeping services and logistics support for the personnel who manage and conduct the affairs of the Center. Specific activities are:

Maintenance and operation of all buildings and facilities
Data processing and computer support
Reliability and quality assurance
Center-wide security and protection
Fire protection
Custodial services
Logistics support including transportation, supplies, etc.
Medical care of employees
Photographic and graphic support.

RESOURCE REQUIREMENTS BY FUNCTION

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
	(Thousands of Dollars)			
I. PERSONNEL AND RELATED COSTS	**123.259**	**128,612**	**132,655**	**133,289**
Summary of Fund Requirements				
A. Compensation and Benefits				
1. Compensation				
a. Permanent positions	107,283	112,208	114,707	115,190
b. Other than full-time permanent positions	1,355	1,806	2,226	2,243
c. Reimbursable details	1,981	2,107	2,736	2,823
d. Overtime and other compensation	872	885	1,013	1,014
Subtotal, Compensation	111,491	117,006	120,682	121,270
2. Benefits	10,810	10,861	11,324	11,298
Subtotal, Compensation and Benefits	122,301	127,867	132,006	132,568
B. Supporting Costs				
1. Transfer of personnel	372	175	149	171
2. Personnel training	586	570	500	550
Subtotal, Supporting Costs	958	745	649	721
Total, Personnel and Related Costs	123,259	128,612	132,655	133,289

Explanation of Fund Requirements

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
A. Compensation and Benefits	122,301	127,867	132,006	132,568
1. Compensation	111,491	117,006	120,682	121,270
a. Permanent positions	107,283	112,208	114,707	115,190

The 1982 estimate will support 3,489 permanent positions. The increase from the 1981 budget estimate to the 1981 current estimate is due to the October 1980 pay increase.

Basis of Cost for Permanent Positions

In 1982, the cost of permanent positions will be $115,190,000, an increase of $483,000. This increase results from the following:

Cost of permanent positions in 1981		114,707
Cost increases in 1982		+1,528
Within grade and career advances:		
Full year effect of 1981 actions	+802	
Partial year effect of 1982 actions	+628	
Full year effect of 1981 pay increase	+98	
Cost of decreases in 1982		-1,045
Turnover savings and abolished positions:		
Full year effect of 1981 actions	-627	
Partial year effect of 1982 actions	-418	
Cost of permanent positions in 1982		115,190

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
b. Other than full-time permanent positions				
1. Cost	1,355	1,806	2,226	2,243
2. Workyears	142	190	205	206

The increase in the 1981 current estimate from the 1981 budget estimate reflects an increased build-up of the Cooperative Training Program. The 1982 estimate includes 206 workyears which will support the following programs:

Program	Workyears
Cooperative training	103
Summer programs	27
Opportunity programs	51
Other temporary employment	25
Total	206

c. Reimbursable detailees	1,981	2,107	2,736	2,823

The military personnel detailed to the Johnson Space Center on a reimbursable basis are individuals experienced in manned flight and related fields. Each individual performs a function essential and critical to the current and future programs. The increase from the 1981 budget estimate to the 1981 current estimate is attributable to the October 1980 pay increase and an increase in the number of detailees.

d. Overtime and other compensaton	872	885	1,013	1,014

Overtime in 1981 will be used primarily for the orbital test flights, e.g., crew training, trajectory optimization, data reduction, integration laboratory, and related support activities. Overtime in 1982 will remain at the same level as 1981.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
	(Thousands of Dollars)			
2. Benefits	10,810	10,861	11,324	11,298
Following are the amounts of contribution by category:				
Civil Service Retirement Fund	7,529	7,951	8,026	8,047
Employee life insurance	314	325	316	323
Employee health insurance	2,019	1,854	2,024	2,062
Workmen's compensation	590	687	687	762
FICA	35	42	40	45
Other	323	2	231	59
Total	10,810	10,861	11,324	11,298

The increase from the 1981 budget estimate to the 1981 current estimate is due primarily to the October 1980 pay increase. The 1982 estimate reflects anticipated decreases in other benefits offset by anticipated increases in health insurance and workmen's compensation. Workmen's compensation costs are based on Department of Labor billings.

B. Supporting Costs	958	745	649	721
1. Transfer of personnel	372	175	149	171

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 in the 1982 estimate reflects an increased number of relocations over 1981.

2. Personnel Training	586	570	500	550

The purpose of the JSC training program is to continue the development of skills and knowledge of civil service employees in order to more efficiently support JSC roles and missions. The decrease from the 1981 budget estimate to the 1981 current estimate reflects lower than planned training programs. The 1982 estimate is based on approximately the same level as 1981 at expected 1982 tuition costs.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
II. TRAVEL	**3,602**	**4,035**	**4,056**	**5,045**
Summary of Fund Requirements				
A. Program Travel	3,052	3,492	3,587	4,449
B. Scientific and Technical Development Travel	133	142	78	98
C. Management and Operations Travel	417	401	391	498
Total, Travel	3,602	4,035	4,056	5,045
Explanation of Fund Requirements				
A. Program Travel	3,052	3,492	3,587	4,449

Program travel is specifically required for accomplishment of the Center's mission and accounts for approximately 90 percent of the travel budget for 1982. The increase in the 1981 current estimate from the 1981 budget estimate partially covers increased travel costs. In 1982, travel will increase for the transition of STS operations from verification of performance to actual operational use. Travel will be required to support operations activity including launch, mission support, coordination of engineering and technical activities, and support of payload technical integration.

B. Scientific and Technical Development Travel	133	142	78	98

Scientific and technical development travel permits employees to participate in meetings and technical seminars with other representatives of the aerospace community. This participation allows them to benefit from exposure to technological advances outside JSC, as well as to present both accomplishments and problems to their associates. Many of these meetings are working panels convened to solve certain problems for the benefit of the Government. Symposia and technical seminars related to the earth observation program and lunar samples are a major requirement in this area. The 1981 current estimate has been reduced to provide for more critical Shuttle program travel. The 1982 estimate represents a partial restoration, but is offset by increased travel costs.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
C. Management and Operations Travel	417	401	391	498

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 1982 estimate reflects a slight increase in travel and increased costs of transportation and per diem.

III. FACILITIES SERVICES	**17,916**	**18,385**	**18,384**	**22,602**

The Johnson Space Center is located on 1,620 acres with a complex of laboratory and office buildings, as well as test facilities. This complex encompasses 2,797,615 gross square feet of building space in 91 primary buildings including eleven major technical facilities. There are also an additional 39 secondary buildings. This physical plant supports an average daily on-site population of approximately 6,800 to 6,900 personnel plus an additional 4,000 personnal located off-site at nearby facilities and Ellington Air Force Base. Many of the test facilities are utilized on schedules involving more than one shift or during off-peak hours. 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

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
A. Maintenance and Related Services	6,200	6,187	5,644	7,294
1. Facilities	6,200	6,187	5,644	7,294
B. Custodial Services	3,651	3,851	3,854	4,820
C. Utility Services	8,065	8,347	8,886	10,488
Total, Facilities services	17,916	18,385	18,384	22,602

Explanation of Fund Requirements

A. Maintenance and Related Services	6,200	6,187	5,644	7,294
1. Facilities	6,200	6,187	5,644	7,294

This activity involves not only the facilities of JSC at Houston, but also at White Sands Test Facility and Ellington Air Force Base. The reduction from the 1981 budget estimate to the 1981 current estimate reflects a reduction of 33 contractor workyears and deferrals of selected facility maintenance into 1982 due to budgetary constraints. The 1982 budget includes an increase for restoration of twelve contractor workyears over the 1981 current estimate, 1981 deferrals, and allowances for negotiated support contract wage increases. Major types of support in this area are:

a. Maintenance and operation of facilities	6,308

This activity includes routine maintenance and facilities support for applicable facilities at JSC and its component installations at White Sands Test Facility and Ellington Air Force Base. Also included are such activities as support for utility systems, administrative office alterations, and painting.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
b. Grounds maintenance				500

This provides for mowing and edging of 540 acres of improved land and mowing another 775 acres of unimproved land. *Also* included is cultivation, mulching, fertilizing, insect control, and care of trees and shrubs.

c. Facilities design engineering				486

This effort involves engineering design, drafting, and specifications preparation for construction of facilities; minor construction and repair projects; and other facility and system design and modification tasks.

B. Custodial Services	3,651	3,851	3,854	4,820

This activity involves support contractor effort at JSC to provide security guard services, janitorial services, fire fighting, and ambulance services. The increase in 1982 is due primarily to an increase of 28 workyears in security and janitorial requirements during the Space Shuttle missions, as well as allowances for support contract wage increases.

1. Janitorial services				2,066

This activity provides janitorial services to some 2.55 million square feet of floor space, including highly specialized services to cleanroom areas. *Also* included are such activities as light bulb replacement, trash removal, and laundry services.

2. Fire protection services				785

This activity will provide for fire protection and other related activities for JSC property and personnel, including:

a. Industrial safety and inspections including insuring compliance with OSHA regulations.
b. Maintenance of alarms and fixed fire fighting equipment.
c. Technical interface with the Houston Fire Department for actual fire fighting activities.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
3. Security services				1,969

This activity includes the protection of personnel at JSC and involves:

a. Protection of all Government facilities and equipment.
b. Badging of all on-site personnel and official visitors.
c. Protecting classified information.
d. Maintaining area surveillance and traffic control.

C. Utilities Services	8,065	8,347	8,886	10,488

This category includes purchased utilities and support contractor effort for the operation and maintenance of the utility distribution system at JSC. The purchased utility costs are as follows:

1. Electricity (154,700 MWH)	7,551
2. Natural gas (237,300 cubic feet)	993
3. Water and sewage	336

The increase from the 1981 budget estimate to the 1981 current estimate and subsequently into 1982, reflects rate increases for natural gas and electricity plus a modest increase in consumption of natural gas because of technical problems encountered in converting from natural gas to electricity.

IV. TECHNICAL SERVICES	**7,529**	**7,529**	**7,332**	**5,556**

Summary of Fund Requirements

A. Automatic Data Processing	5,174	5,233	5,295	3,332
1. Quipment	2,403	2,703	3,016	562
2. Operations	2,771	2,530	2,279	2,770

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
B. Scientific and Technical Information	1,656	1,664	1,466	1,593
1. Library	50	103	---	---
2. Education and information	1,606	1,561	1,466	1,593
C. Shop Support and Services	699	632	571	631
Total, Technical Services	7,529	7,529	7,332	5,556

Explanation of Fund Requirements

A. Automatic Data Processing	5,174	5,233	5,295	3,332

This activity provides accounting and management information to satisfy requirements of NASA management and external authority. Included is support of all JSC administrative functions and prior to 1982, the lease and maintenance costs of all multiuse ADP equipment within JSC's Central Computer Facility. Beginning in 1982, each benefiting program will pay their share of lease, maintenance, and equipment acquisition costs. The major reduction shown for 1982 represents the realignment of lease, maintenance and equipment costs to benefiting programs.

1. Equipment	2,403	2,703	3,016	562

Prior to 1982, the purchase and maintenance costs of all multiuse JSC-owned ADP equipment and the lease costs of all leased ADP hardware within the Central Computer Facility were funded in this function. Starting in 1982, only the Center's administrative requirements will be funded in this catorgy. The increase in the 1981 current estimate from the 1981 budget estimate is due primarily to the lease of a replacement computer for the Univac 1108. currently, these hardware systems include four Univac 1108's, one Univac 1110, one Univac 9300, one IBM 360/22, one CDC 3200, and one Mohawk (data entry) computer system. Also included is associated peripheral equipment such as two microfilm processors, various terminals, and keypunch equipment.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
2. Operations	2,771	2,530	2,279	2,770

This category provides 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. The decrease from the 1981 budget estimate to the 1981 current estimate is due to a reduction of four contractor workyears due to budgetary constraints. The increase in 1982 is due to restoration of the level of effort in this area.

B. Scientific and Technical Information	1,656	1,664	1,466	1,593

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. The decrease in the 1981 current estimate from the 1981 budget estimate is due to the reduction of seven contractor workyears of effort, primarily in the JSC technical library, due to budgetary constraints.

1. Library	50	103	---	---

Support contractor effort provided cataloging, indexing services, and initial distribution of publications in the operation of the JSC Technical Library. Budgetary constraints in 1981 necessitated the elimination of the support contractor effort in this area.

2. Education and information	1,606	1,561	1,466	1,593

The funding in this category provides for support of a JSC public affairs program. Included are motion picture production, from script to screen; film clip preparation; exhibit management and refurbishment; visitor orientation tours; lecturing; mail answering services; and other public affairs activities. The decrease from the 1981 budget estimate to the 1981 current estimate reflects a reduction of one workyear. The 1982 estimate reflects the increase for contract rate escalation.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
C. Shop Support and Services.....	699	632	571	631

These funds provide for support contractor effort to provide JSC with support in areas such as graphics, publications, audio-visual material, microfilm and microfiche, and editorial services for JSC publications. Graphic materials are prepared for use in presentations and senior management reviews. Various kinds of film are processed and reproductions and reprints made. The decrease in 1981 is primarily attributable to a reduction of two contractor workyears. The 1982 estimate provides for approximately the same level of effort as 1981 and assumes an increase to cover contractor wage escalation.

V. MANAGEMENT AND OPERATIONS.....	**12,358**	**12,127**	**11,827**	**13,919**
Summary of Fund Requirements				
A. Administrative Communications.....	3,118	2,788	2,912	3,302
B. Printing and Reproduction.	956	997	802	765
C. Transportation.....	1,204	966	985	1,067
D. Installation Common Services.....	7,080	7,376	7,128	a 785
Total, Management and Operations.....	12,358	12,127	11,827	13,919
Explanation of Fund Requirements				
A. Administrative Communications.....	3,118	2,788	2,912	3,302

Communications support for JSC and WSTF consists of local telephone service, long distance telephone service, and various kinds of other communications services. The 1981 current estimate and 1982 are higher than the 1981 budget estimate because of actual and anticipated FTS cost increases.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
1. Local telephone service				1,749

The major part of this category provides for 3,773 Centrex lines and 6,805 telephone instruments at JSC. Also included are 235 telephones at WSTF and local telephone service at Draper Labs, Cambridge, MA.; Grumman, Bethpage, NY; and SAMSO, El Segundo, CA. About 141 local circuits at JSC and three at WSTF for fire alarms, burglar alarms, public address systems, and other specialized uses are also included in this category.

2. Long distance telephone service..... 1,380

This category includes the cost for FTS, commercial toll calls, two dedicated voice circuits between WSTF and Las Cruces, NM, and two teletype circuits between JSC and GSA in Austin, TX.

3. Other communications services..... 173

These funds provide specialized services such as teletype and wire news services. In addition, the operation and maintenance of a closed circuit TV system is provided along with eight radio networks for fire, security, custodial, and other uses.

B. Printing and Reproduction.....	956	997	802	765

Basic printing requirements are handled by maintaining an on-site printing plant operated by JSC personnel. This printing plant produces approximately 59,300,000 units of printing each year. In addition to this on-site printing plant, JSC must also purchase from private firms, through Government Printing Office contracts, about 52,200,000 units each year. This purchased printing is a combination of overflow requirements that cannot be handled on-site and printing which requires greater or different capabilities than those available at the on-site plant. The decreases reflected in the 1981 current estimate and in 1982 estimate are due to the planned reduction in off-site printing.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
C. Transportation	1,204	966	985	1,067

Transportation functions at JSC include administrative aircraft maintenance and lease of trucks from GSA. The 1981 current estimate is higher than the 1981 budget estimate because of increases in truck lease rates from GSA and in aircraft fuel. The 1982 estimate reflects the same level of effort as in 1981, and included anticipated increases in lease and fuel costs.

D. Installation Common Services	7,080	7,376	7,128	8,785

These services support Center management and staff activities, provide medical services, and cover various installation support services. The decrease in the 1981 current estimate from the 1981 budget estimate is primarily due to a reduction of twelve workyears and the deferral of administrative equipment replacement and maintenance until 1982 due to budgetary constraints. The staffing level remains unchanged in 1982, but increases are necessary to cover the deferrals from 1981 and contract rate escalation.

1. Center management and staff functions 38

This category covers patent searches and applications.

2. Medical services 1,720

Two major types of medical service are provided, occupational medicine and environmental health.

a. Occupational medicine 1,314

Occupational medicine consists of the operation of the JSC on-site clinic, emergency assistance at EAFB, providing physicals for JSC personnel at Downey, CA, medical consultation and crew test support.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		

b. Environmental health..... 406

This category includes industrial hygiene, radiological health, and an environmental health laboratory.

3. Installation support services..... 7,027

a. Administrative supplies, materials and equipment..... 3,626

This category includes all supplies, materials and equipment and their lease and maintenance costs that are used to support administrative functions at the Center and at WSTF.

b. Cataloging of supplies and equipment..... 385

This effort is required for identification and cataloging of requests for supplies into the proper Federal Supply Groups, placing orders on the proper Federal Schedule Contracts, maintaining a stores stock catalog, and other related activities.

c. Warehousing and storage..... 1,079

This category includes the operation of a central receiving depot for supplies; a warehousing function, including bonded storage and storage of hazardous materials; and a stock issuance service. A reduction of two workyears from the 1981 budget estimate is included.

d. Postage.. 734

This category covers the payments to the U.S. Postal Service for postage on official mail.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
e. Moving and hauling				578

This effort is required to handle the shipping and packing of supplies and equipment both locally and for long distance movement; the moving and hauling of items within the Center; and the delivery of supplies, materials, and equipment purchased from local suppliers.

f. Forms distribution..... 145

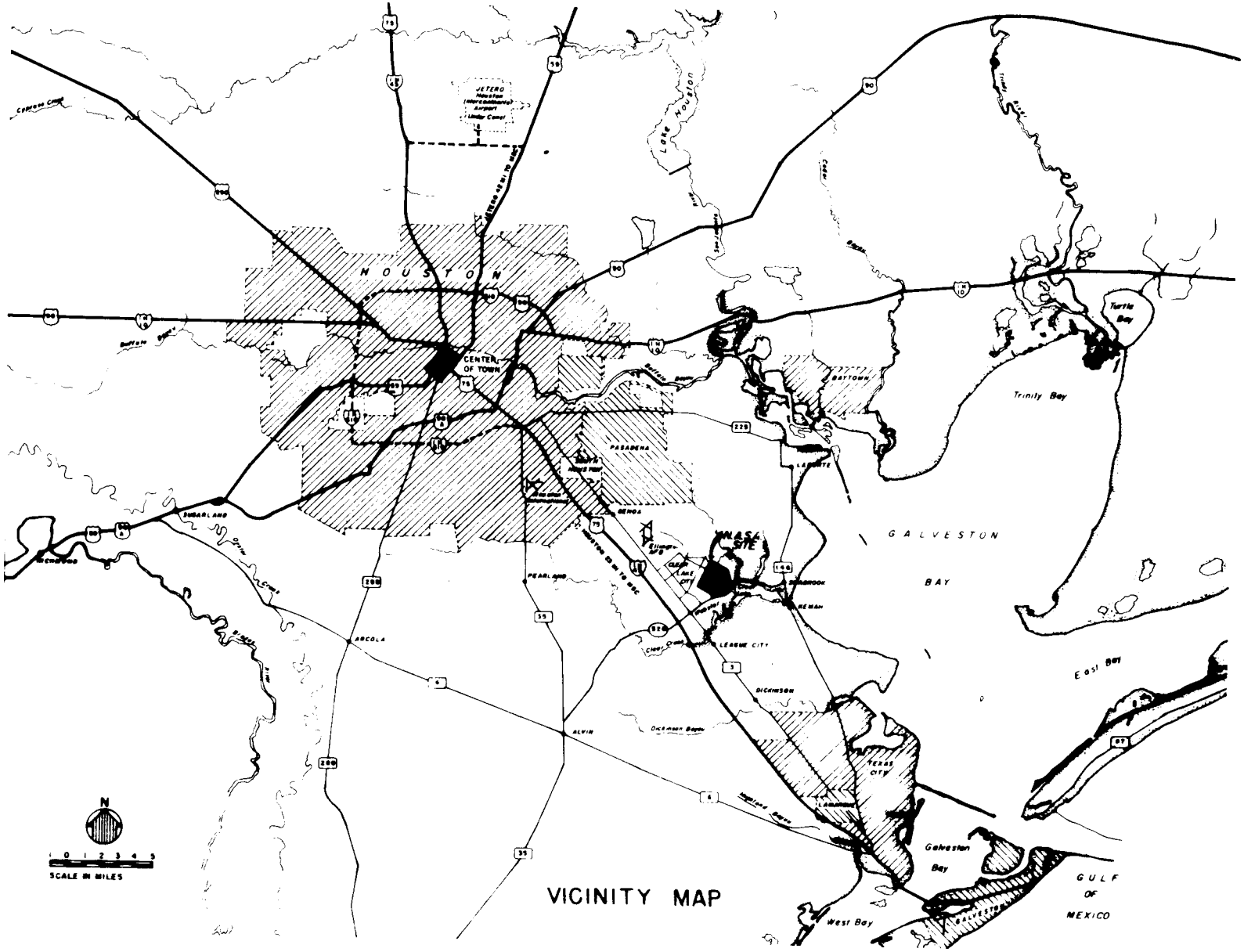
This category covers the support contractor effort required for the distribution of approximately 600,000 forms and publications each year.

g. Administrative support..... 480

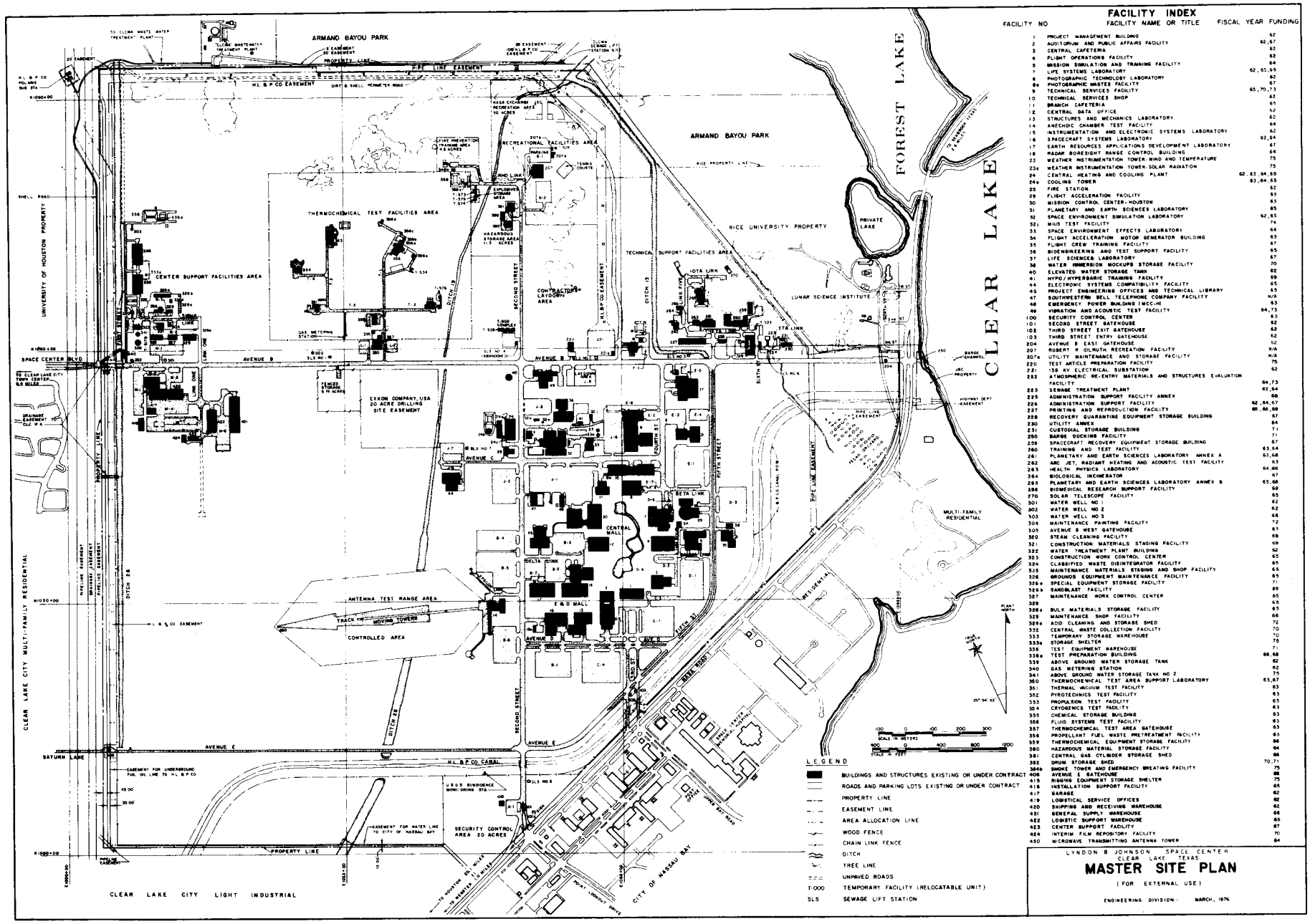
Included herein is the cost of local transportation within the JSC area provided by GSA, the JSC share of operating costs at EAFB, the costs of stenographic services and the costs of torts and claims.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER
HOUSTON, TEXAS

Lyndon B. Johnson Space Center
Houston, Texas 77058



VICINITY MAP



FACILITY INDEX

FACILITY NO	FACILITY NAME OR TITLE	FISCAL YEAR FUNDING
1	PROJECT MANAGEMENT BUILDING	62
2	AUDITORIUM AND PUBLIC AFFAIRS FACILITY	62,67
3	CENTRAL CAFETERIA	62
4	FLIGHT OPERATIONS FACILITY	62
5	MISSION SIMULATION AND TRAINING FACILITY	64
7	LIFE SYSTEMS LABORATORY	62,65,69
8	PHOTOGRAPHIC TECHNOLOGY LABORATORY	62
8a	PHOTOGRAPHIC WASTES FACILITY	67
9	TECHNICAL SERVICES FACILITY	65,70,73
10	TECHNICAL SERVICES SHOP	62
11	BRANCH CAFETERIA	65
12	CENTRAL DATA OFFICE	62
13	STRUCTURES AND MECHANICS LABORATORY	62
14	ANECHOIC CHAMBER TEST FACILITY	64
15	INSTRUMENTATION AND ELECTRONIC SYSTEMS LABORATORY	62
16	SPACECRAFT SYSTEMS LABORATORY	62,64
17	EARTH RESOURCES APPLICATIONS DEVELOPMENT LABORATORY	67
18	RADAR BORESIGHT RANGE CONTROL BUILDING	64
23	WEATHER INSTRUMENTATION TOWER-WIND AND TEMPERATURE	75
23a	WEATHER INSTRUMENTATION TOWER-SOLAR RADIATION	75
24	CENTRAL HEATING AND COOLING PLANT	62,63,64,65
24a	COOLING TOWER	63,64,65
25	FIRE STATION	62
29	FLIGHT ACCELERATION FACILITY	63
30	MISSION CONTROL CENTER-HOUSTON	63
31	PLANETARY AND EARTH SCIENCES LABORATORY	65
32	SPACE ENVIRONMENT SIMULATION LABORATORY	62,65
32a	MMS TEST FACILITY	74
33	SPACE ENVIRONMENT EFFECTS LABORATORY	64
34	FLIGHT ACCELERATION MOTOR GENERATOR BUILDING	63
35	FLIGHT CREW TRAINING FACILITY	67
36	BIOENGINEERING AND TEST SUPPORT FACILITY	65
37	LIFE SCIENCES LABORATORY	67
38	WATER IMMERSION MOCKUPS STORAGE FACILITY	70
40	ELEVATED WATER STORAGE TANK	62
41	HYPO/HYPERBARIC TRAINING FACILITY	69
44	ELECTRONIC SYSTEMS COMPATIBILITY FACILITY	65
45	PROJECT ENGINEERING OFFICES AND TECHNICAL LIBRARY	65
47	SOUTHWESTERN BELL TELEPHONE COMPANY FACILITY	N/A
48	EMERGENCY POWER BUILDING (MCC-H)	63
49	VIBRATION AND ACOUSTIC TEST FACILITY	64,73
100	SECURITY CONTROL CENTER	63
101	SECOND STREET GATEHOUSE	62
102	THIRD STREET EXIT GATEHOUSE	62
103	THIRD STREET ENTRY GATEHOUSE	62
204	AVENUE B EAST GATEHOUSE	62
207	ROBERT R GILRUTH RECREATION FACILITY	N/A
207a	UTILITY MAINTENANCE AND STORAGE FACILITY	N/A
220	TEST ARTICLE PREPARATION FACILITY	75
221	138 KV ELECTRICAL SUBSTATION	62
222	ATMOSPHERIC RE-ENTRY MATERIALS AND STRUCTURES EVALUATION FACILITY	64,73
223	SEWAGE TREATMENT PLANT	62,64
225	ADMINISTRATION SUPPORT FACILITY ANNEX	68
226	ADMINISTRATION SUPPORT FACILITY	62,64,67
227	PRINTING AND REPRODUCTION FACILITY	65,66,69
228	RECOVERY QUARANTINE EQUIPMENT STORAGE BUILDING	67
230	UTILITY ANNEX	64
231	CUSTODIAL STORAGE BUILDING	71
250	BARGE DOCKING FACILITY	71
259	SPACECRAFT RECOVERY EQUIPMENT STORAGE BUILDING	67
260	TRAINING AND TEST FACILITY	63,64
261	PLANETARY AND EARTH SCIENCES LABORATORY ANNEX A	63,68
262	ARC JET, RADIANT HEATING AND ACOUSTIC TEST FACILITY	63
263	HEALTH PHYSICS LABORATORY	64,66
264	BIOLOGICAL INCINERATOR	67
265	PLANETARY AND EARTH SCIENCES LABORATORY ANNEX B	65,68
268	BIOMEDICAL RESEARCH SUPPORT FACILITY	69
270	SOLAR TELESCOPE FACILITY	65
301	WATER WELL NO 1	62
302	WATER WELL NO 2	62
303	WATER WELL NO 3	68
304	MAINTENANCE PAINTING FACILITY	72
305	AVENUE B WEST GATEHOUSE	63
320	STEAM CLEANING FACILITY	68
321	CONSTRUCTION MATERIALS STAGING FACILITY	69
322	WATER TREATMENT PLANT BUILDING	62
323	CONSTRUCTION WORK CONTROL CENTER	65
324	CLASSIFIED WASTE DISINTEGRATOR FACILITY	65
325	MAINTENANCE MATERIALS STAGING AND SHOP FACILITY	65
326	GROUNDS EQUIPMENT MAINTENANCE FACILITY	65
326a	SPECIAL EQUIPMENT STORAGE FACILITY	71
326b	SANDBLAST FACILITY	69
327	MAINTENANCE WORK CONTROL CENTER	65
328		65
328a	BULK MATERIALS STORAGE FACILITY	65
329	MAINTENANCE SHOP FACILITY	66
329a	ACID CLEANING AND STORAGE SHED	72
332	CENTRAL WASTE COLLECTION FACILITY	70
333	TEMPORARY STORAGE WAREHOUSE	70
333a	STORAGE SHELTER	75
338	TEST EQUIPMENT WAREHOUSE	71
338a	TEST PREPARATION BUILDING	66,68
339	ABOVE GROUND WATER STORAGE TANK	62
340	GAS METERING STATION	62
341	ABOVE GROUND WATER STORAGE TANK NO 2	75
350	THERMOCHEMICAL TEST AREA SUPPORT LABORATORY	63,67
351	THERMAL VACUUM TEST FACILITY	63
352	PYROTECHNICS TEST FACILITY	63
353	PROPULSION TEST FACILITY	63
354	CRYOGENICS TEST FACILITY	63
355	CHEMICAL STORAGE BUILDING	63
356	FLUID SYSTEMS TEST FACILITY	63
357	THERMOCHEMICAL TEST AREA GATEHOUSE	63
358	PROPELLANT FUEL WASTE PRETREATMENT FACILITY	63
359	THERMOCHEMICAL EQUIPMENT STORAGE FACILITY	66
360	HAZARDOUS MATERIAL STORAGE FACILITY	64
361	CENTRAL GAS CYLINDER STORAGE SHED	66
362	OHUM STORAGE SHED	70,71
364b	SMOKE TOWER AND EMERGENCY BREATHING FACILITY	75
408	AVENUE E GATEHOUSE	68
415	RIGGING EQUIPMENT STORAGE SHELTER	75
418	INSTALLATION SUPPORT FACILITY	65
417	BARGE	62
419	LOGISTICAL SERVICE OFFICES	62
420	SHIPPING AND RECEIVING WAREHOUSE	62
421	GENERAL SUPPLY WAREHOUSE	64
422	LOGISTIC SUPPORT WAREHOUSE	65
423	CENTER SUPPORT FACILITY	67
424	INTERIM FILM REPOSITORY FACILITY	70
450	MICROWAVE TRANSMITTING ANTENNA TOWER	64

LEGEND

- BUILDINGS AND STRUCTURES EXISTING OR UNDER CONTRACT
- ROADS AND PARKING LOTS EXISTING OR UNDER CONTRACT
- PROPERTY LINE
- EASEMENT LINE
- AREA ALLOCATION LINE
- WOOD FENCE
- CHAIN LINK FENCE
- DITCH
- TREE LINE
- UNPAVED ROADS
- T-000 TEMPORARY FACILITY (RELOCATABLE UNIT)
- SLS SEWAGE LIFT STATION

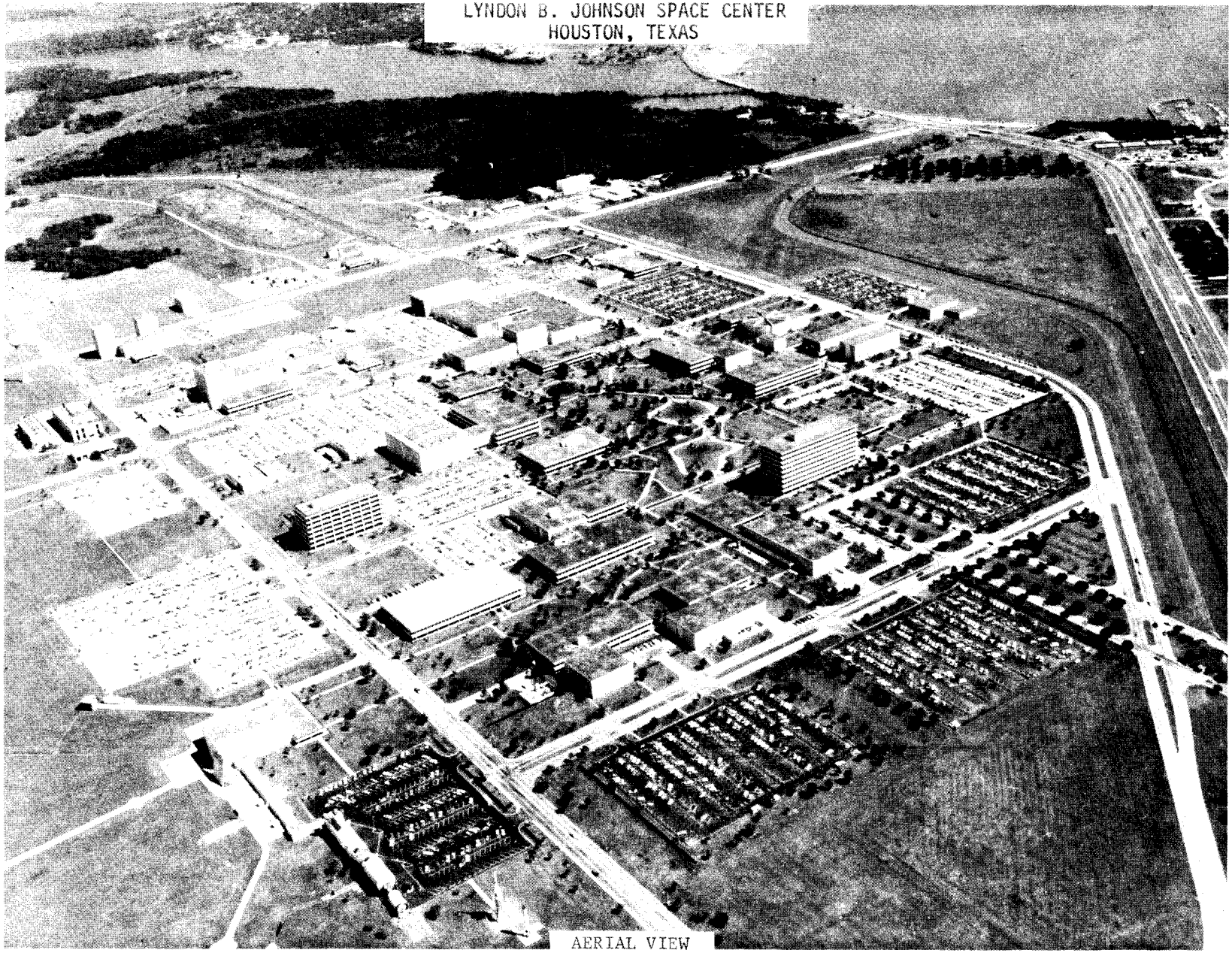
LYNDON B JOHNSON SPACE CENTER
CLEAR LAKE TEXAS

MASTER SITE PLAN

(FOR EXTERNAL USE)

ENGINEERING DIVISION - MARCH, 1976

RPM 1-32



AERIAL VIEW

KENNEDY
SPACE CENTER

JOHN F. KENNEDY SPACE CENTER

DESCRIPTION

The John F. Kennedy Space Center (KSC) is located approximately 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).

Expendable launch vehicle operations are conducted at both the Air Force's Eastern Space and Missile Center, Florida and the Western Space and Missile Center at Vandenberg Air Force Base, California, which is located six miles west of Lompoc, California. Space Shuttle flights begin at KSC in 1981 and at Vandenberg in 1984.

The NASA capital investment at the Kennedy Space Center and Vandenberg Air Force Base, including fixed assets in progress and contractor-held facilities, as of September 30, 1980, was $1,834,573,000.

CENTER ROLES AND MISSIONS

The Kennedy Space 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. This site was chosen because of its unique geographical characteristics, climate, local growth capability, accessibility, and availability. The Center has since grown to become the major free world launch site with a unique civil service staff of unparalleled expertise in the field of 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 are:

Space Transportation System (STS) Ground Operations - includes Space Shuttle launch preparation, launch, recovery and refurbishment, Spacelab and Spacelab payloads ground processing, upper stages ground processing, and operation and maintenance of ground support equipment.

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

SUMMARY OF RESOURCES REQUIREMENTS

Funding Plan By Function

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
	(Thousands of Dollars)			
I. Personnel and Related Costs	73,581	76,554	82,496	84,491
II. Travel	1,800	2,255	2,070	2,985
III. Facilities Services	33,431	34,198	43,200	48,156
IV. Technical Services	7,387	7,611	8,418	8,888
V. Management and Operations	16,990	20,767	15,900	18,440
1981 Budget Amendment	---	-2,153	---	---
Total, fund requirements	133,189	139,232	152,084	162,960

Distribution of Permanent Positions by Program

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
Direct Positions				
Space Transportation Systems and Operations	1,604	1,614	1,615	1,621
Space shuttle	1,227	1,217	1,215	1,198
Space flight operations	240	254	259	355
Expendable launch vehicles	137	143	141	68

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
Space Science	8	8	8	2
Physics and astronomy	6	6	6	---
Life sciences	2	2	2	2
Space and Terrestrial Applications	8	8	8	8
Space applications	6	6	6	6
Technology utilization	2	2	2	2
Aeronautics and Space Technology	1	---	---	---
Energy technology	1	---	---	---
Subtotal, direct positions	1,621	1,630	1,631	1,631
Center Management and Operations Support Positions	570	571	570	570
Total, permanent positions	2,191	2,201	2,201	2,201

F	DESCRIPTION	Permanent Positions (Civil Service)
SPACE SHUTTLE		1,198

The KSC has been assigned the Launch and Landing Project of the Space Shuttle program. Major roles for the accomplishment of this responsibility include launch systems development and Space Transportation Systems (STS) ground operations. In the performance of these roles, 1982 will represent a period of continuing activity at KSC in preparation for a fully operational Shuttle. Orbiter 102 will be used for the first manned orbital flight in 1981, and preparations will be in progress for two additional orbital test flights and the first operational flight in 1982.

Construction of new launch support facilities and modification of most existing facilities will be complete, and the installation and checkout of support equipment in preparation for scheduled flights will be well under way. Major facilities involved are:

Shuttle Landing Facility (SLF)

The installation and checkout of operational systems will be completed, and the ground support equipment previously installed will support Shuttle landings after the fourth orbital flight test.

Orbiter Processing Facility (OPF)

Integration and checkout of all ground support systems in the Low Bay Annex and High Bay 2 will continue in preparation for arrival of the second orbiter at KSC in 1982.

Vehicle Assembly Building (VAB)

Modification of support systems and equipment will continue in preparation for the Solid Rocket Boosters and External Tanks as well as full Shuttle integrated operations. Installation and checkout of support equipment in High Bays 1 and 2 will commence in 1982.

Launch Pad B

Construction activity for preparation of Pad B for operational Shuttle will continue. Installation and checkout of support equipment will begin in 1982.

Mobile Launch Platforms (MLP)

Support equipment installation and checkout of MLP 2 will be completed in 1982. MLP 3 is scheduled for construction in FY 1983.

	Permanent Positions (Civil Service)
SPACE FLIGHT OPERATIONS.....	355

The conduct of the space flight operations program at KSC includes Spacelab, Inertial Upper Stages, Payload support and multimission support that may be assigned to a particular flight.

The Center's role in the Spacelab program is similar to that of the Shuttle, that is, KSC is responsible for launch site development and ground operations. With delivery of the Spacelab engineering model in 1980 and Spacelab flight equipment in 1981, KSC will undertake the responsibiliy for verifying the Spacelab flight and ground systems and ensuring that the experiments that are to be mounted on or in the Spacelab are compatible with the Spacelab, with each other, and with safety requirements. The first Spacelab flight unit will be delivered in 1981 for preparation for the first flight in 1983.

The upper stages currently consist of the Inertial Upper Stage (IUS) and the Spinning Solid Upper Stage (SSUS). The IUS and **SSUS** are expendable, propulsive stages intended for use in the deployment of Shuttle transported payloads to high energy orbits not attainable by the Shuttle alone.

The IUS is being developed by the Air Force, and delivery of the first flight unit is expected in 1982. KSC will be responsible for mating the spacecraft to the IUS. Design review of the IUS integration activities will continue with the first flight scheduled for late 1982.

Under current plans the **SSUS** will be developed, checked out and mated to a payload by the **SSUS** commercial developer. KSC will have responsibility for integration of the SSUS and its payload and then into the Shuttle payload bay.

KSC will provide facilities and support to the various payload developers and experimenters during processing at KSC. Thus, KSC, in concert with other **NASA** organizations, must analyze potential payload requirements, identify payload facility capability at KSC, and prepare documentation for potential payload users. Based on experience gained during the Expendable Launch Vehicle program, KSC will monitor the 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.

In addition to the activity involving major facilities, KSC will continue the design, acquisition, and installation of equipment to be used in support of the Shuttle. This includes not only that equipment provided by KSC contractors, but also that to be supplied by the development contractors as part of their flight vehicle contract. KSC will also continue the refurbishment of selected existing support equipment for reuse on the Shuttle program.

A unique category of support equipment is the Launch Processing System (LPS). This automated checkout system, conceived and developed by KSC, is a major innovation in the checkout and launch of sophisticated space vehicles. This system will provide automated checkout capability for the Shuttle vehicle, along with engineering data for operations and management decisions, and will support the test and checkout of development and operational flights.

Another major role for KSC in the Shuttle program, in addition to ground systems development, is that of ground operations. This includes the test and checkout of each flight element as it arrives at KSC for development flight testing, the integration of the several elements (Orbiter, External Tank, Solid Rocket Booster) into the Shuttle vehicle and integrated testing of the stacked configuration, propellant loading, and launch. Subsequent to landing, the Orbiter will be refurbished by KSC in preparation for the next mission. Also included is retrieval, disassembly, and refurbishment of the expended solid rocket boosters. Since the initial orbital flight test launches will land at Dryden Flight Research Center (DFRC), provisions will be made for ferrying the Orbiter back to KSC for maintenance and launch. The first landing will occur in 1982.

	Permanent Positions (Civil Service)
EXPENDABLE LAUNCH VEHICLES	68

The Center is responsible for the launch preparation, checkout and launch of the current inventory of expendable launch vehicles. This includes the Atlas Centaur and Delta. Launches at both the Eastern Test Range and Vandenberg Air Force Base are the responsibility of KSC. Eleven launches are scheduled for 1982.

LIFE SCIENCES	2

In 1982, KSC will continue its support role in the definition, development, and integration of biomedical experiments into Shuttle payloads 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 life sciences payloads. These experiments are designed to use the environment of space to accomplish medical and biological research for benefit of man through technological advancement of the state of the art.

SPACE APPLICATIONS	6

In the field of applications, KSC will continue in 1982 with Earth observation surveys involving environmental monitoring and in developing methods of sensing and predicting weather and climatic conditions. In the area of specialized application tasks, KSC will be performing studies related to requirements, procedures, and techniques of processing space applications payloads for Spacelab.

	Permanent Positions (Civil Service)
TECHNOLOGY UTILIZATION	2

The objectives of the Technology Utilization program at KSC are to encourage the use of and to expedite the application of new NASA technology in other sectors, and to impart a better understanding of the technology transfer process and its potential impacts.

CENTER MANAGEMENT AND OPERATIONS SUPPORT	570

Center Management and Operations Support is defined as the support or services being provided to all Kennedy Space Center 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 the immediate staff, e.g., Legal, Patent Counsel, Equal Opportunity, Public Affairs (includes operation of the Visitors Information Center and its related NASA tours activitity), and Safety.

Management Support - Includes a wide range of activity categorized as management support for programs and functional organizations for the entire Center. Specific functions include program control, contracting and procurement, and property management.

Operations Support - This is a broad spectrum of activity that is required to maintain and operate facilities, buildings, and equipment and to provide the normal housekeeping services and logistics support for the personnel who manage and conduct the affairs of the Center. Specific activities are:

Maintenance and operation of all buildings and facilities
Data processing and computer support

RESOURCE REQUIREMENTS BY FUNCTION

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
	(Thousands of Dollars)			
I. PERSONNEL AND RELATED COSTS	**73,581**	**76,554**	**82,496**	**84,491**
Summary of Fund Requirements				
A. Compensation and Benefits				
1. Compensation				
a. Permanent positions	64,192	67,780	69,105	71,846
b. Other than full-time permanent positions	1,321	956	1,624	1,724
c. Reimbursable details	70	35	39	---
d. Overtime and other compensation	913	712	3,548	2,295
Subtotal, Compensation	66,496	69,483	74,316	75,865
2. Benefits	6,243	6,521	7,038	7,327
Subtotal, Compensation and Benefits	72,739	76,004	81,354	83,192
B. Supporting Costs				
1. Transfer of personnel	566	255	875	1,006
2. Personnel training	276	295	267	293
Subtotal, Supporting Costs	842	550	1,142	1,299
Total, Personnel and Related Costs	73,581	76,554	82,496	84,491

Explanation of Fund Requirements

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
A. Compensation and Benefits	72,739	76,004	81,354	83,192
1. Compensation	66,496	69,483	74,316	75,865
a. Permanent Positions	64,192	67,780	69,105	71,846

The funds will support 2,201 permanent positions in 1981 and 1982. The funding increases in both years are due primarily to the October 1980 pay increase.

Basis of Cost for Permanent Positions

In 1982, the cost of permanent positions will be $71,846,000, an increase of $2,741,000 from 1981. The increase results from the following:

Cost of permanent positions in 1981		69,105
Cost increases in 1982		+3,379
Within grade and career advances:		
Full year effect of 1981 actions	+1,791	
Partial year effect of 1982 actions	+1,195	
Full year effect of 1981 pay increases	+61	
Change in reimbursable activity	+332	
Cost decreases in 1982		-638
Turnover savings and abolished positions:		
Full year effect of 1981 actions	-383	
Partial year effect of 1982 actions	-255	
Cost of permanent positions in 1982		71,846

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
b. Other than full-time permanent positions				
1. cost	1,321	956	1,624	1,724
2. Workyears	119	119	140	148

The FY 1982 estimate includes 148 workyears which will support the following programs:

Distribution of Other than Full-Time Permanent Workyears

Program	Workyears
Cooperative training	64
Summer employment	30
Opportunity programs	26
Other temporary employment	28
Total	148

The increase in workyears from the 1981 budget estimate to the 1981 current estimate reflects increased emphasis on youth opportunity programs and other temporary employment. The increase in the 1982 estimate is reflected in continued scheduled build-up of youth and opportunity programs as well as increased emphasis on temporary employment.

c. Reimbursable detailees	70	35	39	---

Provides funding for the services of a software applications officer in support of the Space Shuttle program. The increase from the 1981 budget estimate to the 1981 current estimate reflects the October 1980 pay increase and continuation of Department of Defense Shuttle requirements through the First Manned Orbital Flight (FMOF). These services will not be required in FY 1982.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
d. Overtime and other compensation.....	913	712	3,548	2,295

The funding increase from the 1981 budget estimate to the 1981 current estimate is due to the delay in the scheduled launch date for FMOF. This estimate provides additional workhours for the critical scheduling of Shuttle preparation efforts. The decrease in 1982 .reflects the lower requirement for overtime work following the initial orbital flight test in 1981.

2. Benefits.....	6,243	6,521	7,038	7,327

Following are the amounts of contribution by category:

Civil Service Retirement Fund.....	4,553	4,728	5,220	5,372
Employee life insurance.....	189	266	200	230
Employee health insurance.....	1,212	1,211	1,225	1,299
Workmen's compensation.	170	290	290	322
FICA.....	19	26	23	24
Other benefits.....	100	---	80	80
Total.....	6,243	6,521	7,038	7,327

The increase from the 1981 budget estimate to the 1981 current estimate is due primarily to the effect of the October 1980 pay increase. The increase in 1982 is due to increased Workmen's compensation and anticipated increases in health insurance costs. The Workmen's compensation for 1981 and 1982 reflect estimates based on Department of Labor billings.

B. Supporting Costs.....	842	550	1,142	1,299
1. Transfer of personnel.....	566	255	875	1,006

Provides for continuing recruitment and transfer of personnel essential to KSC's Space Transportation Systems missions. The 1'982 estimate provides for an increased number of relocations as well as four overseas moves.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
2. Personnel training	276	295	267	293

These funds provide the means to maintain proficiency in various skills, provide necessary training for those employees with technological expertise to keep abreast of the state of the art in their respective fields, and meet career development and upward mobility needs. The increase in the 1982 estimate from the 1981 current estimate reflects rising tuition costs.

II.	**TRAVEL**	**1.800**	**2,255**	**2,070**	**2,985**
	Summary of Fund Requirements				
A.	Program Travel	845	1,177	992	1,415
B.	Scientific and Technical Development Travel	13	12	12	17
C.	Management and Operations Travel	942	1,066	1,066	1,553
	Total, Travel	1,800	2,255	2,070	2,985
	Explanation of Fund Requirements				
A.	Program Travel	845	1,177	992	1,415

Program Travel is directly related to the accomplishment of KSC's mission and accounts for approximately 47 percent of the Center's travel budget. Program travel reflects the Center's involvement in the design, manufacturing, and testing of Shuttle ground system equipment, design and construction of facilities, and the activation of systems manufacutred at off-site locations. During 1981, effort will be directed toward a satisfactory orbital flight test. Travel to Dryden Flight Research Center, the landing site of the orbital flight tests, will be required. The Spacelab Engineering Model has been delivered to

KSC, and the first flight unit is scheduled to arrive in mid-1981. Support of this schedule requires significant travel to Europe to participate with the European Space Agency (ESA) in combined procedures development and to run subsystem and system tests on the engineering model. However, increased costs and a constrained budget in 1981 will result in fewer trips. The 1982 budget restores the number of trips to the 1980 level to provide adequate travel to support these orbital flight tests, support continuing systems testing on the engineering model of Spacelab and the tests that will be performed on the flight unit.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
B. Scientific and Technical Development Travel	13	12	12	17

Scientific and technical development travel permits employees to participate in meetings and technical seminars with other representatives of the aerospace community. This participation allows them to benefit from exposure to technological advances outside KSC, 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 1982 budget includes anticipated increases in air fares and per diem costs.

C. Management and Operations Travel	942	1,066	1,066	1,553

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 increase in 1982 is required to cover the increased costs of local transportation associated with the larger number of launches plus landings of the Shuttle anticipated in 1982.

III. FACILITIES SERVICES	***33,431***	***34,198***	***43,200***	***48,156***

KSC is located on 139,305 acres and has a complex of facilities which are made up of test and office buildings, as well as launch operations facilities. This complex encompasses 5,573,438 gross square feet of building space, including 13 major buildings. *Also* included are 14 major technical facilities, most of which are utilized on more than one shift. This plant supports an average daily on-Center population of approximately 13,000 people. A substantial increase in services is required in 1981 and 1982 to meet the needs of increasing Shuttle support activities and on-site population. The budget estimate also reflects the needs of KSC's component installation on Vandenberg Air Force Base (VAFB).

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
Summary of Fund Requirements				
A. Rental of Real Property	---	140	23	23
B. Maintenance and Related Services	8,135	8,549	9,097	11,084
1. Facilities	7,827	7,884	8,554	10,489
2. Equipment	308	665	543	595
C. Custodial Services	13,978	14,494	19,007	20,175
D. Utility Services	11,318	11,015	15,073	16,874
Total, Facilities Services	33,431	34,198	43,200	48,156

Explanation of Fund Requirements

A. Rental of Real Property	---	140	23	23

This provides for the rental of off-site facilities for news and reception center activities associated with Shuttle launches and other major public events. The decrease from the 1981 budget estimate to the 1981 current estimate reflects decreased rental of off-site facilities.

B. Maintenance and Related Services	8,135	8,549	9,097	11,084
1. Facilities	7,827	7,884	8,554	10,489

This activity involves the operation and maintenance of institutional facilities at KSC, Cape Canaveral Air Force Station (CCAFS), and VAFB. The size, complexity, and wide geographical dispersion of these facilities place heavy demands on facilities services. The increase from the 1981 budget estimate to

the 1981 current estimate reflects an increase of eleven contractor workyears required to support the three shift/seven days per week level of operations required to support the Shuttle launch schedule and contractor rate increases partially offset by the deferral of maintenance activities into 1982 due to budget constraints. In 1982 the budget increase covers contractor rate increases and maintenance activities deferred from 1981 in addition to maintenance activities already planned for 1982.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
a. Maintenance and operation of facilities				6,139

This activity includes, in addition to the normal activities associated with facility maintenance, management of direct maintenance personnel, the responsibilities for space utilization, utility rate studies and analysis, as well as corrosion control and cathodic protection activities. In addition, there are minor facility related services for items such as internal moves of personnel and related plant rearrangements.

b. Grounds maintenance 1,351

This involves the provision of grounds maintenance and related supplies and equipment as well as reimbursement to the Air Force for the maintenance of NASA grounds and roadways at CCAFS.

c. Facilities design engineering 988

This effort involves inspecting, siting, and other engineering functions associated with institutional facilities.

d. Supplies and facilities equipment 616

These funds provide for building materials, hardware, metals, plumbing supplies, electrical materials, and general maintenance and operating materials.

e. Routine facilities work 1,395

Minor construction, repair, and alteration projects are included in this category.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
2. Equipment.....	308	665	543	595

This funding provides for support contractor effort and related supplies and equipment to maintain and repair heavy equipment items. The increase from 1980 to the 1981 current estimate is due to replacement equipment for high cost maintenance items. The decrease from the 1981 budget estimate to the 1981 current estimate is due to a shift in contractor workyears to facilities and maintenance. The 1982 increase is due to contractor rate escalation.

C. Custodial Services.....	13,978	14,494	19,007	20,175

This category provides funding for security, fire protection, janitorial, and related services. The major part of these services is provided by two support contractors. The demand for these services has been heavy and will continue to increase as the Shuttle program continues to accelerate. The increase from the 1981 budget estimate to the 1981 current estimate reflects the impact of three shifts/seven days per week operations, Center-wide, to support launches and landings of the Shuttle through 1982. An increase of 102 workyears is reflected in the 1981 current estimate. The increase in 1982 is primarily contractor rate escalation with five additional workyears added to support the Shuttle flight programs.

1. Janitorial services..... 3,886

This activity provides janitorial services to approximately two million square feet of KSC floor areas, including highly specialized services to cleanroom areas and Orbiter support equipment.

2. Fire protection services..... 4,054

This activity will provide for fire protection service for KSC property and personnel, including:

a. Support of increasing hazardous tests and operations and Shuttle Orbiter landings.
b. Performing fire drills and fire inspections of facilities and equipment.
c. Providing fire protection instructions.
d. Fighting fires.

This estimate reflects the full activation of both KSC fire stations for Shuttle operations.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
3. Security services				9,679

This activity includes the protection of personnel and property at KSC and involves:

a. Support of increasing hazardous tests and operations.
b. Badging of all on-site personnel and official visitors.
c. Safeguarding flight hardware and other items of high intrinsic value arriving for Orbiter flight test
d. Protecting classified information.
e. Maintaining area surveillance and traffic control.

4. Other related activities 2,556

These activities are as follows:

a. Janitorial services and security services performed on NASA facilities at CCAFS for which the Air Force is reimbursed.
b. Pest control services for KSC which involve five workyears of support contractor effort.
c. Laundry services at both KSC and VAFB.
d. Provision of supplies and equipment related to custodial services.
e. Development and installation of an electronic security system for the protection of Shuttle property and operations.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
D. Utilities Services	11,318	11,015	15,073	16,874

The major utility service at KSC 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 at CCAFS. Water services are purchased from the City of Cocoa and sewage treatment is accomplished on-site. At VAFB, utility services are purchased through the Air Force. Utility plant operations and maintenance and utility distribution systems maintenance are provided by a support contractor and by the Air Force at CCAFS.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		

Purchased utility costs are as follows:

1.	Electricity (199,900 KWH)	10,509
2.	Fuel oil (2,112 K gallons)	2,301
3.	Steam (64,100 lbs.)	288
4.	Water and sewage	148
5.	VAFB - all utilities	170

The increase from the 1981 budget estimate to the 1981 current estimate is the impact of three shift/seven days per week operations to support the launches of the Shuttle and higher than originally planned utility rates. The 1982 increase is due to increased utility and contractor rates.

		1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
IV.	**TECHNICAL SERVICES**	**7,387**	**7,611**	**8,418**	**8,888**
	Summary of Fund Requirements				
A.	Automatic Data Processing	4,573	4,466	5,056	5,106
1.	Equipment	1,088	878	1,250	1,367
2.	Operations	3,485	3,588	3,806	3,739
B.	Scientific and Technical Information	2,165	2,560	2,755	3,121
1.	Library	463	404	465	506
2.	Education and Information	1,702	2,156	2,290	2,615
C.	Shop Support and Services	649	585	607	661
	Total, Technical Services	7,387	7,611	8,418	8,888

Explanation of Fund Requirements

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
	(Thousands of Dollars)			
A. Automatic Data Processing	4,573	4,466	5,056	5,106

These funds provide for the cost of general management ADP programs including the lease, purchase and maintenance of ADP equipment and programming and operations services.

1. Equipment	1,088	878	1,250	1,367

This funding provides for the maintenance and lease of KSC's Honeywell 635 and supporting equipment. The increase in the 1981 current estimate from the 1981 budget estimate is due primarily to the lease of IBM 4341 peripherals to initiate upgrading the Center's institutional computer support to Shuttle operations. The increase in 1982 reflects lease rate escalation.

2. Operations	3,485	3,588	3,806	3,739

A support contractor provides programming and operations services for payroll, general accounting, supply reports, procurement, contract reports, technical support information retrieval, preventive maintenance reports of vehicles components and ground support equipment, contract surveillance reports, personnel status reports, security reports, and resources and financial management reports. The increase in the 1981 current estimate from the 1981 budget estimate reflects an accelerated effort to complete the new financial management system involving 17 additional contractor workyears. The 1982 decrease is due to wage increases, offset by a reduction of thirteen workyears as programming of the financial management system nears completion.

B. Scientific and Technical Information	2,165	2,560	2,755	3,121

This funding provides for operation of a technical library at KSC and for various technical and administrative documentation services throughout the Center, including support to Public Affairs' educational and information program.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
	(Thousands of Dollars)			
1. Library.....	463	404	465	506

A support contractor operates the KSC library facilities. In addition to the usual library services, the contractor also operates a Shuttle/Spacelab documents repository which catalogs, classifies, and indexes documents for storage and retrieval and provides document reference and distribution services. Costs in this category also include the acquisition of technical reports and literature in hard copy and microfiche; scientific, technical, and management books and periodicals; military, federal, and professional society specifications and standards; as well as supplies and equipment used by the contractor. The increase from the 1981 budget estimate to the 1981 current estimate is due to contract rate escalation and supplies costing more than originally planned. In 1982, the increase is due to contract rate escalation and the purchase of supplies and equipment deferred in 1981 due to budgetary constraints.

2. Education and information.....	1,702	2,156	2,290	2,615

The funding in this category provides for a support contract which covers the preparation of publications pertaining to the receipt, checkout, and launch of space vehicles, Space Shuttle/Spacelab activities, design engineering functions, and institutional support. Subject matter covers facility modifications, booster recovery, earth resources, future programs, launch processing, vehicle tests, checkout operations, safety procedures, materials analysis, radiological control, and contingency plans.

Public Affairs support provides for the gathering and dissemination of 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. It also includes photographic support at Vandenberg Air Force Base, which is primarily for public affairs activities.

The increase from the 1981 budget estimate to the 1981 current esimate reflects higher contractor rate escalation than planned. The increase in 1982 is contractor rate escalation and continuing support to launches and initial landings at KSC.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
C. Shop Support and Services	649	585	607	661

These funds provide for a support contractor to perform technical support services, such as exercising coordinative control support activities to assure a constant state of readiness to support test/launch operations. It includes disaster and hurricane planning performed on a Center-wide basis through coordination with the KSC Emergency Preparedness Officer and training of all KSC personnel engaged in hazardous occupations. The increase in 1982 is due to contractor rate escalation.

V. MANAGEMENT AND OPERATIONS	**16,990**	**20,767**	**15,900**	**18,440**
Summary of Fund Requirements				
A. Administrative Communications	2,750	2,617	1,768	2,014
B. Printing and Reproduction	4,878	5,002	3,254	3,830
C. Transportation	2,116	4,141	2,404	2,914
D. Installation Common Services	7,246	9,007	8,474	9,682
Total, Management and Operations	16,990	20,767	15,900	18,440
Explanation of Fund Requirements				
A. Administrative Communications	2,750	2,617	1,768	2,014

These funds provide for the costs of local telephone service, Federal Telecommunications System (FTS) long distance tolls, and teletype services in support of civil service and institutional contractor personnel located at KSC, CCAFS, and VAFB. The decrease from the 1981 budget estimate to the 1981 current estimate reflects a realignment of funding to contracts to more accurately reflect the impact of STS operations. The increase in 1982 in due to rate escalation anticipated in purchased services.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
1. Local telephone service				1,316

This category provides local telephone service for civil service and institutional contractors and includes the administrative telephone switchboard, single line telephones for special areas, telephones acoustically coupled for data transmission, and local exchange lines for adjacent county locations.

2. Long distance telephone service				676

NASA contractors and other institutions which conduct official business with KSC are widely dispersed throughout the United. States. KSC utilizes FTS and other leased lines to minimize costs. Service is provided to authorized users, including institutional on-site contractors. Paid long distance and GSA leased lines are in this category.

3. Other communications				22

These funds provide specialized services such as teletype and wire news services. In addition, the lease and maintenance of various small electrical/electronic systems such as printers which support major communications systems are included.

B. Printing and Reproduction	4,878	5,002	3,254	3,830

This category includes printing and reproduction services for KSC's institutional population, civil service and contractor. A support contractor provides the major part of the printing effort, while copier service is provided through several smaller contracts. The decrease from the 1981 budget to the 1981 current estimate reflects a realignment'of costs to contracts to more accurately reflect the impact of Shuttle operations. The 1982 increase is due to contractor rate escalation, escalation in the cost of printing supplies, and continuing increased demand for copier service.

1. Technical and administrative printing				3,095

Technical printing includes printing of a wide variety of technical materials, microfilming, duplicating, photostating, blue printing, and other photographic reproductions. Administrative printing

includes the KSC house organ and long lead time items such as forms production. Services are also performed by other government agencies, such as Patrick Air Force Base, Vandenberg Air Force Base, and commercial printing firms under contract to the Government Printing Office (GPO).

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
2. Copier service				735

This provides for office copier service to the institutional population, civil service and contractor. Copiers are located in central service centers and individual offices where workload justifies assignment. This arrangement has proven to be an economical way of providing the service.

C. Transportation	2,116	4,141	2,404	2,914

The costs of a centralized motor pool, operated by GSA, for civil service personnel are covered by this category. Also included are the movement of supplies and equipment by commercial carrier, the operation of heavy moving equipment and aircraft, and related supplies and materials. The 1981 budget estimate is high because it included the cost of R&D contractor use of heavy moving equipment and light trucks. Starting in 1980, these costs were incorporated into the user contracts to more accurately reflect benefiting programs. The 1982 increase is primarily due to increased fuel costs in this fuel intensive category, along with contractor rate escalation.

1. Truck rental					133

This category provides cargo type vehicles for use by civil service personnel.

2. Common carrier and related services					2,188

A support contractor performs transportation management functions, which include coordination, check, inspection, document control of all shipments, and delivery of in-bound shipments. The balance of this requirement is supplies used by the support contractor; minor contracts for off-site packing and crating services; maintenance and repair, landing fees, and supplies and equipment associated with the administrative aircraft.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
3. Heavy equipment				593

A support contractor operates KSC-owned heavy equipment such as tractors, cranes, trailers, and trucks. Supplies used by the support contractor are included.

D. Installation Common Services	7,246	9,007	8,474	9,682

These funds provide for logistics services, mail and distribution services, medical services, Center management and staff activities, and a wide variety of minor contracts for special and one-time services. The decrease from the 1981 budget estimate to the 1981 current estimate results from the deferral of supplies and equipment purchases. The 1982 increase is due to contractor rate escalation and the purchase of supplies and equipment deferred in 1981.

1. Center management and staff functions	256

This category includes tort claims, notary public fees, court reporting costs, patent counsel representation, and equal opportunity activities.

2. Medical services	3,153

Two major types of medical services are provided, occupational medicine and environmental health. Occupational medicine includes emergency and first aid care for the KSC workforce, guests, and tour visitors; health maintenance and counseling for civil service employees; and a variety of physical examinations and special programs for health maintenance, applied research, and job certification for civil service and contractor personnel. The contractor has been charged with insuring Occupational Safety and Health Administration standards compliance for all KSC elements. The medical program operates on a three-shift basis to provide emergency and ambulance services and special standby service in support of hazardous tests and operations. This category also covers supplies and equipment used by the contractor and a minor contract at VAFB, primarily for physical examinations.

Environmental health includes industrial hygiene, radiological health, and environmental sanitation. This includes water supply and distribution, sewage treatment and disposal, treatment and disposal of industrial wastes, solid waste management and disposal, selection and use of pesticides, and the surveillance of operations producing atmospheric, water, or soil pollution.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
3. Installation support services...				6,273
a. Supply services				4,157

This support contractor effort provides a broad range of logistics services including receipt, storage, and issue of supplies and equipment, as well as maintaining various supply management systems.

b. Mail				1,166

Mail and distribution services, provided by support contract, include distribution of inter-office mail, classified document control, and operation of the KSC branch post office. Postage costs are included in this category.

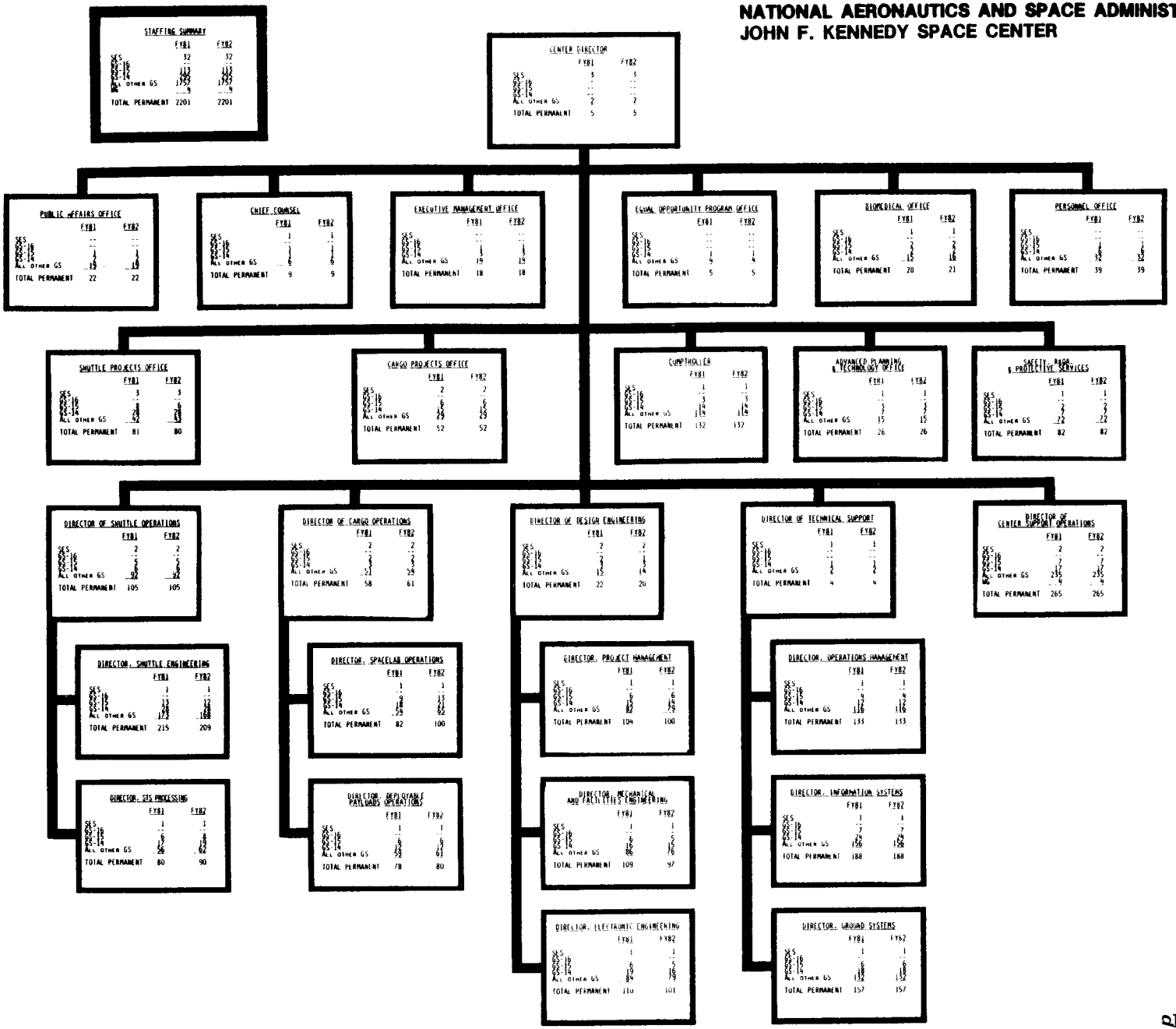
c. Office supplies.....				392

As an economy measure, KSC provides common support to the on-site institutional population, civil service and contractor. This category includes a wide variety of office supplies and materials.

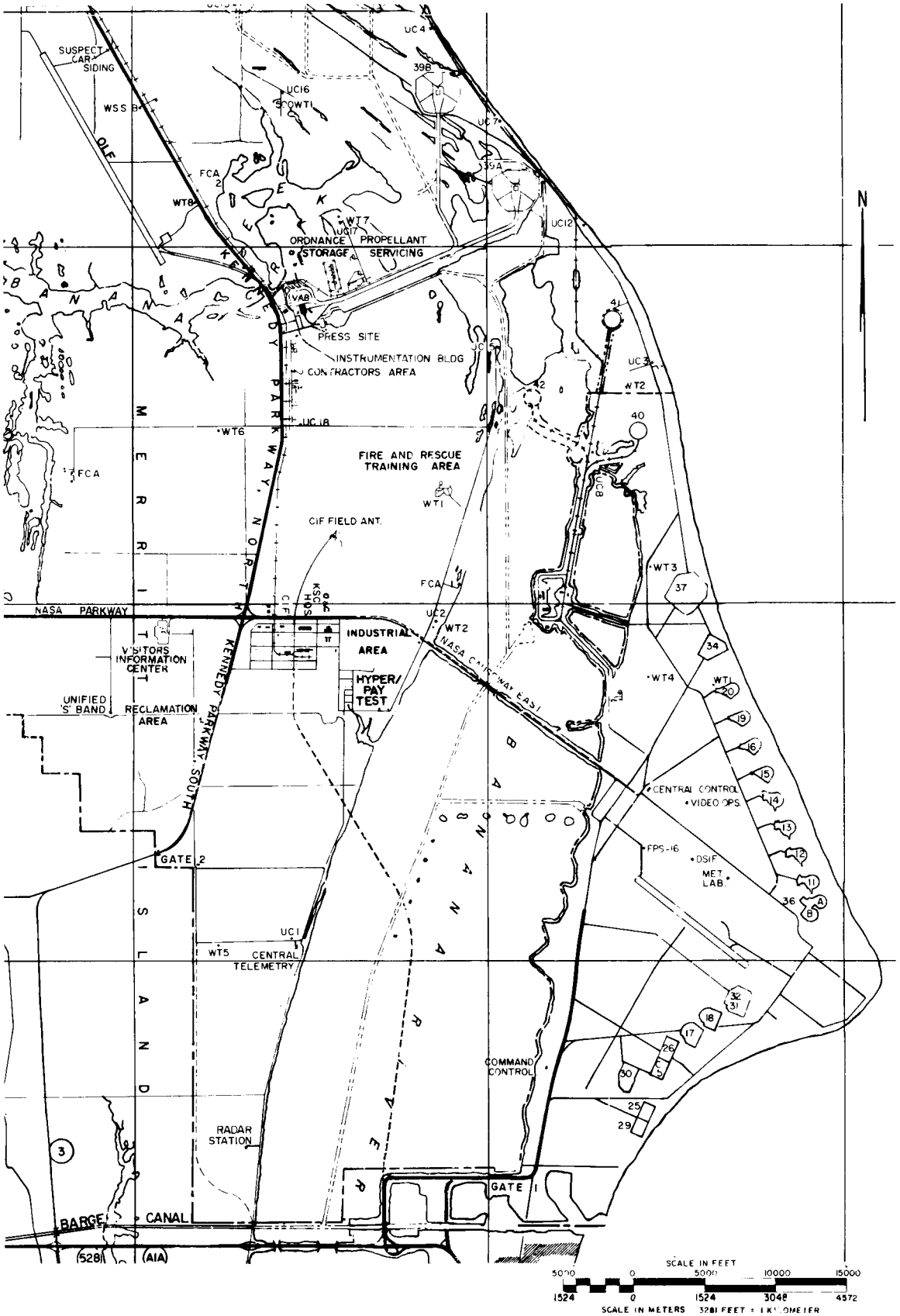
d. Administrative equipment.....				558

This category covers lease, maintenance, and purchase of administrative equipment. Rentals are primarily for special purpose office equipment more economical to lease than purchase. Maintenance is provided for all Government-owned administrative equipment in active service. Purchases are largely replacements of office machines such as typewriters and calculators.

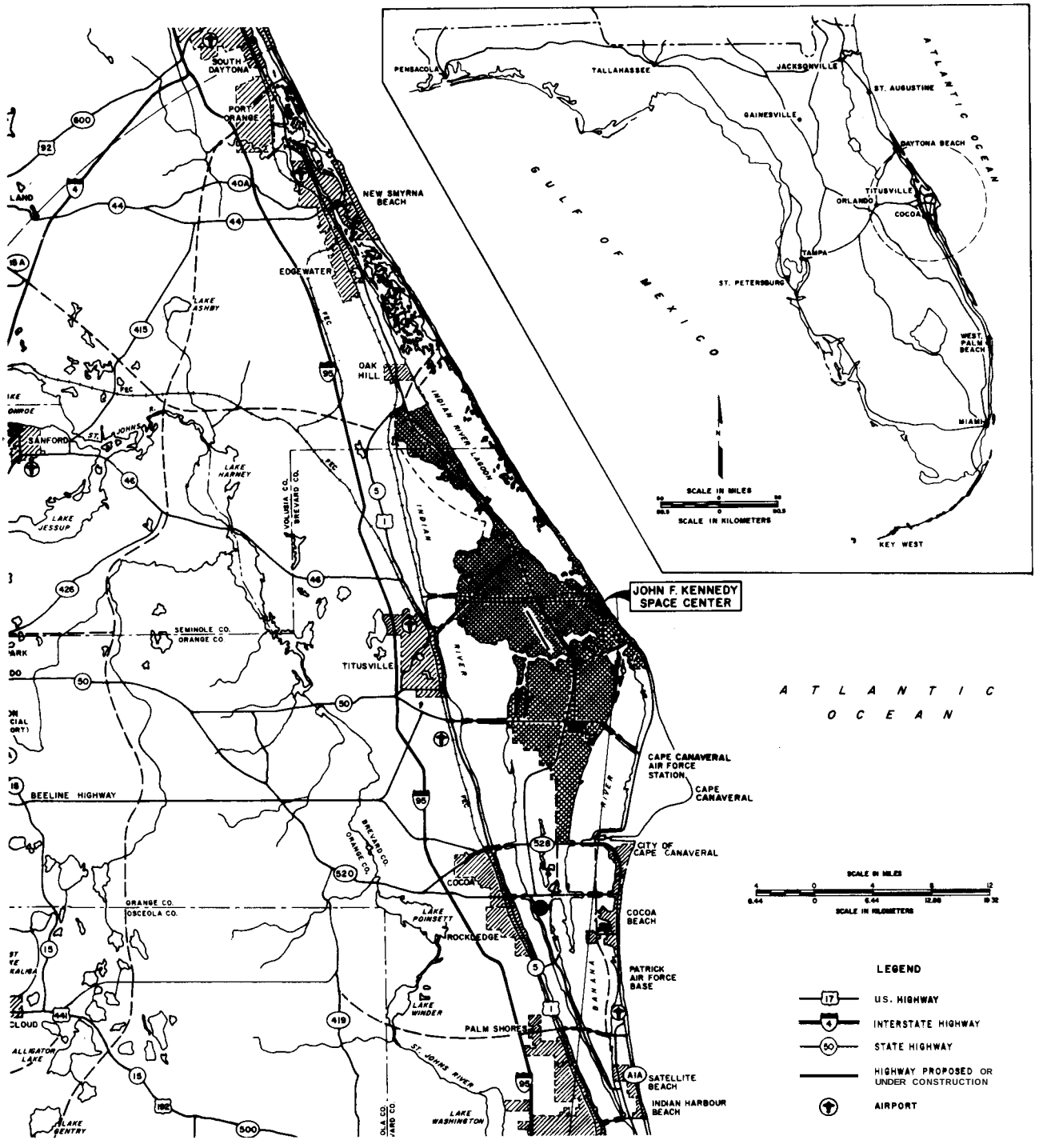
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
JOHN F. KENNEDY SPACE CENTER



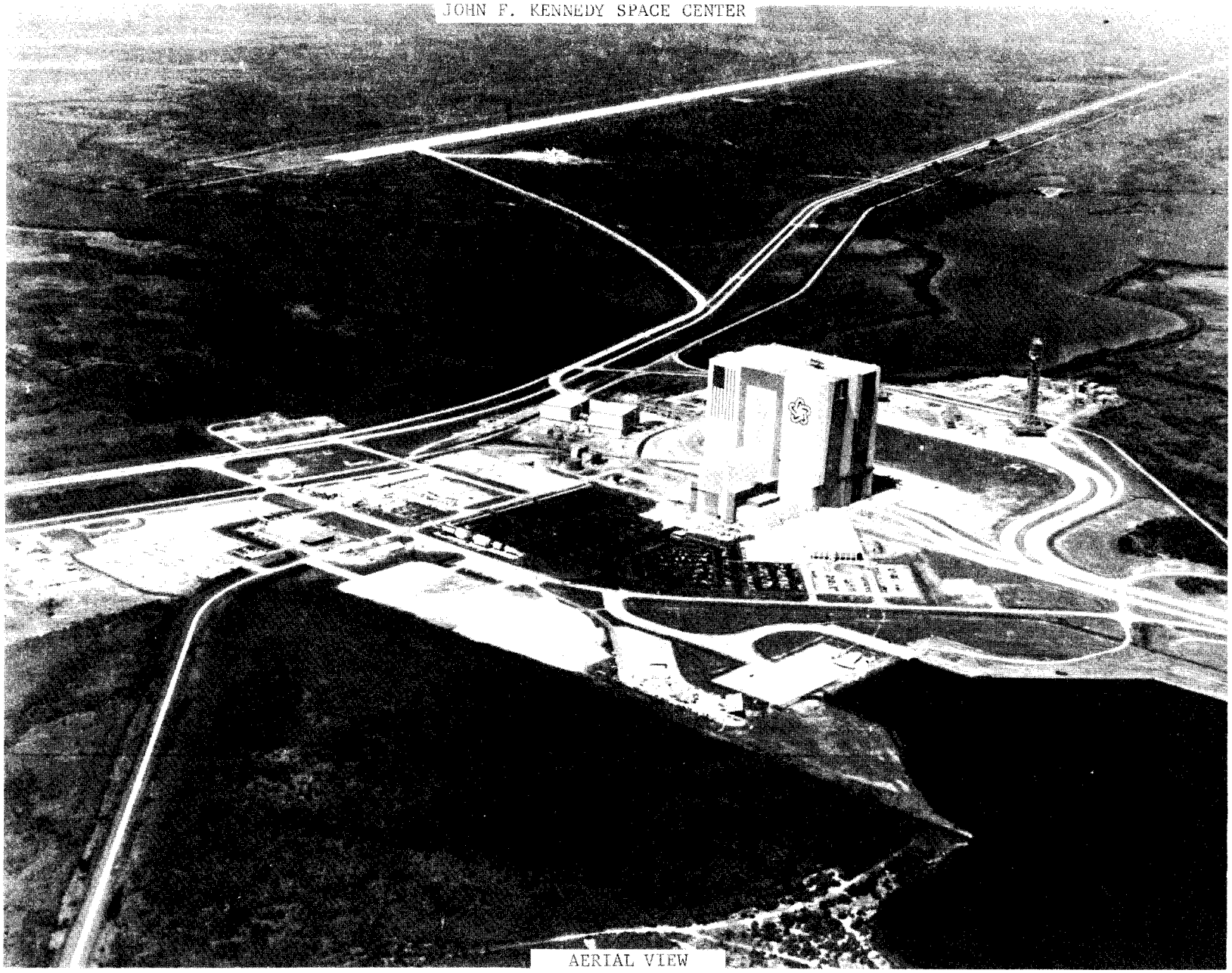
JOHN F. KENNEDY SPACE CENTER, NASA
FISCAL YEAR 1982 ESTIMATES
LOCATION PLAN



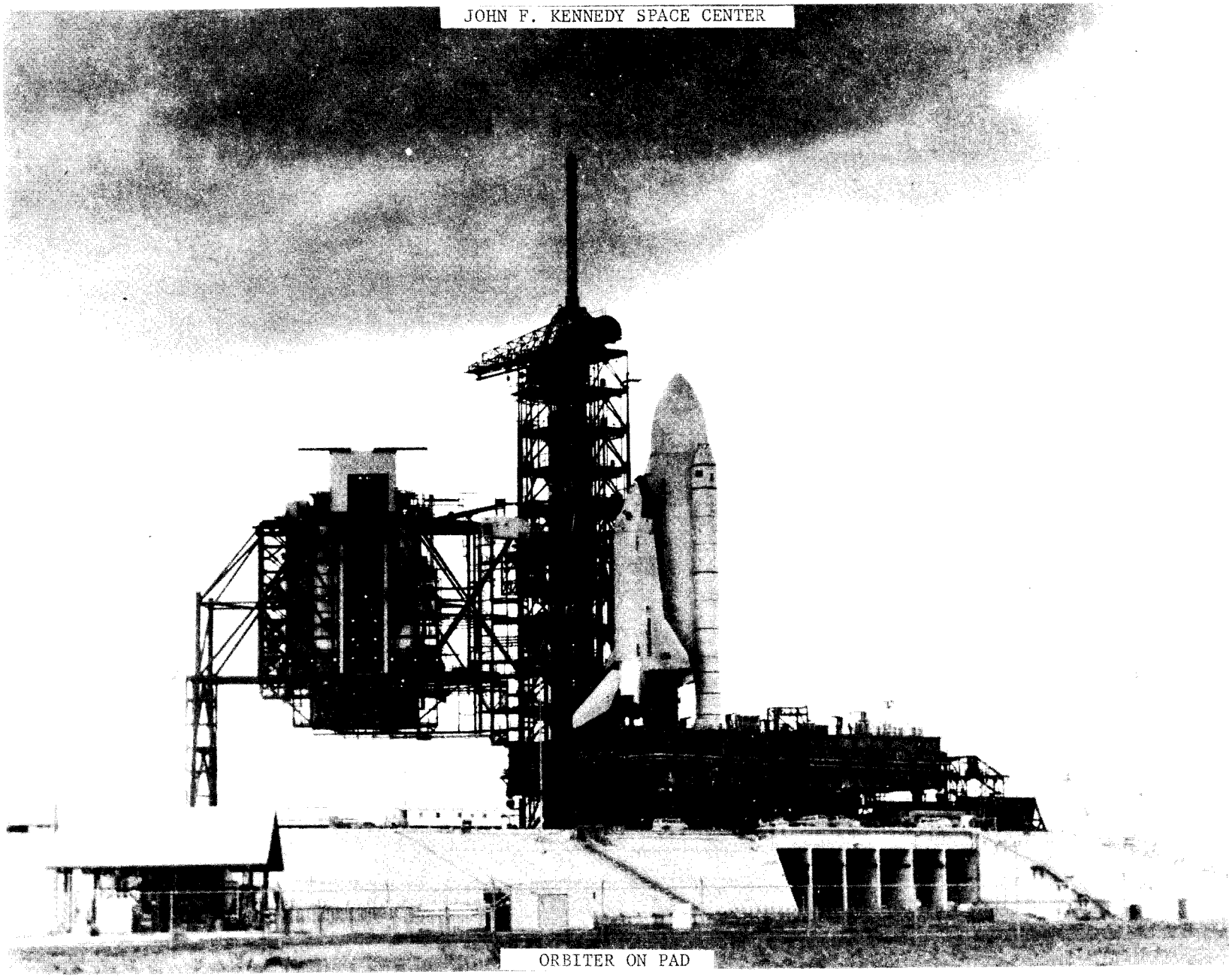
JOHN F. KENNEDY SPACE CENTER, NASA
FISCAL YEAR 1982 ESTIMATES
AREA MAP



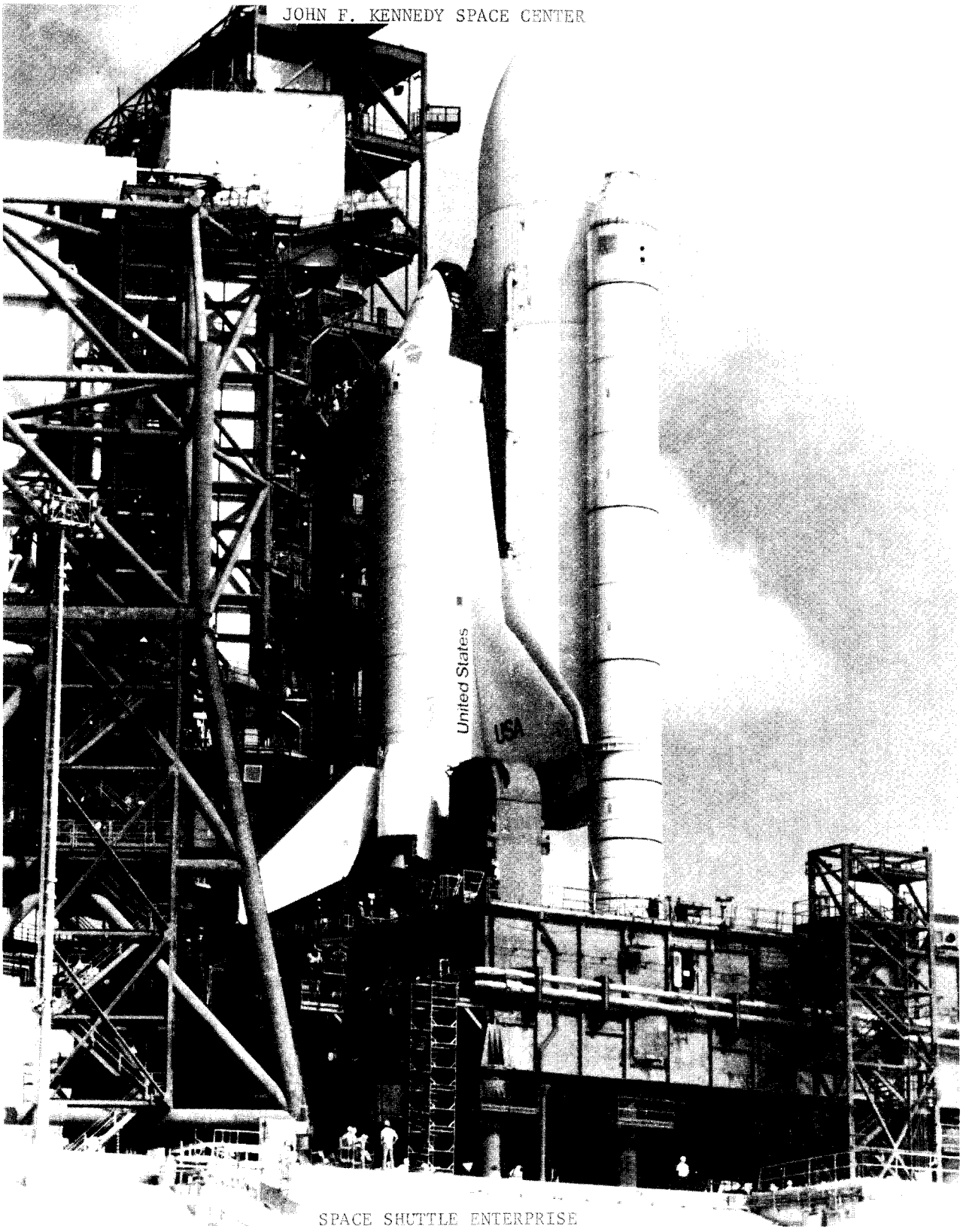
JOHN F. KENNEDY SPACE CENTER



AERIAL VIEW

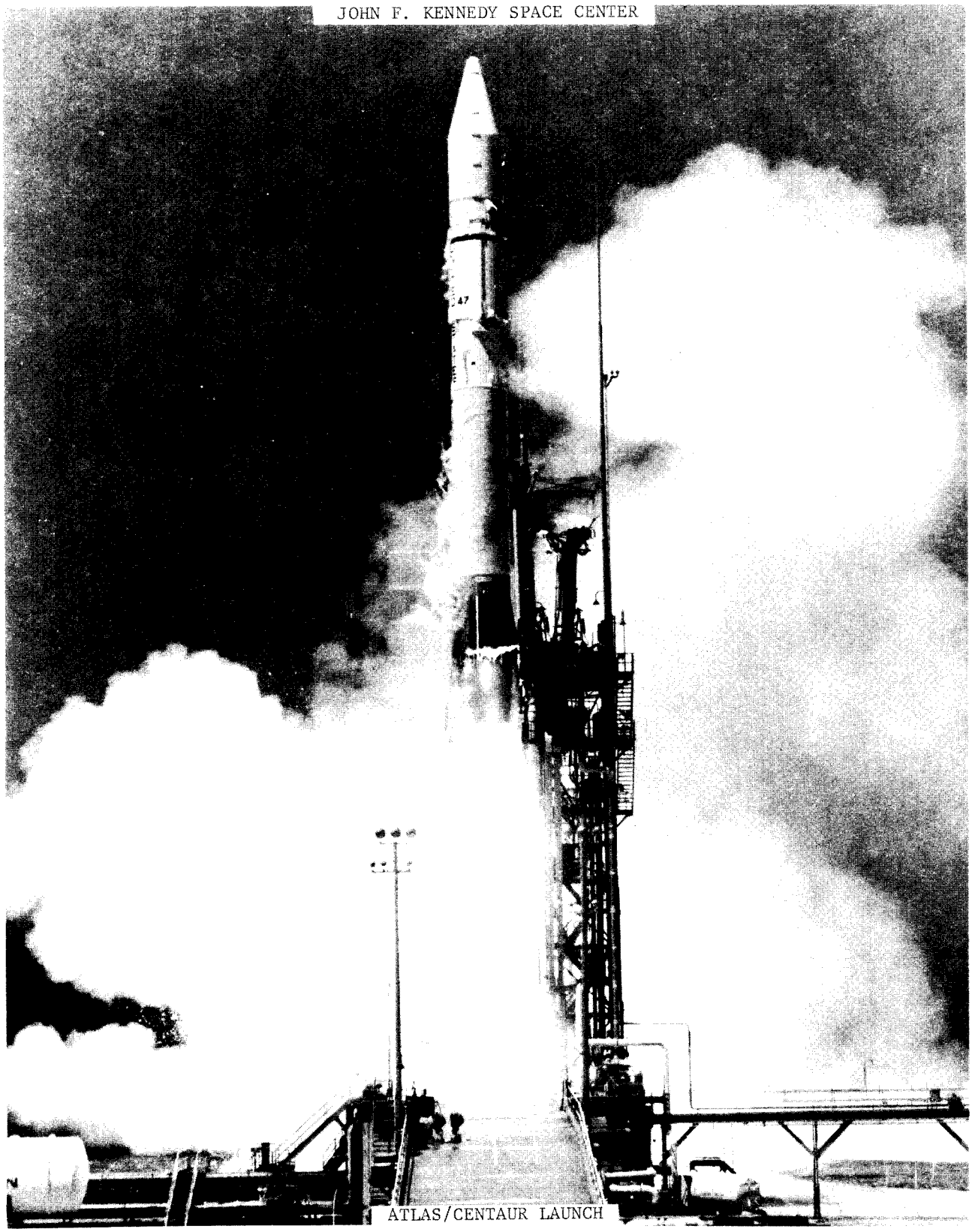

JOHN F. KENNEDY SPACE CENTER
ORBITER ON PAD

JOHN F. KENNEDY SPACE CENTER



SPACE SHUTTLE ENTERPRISE

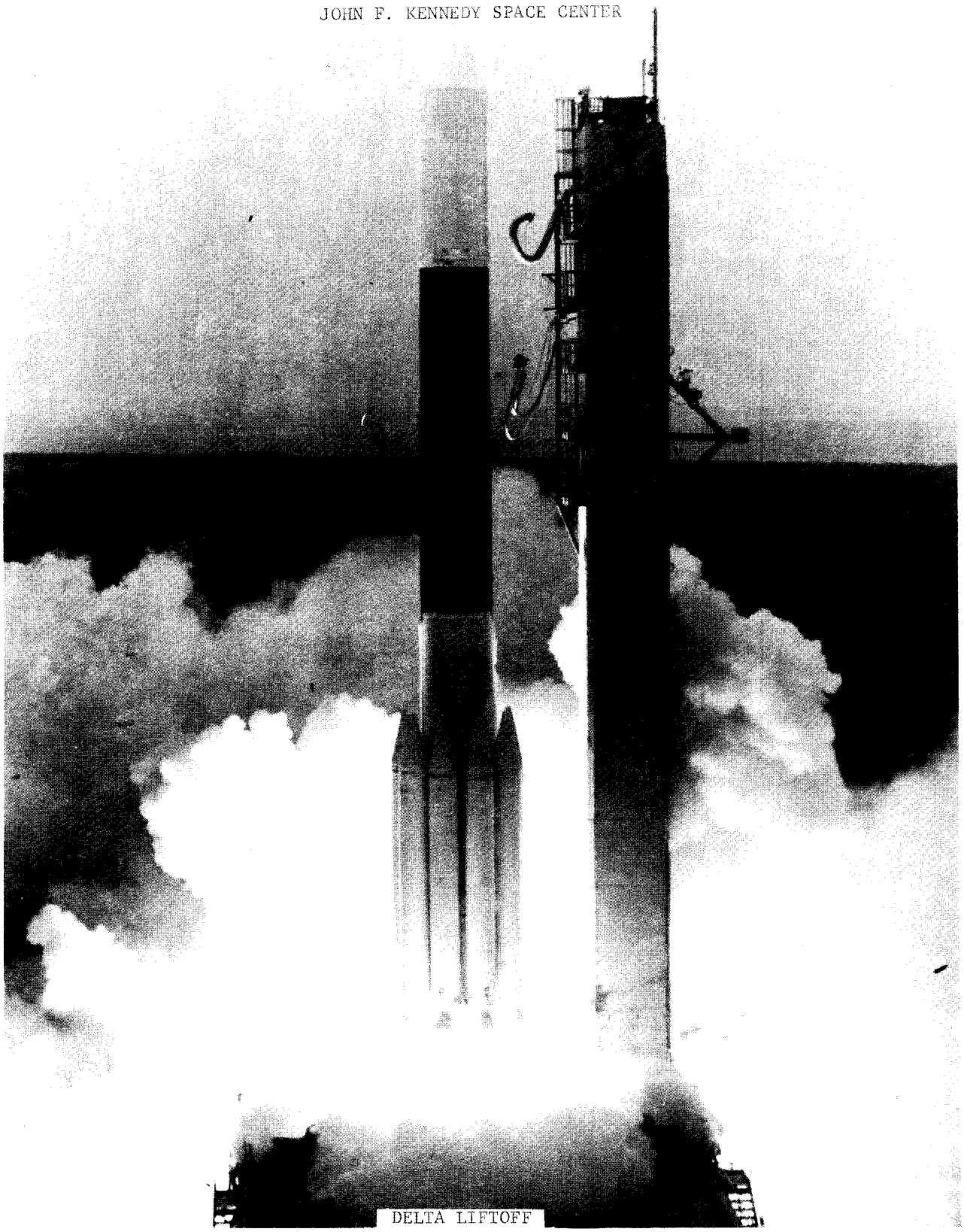
JOHN F. KENNEDY SPACE CENTER



ATLAS/CENTAUR LAUNCH

JOHN F. KENNEDY SPACE CENTER

RPM 2-33



DELTA LIFTOFF

INDUSTRIAL AREA

MARSHALL SPACE
FLIGHT CENTER

RESEARCH AND PROGRAM MANAGEMENT

FISCAL YEAR 1982 ESTIMATES

GEORGE C. MARSHALL SPACE FLIGHT CENTER

DESCRIPTION

Operations at the 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 nonrevocable use permit from the Army. Certain facilities such as the Redstone Arsenal Air Field and some utilities are used jointly by NASA and 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 fifteen miles east of New Orleans, Louisiana, is where the External Tank for the Space Shuttle is being produced and where activities for other Federal agencies are conducted. The Michoud Facility occupies 832 acres and provides 3,557,352 gross square feet of space, including the main assembly plant which has an area of 43 acres under one roof. 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, twenty miles northeast of the Michoud Assembly Facility, occupies fourteen acres and provides centralized computer services for MSFC, Michoud, the National Space Technology Laboratories, other NASA Centers, and associated contractors, as well as other Government agencies as designated.

A number of the individual facilities at MSFC and its component installations are unique within NASA, the Nation, and the rest of the free world. The combined capability of the science and engineering laboratories, special development facilities, and test facilities, provide a unique National resource for the designing, developing, and testing of 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 was $778,539,000 as of September 30, 1980.

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 a principal role within NASA for rocket propulsion systems; the design and development of manned vehicle systems; Spacelab mission management and payload definition; design and development of large, complex, and specialized automated spacecraft; and management of space processing activities. MSFC has a primary role within NASA for the development and processing of science and applications experiments and the conduct of energy-related system studies. 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 engineering, materials processing in space, power systems, guidance and control, fundamental electronics, 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 for the Spacelab program. The principal and supporting roles are:

PRINCIPAL

Propulsion Systems - design, development and procurement of major propulsion-oriented systems and subsystems. Current focus is on space transportation systems, including Space Shuttle main engine, solid rocket booster, external tank, and inertial upper stage in cooperation with the Air Force. Advanced program effort includes the solar electric propulsion systems, the heavy lift launch vehicle, and the orbital transfer vehicle.

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

Spacelab - focus is on systems engineering management, development interface with European Space Agency and procurement.

Advanced Studies - focus is on orbital systems and advanced transportation systems.

Advanced Development - technology advances focused on the advanced missions identified above.

Space Transportation System (STS) Sustaining Engineering - provide sustaining engineering for STS hardware.

Spacelab Mission Management and Payload Definition - management of Spacelab missions 1, 2, and 3, and definition and development of combinations of payloads, facilities, experiments and instruments for missions as assigned.

Specialized Automated Spacecraft - design and development of large, complex and/or specialized automated spacecraft as assigned. Current focus is on spacecraft systems and experiment integration for Space Telescope and spacecraft studies of the Advanced X-Ray Astrophysics Facility and the Gravity Probe B.

Space Power Systems - free-flying as attached to other spacecraft or as docked to the Shuttle orbiter, providing power, communications, stabilization, and supporting services.

Space Processing - developing space processing discipline base, enlisting user interest in potential applications, and developing and managing space processing experiments.

SUPPORTING

Space Vehicle Structures and Materials - contributing to the development of large, complex space structures vehicle and materials technology base.

Energy Technology - conducting energy-related system studies for reimbursable activity with primary focus on solar and fossil fuel energy applications technology.

Satellite Power System - conducting definition study activities.

Space 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

		1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)			
I.	Personnel and Related Costs	124,572	127,967	132,366	133,256
II.	Travel	2,621	2,982	2,956	3,698
III.	Facilities Services	12,716	12,881	14,634	16,273
IV.	Technical Services	6,507	6,687	6,104	6,832
V.	Management and Operations	9,477	9,860	9,059	11,091
	1981 Budget Amendment	---	-2,073	---	---
	Total Fund Requirements	155,893	158,304	165,119	171,150

Distribution of Permanent Positions by Program

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
Direct Positions				
Space Transportation Systems and Operations.....	1,838	1,878	1,809	1,849
Space shuttle.....	1,322	985	1,180	784
Space flight operations.....	516	893	629	1,065
Space Science.....	594	451	613	548
Physics and astronomy.....	594	451	613	548
Space and Terrestrial Applications.....	255	328	276	307
Space applications.....	244	317	265	296
Technology utilization.....	11	11	11	11
Aeronautics and Space Technology.....	290	310	284	278
Aeronautical research and technology.....	11	7	11	11
Space research and technology.....	135	119	137	142
Energy technology.....	144	184	136	125
Subtotal, direct positions.....	2,977	2,967	2,982	2,982
Center Management and Operations Support Positions...	584	594	579	579
Total, permanent positions	3,561	3,561	3,561	3,561

PROGRAM DESCRIPTION

	Permanent Positions (Civil Service)
SPACE SHUTTLE	784

The major MSFC Shuttle element assignments consist of: (1) the Space Shuttle Main Engine (SSME); (2) the Solid Rocket Booster (SRB); *(3)* the External Tank (ET); (4) planning, preparation and conduct of major Shuttle systems tests; and (5) Shuttle system level analysis, test and integration tasks such as: ascent control and stability analysis; flight predictions; structural dynamic analysis and modeling; systems safety and risk analysis; and test, checkout and launch criteria requirements.

The first and second manned orbital flights are scheduled in 1981 with two additional OFT flights scheduled during FY 1982. Significant effort will be required to provide flight hardware and to evaluate hardware and system performance for these early flights in preparation for the first operations flight (STS-5) in late FY 1982.

Some current test activities that will continue in 1982 are: (1) main engine system level testing at the National Space Technology Laboratories (NSTL) and at the Santa Susana Facility to provide Full Power Level (FPL) certification in 1982 to demonstrate the engine flight life; (2) the SSME Control Simulation Laboratory in the Systems Dynamic Laboratory will continue in operation to assist in-flight planning to investigate system failure modes and anomalies which may occur during OFT; and *(3)* the Main Propulsion Test (MPT) Program at NSTL will continue into the third quarter of FY 1982 with the Shuttle Main Propulsion System tests at 109%Rated Power Levels (RPL) and to provide through the test facility/capability backup support to resolve any problems which may occur during OFT. SRB refurbishment design and procedures will be verified during OFT to assure meeting the design reuse goals. The external tank weight reduction activities will continue through 1982. Refinements in design will be pursued to reduce cost per flight, reduce weight, improve producibility, and improve overall Shuttle system performance. Continuing efforts in configuration management, interface control, documentation, logistics, and ground operations will require significant effort in 1982. Support will be provided to the Air Force for activation of the Western Test Range.

SPACE FLIGHT OPERATIONS	1,065

The Space Flight Operations program includes Space Transportation System Operations, Spacelab, Space Transportation System Operation Capability Development, Test and Mission Support, and Advanced Programs. The STS Operations Capability Development activity includes two major areas of effort: STS Upper Stages and Performance Augmentation.

STS Operations

The Shuttle Operations phase is the major element of Space Flight Operations and starts with flight five (STS-5) scheduled for launch in late FY 1982. During 1982, the activities will include the production and acquisition of hardware for operational flights. Typical functions will be production engineering, manufacturing, sustaining engineering, anomaly resolution, logistics and contract monitoring. Additional effort will be required to increase manufacturing/tooling capacity to provide production rate capability to support the current Shuttle Mission Model. Also included in the Space Transportation System Operations activity is the Inertial Upper Stage flight hardware production for STS operational flights commencing in 1982.

Spacelab

FY 1982 activities include continuation of program management; final deliveries of ESA provided hardware and software; initial deliveries of follow-on production hardware procured from the European consortium; integration of ESA and NASA provided hardware and software; and operational flow processing planning in preparation for the fourth OFT flight (OSS-1) in FY 1982, and the first Spacelab flight in FY 1983. Manufacturing and testing of the Spacelab Transfer Tunnel will also continue through FY 1982, with delivery in FY 1983. The delivery of U.S. source spares and Delta European spares are also scheduled to be completed in FY 1983.

Chemical Upper .Stapes

Completion of the production and delivery of the first three NASA two-stage IUS Vehicles will occur in FY 1982. The first NASA two-stage launch (TDRS-A mission) is scheduled for late FY 1982. Fabrication of the Line Replacement Units (LRU) for the remaining IUS production vehicles will continue in FY 1982.

The NASA-unique (three stage) Inertial Upper Stage for planetary programs is currently under review. Alternative concepts are being considered with a decision expected in early CY 1981.

Performance Augmentation

FY 1981 activities will investigate and compare two alternative approaches to supplementing the Shuttle payload capability. The Liquid Boost Module (LBM), derived from the Air Force Titan launch vehicle, will continue to be studied in a limited fashion, with effort concentrated on structural loads impacts and systems avionics definition. In addition, a filament wound composite case version of the Solid Rocket Booster will be investigated, primarily from the standpoint of manufacturing feasibility and Shuttle systems

implications. Both approaches will provide the required Mission-4 lift capability from the Western Test Range, scheduled for 1986. An alternative approach to the LBM may be the upgrading of the SSME to 115% thrust level. A concept decision is expected to be made in the FY 1981/1982 time frame.

Solar Electric Propulsion System (SEPS)

The Solar Electric Propulsion System (SEPS) will continue the initial phase of hardware development in FY 1982. Emphasis will be placed on the design and procurement of long lead time components for development hardware, primarily in the thruster, power processor unit, and solar array areas. Fabrication and testing of some development hardware will begin.

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 decisionmaking data needed prior to proposing future space programs. Major FY 1982 advanced studies activities include: 25kW Power System, Tether Satellite, fabrication of structural elements in space; studies of improved propulsion systems capable of using different propellants in the same system; continue concept studies of geostationary platforms and materials experimentation carriers/modules; and studies of advanced manipulator systems, remote controls, visual aids and sensory systems to augment the ability of humans to function efficiently in space.

	Permanent Positions (Civil Service)
PHYSICS AND ASTRONOMY.....	548

The Center provides leadership in the Agency's Space Science program for the Space Telescope; Spacelab Payload Mission Management for Spacelabs 1, 2 and 3; Spacelab experiment development; the Chemical Release Module development, which will be flown on the Shuttle/Spacelab; and provides supporting research and technology support to identify the new technologies required for future missions.

Space Telescope

Marshall is the lead Center for the management of the Space Telescope project and has overall implementation responsibility. The Center is responsible for directing all NASA and contractors' efforts, for establishing and maintaining effective project management activities, and for preparing and maintaining the detailed technical specifications which will define the requirements for all elements of the project. This includes technical assessment and evaluation of contracted activities for system engineering, design and development, and assembly and verification. In FY 1982, fabrication and assembly will continue on the Scientific Instruments and Optical Telescope Assembly. The Critical Design Review (CDR), to assure that the detail design is in accordance with the specifications, will be completed on the Support Systems Module, and extensive fabrication activities will be initiated.

Spacelab Payload Mission Management

Marshall is the lead center for the management and implementation of Spacelab Missions 1, 2, 3, OAST-1 OSTA-2 and Materials Processing in Space (MPS-1) missions. The Center is also responsible for in-house development of selected experiments to be flown on these missions. This responsibility begins with the definition and recommendation of the payload complement and ends with the dissemination of flight/mission-related data and materials required for experiment analysis and processing. During FY 1982, MSFC will continue to manage development of the mission experiment complements and supporting hardware/software. Spacelab missions 1 and 2 are scheduled to be launched in FY 1983 and early FY 1984, respectively. During FY 1982, interfaces will continue to be maintained with the NASA discipline program offices, the principal investigators, and appropriate engineering groups to assure that the scientific objectives of the missions are achieved. MSFC will continue to participate in and manage the analysis of the requirements, objectives, characteristics, and payload components to insure physical, functional, and operational compatibility for all levels of integration.

Chemical Release Module Facility

The Chemical Release Module is an efficient reusable Spacelab facility, which will be used to conduct investigations in atmospheric and space physics. During FY 1982, the development activity will be completed and qualification testing will be initiated.

Supporting Research and Technology

The supporting research and technology activities at MSFC are oriented toward development of new technologies required for future science missions. The principal science areas are the Astrophysics and

Solar Physics. In 1982, definition studies of the Gravity Probe-B (GP-B) and an Advanced X-Ray Astrophysics Facility will be continued.

	Permanent Positions (Civil Service)
SPACE APPLICATIONS	296

The MSFC activities for this program are concentrated in two major space applications assignments: Materials Processing in Space and Atmospheric Supporting Research.

Materials Processing in Space

The Materials Processing in Space 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 FY 1982, the Materials Processing in Space program at the Marshall Space Flight Center will reflect a gradual buildup of research and development activities in such areas as: (1) crystal growth and solidification, (2) containerless processing, (3) fluid and chemical processing, (4) vacuum research, and (5) commercialization studies. Expansion of the program to include a wider base of investigations using other existing or new hardware is being planned for the latter part of the five-year period, 1982-1986, based on the outcome of prior research activities. The activities include ground-based SRT, engineering and scientific analyses, advanced studies, and technical management of definition, design, development, and operation of material processing experiments, apparatus, and payloads.

Atmospheric Supporting Research

Theoretical and experimental research will be done in the area of severe storms and local weather. Efforts will be concentrated on the analysis of applications programs including weather and climate and communications.

TECHNOLOGY UTILIZATION	11

The Technology Utilization program transfers new knowledge and innovative technology resulting from NASA's R&D programs for application in industry, medicine, and public sectors areas. MSFC civil service engineering and science personnel provide the primary source of technical skills necessary to accomplish the technology transfer to the public sectors.

	Permanent Positions (Civil Service)
AERONAUTICAL RESEARCH AND TECHNOLOGY	11

The Aeronautical Research and Technology effort is concerned with aircraft operational safety. The major activites in FY 1982 will be to continue studies of turbulence over the surface of an aircraft wing, perform gust correlations, investigate the dissipation of fog, and continue development of a Clear Air Turbulence (CAT) detection system. Atmospheric flow systems will be measured remotely by using infrared lasers, and studies are currently underway to determine the feasibility of performing tropospheric wind measurements on a global basis from a satellite platform.

SPACE RESEARCH AND TECHNOLOGY	142

The major Space Research and Technology discipline efforts at MSFC are in materials, structures, dynamics, high density circuit technology, guidance and control, data processing technology, large solar array technology, electronic systems technology, and cryophysics and propulsion. In FY 1982, these efforts will focus on developing technology for high performance propulsion and power systems as well as advanced data processing and large space systems for the future.

Also included in this area is the Shuttle/Spacelab Payloads effort concerned primarily with the Induced Environmental Contamination Monitor (IECM), the Solar Electric Propulsion (SEP) Solar Array, and Tribological Experiments. All of these areas will have continuing emphasis throughout FY 1982.

ENERGY TECHNOLOGY APPLICATIONS	125

Marshall Space Flight Center is responsible in FY 1982 for continuing support to three major areas of the overall program for Solar Heating and Cooling: (1) the "Development in Support of Demonstration Program"; (2) the "International Program"; and (3) the "Demonstration of Solar Heating and Cooling in Federal Building Program." The purpose of the Development in Support of Demonstration Program is to use present technology and technology emerging from the national research and technology program to bring solar heating and cooling systems and subsystems to the point where they will be tested and ready for use in residential and commerical applications. The international program involves planning and overall systems integration of selected solar energy projects located outside the United States. The Federal Building Program is designed to stimulate growth and improve the efficiency of the solar industry by demonstrating Federal Government confidence in and support of the industry. Other activities include: (1) systems engineering support to

TVA's Coal Gasification Program; (2) participation with the Department of Energy in ocean thermal energy conversion projects; and (3) energy definition studies in satellite power system and nuclear waste management.

	Permanent Positions (Civil Service)
CENTER MANAGEMENT AND OPERATIONS SUPPORT.....	579

Center Management and Operations Support is defined as indirect support being provided to all MSFC organizations and programs. This activity includes the following:

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

Management Support - Includes a wide range of activity categorized as management support for programs and functional organizations for the entire Center. Specific functions include resource and budget analysis, program control, contracting and procurement, personnel management, property management, resource control and management information systems and analysis.

Operations Support - This is a broad spectrum of activity that is required to maintain and operate facilities, buildings, and equipment and provide the normal housekeeping services and logistics support for the personnel who manage and conduct the affairs of the Center. Specific activities are:

Maintenance and operation of administrative buildings and facilities
Data processing and computer support
Center-wide security and protection
Fire protection
Custodial services
Logistics support including transportation, supplies
Medical care of employees
Photographic and graphic support
Energy management

RESOURCE REQUIREMENTS BY FUNCTION

		1980 Actual	FY 1981 Budget Estimate	FY 1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)			
10	**PERSONNEL AND RELATED COSTS**	**124,572**	**127,967**	**132,366**	**133,256**

Summary of Fund Requirements

A.	Compensation and Benefits				
1.	Compensation				
a.	Permanent positions	109,972	112,755	116,304	116,899
b.	Other than full-time permanent positions	1,481	1,407	1,987	2,004
c.	Reimbursable details	12	33	---	---
d.	Overtime and other compensation	1,051	1,136	1,116	1,117
	Subtotal, Compensation	112,516	115,331	119,407	120,020
2.	Benefits	11,278	11,900	12,057	12,222
	Subtotal, Compensation and Benefits	123,794	127,231	131,464	132,242
B.	Supporting Costs				
1.	Transfer of personnel	345	246	424	488
2.	Personnel training	433	490	478	526
	Subtotal, Supporting Costs	778	736	902	1,014
	Total, Personnel and Related Costs	124,572	127,967	132,366	133,256

Explanation of Fund Requirements

	1980 Actual	FY 1981 Budget Estimate	FY 1981 Current Estimate	1982 Budget Estimate
	(Thousands of Dollars)			
A. Compensation and Benefits	123,794	127,231	131,464	132,242
1. Compensation	112,516	115,331	119,407	120,020
a. Permanent Positions	109,972	112,755	116,304	116,899

The 1982 estimate will support 3,561 permanent positions. The increase from the 1981 budget estimate to the 1981 current estimate is due primarily to the October 1980 pay increase.

Basis of Cost for Permanent Positions

In 1982, the cost of permanent positions will be $116,899,000, an increase of $595,000 from 1981. This increase results from the following:

Cost of permanent positions in 1981		116,304
Cost increases in 1982		+1,541
Within grade and career advances:		
Full year effect of 1981 actions	+804	
Partial year effect of 1982 actions	+633	
Full year effect of 1981 pay increase	+104	
Cost decreases in 1982		-946
Turnover savings and abolished positions:		
Full year effect of 1981 actions	-605	
Partial year effect of 1982 actions	-341	
Cost of permanent positions in 1982		116,899

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
b. Other than full-time permanent postions				
1. cost	1,481	1,407	1,987	2,004
2. Workyears	157	165	192	194

The 1982 estimate includes 194 workyears which will be used to support the following programs:

Distribution of Other than Full-Time Permanent Workyears

Program	WorkYears
College cooperative training	77
Summer employment	21
Opportunity programs	70
Other temporary employment	26
Total	194

The increase in nonpermanent workyears from the 1981 budget estimate to the 1981 current estimate is due to efforts to meet EEO goals and to implement new Federal sponsored minority programs through the use of the youth opportunity programs.

c. Reimbursable detailees	12	33	---	---

The reimbursable detailee program has been completed.

d. Overtime and other compensation	1,051	1,136	1,116	1,117

The estimate for overtime and other compensation is essentially level in 1981 and 1982.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
	(Thousands of Dollars)			
2. Benefits	11,278	11,900	12,057	12,222
Following are the amounts of contribution by category:				
Civil Service Retirement Fund	7,663	7,876	8,191	8,310
Employee life insurance	341	493	348	366
Employee health insurance	2,178	2,243	2,310	2,312
FICA	39	51	44	46
Workmen's compensation	1,057	1,237	1,164	1,188
Total	11,278	11,900	12,057	12,222

The increase in the 1981 current estimate is primarily due to the October 1980 pay increase. The 1982 estimate reflects a higher projection #or Workmen's compensation and increased cost for health insurance. Workmen's compensation costs are based on Department of Labor billings.

B. Supportinp Costs	778	736	902	1,014
1. Transfer of Personnel	345	246	424	488

The estimated costs provide for certain relocation costs, such as the expenses of selling and buying a home and the movement of household goods. The 1981 current estimate the costs associated with the replacement of Spacelab personnel supporting the European Space Agency. The 1982 level is essentially the same as 1981.

		1980 Actual	FY 1981 Budget Estimate	FY 1981 Current Estimate	1982 Budget Estimate
			(Thousands of Dollars)		
2.	Personnel Training.....	433	490	478	526

The purpose of the **MSFC** training program is to continue the development of skills and knowledge of civil service employees 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 workforce; development of needed skills and knowledge required in MSFC mission activities; and extending MSFC workforce capability and increasing productivity. The 1982 estimate is based on the same level of training as in 1981 at expected 1982 tuition rates.

II.	**TRAVEL**.....	**2,621**	**2,982**	**2,956**	**3,698**
	Summary of Fund Requirements				
A.	Program Travel.....	2,380	2,768	2,700	3,369
B.	Scientific and Technical Development Travel..	61	35	65	87
C.	Management and Operations Support.....	180	179	191	242
	Total, Travel.....	2,621	2,982	2,956	3,698

Explanation of Fund Requirements

	1980 Actual	FY 1981 Budget Estimate	FY 1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
A. Program Travel	2,380	2,768	2,700	3,369

Program travel is directly related to the accomplishment of the Center's mission and in 1980 it was approximately 91 percent of the total MSFC travel. Approximately the same level is required in 1981. Travel requirements include those for ongoing programs such as the Space Shuttle Main Engine, External Tank and Solid Rocket Booster, STS Operations, Spacelab, Inertial Upper Stage, Space Telescope, space science and applications payloads and basic/supporting research and technology. Travel for Spacelab, Spacelab Payloads, and Space Telescope will require both domestic and European travel. The increase in 1982 reflects increased per diem and transportation costs.

B. Scientific and Technical Development Travel	61	35	65	87

Scientific and technical development travel permits employees to participate in meetings and technical seminars with representatives of the aerospace community. This participation allows them to benefit from exposure to technological advances outside MSFC, as well as to present both accomplishments and problems to their associates. These meetings are principally working panels convened to solve problems for the benefit of the Government. The increase in the 1981 current estimate is based on actual 1980 experience. The increase in 1982 reflects increased per diem and transportation costs.

C. Management and Operations Travel	180	179	191	242

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 Headquartes, other NASA Centers, and local transportation. The increase in 1982 partially restores the level of management and operations travel required and reflects increased per diem and transportation costs.

	1980 Actual	FY 1981 Budget Estimate	FY 1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
III. FACILITIES SERVICES	**12,716**	**12,881**	**14,634**	**16,273**

MSFC occupies 1,841 acres under Department of the Army permit in a complex of science and engineering laboratories and special development and test facilities. The complex encompasses 3,645,000 gross square feet of building space including eighteen major buildings. Also included are seventeen major technical facilities. This physical plant houses an average daily on-Center population of approximately 4,800 personnel.

Summary of Fund Requirement

A.	Maintenance and Related Services	2,844	3,221	3,132	3,536
	1. Facilities	2,404	2,827	2,478	2,930
	2. Equipment	440	394	654	606
B.	Custodial Services	2,596	3,119	3,079	3,312
C.	Utilities Services	7,276	6,541	8,423	9,425
	Total, Facilities Services	12,716	12,881	14,634	16,273

Explanation of Fund Requirements

A.	Maintenance and Related Services	2,844	3,221	3,132	3,536
	1. Facilities	2,404	2,827	2,478	2,930

This activity involves a total of 206 facilities (buildings, structures, and trailers) with 3.7 million square feet of floor area. Also involved are 1,841 acres of land area, one million square yards of surfaced area, and several special structures and systems. The 1981 budget estimate to the current estimate reflects a reduction in repair and alteration projects, painting and the purchase of supplies and materials

due to budgetary constraints. The increase from the 1981 current estimate to 1982 is due to escalation of support contractor rates and the cost of supplies and materials, plus facility repairs and painting deferred from 1981.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
a. Maintenance of buildings and grounds				2,713

The estimate provides for buildings and grounds maintenance and effort for repair and alteration projects, routine facility work, engineering design, and reimbursements to the Army (Redstone Arsenal) for facility maintenance and related services for such items as electrical distribution lines, aerial roads, grounds related to MSFC, and use of Army facilities.

b. Supplies and materials 217

This estimate provides for the acquisition of building, electrical, electronic, general maintenance, general operating and general service materials as well as metals, gauges, pipes, valves, and fittings.

2. Equipment	440	394	654	606

This activity involves maintenance and repair of equipment at MSFC. The 1981 budget to current estimate increase provides for a slight increase in support contractor manpower to perform preventive and corrective maintenance on aging MSFC shop equipment, plus contract cost escalation.

B. Custodial Services	2,596	3,119	3,079	3,312

Custodial services include janitorial services, security services, fire protection, trash removal, sanitary landfill operations, pest control activities, and related supplies and materials.

	1980 Actual	FY 1981 Budget Estimate	FY 1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		

1. Janitorial services..... 1,642

This activity provides janitorial service to about three million square feet of facility space and trash removal from approximately 125 separate locations. Janitorial service is performed principally through a support contractor.

2. Security and fire protection..... 1,637

Services are provided by a support contractor and through the Army (Redstone Arsenal). Included are 24-hour security coverage of MSFC property, law enforcement, motor vehicle control and registration, and fire protection.

3. Minor requirements..... 33

Services are reiated to landfill operations.

C. Utilities Services.....	7,276	6,541	8,423	9,425

The Army (Redstone Arsenal) provides electricity, steam, water, and sewage disposal services to MSFC on a reimbursable basis, and the estimates, therefore, are included in this activity. Also provides for propane and burner fuel for generating steam for environmental heating and cooling. The increase in the 1981 current estimate and 1982 provides for increased utilitiy rates offset by reduced consumption. The cost of purchased utilities are as follows:

1.	Electricity (109,000 mW/Hrs.).....	5,340
2.	Propane (12,000 gals.).....	71
3.	Fuel oil (544,000 gals).....	349
4.	Steam (219,400 K/lbs.).....	2,547
5.	Water and sewage.....	938
6.	Natural gas.....	180

		1980 Actual	FY 1981 Budget Estimate	FY 1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)			
IV.	**TECHNICAL SERVICES**	**6,507**	**6,687**	**6,104**	**6,832**
	Summary of Fund Requirements				
A.	Automatic Data Processing	4,203	4,187	4,029	4,384
	1. Equipment	1,107	912	653	721
	2. Operations	3,096	3,275	3,376	3,663
B.	Scientific and Technical Information	925	977	936	983
	1. Library	792	822	814	858
	2. Education and information	133	155	122	125
C.	Shop Support and Services	1,379	1,523	1,139	1,465
	Total, Technical Services	6,507	6,687	6,104	6,832
	Explanation of Fund Requirements				
A.	Automatic Data Processing	4,203	4,187	4,029	4,384

Provides the management and administrative computing requirements. Also includes maintenance of ADP equipment and related supplies and materials.

	1980 Actual	FY 1981 Budget Estimate	FY 1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
1. Equipment.....	1,107	912	653	721

Maintenance is provided under separate contracts for central-site computers and associated equipment. Equipment maintained includes Univac 1100/82 system, FR-80 microfiche system, systems software support, and a key-to-disc which colle'cts, controls, organizes, and edits raw data for input into the Univac 1100/82 system. The decrease from the 1981 budget estimate to the 1981 current estimate is due to the installation of new Univac 1100/82 systems. Less maintenance is anticipated on the new equipment than was required on the old Univac 1108 systems. The increase from the 1981 current estimate to 1982 is due to cost escalation and increased systems software support.

2. Operations.....	3,096	3,275	3,376	3,663

This function provides for the development and utilization of computer techniques and systems programming of all digital computers and associated equipment at MSFC. The computer systems include the Univac 1100/82 system, seven Univac 9300 Remote Job Entry terminals, two FR-80 Electronic platters, Xerox forms copiers, and punch card accounting machines (PCAM). Also included are the operation of two large magnetic tape libraries containing a combined total of 60,000 reels; receipt, control, and distribution of program and data processing products; and testing and cleaning of magnetic tapes. Also included in the operation costs are program design and development, and development of data base management, configuration management, and accounting software systems. Support is also provided for developing engineering drawings and parts management systems. The increase from 1981 to 1982 is due to cost escalation.

B. Scientific and Technical Information.....	925	977	936	983

This activity provides for the operation of the Redstone Scientific Information Center library on Redstone Arsenal and support to the Center in various scientific and technical information services.

1. Library.....	792	822	814	858

Scientific information and library services are provided to MSFC employees and associated contractor personnel through the Redstone Scientific Information Center (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 costs shared. The increase in the 1982 estimate is due to cost escalation.

	1980 Actual	FY 1981 Budget Estimate	FY 1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
2. Education and information.....	133	155	122	125

The funds provide for the preparation of reproducible pages for publication of technical manuscripts and related documents. Included is MSFC's share of the operation of the MSFC Visitor Information Center located at the Alabama Space and Rocket Center. The decrease from the 1981 budget estimate to the 1981 current estimate reflects a reduction in the purchase of supplies and materials due to budgetary constraints, offset by some cost escalation for the MSFC Visitor Information Center and technical publications.

C. Shop Support and Service.....	1,379	1,523	1,139	*1,465*

These funds provide the Center with support in the areas of graphics, models and design, construction, and management of exhibits. Related supplies, materials, and equipment are also included in this activity. Graphic materials are prepared for use in such presentations as senior management meetings. The decrease from the 1981 budget estimate to the current estimate is due to reprioritization due to budgetary constraints. The increase from the 1981 current estimate to 1982 is due to normal escalation in support contractor rates, the return to a realistic operating level in supplies and materials and the replacement of some obsolete or worn-out equipment which is no longer economical to repair.

1. Instrumentation support. 28

This category provides funds for gauge calibration services work procured from the Army (Redstone Arsenal). Included are microwave, radio frequency, and optical and acoustic instrumentation calibration.

	1980 Actual	FY 1981 Budget Estimate	FY 1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
2. Photographic services				513

Consists of procurement of off-site commercial still photographic and motion picture production services. Also includes operation of the film library. Still photographic services include printing and processing of color and black and white prints, slides, vugraphs, and copy camera photography. Motion picture production services include script writing, film editing, sound recording, and printing and processing of sound motion pictures.

3. Graphics. 924

Provides for the preparation of charts, graphs, vugraphs and similar visuals for administrative and operational requirements. Also includes the design, construction, and management of exhibits in connection with MSFC's public affairs activity.

V. MANAGEMENT AND OPERATIONS	***9,477***	***9.860***	***9,059***	***11,091***
Summary of Fund Requirements				
A. Administrative Communications	2,695	3,131	2,935	3,129
B. Printing and Reproduction	546	615	465	520
C. Transportation	2,576	2,638	1,831	2,750
D. Installation Common Services	3,660	3,476	3,828	4,692
Total, Management and Operations	9,477	9,860	9,059	11,091

Explanation of Fund Requirements

	1980 Actual	FY 1981 Budget Estimate	FY 1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
A. Administrative Communications.....	2,695	3,131	2,935	3,129

Provides for communications support for MSFC which consists of local telephone service, long distance telephone service, and various kinds of other nontelephone communications. The decrease from the 1981 budget estimate to the 1981 current estimate is due to a reduction in supplies and materials. The increase from the 1981 current estimate to the 1982 budget estimate is due to rate increases.

1. Local telephone service..... 1,603

The MSFC Central Exchange provides instruments and lines at the Center for local telephone service.

2. Long distance telephone service..... 1,135

Provides for MSFC use of the GSA operated long distance telephone network. Cost results from a formula which is based primarily on the number of calls made two years in the past and the number of circuits used by the Center. Included are such items as long distance commercial tolls and the Autodin network for ordering supplies and materials and sending and receiving classified information. Also included are the costs of leased lines for the teleconferencing network.

3. Other communication services..... 391

These funds provide for use of Weeden Mountain radio transmission facilities, support of the Emergency Warning System, and operation of MSFC's Fire Surveillance System. Also provided are payments for entry into the GSA teletype system for Government subscribers, entry into the Western Union teletype system for commercial subscribers, and overseas telegrams and cable system upkeep.

	1980 Actual	FY 1981 Budget Estimate	FY 1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
B. Printing and Reproduction	546	615	465	520

A portion of MSFC's printing/reproduction requirements are met by an on-site reproduction plant operated by MSFC personnel. In addition to the on-site reproduction plant, MSFC must also purchase reproduction services from the Government Printing Office (GPO), the Army, and private firms. This purchased printing is either an overflow requirement that cannot be handled within the on-site workload, or cannot be handled with the limited capability of the on-site equipment. The decrease from the 1981 budget estimate to the 1981 current estimate is due to the elimination of contractor support to the four duplication service centers and conversion to a self-service type operation. Reflected here also is a reduction in supplies and materials due to budgetary constraints. The 1982 estimate restores funding to the earlier operating level.

C. Transportation	2,576	2,638	1,831	2,750

Transportation functions at MSFC include support contractor effort for operation and maintenance of vehicles and aircraft, transportation related supplies and materials, purchase of transportation equipment, and transportation of things. Included in this category is the maintenance of general purpose vehicles, material handling equipment, special purpose trailers and vehicles, equipment such as "A" frame cranes, "H" frame cranes, cranes, tractors, generators and welders; intermediate inspections at 6,000 miles or six months; and major inspections at 12,000 miles or twelve months. Freight charges for shipment by both surface and air transportation of materials and equipment are also included. The decrease from the 1981 budget estimate to the 1981 current estimate is due to elimination of planned purchase of trucks and a reduction in purchased transportation related supplies and materials due to budgetary constraints. The increase in 1982 is due to automotive and aircraft fuel cost escalation and the replacement of aging vehicles.

D. Installation Common Services	3,660	3,476	3,828	4,692

This category provides support to Center Management and staff activities, medical services, and various other installation support services. The increase from the 1981 budget estimate to the current estimate is an increase in support contractor effort required to establish adequate support in the logistics support activity. The increase in 1982 is primarily to replenish stocks of supplies and materials, and support contractor wage escalation.

	1980 Actual	FY 1981 Budget Estimate	FY 1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		

1. Medical services..... 997

Provides occupational medicine and environmental health services totaling nineteen workyears of support contractor effort for the maintenance and improvement of employee health at MSFC, with emphasis on prevention, diagnosis, treatment, and care of illnesses and injuries caused or aggravated by the work environment.

2. Installation support services..... 3,695

Maintenance and repair of office equipment, equipment rental, acquisition of supplies and materials and miscellaneous services are included in this activity.

a. Maintenance and repair of equipment..... 627

Maintenance and repair of office equipment includes the maintenance and repair services for office machines and equipment (i.e., typewriters, calculators, time stamp equipment); maintenance and repair services for photographic and reproduction equipment (i.e., enlargers, cameras, exposure controls print copiers, projectors, power supplies, tape recorders, stroboflash, film viewer, motion analyzer, copiers, copy camera, processor camera, super diazo).

b. Rental of equipment... 150

Rental of equipment such as Xerox machines at the resident office at Canoga Park, California and Visual Search Microfilm Files located at MSFC, and other reproduction equipment are included in this category.

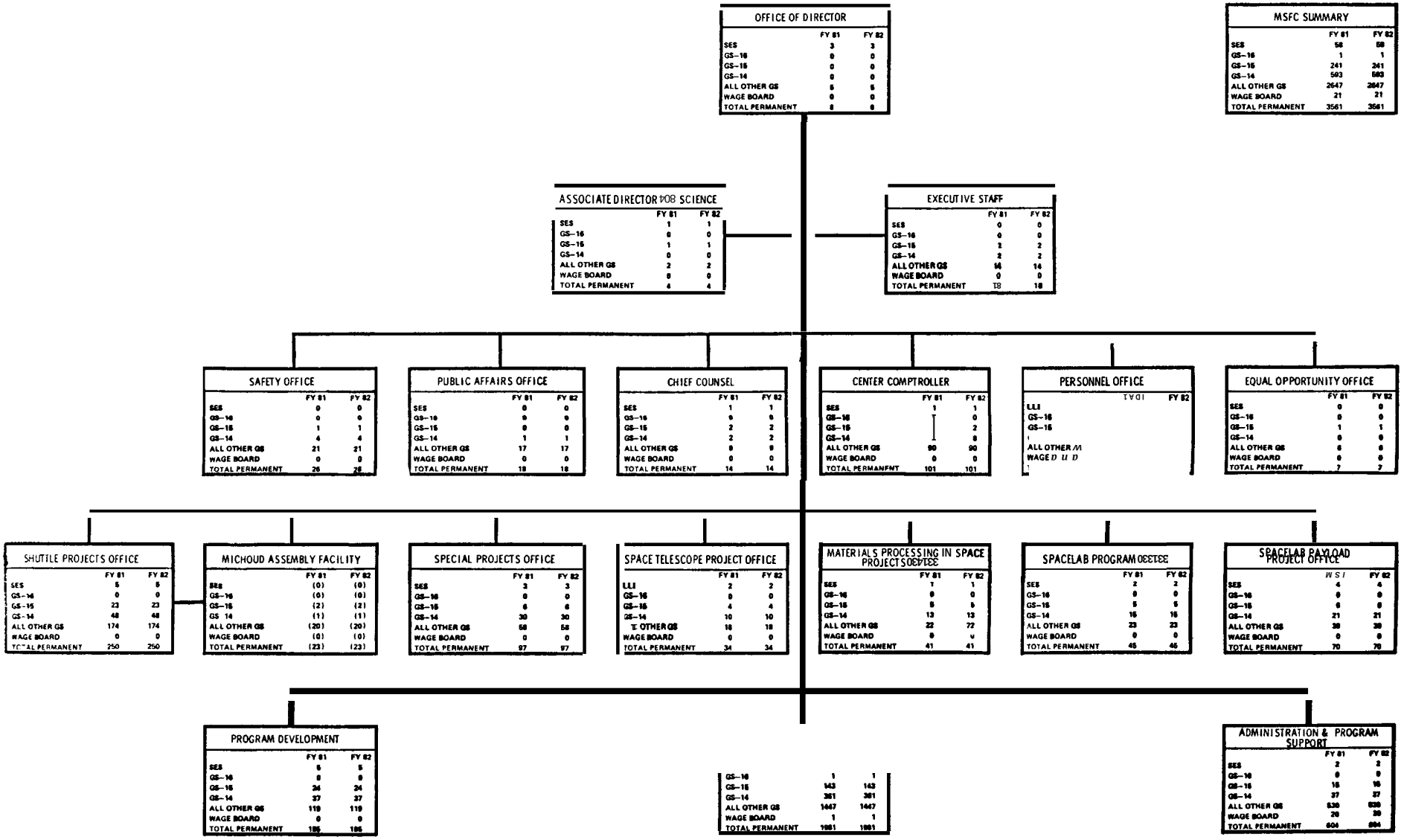
c. Supplies, materials, and equipment..... 1,025

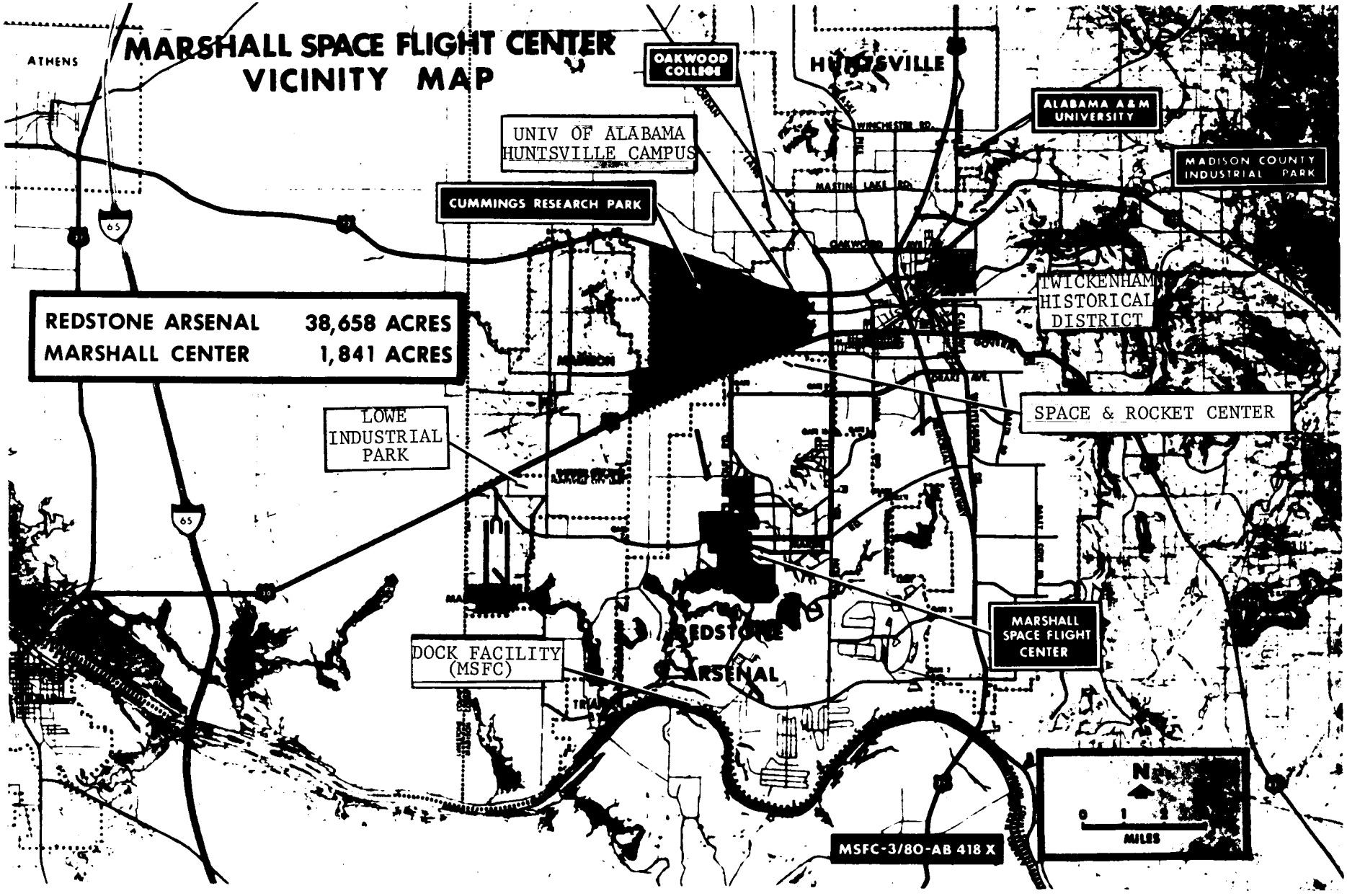
Acquisition of primarily office type supplies and materials, photo supplies, and general service type supplies, and materials.

	1980 Actual	FY 1981 Budget Estimate	FY 1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
d. Miscellaneous services				1,893

Provides services required in the logistics support function in the areas of: (1) receiving supplies, materials, and equipment; (2) distributing supplies, materials, equipment, and program-critical hardware; (3) preparing supplies, materials, and equipment for shipment to include packing and crating and constructing required shipping containers according to government-provided specifications; and (4) warehousing of raw materials. Also provided are such services as the disposal of toxic wastes; inspection of hazardous cargo prior to entry to Redstone Arsenal; receipt, storage, and issue services for hazardous compounds such as explosives, pyrotechnics and solid rocket motors; minor services such as laundry, furniture repair, potassium cyanide disposal, postage, and acquisition of supplies and materials.

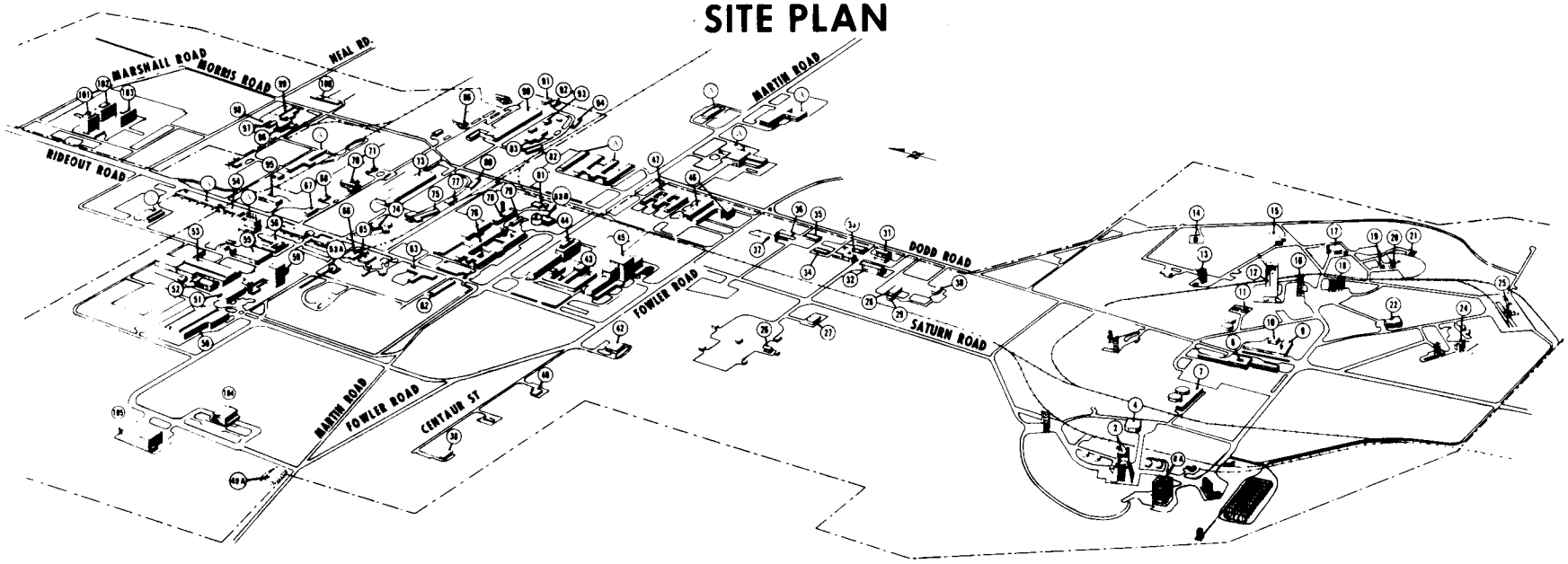
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
GEORGE E. MARSHALL SPACE FLIGHT CENTER




MARSHALL SPACE FLIGHT CENTER
VICINITY MAP
ATHENS
OAKWOOD COLLEGE
HUNTSVILLE
ALABAMA A&M UNIVERSITY
UNIV OF ALABAMA HUNTSVILLE CAMPUS
MADISON COUNTY INDUSTRIAL PARK
CUMMINGS RESEARCH PARK
TWICKENHAM HISTORICAL DISTRICT
REDSTONE ARSENAL 38,658 ACRES
MARSHALL CENTER 1,841 ACRES
LOWE INDUSTRIAL PARK
SPACE & ROCKET CENTER
MARSHALL SPACE FLIGHT CENTER
DOCK FACILITY (MSFC)
REDSTONE ARSENAL
N
0 1 2
MILES
MSFC-3/80-AB 418 X

MARSHALL SPACE FLIGHT CENTER

SITE PLAN



HEADQUARTERS AREA

95	4207	COMMUNICATIONS FACILITY
96	4241	SHOP AND STORAGE BUILDING
97	S-4244	STORACE BUILDING
98	S-4251	EQUIPMENT SHED
W	4250	OFFICE AND SHOP BUILDING
100	4249	OFFICE BUILDING
101	4200	OFFICE BUILDING
102	4202	OFFICE BUILDING
103	4201	OFFICE BUILDING

LAB AND SUPPORT AREA

38	4628	CRYOGENIC TESTING FACILITY
40	4623	LABORATORY BUILDING
42	4605	NON-DESTRUCTIVE EVALUATION LABORATORY
43	4612	MATERIALS LABORATORY
44	4610	OFFICE AND ENGINEERING BUILDING
45	4619	STRUCTURES AND MECHANICS LABORATORY
46	4650	SHOP AND CALIBRATION LABORATORY
47	4663	COMPUTER FACILITY
49A	4740	WATER POLLUTION CONTROL FACILITY
50	4708	ENGINEERING AND DEVELOPMENT LABORATORY
51	4760	SURFACE TREATMENT FACILITY
52	S-4706	NEUTRAL BUOYANCY FACILITY
53	4706	FABRICATION AND MACHINE SHOP
53A	4775	HIGH REYNOLDS FACILITY
53B	4467	CELESTIAL & OPTICAL SENSORS FACILITY
54	14723	TRAINING FACILITY
55	4711	DEVELOPMENTAL PROCESSES LABORATORY
56	4712	OFFICE BUILDING
59	4707	SHOP AND ASSEMBLY BUILDING
62	S-4747	AIR COMPRESSOR BUILDING
63	4146	CALIBRATION LABORATORY
65	4132	BISONIC WIND TUNNEL FACILITY
66	4133	IMPULSE BASE FLOW FACILITY
67	4306	OFFICE BUILDING
68	4312	OFFICE BUILDING
70	4313	SHOP BUILDING
71	4332	ENVIRONMENTAL TEST LABORATORY
13	4471	STORAGE AND OFFICE BUILDING
14	4485	OFFICE BUILDING
15	4491	OFFICE AND LABORATORY BUILDING
16	4487	LABORATORY AND OFFICE BUILDING
77	S-4479	STORAGE SHED
18	4476	ENVIRONMENTAL TEST FACILITY
19	S-4436	AUTOMATION CHECKOUT BUILDING
80	4492	ELECTRICAL SYSTEMS LABORATORY BUILDING
81	4475	HAZARDOUS OPERATIONS LABORATORY
82	4493	SHOP AND STORAGE BUILDING
83	4483	VEHICLE MAINTENANCE SHOP
86	4353	PHOTO LAB
90	4481	SPACE SCIENCES LABORATORY
91	S-4498	STORAGE BUILDING
92	S-4499	STORAGE BUILDING
93	4482	TRANSPORTATION SUPPORT BUILDING
94	4494	CENTER ACTIVITIES BUILDING
104	4752	MULTIPURPOSE HIGH BAY FACILITY
105	4755	HIGH BAY ASSEMBLY FACILITY

TEST AREA

WEST AREA

2	4670	PROPULSION & STRUCTURAL TEST FACILITY
4	4674	BLOCKHOUSE
7	4667	PUMP HOUSE
8	4666	OFFICE BUILDING
8A	4699	STRUCTURAL TEST FACILITY

EAST AREA

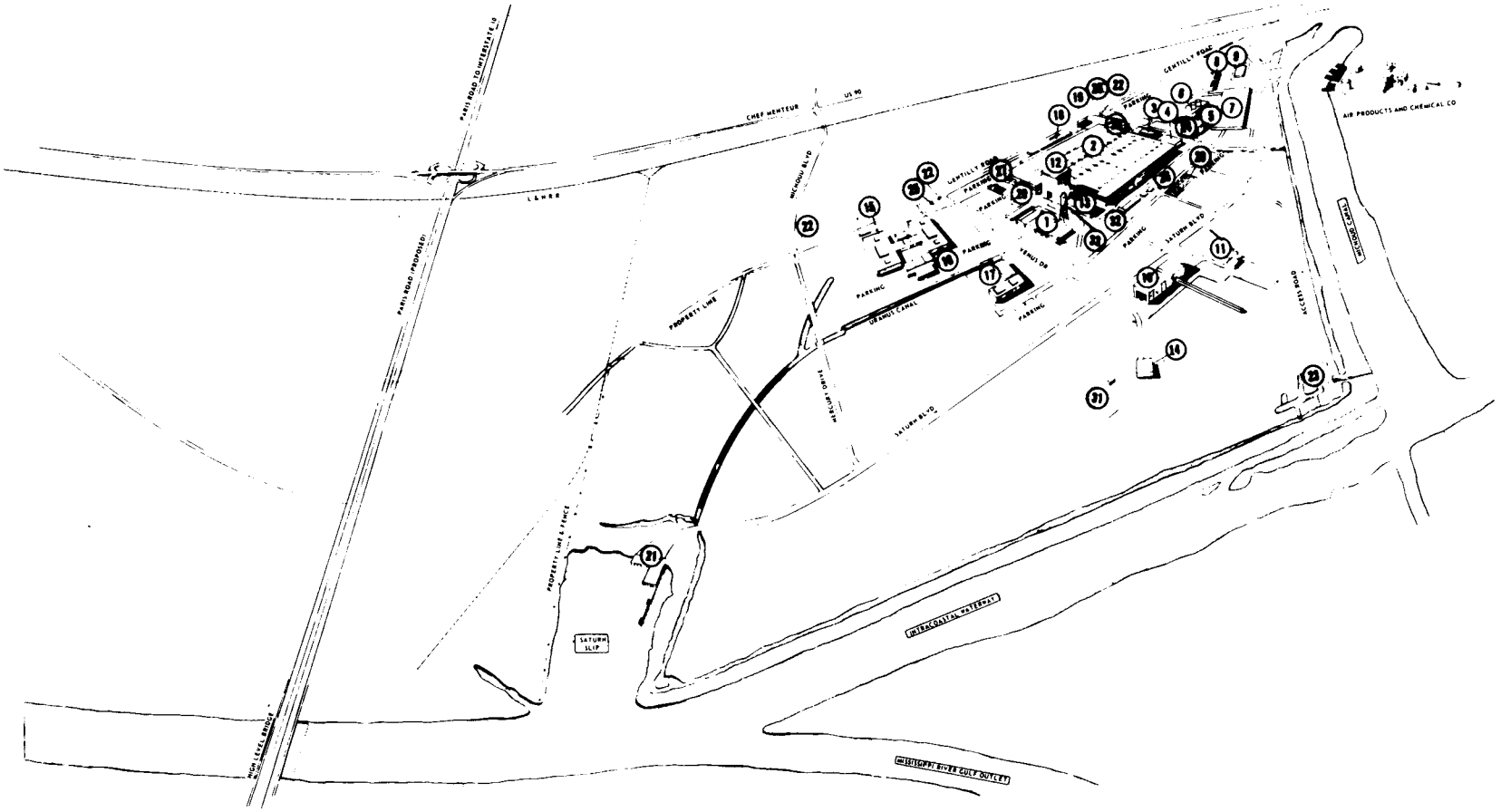
9	4566	DOCUMENTATION REPOSITORY
10	4567	PUMP AND BOILER HOUSE
11	S-4549	DEIONIZED WATER PLANT
12	14550	STRUCTURAL TEST FACILITY
13	4522	PROPULSION SYSTEMS COMPONENT TEST STAND
14	4530	PROPUSION SYSTEMS COMPONENT TEST STAND
15	4561	SHOP AND LABORATORY BUILDING
16	4551	STRUCTURAL TEST FACILITY
17	4583	TEST AND DATA RECORDING FACILITY
18	4548	PROPULSION SYSTEMS COMPONENT TEST FACILITY
19	S-4539	TEST STAND SUPPORT BUILDING
20	4540	MODEL PROPULSION SYSTEMS TEST STAND (ACOUSTIC)
21	4541	TEST STAND CONTROL BUILDING
22	4510	BLOCKHOUSE AND CABLE TUNNELS
24	4514	PROPULSION SYSTEMS TEST STAND
25	4512	PROPULSION AND STRUCTURAL TES' FACILITY

TEST SUPPORT AREA

26	4646	OFFICE BUILDING
27	4648	HIGH PRESSURE FACILITY
28	S-4659	HP GH_2 FACILITY
29	S-4660	BOILER PLANT
30	S-4647	COMPRESSOR BUILDING
31	S-4655	MULTI PURPOSE HIGH BAY FACILITY
32	S-4656	HYDRAULIC EQUIPMENT DEVELOPMENT FACIL
33	S-4653	COMPONENTS SERVICE BUILDING
34	4678	OFFICE AND STORAGE BUILDING
35		OFFICE BUILDING
36	S-4654	SHOP BUILDING
37	4649	MULTI PURPOSE HIGH BAY FACILITY

MICHOUD ASSEMBLY FACILITY

SITE PLAN



MANUFACTURING AND ASSEMBLY

1	303	HANGAR
2	103	MANUFACTURING
3	111	LABORATORY
4	104	BATTERY CHARGING 6 STORAGE
5	207	BOILER HOUSE
6	202	COOLING TOWER
7	220	COMPONENT SUPPLY
8	203	MAINTENANCE SUPPLY
9	221	HAZARDOUS MATERIAL STORAGE

TEST FACILITIES

10	420	TEST 6 CHECKOUT FACILITY
11	404	HIGH PRESSURE TEST FACILITY
12	410	VERTICAL ASSEMBLY & HYDROSTATIC TEST

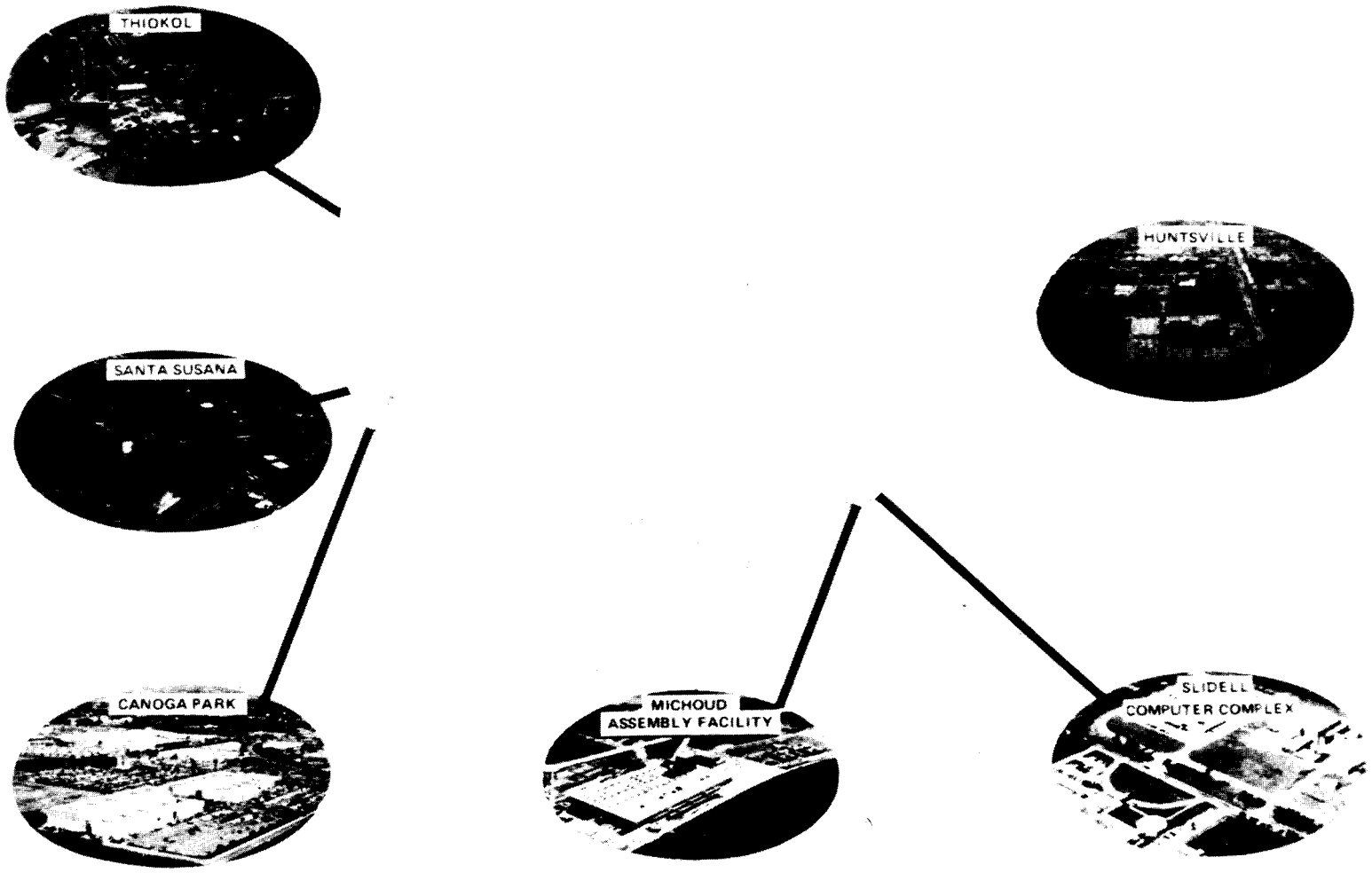
EN

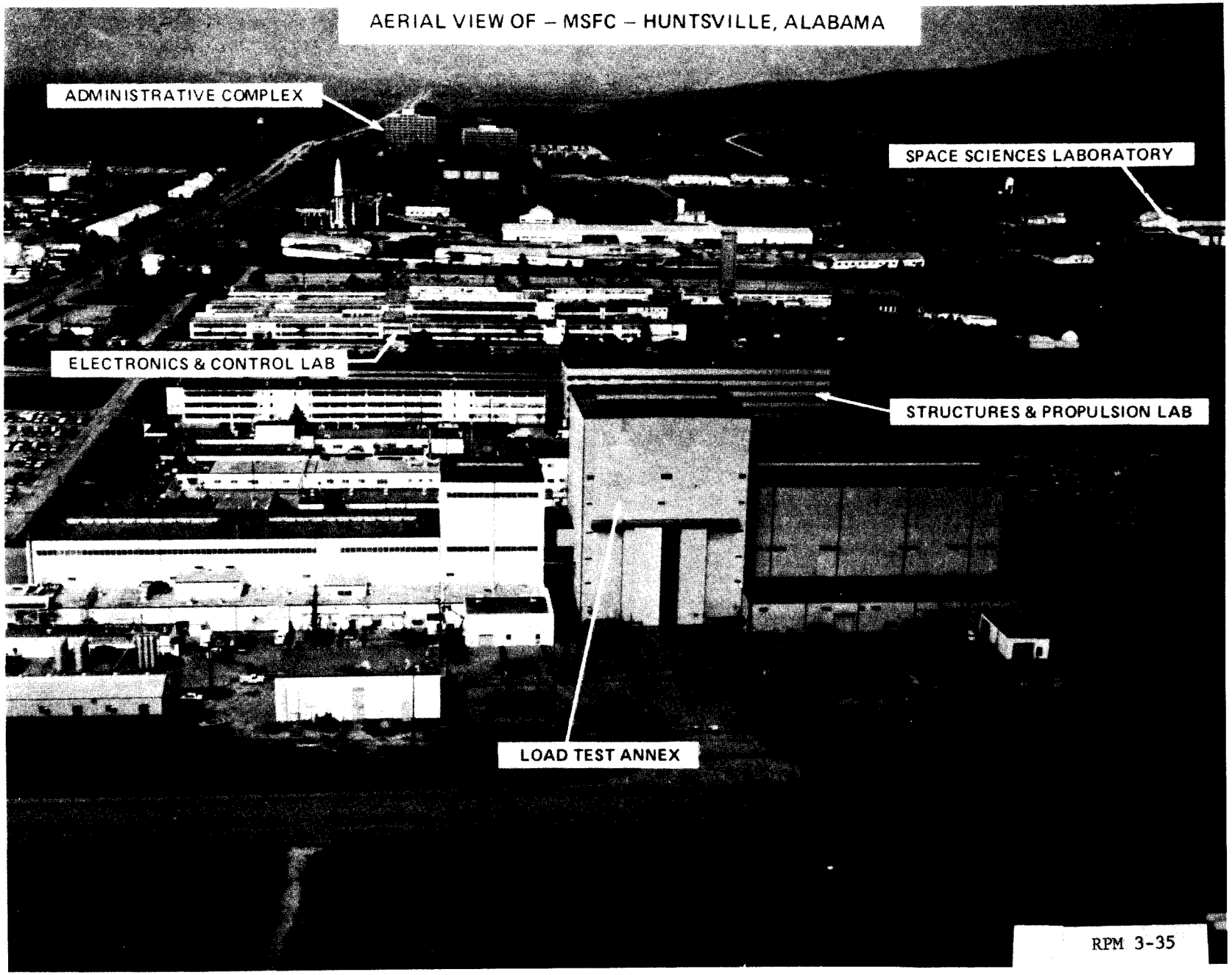
15	350	OFFICE AND ENGINEERING BUILDING
16	351	CAFETERIA
17	320	CONTRACTOR SERVICES BUILDING
18	101	ADMINISTRATION
19	102	ENGINEERING
20	301	MAINTENANCE SHOP

24	201	PUMP STATION NO 1
25	304	PUMP STATION NO 3
26	143	PUMP STATION NO 4
27	308	WEST MASTER SUBSTATION
28	121	MAIN SUBSTATION
29	170	CHEMICAL WASTE LAGOON
30	119	PAINT SHOP
31	403	SALVAGE YARD
32	105	TRANSPORTATION
33	302	ELEVATED WATER TOWER

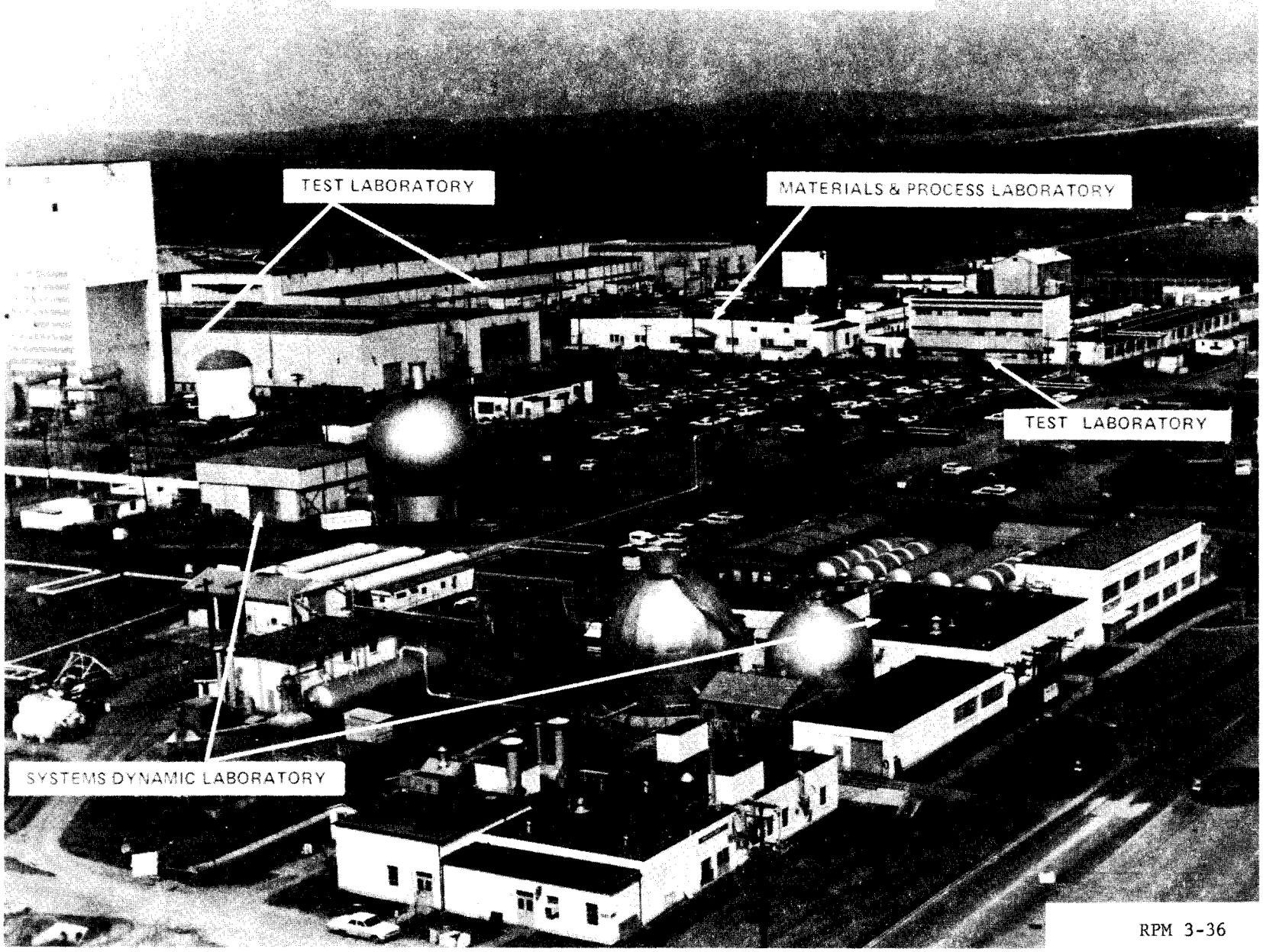
MARSHALL SPACE FLIGHT CENTER

MAJOR PROGRAM FACILITES

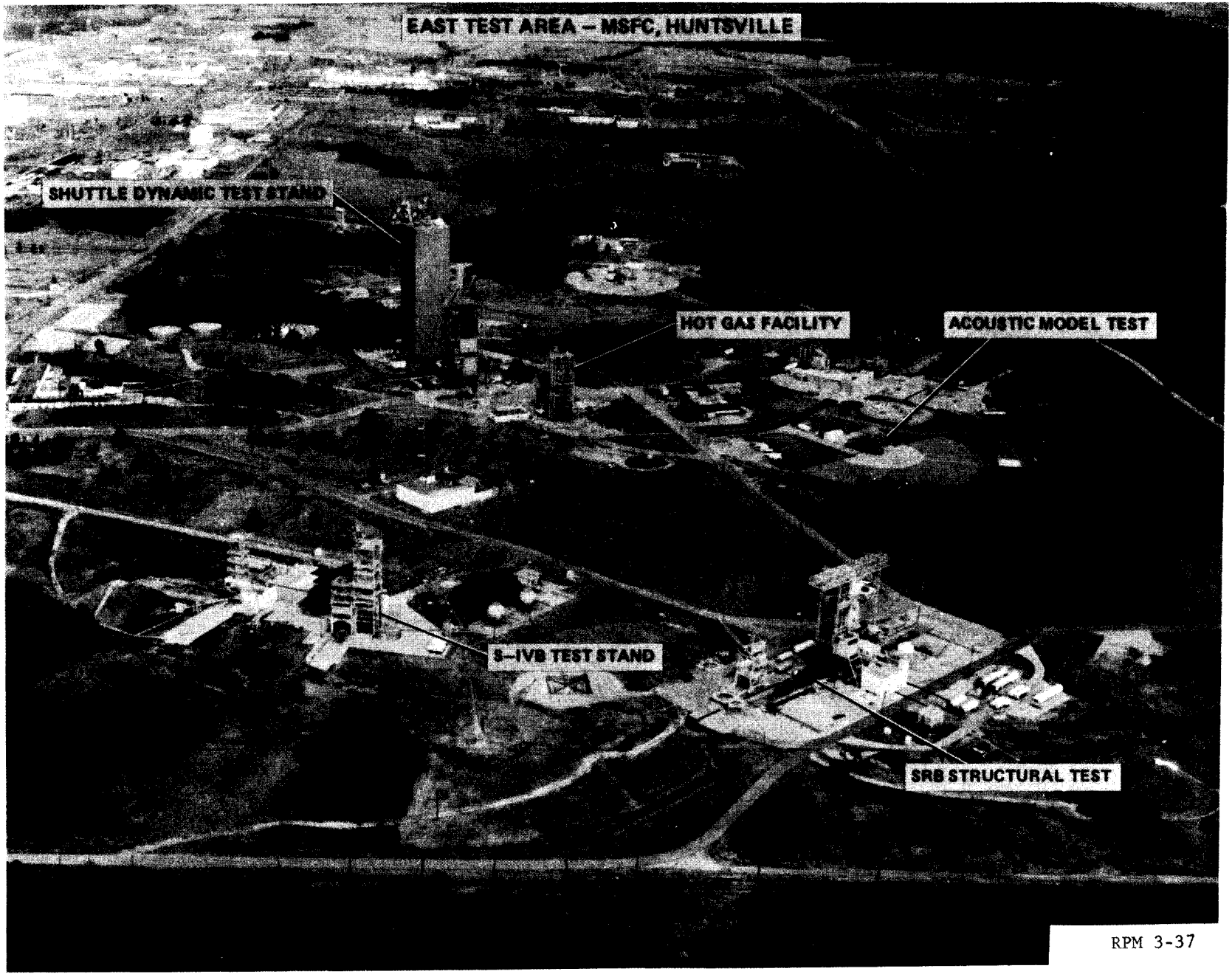



AERIAL VIEW OF – MSFC – HUNTSVILLE, ALABAMA
ADMINISTRATIVE COMPLEX
SPACE SCIENCES LABORATORY
ELECTRONICS & CONTROL LAB
STRUCTURES & PROPULSION LAB
LOAD TEST ANNEX
RPM 3-35

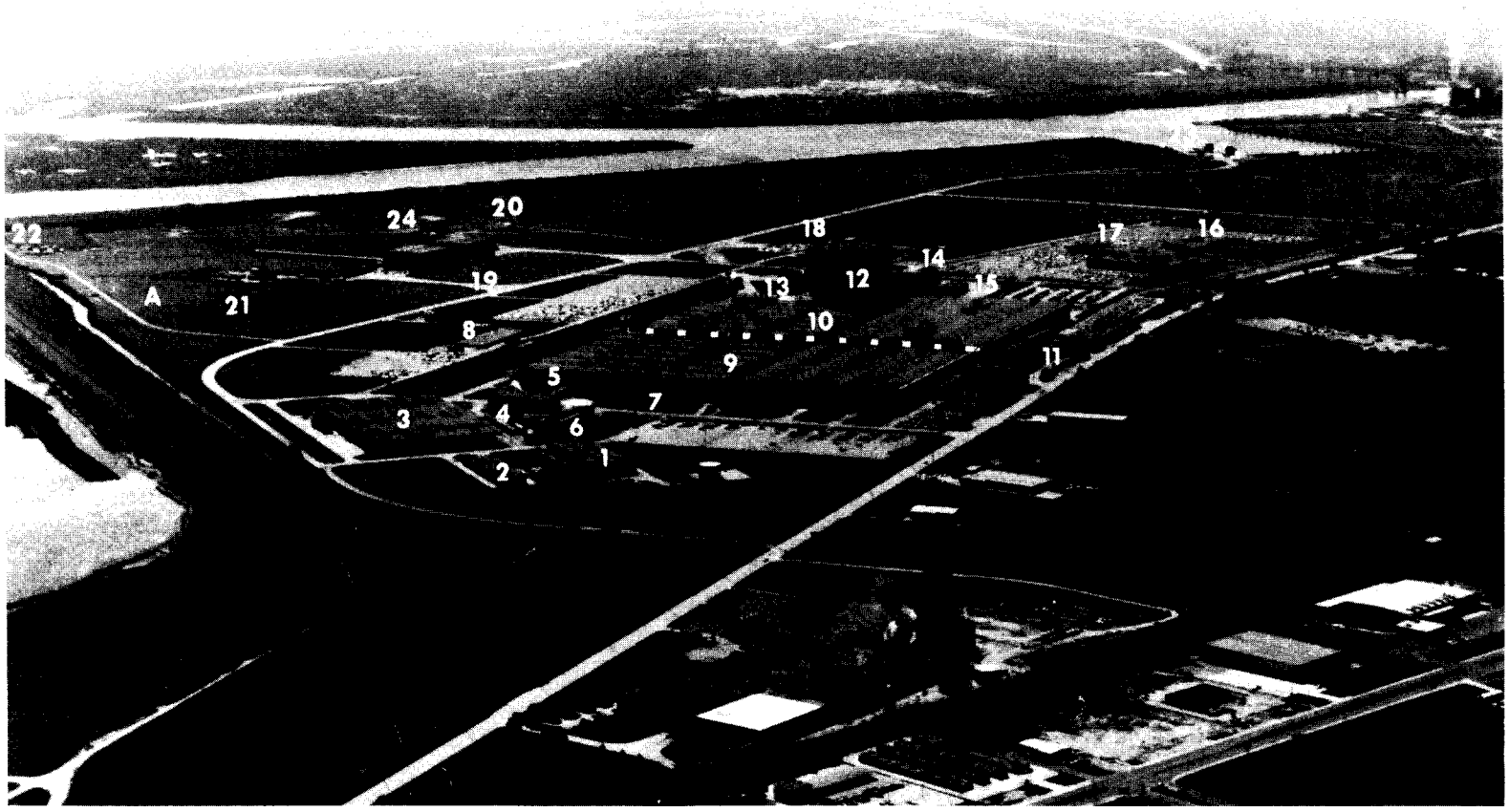
SCIENCE & ENGINEERING AREA MSFC, HUNTSVILLE



RPM 3-36


EAST TEST AREA – MSFC, HUNTSVILLE
SHUTTLE DYNAMIC TEST STAND
HOT GAS FACILITY
ACOUSTIC MODEL TEST
S–IVB TEST STAND
SRB STRUCTURAL TEST

MICHOUD ASSEMBLY FACILITY



1. MAINTENANCE SUPPLY
2. HAZARDOUS MATLS STORAGE
3. COMPONENT SUPPLY
4. BOILER PLANT & FUEL TANKS
5. BATTERY CHARGING
6. COOLING TOWER
7. LABORATORY
8. CHEMICAL WASTE RESERVOIR
9. FAB AREA
10. FABAREA
11. ENGINEERING BUILDINGS
12. VERT ASSY & HYDROSTATIC TEST
13. SYSTEMS ENGINEERING BLDG.
14. HANGAR
15. MAINTENANCE
16. ENGINEERING & OFFICE BLDG.
17. CAFETERIA
18. CONTRACTOR SERVICES BLDG.
19. TEST & CHECK OUT
20. SALVAGE YARD
21. HIGH PRESSURE TEST FACILITY
22. MAIN PUMPING STATION
23. BARGE DOCK
24. PNEUMATIC TEST FACILITY

NATIONAL SPACE
TECHNOLOGY
LABORATORIES

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 Intercoastal Waterway. Capital investment for the National Space Technology Laboratories, as of September 30, 1980, was $306,752,000.

CENTER ROLES AND MISSIONS

The National Space Technology Laboratories (NSTL), formerly the Mississippi Test Facility (MTF), was constructed and operated during the 1960's for acceptance testing of the booster stages of the Saturn V rocket system. NSTL 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 efforts.

NSTL is presently engaged in development and acceptance testing of the Space Shuttle Main Engines and development testing of the Shuttle's Main Propulsion Test Article. NSTL also conducts applied research, develops techniques and demonstrates and transfers to the user community applications of NASA-developed technology in the fields of remote sensing, satellite aommunication, 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 collocated elements of other executive agencies. These agencies are engaged in compatible research, development, and operational activities. They include the Department of Interior, the Department of Commerce, the Environmental Protection Agency, the Department of Transportation, the Department of Defense, 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 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 applied research, develops techniques, and demonstrates and transfers to the user community applications of NASA-developed technology in the fields of remote sensing, satellite communication and environmental sciences.

SUMMARY OF RESOURCES REQUIREMENTS

Funding Plan By Function

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
	(Thousands of Dollars)			
I. Personnel and Related Costs	3,343	3,444	3,716	3,749
II. Travel	121	147	162	407
III. Facilities Services	1,118	1,286	668	611
IV. Technical Services	70	43	121	140
V. Management and Operations	254	188	899	717
1981 Budget Amendment	---	-66	---	---
Total, fund requirements	4,906	5,042	5,566	5,624

Distribution of Permanent Positions by Programs

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
Direct Positions				
Space Transportation Systems and Operations	5	5	5	5
Space shuttle	5	5	5	5
Space and Terrestrial Applications	39	39	40	40
Space applications	39	39	40	40
Subtotal, direct positions	44	44	45	45
Center Management and Operations Support Positions	59	59	58	58
Total, permanent positions	103	103	103	103

PROGRAM DESCRIPTION

	Permanent Positions (Civil Service)
SPACE SHUTTLE	5

In 1982, 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 and 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.

	Permanent Positions (Civil Service)
SPACE APPLICATIONS	40

In 1982, the National Space Technology Laboratories' Earth Resources Laboratory's program will continue:

a. To conduct research investigations in the application of remotely sensed data, stressing interests and needs of potential user agencies. This research activity uses 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 and to devise cost-effective methods of transferring those techniques to the user agencies.

b. To conduct applications demonstration projects in cooperation with Federal, state, regional and local government agencies and private industry to promote the effective transfer of applications technology as well as to reduce systems costs, increase adaption to the users systems, and improve compatibility with other information sources and products routinely used by the user organization.

c. To systematically transfer, primarily to state and local governments in the 17-state region in the midwest, south and southeast, the ability to effectively use Landsat data for their resource management and planning decision through the Southern Regional Remote Sensing Applications Center.

d. To conduct research, develop applications and transfer technology to the user community in non-remote sensing applications primarily in such areas as data collection systems, environmental system development, and closed ecosystems development.

CENTER MANAGEMENT AND OPERATIONS SUPPORT	58

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

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

Management Support - Includes a wide range of activity categorized as management support for programs and functional organizations for the entire Installation. Specific functions include resource and budget management, program control, contracting and procurement, personnel management, property management, financial management, resource control and management information systems and analysis.

Operations Support - This is a broad spectrum of activity that is required to maintain and operate facilities, buildings and equipment and provide the normal housekeeping services and logistics support for the personnel who manage and conduct the affairs of the Installation. Specific activities are:

Maintenance and operations of all buildings and facilities
Data processing and computer support
Reliability and quality assurance
Centerwide security and protection
Fire protection
Custodial services
Logistics support including transportation, supplies, etc.
Medical care of employees
Photographic and graphic support
Safety

RESOURCE REQUIREMENTS BY FUNCTION

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
I. PERSONNEL AND RELATED COSTS	**3,343**	***3,444***	***3,716***	***3,749***
Summary of Fund Requirements				
A. Compensation and Benefits				
1. Compensation				
a. Permanent positions	2,920	2,971	3,185	3,243
b. Other than full-time permanent positions	111	145	182	147
c. Overtime and other compensation	17	15	15	16
Subtotal, Compensation	3,048	3,131	3,382	3,406
2. Benefits	275	288	304	309
Subtotal, Compensation and Benefits	3,323	3,419	3,686	3,715
B. Supporting Costs				
1. Transfer of Personnel	7	10	15	17
2. Personnel Training	13	15	15	17
Subtotal, Supporting Costs	20	25	30	34
Total, Personnel and Related Costs	3,343	3,444	3,716	3,749

Explanation of Fund Requirements

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
A. Compensation and Benefits	3,323	3,419	3,686	3,715
1. Compensation	3,048	3,131	3,382	3,406
a. Permanent positions	2,920	2,971	3,185	3,243

The funds shown will support 103 permanent positions in 1982. The current estimate for 1981 reflects an increase over the 1981 budget estimate due to the October 1980 pay increase.

Basis of Cost for Permanent Positions

In 1982, the cost of permanent positions will be $3,243,000, an increase of $58,000 from 1981. The increase results from the following:

Cost of permanent positions in 1981		3,185
Cost increases in 1982		+110
Within grade and career advances:		
Full year effect of 1981 actions	+57	
Partial year effect of 1982 actions	+50	
Full year effect of 1981 pay increases	+3	
Cost decreases in 1982		-52
Turnover savings and abolished positions:		
Full year effect of 1981 actions	-33	
Partial year effect of 1982 actions	-19	
Cost of permanent positions in 1982		3,243

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
b. Other than full-time permanent positions				
1. cost	111	145	182	147
2. Workyears	12	13	15	13

The 1982 estimate will support the following programs:

Distribution of Other than Full-Time Permanent Workyears

Program	Workyears
Cooperative training	5
Opportunity programs	1
Other temporary employment	7
Total	13

The increase from the 1981 budget estimate to the 1981 current estimate is a result of the October 1980 pay increase. The 1982 estimate is the result of a reduction of two workyears and changes in the temporary appointments planned for 1982.

c. Overtime and other compensation	17	15	15	16

The overtime levels included are necessary to meet management and administrative requirements in such areas as procurement and financial management. The 1982 estimate is essentially level with 1981.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
	(Thousands of Dollars)			
2. Benefits	275	288	304	309
Following are the amounts of contribution by category:				
Civil Service Retirement Fund	202	212	224	228
Employee life insurance	9	15	8	9
Employee health insurance	61	60	62	62
FICA	3	1	4	4
Other benefits	---	---	6	6
Total	275	288	304	309

The increase from the 1981 budget estimate to the 1981 current estimate is a result of the October 1980 pay increase.

B. Supporting Costs	20	25	30	34
1. Transfer of personnel	7	10	15	17

The amount estimated for 1982 is based on the estimated personnel replacements.

2. Personnel training	13	15	15	17

The personnel training costs are primarily for "Upward Mobility" training for women and minorities, and Equal Employment Opportunity (EEO) training. The increase in 1982 is due to the greater demand for upward mobility training, and increased costs of these types of courses.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
II. TRAVEL	**121**	**147**	**162**	**407**
Summary of Fund Requirements				
A. Program Travel	56	67	69	76
B. Scientific and Technical Development Travel	3	4	3	3
C. Management and Operations Travel	62	76	90	328
Total, Travel	121	147	162	407
Explanation of Fund Requirements				
A. Program Travel	56	67	69	76

Program travel requirements are directly related to the accomplishment of the Laboratories' mission, and will mainly be in support of Space and Terrestrial Applications. The 1981 current and the 1982 budget estimates reflect transportation and per diem rate increases.

B. Scientific and Technical Development Travel	3	4	3	3

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 them to benefit from exposure to technological advances outside NSTL 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.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
C. Management and Operations Travel	62	76	90	328

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 Laboratories' top management to NASA Headquarters and other NASA Centers; and local transportation. The 1982 estimate includes the rental costs of GSA vehicles for the Earth Resources Laboratory (ERL), and reflects the functional reallignment of local transportation costs, including vehicles used by non-ERL NASA elements and the support contractors, from the Transportation subfunction to this function.

III. FACILITIES SERVICES	**1,118**	**1,286**	**668**	**611**

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 1,178,177 gross square feet of building space including seven main buildings. *Also* included are five major technical facilities. This physical plant supports an average daily on-site population of 3,000 to 3,500 personnel. Many of the test facilities are utilized on schedules involving more than one shift and/or frequently during off-peak hours.

Summary of Fund Requirements

A. Maintenance and Related Services	161	100	123	136
1. Facilities	160	100	123	136
2. Equipment	1	---	---	---
B. Custodial Services	117	246	101	113
C. Utilities Services	840	940	444	362
Total, Facilities Services	1,118	1,286	668	611

Explanation of Fund Requirements

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
	(Thousands of Dollars)			
A. Maintenance and Related Services.....	161	100	123	136
1. Facilities.....	160	100	123	136

This activity provides for the modifications and alterations of facilities for normal recurring movements of personnel and equipment of the Earth Resources Laboratory. The increases from the 1981 budget estimate to the 1981 current estimate to 1982 is due to a reassessment of requirements based on prior year experience, as well as cost escalation.

2. Equipment.	1	---	---	---

Provided for one-time purchase of equipment needed for the Earth Resources Laboratory.

B. Custodial Services.....	117	246	101	113

Provides for NASA's share of security guard services, janitorial services and fire protection to personnel by the National Space Technology Laboratories institutional support services contractor. The decrease from the 1981 budget estimate reflects the realignment undertaken to more accurately portray NASA and tenant share of the cost of these services.

C. Utility Services.....	840	940	444	362

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 1981 budget estimate to the 1981 current estimate and subsequently to 1982 directly reflects the realignment undertaken to more accurately portray NASA and tenant share of the cost of these services.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
	(Thousands of Dollars)			

The estimated requirements for purchased utilities are as follows:

1	Electricity (1,886 mW/Hrs)	111
2	Natural gas (20,189 K cu. ft)	86

IV.	**TECHNICAL SERVICES**	70	43	121	140
	Summary of Fund Requirements				
A.	Automatic Data Processing				
	1. Operations	34	37	36	39
B.	Scientific and Technical Information	10	6	61	73
	1 Library	5	6	6	7
	2. Education and information	5	---	55	66
C.	Shop Support and Services	26	---	24	28
	Total, Technical Services	70	43	121	140
	Explanation of Fund Requirements				
A.	Automatic Data Processing	34	37	36	39
	1. Operations	34	37	36	39

Provides for the supplies, materials and software programs in support of the Earth Resources Laboratory's ADP requirements.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
	(Thousands of Dollars)			
B. Scientific and Technical Information	10	6	61	73
1. Library	5	6	6	7

Provides for the books, periodicals and other technical reports required by the Earth Resources Laboratory.

2. Education and information	5	---	55	66

Provides for NASA's share of upgrading and operating the NSTL Visitor Information Center. This is a comprehensive three-phase program not planned at the time of the 1981 budget estimate.

C. Shop Support and Services	26	---	24	28

Provides for NASA's share of such technical services as reliability and quality assurance, safety, photography and graphics. The inclusion of these Services reflect the realignment undertaken to more accurately portray NASA and tenant sharing of services.

V. MANAGEMENT AND OPERATIONS	**254**	**188**	**899**	**717**
Summary of Fund Requirements				
A. Administrative Communications	93	25	406	445
B. Printing and Reproduction	41	48	40	45
C. Transportation	35	18	347	127
D. Installation Common Services	85	97	106	100
Total, Management and Operations	254	188	899	717

Explanation of Fund Requirements

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
	(Thousands of Dollars)			
A. Administrative Communications	93	25	406	445

Provides for NASA's share of the local telephone service, FTS, long distance, and operation and maintenance of the on-site communications equipment and switchboard. The increase in 1981 from the budget estimate is due to the realignment of NASA and tenant funding. The 1982 increase is due to increased costs for these services.

B. Administrative Printing	41	48	40	45

Provides for printing and reproduction services in support of the Earth Resources Laboratory. The decrease from the 1981 budget estimate to the current estimate reflects a rephasing of requirements. The increase in 1982 results from increased requirements as well as increased costs for these services.

C. Transportation	35	18	347	127

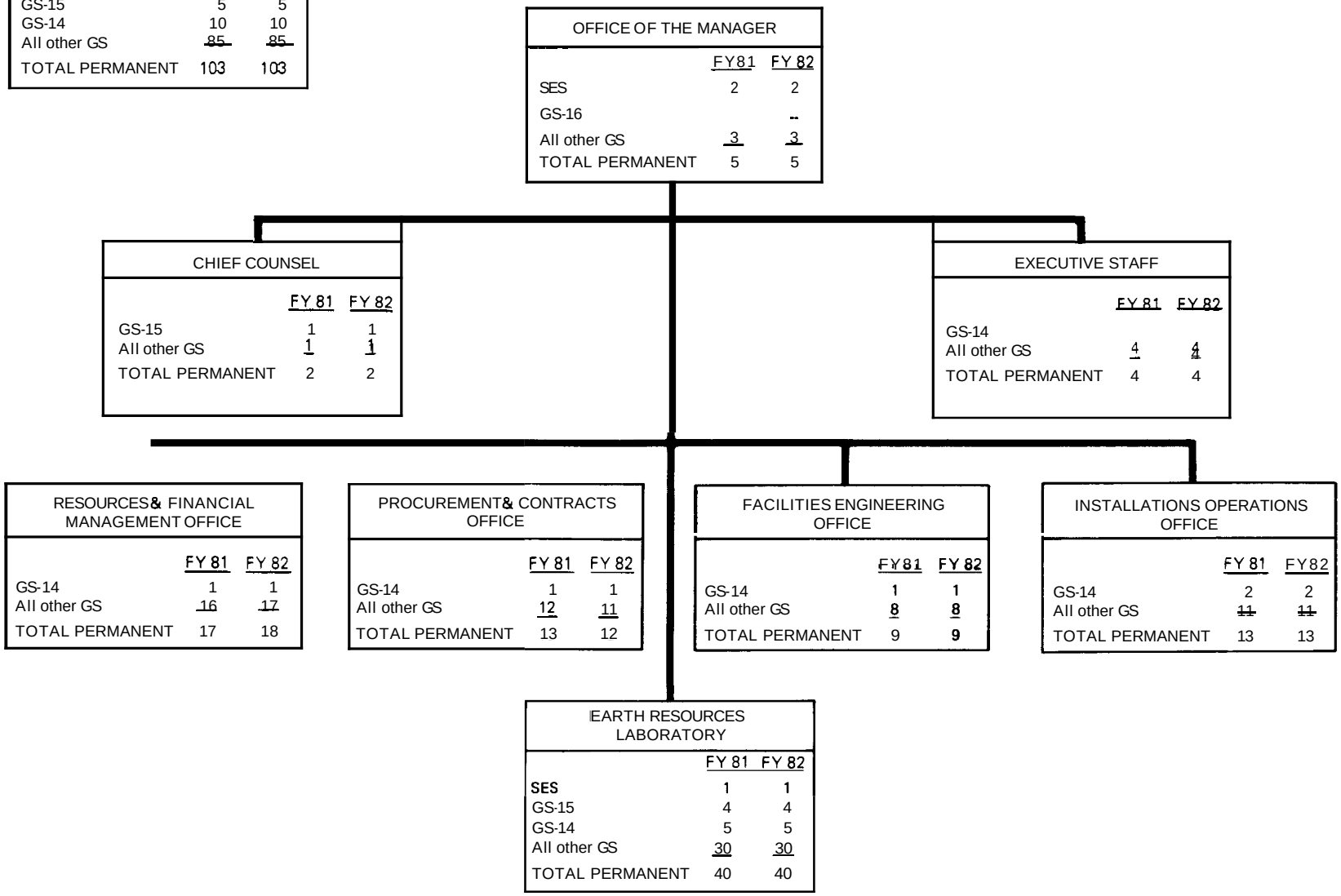
This estimate includes freight costs, government bills of lading, air freight, other general shipments and related transportation costs. The 1981 current estimate reflects the realignment of certain local transportation costs, including rental of vehicles used by non-Earth Resources Laboratory NASA elements and contractors, to more realistically portray NASA versus tenant usage of functional services. The 1982 estimate reflects a functional realignment between the transportation and management and operations travel functions involving certain local transportation costs.

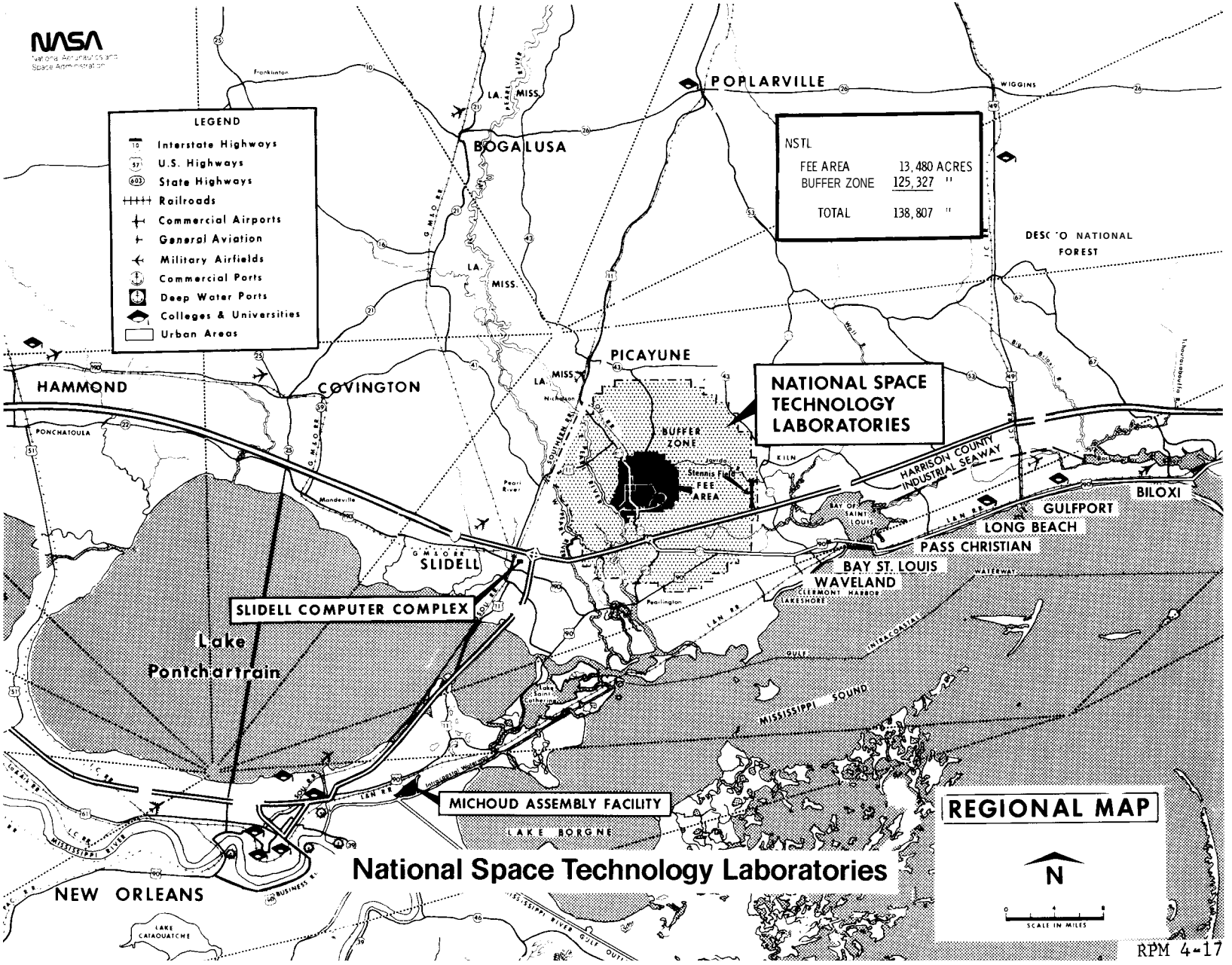
D. Installation Common Services	85	97	106	100

Provides supplies, materials and equipment for the Earth Resources Laboratory. The decrease from the 1981 current estimate to the 1982 estimate reflects a slight decrease in requirements.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
NATIONAL SPACE TECHNOLOGY LABORATORIES

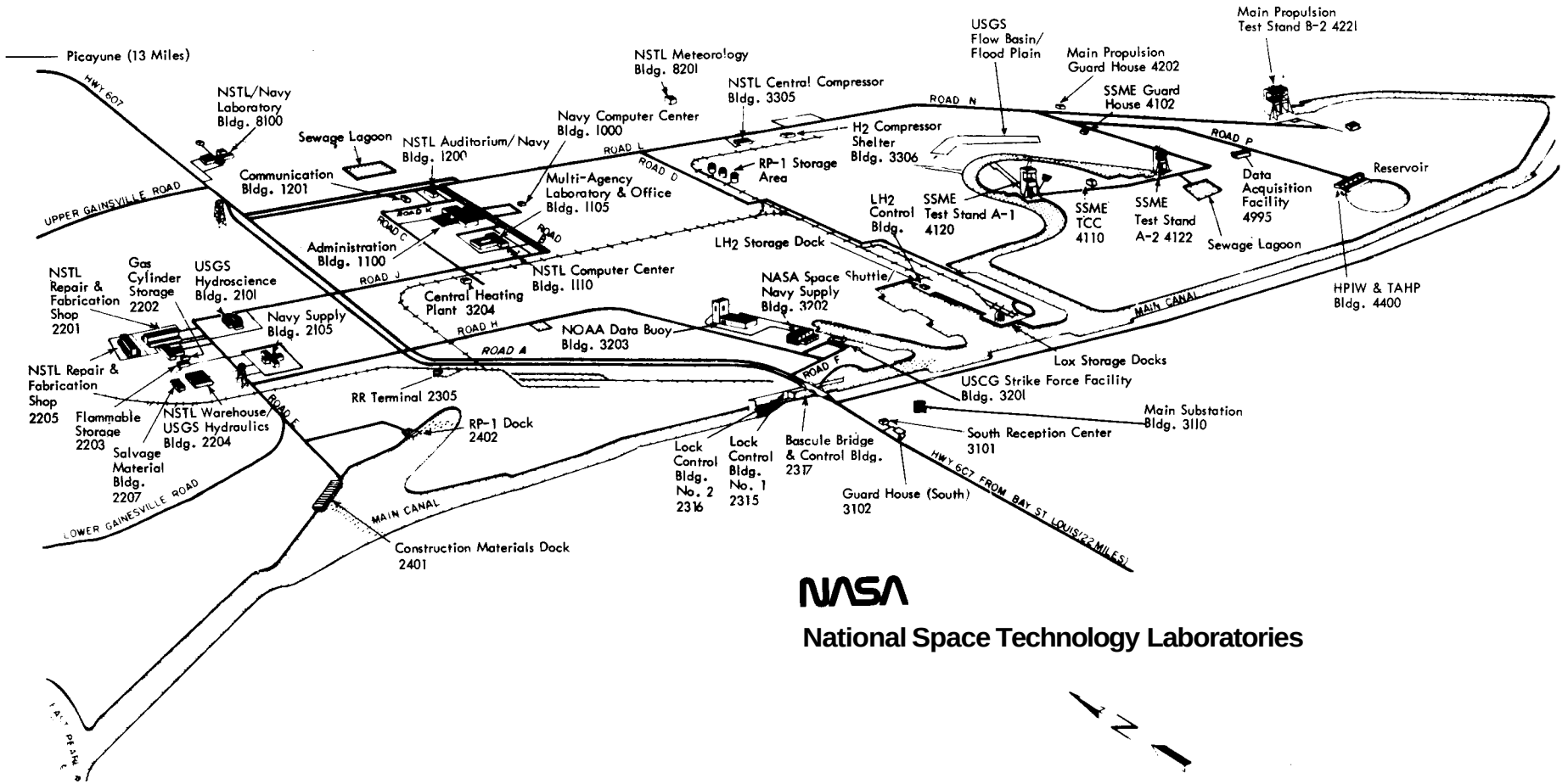
NSTL SUMMARY STAFFING	FY 81	FY 82
SES	3	3
GS16		
GS-15	5	5
GS-14	10	10
All other GS	85	85
TOTAL PERMANENT	103	103




NASA
National Aeronautics and Space Administration
LEGEND
Interstate Highways
U.S. Highways
State Highways
Railroads
Commercial Airports
General Aviation
Military Airfields
Commercial Ports
Deep Water Ports
Colleges & Universities
Urban Areas
NSTL
FEE AREA 13,480 ACRES
BUFFER ZONE 125,327 "
TOTAL 138,807 "
NATIONAL SPACE TECHNOLOGY LABORATORIES
BUFFER ZONE
FEE AREA
SLIDELL COMPUTER COMPLEX
MICHOUD ASSEMBLY FACILITY
HAMMOND
COVINGTON
PICAYUNE
POPLARVILLE
BOGALUSA
SLIDELL
NEW ORLEANS
BILOXI
GULFPORT
LONG BEACH
PASS CHRISTIAN
BAY ST. LOUIS
WAVELAND
Lake Pontchartrain
LAKE BORGNE
MISSISSIPPI SOUND
HARRISON COUNTY INDUSTRIAL SEAWAY
DESOTO NATIONAL FOREST
PONCHATOULA
Mandeville
Pearlington
Stennis Field
KILN
BAY OF SAINT LOUIS
CLERMONT HARBOR
LAKESHORE
WATERWAY
INTRACOASTAL
GULF
LAKE CATAOUATCHE
REGIONAL MAP
N
SCALE IN MILES
National Space Technology Laboratories

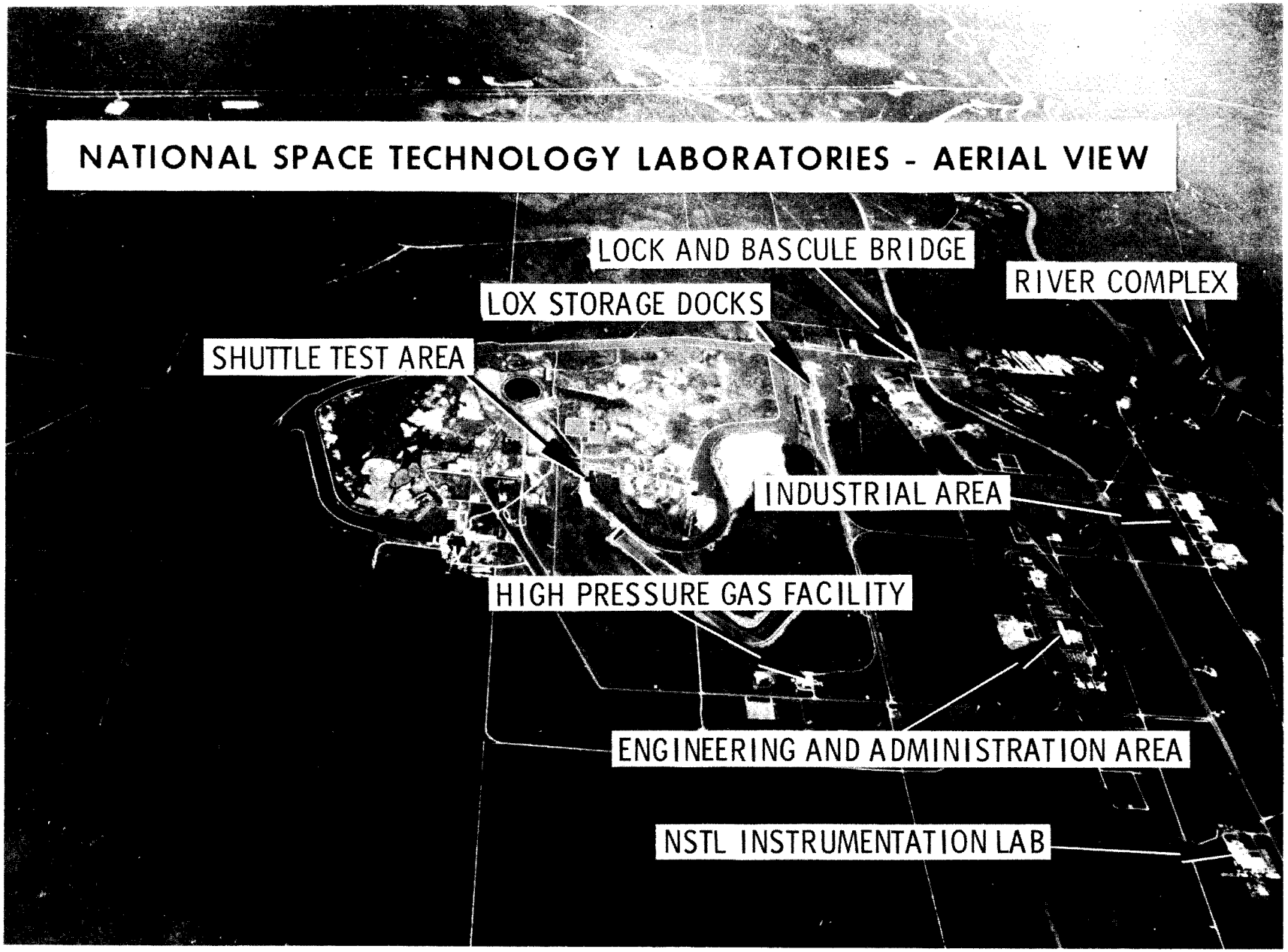
RPM 4-17

NSTL LOCATION PLAN



NASA

National Space Technology Laboratories


NATIONAL SPACE TECHNOLOGY LABORATORIES - AERIAL VIEW
LOCK AND BASCULE BRIDGE
RIVER COMPLEX
LOX STORAGE DOCKS
SHUTTLE TEST AREA
INDUSTRIAL AREA
HIGH PRESSURE GAS FACILITY
ENGINEERING AND ADMINISTRATION AREA
NSTL INSTRUMENTATION LAB

RESEARCH AND PROGRAM MANAGEMENT

FISCAL YEAR 1982 ESTIMATES

GODDARD SPACE FLIGHT CENTER

DESCRIPTION

The Goddard Space Flight Center, located 15 miles northeast of Washington, D.C., at Greenbelt, Maryland is situated on a 552-acre main site. Three additional nearby plots of 601 acres comprise the remote site area and contain the Goddard Antenna Test Range, the Goddard Optical Facility, the Propulsion Research Facility, the Magnetic Fields Component Test Facility, the Attitude Control Test Facility, and the Network Training and Test Facility. The total capital investment for the Goddard Space Flight Center, including tracking stations and contractor-held facilities at various locations as of September 30, 1980, was $724,218,000.

The majority of the Goddard Center's personnel are located at Greenbelt, Maryland; other personnel are located at the Goddard Institute for Space Studies in New York City, and throughout the world, managing the operation of satellite tracking and communications network stations.

CENTER ROLES AND MISSIONS

The Goddard Space Flight Center (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 space science and applications. 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, data acquisition and analysis; and scientific research to include both theoretical studies and the development of many significant scientific experiments flown on satellites. The principal and supporting roles are:

PRINCIPAL

Earth Orbital Spacecraft Development and Flight Operations - including 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, and the planning and conducting of associated flight operations.

Tracking and Data Acquisition Systems and Support Operations - planning, developing and implementing the tracking network, data processing and analysis, communications, and mission control systems and facilities; planning and conducting support of Earth orbital spacecraft, which includes flight control, tracking, data acquisition, communications, and information processing and analysis; and network planning and implementation support for Shuttle, including Orbital Flight Tests. (Tracking and data acquisition responsibilities include orbital phase acquisition of all mission types such as manned and deep space).

Spacelab Payloads - developing, analytically integrating and processing data for Spacelab payloads in astrophysics, solar terrestrial physics, astronomy, and applications.

Space Physics and Astronomy Payloads - developing the technical discipline base, including astronomical sensors; developing and implementing flight experiments, including space physics and experimentation for planetary missions.

Applications Research and Development - developing the technical discipline base, spaceborne sensors, ground data processing and analysis systems, and implementing applications experiments for Environmental Observations and Resources Observations.

Upper Atmospheric Research - developing and applying analytical techniques, evaluating advanced instrumentation concepts for atmospheric constituent analysis, and developing concepts for future flight missions.

Information Systems Technology - developing and maintaining a technology base.

Sounding Rocket Development, Procurement and Operations - developing and procuring sounding rockets and carrying out all phases of operations from mission/flight planning to landing and recovery. Includes supporting systems (i.e., guidance, telemetry and attitude control), payload carrier development and development acquisition. Most GSFC sounding rocket activities involve the higher performance, more complex vehicle support systems. Most activities involving lower performance vehicle systems are assigned to Wallops Flight Center.

Launch Vehicle Procurement - focusing on Delta procurement for Space Science and Space Applications-oriented missions, reimbursable missions for other Government agencies, domestic commercial users, and international users.

SUPPORTING

Planetary Science - developing and applying techniques for the analysis of planetary atmospheres.

SUMMARY OF RESOURCES REQUIREMENTS

Funding Plan by Function

		1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)			
I.	Personnel and Related Costs	112,996	115,638	120,231	123,242
II.	Travel	2,476	2,712	2,677	3,385
III.	Facilities Services	8,772	11,816	11,383	14,574
IV.	Technical Services	3,111	3,076	2,917	2,932
V.	Management and Operations	6,120	6,093	6,511	7,472
	1981 Budget Amendment	---	-1,760	---	---
	Total, fund requirements	133,475	137,575	143,719	151,605

Distribution of Permanent Positions by Program

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
Direct Positions				
Space Transportation Systems and Operations	142	72	154	141
Space shuttle	32	3	38	23
Space flight operations	42	21	40	42
Expendable launch vehicles	68	48	76	76
Space Science	1,052	967	992	985
Physics and astronomy	961	881	908	913
Planetary exploration	91	86	84	72
Space and Terrestrial Applications	843	984	912	915
Space applications	822	971	893	894
Technology utilization	21	13	19	21
Aeronautics and Space Technology	120	128	118	147
Space research and technology	120	128	118	147
Space Tracking and Data Systems	580	538	558	546
Tracking and data acquisition	580	538	558	546
Subtotal, direct positions	2,737	2,689	2,734	2,734
Center Management and Operations Support Positions	707	751	710	710
Total, permanent positions	3,444	3,440	3,444	3,444

PROGRAM DESCRIPTION

	Permanent Positions (Civil Service)
SPACE SHUTTLE	23

The objective of the Space Shuttle activities at GSFC is to plan and implement the equipment systems, communications data, voice circuits, and operational procedures required for support during the Orbital Flight Test phase and the subsequent operational phase of the Shuttle program.

SPACE FLIGHT OPERATIONS	42

The objective of the GSFC activities in this area is to provide the technical support and data to effectively integrate GSFC free-flyer payloads into the Space Transportation System. During 1982, GSFC will perform a variety of studies, utilizing its scientific and technical base, to better develop the Shuttle payload requirements and interface for the Goddard free-flyer payloads.

EXPENDABLE LAUNCH VEHICLES	76

The GSFC is the management center for the Delta launch vehicle. The Delta vehicle is NASA's only medium class standard launch vehicle and has the capability of accurately putting a wide variety of spacecraft into a broad spectrum of orbits, ranging from equatorial to polar inclinations. The Delta is used for NASA missions, for a wide range of reimbursable missions for other Government agencies, domestic commercial users, and international users. The Delta program provides for production of the launch vehicles required for approved missions, necessary operations support, production capability for projected missions and solid propellant upper stages and apogee booster motors. The Delta project provides engineering, quality, and configuration control services to maintain operational capability with high reliability.

PHYSICS AND ASTRONOMY	913

Physics and Astronomy is comprised of research in two major areas: Astrophysics and Solar Terrestrial Research.

Astrophysics activities have the objectives of: accomplishing laboratory and flight scientific research to increase human knowledge of the Earth's space environment, the stars, and other celestial objects; and providing advanced technical development of experiments and spacecraft components for astrophysics missions.

To this end, GSFC has organized its activities to accomplish scientific progress in all of the following discipline areas of astrophysics: gamma ray astronomy, X-ray astronomy, ultraviolet and optical astronomy, infrared and radio astronomy, and particle astrophysics.

Solar Terrestrial activities seek to understand the processes that generate energy in the Sun, transform and transport that energy to the Earth, as well as the interactions of that energy with the Earth's space environment and magnetic field. Therefore, the Solar Terrestrial activities at GSFC involve both solar and space plasma physics.

During **1982,** GSFC investigators will actively be involved in development of instruments for the Space Telescope, Gamma Ray Observatory, Cosmic Background Explorer, Shuttle Payloads and Integrated Rocket Experiments, International Solar Polar Mission, and analysis of data from several major Physics and Astronomy missions, the High Energy Astronomy Observatory, the Dynamics Explorer, the Solar Maximum Mission, the Orbiting Astronomical Satellite, the Atmosphere Explorer, the International Monitoring Probe, and the Small Astronomy Satellite.

In **1982,** the International Ultraviolet Explorer (IUE) 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, quickly make observations, and receive data in visual formats. Additionally, it is expected that the International Sun-Earth Explorer (ISEE) series will provide unusual opportunities to study the dynamic interactions of solar wind and the Earth's magnetosphere from various points in space.

In **1982,** other Explorer efforts will continue. It is anticipated that we will move into development of the following Explorer missions: Active Magnetosphere Particle Tracer Experiment; Cosmic Background Explorer; and Extreme Ultraviolet Explorer.

GSFC will provide the management and support of NASA Domestic and International Sounding Rocket programs. The project involvement extends from the conception through launch and data analysis in support of research within Galactic Astronomy, High Energy Astrophysics, Solar Physics, Aeronomy, Meteorology, Planetary Astronomy, and the space applications of materials processing science. During **1982,** we plan to introduce sounding rocket technology to the Shuttle via the mode of Experiments of Opportunity (EOP). This is a cost-effective approach which allows the experimenter to obtain scientific data from an instrument designed to fly on a sounding rocket or the Shuttle. In **1982,** we anticipate the accomplishment of the development and implementation of logistic and technical consultation services for the Shuttle's self-contained payload containers (Getaway Special Program).

	Permanent Positions (Civil Service)
PLANETARY EXPLORATION	72

The GSFC science activity within the Planetary Exploration program is designed to emphasize the physics of interplanetary space and planetary environments. To this end, GSFC will, in 1982, maintain as strong and viable a research group as is required to carry out this role.

During 1982, GSFC investigators will be actively involved in the development of two instruments, the Neutral Mass Spectrometer and the Photopolarimeter Radiometer for Galileo. These instruments will measure chemical composition and the physical properties of clouds in the atmosphere of Jupiter. GSFC will also be involved in the data analysis activity of various instruments on Voyager and Pioneer Venus.

SPACE APPLICATIONS	*894*

The Space and Terrestrial Applications program for 1982 spans this Center's broad roles and missions mandate. Included for 1982 are activities in the discipline areas of Resource Observations and Environmental Observations.

GSFC is engaged in three major types of activities in these areas: a. Research and Technology; b. Flight Projects; and c. Application Demonstrations. These activities may be characterized as follows:

A. The Applications Research and Technology effort, in general, is directed toward solving major problems in the above mentioned major applications disciplines. It stresses continuity of applied research from the assessment of these problems to conceptual instrument design and testing, mission and payload studies, concepts of flight missions, and their final analyses and evaluation after launch. It includes the design and construction of mathematical models to study:

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

2. The dynamics of the Earth to provide improved understanding of geodynamics and earthquake processes, and gravity fields;

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

4. The Earth's renewable and nonrenewble resources for better monitoring, assessment, and management; and

5. The environment of the Earth's atmosphere and hydrosphere.

Other examples of efforts of more specific nature include: new instrument development for measuring temperature and pressure profiles in the atmosphere which are essential input parameters for our weather and climate models; user active and passive microwave systems for measuring sea surface temperatures and winds, as well as soil moisture essential for water resources modeling and agriculture yield predictions; new instruments for ocean color measurements important for ocean studies and pollution determination; new high precision laser electronic ranging systems to support our Earth and ocean dynamics efforts; new low cost data collection platforms; and low cost global positioning system terminals for civilian application.

B. Application's Flight Project responsibilities for 1981 and 1982 include:

1. Operational weather satellite missions for the ,National Oceanic and Atmospheric Administration (NOAA).

   a. NOAA-C--Scheduled for launch during the 2nd quarter of 1981;

   b. NOAA-D--Available for launch during the 3rd quarter of 1981;

   c. NOAA-E Bus--modifications for incorporation of Search and Rescue components will be completed, and delivery of the Bus will occur in the 1st quarter 1981;

   d. Geostationary Operational Environmental Satellite (GOES-E)--to be launched in the 1st quarter of 1981; and

   e. Geostationary Operational Environmental Satellite (GOES-F)--scheduled for launch during the 4th quarter of 1982.

2. Landsat and Nimbus satellites extended operations--will continue to provide remotely sensed resources and environmental observations to a worldwide applications research science community.

3. Landsat-D--Fabrication, assembly and test of the Landsat-D Thematic Mapper, Multispectral Scanner System and Multimission Spacecraft will continue. Delivery of all observatory components and subassemblies of the mission system contractor for integration and test of the first space segment will be completed during 1981. Launch is scheduled for the third quarter of 1982.

4. Earth Radiation Budget Experiment-delivery of the flight models 1 and 2 are scheduled in 1982.

5. Stratospheric Aersol Gas Experiment II--fabrication, assembly, and test of the instrument will be completed by the end of 1982.

6. National Oceanic Satellite System (NOSS)--main areas of emphasis in 1982 are the system design and fabrication of instruments.

C. Applications Demonstration activities involve the formulation, analysis, and distribution of applications data received from satellites for which Goddard has management responsibility. Such demonstrations concern the use of data from Nimbus-7 spacecraft for the solution of problems concerning pollution, ocean resources and dynamics, and weather and climate. Analysis of data received from the Heat Capacity Mapping Mission (HCMM) will be analyzed to evaluate the utility of thermal measurements from satellites for determining such parameters as soil moisture and rock types inferred from surface temperatures and thermal inertia. Data from the Landsat-3 spacecraft will be of use to investigators in the agricultural, forestry, geology, land use, cartography, hydrology, ecology, and oceanography disciplines. A major activity is the transfer of Landsat data applications technology to state and local government organizations and private industry. GSFC, with the Eastern Regional Sensing Applications Center, has responsibility for remote sensing technology in 17 states.

	Permanent Positions (Civil Service)
TECHNOLOGY UTILIZATION.....	21

Technology Utilization activities are directed toward the application of space technology to public and private sector needs. Foremost among the technology applications projects in 1982 are the following:

1. New technology identification, evaluation, and publication,

2. Dissemination methods and techniques, and

3. Public sector technology applications projects.

	Permanent Positions (Civil Service)
SPACE RESEARCH AND TECHNOLOGY	147

The objective of GSFC in Space Research and Technology program activities is to enhance space mission capabilities. Past efforts have produced many worthwhile advances in space system capability, reliability, and effectiveness. During 1982, areas of increasing attention include cryogenics for space flight, information systems, sensors, and laser ranging.

TRACKING AND DATA ACQUISITION	546

The Tracking and Data Acquisition program at GSFC is broken into two main areas: operation of the Spaceflight Tracking and Data Network (STDN); and mission control, data processing, and computation support for flight projects.

The STDN is operated in direct support of NASA's Earth orbiting scientific and applications satellites and Shuttle/Spacelab programs. In addition, the Network provides 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 Deep Space Network (DSN).

NASA Communications Network (NASCOM) provides all operational communications required by NASA. Facilities of this Network link the stations of the STDN and will make it possible for the Tracking and Data Relay Satellite System (TDRSS) to operate as a part of the overall tracking and data acquisition complex for which NASA has responsibility.

The TDRSS will provide the satellite relay of Earth orbiting spacecraft data to a single ground station located at White Sands, New Mexico. The system will employ 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 STDN ground stations will be closed. However, some of the current stations will be maintained to provide for Shuttle launch and high altitude orbit support that cannot be provided by the TDRSS.

During 1982, the STDN is projecting support for approximately 43 missions including: Space Transportation System flights, High Energy Astronomy Observatories, Fleet Satellite Communications-4, International Sun-Earth Explorers, International Ultraviolet Explorer, Magsat, Solar Maximum Mission, and Stratospheric Aerosol and Gas Experiment.

The mission and data operations function provides support to flight missions in the categories of mission control, operational computing, and sensor data processing. This includes mission and systems analysis, systems design and implementation, and the operation and maintenance of multimission and dedicated technical facilities to support both Goddard and non-Goddard missions.

During 1982, emphasis will continue to be placed on defining concepts for spacecraft and data autonomy in order to modify designs of flight and ground systems to improve the response, capacity, and effectiveness of the end-to-end data system, as well as the development of system concepts and techniques to provide data to multiple users from multiple data sources.

In the area of mission control, work will continue on the first Payload Operations Control Center Network (POCCNET) cluster to allow the reuse of standard components and designs in order to share expensive resources among a large number of missions.

Two major operational computing efforts will be continued. The first will be to put in place a new metric data handling system to provide an improved central point of metric data reception from the STDN; and, the second is to size the computational requirements for the Shuttle era and provide a new computing capability for flight dynamics, including attitude computations and command management.

Emphasis will be placed on end-to-end data concepts and, in addition, a major effort will be required to develop and implement a new capability to process and distribute Spacelab payload data.

	Permanent Positions (Civil Service)
CENTER MANAGEMENT AND OPERATIONS SUPPORT.....	710

Center Management and Operations Support is defined as that support or services being provided to all GSFC 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, and staff organizations, e.g., Legal, Patent Counsel, Equal Opportunity, Planning and Analysis, Public Affairs, and Safety.

Management Support - Includes a wide range of activities generally categorized as activities of a general and administrative nature which are required to operate and maintain the installation. Specific functions include resources and budget management, program control, contracting and procurement, personnel management, property management, financial management, and resource control and management information systems and analysis.

Operations Support - This is a broad spectrum of activity that is requred to maintain and operate facilities, buildings, and equipment; and to provide the normal housekeeping services and logistics support for the personnel who manage and conduct the affairs of the Center. Specific activities are:

Maintenance and operation of all buildings and facilities
Data processing and computer support
Reliability and quality assurance
Security and protection
Fire protection
Custodial services
Logistics support including transportation, supplies
Medical care of employees
Photographic and graphic support

RESOURCE REQUIREMENTS BY FUNCTION

		1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)			
I.	**PERSONNEL AND RELATED COSTS**	**112,996**	**115,638**	**120,231**	**123,242**
	Summary of Fund Requirements				
A.	Compensation and Benefits				
1.	Compensation				
a.	Permanent positions	101,178	102,837	107,191	109,889
b.	Other than full-time permanent positions	908	965	1,180	1,187
c.	Overtime and other compensation	939	897	945	945
	Subtotal, Compensation	103,025	104,699	109,316	112,021
2.	Benefits	9,100	9,361	9,670	9,834
	Subtotal, Compensation and Benefits	112,125	114,060	118,986	121,855
B.	Supporting Costs				
1.	Transfer of personnel	109	163	330	380
2.	Personnel training	762	1,415	915	1,007
	Subtotal, Supporting Costs	871	1,578	1,245	1,387
	Total, Personnel and Related Costs	112,996	115,638	120,231	123,242

Explanation of Fund Requirements

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
A. Compensation and Benefits	112,125	114,060	118,986	121,855
1. Compensation	103,025	104,699	109,316	112,021
a. Permanent positions	101,178	102,837	107,191	109,889

The estimate for 1982 will support 3,444 permanent positions. The increase from the 1981 budget estimate to the 1981 current estimate is due to the October 1980 pay increase. The cost of permanent positions in 1982 will be $109,889,000, an increase of $2,698,000 over 1981. The increase from 1981 results from the following:

Basis of Cost for Permanent Positions

Cost of permanent positions in 1981		107,191
Cost increases in 1982		3,371
Within grade and career advances:		
Full year effect of 1981 actions	+1,905	
Partial year effect of 1982 actions	+1,379	
Full year effect of 1981 pay increases	+87	
Cost decreases in 1982		-673
Turnover savings:		
Full year effect of 1982 actions	-403	
Partial year effect of 1982 actions	-270	
Cost of permanent positions in 1982		109,889

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
b. Other than full-time permanent positions				
1. Costs	908	965	1,180	1,187
2. Workyears	93	95	105	106

The 1982 estimate includes 106 workyears which will support the following programs:

Distribution of Other than Full-Time Permanent Workyears

Program	Workyears
Cooperative training	43
Summer employment	5
Opportunity programs	21
Other temporary employment	37
Total	106

The workyear increases from the 1981 budget estimate to the 1981 current estimate reflect a build-up in the Cooperative Training program. The 1981 current estimate reflects the full year effect of the October 1980 pay increase.

c. Overtime and other compensation	939	897	945	945

Overtime at GSFC is required to meet peak operational requirements where additional workhours are essential, generally culminating in the launch of a manned or automated spacecraft. Some of the areas involved are fabrication, experimentation, testing, launching and tracking of the spacecraft. The increase from the 1981 budget estimate to the 1981 current estimate reflects the October 1980 pay increase.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
2. Benefits	9,100	9,361	9,670	9,834

The following table indicates the cost of personnel benefits by the major categories:

Civil Service Retirement Fund	6,833	7,274	7,450	7,678
Employee life insurance	240	245	245	252
Employee health insurance	1,534	1,691	1,567	1,585
Workmen's compensation	186	126	126	140
FICA	18	25	19	19
Other benefits	289	---	263	160
Total	9,100	9,361	9,670	9,834

The increase from the 1981 budget estimate to the 1981 current estimate reflects the October 1980 pay increase. Workmen's compensation costs are based on the Department of Labor billings. The 1982 estimate reflects anticipated increases in health insurance costs, life insurance costs and workmen's compensation partially offset by decreases in other benefits.

B. Supporting Costs	871	1,578	1,245	1,387
1. Transfer of personnel	109	163	330	380

Provides for the movement and storage of household goods to the employee's new duty station, and other relocation expenses.

2. Personnel training	762	1,415	915	1,007

The personnel training costs are based on current training programs and the need to reorient skills of employees into areas compatible with the direction of the current space program and GSFC's role in the program. The decrease in the 1981 budget estimate to the 1981 current estimate reflects the revised training estimates associated with the Civil Service Reform Act (CSRA) implementation, and the Tracking and Data reorganization. The 1982 estimate is essentially the same as the 1981 level before training for the CSRA and includes anticipated increased tuition costs.

		1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
			(Thousands of Dollars)		
II.	**TRAVEL**	***2,476***	***2,712***	***2,677***	**3,385**
	Summary of Fund Requirements				
A.	Program Travel	2,069	2,304	2,273	2,954
B.	Scientific and Technical Development Travel	268	266	258	276
C.	Management and Operations Travel	139	142	146	155
	Total, Travel	2,476	2,712	2,677	3,385
	Explanation of Fund Requirements				
A.	Program Travel	2,069	2,304	2,273	2,954

Program travel is essential to the accomplishment of the Center's mission, particularly with regard to the Physics and Astronomy, Space and Terrestrial Applications, Tracking and Data Acquisition, and Space Transportation Systems 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 in the 1982 estimate over the 1981 current estimate is due to increased requirements associated with such programs as Shuttle, Space Telescope, the Cosmic Background Explorer, TDRSS, Upper Atmospheric Research Satellite, Landsat-D, and Gamma Ray Observatory.

B.	Scientific and Technical Development Travel	268	266	258	276

Scientific and technical development travel permits employees to participate in meetings and technical seminars with other representatives of the aerospace community. This participation allows them to benefit from exposure to technological advances outside GSFC, as well as to present both accomplishments and problems to their associates. Many of the meetings are working panels convened to solve problems for the

benefit of the Government. Space Science programs are the primary users of travel in this area. The decrease from the 1981 budget estimate to the 1981 current estimate reflects a reduction in travel due to budgetary constraints. The 1982 estimate partially covers anticipated cost increases resulting in a further decline in the number of trips.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
C. Management and Operations Travel.....	139	142	146	155

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, and travel of the Center's top management to other NASA Centers.

III. FACILITIES SERVICES.....	**8,772**	**11,816**	**11,383**	**14,574**

GSFC is located on a 552-acre main site and on a 601-acre remote site area with a complex of laboratory and office-type buildings as well as test facilities. This complex encompasses 2,363,500 gross square feet of building space including 34 buildings. This physical plant supports an average daily on-Center population of 5,800 to 6,100 personnel. Many of the test facilities are utilized on schedules involving more than one shift and during off-peak hours.

Summary of Fund Requirements

A. Rental of Real Property.....	678	966	828	725
B. Maintenance and Related Services.....	1,277	1,442	1,145	1,658
1. Facilities.....	1,262	1,427	1,130	1,642
2. Equipment.....	15	15	15	16
C. Custodial Services.....	1,356	2,121	2,247	2,537

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
D. Utilities Services	5,461	7,287	7,163	9,654
Total, Facilities Services	8,772	11,816	11,383	14,574

Explanation of Fund Requirements

A. Rental of Real Property	678	966	828	725

Provides space for personnel at three tracking stations and the Goddard Institute for Space Studies (GISS) in New York, as well as storage and warehouse space for equipment, supplies and materials. The area requirements in 1981 are the same as those rented in 1980. The decrease from the 1981 budget estimate to the 1981 current estimate is due to GSA's reevaluation of rental rates. The further decrease in the 1982 budget estimate is due to vacating a portion of the leased space.

B. Maintenance and Related Services	1,277	1,442	1,145	1,658
1. Facilities	1,262	1,427	1,130	1,642

This activity includes maintenance items such as roof replacement, lamp replacement in offices to achieve energy savings, rehabilitation of air-conditioning systems to achieve energy reduction, and other miscellaneous items. The decrease from the 1981 budget estimate to the 1981 current estimate reflects a necessity of deferrals such as maintenance painting and equipment upgrading due to budgetary constraints. The increase in 1982 provides for some long-deferred items which need to be completed, such as upgrading power plant operations for energy conservation. The major services included are:

a. Maintenance and operation	502

These funds provide general buildings maintenance including painting, inspection, and mechnical and electrical maintenance.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
b. Ground maintenance				200

Provides for mowing, cultivation, mulching, fertilizing and care of trees and shrubs.

c. Supplies and facilities equipment				450

Included in this category are chemicals, building materials, electrical and electronics materials, general maintenance and operating materials, metals, pipes, valve, and fittings.

d. Routine facilities work				490

Included in this activity is support for rehabilitation and modification of facilities, office alteration and safety upgrading.

2. Equipment	15	15	15	16

Provides for maintenance of and equipment for the on-site radio communications network.

C. Custodial Services	1,356	2,121	2,247	2,537

The 1982 estimate reflects an additional three support contractor workyears and provides for anticipated wage rate increases.

1. Janitorial services				1,803

This activity is applicable to about 2.3 million square feet of area and includes washing and relamping of light fixtures, office cleaning, minor laundry services, and trash removal.

2. Security guard services				734

This activity includes badging of all on-site personnel and visitors, vehicle identification, and protection of all Government facilities and equipment including the GISS in New York City.

	1980 Actual	1981 Budget. Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
D. Utilities Services	5,461	7,287	7,163	9,654

The estimate provides for operation and 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. Electricity is purchased from the Potomac Electric and Power Company, natural gas from Washington Gas Light Company and fuel oil from a local supplier. Water and sewage is provided by the Washington Suburban Sanitary Commission. The decrease from the 1981 budget estimate to the 1981 current estimate is due to revised usage projections based on continued energy conservation partially offset by six additional support contractor workyears. The increase in 1982 provides for anticipated utility rate increases while reducing consumption as part of continued conservation efforts, and 27 additional support contractor workyear requirements to support the Central Power Plant. The purchased utilities are as follows:

1.	Electricity (92,141 MW/hrs)	5,318
2.	Natural gas (276,000 M cu. ft)	1,374
3.	Fuel oil (87,000 K gals)	123
4.	Water and sewage	353

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
IV. TECHNICAL SERVICES	**3,111**	**3,076**	**2,917**	**2,932**
Summary of Fund Requirements				
A. Automated Data Processing	1,868	1,936	2,035	1,847
1. Equipment	112	628	648	279
2. Operations	1,756	1,308	1,387	1,568
B. Scientific and Technical Information	1,041	925	662	835
1. Library	861	719	472	570
2. Education and Information	180	206	190	265
C. Shop Support and Services	202	215	220	250
Total, Technical Services	3,111	3,076	2,917	2,932
Explanation of Fund Requirements				
A. Automated Data Processing	1,868	1,936	2,035	1,847

This funding provides accounting and management information to satisfy requirements of NASA and GSFC management. Included is support of GSFC business data functions.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
1. Equipment.....	112	628	648	279

The lease and purchase costs of all administrative ADP hardware are included in this estimate. Leased equipment includes Xerox 1200 printer, various terminals, and other peripheral equipment. The increase from the 1980 actual to the 1981 current estimate includes the purchase of an administrative computer. The 1982 estimate includes a computer for the library circulation system, plus some additional hardware for a new business computer.

2. Operations.....	1,756	1,308	1,387	1,568

The systems supported include institutional management, finance and accounting, procurement and personnel management. The increase from the 1981 budget estimate to the 1981 current estimate is due to increased contractor rates and increased cost of supplies and materials. The 1982 estimate provides for anticipated increases for wage rates, supplies, and services.

B. Scientific and Technical Information.....	1,041	925	662	835

These funds provide for the operation of a technical library at GSFC, a public affairs educational and informational program, and support to the Center in the provision of various scientific and technical information services.

1. Library	861	719	472	570

Catalog, reference, translating services, and distribution of books and publications in the operation of the GSFC library are funded in this estimate. This includes over 65,000 books, 45,000 journals, plus almost one million microfiche copies of aerospace documents. The decrease from the 1981 budget estimate to the 1981 current estimate is due to a reduction in purchases due to budgetary constraints. The 1982 estimate provides for anticipated contractor rate increases.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
2. Education and information	180	206	190	265

This estimate includes funds for exhibit management and refurbishment, spacemobile operation, demonstration models, workshops and symposia, and educational and information materials. The 1981 current estimate limits activity below the 1980 level due to budgetary constraints. The increase in 1982 is required to cover increases for symposia support, informational materials, exhibit upgrading and/or replacement, and models for regional display.

C. Shop Support and Services	202	215	220	250

Support is provided in the areas of safety, photo servfces, graphics, and publications. Fire protection system maintenance and related supplies and equipment; film and print processing, photographic supplies and repair of photographic equipment, art work services and related supply and equipment costs; and materials and equipment maintenance for compilation of documents comprise this category. The increase from the 1981 current estimate to the 1982 estimate reflects increased programmatic requirements for photo and graphic services.

V. MANAGEMENT AND OPERATIONS	*6,120*	*6,093*	6,511	*7,472*
Summary of Fund Requirements				
A. Administrative Communications	2,470	2,284	2,275	2,489
B. Printing and Reproduction	309	256	221	285
C. Transportation	1,473	1,978	2,097	2,320
D. Installation Common Services	1,868	1,575	1,918	2,378
Total, Management and Operations	6,120	6,093	6,511	7,472

Explanation of Fund Requirements

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
A. Administrative Communications	2,470	2,284	2,275	2,489

Provides for local telephone service, long distance telephone service, and other nontelephone communications. The 1981 current estimate reflects a reduction of lines and services across the Center. The 1982 estimate provides for the same level of service at increased cost.

1. Local telephone services.. 1,473

Covers 3,900 PBX internal lines and 6,000 telephone instruments. There are ten tielines for Baltimore-area communications. Four hundred centrex lines are used for computer data operations.

2. Long distance telephone service..... 921

a. Federal Telecommunications System use will approximate 869,000 calls in 1982.
b. Tolls or commercial long distance costs are included.

3. Other communication services..... 95

a. Teletype costs including the GSA Automatic Records System (ARS).
b. Also included is a United Press International Wire Service for the Public Affairs Office.

B. Printing and Reproduction	309	256	221	285

This estimate provides the funding for an on-site printing plant operated by Goddard personnel. This printing plant produces approximately 17,000,000 units of printing each year. In addition to this on-site printing plant, GSFC must also purchase from private firms under Government Printing Office contract about 30,000,000 units of printing each year. This purchased printing is a combination of an overflow requirement that cannot be handled because of the on-site workload and items that cannot be handled with the on-site equipment. Types of printing accomplished by off-site private firms are multiple-copy forms, multicolor work, and forms for computer use. The decrease from the 1981 budget estimate to the 1981 current estimate

is a reduction in the level of printing activity due to budgetary constraints. The 1982 estimate reflects planned increases in off-site contractor printing requirements.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
C. Transportation	1,473	1,978	2,097	2,320

This estimate provides for the operation of Center transportation and storage areas and other miscellaneous services. *Also* included are supplies and equipment for vehicle maintenance, gasoline, contracted services for vehicle maintenance, and special vehicle rental. The increase from the 1981 budget estimate to the 1981 current estimate reflects contractor rate escalation. The 1982 increase is due to further anticipated increases in support contractor rates.

1. Contractor support provides the following services:

a. Operation of Transportation Center -- includes drivers, dispatchers, supervisory personnel; provide pickup and delivery of purchased items and stock items, mail delivery, shuttle transportation, issuance of motor pool vehicles.

b. Packing and crating--preparation of shipments.

c. Rigging--rigging equipment for relocation on the Center .for shipment elsewhere.

d. Tape storage--operation of central magnetic tape depository.

e. Storage and warehousing--operation of receiving areas for supplies, stock issuance, and warehousing and storage function.

f. Moving and hauling--moving of equipment and furniture on emergency basis.

D. Installation Common Services	1,868	1,575	1,918	2,378

This activity supports Center management and staff activities, provides medical services, and covers various installation support services. The increase in 1981 from the budget estimate to the current estimate is due to increased contractor support and contractor rate escalation. The 1982 estimate provides for rate increases and replacement of vehicles.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
1. Center management and staff				426

Includes patent searches and applications; stenographic services, handbook revisions, Equal Opportunity programs; and general administrative supplies, materials, equipment, and equipment maintenance (microfilm, copiers, special typewriters) for staff offices.

2. Medical services 848

Provides support in Occupational Medicine and Environmental Health.

a. Occupational medicine 586

This activity consists of operation of the Goddard on-site health unit and medical services for the Goddard Institute for Space Studies (GISS) employees in New York. Provides for emergency care on-site, annual physical exams for Goddard employees, fitness programs, immunizations and counseling. Annual physical exams are provided for approximately 3,444 employees at the Center. The necessary supplies, materials, and equipment for operation of the Health Unit are included.

b. Environmental health 262

Environmental health consists of industrial hygiene and an environmental health laboratory for detection and correction of health hazards. Necessary supplies, materials and equipment are included.

3. Installation support services 1,104

This estimate includes all administrative support items not specifically identified elsewhere. Among these are the purchase of office furniture and operating supplies issued from stock; maintenance of all Center labor-saving devices; materials for mailroom and warehouse operation; operation of the mailroom; and postage costs.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		

a. Office supplies..... 261

General office supplies, furniture, and operating supplies for warehouse and mailroom, such as pallets and gas cylinders are included in this estimate.

b. Maintenance of general administrative equipment.. 122

This funding provides maintenance of copiers, time stamps, electronic calculators, electric typewriters, calculators, and adding machines; as well as cylinder and electric file maintenance.

c. Postage..... 341

d. Vehicles..... 185

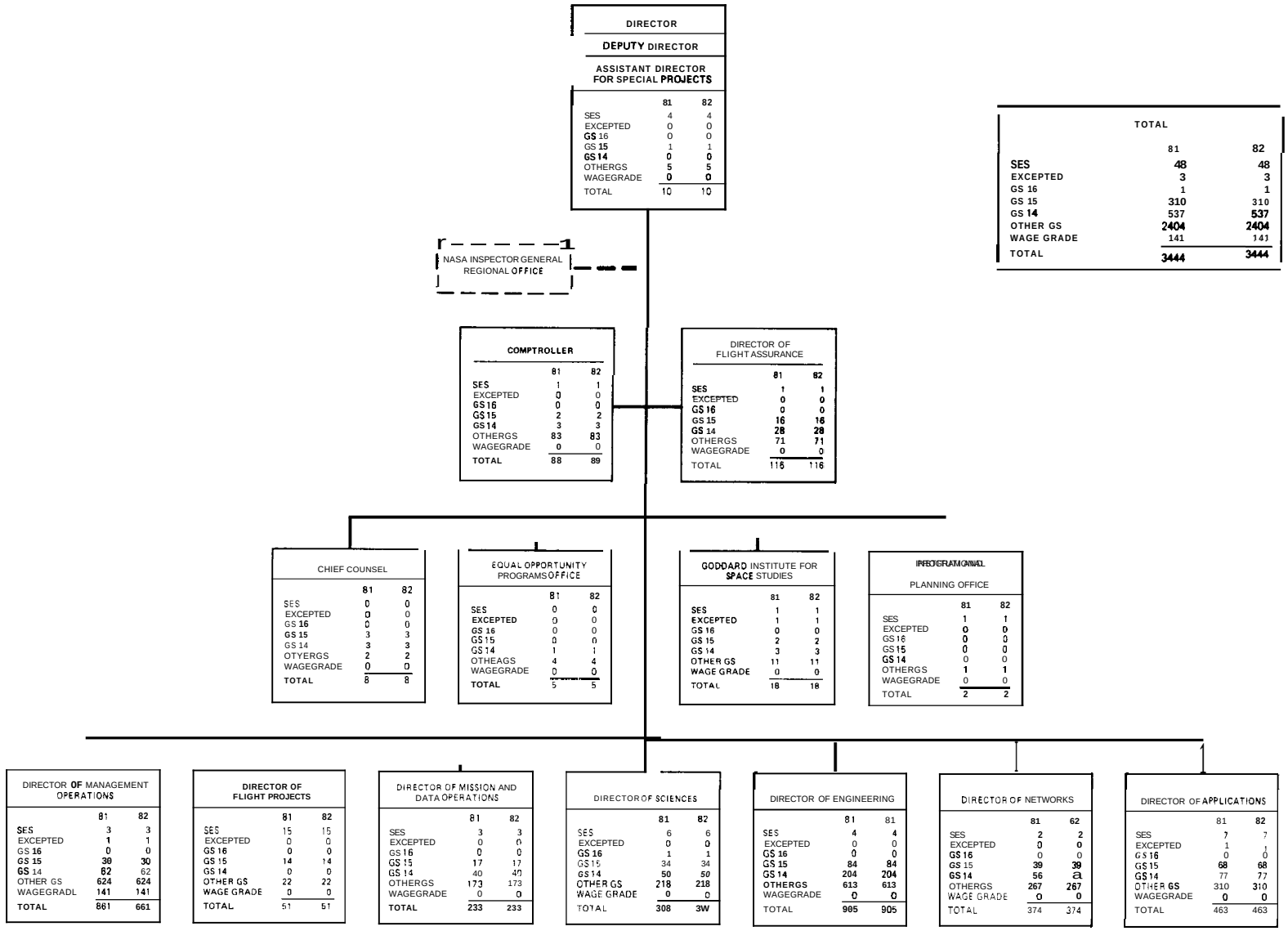
Funding provides for replacement cars and trucks for the Center's fleet.

e. Mailroom contract..... 195

This contract provides for operation of the Center's mailroom.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

GODDARD SPACE FLIGHT CENTER
GREENBELT. MARYLAND



	81	82
SES	4	4
EXCEPTED	0	0
GS 16	0	0
GS 15	1	1
GS 14	0	0
OTHERGS	5	5
WAGEGRADE	0	0
TOTAL	10	10

TOTAL	81	82
SES	48	48
EXCEPTED	3	3
GS 16	1	1
GS 15	310	310
GS 14	537	537
OTHER GS	2404	2404
WAGE GRADE	141	141
TOTAL	3444	3444

COMPTROLLER	81	82
SES	1	1
EXCEPTED	0	0
GS 16	0	0
GS 15	2	2
GS 14	3	3
OTHERGS	83	83
WAGEGRADE	0	0
TOTAL	88	89

DIRECTOR OF FLIGHT ASSURANCE	81	82
SES	1	1
EXCEPTED	0	0
GS 16	0	0
GS 15	16	16
GS 14	28	28
OTHERGS	71	71
WAGEGRADE	0	0
TOTAL	116	116

CHIEF COUNSEL	81	82
SES	0	0
EXCEPTED	0	0
GS 16	0	0
GS 15	3	3
GS 14	3	3
OTYERGS	2	2
WAGEGRADE	0	0
TOTAL	8	8

EQUAL OPPORTUNITY PROGRAMS OFFICE	81	82
SES	0	0
EXCEPTED	0	0
GS 16	0	0
GS 15	0	0
GS 14	1	1
OTHEAGS	4	4
WAGEGRADE	0	0
TOTAL	5	5

GODDARD INSTITUTE FOR SPACE STUDIES	81	82
SES	1	1
EXCEPTED	1	1
GS 16	0	0
GS 15	2	2
GS 14	3	3
OTHER GS	11	11
WAGE GRADE	0	0
TOTAL	18	18

PLANNING OFFICE	81	82
SES	1	1
EXCEPTED	0	0
GS 16	0	0
GS 15	0	0
GS 14	0	0
OTHERGS	1	1
WAGEGRADE	0	0
TOTAL	2	2

DIRECTOR OF MANAGEMENT OPERATIONS	81	82
SES	3	3
EXCEPTED	1	1
GS 16	0	0
GS 15	30	30
GS 14	62	62
OTHER GS	624	624
WAGEGRADL	141	141
TOTAL	861	661

DIRECTOR OF FLIGHT PROJECTS	81	82
SES	15	15
EXCEPTED	0	0
GS 16	0	0
GS 15	14	14
GS 14	0	0
OTHER GS	22	22
WAGE GRADE	0	0
TOTAL	51	51

DIRECTOR OF MISSION AND DATA OPERATIONS	81	82
SES	3	3
EXCEPTED	0	0
GS 16	0	0
GS 15	17	17
GS 14	40	40
OTHERGS	173	173
WAGEGRADE	0	0
TOTAL	233	233

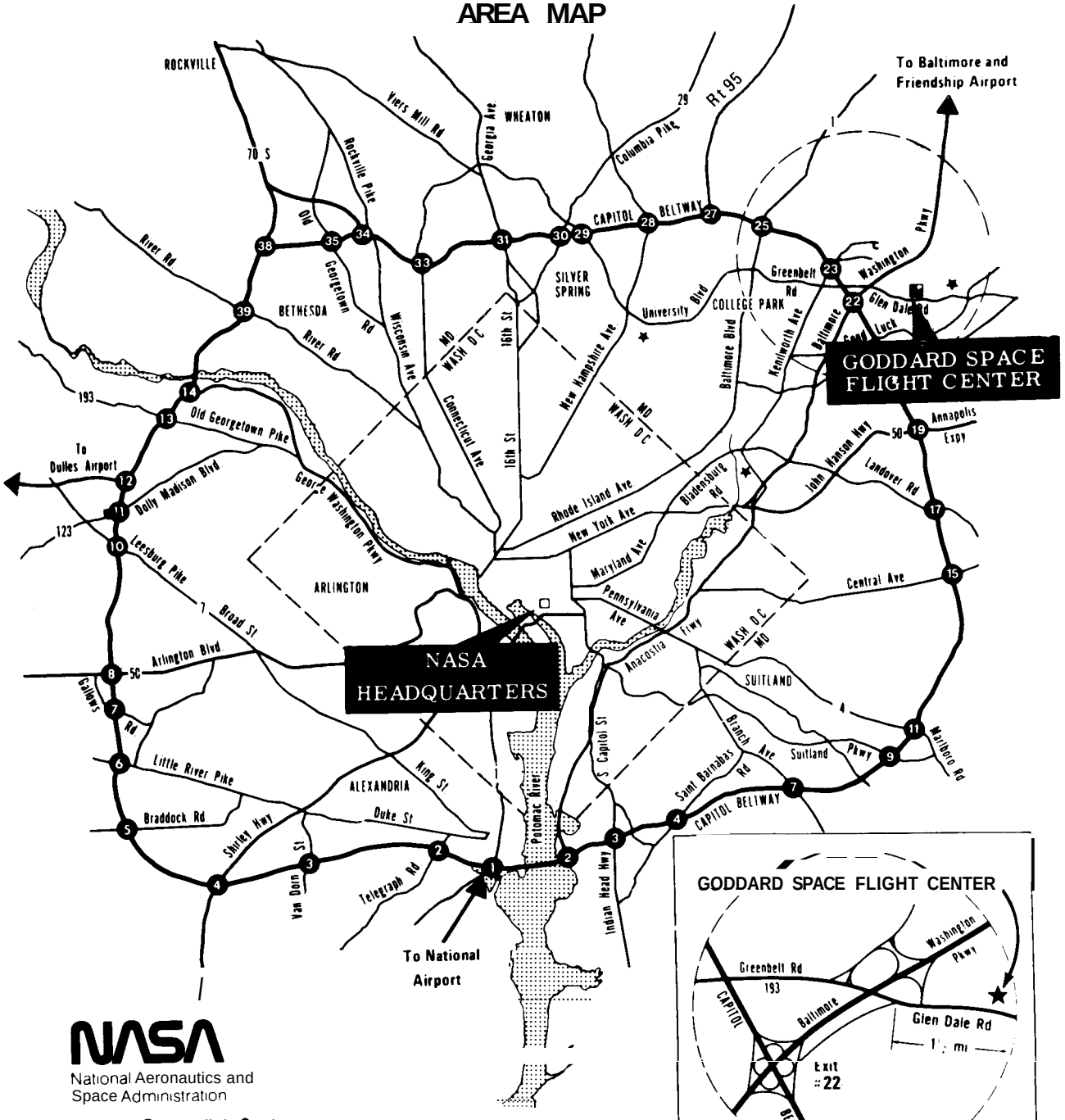
DIRECTOR OF SCIENCES	81	82
SES	6	6
EXCEPTED	0	0
GS 16	1	1
GS 15	34	34
GS 14	50	50
OTHER GS	218	218
WAGE GRADE	0	0
TOTAL	308	3W

DIRECTOR OF ENGINEERING	81	81
SES	4	4
EXCEPTED	0	0
GS 16	0	0
GS 15	84	84
GS 14	204	204
OTHERGS	613	613
WAGEGRADE	0	0
TOTAL	905	905

DIRECTOR OF NETWORKS	81	62
SES	2	2
EXCEPTED	0	0
GS 16	0	0
GS 15	39	39
GS 14	56	21
OTHERGS	267	267
WAGE GRADE	0	0
TOTAL	374	374

DIRECTOR OF APPLICATIONS	81	82
SES	7	7
EXCEPTED	1	1
GS 16	0	0
GS 15	68	68
GS 14	77	77
OTHER GS	310	310
WAGEGRADE	0	0
TOTAL	463	463

GODDARD SPACE FLIGHT CENTER
FISCAL YEAR 1982 ESTIMATES
AREA MAP



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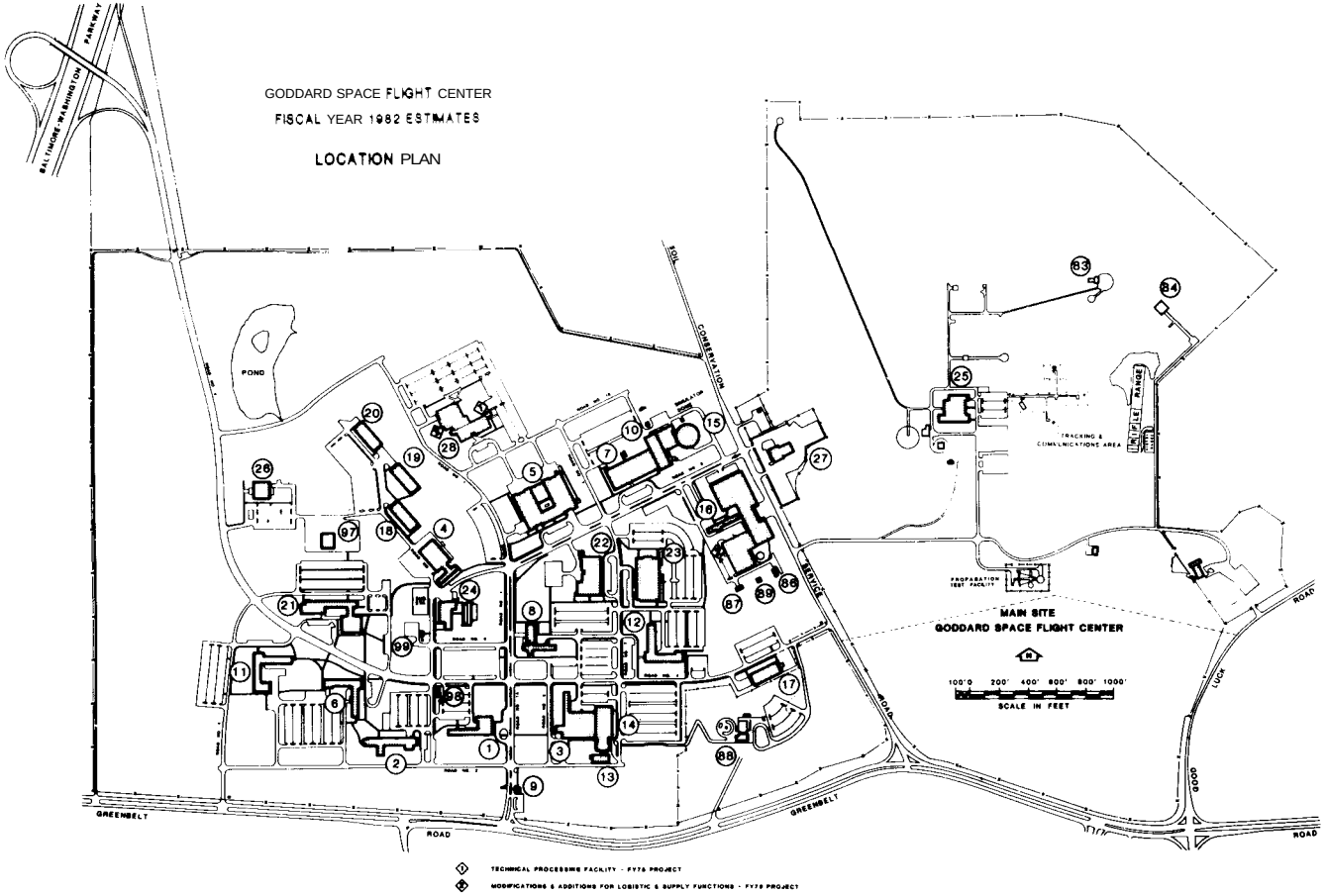


GSFC MAIN SITE BUILDINGS

Bldg. 1 – Space Projects Building
Bldg. 2 – Research Projects Laboratory
Bldg. 3 – Central Flight Control & Range Operations Building
Bldg. 4 – Plant Operations Building
Bldg. 5 – Instrument Construction & Installation Laboratory
Bldg. 6 – Space Sciences Laboratory
Bldg. 7 – Payload Testing Facility
Bldg. 8 – Administration Building
Bldg. 9 – Main Gate House
Bldg. 10 – Environmental Testing Laboratory
Bldg. 11 – Applied Sciences Laboratory
Bldg. 12 – Tracking & Telemetry Laboratory
Bldg. 13 – Network Control Center Facility
Bldg. 14 – Spacecraft Operations Facility
Bldg. 15 – Launch Phase Simulator
Bldg. 16 – Logistic & Supply Facility
Bldg. 16W – Logistic & Supply Facility
Bldg. 17 – Administrative Support Building
Bldg. 18 – Administrative Support Building
Bldg. 19 – Technical Support Building
Bldg. 20 – Technical Support Building
Bldg. 21 – Meteorological Systems Development Laboratory
Bldg. 22 – Space & Terrestrial Applications Facility
Bldg. 23 – Data Interpretation Laboratory
Bldg. 24 – Central Heating & Refrigeration Plant
Bldg. 25 – NTTF and Hydromechanical Laboratory
Bldg. 26 – NASA Space Science Data Center
Bldg. 27 – Mobile Equipment Support Facility
Bldg. 83 – Satan Transmitting Facility
Bldg. 84 – Frequency Standard & Test Facility
Bldg. 86 – Day Care Center
Bldg. 87 – Gas Cylinder Storage Building
Bldg. 88 – Visitor Center
Bldg. 89 – Ordinance Building
Bldg. 97 – Plant Maintenance Support Facility
Bldg. 98 – GEWA Store
Bldg. 99 – Director's Special Project Building

SPACE FLIGHT CENTER

AERIAL VIEW

NASA Goddard Space Flight Center
Greenbelt, Maryland 20771

RPM 5-32

WALLOPS
FLIGHT CENTER

RESEARCH AND PROGRAM MANAGEMENT

FISCAL YEAR 1982 ESTIMATES

WALLOPS FLIGHT CENTER

DESCRIPTION

Wallops Flight Center (WFC) includes three separate areas on the Atlantic Coast of Virginia's Eastern Shore: the main base, the Wallops Island launching site, and the Wallops mainland site. The administrative offices, range control center, support shops, and main telemetry buildings are located on the main base. Wallops Island is about seven miles southeast of the main base and is connected to the mainland by a causeway and bridge. The island is about five miles long and one-half mile wide at its widest point. Located on the island are rocket storage buildings, blockhouses, assembly shops and launch sites. The Wallops mainland site is a one-half mile strip west of the island which houses the radar and optical tracking sites.

Wallops Flight Center, totaling 6,166 acres, consists of 1,833 acres on the main base, 3,095 acres on Wallops Island, 108 acres on the mainland tracking site, and 1,140 acres of marsh land. The total capital investment, including fixed assets in progress and contractor-held facilities at various locations, as of September 30, 1980, was $145,362,000.

CENTER ROLES AND MISSIONS

Wallops Flight Center prepares, assembles, launches and tracks space vehicles and acquires scientific information from them. WFC also operates a research airport in support of NASA's aeronautical research programs which include projects associated with airport-aircraft interface, air traffic control, avionics systems technology, final approach and landing systems, airport configuration, high speed turn-off techniques, airport environmental studies, noise reduction technology, and general aviation research focused on aircraft spin characteristics, cross-wind landings, pilot performance, and procedures and aids at uncontrolled airports and airspace. Its facilities are utilized by the scientists and engineers from the laboratories and research centers of NASA, other governmental agencies, colleges and universities, and the worldwide scientific community. Center personnel assist these scientific research teams with their projects and develop, as necessary, special types of instrumentation and equipment to complete the mission. The principal and supporting roles are:

PRINCIPAL

Sounding Rocket Development, Procurement and Operations - development of sounding rockets and carrying out all phases of operations from mission and flight planning to landing and recovery. Payload carrier development, telemetry, experiment aanagement support to other institutions, launch operatidns, and tracking and data acquisition are included.

Balloon Program - managing, monitoring, scheduling, and analyzing balloon activities conducted for NASA, the Office of Naval Research and the National Science Foundation.

SUPPORTING

Sounding Rocket Payload Carrier Development and Experiment Management Support - providing support in the applications disciplines of weather and climate.

Aeronautical Flight Test Support - providing flight test support for Langley Research Center's aeronautical flight test programs, including tracking and data acquisition.

SUMMARY OF RESOURCES REQUIREMENTS

Funding Plan By Function

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
	(Thousands of Dollars)			
I. Personnel and Related Costs	11,386	11,440	12,187	12,360
II. Travel	281	347	326	407
III. Facilities Services	3,654	3,771	4,056	4,609
IV. Technical Services	631	963	591	1,139
V. Management and Operations	1,733	2,456	3,206	1,899
1981 Budget Amendment	---	-280	---	---
Total, Fund Requirements	17,685	18,697	20,366	20,414

Distribution of Permanent Positions by Program

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
Direct Positions				
Space Transportation Systems and Operations	1	4	4	4
Space flight operations	1	2	2	2
Expendable launch vehicles	---	2	2	2

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
Space Science	70	72	72	72
Physics and astronomy	70	72	72	72
Space and Terrestrial Applications	68	55	61	61
Space applications	66	54	58	58
Technology utilization	2	1	3	3
Aeronautics and Space Technology	22	34	24	24
Aeronautical research and technology	22	34	24	24
Space Tracking and Data Systems	109	105	109	109
Tracking and data acquisition	109	105	109	109
Subtotal, direct positions	270	270	270	270
Center Management and Operations Support Positions	125	125	125	125
Total, permanent positions	395	395	395	395

PROGRAM DESCRIPTION

	Permanent Positions (Civil Service)
SPACE FLIGHT OPERATIONS	2

In 1982, the civil service personnel will provide mission and range safety support for Space Shuttle launches. WFC tracking activities will also support Space Shuttle missions during the orbital phase.

	Permanent Positions (Civil Service)
EXPENDABLE LAUNCH VEHICLES	2

In 1982, WFC civil service personnel will receive, inspect and store the Scout expendable launch vehicle and maintain the launch facility for future Scout missions.

PHYSICS AND ASTRONOMY	72

Sounding Rocket Program

The objective of this program is to support space research, using low-cost sounding rockets, in the fields of Solar Physics, Galactic Astronomy, Fields and Particles, and Ionospheric Physics. WFC provides flight systems support, launch range support, and support to experiments utilizing sounding rockets.

In 1982, the Wallops Launch Range will provide launch activities and ground instrumentation/support of the launches at WFC and at the Poker Flats Research Range near Fairbanks, Alaska, plus expedition type support to other areas. The WFC launch range is equipped with launchers capable of handling sounding rockets of all sizes. The Poker Flats Research Range, jointly supported by WFC and the Defense Nuclear Agency, has limited capability, although its facilities can be supplemented by the mobile equipment from WFC.

Balloon Program

The objective of this program is to support space research, using low-cost balloon platforms, in the fields of Solar Physics, Galactic Astronomy, Stratospheric Composition and Aeronomy.

In 1982, WFC will provide ground instrumentation support, technical, and flight hardware support to experimenters in the balloon program.

The majority of the flights are conducted from the National Scientific Balloon Facility site at Palestine, Texas, or the United States Air Force site at Holloman, New Mexico; however, some flights are supported from remote sites in the northern United States, Canada, Alaska, Australia, New Zealand, Argentina and Brazil.

	Permanent Positions (Civil Service)
SPACE APPLICATIONS.....	58

Environmental Observations

In 1982, the WFC civil service personnel will continue to conduct the Meteorological Rocket Network project. The objectives of this project are:

1. To investigate the processes which characterize the physical state of the strato-mesosphere region of the atmosphere and to determine interactions within this layer of the atmosphere and with the troposphere.

2. To provide data for climatology of the upper atmosphere.

3. To provide in situ measurement data which are used to calibrate satellite remote sensors.

Through the Meteorological Rocket Networks project, WFC manages NASA's participation in the Cooperative Meteorological Rocket Network (CMRN), the Experimental Inter-American Meteorological Rocket Network (EXAMETNET) and the Eastern-Western Hemisphere Meteorological Rocket Network.

In ocean processes, where the primary emphasis is being placed, investigations in the broad areas of sea-state measurement, surface currents, ocean topographical mapping, and their supporting ground truth are in progress.

In 1982, the WFC civil service personnel will be involved in investigating the feasibility of determining ocean surface currents from satellites and aircraft measurement of the local surface wave structure; investigating the "sea state bias effect" in satellite altimetry to develop methods of correcting the error; determining the mean sea surface of the geoid; evaluating and determining the inadequacies of existing predictive and descriptive synoptic ocean circulation models and investigating the impact of utilizing synoptic altimeter data as input to the models; and developing techniques of using altimeter pulse wave from data for the determination of sea state.

Balloon Program

The objective of this program is to support the Space and Terrestrial Applications program using low cost balloon platforms in the field of stratospheric composition, meteorology and aeronomy.

	Permanent Positions (Civil Service)
TECHNOLOGY UTILIZATION	3

In 1982, the Technology Utilization program at WFC involves expediting application of new technology, encouraging the use of NASA technology in other sectors, and understanding more fully the technology transfer process and its impact.

AERONAUTICAL RESEARCH AND TECHNOLOGY	24

In 1982, the WFC airport will be involved in conducting research tests of various aircraft in the 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 automatic landing of aircraft. One runway has been modified to study the effect of runway grooving as a means of controlling aircraft hydroplaning on wet or slush-covered runways. Studies of automotive hydroplaning have also been conducted using this runway. The data required from the aircraft and automotive tests will ultimately assist in the development of safer, more flexible transportation systems. WFC will also continue to support general aviation stall/spin research, single-pilot IFR flight test, and agricultural aerial applications research.

TRACKING AND DATA ACQUISITION	109

Tracking and data acquisition activities provide both fixed and mobile equipment for tracking, data acquisition, and communications. These activities will encompass the acquisition of new systems, modifications and updating of existing systems and the operation, maintenance, and repair of these instrumentation systems. Included are highly precise instrumentation radars, and systems involving analog and digital telemetry, precise range timing, range intercommunication, radio communication, tracking laser, digital data transmission, command and control, and digital data processing. These instrumentation systems are used in support of both aeronautical and rocket launched flight projects. These flight projects are conducted at WFC or at off-range locations in various parts of the world, depending upon the scientific experiment requirements. The sounding rocket programs supported at Wallops will cover all of the atmospheric and space disciplines in which research is undertaken, utilizing a family of launch vehicles varying in size and power from the small meteorological rockets to the 72-foot Scout with orbital capability. In 1982, more than 300 sounding rockets are to be launched from Wallops Island and remote sites around the world, carrying experiments in the fields of aeronomy, energetic particles, ionospheric physics, meteorology, and solar physics.

Of particular interest is the current effort to measure the effect of aerosols on the protective layer of ozone in the upper atmosphere which filters out harmful solar radiation.

	Permanent Positions (Civil Service)
CENTER MANAGEMENT AND OPERATIONS SUPPORT.....	125

Center Management and Operations Support is defined as the support or services being provided to all WFC 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 the immediate staff, e.g., Legal, Patent Counsel, Equal Opportunity, Planning and Analysis, Public Affairs and Safety.

Management Support - This category includes a wide range of activity categorized as management support for programs and functional organizations for the entire Center. Specific functions include resource and budget management, program control, contracting and procurment, personnel management, property management, financial management, resource control and management information systems and analysis.

Operations Support - This is a broad spectrum of activity that is required to maintain and operate facilities, buildings and equipment and to provide the normal housekeeping services and logistics support for the personnel who manage and conduct the affairs of the Center. Specific activities are:

Maintenance and operation of all buildings and facilities
Data processing and computer support
Reliability and quality assurance
Center-wide security and protection
Fire protection
Custodial services
Logistics support including transportation and supplies
Medical care of employees
Photographic and graphic support

RESOURCE REQUIREMENTS BY FUNCTION

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
	(Thousands of Dollars)			
I. PERSONNEL AND RELATED COSTS	**11,386**	***11,440***	**12,187**	**12,360**
Summary of Fund Requirements				
A. Compensation and Benefits				
1. Compensation				
a. Permanent positions	9,765	9,936	10,427	10,589
b. Other than full-time permanent positions	293	241	390	398
c. Overtime and other compensation	252	210	210	210
Subtotal, Compensation	10,310	10,387	11,027	11,197
2. Benefits	1,019	998	1,105	1,101
Subtotal, Compensation and Benefits	11,329	11,385	12,132	12,298
B. Supporting Costs				
1. Transfer of personnel	16	10	10	12
2. Personnel training	41	45	45	50
Subtotal, Supporting Costs	57	55	***55***	62
Total, Personnel and Related Costs	11,386	11,440	12,187	12,360

Explanation of Fund Requirements

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
A. Compensation and Benefits	11,329	11,385	12,132	12,298
1. Compensation	10,310	10,387	11,027	11,197
a. Permanent positions	9,765	9,936	10,427	10,589

The funds will support 395 permanent positions in 1982. The cost increase from the 1981 budget estimate to the 1981 current estimate is due primarily to the October 1980 pay increase.

Basis of Cost for Permanent Positions

In 1982, the cost of permanent positions will be $10,589,000, an increase of $162,000 from 1981. The increase results from the following:

Cost of permanent positions in 1981		10,427
Cost increases in 1982		+290
Within grade and career advances:		
Full year effect of 1981 actions	+165	
Partial year effect of 1982 actions	+89	
Full year effect of 1981 pay increases	+36	
Cost decreases in 1982		-128
Turnover savings and abolished positions:		
Full year effect of 1981 actions	-82	
Partial year effect of 1982 actions	-46	
Cost of permanent positions in 1982		10,589

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
	(Thousands of Dollars)			
b. Other than full-time permanent positions				
1. Cost	293	241	390	398
2. Workyears	33	31	39	*40*

The increase from the 1981 budget estimate to the 1981 current estimate is due to the October 1980 pay increase and an increase in the number of youth opportunity positions.

The 1982 plan includes 40 workyears which is an increase of one over the 1981 current estimate and will support the following programs:

Distribution of Other than Full-Time Permanent Workyears

Program	Workyears
Cooperative training	18
Summer employment	2
Opportunity programs	16
Other temporary employment	*4*
Total	*40*

c. Overtime and other compensation	252	210	210	210

Overtime funds are required at WFC primarily to meet operational requirements of the sounding rocket program of the Physics and Astronomy and Space Applications programs. Many factors beyond the Center's control, such as launch schedules, weather holds, and range clearance problems necessitate work beyond normal hours to operate the launch facilities, provide instrumentation support, and conduct tracking and data acquisition activities required to assure mission success.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
	(Thousands of Dollars)			
2. Benefits	1,019	998	1,105	1,101
Following are the amounts of contribution by category:				
Civil Service Retirement Fund	704	693	756	761
Employee life insurance	32	32	32	33
Employee health insurance	245	239	248	258
Workmen's compensation	11	30	30	33
FICA	6	3	7	7
Other	21	1	32	9
Total	1,019	998	1,105	1,101

The increase from the 1981 budget estimate to the 1981 current estimate reflects the October 1980 pay increase. The decrease in 1982 from the 1981 current estimate is related to a decrease in severance pay partially offset by anticipated increases in the cost of health insurance. Workmen's compensation estimates are based on the Department of Labor billings.

B. Supporting Costs	57	55	55	62
1. Transfer of Personnel	16	10	10	12

The transfer of personnel costs in 1981 and 1982 will cover the expenses for one permanent change of station move planned each year.

2. Personnel Training	41	45	45	50

The estimates for personnel training include costs of the WFC engineering technician apprentice program. The 1982 estimate assumes approximately the same level of effort as in 1981.

		1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
			(Thousands of Dollars)		
II.	**TRAVEL**	**281**	**347**	**326**	**407**
	Summary of Fund Requirements				
A.	Program Travel	228	248	266	341
B.	Scientific and Technical Development Travel	17	57	20	22
C.	Management and Operations Travel	36	42	40	44
	Total, Travel	281	347	326	407
	Explanation of Fund Requirements				
A.	Program Travel	228	248	266	341

Program travel is directly related to the accomplishment of the Center's mission and reflects the continuing effort in the procurement and launch activities, the sounding rocket development program, the balloon program, and the aeronautical flight test program. The increase from the 1981 budget estimate to the 1981 current estimate and from 1981 to 1982 is due to increased travel requirements in support of off-site launch activity. This includes Sounding Rocket Program support for the joint Canadian/U.S. Cooperative mission at Cape Parry, Canada, as well as missions in Norway, Sweden, New Mexico and Alaska.

B.	Scientific and Technical Development Travel	17	57	20	22

Scientific and technical development travel permits employees to participate in meetings and technical seminars with other representatives of the aerospace community. This participation allows them to benefit from exposure to technological advances outside WFC, 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 decrease from the 1981 budget estimate to the 1981 current estimate is due to a reassessment of travel requirements.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
	(Thousands of Dollars)			
C. ~~Management and Operations Travel~~	36	42	40	44

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, procurement activities, travel of the Center's top management to NASA Headquarters and other NASA Centers; and local transportation.

III. FACILITIES SERVICES	***3,654***	***3,771***	***4,056***	***4,609***

Wallops Flight Center involves 6,166 acres and a complex of facilities which mainly consist of research, airport, and launch operations facilities. This complex encompasses 1,057,344 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-Center population of 900 to 1,100 personnel housed on-site. Many of the test facilities are utilized on schedules involving more than one shift and/or frequently during off-peak hours.

Summary of Fund Requirements

A. Maintenance and Related Services	1,089	1,152	1,077	1,188
1. Facilities	1,089	1,031	1,077	1,188
2. Equipment	---	121	---	---
B. Custodial Services	733	801	714	769
C. Utilities Services	1,832	1,818	2,265	2,652
Total, Facilities Services	3,654	3,771	4,056	4,609

Explanation of Fund Requirements

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
	(Thousands of Dollars)			
A. Maintenance and Related Services	1,089	1,152	1,077	1,188
1. Facilities	1,089	1,031	1,077	1,188

This activity provides for the maintenance, repair and alteration of over 300 buildings and one million square feet of building space on 6,166 acres of land. The corrosive environment at WPC, caused by its proximity to the ocean, requires frequent maintenance and repair of exterior surfaces, roofing, utility distribution systems, mechanical doors, hardware and building equipment.

The increase from the 1981 current estimate to the 1982 budget estimate is for negotiated support contract wage increases. Major types of support in this area are:

a. Ground maintenance 295

Provides for maintenance of lawns, trees and shrubs, and for snow removal.

b. Maintenance and operations 506

Provides for the maintenance and operation of over 300 buildings including heating, plumbing and air conditioning systems.

c. Supplies 387

Provides for the replacement of supplies necessary to the operation of the WPC facility.

2. Equipment	---	121	---	---

The 1981 budget estimate included building equipment maintenance which has been transferred to the facilities function.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
B. Custodial Services	733	801	714	769

Provides for support service contractor effort for janitorial services, fire fighting and ambulance service, and plant security. Also provides for refuse removal, pest control and other miscellaneous services. Efficiencies in the fire fighting and security areas (a reduction of three contractor workyears) have reduced funding requirements from the 1981 budget estimate.

1. Janitorial services... 230

   Provides for the cleaning of buildings.

2. Fire fighting and plant security 450

   Provides for fire fighting, ambulance, and security guard service.

3. Miscellaneous 89

   Provides for refuse removal, pest control, laundry and other miscellaneous services.

C. Utilities	1,832	1,818	2,265	2,652

The only purchased utilities at WFC are electricity and fuel oil to operate the heating plant. This funding also provides for the operation and maintenance of the heating plant and water and sewage facilities. The increase in 1981 from the budget estimate to the current estimate is due to increased utility rates. The increase in 1982 is due to utility rate and negotiated support service contract rate increases. The purchased utilities are as follows:

1. Electricity (14,732 MWH) 1,035
2. Fuel oil (1,300 K Gal.) 1,151

		1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)			
IV.	**TECHNICAL SERVICES**	**631**	**963**	**591**	**1,139**
	Summary of Fund Requirements				
A.	Automatic Data Processing	161	578	218	714
	1. Equipment	17	416	23	496
	2. Operations	144	162	195	218
B.	Scientific and Technical Information	117	220	150	183
	1. Library	102	120	117	129
	2. Education and information	15	100	33	54
C.	Shop Support and Services	353	165	223	242
	Total, Technical Service	631	963	591	1,139
	Explanation of Fund Requirements				
A.	Automatic Data Processing	161	578	218	714

Provides for administrative data processing including equipment maintenance, programming, and operation. The decrease from the 1981 budget estimate to the 1981 current estimate and the increase in the 1982 estimate over 1981 is due to a delay of one year in the replacement of the Honeywell 625 Real-Time Data Processing System.

1.	Equipment	496

Provides for annual maintenance of remote terminals and peripheral equipment used for administrative data processing, and in 1982, for the replacement of the Honeywell 625 Real-Time Data Processing System.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
2. Operations				218

Provides programming and operation of equipment used for processing of necessary business data such as payroll and other fiscal records, procurement, and personnel and supply data.

B. Scientific and Technical Information	117	220	150	183

Includes the purchases of books, supplies and materials for, and the operation of, the WFC Technical Library. It also provides for public information services and for the exhibits and operation of a Visitor Information Center (VIC). The increases in 1981 and 1982 over the 1980 level reflect the completion of the VIC in 1981 and subsequent operational costs. The decrease of the 1981 current estimate from the 1981 budget estimate reflects completion of the VIC later in 1981 than previously anticipated resulting in reduced operations requirements.

1. Library				129

Provides for the operation of the library as well as the procurement of books, subscriptions, supplies, and materials.

2. Education and information				54

Provides for tour guide services for visitors. Provision is also made for the cost of exhibits and the operation of the soon to be completed VIC as well as for miscellaneous public information services.

C. Shop Support and Services	353	165	223	242

Includes engineering and fabrication support for facility planning and alteration. Also provides for safety and reliability and quality assurance requirements and other technical services. The increase from the 1981 budget estimate to the 1981 current estimate and 1982 reflects an increase in the engineering services and machine shop support requirements based upon prior year experience.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
	(Thousands of Dollars)			
V. MANAGEMENT AND OPERATIONS	**1,733**	**2,456**	**3,206**	**1,899**
Summary of Fund Requirements				
A. Administrative Communications	170	146	151	166
B. Printing and Reproduction	94	80	95	105
C. Transportation	431	1,208	1,850	398
D. Installation Common Services	1,038	1,022	1,110	1,230
Total, Management and Operations	1,733	2,456	3,206	1,899
Explanation of Fund Requirements				
A. Administrative Communications	170	146	151	166

Provides for the operation of the WHC main switchboard and teletype facility, for the cost of leased lines and long distance tolls, and for maintenance services. The increase from 1981 to 1982 is to cover the cost of negotiated support contract rate increases.

1. Long distance telephone service 6

Covers the cost of leased lines and long distance tolls.

2. Other communications services 160

Provides for the operation of the WHC main switchboard and teletype facility. Provision is also made for maintenance and repair services.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
	(Thousands of Dollars)			
B. Printing and Reproduction	94	80	95	105

Provides for support service contractor effort to operate the printing and reproduction facility at WFC. The increase in the 1981 current estimate over that anticipated in the 1981 budget estimate reflects increased costs of supplies and materials and a slight increase in contractor rates. The increase from 1981 to 1982 is to cover the cost of negotiated support contract wage increases.

C. Transportation	431	1,208	1,850	398

Includes the cost of commercial off-base services and repairs to the Government-owned motor vehicle fleet; the maintenance and repair of the WFC Queen Air aircraft; and freight and related transportation costs. The 1981 budget estimate includes the cost of replacing the 18 year-old Queen Air aircraft with a more modern fuel efficient, turbine powered, and reliable aircraft. This replacement is in keeping with the requirement to upgrade the Queen Air aircraft within NASA with newer aircraft that will provide long-term dependability. The replacement aircraft will also increase reliability, safety, maintainability, and performance in satisfying WFC's continuing needs. The increase from the 1981 budget estimate to the 1981 current estimate reflects increased costs of maintenance and repair of motor vehicles and aircraft, a revised estimate of the cost of replacing the Queen Air aircraft and an additional contractor workyear of effort in aircraft maintenance.

1. Local transportation services 125

   Provides for shuttle bus services on Center and to other nearby installations,

2. Transportation of things 5

   Covers the cost of freight charges and costs related to local moves, i.e., drayage and parcel post.

3. Maintenance, repair and replacement of vehicles 143

   Provides for commercial services and repairs to the Government-owned motor vehicle fleet.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
4. Maintenance and repair of aircraft				125

Provides for parts and supplies required to maintain the WFC Queen Air aircraft.

D. Installation Common Services	1,038	1,022	1,110	1,230

Provides for medical services, rental of copying machines, supplies, materials and equipment used for administrative purposes, supply management, materials handling, and postage. The increase from the 1981 budget estimate to the 1981 current estimate is due to higher costs for supplies and materials, machine rentals and postage and an additional two contract workyears of effort in supply management. The increase from 1981 to 1982 is for negotiated support contract rate increases.

1. Medical services	58

Provides for the part-time services of medical doctors in support of the WFC Occupational Health program.

2. Machine rental	125

Covers the rental and maintenance of copying equipment.

3. Supplies and equipment	501

Provides for supplies, materials, and equipment necessary for the administrative functions at WFC.

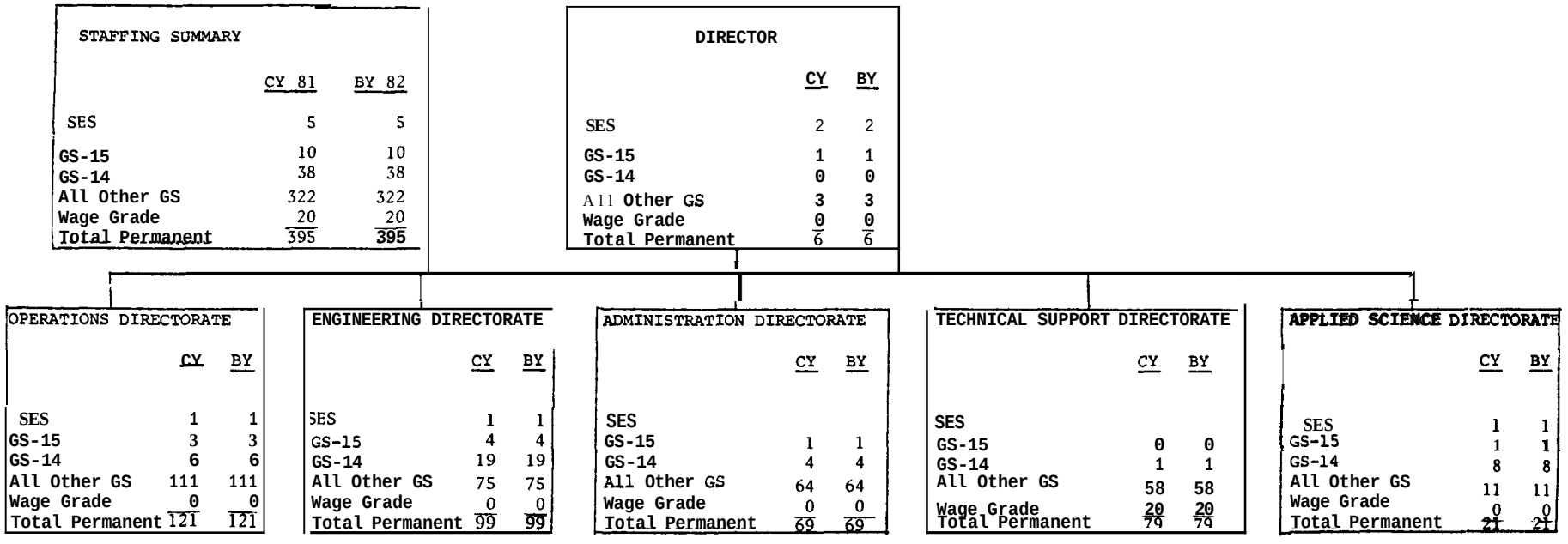
4. Supply management	511

Provides for moving and materials handling and operating the supply system at WFC.

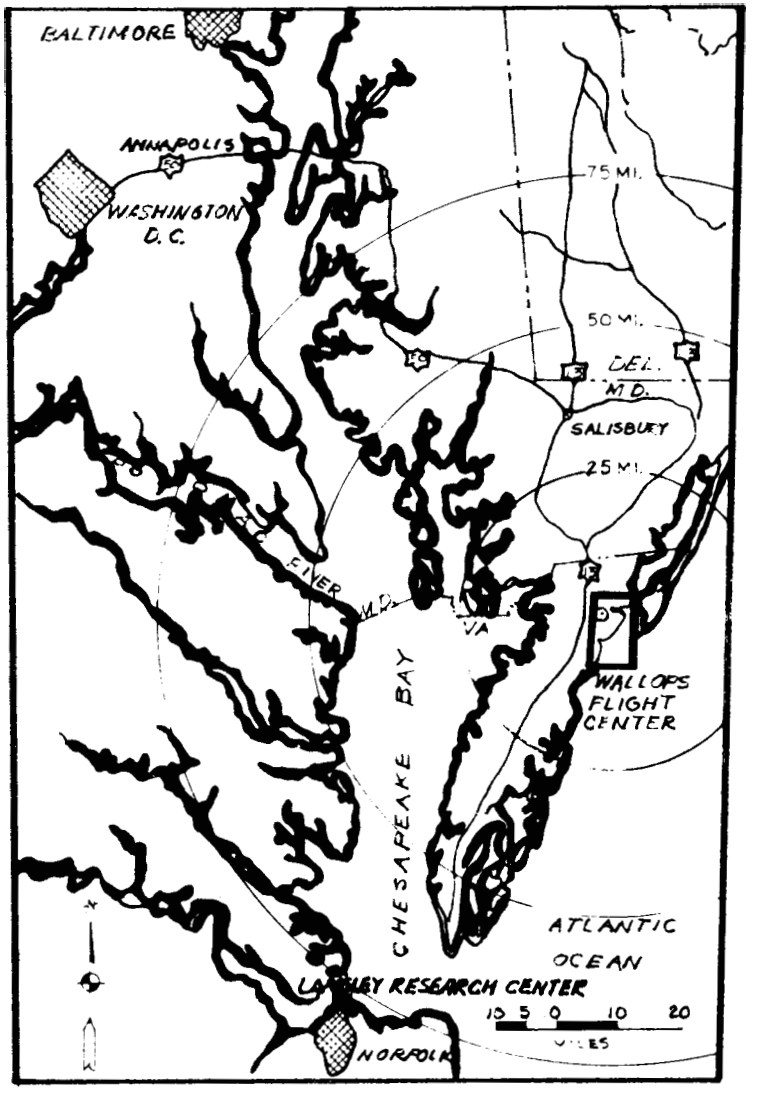
5. Postage	35

Covers the cost of the Center's postal bill.

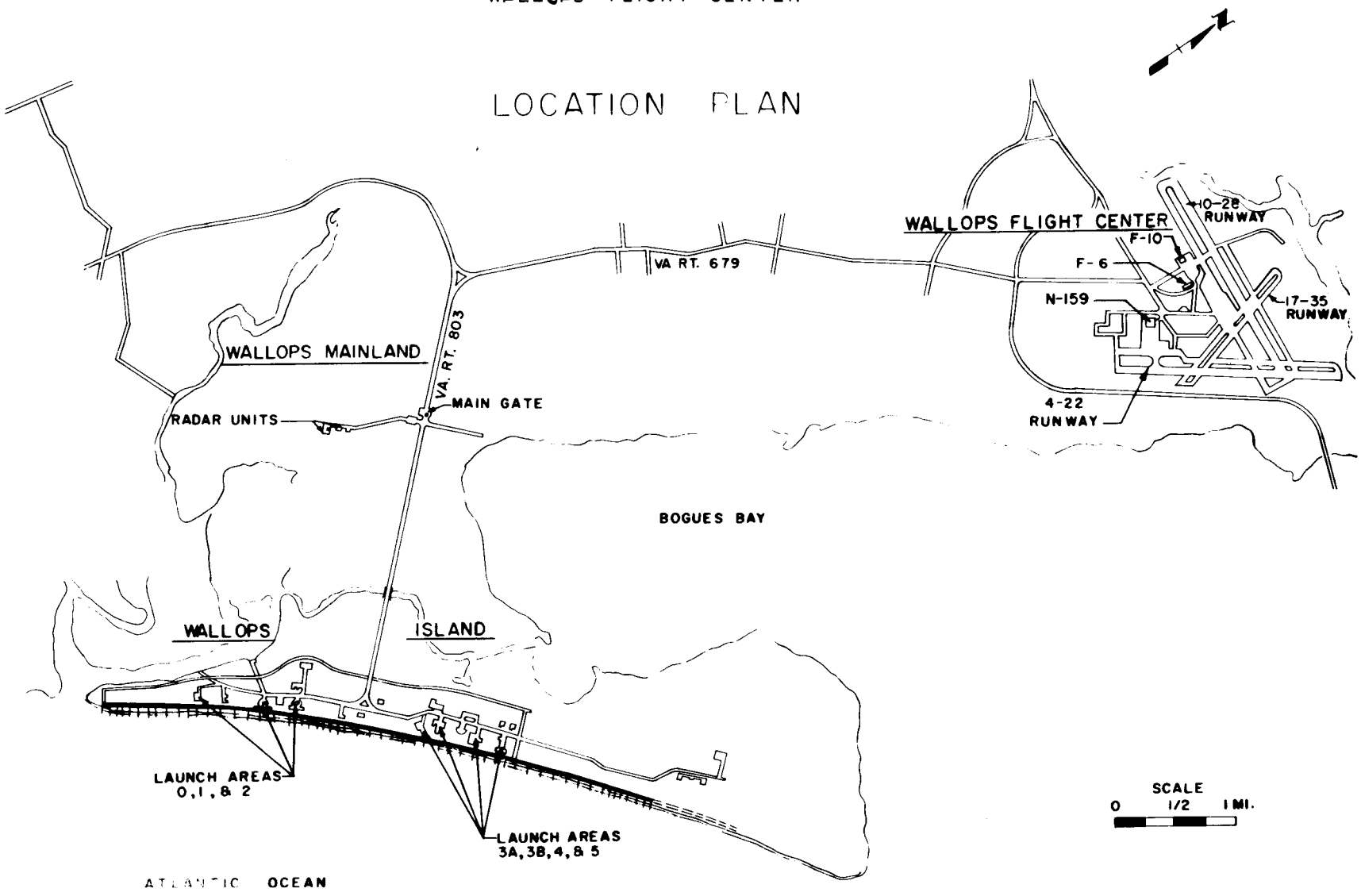
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
ORGANIZATION AND STAFFING CHART
WALLOPS FLIGHT CENTER



— WALLOPS —
FLIGHT CENTER LOCATION



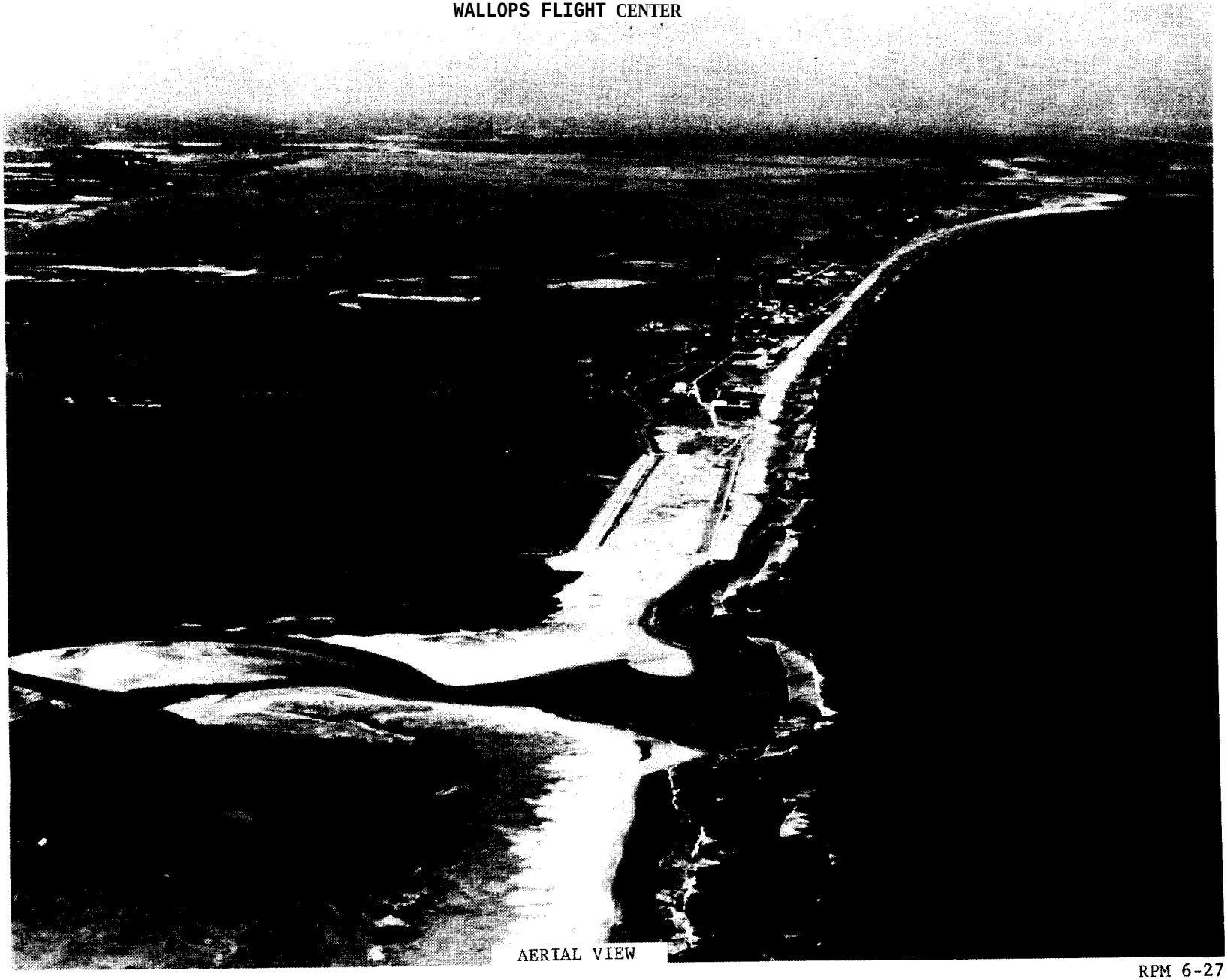
WALLOPS FLIGHT CENTER



RPM 6-24

RPM 6-25

AERIAL VIEW



AERIAL VIEW

RPM 6-27

RESEARCH AND PROGRAM MANAGEMENT

FISCAL YEAR 1982 ESTIMATES

AMES RESEARCH CENTER

DESCRIPTION

The Ames Research Center (ARC) is located on 421 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 the ARC is the U.S. Army Research and Technology Laboratory. Personnel from this laboratory work closely with ARC personnel on research of mutual interest. The capital investment at the ARC, including fixed assets in progress and contractor-held facilities at various locations, as of September 30, 1980, was $518,282,000.

CENTER ROLES AND MI

The programs at ARC involve research and development in the fields of aeronautics, space science, life science, and space technology, as well as applications to national needs of the new science and technology growing out of the aerospace program. Specifically, the Center's major program responsibilities are concentrated in: short-haul aircraft technology, rotorcraft technology, flight simulation, computational fluid dynamics, planetary probes, airborne sciences and applications, and aeronautical and space life sciences. In addition to these major program responsbilities, the Center provides support for military programs and various civil aviation projects. The principal and supporting roles are:

PRINCIPAL

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

Short-Haul Aircraft Technology - developing a technology base for facilitating incorporation of short-haul aircraft into overall air transportation systems.

Rotorcraft Technology - developing a technology base for improving efficiency and flexibility for both civil and military use.

Computational Fluid Dynamics - furthering the state of the art through the definition of new systems, both hardware and software, and application to aeronautical and other related areas.

Flight Simulation - improving the state of the art to permit more effective use of simulators in aircraft design and validation-of-flight simulation.

Military Support - providing the technical support to military aviation in areas consistent with other ARC aeronautics roles and unique ARC capabilities.

Airborne Research and Applications - operating instrumented jet aircraft for the purpose of conducting airborne research and applications experiments.

Planetary Probes - developing thermal protection systems required for planetary atmosphere entry probes and managing probe development.

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

Life Sciences:

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

Biomedical Support Systems - developing advanced technology for long duration life support systems and protective systems.

Biological Experiments - developing, managing and operating experiments for determining effects of space flight on living organisms (non-human) and for providing information applicable to solving space medicine problems.

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

SUPPORTING

Space Transportation Passenger Selection Criteria - developing and evaluating the medical criteria for non-crew passenger selection.

Astronomical Observation Techniques - focusing on airborne research and the developing of infrared techniques and supporting systems for use in Spacelab payloads.

Vertical/Short Take-Off and Landing; (V/STOL) Technology - developing a technology base for military V/STOL in support of Department of Defense missions.

SUMMARY OF RESOURCES REQUIREMENTS

Funding Plan By Function

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
I. Personnel and Related Costs	55,722	57,113	59,043	60,377
II. Travel	1,332	1,446	1,417	1,798
III. Facilities Services	6,183	8,736	8,455	10,541
IV. Technical Services	981	924	1,528	1,576
V. Management and Operations	3,156	3,250	3,406	3,629
1981 Budget Amendment	---	-919	---	---
Total, fund requirements	67,374	70,550	73,849	77,921

Distribution of Permanent Positions by Program

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
Direct Positions				
Space Science	304	303	303	299
Physics and astronomy	101	98	99	95
Planetary exploration	73	69	74	74
Life sciences	130	136	130	130

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
Space and Terrestrial Applications	107	117	107	108
Space applications	100	109	100	101
Technology utilization	7	8	7	7
Aeronautics and Space Technology	821	820	821	824
Aeronautical research and technology	671	655	674	677
Space research and technology	150	165	147	147
Subtotal, direct positions	1,232	1,240	1,231	1,231
Center Management and Operations Support Positions	426	418	427	427
Total, permanent positions	1,658	1,658	1,658	1,658

AM DESCRIPTION

	Permanent Positions (Civil Service)
PHYSICS AND ASTRONOMY	95

Ames concentrates its physics and astronomy activities in the field of infrared astrbnomy, taking the Agency lead in this discipline.

In 1982, the civil service personnel will provide support for the airborne astronomy program which includes a C-141 aircraft--the Kuiper Airborne Observatory (KAO)--as well as a Lear Jet aircraft. These aircraft are operated by Ames as flying astronomical observatories with the bulk of the observing accomplished by various University research teams. Ames supports these facilities with its in-house science competence and with its in-house capability to operate research aircraft.

Infrared astronomy observation from space platforms avoids obscuration caused by the Earth's atmosphere. Ames has responsibility for instruments to accomplish these observations including development of the telescope portion of the Infrared Astronomical Satellite (IRAS), definition of an advanced instrument for use on Spacelab missions, and studies of instruments that may eventually be used as free-flyers in space.

	Permanent Positions (Civil Service)
PLANETARY EXPLORATION	74

These civil service personnel are required in 1982 to accomplish the ongoing programs in support of Agency goals in planetary exploration. This program consists of a continuing series of project management activities, backed by the scientific expertise of principal investigators from Ames, other NASA Centers and the University community. An in-house supporting research and technology program serves both to maintain the Center's scientific and technological expertise and provide the stimulus and definition for new planetary missions.

In 1982, the civil service personnel will continue to provide project management and scientific support for: (1) Pioneers 6-9, a series of spacecraft exploring the physics of the interplanetary medium and providing ongoing data on the plasma in which the Earth is immersed; (2) Pioneers 10 and 11, two spacecraft that made close approaches to the planet Jupiter to study both the planet itself and the interaction of the solar wind with the planet's strong magnetic field (these spacecraft were then retargeted by being swung in the Jovian gravity field to explore other regions of the solar system--Pioneer 11 made the first close reconnaissance of Saturn in 1979, and Pioneer 10 has now crossed the orbit of Uranus on its way out of the solar system); (3) Pioneer Venus, launched in 1978, with its orbiter now in place around Venus; and (4) the Galileo project, a natural outgrowth of the Pioneer Venus atmospheric probes, and development of the Galileo Probe.

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

Ames maintains an active program of laboratory and theoretical studies to develop basic atmospheric modeling concepts, obtain the necessary physical data on a molecular scale 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.

	Permanent Positions (Civil Service)
LIFE SCIENCES	130

In 1982, 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 nonhuman biological experiments in space; developing advanced life support concepts and systems; and understanding the origin, evolution, and distribution of life and life-related chemicals on Earth and elsewhere in the universe.

Space flight simulation studies will continue in FY 1982 with testing of 40-to-50-year old males to observe cumulative physiological change that may occur upon varying recovery periods. Findings will provide a basis for flight schedule and rotation for future Shuttle crew members. Ames investigators will be involved in the development phase of both animal and human experiments for the first dedicated life sciences Spacelab. Research will continue to try to determine whether learned autonomic control (biofeedback training) to suppress the symptoms of motion or space sickness is still effective during the performance of a complex cognitive or motor tasks.

Launch of the first life sciences experiment to fly on the Shuttle will occur on a Shuttle orbital flight test mission. The first flight unit of the Research Animal Holding Facility, configured to hold mice and rats, will be fabricated and quality tested in FY 1982 with checkout and testing at Ames prior to its flight on Spacelab III. Hardware for U.S. experiments will be delivered to the Soviet Union for the Joint US/USSR Cosmos biological satellite flight in FY 1982 for launch in the last quarter of FY 1982.

Studies will be continued in FY 1982 using closed chambers for investigations of controlled ecology life support systems for space flight.

Research in the origin and distribution of life and life-related molecules will also be continued in FY 1982 through analyses of biochemical pathways in living systems and analysis 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 deoxyribonucleic acid (DNA) segments.

	Permanent Positions (Civil Service)
SPACE APPLICATIONS.....	101

A highly diversified group of scientifically capable people is required to support programs in Resource and Environmental Observations including space, atmospheric, and stratospheric programs; to provide skilled personnel and specialized airborne platforms in support of the Agency's applications satellite programs; to interpret and process both spaceborne and airborne remotely sensed data; to interact with and disseminate data and associated processing techniques to the user community.

The Ames stratospheric research program is an integrated activity that blends the expertise of the Center and University scientists both in the development of computer models for the upper atmosphere and in the measurement of stratospheric constituents and properties from aircraft platforms. Computer modeling of the stratosphere is being performed at Ames to understand the unperturbed stratosphere and predict the effects on the stratosphere of various pollutants, such as aircraft emissions and fluorocarbons, and of natural events such as the solar cycle and solar storms. A similar program is under way focusing on the climatic effects of aerosols in the Earth's atmosphere through models of aerosols and their radiative effects, and measurements of aerosol properties from Ames aircraft.

Further, the Center's Space Applications role is fulfilled by: (1) conducting an active and continuing broad program of applied research and development to enhance the use of remote and in situ sensing technology for Earth resources applications; (2) to transfer the ability to use this technology to a variety of Federal, State, regional, and local agencies by working with these agencies to plan, initiate, and develop feasible and economical Earth resources sensing projects tailored to their specific needs; and (3) defining, developing, and evaluating potential satellite sensors, data acquisition and processing techniques, and associated communications technology. The Center controls a variety of operational aircraft, some of which serve as 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.

In addition, this diversified scientific group: (1) provides management support to the Office of Space and Terrestrial Applications for the airborne instrumentation research program at Ames and other NASA Centers; and (2) provides a mechanism for implementation of applications transfer activities through the Western Regional Remote Sensing Applications Center.

	Permanent Positions (Civil Service)
TECHNOLOGY UTILIZATION	7

The Technology Utilization program at Ames is a community undertaking involving the part-time efforts of scientists and engineers in many disciplines and in many Center organizations working under the leadership and coordination of a full-time Technology Utilization Office staff to move knowledge developed from the NASA programs into industry for effective use in the marketplace.

AERONAUTICAL RESEARCH AND TECHNOLOGY	677

In 1982, the content of the Ames program in aeronautics is characterized in terms of three elements: Generic Research and Technology, Vehicle Specific Technology (Powered-Lift, Rotorcraft) and aeronautical support to other agencies and to industry. These three elements form a coherent and interdependent program to meet the Vertical/Short Take-Off and Landing (V/STOL) and rotorcraft objectives of improved aerodynamic and operational performance, to improve terminal area safety and efficiency, and to reduce aircraft noise and vibrations.

Generic Research and Technology:

The Generic Research and Technology program at Ames is principally focused in the areas of computational aerodynamics, experimental methods, avionics, and safety. The program is concentrated in the disciplines of aerodynamics and aeroelasticity, 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 our ability to compute the theoretical behavior of aerodynamic flow and to measure experimental aircraft configuration parameters. In 1982, a major thrust to develop the Numerical Aerodynamic Simulator will be initiated to provide a revolutionary advance in computational speed and memory for aeronautical research, research programs in flight dynamics will define the important interrelationships between vehicle dynamics, stability and control, and handling qualities in the regime of hover, and in transition from vertical to horizontal flight for advanced V/STOL aircraft and rotorcraft. In guidance and control, the use of optimal control theory in conjunction with dynamic modeling of aircraft and ground-based guidance aids will provide new insight into the definition of air traffic control algorithms, particularly for the terminal area.

In 1982, highlights in the human factors program will include: continuation of development of a baseline generic display of air traffic information for use in an aircraft cockpit; development of helicopter display

and control integration to reduce pilot workload; study of advanced flight display formats for improving information presentation to aircrews; and, more complete understanding of human fatigue and circadian desynchronosis effects on aircraft pilots.

Vehicle Specific Technology:

The Vehicle Specific Technology at Ames is focused on short-haul aircraft, both civil and military; Rotorcraft, V/STOL and Short-Range Conventional Take-Off and Land (CTOL) aircraft. These aircraft have unique characteristics including: a dependence on propulsive lift (in addition to aerodynamic lift); greater capability for versatile operations in the terminal area; and, a greater degree of integration of man and machine. The vehicle technology emphasis at Ames relates to, and depends on, the basic capabilities and the aeronautical research disciplines described previously. In 1982, the research program will include small-scale and large-scale wind tunnel testing and ground-based simulation, and flight research utilizing both rotorcraft and powered-lift research aircraft. This class of aircraft is dependent on high lift technology and low cost guidance and control systems, both of which are part of the ongoing program at ARC. The program includes wind tunnel and simulation investigations to achieve a significantly improved short-haul transport aircraft concept and compatible low-cost avionics.

Other Support:

The Ames Research Center has traditionally received requests from other agencies and from the industry for test support of their aircraft and systems development programs. The Navy and NASA have agreed to a comprehensive technical support program for the Navy V/STOL aircraft technology development. The Army Research and Technology Laboratories of the U.S. *Army* Aviation Research and Development Command (AVRADCOM) is located at Ames. The Aeromechanics Laboratory, the primary investigator of Army rotorcraft flight dynamics and controls, is also located at Ames, working both on independent R&D 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 and the Naval Air Systems Command, Federal Aviation Administration and the Coast Guard. Examples of these joint programs are with the Air Force on Advanced Fighter Technology Integration, Advanced Flight Control Systems, Laser Velocimeter Vortex Flow Measurements and Aero-Optics Program; the Navy on V/STOL Fighter Studies, Wing Design Optimization Studies, and Tilt Rotor concept evaluation; the Coast Guard on Lighter-than-Air Technology Program.

	Permanent Positions (Civil Service)
SPACE RESEARCH AND TECHNOLOGY.....	147

In 1982, the number of civil service personnel requested 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. The project work supports Space Shuttle, Galileo, and the Orbiter Experiment program (OEX).

In 1982, the entry technology research will provide the aerothermodynamic data required for the design, development, and verification of planetary entry vehicles, and for computational fluid dynamic codes to predict space vehicle flow fields and performance. Work is proceeding to apply laser physics and laser techniques to the development of flow diagnostic tools to remotely probe gas dynamic flows in order to define and verify turbulence models. Research efforts in the materials area will provide thermal protection systems concepts and materials for heat shields to protect Earth and planetary entry vehicles (probes), 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 area 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.

In 1982, the Shuttle project will be supported 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. 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 Research Center is supporting two Space Shuttle Orbiter experiments. The first is an OEX experiment for Infrared Imaging of Shuttle (IRIS) to obtain measurements of surface temperatures of the lower and side surfaces of the orbiter by remote imagery from the C-141 Kuiper Airborne Observatory (KAO). The second is to conduct OEX thermal protection experiments to study advanced materials and evaluate possible cost and weight reductions for the thermal protection system for Shuttle and advanced Space Transportation Systems.

CENTER MANAGEMENT AND OPERATIONS SUPPORT.....	427

Center Management and Operations Support is defined as that support or services being provided to all Ames Research Center 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 the immediate staff, e.g., legal, patent counsel, equal opportunity, planning and analysis, public affairs, energy management and safety.

Management Support - Includes a wide range of activity categorized as management support for programs and functional organizations for the entire Center. Specific functions include resource and budget management, program control, contracting and procurement, personnel management, property management, financial management, and management information and analysis.

Operations Support - This is a broad spectrum of activity that is required to maintain and operate facilities, buildings, and equipment, and provide the normal housekeeping services and logistics support for the personnel who manage and conduct the affairs of the Center. Specific activities are:

Maintenance and operation of all buildings and facilities
Administrative data processing and computer support
Centerwide security and protection
Fire protection
Custodial services
Logistics support including transportation, supplies, etc.
Medical care of employees

RESOURCE REQUIREMENTS BY FUNCTION

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
I. PERSONNEL AND RELATED COSTS	**55,722**	**57,113**	**59,043**	**60,377**
Summary of Fund Requirements				
A. Compensation and Benefits				
1. Compensation				
a. Permanent positions	48,860	49,883	51,242	52,353
b. Other than full-time permanent positions	1,074	1,240	1,571	1,584
c. Reimbursable detailees	40	168	91	123
d. Overtime and other compensation	463	515	566	586
Subtotal, Compensation	50,437	51,806	53,470	54,646
2. Benefits	4,769	4,895	5,123	5,233
Subtotal, Compensation and Benefits	55,206	56,701	58,593	59,879
B. Supporting Costs				
1. Transfer of personnel	98	85	45	52
2. Personnel Training	418	327	405	446
Subtotal, Supporting Costs	516	412	450	498
Total, Personnel and Related Costs	55,722	57,113	59,043	60,377

Explanation of Fund Requirements

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
	(Thousands of Dollars)			
A. Compensation and Benefits	55,206	56,701	58,593	59,879
1. Compensation	50,437	51,806	53,470	54,646
a. Permanent positions	48,860	49,883	51,242	52,353

The funds will support 1,658 permanent positions in 1981 and 1982. The increase from the 1981 budget estimate to the 1981 current estimate is due primarily to the October 1980 pay increase.

Basis of Cost for Permanent Positions

In 1982, the cost of permanent positions will be $52,353,000. The increase from 1981 results from the following:

Cost of permanent positions in 1981		51,242
Cost increases in 1982		+1,461
Within grade and career advances:		
Full year effect of 1981 actions	+651	
Partial year effect of 1982 actions	+549	
Full year effect of 1981 pay increases	+261	
Cost decreases in 1982		-350
Turnover savings and abolished positions:		
Full year effect of 1981 actions	-227	
Partial year effect of 1982 actions	-123	
Cost of permanent positions in 1982		52,353

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
b. Other than full-time permanent positions				
1. cost	1,074	1,240	1,571	1,584
2. Workyears	88	116	117	118

The 1982 estimate will support the following programs:

Distribution of Other than Full-Time Permanent Workyears

Program	Workyears
Cooperative training	32
Summer employment	17
Opportunity programs	32
Other temporary employment	37
Total	118

The increase from the 1981 budget estimate to the 1981 current estimate is primarily due to costs associated with the October 1980 pay increase. The 1982 estimate reflects a continuation of the 1981 level.

c. Reimbursable detailees	40	168	91	123

The military personnel detailed to the Ames Research Center on a reimbursable basis are individuals experienced in aeronautics, rotorcraft technology and related fields. The decrease from the 1981 budget estimate to the 1981 current estimate is due to the inability of the military to provide the full support anticipated. The increase in 1982 is due to the full-year cost of three detailees to support the rotorcraft program.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
d. Overtime and other compensation....	463	515	566	586

Overtime and night differential are used primarily for off-shift operation of major facilities such as the Unitary Plan Wind Tunnel System, the 40-by 80-Foot Subsonic Wind Tunnel, and the 6-by 6-Foot Supersonic Wind Tunnel. The increase from the *1981* budget estimate is due to the additional effort needed to support the 40-by 80-Foot Subsonic Wind Tunnel modification project, and the cost of the October *1980* pay increase. Overtime in *1982* is essentially level with *1981*.

2. Benefits....	4,769	4,895	5,123	5,233
Following are the amounts of contribution by category:				
Civil Service Retirement Fund..	3,414	3,560	3,723	3,788
Employee life insurance.....	133	159	134	136
Employee health insurance.....	946	880	956	968
Workmen's compensation.....	246	276	276	306
FICA.....	30	20	34	35
Total.....	4,769	4,895	5,123	5,233

The increase from the *1981* budget estimate to the *1981* current estimate is due to the October *1980* pay increase. Workmen's compensation estimates reflect the Department of Labor billings. The increase in *1982* over *1981* is related to personnel compensation.

B. Supporting Costs.....	516	412	450	498
1. Transfer of personnel...	98	85	45	52

The decrease from the *1981* budget estimate to the *1981* current estimate is due to completion of personnel transfers related to the rotorcraft project earlier than planned.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
2. Personnel training	418	327	405	446

The increase from the 1981 budget estimate to the 1981 current estimate and the 1982 estimate is due to the rise in tuition costs.

II.	**TRAVEL**	**1,332**	**1,446**	**1,417**	**1,798**
	Summary of Fund Requirements				
A.	Program Travel	844	1,031	1,010	1,315
B.	Scientific and Technical Development Travel	177	155	125	141
C.	Management and Operations Travel	311	260	282	342
	Total, Travel	1,332	1,446	1,417	1,798
	Explanation of Fund Requirements				
A.	Program Travel	844	1,031	1,010	1,315

Program travel is required for the accomplishment of the Center's missions and is the largest part of the Ames travel budget, accounting for 73 percent of travel costs for 1982. Travel for program purposes is required for the continuing efforts in space research, aircraft technology, flight simulation, fluid mechanics, airborne research and applications, and space life sciences. The estimate for 1982 reflects an increase in the requirement for program travel as a result of international joint programs in space research and technology and life sciences programs.

The increase of the 1981 current estimate over the 1980 actual is required for support of the Infrared Astronomy Satellite, Galileo, and Western Regional Applications programs, increased C-141 flights, monitoring contractors performance in the construction of the 80-by 120-Foot Wind Tunnel Test Section, scheduled flight testing of the Tilt Rotor and the new Rotorcraft; the management, coordination and integration of 45 experiments in the Life Science Flight Experiments program for Spacelab-3 and-4 (which involves trips to institutions in the U.S., Europe, and Australia); the Ames participation in the joint US/USSR Cosmos project (Cosmos '81 and Cosmos '83 require trips to Moscow and other foreign cities). The 1982 increase provides for continuing growth in these requirements and the US/USSR Cosmos Satellite Flight scheduled in the last quarter of 1982.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
B. Scientific and Technical Development Travel.....	177	155	125	*141*

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 ARC, 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 in the 1981 current estimate from the 1981 budget estimate is due to budgetary constraints. The level of travel in 1982 is expected *to* provide for presentation of additional aeronautical, life sciences and space and astronautical papers to the scientific community.

C. Management and Operations Travel.....	311	260	282	342

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 activities, and travel of the Center's top management to NASA Headquarters, other NASA Centers, contractor plants, and local transportation. The increase in the 1981 current estimate from the budget estimate reflects an estimate that is more in line with the most recent experience. The 1982 increase allows only for the escalation of the General Services Administration (GSA) rental rates for passenger vehicles and the escalation of fuel costs for passenger vehicles.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
III. FACILITIES SERVICES	***6,183***	***8,736***	***8,455***	***10,541***

Ames Research Center is located on 421 acres of ground in a complex of facilities made up of laboratory and office type buildings as well as research wind tunnels. This complex encompasses 2,101,754 gross square feet of building space including 10 major buildings. *Also* included are 11 major technical facilities. This physical plant supports an average daily population of 2,500 to 2,900 personnel. Many of the facilities are utilized on schedules involving more than one shift and frequently during off-peak hours.

Summary of Fund Requirements

A. Maintenance and Related Services	341	203	392	431
1. Facilities	283	135	357	393
2. Equipment	58	68	35	38
B. Custodial Services	1,731	1,841	1,953	2,165
C. Utilities Services	4,111	6,692	6,110	7,945
Total, Facilities Services	6,183	8,736	8,455	10,541

Explanation of Fund Requirements

A. Maintenance and Related Services	341	203	392	431
1. Facilities	283	135	357	393

Maintenance and repair includes the maintenance of grounds and emergency repairs of heating, ventilating, lighting equipment of institutional buildings and offices. The maintenance of grounds include general landscape maintenance of approximately 30 acres of improved planted areas and includes pest control in these areas; maintenance of approximately 45 acres of unimproved areas such as substations, aircraft

taxiways, drainage ditches, large fields and along roadways within these areas; and vacuum sweeping approximately 42 acres of streets, parking lots, aircraft ramp, taxiway and V/STOL areas. The 1980 actual costs were expended primarily on emergency repairs, such as, repair of break in heating, ventilation, air-conditioning, elevator and natural gas distribution systems. The increases in 1981 and 1982 allows for gradual return to normal maintenance levels of facilities in addition to emergency repairs.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
2. Equipment	58	68	35	38

Equipment repair is done on an on-call basis. The decrease in the 1981 current estimate from the 1981 budget estimate reflects the withdrawal of older office equipment, thus reducing the need for maintenance. 1982 reflects the same level of repair as in 1981.

B. Custodial Services	1,731	1,841	1,953	2,165

This activity involves support contractor effort which provides janitorial and security services, fire protection provided by the U.S. Navy, and other miscellaneous custodial services and supplies. The increase from the 1981 budget estimate to the 1981 current estimate is due to increased costs of supplies and services. The 1982 increase will provide for the full year effect of previously negotiated contract rates and an increase of one contractor workyear for increased life sciences laboratory space.

1. Janitorial services 983

Janitorial and building cleaning services are associated with approximately 1.6 million square feet of various types of space located in 75 buildings. Services are also provided for 50 trailers being utilized to provide temporary office and shop space.

2. Fire protection services 395

Fire protection services are provided by the U.S. Naval Air Station, Moffett Field, California. The 1982 estimate is based on the most recent actual cost experience.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
3. Security services				635

Included are security services for buildings and property including aircraft and computer facilities. Included also is the provision of "round-the-clock" staffing of the emergency duty office which monitors fire security, safety alarms, and coordinates fire, security, and safety areas in emergency situations.

4. Other services				152

Pest control services, on an as needed basis, are funded in this activity. Also included are refuse collection, laundry and custodial supplies.

C. Utilities Services	4,111	6,692	6,110	7,945

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

1. Electricity (241,000 mW/Hrs.)	6,303
2. Natural gas (202,000 K cu. ft.)	1,506
3. Fuel oil (55,000 gal.)	31
4. Water and sewage	105

Electricity is provided by the U.S. Bureau of Reclamation's (USBR) Central Valley Project, marketed by the Western Area Power Administration of the Department of Energy (WAPA/DOE) and 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 is consumed in the operation of high power demand research facilities such as the Unitary Plan Wind Tunnel System, the 40- by 80-Foot Wind Tunnel, the 3.5-Foot Hypersonic Tunnel, the 14-Foot Transonic Wind Tunnel and in the operation of simulators and smaller wind tunnels, and other research facilities. Approximately 55 percent of the natural gas is used in research facilities; the other part is used for heating and ventilation of institutional buildings.

The estimated energy usage and funding levels requested for the 1981 current estimate and the 1982 estimate are based on current requirements for wind tunnel tests scheduled for the two fiscal years, and reflects current estimates of anticipated increased utility rates.

The difference between the 1981 budget estimate and the 1981 current estimate is primarily in consumption of electricity. The 1981 budget estimate was based on electric energy usage of 242 million kilowatt hours (M KWH). The 1981 current estimate is based on usage of 227 M KWH to support the level of wind tunnel testing and operations (eight shifts) required in 1981 adjusted for the effect of energy conservation initiatives instituted during 1979 and 1980. The 1982 estimated usage of 241 M KWH allows for the greater energy requirements of the re-powered motors of the 40-by 80-foot and 80-by-120 foot wind tunnels which will start operating in late 1981 and be in full operation in 1982.

		1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)			
IV.	**TECHNICAL SERVICES**	**981**	**924**	**1,528**	**1,576**
	Summary of Fund Requirements				
A.	Automatic Data Processing	551	555	1,184	1,202
	1. Equipment	---	---	370	348
	2. Operations	551	555	814	854
B.	Scientific and Technical Information				
	1. Education and information	273	259	253	274
C.	Shop Support and Services	157	110	91	100
	Total, Technical Services	981	924	1,528	1,576

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
	(Thousands of Dollars)			
Explanation of Fund Requirements				
A. Automatic Data Processing	551	555	1,184	1,202

This category reflects the central ADP facility operating costs which are incurred by administrative organizations. These costs are incurred through a system whereby user organizations are charged for actual usage of the ADP central facility's equipment and services.

1. Equipment	---	---	370	348

The 1981 current estimate provides for the acquisition of a stand-alone computer to be dedicated wholly to administrative data processing and management. The 1982 estimate provides for the procurement of peripheral equipment to expand the system's capability and to support on-line management information systems and telecommunications with Headquarters and other NASA Centers.

2. Operations	551	555	814	854

This function includes ADP computer operations and programming that are charged to administrative organizations through the Center's charge-back systems. The charges include the organizations' proportionate share of support service contracts. The increase from the 1981 budget estimate to the 1981 current estimate is due to an increase in contract support services to support the stand-alone computer and the cost of additional computer printing paper, supplies, materials and maintenance associated with the new system. Included in the 1981 current estimate is a one-time cost for setting up the computer and providing the training for its operation. Also included in 1981 are two additional workyears to operate the new computer. The 1982 estimate provides for an increase of one workyear for contractor programming support for the development of the expanded management information system.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
B. Scientific and Technical Information.....	273	259	253	274
1. Education and information.....	273	259	253	274

Included in this category is a support contract to perform public information services (e.g., tour guide), media development (e.g., public exhibits, etc.) and educational programs. The increase in 1982 is due primarily to estimated Department of Labor wage determination increases.

C. Shop Support and Services.....	157	110	91	100

This category includes administrative shop, photo and graphics services. Approximately 61 percent of this function cost is to support the public affairs activity. The decrease in the 1981 current estimate from the 1981 budget estimate reflects the reduction of the PAO activity in 1981. The increase in 1982 reflects an escalation in cost of supplies and materials.

V. MANAGEMENT AND OPERATIONS.....	**3,156**	**3,250**	**3,406**	**3,629**
Summary of Fund Requirements				
A. Administrative Communications.....	853	916	1,013	1,149
B. Printing and Reproduction	137	92	95	104
C. Transportation.	170	194	193	191
D. Installation Common Services.....	1,996	2,048	2,105	2,185
Total, Management and Operations..	3,156	3,250	3,406	3,629

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		

Explanation of Fund Requirements

A. Administrative Communications	853	916	1,013	1,149

Communications services are provided by the General Services Administration (GSA) for the Federal Telecommunications Service (FTS) and the Pacific Telephone and Telegraph Company for local service. Other communications consists of teletype equipment and services provided by Western Union. The 1981 current estimate and the 1982 estimate reflect increases in rates.

1. Local telephone service 548

The major part of this covers 1,607 Centrex lines and 2,386 telephone instruments which serve about 3,506 individuals on-site at ARC, including on-site contractors and tenants from other Government agencies.

2. Long distance telephone service 572

This service is primarily (81 percent) FTS services; the balance is commercial long distance, message unit charges and leased line service charges.

3. Other communication services 29

Includes Western Union Telegraphic Services and leased equipment.

B. Printing and Reproduction	137	92	95	104

The estimates for administrative printing includes the Printing and Reproduction Facility operating costs incurred by administrative organizations and includes supplies, materials, equipment acquisition and outside procurements. The 1982 estimate reflects an escalation in procurement costs.

C. Transportation	170	194	193	191

The estimates include the motor pool operation cost including GSA truck rentals, freight costs, Government bills of lading, air freights and other general shipments.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
D. Installation Common Services.....	1,996	2,048	2,105	2,185

These services include the Center Management and Staff function, medical services operation, and the installation support services activities. The increase in the 1981 budget estimate to 1981 current estimate reflects a postal rate increase and an increase in contract workyear rates offset by a five workyear reduction in installation support services. The 1982 increase allows for a restoration of three of the five workyears cut in 1981.

1. Center management and staff..... 444

Includes the general management of the Center and includes such activities as the Directorate offices, general and patent legal services, personnel, procurement, and financial management services. Significant cost items include the various Equal Employment Opportunity (EEO) programs, the Intergovernmental Personnel Act (IPA) programs, various management studies, and management information systems development.

2. Medical services..... 220

Medical services include the staffing of the health unit, laboratory service fees, clinic supplies, and maintenance of clinic equipment.

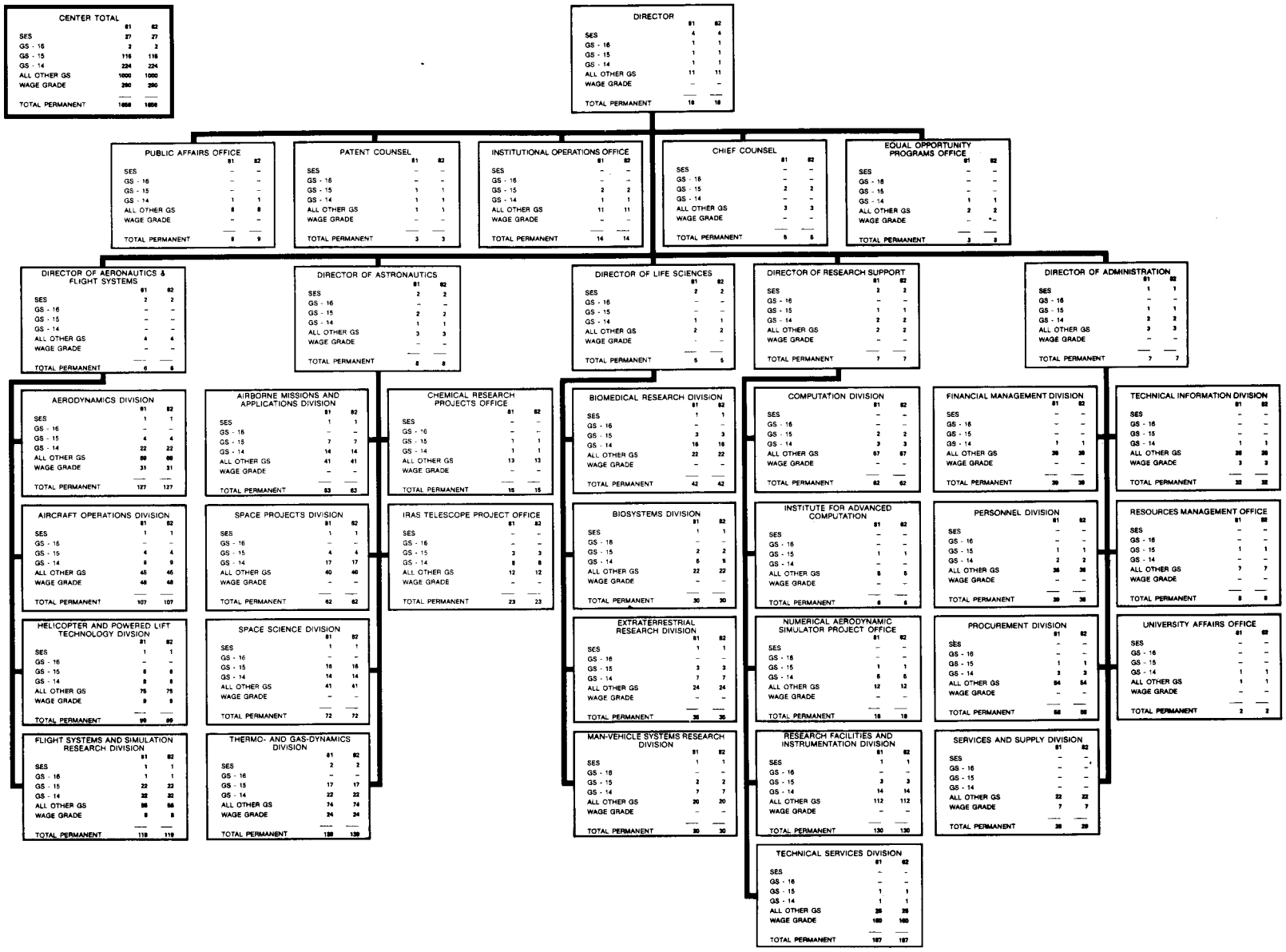
3. Installation support services..... 1,521

Installation support services consist predominantly of the support service contract for supply management, mail, and pickup and delivery services. The balance of the functional costs consists of administrative equipment acquisition; office supplies and materials; maintenance, repair and lease of office equipment; and postage.

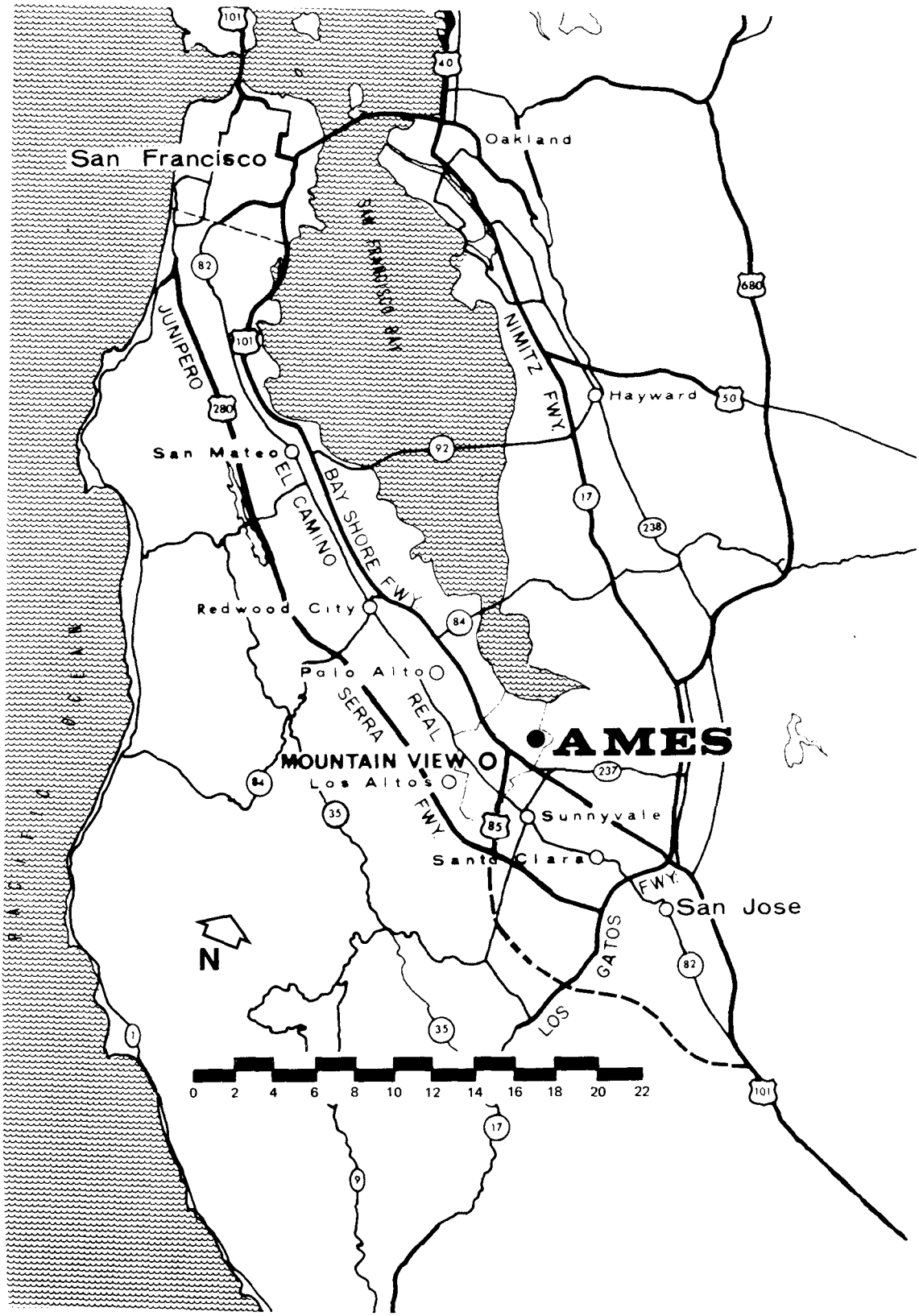
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

ORGANIZATION AND STAFFING CHART

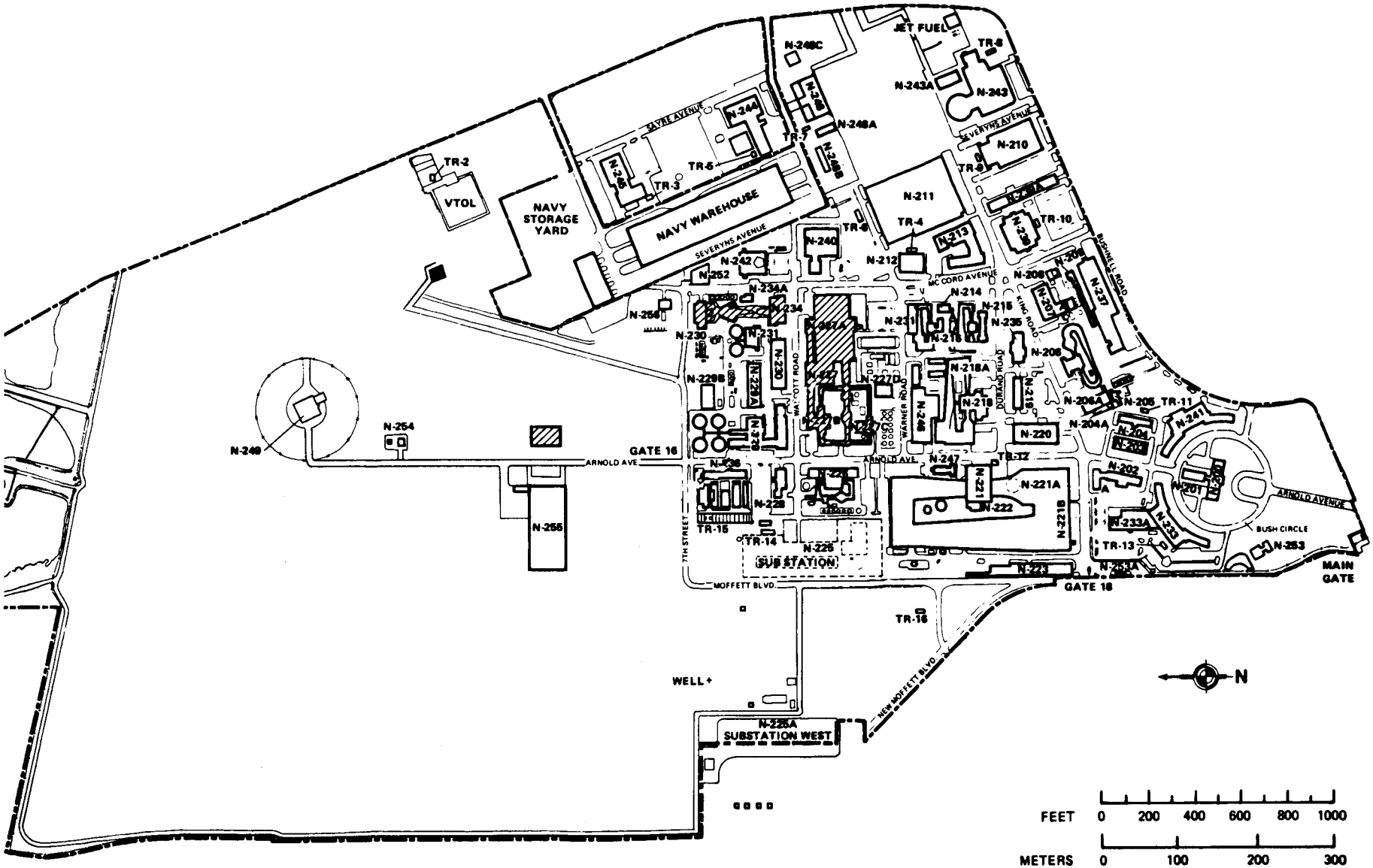
AMES RESEARCH CENTER



LOCATION MAP



AMES RESEARCH CENTER
FISCAL YEAR 1982 ESTIMATES
LOCATION PLAN



RPM 7-29

AMES RESEARCH CENTER

AERIAL VIEW

DRYDEN FLIGHT
RESEARCH CENTER

RESEARCH AND PROGRAM MANAGEMENT

FISCAL YEAR 1982 ESTIMATES

HUGH L. DRYDEN FLIGHT RESEARCH CENTER

DESCRIPTION

The Hugh L. Dryden Flight Research Center (DFRC), Edwards, California, is 65 air miles northeast of Los Angeles. The Center is located at the north end of Edwards Air Force Base on 521 acres of land under a permit from the Air Force. The Air Force Base encompasses 300,722 acres. The Center is adjacent to Rogers Dry Lake, a 55-square mile area with a complex of runways varying in length from five to eleven miles.

The physical plant consists of an office-laboratory building with adjoining shops, a flight maintenance hangar, a flight loads research facility, and an integrated support facility. Special Shuttle support facilities include the Orbiter hangar and the Orbiter mating-demating facility. Auxiliary buildings include warehouses, an auxiliary power system building, an aircraft maintenance dock, and hangar. The aerodynamic test range is operated with a site at Edwards, California. The total capital investment of the DFRC, including fixed assets in progress and contractor held facilities at various locations was $83,302,000, as of September 30, 1980.

CENTER ROLES AND MISSIONS

The primary mission of the DFRC, established in 1947, is to conduct aeronautical flight research in the areas of aerodynamics, structures, control systems, propulsion systems, disciplinary integration effects, safety, operations, and human-vehicle interactions in support of both military and civil national needs. This includes planning, conducting, analyzing, and reporting of flight research for the purposes of verification of predicted characteristics and the identification of unanticipated problems in actual flight. The principal and supporting roles of the Center are:

PRINCIPAL

Aeronautical Flight Research - conducting flight research using aircraft as test facilities; conducting flight research programs of advanced aerospace vehicle concepts; and employing flight research vehicles for innovative conceptual testing such as remotely piloted research and augmented vehicles.

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

Flight Instrumentation Development - directing the cooperative efforts in development of new methods and equipment for flight measurements.

Avionic and Flight Control - conducting flight test evaluation of new and innovative concepts in flight control to validate design methods and verify system performance in the flight environment.

Low Speed Aircraft - establishing a flight data base for Vertical/Short Take-Off and Landing (V/STOL) aircraft in flight dynamics and operating systems for utilization in the design and development of future civil and military aircraft.

High Speed Aircraft - conducting flight research on advanced configurations and demonstrating the potential for improved aircraft performance through the integration of aircraft systems.

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

DFRC also provides host Center functions for NASA flight activities which are managed by other Centers, but which require testing at the Edwards Air Force Base complex. This function includes all institutional support and coordination as well as supervision of flight operations.

SUPPORTING

Shuttle Orbiter - providing landing and recovery capability during Orbital Flight Test (OFT) missions and contingency recovery capability for subsequent operational flights.

Aerodynamics - supporting the development of the technology data base for laminar flow control concepts which could be utilized in future commercial aircraft.

Transport Aircraft - exploring as a cooperative effort, the development and validation of integrated design methods which utilized active flight controls to enhance aircraft structural efficiency and flight tests of laminar flow control wing leading edge systems.

Advanced Propulsion - supporting flight research programs to establish a technology data base for advanced turbopropeller systems to improve the energy efficiency of future aircraft.

Rotorcraft - supporting the envelope expansion and hazardous flight research testing of research rotorcraft.

SUMMARY OF RESOURCES REQUIREMENTS

Funding Plan By Function

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
	(Thousands of Dollars)			
I. Personnel and Related Costs	15,080	15,142	16,329	16,475
II. Travel	365	400	375	523
III. Facilities Services	2,786	3,150	3,130	3,572
IV. Technical Services	458	789	534	890
V. Management and Operations	1,719	2,200	2,219	2,307
1981 Budget Amendment	---	-295	---	---
Total, fund requirements	20,408	21,386	22,587	23,767

Distribution of Permanent Positions by Program

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
Direct Positions				
Space Transportation Systems and Operations	40	30	43	47
Space shuttle	40	30	43	47

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
Space Science	1	2	1	1
Life sciences	1	2	1	1
Space and Terrestrial Applications	1	1	1	1
Technology utilization	1	1	1	1
Aeronautics and Space Technology	299	306	296	292
Aeronautical research and technology	294	301	286	281
Space research and technology	5	5	10	11
Space Tracking and Data Systems	29	29	29	29
Tracking and data acquisition	29	29	29	29
Subtotal, direct positions	370	368	370	370
Center Management and Operations Support Positions	91	93	91	91
Total, permanent positions	461	461	461	461

PROGRAM DESCRIPTION

	Permanent Positions (Civil Service)
SPACE SHUTTLE	47

In 1982, DFRC will support the Shuttle Orbital Flight Test (OFT) missions and other Shuttle activities. Current planning is for Edwards Air Force Base to be the primary landing site for the first four missions

and the secondary landing site for subsequent missions. After landing, the Shuttle Orbiter will be returned to Kennedy Space Center by Shuttle carrier aircraft. DFRC will provide operational and institutional support for the Space Shuttle landing activities at Edwards. In addition, DFRC will provide aircraft to test the Microwave Scanning Beam Landing System (MSBLS), provide Orbiter convoy operations support, and maintain the Shuttle/Carrier Aircraft facility.

	Permanent Positions (Civil Service)
LIFE SCIENCES	1

In 1982, it is planned to analyze and evaluate cost effective, reliable human-machine control systems for use in remote manipulation such as manual landing of Shuttle type vehicles. Flight studies of remotely piloted high performance vehicles will be performed to determine information requirements and procedures necessary for descent, approach, flare, touchdown, and rollout without direct external vision. Television sensors and displays with inside-out references will be evaluated to define optimum human-machine design characteristics.

TECHNOLOGY UTILIZATION	1

In 1982, one civil servant is required to continue studies of various means to improve the aerodynamic efficiency of ground vehicles. Various add-on devices, which potentially could be manufactured by small businesses, will be evaluated.

AERONAUTICAL RESEARCH AND TECHNOLOGY	281

The aeronautical program includes continuing work in research and technology base areas and conducting specific systems technology flight research programs involving aerodynamics, propulsion, structures, avionics and controls, human factors and multidisciplinary research, utilizing Conventional Take-Off and Landing (CTOL), rotorcraft, Vertical/Short Take-Off and Landing (V/STOL), and high performance type aircraft. The majority of the programs are joint or cooperative efforts with the military, other NASA Centers or Government agencies where the unique flight research facilities and capabilities at DFRC provide the critical element in the development or demonstration of technology areas of interest.

In 1982, the objective of the activities under the research and technology base program is to provide continuing research and development efforts in all technical discipline areas so that improved understanding can be applied to problems associated with aircraft in all flight regimes. Flight research in the Research

and Technology (R&T) base program in 1982 includes preparations for the Decoupler Pylon (DCP) flight test; flight tests of an AV-8 to establish a flight data base in flight dynamics and operating systems for V/STOL aircraft; and flight tests of digital fly-by-wire experiments to support development of advanced avionics technology. Effort will also continue toward the development of new or improved flight test techniques and flight test instrumentation to increase NASA's capability to conduct flight research.

The systems technology program in 1982 will include participation in the joint NASA/USAF AFTI/F-111 program for research and development of a Mission Adaptive Wing to obtain in-flight smooth contour changes to the wing aerodynamic shape to achieve improved aerodynamic efficiency; 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; continued joint NASA/Navy F-14 flight research for validation of Flush Air Data System (FADS) and Full Authority Digital Electronic Control (FADEC) technologies; modification of the Jetstar aircraft in preparation for laminar flow control systems flight research; continued flight evaluation of the advanced technologies incorporated in the Highly Maneuverable Aircraft Technology (HiMAT) aircraft; Aircraft Energy Efficiency (ACEE) programs including flight evaluation of an active control system that will provide gust alleviation, manewer load control and flutter suppression for the Aeroelastic Research Wing Vehicle (ARW-2) as part of a joint Langley/Dryden program; and, acoustic flight tests of advanced high tip-speed propellers, developed by Lewis Research Center, in support of the advanced turboprop program.

The Dryden Flight Research Center (DFRC) has traditionally received requests from other agencies and from the industry for test support of their aircraft, missiles and systems development programs. Extensive use is made of the unique flight research facilities at DFRC in support of DOD requests for assistance in military aeronautical research and development programs. The main thrust of this assistance is to evaluate and improve specific military systems in the current inventory or under active development. There are also numerous joint programs with the Air Force Systems Command and the Naval Air Systems Command. Examples of these joint and support programs include: Air Force Fighter Technology Integration Program, Navy Firebrand Research Test Vehicle Program, Navy F-14 Aileron Rudder Interconnect Program, and Navy F-18 Program.

	Permanent Positions (Civil Service)
SPACE RESEARCH AND TECHNOLOGY	11

This work is 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 the Johnson Space Center Shuttle Program manager in analysis and solution of various problems that exist in certain flight profile areas between entry and landing; evaluation of the performance of the Shuttle Entry Air Data System (SEADS); 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 system, stability and control, performance, and structural and atmospheric turbulence characteristics in the Shuttle reentry environment.

High temperature space structures disciplinary research will involve analysis 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.

TRACKING AND DATA ACQUISITION	29

In 1982, DFRC will maintain and operate the NASA Aerodynamic Test Range (ATR), which provides direct operational support for a wide variety of aerodynamic and aerospace programs. During mission support operations, the various functional elements such as radar, tracking and data processing, communications, video telemetry acquisition, and telemetry data processing all function in a coordinated manner to provide real time control and monitoring capabilities.

CENTER MANAGEMENT AND OPERATIONS SUPPORT	91

Center Management and Operations Support is defined as that support or service being provided to all DFRC 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, immediate staff, and staff organizations, e.g., Legal, Patent Counsel, Equal Opportunity, Safety and Public Affairs.

Management Support - Includes a wide range of activity categorized as management support for program and functional organizations for the entire Center. Specific functions include resources and budget management, program control, contracting and procurement, personnel management, institutional support, financial management and management information systems analysis, development, and maintenance.

Operations Support - This is a broad spectrum of activity that is required to maintain and operate facilities, buildings, and equipment, and to provide the normal housekeeping services and logistics support for the personnel who manage and conduct the affairs of the Center. Specific activities are:

Maintenance and operation of all buildings and facilities
Data processing and computer support
Reliability and quality assurance
Center-wide security and protection
Fire protection
Custodial services
Logistics support including transportation, supplies, etc.
Medical care of employees
Photographic and graphics support
Word processing support
Communications support

RESOURCE REQUIREMENTS BY FUNCTION

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
	(Thousands of Dollars)			
I. PERSONNEL AND RELATED COSTS	**15,080**	**15,142**	**16,329**	**16,475**
Summary of Fund Requirements				
A. Compensation and Benefits				
1. Compensation				
a. Permanent positions	12,769	12,762	13,730	13,879
b. Other than full-time permanent	440	595	640	624
c. Reimbursable detailees	82	78	98	98
d. Overtime and other compensation	267	230	271	250
Subtotal, Compensation	13,558	13,665	14,739	14,851
2. Benefits	1,324	1,298	1,416	1,430
Subtotal, Compensation and Benefits	14,882	14,963	16,155	16,281
B. Supporting Costs				
1. Transfer of personnel	77	63	63	72
2. Personnel training	121	116	111	122
Subtotal, Supporting Costs	198	179	174	194
Total Personnel and Related Costs	15,080	15,142	16,329	16,475

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
Explanation of Fund Requirements				
A. Compensation and Benefits	14,882	14,963	16,155	16,281
1. Compensation	13,558	13,665	14,739	14,851
a. Permanent positions	12,769	12,762	13,730	13,879

The 1982 estimate supports a permanent personnel complement of 461 positions. The current estimate for 1981 is increased from the 1981 budget estimate as a result of the October 1980 pay increase.

Basis of Cost for Permanent Positions

In 1982, the cost of permanent positions will be $13,879,000. The increase results from the following:

Cost of permanent positions in 1981		13,730
Cost of increases in 1982		+323
Within grade and career advances:		
Full year effect of 1981 actions	+179	
Partial year effect of 1982 actions	+131	
Full year effect of 1981 pay increase	+13	
Cost decreases in 1982		-174
Turnover savings and abolished positions:		
Full year effect of 1981 actions	-104	
Partial year effect of 1982 actions	-70	
Cost of permanent positions in 1982		13,879

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
b. Other than full-time permanent positions:				
1. Cost	440	595	640	624
2. Workyears	41	62	60	58

The increase from the 1981 current estimate to the 1981 budget estimate is due to the October 1980 pay increase, partially offset by a reduction in workyears associated with a decrease in temporary employment.

The 1982 estimate will support the following programs:

Distribution of Other than Full-Time Permanent Workyears

Program	Workyears
Cooperative training	32
Summer employment	2
Opportunity programs	16
Other temporary employment	8
Total	58

c. Reimbursable details	82	78	98	98

The services of a small group of military officers are used in the Center's programs where such assignments are of mutual benefit to NASA and the respective Service. Under the existing agreements, the parent organization is reimbursed for salaries and related costs. The increase from the 1981 budget estimate to the 1981 current estimate is due to the October 1980 pay increase and increased permanent change of station rates.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
d. Overtime and other compensation	267	230	271	250

Overtime is restricted to emergency repairs and unusual temporary workload. A substantial portion is used to prepare for test flights. The *1981* current estimate increase from the *1981* budget estimate reflects the Shuttle schedule delay into *1981*, and the October *1980* pay increase. The *1982* estimate reflects the completion of Space Shuttle testing.

2. Benefits	1,324	1,298	1,416	1,430
Following are the amounts of contribution by category:				
Civil Service Retirement Fund	910	941	987	987
Employee life insurance	39	43	42	42
Employee health insurance	274	263	308	339
Workmen's compensation	35	42	42	47
FICA	7	9	10	10
Other benefits	59	---	27	5
Total	1,324	1,298	1,416	1,430

The current estimate for *1981* is higher than the *1981* budget estimate due to the October *1980* pay increase. The *1982* estimate reflects the cost of benefits related to the compensation estimates. Workmen's compensation costs are based on the Department of Labor billings.

B. Supporting Costs	198	179	174	194
1. Transfer of personnel	77	63	63	72

The costs associated with the transfer of personnel include movement of household goods, subsistence and temporary expenses, real estate costs and miscellaneous moving expenses related to change of duty station. The *1982* estimate is based on the estimated number of anticipated moves.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
2. Personnel training.....	121	116	111	122

Training funds provide for the maintenance and expansion of skills which are essential in carrying out the Agency's many complex technical programs. The cost reflects tuition and related fees at a number of government and nongovernment institutions. The increase in 1982 reflects a slight increase in tuition costs.

II. TRAVEL	**365**	***400***	**375**	**523**
Summary of Fund Requirements				
A. Program Travel.....	207	270	270	364
B. Scientific and Technical Development Travel..	29	29	29	36
C. Management and Operations Travel.....	129	101	76	123
Total, Travel.....	365	400	375	523
Explanation of Fund Requirements				
A. Program Travel.....	207	270	270	364

Program travel is directly related to the accomplishment of the Center's mission. Travel for program purposes is required for continued joint programs between DFRC and other Centers and includes the support of flight test techniques, flight measurements, avionics and flight control, and flight measurement development activities. The increase in 1982 is due to increased costs and travel associated primarily with Space Shuttle landing operation, high performance aircraft technology investigations, and the highly augmented aircraft joint programs with the Army, Air Force, Navy and other NASA Centers.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
B. Scientific and Technical Development Travel.....	29	29	29	36

Scientific and technical development travel permits employees to participate in meetings and seminars with other representatives of the aerospace community. This participation allows them to benefit from exposure to technical advances outside DFRC, as well as to present accomplishments and problems to their associates. Many of the meetings consist of working panels convened to solve specific governmental problems. The increase in 1982 will allow additional trips so that employees may stay current on state of the art scientific and technical developments.

C. Management and Operations Travel..	129	101	76	123

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; training; and local transportation. The decrease from the 1981 budget to the 1981 current estimate reflects a cutback due to budget constraints in the travel function. The 1982 estimate provides for an increase in travel due to Shuttle landing support requirements.

III. FACILITIES SERVICES.....	**2,786**	**3,150**	**3,130**	**3,572**

The DFRC is located on 521 acres and occupies a complex of facilities consisting of laboratory and office-type buildings as well as flight test facilities. This complex encompasses 467,172 gross square feet of building space including eight major technical facilities. This physical plant houses an average daily on-Center population of 1,200 to 1,500 personnel. Many of the test facilities are utilized on schedules involving more than one shift.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
Summary of Fund Requirements				
A. Rental of Real Property	49	37	50	98
B. Maintenance and Related Services	1,526	1,524	1,660	1,878
1. Facilities	1,493	1,422	1,660	1,878
2. Equipment	33	102	---	---
C. Custodial Services	766	1,089	884	1,020
D. Utility Services	445	500	536	576
Total, Facilities Services	2,786	3,150	3,130	3,572
Explanation of Fund Requirements				
A. Rental of Real Property	49	37	50	98

This item provides for the rental of trailers to provide office, shop, laboratory, and storage space in support of the Space Shuttle Orbital Flight Test (OFT) program. The 1981 current estimate is increased from the 1981 budget estimate due to an increase in OFT support in 1981. The increase in 1982 is based upon anticipated contract renegotiations.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
B. Maintenance and Related Services	1,526	1,524	1,660	1,878
1. Facilities	1,493	1,422	1,660	1,878

This activity involves all DFRC and facilities provided by the Air Force, including those used for Shuttle, tracking and communication facilities. The increase in the 1981 current estimate over the 1981 budget estimate is due to Shuttle rescheduling, the functional redistribution of collateral equipment, and an increase of five workyears.

a. Maintenance and repair services	1,502
b. Engineering services	113
c. Supplies and materials	17
d. Other services	246

2. Equipment	33	102	---	---

This activity involves three workyears of effort for the maintenance of facility-type equipment by a support service contractor. During contract negotiations, the equipment was determined to be collateral type and is therefore reported under facilities maintenance and repair services for the 1981 current estimate and the 1982 budget estimate.

C. Custodial Services	766	1,089	884	1,020

This activity provides for security, janitorial, and refuse handling services. The reduction from the 1981 budget estimate to the current estimate reflects a cutback in services and a decrease of six workyears in the custodial contract due to budget constraints. The 1982 increase provides for a partial restoration of two workyears in the custodial contract.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
Janitorial services..				268

This activity includes:

a. Janitorial services
b. Refuse handling

Security guard services				752

This activity includes:

a. Security of all on-site Government facilities and equipment
b. Mail and messenger service
c. Badging of all on-site personnel and visitors

D. Utility Services	445	500	536	576

Utility services are purchased through Air Force contracts with regional utility companies. Costs are based on Air Force projected rates. The major amount is for electricity with lesser amounts for natural gas, fuel oil, water and sewage services. The increase from the 1981 budget estimate to the 1981 current estimate is due to utility rate increases. Rate increases are projected in the 1982 budget estimate. A summary of the proposed DFRC utilities budget for 1982 is as follows:

1. Electricity (12,000	402
2. Natural gas (22,000 K cu. ft.)	146
3. Fuel oil (8,000 gals.).	11
4. Water and sewage	17

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
IV. TECHNICAL SERVICES	**458**	**789**	**534**	**890**
Summary of Fund Requirements				
A. Automatic Data Processing	270	559	308	684
1. Equipment	62	229	29	232
2. Operations	208	330	279	452
B. Scientific and Technical Information	51	82	84	93
1. Library	18	17	19	21
2. Education and information	33	65	65	72
C. Shop Support and Services	137	148	142	113
Total, Technical Services	458	789	534	890
Explanation of Fund Requirements				
A. Automatic Data Processing	270	559	308	684
1. Equipment	62	229	29	232

Includes the support, purchase and lease of equipment that is necessary to satisfy the payroll, personnel, accounting and management information systems requirements of NASA and DFRC management. The decrease in the *1981* current estimate reflects a delay in the purchase of accounting system hardware previously planned for *1981*. The *1982* estimate now includes the one-time purchase of this hardware.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
	(Thousands of Dollars)			
2. Operations.....	208	330	279	452

This function includes administrative key punch, technician and programming services required to support the management information system. The decrease in the 1981 current estimate from the 1981 budget estimate reflects the delay of the software redesign and development previously planned for 1981. The increase in 1982 includes this software redesign and development and an increase of one workyear for operations.

B. Scientific and Technical Information.....	51	82	84	93
1. Library.....	18	17	19	21

Provides for the purchase of books, supplies, and materials for the operation of the DFRC library.

2. Education and information.....	33	65	65	72

Provides for the gathering and dissemination of information about the Center's program to the mass communications media, the general public, and to the educational community at the elementary and secondary school levels. Assistance to the mass communications media includes the gathering and exposition of newsworthy material in support of media requests and takes such forms as press kits, news releases, television and radio information tapes and clips, and feature material. The 1982 estimate provides for approximately the same level of activity as in 1981.

C. Shop Support and Services.....	137	148	142	113

Provides funding for support service contractors for graphics, safety, and audio visual services. The 1982 estimate is reduced due to the projected phase out of one contract workyear for Shuttle support in this area.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
V. MANAGEMENT AND OPERATIONS	1,719	2,200	2,219	2,307
Summary of Fund Requirements				
A. Administrative Communications	418	551	593	582
B. Printing and Reproduction	98	90	106	117
C. Transportation	252	328	402	423
D. Installation Common Services	951	1,231	1,118	1,185
Total, Management and Operations	1,719	2,200	2,219	2,307
Explanation of Fund Requirements				
A. Administrative Communications	418	551	593	582

Includes estimates for Federal Telecommunications Systems (FTS), local telephone and exchange service, rental of TWX equipment, and telephone operators. The *1981* current estimate exceeds the *1981* budget estimate due to increased telephone rates and a one-time installation of a new direct dial switchboard. The *1982* budget estimate includes operating costs of the direct dial switchboard and estimated increased telephone rates.

1. Local telehone service..... *373*

This funding covers the service for *535* main lines, *792* telephone instruments at the Center, and five main lines to Lancaster, California. ***Also*** included are the lease of switchboard equipment and the support service contract for telephone operators.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
2. Long distance telephone service				165

This category reflects funding to support 26 FTS lines and commercial toll charges.

3. Other communications services 44

This funding covers the teletype (TWX) service, data telecommunication systems and the DFRC public address system.

B. Printing and Reproduction	98	90	106	117

Includes the contractual publication of information and materials and the related composition and binding operations. All common processes of duplication, including photostating, blue printing and microfilming are included. The 1981 current estimate reflects the higher than anticipated cost for supplies and duplicating equipment maintenance. The 1982 estimate reflects approximately the same level of activity as in 1981.

C. Transportation	252	328	402	423

Provides funds for Government bills of lading issued to common carriers to move freight by rail, truck, water, and air; to fund shipments by United Parcel Services; and contract support for the Center's general purpose vehicles. The increase from the 1981 budget estimate to the 1981 current estimate is due to changes in Shuttle scheduling. The increase in the 1982 estimate reflects anticipated rate increases.

D. Installation Common Services	951	1,231	1,118	1,185

This category provides for physical examinations for DFRC pilots; funding for the Occupational Health Support contract; supplies, materials, and equipment to support the general administrative effort; rental of equipment; and the supply management support service contract. The decrease in the 1981 current estimate from the 1981 budget estimate reflects a decrease in estimated requirement for supplies and rental equipment and five contract workyears in support of Shuttle. The increase in 1982 reflects support contractor wage escalation with the level of activity remaining at the 1981 level of operations.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
1. Center management and staff functions				103

This category includes supplies, materials and services in support of center management, general and patent legal services, personnel and other staff functions.

2. Medical services				274

This category includes the Occupational Health Contract and provides for DFRC pilot physicals.

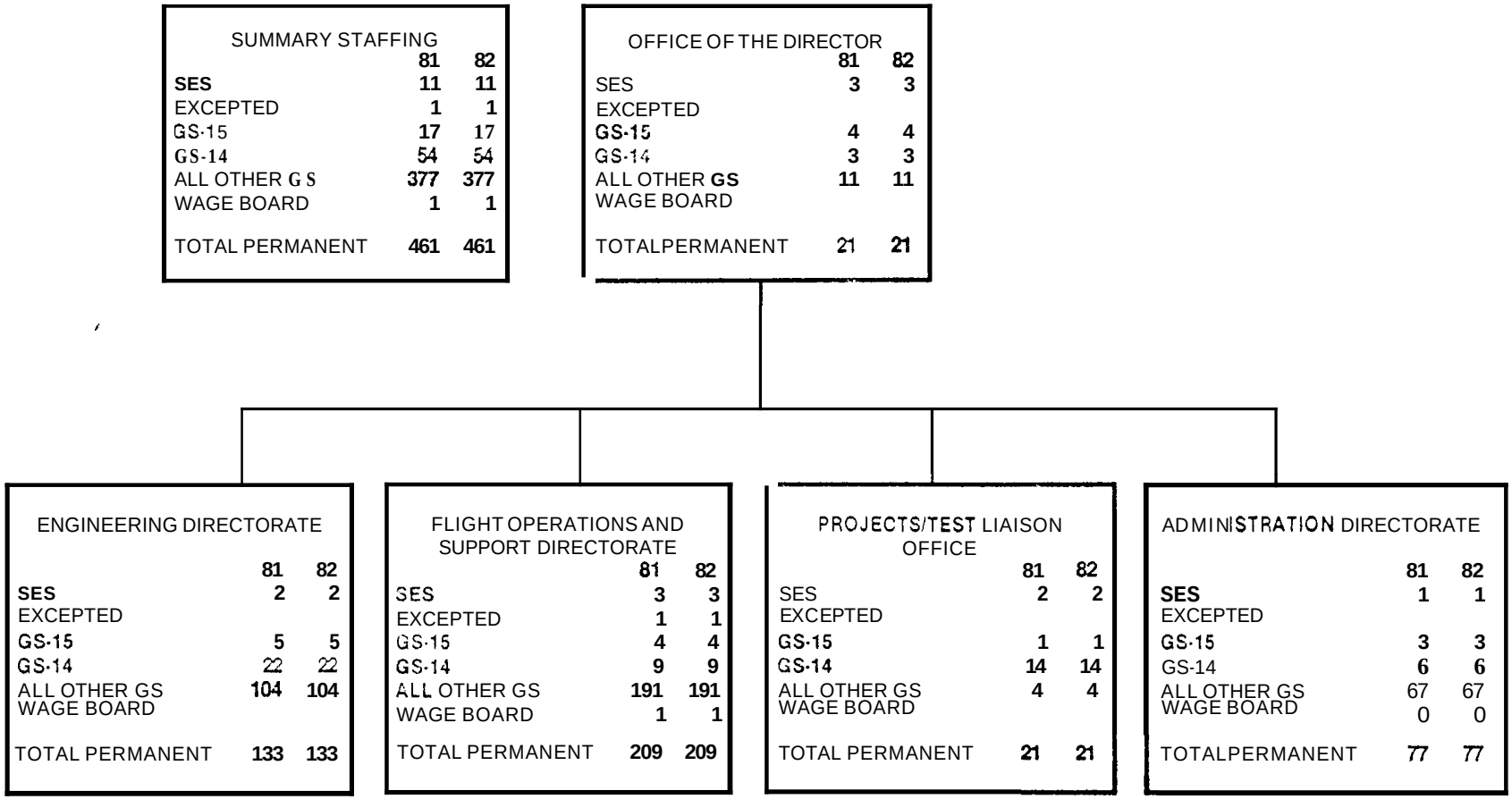
3. Installation support services				808
a. Supply management				593

This function includes the DFRC and Shuttle supply system operation.

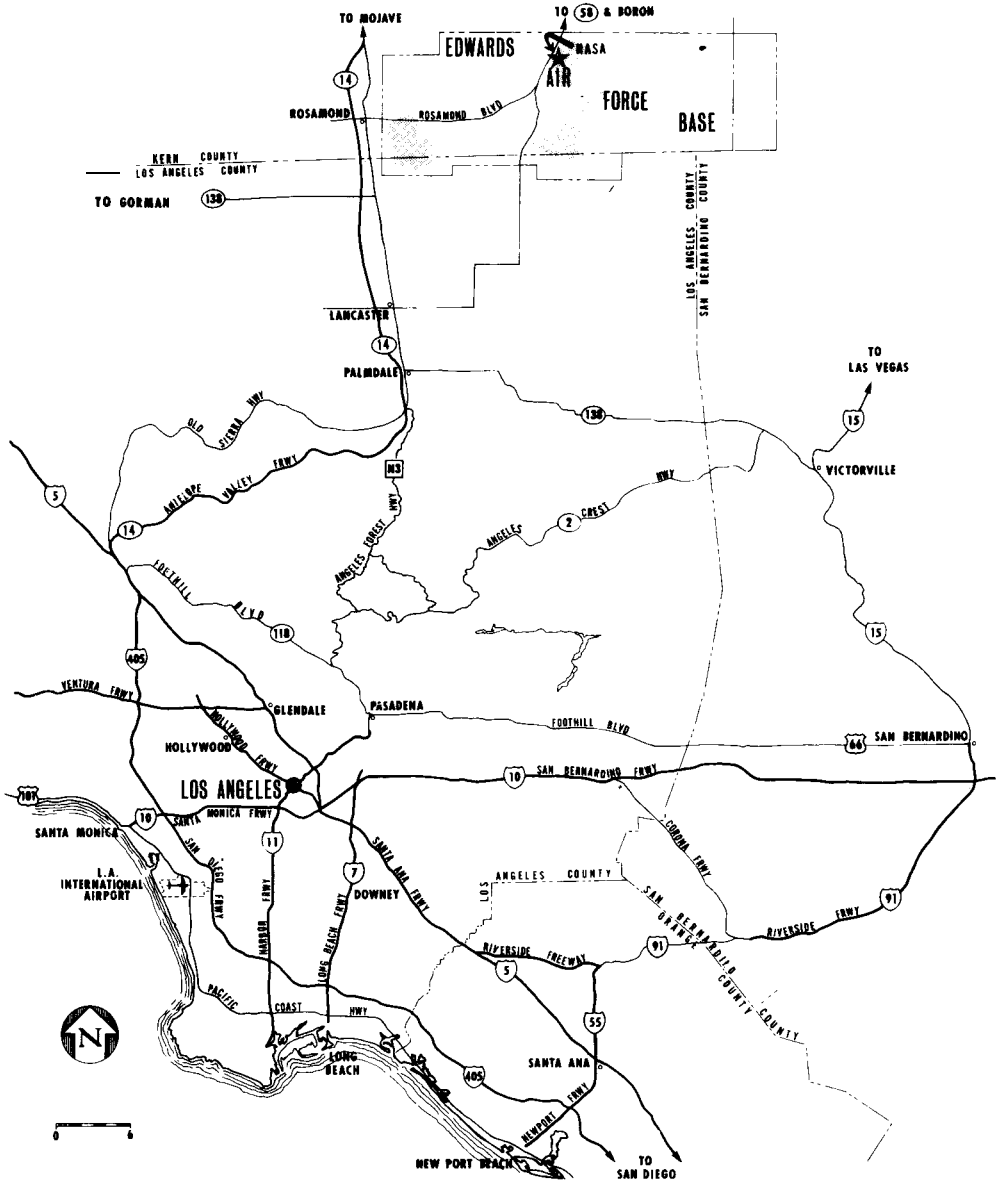
b. Other support services				215

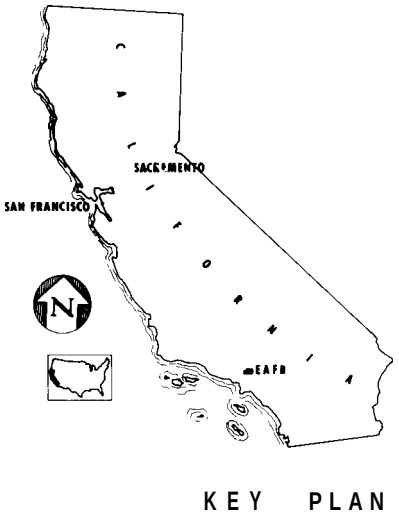
Includes postage; purchase, lease and maintenance of Center support equipment; and supplies and materials used in support of the installation.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
HUGH L. DWYDEN FLIGHT RESEARCH CENTER



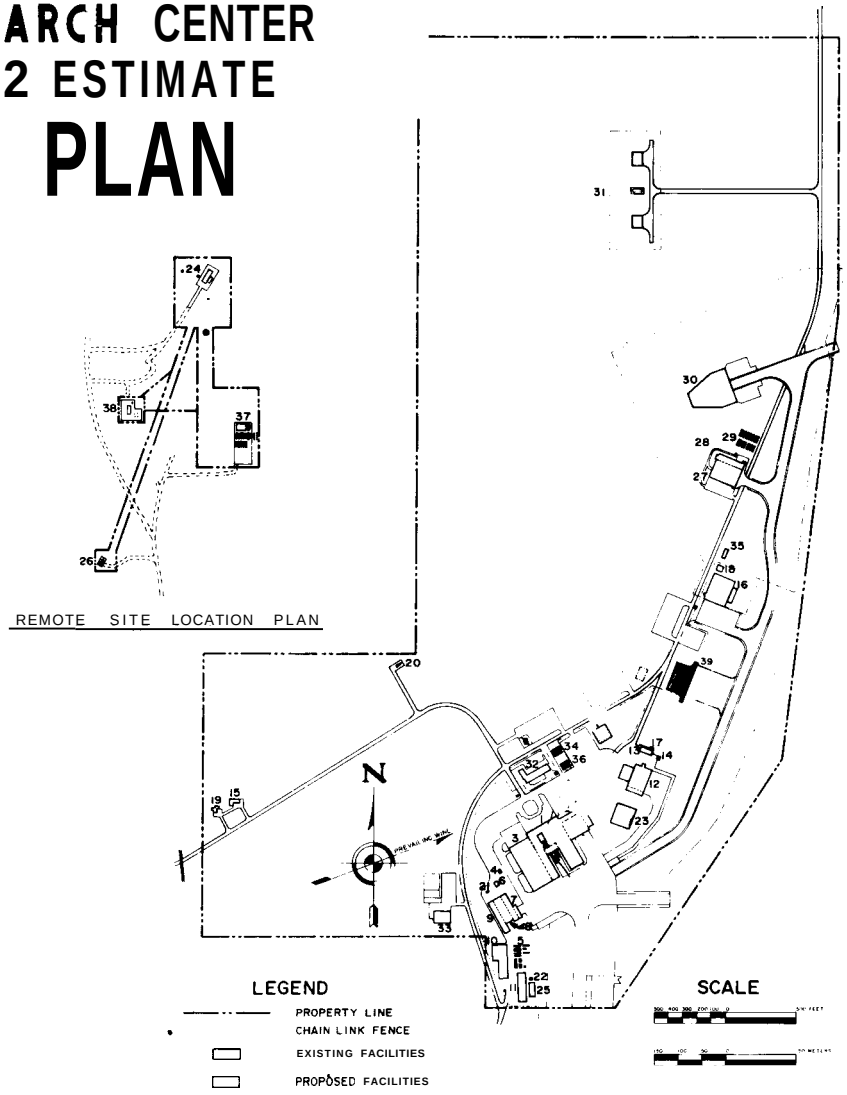
DRYDEN FLIGHT RESEARCH CENTER
FISCAL YEAR 1982 ESTIMATES
AREA MAP





KEY PLAN

DRYDEN FLIGHT RESEARCH CENTER
FISCAL YEAR 1982 ESTIMATE
LOCATION PLAN



EXISTING FACILITIES

1 LABORATORY BUILDING (4800)
2 AIRCRAFT CONSTRUCTION AND MODIFICATION HANGAR (4801)
3 MAIN HANGAR (4802)
4 AIRCRAFT TIRE REPAIR SHOP (4803)
5 TRAILER PARK AND MODULAR BUILDINGS
6 BOILER HOUSE (4886)
7 SHOPS(AGE. MODEL, BATTERY. GARAGE)(4806)
8 STORAGE BUILDING (4807)
9 WAREHOUSE NP 2 (4808)
10 WAREHOUSE № 3 (4809)
11 WAREHOUSE № 4 (4810)
12 FLIGHT LOADS RESEARCH BUILDING (4820)
13 PAINT SPRAY BUILDING (4821)
14 PAINT STORAGE BUILDING (4822)
15 COMMUNICATIONS BUILDING (4824)
16 MAINTENANCE DOCK (4826)
17 WOOD SHOP (4830)
18 WAREHOUSE № 5 (4831)
19 RADAR BUILDING (4870)
20 IOOFT. TOWER, BORESITE TARGET ASSEMBLY AND EOUIP. BUILDING (4887)
21 CENTRAL STANDBY ELECTRICAL POWER FACILITY (4889)
22 STORAGE BUILDING (4804)
23 AIRCRAFT SERVICING DOCK (4823)
24 FPS-16 RADAR FACILITY (4982)
25 WAREHOUSE № 6 (4827)
26 100 FT. TOWER, BORESITE TARGET ASSEMBLY AND EQUIP. BUILDING (4981)
27 SHUTTLE HANGAR (4833)
28 SHUTTLE SHOP (4834)
29 SHOP TRAILER COMPLEX (4854)
30 SHUTTLE MATING STRUCTURE (4860)
31 PROPELLANT FUEL AND OXIDIZER STORAGE AREA (4855)
32 INTEGRATED SUPPORT FACILITY (4825)
33 WAREHOUSE NO 7 (4832)
34 PAO TRAILERS
35 PUMP STATION NP 1 (4853)
36 TRAINING TRAILERS
37 GFSC STDN SPACE SHUTTLE ALT FACILITY (4918)
38 RCA EARTH STATION (4917)
39 LARGE AIRCRAFT MAINTENANCE DOCK

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION DRYDEN FLIGHT RESEARCH CENTER EDWARDS, CALIFORNIA	DR	P. CONNALLY 1/27/7
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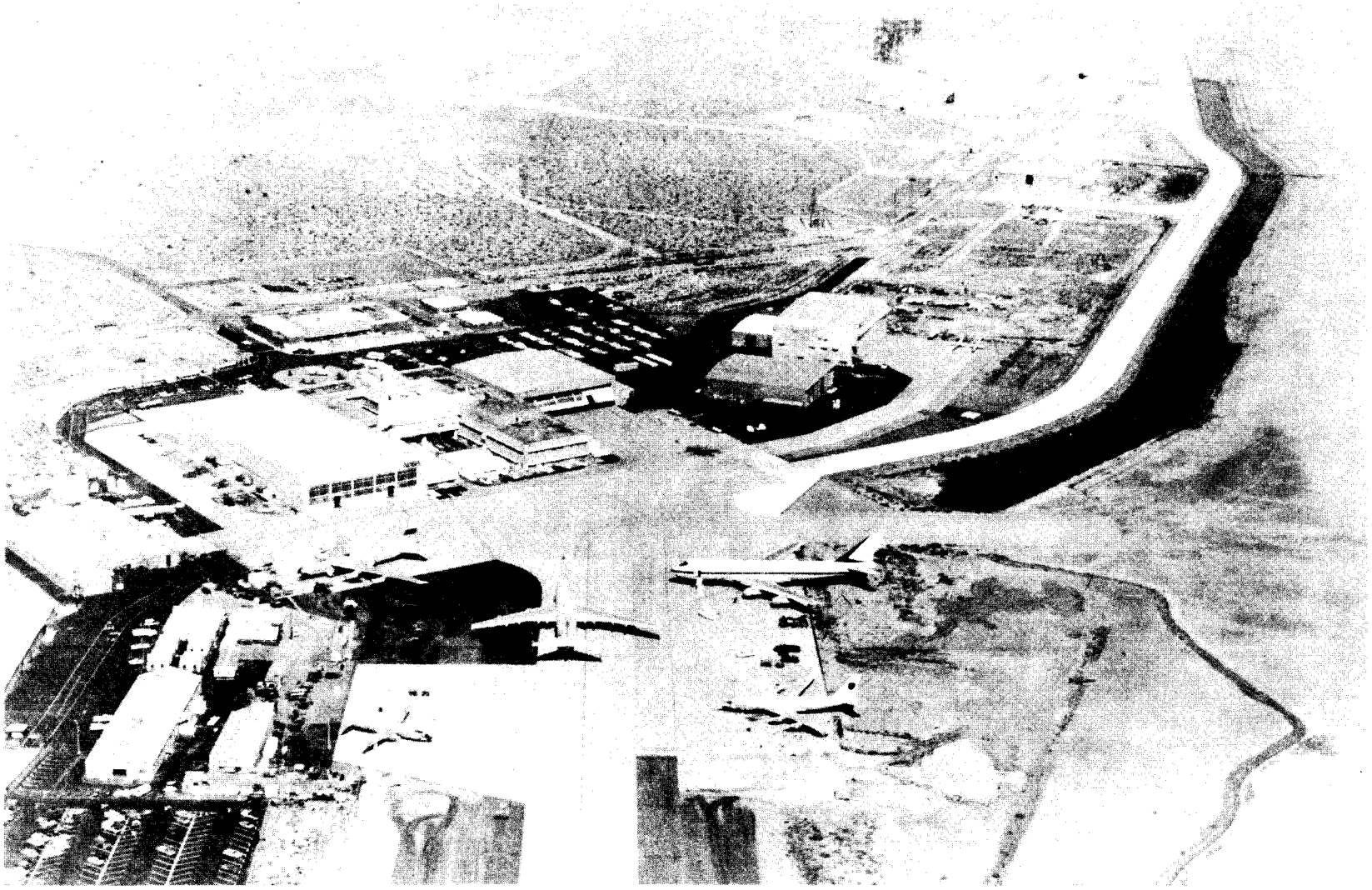
HUGH L. DRYDEN FLIGHT RESEARCH CENTER
FISCAL YEAR 1982 ESTIMATES



FISCAL YEAR 1982 ESTIMATES

LANGLEY RESEARCH CENTER

DESCRIPTION

The Langley Research Center is located at Hampton, Virginia. 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. The West Area consists of 787 acres, all owned by NASA. The East Area comprises 20 acres under permit from the Air Force. 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 acreage presently owned, under permit, or leased, is 4,193. 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, 1980, was $608,613,000.

CENTER ROLES AND MISSIONS

Langley Research Center (LaRC) continues to play a major role in the development of aeronautics and space technology in the United States.

Langley has developed recognized areas of technical excellence within the civil service staff and facilities of superior merit; that is, major technical facilities which constitute a national resource. The principal and supporting roles are:

PRINCIPAL

Long-Haul Aircraft Technology - developing a technology base for improving long-haul aircraft as a cost effective, safe and environmentally compatible transportation mode.

General Aviation Aircraft Technology - developing and maintaining an engineering technology base related to improving general aviation aircraft.

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

Acoustics and Noise Reduction - conducting research and developing a technology base related to reducing aircraft noise.

Aerospace Vehicle Structures and Materials - developing a technology base for facilitating advances.

Avionics Technology - developing a technology base related to improving avionics.

Military Support - providing technical support to military aviation in areas consistent with other LaRC aeronautics roles and unique capabilities.

Advanced Space Vehicle Configurations Technology - developing a technology base related to advanced configurations, including advanced space transportation concepts.

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

Technology Experiments in Space - developing and managing the Long Duration Exposure Facility (LDEF). Defining and developing experiments in areas consistent with other LaRC space roles.

Environmental Quality Monitoring Technology - developing improved techniques for environmental monitoring. Includes research, experiment development/management, data analysis, and investigator management and specialized ground/aircraft investigations. Also includes development of Shuttle payloads related to environmental monitoring.

SUPPORTING

Rotorcraft Technology - contributing to the development of the technology base with emphasis on structures aeroelasticity, acoustics, noise, and avionics components.

Hypersonic Propulsion Systems - contributing to technology base of air breathing propulsion systems by advancing the state of the art of hypersonic propulsion.

Planetary Entry Technology - providing planetary and Earth entry aerothermodynamics experimental and analytical data.

Computational Fluid Dynamics - contributing to the software technology base.

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

Launch Vehicle Procurement - procurement for science/applications missions of the Scout launch vehicle.

SUMMARY OF RESOURCES REQUIREMENTS

Funding Plan By Function

		1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)			
I.	Personnel and Related Costs	92,891	95,782	98,490	99,a53
II.	Travel	1,992	2,021	2,051	2,540
III.	Facilities Services	11,580	12,537	14,170	15,870
IV.	Technical Services	1,328	2,453	2,446	2,747
V.	Management and Operations	6,191	6,352	5,a43	6,610
	1981 Budget Amendment	---	-1,540	---	---
	Total, fund requirements	113,982	117,605	123,000	127,620

Distribution of Permanent Positions by Program

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
Direct Positions				
Space Transportation Systems and Operations	43	44	40	40
Space shuttle	10	2	7	7
Space flight operations	1	---	1	1
Expendable launch vehicles	32	42	32	32
Space and Terrestrial Applications	230	220	222	220
Space applications	215	204	213	211
Technology utilization	15	16	9	9
Aeronautics and Space Technology	1,991	2,005	2,007	2,009
Aeronautical research and technology	1,444	1,482	1,472	1,480
Space research and technology	547	523	535	529
Subtotal, direct positions	2,264	2,269	2,269	2,269
Center Management and Operations Support Positions	716	711	711	711
Total, permanent positions	2,980	2,980	2,980	2,980

PR DESCRIPTION

	Permanent Positions (Civil Service)
SPACE SHUTTLE	7

In 1982, civil service personnel will be measuring and evaluating Shuttle launch vehicle effluents and Shuttle entry sonic boom.

SPACE FLIGHT OPERATIONS	1

The objective of this work is to develop a reliable method of calculating the flowfield properties in the highly expanded fan-field region of rocket engine exhaust flow fields.

EXPENDABLE LAUNCH VEHICLES	32

The expendable launch vehicle program provides centralized procurement of the Scout launch vehicle. In 1982, 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 Test Range in California, and the San Marco platform off the coast of Kenya, Africa.

SPACE APPLICATIONS	211

The space applications program is characterized by a research capability that is a National resource for understanding environmental problems and for developing related monitoring 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 to assess any changes caused by man and to determine whether or not there is any associated change in the transmission of solar radiation. Effort will be continued for the definition of experiments for the Spacelab/Shuttle which will provide atmospheric measurements of trace constituent, clouds, aerosols, and temperature in the troposphere and stratosphere.

The Center's sensor development and applications 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.

A significant improvement in the understanding of man's impact on the stratosphere 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 Nimbus-7, SAGE, and the Halogen Occultation Experiment (HALOE). The HALOE instrument will measure stratospheric species involved in ozone destruction by chlorine chemistry.

Studies of the Earth's radiation budget will be fundamental to the understanding of climate phenomena. Langley has the responsibility for the science, 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.

Increased knowledge of oceanic processes (winds, fronts, temperature, salinity) will be pursued through experiments and data analysis using Langley-developed microwave scatterometer and radiometer instrument techniques. In addition, fundamental understanding of sea and lake ice properties will be obtained using these techniques. Application of this sensing and analysis technology to future spacecraft systems (such as the National Oceanic Satellite System (NOSS) will be carried out.

A unique Langley marine research capability for coupled laboratory tests, field tests, data processing algorithm and display development, and predictive model development has been demonstrated. The program will provide the technology base for design of future integrated remote sensing systems for increasing our understanding of water pollution problems.

	Permanent Positions (Civil Service)
TECHNOLOGY UTILIZATION	9

The overall 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 resulting from aeronautical and space research and development efforts to the non-aerospace segments of the economy.

In 1982, civil service personnel will provide the following support:

1. Expedite the application of new technology by compressing the time required from generation of technology to its use in the economy.

2. Encourage the use of aerospace technology in non-aerospace segments of the economy having problems amenable to technological solutions.

3. Understand more fully the technology transfer process and its impact and systematically manage and optimize the process.

	Permanent Positions (Civil Service)
AERONAUTICAL RESEARCH AND TECHNOLOGY	1,480

The aeronautical research and 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 indepth look at future technology requirements. The diversity of activities in such disciplines as materials, structures, flight stability and control, avionics, and aerodynamics provides the expertise to pursue the broader problems such as those involved in the Terminal Configured Vehicle and Aircraft Energy Efficiency technology programs. 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 encompasses extensive theoretical, experimental, and applications 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 STAR Computer and recently developed cryogenic wind tunnel testing techniques, which provide the capability of simulating flight conditions.

Aspects of the problems which are studied include airfoil and wing design, flowfield analysis, configuration design processes, aircraft noise prediction, analysis and control, propulsion system integration, fuel efficiency, flight dynamics, and economic feasibility. Tunnel testing techniques will be further enhanced by combining the technology developed for non-optical positioning sensing of models with the superconducting coil technology to provide for the design of an advanced magnetic balance and suspension

system. The STAR computer will be used in the areas of far-field jet noise, 3-D potential flow programs, and in the solution of 2-D and 3-D Navier-Stokes equations. Generation and documentation of the aerodynamic behavior of new airfoils will be furthered by the continued definition of the aerodynamic characteristics of a range of supercritical airfoils. Application of advanced transonic theories to the design of improved 3-D wings will be continued and evaluated by wind tunnel tests. Wind tunnel and flight tests will be continued cn general aviation aircraft configurations having the potential for practical stall immunity and means for spin avoidance. Research will continue on the development of supersonic aerodynamic technologies to more than double the range of current tactical aircraft while providing enhanced maneuverability and survivability.

An improved data base for the aircraft noise prediction computer program will be developed so that noise contours can be predicted within 1.5 dB accuracy. Other activities in the acoustics and noise reduction areas include research on jet noise, duct acoustics, forward speed effects on fan noise, interior noise, rotating blade noise, atmospheric propagation, and community impact and annoyance produced by aircraft noise.

Transport and general aviation operations research will add to aircraft safety and productivity. In the area of aircraft energy efficiency technology, major activities include continuation of work required for the design and testing of a laminar flow control wing box, cover panel and ducting, and for the design of a laminar flow control compatible supercritical airfoil section for flight test evaluation; the establishment of design data for high aspect ratio supercritical wings; investigations of high-lift aerodynamics configurations for advanced transports; and the evaluation of performance benefits achievable by incorporating winglets and wing tip extensions to wide-body transports. This technology also has application to improved mission performance for general aviation aircraft and for advanced maneuvering air combat aircraft and missile systems and is being investigated in relation to subsonic, supersonic, and hypersonic configuration concepts. In the area of supersonic configurations, improved aerodynamic platforms will be experimentally determined by subsonic, transonic, and supersonic wind tunnel tests.

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 focused on research on advanced composite 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 manewer loads is being pursued in both theoretical and wind tunnel studies.

Emerging technological advances in computer systems are being exploited to signficantly increase the utility and reduce the cost of engineering computations. A finite element computational device using microprocessor components will be defined in 1982 that is capable of reducing computational costs and/or times by a factor of ten over present devices.

The avionics work at Langley includes technology development in aircraft guidance and navigation, aircraft control systems, crew station avionics, and integration and interfacing techniques. *Also,* major efforts in aircraft flightpath management and operations technology and active controls technology for conventional takeoff and landing (CTOL) are being conducted in this program area. The work includes requirements analyses, design studies, systems and component technology development, ground simulation and technology validation, and proof-of-concept validation through experimental flight programs. The Langley expertise in the avionics area is being applied to terminal configured vehicle systems and operations technology, broadly applicable technology for development of low-cost Global Positioning System (GPS) navigation hardware and software, advanced control laws for various aircraft classes, intersystems communications networks for enhanced interfacing and integration of functions within an aircraft, and advanced technology for improved display media and pilot/system interfaces in aircraft cockpits. Emphasis in 1382 will be on investigations of the capacity, efficiency, and safety potential of cockpit-displayed air traffic information concepts with elements of an advanced air traffic control system, the development of technology for enhanced function and hardware integration to increase aircraft systems reliability and reduce operating costs, definition of requirements and technology to facilitate general aviation single-pilot guidance and control in Instrument Flight Regime (IFR) environments, and the investigation of concepts and technology which will result in greatly improved pilot displays and input/output capabilities. Other avionics technology applications are also found in work on advanced digital flight control systems, fluidics instrumentation for general aviation aircraft, and the development of mathematical tools to investigate and enhance reliability prediction and assessment, control algorithm design, and pilot describing functions.

The Langley Research Center has traditionally received requests from other agencies and from the industry for test support of their aircraft, missiles and systems development program. The Structures Laboratory of the Army Research and Technology Laboratories of the U.S. Army Aviation Research and Development Command (AVRADCOM) is located at Langley. This Laboratory, the primary investigator of Army rotorcraft structures, works on independent R&D projects and on projects of mutual interest with a staff integrafed 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 and the Federal Aviation Administration.

	Permanent Positions (Civil Service)
SPACE RESEARCH AND TECHNOLOGY.....	529

The space research and technology program is characterized by work in several discipline areas and the application of this discipline expertise to current and future technology requirements. Longer range studies are directed at defining the technology requirements for future space systems and missions.

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. Material 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. 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 spacecraft 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. A complete radiation heat transfer, large deflection, and nonlinear materials property analysis capability will be available in 1982. Analysis, design, and loads determination methodology for deployable and erectable large space platforms, antennae, and booms are being studied as part of a multi-Center, multidisciplinary program for advanced technology. By mid-1982, an improved structural analysis methodology for substantially improved computational efficiency will be developed and verified. It will include the effects of plasticity, large deflections, large rotations, and other sources of nonlinear behavior, and will require application of evolving advanced numerical techniques, computer software and computer hardware.

An extensive program in electronic component technology development, data processing, and sensor development is conducted at Langley. Sensor developments include laser backscatter and fluorescence techniques for water quality measurements, continuously tunable infrared laser techniques, and high power/high pressure tunable gas lasers for the measurement of low concentration atmospheric constituents. In 1982, Langley will complete design and analysis studies to meet the requirements for fabrication of a

Laser Heterodyne Spectrometer aircraft instrument to measure stratospheric constituents in the 9-12um region, and will design and evaluate an array of microwave radiometer receivers for high resolution ($\pm$1 km) oceanographic sensing. Specific devices required to support the development of a charge coupled device onboard data processor are being developed and evaluated. The broad objective of this work is to develop an onboard processor technology base for remote sensing vehicles with the potential of leading to a 1000-fold decrease in the density of data sent back to Earth processing stations. The evaluation of a solid state data storage system using bubble domain technology is underway at Langley. The overall objective is to provide an adequate bit solid state data storage system suitable for replacing tape recorders in many aerospace vehicle applications. Other space electronics technology efforts are focused on detectors for remote sensing (e.g., infrared and pyroelectric devices), spacecraft attitude control (using magnetically suspended momentum storage or vernier pointing devices), and multipurpose, user-oriented, software development verification and validation techniques.

The objectives of the entry technology program are to develop experimental and theoretical data bases to support (1) development of space transportation system vehicles for the 1990's and beyond employing technologies beyond those utilized for the Space Shuttle, (2) planning of advanced planetary entry missions and development of approved missions, and **(3)** analysis of the evolving STS program and its operational problems as they surface.

The objectives are being met through the development and application of experimental and theoretical techniques employing Langley 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 flowfield techniques.

The 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 data during routine Shuttle operation. Experiments are being developed for early Shuttle flights which will provide unique measurements for direct comparison with ground-based facility measurements and theoretical techniques. The Shuttle will also be utilized as a laboratory from which to perform Langley developed payload experiments extending basic research and technology development into the space environment when economically advantageous or when the development can only be achieved in space.

Langley programs in Space Power and Electric Propulsion Research and Technology have two primary foci: advanced radiant energy conversion and advanced gallium arsenide solar cells. The objective of the energy conversion effort is to perform basic research on nuclear- and solar-pumped lasers for conversion of nuclear and solar energy directly into electromagnetic radiation, laser power, or work for potential power

generation, transmission, and storage for future space missions. The objective of the gallium arsenide solar cell research is to develop the technology to improve the conversion efficiency, reduce the mass and cost, and increase the operating life of the cells in the hostile space environment. Indications are that these solar cells offer the potential of significantly outperforming silicon solar cells; therefore, this effort can lead to a more reliable, economical, and refined space power system.

	Permanent Positions (Civil Service)
CENTER MANAGEMENT AND OPERATIONS SUPPORT.....	711

Center management and operations support is defined as that support or services being provided to all Langley Research Center 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., Legal, Patent Counsel, Equal Opportunity, Public Affairs, and Safety.

Management Support - Includes a wide range of activity categorized as management support for programs and functional organizations for the entire Center. Specific functions include resource and budget management, program control, contracting and procurement, personnel management, property management, financial management, resource control, and management information systems and analysis.

Operations Support - This is a broad spectrum of activity that is required to maintain and operate facilities, buildings, and equipment; and to provide the normal housekeeping services and logistics support for the personnel who manage and conduct the affairs of the Center. Specific activities are:

Maintenance and operation of all buildings and facilities
Reliability and quality assurance
Custodial services
Logistics support including transportation, supplies, etc.
Photographic and graphic support

RESOURCE REQUIREMENTS BY FUNCTION

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
I. PERSONNEL AND RELATED COSTS	**92,891**	**95,782**	**98,490**	**99,853**
Summary of Fund Requirements				
A. Compensation and Benefits				
1. Compensation				
a. Permanent positions	81,612	84,321	86,489	87,502
b. Other than full-time permanent positions	1,733	1,491	1,635	1,664
c. Overtime and other compensation	780	632	726	745
Subtotal, Compensation	84,125	86,444	88,850	89,911
2. Benefits	8,046	8,603	8,817	9,035
Subtotal, Compensation and Benefits	92,171	95,047	97,667	98,946
B. Supporting Costs				
1. Transfer of personnel	122	66	40	46
2. Personnel training	598	669	783	861
Subtotal, Support Costs	720	735	823	907
Total, Personnel and Related Costs	92,891	95,782	98,490	99,853

Explanation of Fund Requirements

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
A. Compensation and Benefits	92,171	95,047	97,667	98,946
1. Compensation	84,125	86,444	88,850	89,911
a. Permanent positions	81,612	84,321	86,489	87,502

The funds shown above will support 2,980 permanent positions in 1982. The current estimate for 1981 reflects an increase over the 1981 budget estimate primarily due to the October 1980 pay increase.

Basis of Cost for Permanent Positions

In 1982, the cost of permanent positions will be $87,502,000, an increase of $1,013,000 over 1981. This increase results from the following:

Cost of permanent positions in 1981		86,489
Cost increase in 1982		+1,647
Within grade and career advances:		
Full year effect of 1981 actions	+915	
Partial year effect of 1982 actions	+648	
Full year effect of 1981 pay increase	+84	
Cost decreases in 1982		-634
Turnover savings and abolished positions:		
Full year effect of 1981 actions	-411	
Partial year effect of 1982 actions	-223	
Cost of permanent positions in 1982		87,502

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
b. Other than full-time permanent positions				
1. cost	I, 733	1,491	1,635	1,664
2. Workyears	139	148	148	148

The 1981 distribution of work years is as follows:

Distribution of Other than Full-Time Permanent Workyears

Program	Workyears
Cooperative training	81
Summer employment	12
Opportunity programs	40
Other temporary employment	15
Total	148

The increase from the 1981 budget estimate to the 1981 current estimate is due to the October 1980 pay increase.

c. Overtime and other compensation	780	632	726	745

The use of overtime and other compensation is limited to emergency repairs and work that cannot be accomplished during ncrmal working 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 rates. The 1982 estimate reflects the Center's continuing effort to hold overtime to the minimum hours necessary to achieve the Center's mission.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
2. Benefits	8,046	8,603	8,817	9,035
Following are the amounts of contribution by category:				
Civil Service Retirement Fund	5,608	6,010	6,236	6,341
Employee life insurance	203	298	211	218
Employee health insurance	1,870	1,850	1,945	2,006
Workmen's compensation	363	405	405	450
FICA	2	40	2	2
Other benefits	---	---	18	18
Total	8,046	8,603	8,817	9,035

The increase from the 1981 budget estimate to the current estimate is primarily due to the October 1980 pay increase. The increase in 1982 over the 1981 current estimate is related to the increases in personnel compensation and anticipated increases in the cost of health insurance. Workmen's compensation estimates are based on Department of Labor billings.

B. Supporting Costs	720	735	823	907
1. Transfer of personnel	122	66	40	46

Transfer of personnel costs include actual expenses involved in the movement and temporary storage of employees' household goods, subsistence and temporary expenses, real estate costs, and miscellaneous moving expenses. The 1982 estimate reflects the same level of activity as 1981 adjusted for rising real estate costs.

2. Personnel training	598	669	783	861

The increase from the 1981 budget estimate to the 1981 current estimate and the 1982 estimate reflects the large increase in tuition costs as well as the increased cost of aircraft fuel which impacts the cost of pilot training. The 1982 estimate assumes approximately the same level of effort as 1981 and a continued increase in tuition rates.

		1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
			(Thousands of Dollars)		
II.	**TRAVEL**	**1,992**	**2,021**	**2,051**	***2,540***
	Summary of Fund Requirements				
A.	Program Travel	1,553	1,573	1,583	1,974
B.	Scientific and Technical Development Travel	272	282	272	385
C.	Management and Operation Travel	167	166	196	181
	Total, Travel	1,992	2,021	2,051	2,540
A.	Program Travel	1,553	1,573	1,583	1,974

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, and Shuttle support. The increase in the 1982 budget estimate is a result of increased costs and travel associated with Space Shuttle development, Long Duration Exposure Facility, Halogen Occultation Experiment and Earth Radiation Budget Experiment.

B.	Scientific and Technical Development Travel	272	282	272	385

Scientific and technical development travel permits employees to participate in meetings and technical seminars with other representatives of the aerospace community. This participation allows them to benefit from exposure to technological advances outside LaRC, 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 increase from the 1981 current estimate to the 1982 budget estimate reinstates scientific and technical development travel to a level consistent with maintaining the necessary contacts and interactions with the scientific community.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
C. Management and Operations Travel.....	167	166	196	181

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 1981 current estimate reflects a one-time effort in support of the Agency's Project Management Study. The 1982 budget estimate reflects the same level of travel as in 1981 with the one-time study eliminated.

III. FACILITIES SERVICES.....	**11,580**	**12,537**	**14,170**	**15,870**

Langley Research Center (LaRC) is located on 787 acres of grounds in a complex made up of laboratory and office type buildings as well as research wind tunnels. This complex encompasses 2,074,145 gross square feet of building space including eleven major buildings. Also included are 18 major technical facilities. This physical plant houses an average daily on-Center population of 4,200 to 4,500 personnel. Many of the test facilities are utilized on more than one shift/or during off peak hours.

Summary of Fund Requirements

A. Rental of Real Property.....	1	1	1	1
B. Maintenance and Related Services				
1. Facilities.....	624	758	515	661
C. Custodial Services.....	2,291	2,329	2,391	2,699

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
	(Thousands of Dollars)			
D. Utility Services..	8,664	9,449	11,263	12,509
Total, Facilities Services..	11,580	12,537	14,170	15,870

Explanation of Fund Requirements

A. Rental of Real Property	1	1	1	1

The amounts provided here cover the cost of leasing rights of way for access to model drop zone areas.

B. Maintenance and Related Services

1. Facilities	624	758	515	661

This estimate provides funds for maintenance and repair of administrative facilities, utility lines and grounds maintenance. The decrease in the 1981 current estimate from the 1981 budget estimate reflects deferral of maintenance and repair projects to 1982 and a reduction in the level of grounds maintenance service due to budgetary constraints.

C. Custodial Services..	2,291	2,329	2,391	2,699

This activity provides for janitorial and security services. Also included are funds for fire protection services provided by the City of Hampton. The increase from the 1981 budget estimate to the 1981 current estimate reflects a reduction of three workyears for janitorial services, offset by rate increases and increased costs of supplies and materials. The 1982 estimate provides for janitorial services at approximately the 1981 level plus the full year effect of wage increases negotiated in 1980.

D. Utilities Services..	8,664	9,449	11,263	12,509

Included in this item is the purchase of electric service from Virginia Electric and Power Company (VEPCO), fuel oil from a local supplier, and water and sewage charges. Also included are funds for heat and steam services from the USAF-Langley for East Area facilities and the purchase of steam from the City of Hampton for facilities located in the West Area of LaRC.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		

A breakdown of the utilities costs is as follows:

1.	Electricity (134,000 mWh)	8,860
2.	Fuel oil (750,000 gals.)	612
3.	Heat and steam (USAF)	170
4.	Water and sewage	115
5.	Steam (City of Hampton)	2,752

The increase in the 1981 current estimate over the 1981 budget estimate is the result of VEPCO rate increases and increases in the final negotiated cost of steam purchased from the City of Hampton. The 1982 estimate reflects rate increases partially offset by reduced electricity consumption.

IV.	**TECHNICAL SERVICES**	**1,328**	**2,453**	**2,446**	**2,747**
	Summary of Fund Requirements				
A.	Automatic Data Processing	974	2,015	1,844	2,079
	1. Equipment	76	270	213	238
	2. Operations	898	1,745	1,631	1,841
B.	Scientific and Technical Information	354	438	602	668
	1. Library	165	142	175	195
	2. Education and information	189	296	427	473
	Total, Technical Services	1,328	2,453	2,446	2,747

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
Explanation of Fund Requirements				
A. Automatic Data Processing.....	974	2,015	1,844	2,079

Funds for the Center's business computer complex which provides the accounting and management information data required by the Center and NASA, are provided for in this function. Included are equipment lease, purchase and maintenance; paper and other expendable supplies; a contract for programming and operations; and several small miscellaneous contracts.

1. Equipment	76	270	213	238

This activity includes the lease and purchase of equipment associated with Langley's business computer complex. The decrease in the 1981 current estimate from the 1981 budget estimate reflects a change in the schedule for disk-drive update. The 1982 estimate provides for a continuing level of equipment replacement and update.

2. Operations	898	1,745	1,631	1,841

This estimate includes ADP equipment maintenance, supplies, and the support service contract for programming and operations. The reduction in the 1981 current estimate from the 1981 budget estimate is due to a three workyear reduction in the support contract for programming and operations and deferral of minor software updating due to budgetary constraints. The 1982 estimate reflects approximately the same level of service provided in the 1981 budget estimate and an increase in contractor rates.

B. Scientific and Technical Information..	354	438	602	668

This estimate provides support service contract assistance in the operation of the Technical Library and Visitor Information Center. *Also* included are funds for public information services. The increase in the 1981 current estimate from the 1981 budget estimate reflects increased support service contract costs and provides funds for update of Visitor Information Center exhibits. The 1982 estimate reflects activity approximately level with the 1981 effort.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
	(Thousands of Dollars)			
1. Library.....	165	142	175	195

These funds provide for the operation of the technical library. The increase in the 1981 current estimate is due to increased wage rates. The 1982 estimate reflects the same level of effort provided in 1981.

2. Education and information.....	189	296	427	473

Funding for all the Center's public affairs activities are included in these estimates. 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 information programs. The increase in the 1981 current estimate from the 1981 budget estimate is due to increased support service contract costs. The increase also reflects updating of Visitor Information Center exhibits. The 1982 estimate reflects a level of operations approximately equal to the 1981 effort and a slight increase to cover anticipated wage escalation in support service contracts.

V. MANAGEMENT AND OPERATIONS.....	**6,191**	**6,352**	**5,843**	**6,610**
Summary of Fund Requirements				
A. Administrative Communications.....	1,134	1,377	1,292	1,443
B. Printing and Reproduction...	162	193	183	200
C. Transportation.....	1,670	1,568	1,516	1,742
D. Installation Common Services..	3,225	3,214	2,852	3,225
Total, Management and Operations.....	6,191	6,352	5,843	6,610

Explanation of Fund Requirements

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
A. Administrative Communications	1,134	1,377	1,292	1,443

This estimate includes funds for local telephone and exchange costs; Federal Telecommunications System (FTS) service; and datafax and telegraph service. The decrease in the 1981 current estimate from the 1981 budget estimate is due to reductions in the level of local telephone services due to budgetary constraints. The 1982 estimate provides for the full year effect of rate increases for communication services.

1. Local telephone services 844

This estimate provides for local telephone and exchange costs. The 1982 estimate provides for the full year effect of rate increases.

2. Long distance telephone service 569

These funds provide for long distance telephone service for the FTS. The 1982 estimate provides for the full year effect of rate increases for this service.

3. Other communications services 30

Included in this activity are costs for other miscellaneous communications such as teletype and datafax services. The 1982 estimate provides for the full year effect of rate increases for these services.

B. Printing and Reproduction	162	193	183	200

This estimate provides for special printing and reproduction supplies for reproduction services. The decrease from the 1981 budget estimate to the 1981 current estimate is due to a slight decrease in requirements for supplies and materials. The increase from the 1981 current estimate to the 1982 budget estimate is to cover the cost of negotiated support contract wage increases.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
	(Thousands of Dollars)			
C. Transportation	1,670	1,568	1,516	1,742

This activity 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, other bulk objects, and operation and maintenance of the **NASA-1** aircraft. This effort also includes all of the **NASA-1** aircraft fuel, equipment, and expendable supplies. The decrease in the 1981 current estimate from the 1981 budget estimate is due to a decrease in local transportation service due to budgetary constraints. The 1982 estimate provides for anticipated escalation in costs for fuel, equipment, supplies and transportation services.

D. Installation Common Services	3,225	3,214	2,852	3,225

These funds provide 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 reduction in the 1981 current estimate from the 1981 budget estimate is due to a reduction in supply and equipment purchases due to budgetary constraints and a reduced postage budget based on 1980 experience. The increase in the 1982 estimate provides for a resumption of service to the 1980 level.

1. Center management and staff 442

This function includes general supplies and equipment purchases for all administrative support organizations at the Center.

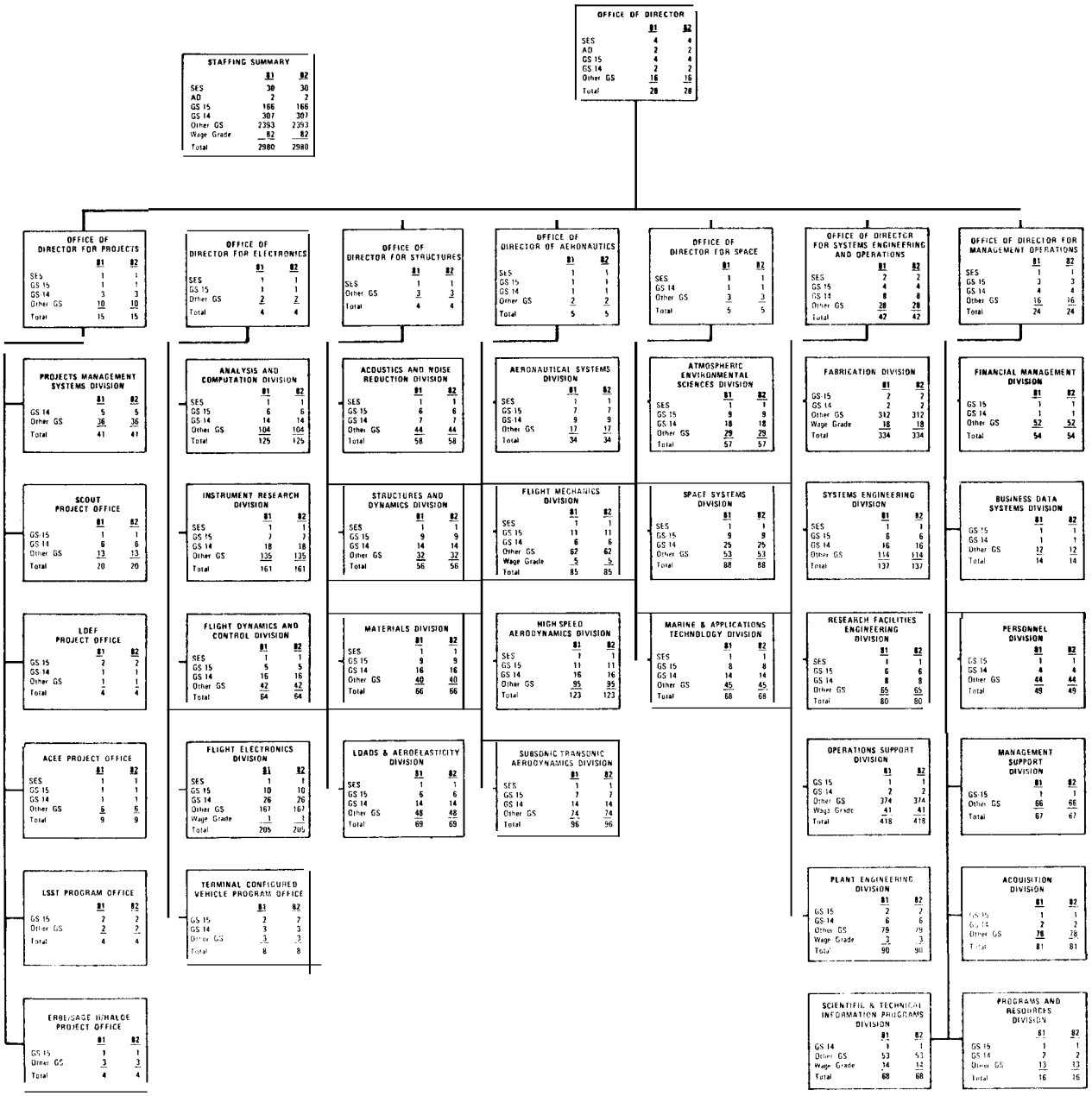
2. Medical services 586

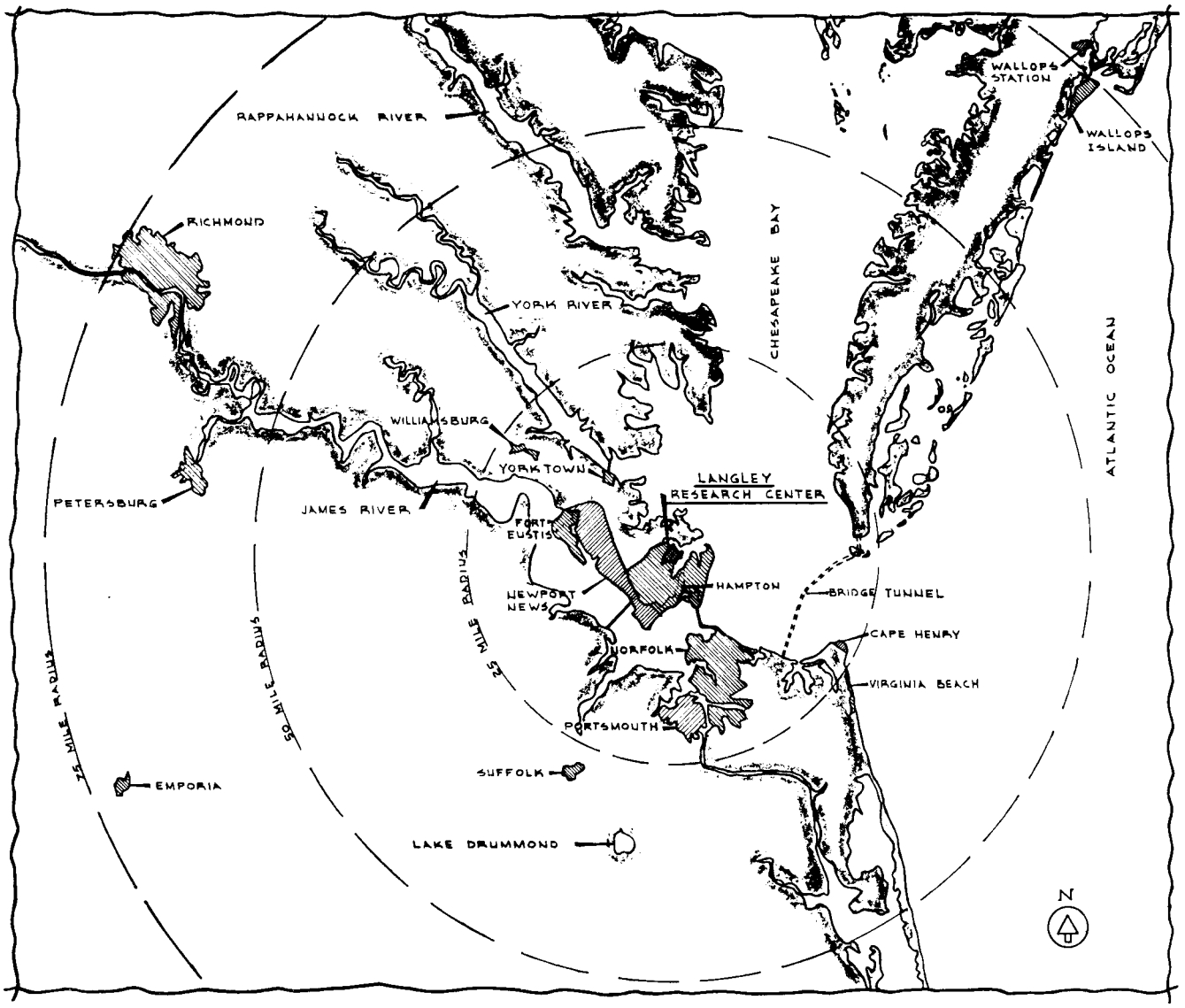
This function provides for occupational and environmental health services. Included are dispensary services, emergency ambulance service, medical examinations, and health physicals and industrial hygiene services.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
3. Installation support services.....				2,197

These funds provide for mail delivery, stock issuance and warehousing operations, and micrographics services. Also included are the purchase, maintenance and rental of office copy machines, typewriters and other office equipment, and postage costs.

LANGLEY RESEARCH CENTER

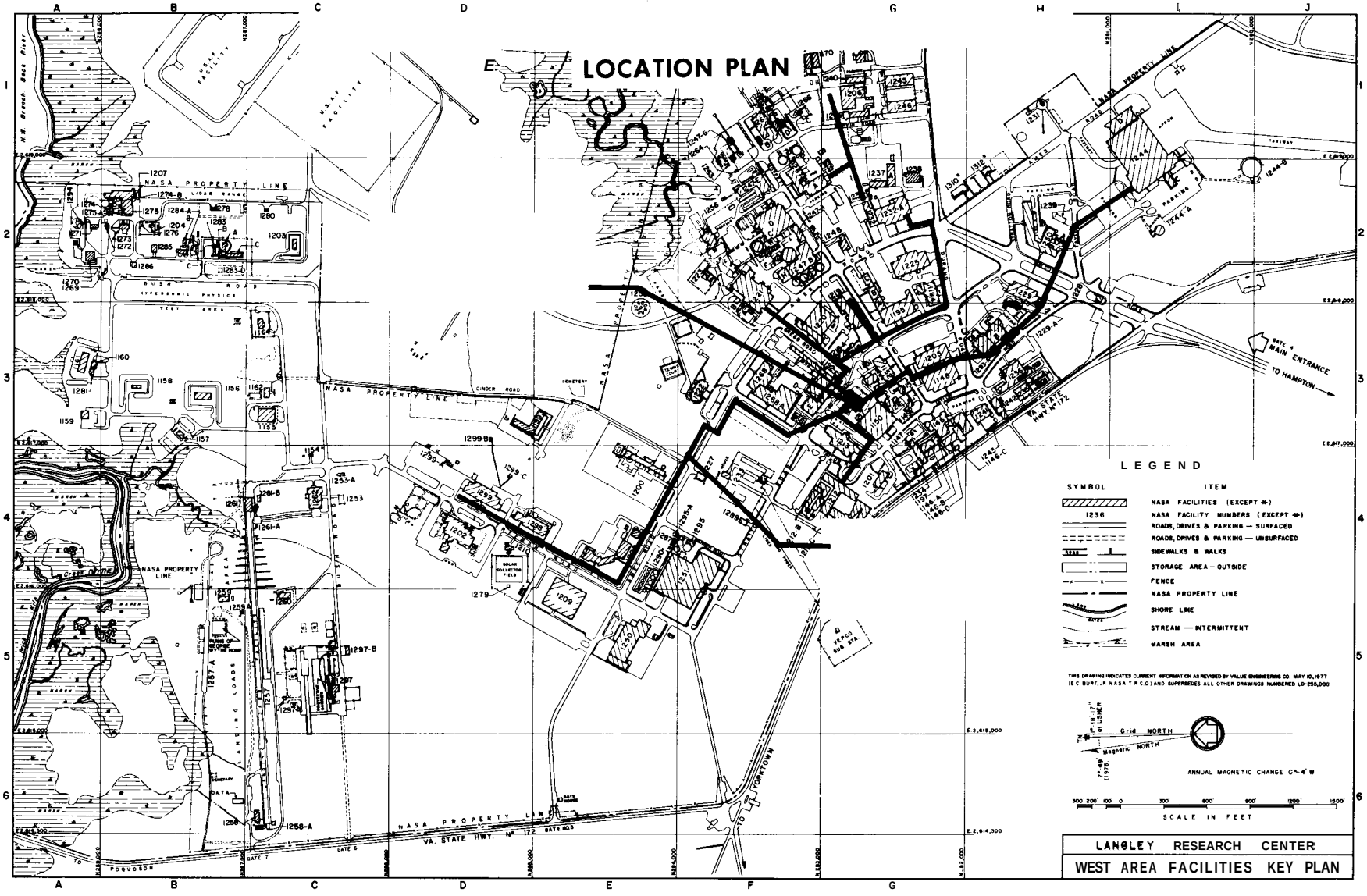




LANGLEY RESEARCH CENTER AND VICINITY

1" = 8 MILES

LANGLEY RESEARCH CENTER
FISCAL YEAR 1982 ESTINATES



AERIAL VIEW

AERIAL VIEW

RESEARCH AND PROGRAM MANAGEMENT

FISCAL YEAR 1982 ESTIMATES

LEWIS RESEARCH CENTER

DESCRIPTION

The Lewis Research Center occupies two sites in north central Ohio. The original site, established in 1941 adjacent to the Cleveland-Hopkins International Airport, has 366 acres including 14 acres leased from the City of Cleveland. There are over 170 buildings and structures, including wind tunnels, test chambers, laboratories and other research facilities.

The Plum Brook Station, established in 1956, is located south of Sandusky, O'hio, about SO miles west of Cleveland, on land formerly occupied by the Plum Brook Ordnance works. There are 5,853 acres owned and approximately 47 acres in easements. There are 69 buildings and 99 concrete storage bunkers. A 100 KW Electric Wind Turbine Generator Facility designed to be operated remotely is in operation for a program jointly sponsored by the U.S. Department of Energy and NASA. During 1975, consistent with our future research and technology needs, the principal facilities were placed in a standby mode.

The total capital investment of the Cleveland site and the Plum Brook Station, including fixed assets in progress and contractor-held facilities at various locations as of September 30, 1980, was $463, 259,000.

CENTER ROLES AND MISSIONS

The Lewis Research Center was established in 1941 as an aircraft engine research laboratory to meet the immediate needs to develop superior aircraft propulsion systems. Since then, Lewis has developed the capability for testing full-scale aircraft engines and engine components, chemical rocket engines, electric propulsion, space and terrestrial power generation systems and space communication systems, including the construction of outstanding technical facilities for the effort. The principal and supporting roles are:

PRINCIPAL:

Aeronautics - Development of an advanced technology base for advanced civil and military aircraft propulsion systems within environmental, safety, and energy constraints. Development of a technology base to advance the state of the art in aeronautical propulsion systems and components, including engine noise

reduction, high temperature materials and structures, improved engine efficiency, pollution control, computational fluid mechanics, and technical support to military aviation programs.

Launch Vehicle Procurement - Management and operation of the Centaur launch vehicle system for scientific and application missions for Government and commercial users.

Space Propulsion Systems Technology - Development and maintenance of the space propulsion systems technology base, including associated structures and materials work.

Space Energy Processes and Systems Technology- - Development and maintenance of a technology base, including associated structures and materials work.

Energy Technology - Conducting energy-related research and development, primarily on a reimbursable basis, with broad emphasis on solar, gas turbine, ground propulsion and other terrestrial energy systems.

Communications Systems Technology - Development of communications technology, including high power microwave and millimeter-wave components and systems oriented towards satellite-based applications. Includes flight experiment development and management.

SUPPORTING:

Environmental Observations - Development of remote sensing technology and systems for applications to water quality in the Great Lakes.

SUMMARY OF :ES REQUIREMENTS

Funding Plan By Function

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
I. Personnel and Related Costs	79,387	84,262	83,886	87,772
II. Travel	1,066	1,244	1,108	1,555
III. Facilities Services	10,627	12,307	12,884	14,756
IV. Technical Services	817	1,043	997	969
V. Management and Operations	2,945	2,504	2,550	2,984
1981 Budget Amendment	---	-1,304	---	---
Total, fund requirements	94,842	100,056	101,425	108,036

Distribution of Permanent Positions by Program

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
Direct Positions				
Space Transportation Systems and Operations	84	71	77	77
Space flight operations	1	1	---	---
Expendable launch vehicles	83	70	77	77

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
Space and Terrestrial Applications	126	122	139	140
Space applications	115	111	127	128
Technology utilization	11	11	12	12
Aeronautics and Space Technology	1,965	1,982	1,959	1,958
Aeronautical research and technology	1,225	1,211	1,224	1,221
Space research and technology	380	375	380	387
Energy technology	360	396	355	350
Subtotal, direct positions	2,175	2,175	2,175	2,175
Center Management and Operations Support Positions	660	660	660	660
Total, permanent positions	2,835	2,835	2,835	2,835

PROGRAM DESCRIPTION

	Permanent Positions (Civil Service)
EXPENDABLE LAUNCH VEHICLES	77

The Centaur launch vehicle program provides launch vehicles and launch operations for automated space missions. The program includes the procurement of vehicle systems hardware, launch services, engineering and management support as well as maintenance and operation of ground support equipment. In 1982, civil service personnel working on the Centaur launch vehicle program will continue to support the Intelsat V and VA programs. Substantial performance improvement of the Atlas-Centaur vehicle is required for the Intelsat VA program.

	Permanent Positions (Civil Service)
SPACE APPLICATIONS	128

Space Applications at the Lewis Research Center consists of space communications and environmental observations. In 1982, civil service personnel will continue to support these programs as follows:

Communications - Lewis, as the responsible Center for communications research and development, is studying the capabilities and costs of various advanced satellite communications systems concepts directed at providing additional frequency bands and improved communication service. The studies are being focused on the needs of the public and private sectors-both nationally and internationally. Lewis is working on experimental systems with possible application to both the ground and space segments of any future advanced communications systems. Lewis has begun a technology development program to expand the communication bands usable for communications to meet the increasing needs for additional frequencies. The principal focus of the program is the 20 to *30* gigahertz band. Additional research and technology efforts dealing with a wide range of frequency bands are also being conducted.

Environmental Observations - Carrying out its role of applying NASA's technology to regional needs, LeRC is developing and applying remote sensing technology to important areas of the Earth's surface characteristics. Program milestones include verification of remote sensing data for organic and inorganic matter in the Great Lakes and evaluating coastal zone color scanner algorithms.

TECHNOLOGY UTILIZATION	12

Civil service personnel in the Technology Utilization program are involved in transfer of new knowledge and innovative technology resulting from NASA R&D programs for application in industry, the public sector, and medicine. The primary objectives are to: (1) increase the return on the national investment in aerospace R&D; (2) shorten the time from discovery to application; *(3)* aid the movement of new knowledge to potential users; and *(4)* contribute to the development of improved means of transferring the new knowledge to other places of potential applications.

AERONAUTICAL RESEARCH AND TECHNOLOGY	1,221

The Center's major research and technology responsibility within aeronautics is propulsion. The general goals are to provide the technology base for developing advanced civil and military aeronautical propulsion systems which are economical, fuel-conservative, reliable, and which operate with minimum environmental

impact. The civil service personnel in 1982 will be involved in conducting the ongoing program at the Center as described below:

In aeronautical propulsion-related research, the goals are to develop an understanding of the physical phenomena related to propulsion systems and components including aeroelasticity phenomena, computational fluid mechanics, low and high temperature composite materials, fatigue mechanisms, reduced fuel consumption for general aviation and turbine engines, alternate fuels characterization, noise generation mechanisms, and integrated control concepts.

The major goal in the components technology program is to advance the state of the art in engine components including composite fan blades, low aspect ratio compressor stages, core turbine cooling, blade clearance controls, advanced transmissions, prevaporizing combustors, two-dimensional nozzles, supersonic inlets, high and low speed propellers, bearings, seals and instrumentation.

In engine systems technology, LeRC is studying problems encountered in complete engines and propulsion systems including engine performance at various altitudes, inlet flow distortion effects, dynamic component interactions, thrust augmentation, advanced control systems, techniques for reduced fuel consumption, engine emission and noise reduction, propulsion system airframe interactions, aviation safety, and icing research and technology associated with propulsion systems.

Within the aeronautics program, work is being performed on a number of major project areas including materials for advanced turbine engines, energy efficient engine, variable cycle engine, advanced low emissions combustors, supersonic cruise research, advanced turboprops, advanced helicopter transmissions, broad property fuels, and advanced. engine technology for general aviation.

An extensive effort in materials and structures development supports the aeronautics propulsion program. The scope of this program involves both metallic and non-metallic materials and their application to advanced aircraft engines. Areas of emphasis include the development of alloys and matrix composites capable of higher operating temperatures, with longer operating lifetimes, and lower fabrication costs. The fatigue and fracture behavior of alloys under operating conditions and the development of operating life prediction techniques are an integral part of this materials development effort.

The Lewis Research Center receives requests from other agencies and from the industry for test support of their aircraft, missiles and systems development programs. The Propulsion Laboratory of the Army Research and Technology Laboratories of the U. S. Army Aviation Research and Development Command (AVRADCOM) is located at Lewis. This Laboratory, the primary investigator of Army rotorcraft propulsion, works on independent R&D projects and on projects of mutual interest with a staff integrated into the NASA organization. Extensive

use is made of Lewis facilities in these research activities. There are also numerous joint and support programs with the Air Force Systems Command, the Naval Air Systems Command, the Federal Aviation Administration and the National Transportation Safety Board.

	Permanent Positions (Civil Service)
SPACE RESEARCH AND TECHNOLOGY.....	387

The major roles of the Lewis in Space Research and Technology are to advance the state of the art and maintain a technology base for advanced propulsion and power systems, including associated materials and structures work and space power processing. The civil service personnel in 1982 will be utilized in the activities described below:

The space propulsion programs include chemical and electric propulsion technology and component and systems development. The chemical propulsion program emphasizes advanced engine systems and components required for future space systems beyond the capability of the Space Shuttle. Improved components and methods of life prediction are being developed and demonstrated, advanced fuel-oxidant combinations are being tested, and complete engine systems tests are being conducted. Technology developments include advanced cooling techniques, fabrication techniques and materials for rocket chambers and nozzles, and advanced high pressure fuel/oxidant feed systems.

Electric propulsion supports both primary propulsion and auxiliary propulsion applications. The primary propulsion technology program consists of further thruster performance verification tests, performance testing of supporting power processor systems to deliver power to the thruster and its controls, and the integration testing of complete thruster systems, including the thruster, power processor, propellant storage and distribution system, thruster gimbal mechanism, controllers, and thermal control systems. Auxiliary electric propulsion meets spacecraft requirements for maneuvering, station keeping and altitude control. The present program objectives are to verify the performance of a one-millipound thruster, develop and test thruster power systems, and perform complete system verification tests through flight test.

Space power generation activities include solar photovoltaic, electrochemical energy conversion and power circuit development. The photovoltaic program is directed toward an improvement in solar cell efficiency, reduced cost and improved operating life. Electrochemical research and development supports extended operating life and improved energy density for space batteries and fuel cell components and systems.

Power circuit technology development is needed for management of multihundred KW power systems on space vehicles of the future, and new modes of power generation and conversion are being investigated. The interactions of the space plasma environment with high voltage power systems and components are also being studied, and technology is being developed to control these interactions and prevent power system failures.

The space communications technology program includes applied research and advanced development in microwave electron beam amplifiers, microwave solid state devices, and antennas 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 program in space materials technology emphasizes the development of improved materials for advanced space power generation, propulsion and communications systems. Studies include lubrication problems in mechanical components.

	Permanent Positions (Civil Service)
ENERGY TECHNOLOGY.....	350

Civil service personnel will be involved in ongoing energy research and development projects related to meeting program milestones of 1982 and subsequent years.

Lewis provides a supporting research and technology base in terrestrial energy conversion and advanced ground propulsion under sponsorship of the Department of Energy. Presently under development are large wind turbogenerators (200 to 2,500 kilowatts) to help meet public power requirements and photovoltaic stand-alone power systems where their application appears practical. Other programs, supporting stationary power generation, include improved coal-fired utility gas turbine and magnetohydrodynamic system studies and fuel cell systems. A fuel cell for storing electric power is also under development.

Ground propulsion systems development includes advanced heat engines and electric vehicles. The major thrust of the heat engine project is to advance the technology level of the auto gas turbine and Stirling engine propulsion systems such that their application to automotive propulsion will be energy efficient and cost effective. The electric vehicle project provides near-term technology improvements to existing electric vehicle propulsion components and systems, as well as furthering the development of advanced components and systems.

	Permanent Positions (Civil Service)
CENTER MANAGEMENT AND OPERATIONS SUPPORT.....	660

Center Management and Operations Support is defined as that 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. Equal Opportunity, and Public Affairs.

Management Support - Includes a wide range of activity categorized as management support for programs and functional organizations for the entire Center. Specific functions include resource and budget management, legal and patent counsel, program control, contracting and procurement, personnel management, property management, financial management, environmental health, resource control and management information systems and analysis.

Operations Support - This is a broad spectrum of activity that is required to maintain and operate facilities, buildings, and equipment, and to provide the normal housekeeping services and logistics support for the personnel who manage and conduct the affairs of the Center. Specific activities are:

Maintenance and operation of all buildings and facilities
Data processing and computer support
Reliability and quality assurance
Centerwide security and protection
Fire protection
Custodial services
Logistics support including transportation, supplies, etc.
Medical care of employees
Photographic and graphic support

RESOURCE REQUIREMENTS BY FUNCTION

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
I. PERSONNEL AND BELATED COSTS	**79,387**	**84,262**	**83,886**	**87,772**
Summary of Fund Requirements				
A. Compensation and Benefits				
1. Compensation				
a. Permanent positions	69,360	73,673	73,287	76,773
b. Other than full-time permanent positions	1,306	1,249	1,434	1,460
c. Overtime and other compensation	1,213	1,502	1,373	1,436
Subtotal, Compensation	71,879	76,424	76,094	79,669
2. Benefits	6,989	7,361	7,362	7,628
Subtotal, Compensation and Benefits	78,868	83,785	83,456	87,297
B. Supporting Costs				
1. Transfer of personnel	36	46	25	29
2. Personnel training	483	431	405	446
Subtotal, Supporting Costs	519	477	430	475
Total, Personnel and Related Costs	79,387	84,262	83,886	87,772

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		

Explanation of Fund Requirements

A.	Compensation and Benefits	78,868	83,785	83,456	87,297
1.	Compensation	71,879	76,424	76,094	79,669
a.	Permanent Positions	69,360	73,673	73,287	76,773

The funds will support 2,835 permanent positions in 1981 and 1982.

Basis of Cost for Permanent Positions

In 1982, the cost of permanent positions will be $76,773,000; an increase of $3,486,000 from 1981. The increase results from the following:

Cost of permanent positions in 1981		73,287
Cost increases in 1982		+4,298
Within grade and career advances:		
Full year effect of 1981 actions	+1,410	
Partial year effect of 1982 actions	+938	
Full year effect of 1981 pay increases	+1,950	
Cost decreases in 1982		-812
Turnover savings and abolished positions:		
Full year effect of 1981 actions	-487	
Partial year effect of 1982 actions	-325	
Cost of permanent positions in 1982		76,773

b.	Other than full-time permanent positions				
1.	Cost	1,306	1,249	1,434	1,460
2.	Workyears	119	132	123	123

The *1982* estimate will support the following programs:

Distribution of Other than Full-Time Permanent Workyears

Program	Workyears
Cooperative training	50
Summer employment	20
Opportunity programs	28
Other temporary employment	25
Total	123

The decrease in workyears from the *1981* budget estimate to the *1981* current estimate reflects a decrease in other temporary employment.

	1980 Actual	*1981* Budget Estimate	*1981* Current Estimate	*1982* Budget Estimate
	(Thousands of Dollars)			
c. Overtime and other compensation	*1,213*	*1,502*	*1,373*	*1,436*

The increase in overtime and other compensation in *1982* is related primarily to the full year cost of the October *1980* pay increase.

2. Fknefits	*6,989*	*7,361*	*7,362*	*7,628*

Following are the amounts of contribution by category:

Civil Service Retirement Fund	*4,729*	*5,198*	*5,126*	*5,356*
Employee life insurance	*187*	*218*	*207*	*222*
Employee health insurance	*1,415*	*1,586*	*1,518*	*1,615*
Workmen's compensation	*363*	*313*	*313*	*347*
FICA	*36*	*41*	*42*	*45*
Other	*259*	*5*	*156*	*43*
Total	*6,989*	*7,361*	*7,362*	*7,628*

The 1982 increase is attributable primarily to anticipated increases in health insurance costs, Civil Service Retirement Fund and Workmen's compensation. Workmen's compensation costs are based on the Department of Labor billings.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
	(Thousands of Dollars)			
B. Supporting Costs	519	477	430	475
1. Transfer of personnel	36	46	25	29

Transfer of personnel in 1980, 1981, and 1982 reflects the expenses involved in the movement and temporary storage of employees' household goods, subsistence and miscellaneous moving expenses. The decrease from 1981 budget estimate to the 1981 current estimate reflects a revised number of relocations. The 1982 estimate reflects approximately the same number of relocation as in 1981.

2. Personnel training	483	431	405	446

About 38% of the training cost is for technically oriented training. Another 33% is provided specifically for the scientific and engineering staff. The remaining 29% supports other programs, including administrative and clerical. The higher training cost in 1980 is due to special training required for the implementation of the Civil Service Reform Act (CSRA). The decrease in the 1981 budget estimate to the 1981 current estimate reflects rephasing a portion of training requirements to 1980. The, 1982 estimate provides for maintaining training at approximately the 1980–1981 average rate, and includes anticipated increases in tuition costs.

		1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
			(Thousands of Dollars)		
II.	**TRAVEL**	**1,066**	**1,244**	**1,108**	**1,555**
	Summary of Fund Requirements				
A.	Program Travel	804	1,034	900	1,267
B.	Scientific and Technical Development Travel	182	134	124	200
C.	Management and Operations Travel	80	76	a4	88
	Total, Travel	1,066	1,244	1,108	1,555
	Explanation of Fund Requirements				
A.	Program Travel	804	1,034	900	1,267

Program travel is directly related to the accomplishment of the Center's mission and accounts for approximately 80% of travel costs. It provides funds necessary to manage major contractual programs in aeronautical research and technology, space propulsion, materials research and development and energy technology. Program travel is also essential to the management and procurement of launch vehicles. The decrease from the 1981 budget estimate to the 1981 current estimate reflects a reduction in travel due to budgetary constraints. The 1982 estimate provides for essentially the same level of travel activities as originally planned in 1981 along with transportation and per diem rate increases.

B.	Scientific and Technical Development Travel	182	134	124	200

Scientific and technical development travel permits employees to participate in meetings and seminars with other representatives of the aerospace community. This participation allows them to benefit from exposure to technological advances outside Lewis, as well as to present both accomplishments and problems to their associates. Many of the meetings are working panels convened to solve problems for the benefit of the Government. The decrease from the 1981 budget estimate to the 1981 current estimate reflects a reduction in

travel due to budgetary constraints. The 1982 estimate provides for a partial return to the same level of travel activities as in 1980, offset by transportation and per diem rate increases.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
C. Management and Operations Travel	80	76	84	88

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, and local transportation. The number of trips in this area continue to decline as increased costs more than offset budget growth.

III.	**FACILITIES SERVICES**	**10,627**	**12,307**	**12,884**	**14,756**
	Summary of Fund Requirements				
A.	Maintenance and Related Services	869	1,449	910	1,124
	1. Facilities	869	1,365	910	1,124
	2. Equipment	---	84	---	---
B.	Custodial Services	2,336	2,353	2,948	3,062
C.	Utility Services	7,422	8,505	9,026	10,570
	Total, Facilities Services	10,627	12,307	12,884	14,756
	Explanation of Fund Requirements				
A.	Maintenance and Related Services	869	1,449	910	1,124
	1. Facilities	869	1,365	910	1,124

This activity provides for the operation and maintenance of facilities at the main Installation at Cleveland and at the Plum Brook Station. At Cleveland, facilities maintenance includes grounds maintenance and maintenance of heating, ventilating, and air-conditioning (HVAC) equipment. Maintenance of buildings and grounds at Plum Brook Station is accomplished by nine support contractor workyears.

The decrease in the 1981 current estimate from the 1981 budget estimate is due to the reduction of four contractor workyears and other facility maintenance activities to remain within budgetary constraints. The increase in 1982 is primarily due to contractor rate escalation, the addition of one contractor workyear and facility maintenance work deferred during 1981.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
2. Equipment...	---	84	---	---

Equipment purchases planned for 1981 is no longer required.

B. Custodial Services	2,336	2,353	2,948	3,062

Security, janitorial, and fire protection services are provided by a support contractor at Cleveland and the Plum Brook Station. The increase in the 1981 current estimates over the 1981 budget estimate is due primarily to increased costs on the security and janitorial contracts. These contracts were re-competed during 1979, and follow-on contracts cost significantly more than orginally anticipated. Five additional workyears were added in the janitorial area in 1981 to service added floor space. The change from 1981 to 1982 reflects an increase in reimbursable tasks offset by contractor rate escalation.

1. Security.....	1,169
2. Janitorial.....	1,537
3. Security and custodial - Plum Brook Station.....	158
4. Other services.....	198

Other services include rubbish disposal, fly ash removal, and industrial cleaning of walls, lights and windows on an as needed basis.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
C. Utilities Services	7,422	8,505	9,026	10,570

The 1982 estimate covers the projected consumption at Cleveland and the Plum Brook Station. Electrical power is provided by the local utility company. Natural gas is the primary heating fuel used at Lewis with oil as a backup fuel. A support contractor operates the central heating plant. The increase in the 1981 current esimate from the 1981 budget estimate is due to increased utility rates and a new contract for operation of the Center's electrical power substation. The 1982 estimate reflects rate escalation, with consumption held essentially level.

1.	Electricity (166,700/MWH)	7,573
2.	Natural gas (437,000 K cu. ft)	1,827
3.	Fuel oil (54,000 gal)	68
4.	Water and sewage	284
5.	Operation of electrical power substation	273
6.	Operation of central heating plant	545

IV.	**TECHNICAL SERVICES**	**817**	**1,043**	**997**	**969**
	Summary of Fund Requirements				
A.	Automatic Data Processing	115	214	342	165
	1. Equipment	16	22	20	22
	2. Operations	99	192	322	143
B.	Scientific and Technical Information				
	1. Education and information	702	829	655	804
	Total, Technical Services	817	1,043	997	969

Explanation of Fund Requirements

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
A. Automatic Data Processing..	115	214	342	165

The funding provides for administrative data processing including equipment maintenance, programming and operations.

1. Equipment	16	22	20	22

Funding in this category is required for the rental, and periodic replacement and updating of administrative ADP equipment. The increase from 1981 to 1982 is due to escalation of lease rates.

2. Operations.....	99	192	322	143

Key punch services for business management systems are covered in this category. The increase from the 1981 budget estimate to the 1981 current estimate provides for a study of Lewis management systems requirements for ADP support in the future. The 1982 estimate provides for the same level of key punch services as 1980 as well as for rate escalation anticipated for purchased services.

B. Scientific and Technical Information.....	702	829	655	804

Included in this activity are the purchase of pamphlets, supplies, and materials required for the operation of the Center's educational programs, public information services, and the operation of the Visitor Information Center. (VIC).

1. Education and information.....	702	829	655	804

Funding for operation of the VIC, conduct of tours and special events, construction and transport of special exhibits, and related activities are included in this category. The decrease in the 1381 current estimate from the 1981 budget estimate is due to the nonavailability of funds for projects such as updating the VIC and expansion of other public affairs activities. The increase in 1982 is due to contractor wage escalation and the VIC update deferred from 1981.

		1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
			(Thousands of Dollars)		
V.	MANAGEMENT AND OPERATIONS	2,945	2,504	2,550	2,984
	Summary of Fund Requirements				
A.	Administrative Communications	687	731	845	946
B.	Printing and Reproduction	102	4	30	38
C.	Transportation	1,384	1,258	1,070	1,285
D.	Installation Common Services	772	511	605	715
	Total, Management and Operations	2,945	2,504	2,550	2,984
	Explanation of Fund Requirements				
A.	Administrative Communications	687	731	845	946

This estimate provides for leased lines and equipment for local and long distance telephone service, and nontelephone communications outlined below. The increase in the 1981 current estimate from the 1981 budget estimate is due to an increase in rates for Ohio Bell equipment and leased lines. The 1982 estimate is based on the same level of service as in 1981, provided at higher rates.

1. Local telephone service..... 516

This activity includes the leased lines and equipment necessary to serve the Center and is comprised of approximately 1,900 instruments, 950 stations and 50 incoming and outgoing lines.

2. Long distance telephone service..... 385

Commercial long distance costs, FTS costs, and overseas calls are included in this category.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
3. Nontelephone communications				45

This estimate includes funds for telex, advanced record system teletype, rapidfax, datafax, teleconference equipment, oceanic cable service, and usage charges for airline reservation service.

B. Printing and Reproduction	102	4	30	38

This activity provides for administrative printing and copier service. A large capacity copying machine was purchased in 1980. The increase from the 1981 budget estimate to the 1981 current estimate reflects the unanticipated requirement to replace aging office copier machines in 1981. The 1982 estimate continues this level of equipment replacement.

C. Transportation	1,384	1,258	1,070	1,285

This activity includes the cost of the support contract for bus, mail and package delivery and stock issuance. It also includes moving and hauling services, motor vehicle purchase and maintenance and aircraft operations and maintenance. The decrease in costs from the 1981 budget estimate to the 1981 current estimate reflects the deferral of the purchase of replacement trucks in 1981 and the reduction of one contractor workyear due to budget constraints. The 1982 budget estimate includes the cost of replacement trucks deferred in 1981 and contractor rate escalation.

D. Installation	772	511	605	715

This funding covers support to Center management and staff activities, medical services, and a variety of minor administrative services. The increase from the 1981 budget estimate to the 1981 current estimate is due to higher contractor rate escalation than originally planned and higher rates for purchased services and supplies. The increase in 1982 is primarily due to contractor rate escalation.

1. Center management and staff	230

This funding provides minor administrative services for Center management and staff and administrative record keeping at Plum Brook Station.

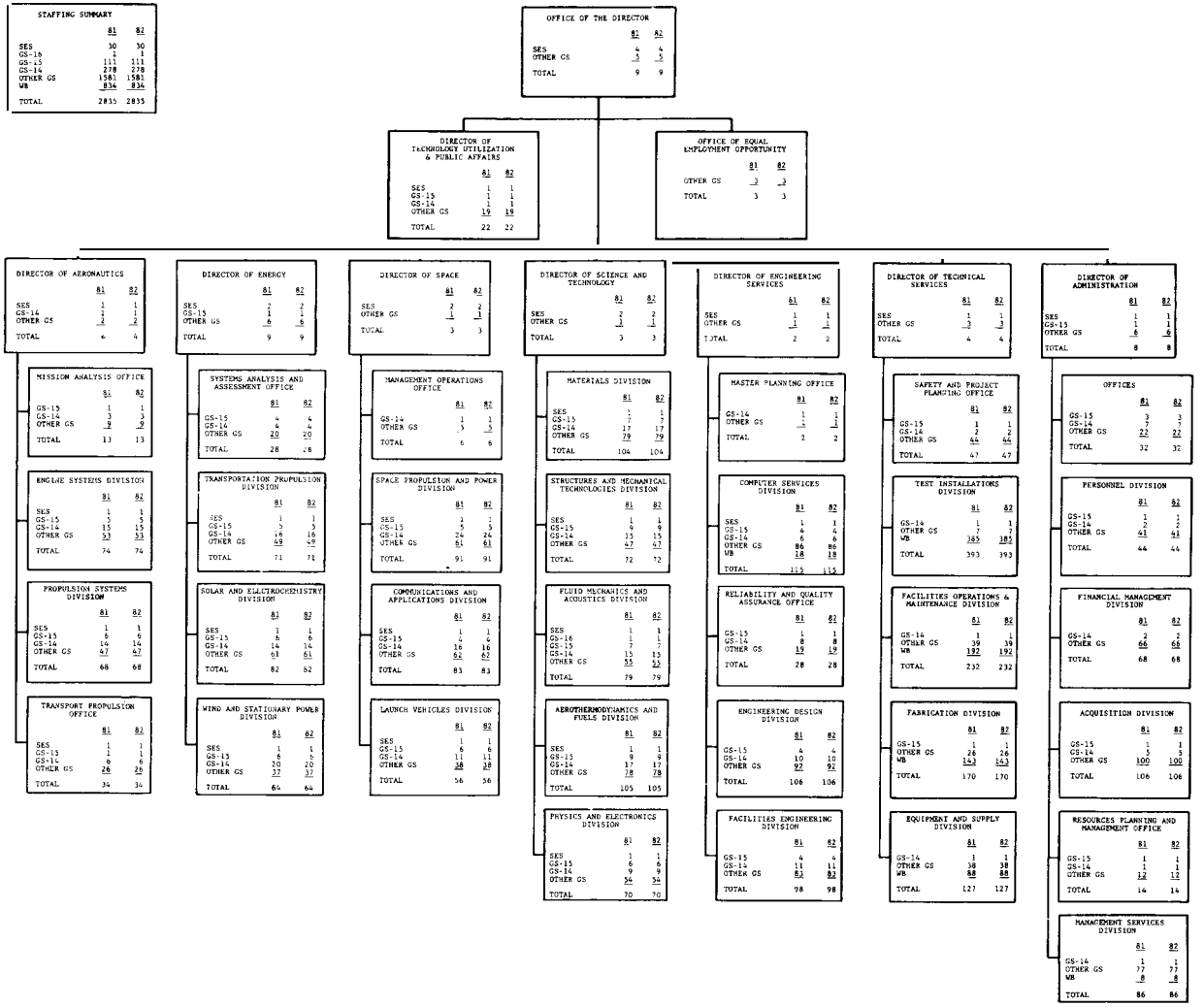
	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
	(Thousands of Dollars)			
2. Medical services				323

At Cleveland this category includes the cost of staff examinations, clinic support, medical supplies and special x-ray and medical examinations for the in-house occupational health program. These services are provided by a support contractor. At the Plum Brook Station, the health physicist effort is required to monitor the nuclear reactor and is provided by a support contractor.

3. Installation support services 162

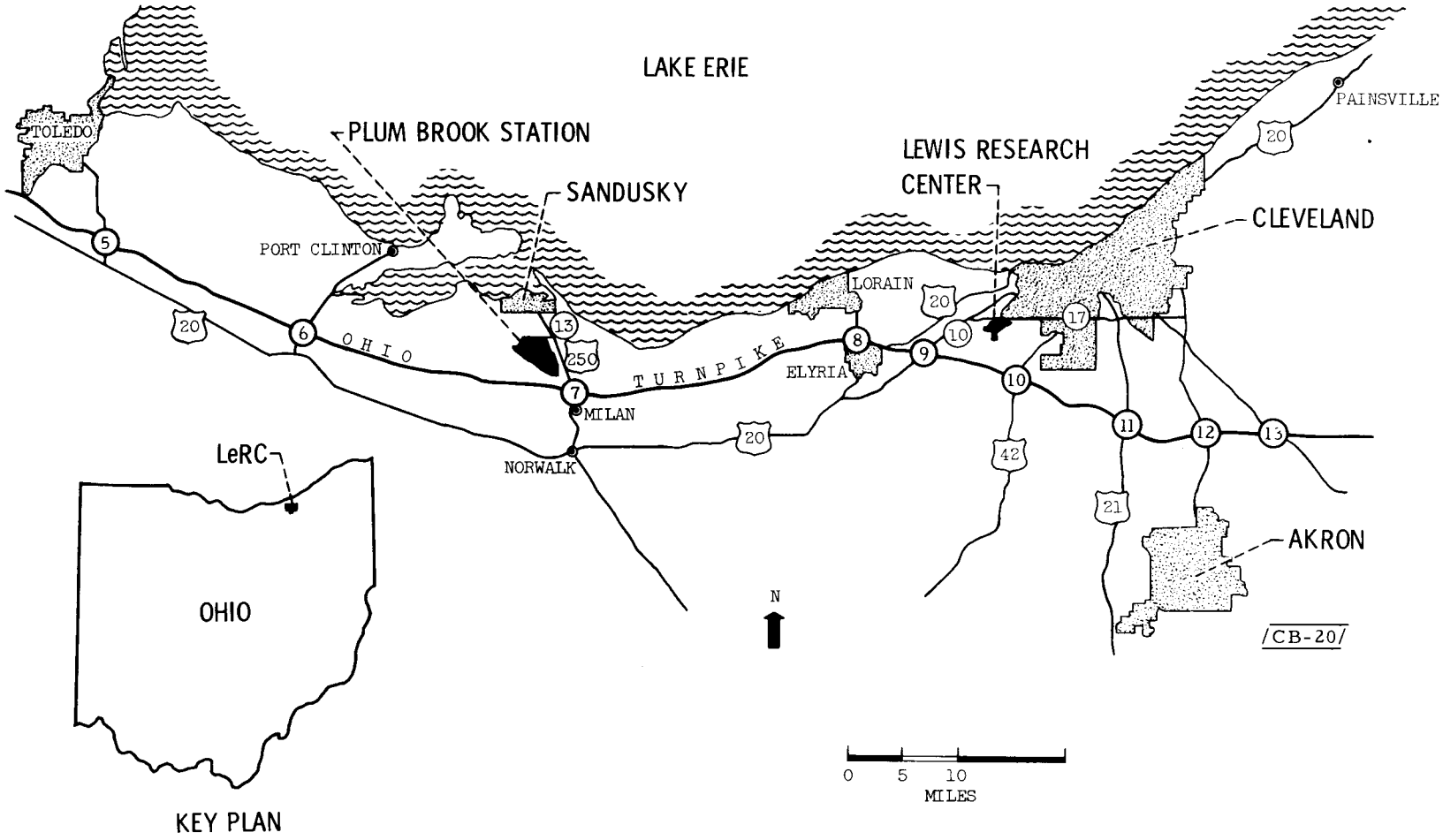
This provides for the maintenance and periodic replacement of administrative equipment, administrative supplies, and postage.

National Aeronautics and Space Administration
Organization and Staffing Chart
LEWIS RESEARCH CENTER
Cleveland, Ohio



LEWIS RESEARCH CENTER
FISCAL YEAR 1982 ESTIMATES

AREA MAP



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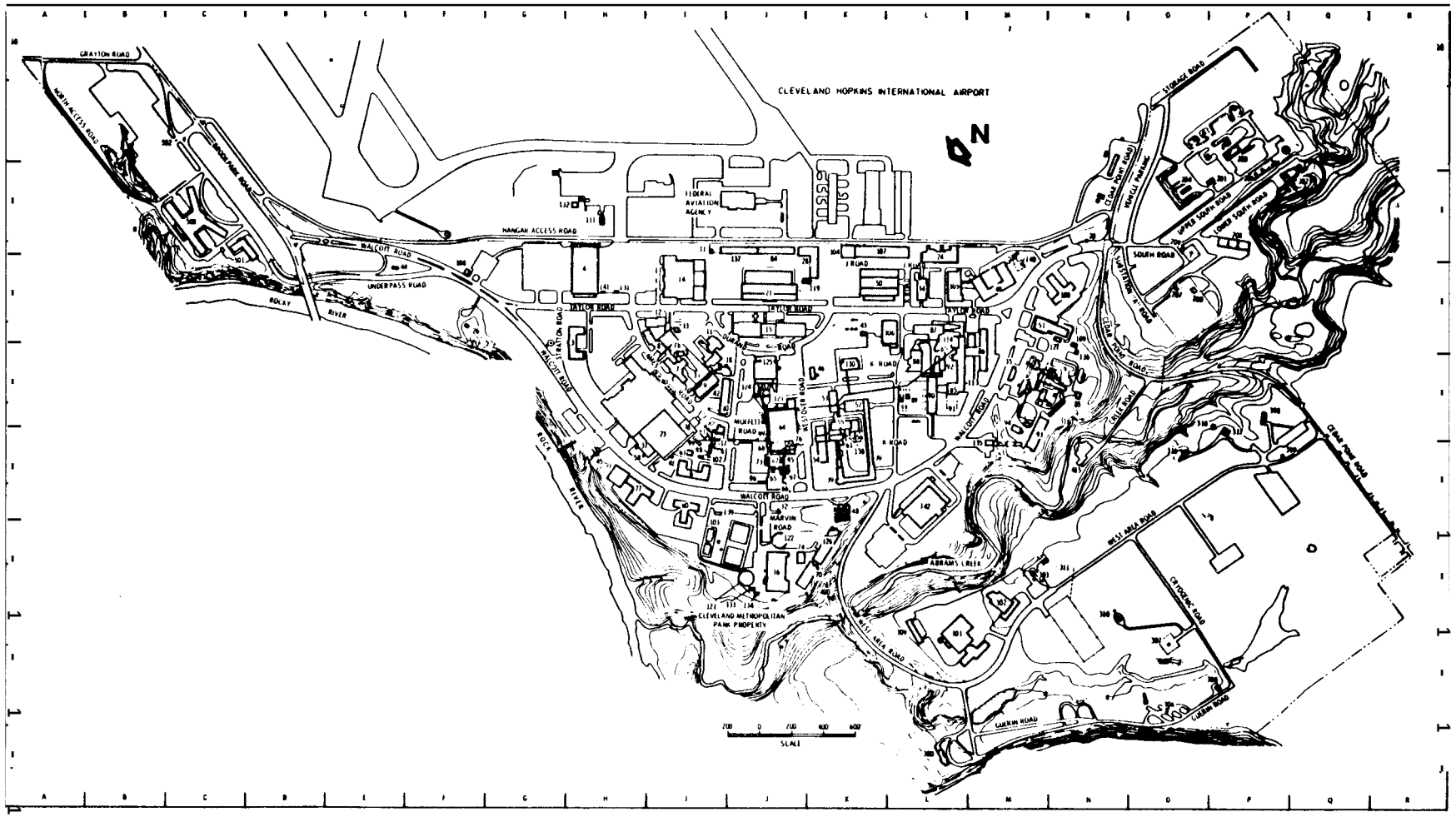
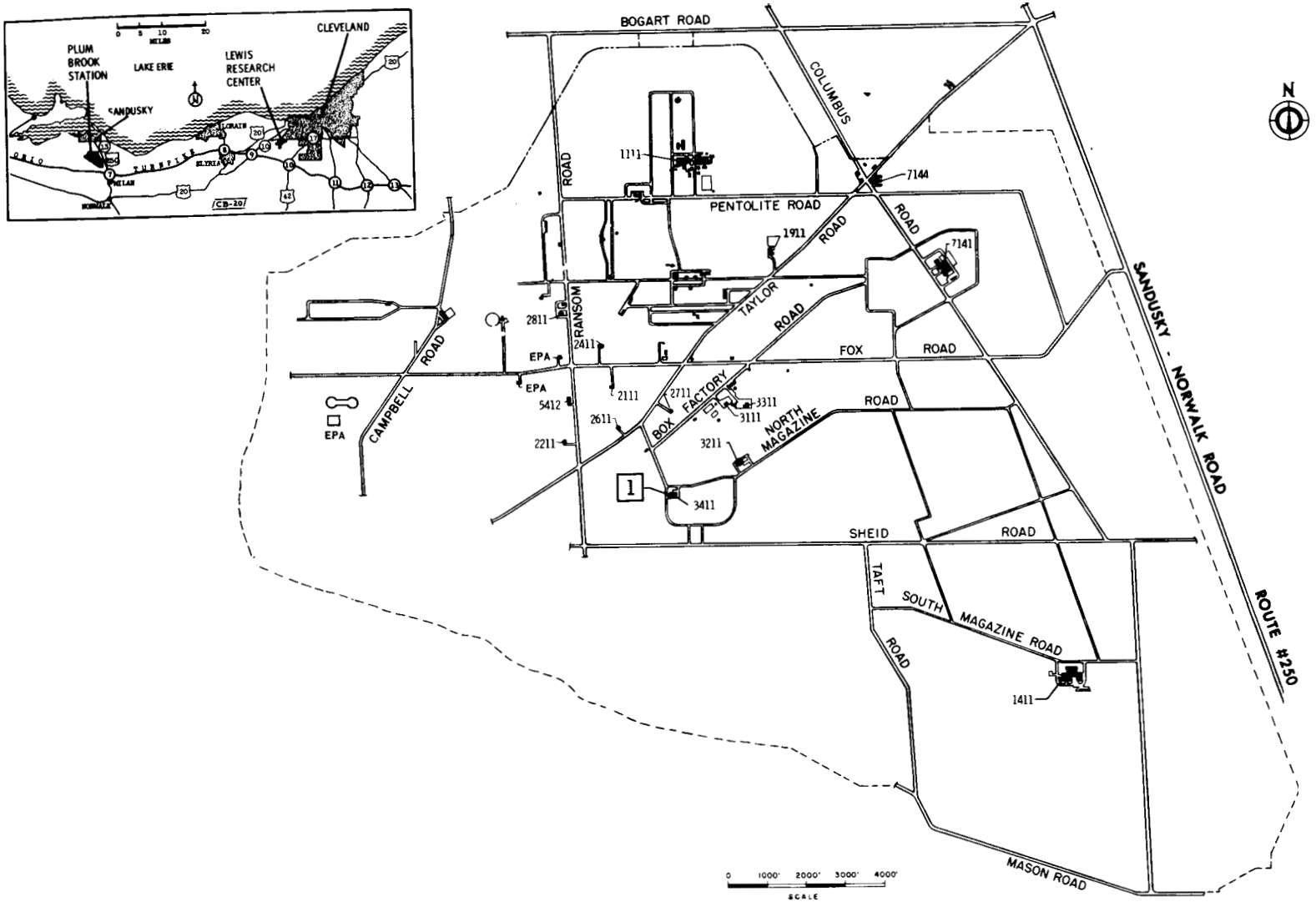
LEWIS RESEARCH CENTER
FISCAL YEAR 1982 ESTIMATES
LOCATION PLAN



LEWIS RESEARCH CENTER
PLUM BROOK STATION
FISCAL YEAR 1982 ESTIMATES

LOCATION PLAN



LEWIS RESEARCH CENTER
FISCAL YEAR 1982 ESIMATES

CLEVELAND FACILITIES

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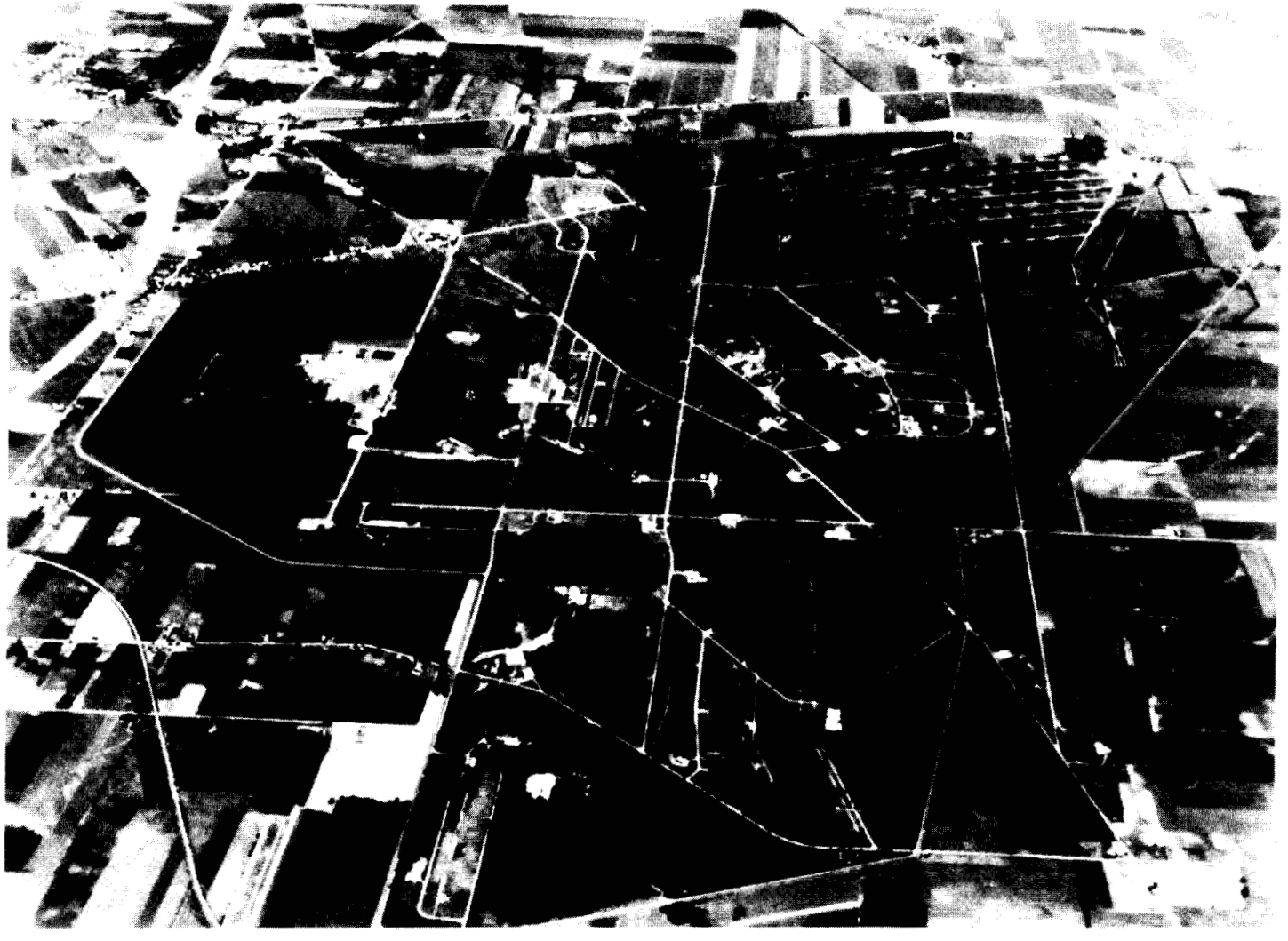
LEWIS RESEARCH CENTER
FISCAL YEAR 1982 ESTIMATES

PLUM BROOK FACILITIES



NASA
HEADQUARTERS

RESEARCH AND PROGRAM MANAGEMENT

FISCAL YEAR 1982 ESTIMATES

NASA HEADQUARTERS

DESCRIPTION

NASA Headquarters is located at 400 Maryland Avenue, SW, Washington, D.C., and occupies other buildings in the District of Columbia, Maryland and Virginia. Except for some office space leased in the District of Columbia and a storage area in Virginia, personnel occupy Government-owned buildings.

HEADQUARTERS ROLES AND MISSIONS

The mission of the National Aeronautics and Space Administration 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:

1. Extend our knowledge of the Earth, its environment, the solar system, and the universe;

2. Expand practical applications of space technology;

3. Develop, operate, and improve manned and unmanned space vehicles;

4. Improve the civil and military usefulness of aeronautical vehicles, while minimizing their environmental effects and energy consumption;

5. Disseminate pertinent findings to potential users; and

6. 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 Transportation Systems: Responsible for the development and acquisition aspects of space flight programs which includes the Space Shuttle, a versatile, economical space transportation system that

will be used to conduct the space operations of the 1980's. Included in space transportation systems are orbiters, engines, external tanks, solid rocket boosters, upper stages and ground systems.

Office of Space Transportation Operations: Responsible for the effective accomplishment of that part of the overall NASA program that involves space transportation operations. Develops and implements necessary policy for all space transportation system users. Develops and implements policies for expendable launch vehicle users to transition to the STS. Promotes improvements in effectiveness, cost efficiency and timeliness of STS performance.

Office of Space Science: Responsible for scientific research and development effort 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. The Life Sciences program is also under the direction of the Office of Space Science.

Office of Space and Terrestrial Applications: Responsible for 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; resources observations, environmental observations, space communications, materials processing in space, applications systems, technology transfer, and technology utilization.

Office of Aeronautics and Space Technology-: Responsible for the aeronautical, space and energy research and technology programs. 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. The energy program provides an interface with and support to the Department of Energy in the execution of interagency related activities conducted by NASA. The Office of Aeronautics and Space Technology is also responsible for coordinating 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: Responsible for the development, implementation, and operation of 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 the administrative communications of NASA installations.

Research and Program Management (R&PM) funding is used to support the staffing and operation of NASA Headquarters in Washington, D.C. The overall capability of the Agency to operate effectively is dependent upon sufficient R&PM funds to hire and support a Headquarters workforce to furnish direction and coordinate the accomplishment of the Agency mission. This portion of the budget supports the accomplishment of the following objectives:

- To provide a balanced Agency Headquarters workforce capable of planning, formulating, advocating and providing executive direction to national programs to implement the objectives stated in the National Aeronautics and Space Act of 1958, as amended.

- To provide a balanced Headquarters supporting workforce capable of providing necessary administrative,' operational and logistical support to those Headquarters elements concerned with carrying out the mission of the National Aeronautics and Space Administration.

- To provide adequate facilities to house the workforce in Washington, D.C.

- To provide for technical, administrative and logistic support necessary to facilitate accomplishment of NASA goals and objectives as administered by the Headquarters.

The Headquarters workforce consists of a professional and clerical staff organized into the program offices indicated above and appropriate supporting staff offices. Funding for pay, travel and necessary support services are included in this portion of the budget submission. Each office is assigned a function consistent with the NASA Headquarters 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. He is assisted by heads of special and technical staff offices which perform functions necessary to the effective operation of the Agency and the Headquarters. Such offices are concerned with administration management or support of the Headquarters. Included are such offices as the Chief Engineer, Chief Scientist, Comptroller, General Counsel, External Relations, Management Operations, Aerospace Safety Advisory Panel, Equal Opportunity, Procurement and the Inspector General. The Headquarters currently has eleven (11) installations throughout the U.S. which perform Agency operational missions under direction of the Headquarters staff.

Technical support required by Headquarters is performed primarily by support service contractors. Currently, contractors support Headquarters automatic. data processing and the scientific and technical information programs. Administrative and logistical support is provided by the in-house workforce assisted by miscellaneous contract services. Such support includes communications, printing, supplies, materials, equipment, transportation, occupational medicine and health, and other administrative support services.

SUMMARY OF RESOURCES REQUIREMENTS

Funding Plan By Function

		1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)			
I.	Personnel and Related Costs	58,778	64,037	63,683	65,478
II.	Travel	3,187	3,236	3,627	3,949
III.	Facilities Services	5,790	5,804	5,783	6,326
IV.	Technical Services	14,851	16,878	17,717	19,942
V.	Management and Operations	6,944	7,674	8,621	11,097
	1981 Budget Amendment	---	-1,355	---	---
	Total, fund requirements	89,550	96,274	99,431	106,792

Distribution of Permanent Positions by Program

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
Direct Positions				
Space Transportation Systems and Operations	203	230	230	230
Space shuttle	89	89	110	112
Space flight operations	103	130	107	105
Expendable launch vehicles	11	11	13	13
Space Science	114	114	114	114
Physics and astronomy	60	60	60	60
Planetary exploration	31	31	31	31
Life sciences	23	23	23	23
Space and Terrestrial Applications	114	114	114	114
Space applications	95	95	94	94
Technology utilization	19	19	20	20
Aeronautics and Space Technology	142	142	134	134
Aeronautical research and technology	74	74	63	63
Space research and technology	47	47	44	44
Energy technology	21	21	27	27
Space Tracking and Data Systems	5c	52	57	57
Tracking and data acquisition	50	52	57	57
Subtotal, direct positions	623	652	649	649
Management and Operations Support Positions	893	933	937	937
Total, permanent positions	1,516	1,585	1,586	1,586

RESOURCE REQUIREMENTS BY FUNCTION

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
I. PERSONNEL AND RELATED COSTS	**58,778**	**64,037**	**63,683**	**65,478**
Summary of Fund Requirements				
A. Compensation and Benefits				
1. Compensation				
a. Permanent positions	47,773	53,497	52,721	54,310
b. Other than full-time permanent positions	2,223	1,446	1,939	1,947
c. Reimbursable detailees	475	537	532	508
d. Overtime and other compensation	1,370	2,184	1,245	1,245
Subtotal, Compensation	51,841	57,664	56,437	58,010
2. Benefits	5,246	4,989	5,110	5,245
Subtotal, Compensation and Benefits	57,087	62,653	61,547	63,255
B. Supporting Costs				
1. Transfer of personnel	581	400	861	1,016
2. Office of Personnel Management services	297	146	176	187
3. Personnel training	813	838	1,099	1,020
Subtotal, Supporting Costs	1,691	1,384	2,136	2,223
Total, Personnel and Related Costs	58,778	64,037	63,683	65,478

Explanation of Fund Requirements

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
A. Compensation and Benefits	57,087	62,653	61,547	63,255
1. Compensation	51,841	57,664	56,437	58,010
a. Permanent positions	47,773	53,497	52,721	54,310

The estimates shown will support 1,586 permanent positions in 1981 and 1982.

Basis of Cost for Permanent Positions

In 1982, the cost of permanent positions will be $54,310,000 an increase of $1,589,000 from 1981. The increase results from the following:

Cost of permanent positions in 1981		52,721
Cost increase in 1982		+2,284
Within grade and career advances:		
Full year effect of 1982 actions	+1,280	
Partial year effect of 1982 actions	+963	
Full year effect of 1981 pay increases	+41	
Cost decreases in 1982		-695
Turnover savings and abolished positions:		
Full year effect of 1981 actions	-417	
Partial year effect of 1982 actions	-278	
Cost of permanent positions in 1982		54,310

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
b. Other than full-time permanent positions				
1. cost	2,223	1,446	1,939	1,947
2. Workyears	150	141	130	132

The increase from the 1981 budget estimate to the 1981 current estimate is primarily due to the effect of the October 1980 pay increase. The 1982 estimate includes 132 workyears, which will be used to support the following programs:

Distribution of Other Than Full-Time Permanent Workyears

Program	Workyears
Cooperative training	12
Summer employment	20
Opportunity programs	31
Other temporary employment	69
Total	132

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
c. Reimbursable detailees	475	537	532	508

The services of a small group of military officer and civilian detailees from other Government agencies are utilized by NASA Headquarters where such assignments are of mutual benefit. The number of personnel detailed varies from seven to sixteen, all of whom are assigned to Headquarters program offices with the exception of three who are assigned to the Office of Facilities.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
d. Overtime and other compensation	1,370	2,184	1,245	1,245

The decrease from the *1981* budget estimate to the *1981* current estimate reflects the revision of overtime estimates for the current year. The *1982* estimate is level with *1981*.

2. Benefits	5,246	4,989	5,110	5,245
Following are the amounts of contributions by category:				
Civil Service Retirement Fund	3,450	3,755	3,682	3,793
Employee life insurance	144	166	166	170
Employee health insurance	770	830	886	930
Workmen's compensation	143	150	167	167
FICA	71	88	90	90
Other benefits	668	---	119	95
Total	5,246	4,989	5,110	5,245

The increase in the *1981* current estimate from the *1981* budget estimate reflects increased Workmen's compensation costs based on the Department of Labor billings and increases in health insurance and other benefits.

E. Supporting Costs	1,691	1,384	2,136	2,223
1. Transfer of personnel	581	400	861	1,016

The costs associated with the transfer of personnel include the movement of household goods, subsistence and temporary expenses, real estate costs and miscellaneous moving expenses related to change of duty station. The *1981* current estimate reflects an increased number of relocations over the *1981* budget estimate. The *1982* estimate represents a slight increase in the number of relocations over *1981*. The estimates for *1981* and *1982* are based on the current average cost of relocations estimated at Headquarters and in anticipation of bringing on board additional personnel to work in the Space Transportation Systems and Operations areas.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
2. Office of Personnel Management services....	297	146	176	187

Headquarters reimburses the Office of Personnel Management (OPM) and others 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 OPM or other agencies. There is also a payment to OPM for Federal wage system surveys. The 1982 level is essentially the same as 1981.

3. Personnel training	813	838	1,099	1,020

The maintenance and expansion of the 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 nongovernmental 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. The increase in the 1981 current estimate over the 1981 budget estimate is due to new training requirements for the Civil Service Reform Act implementation. The 1982 estimate is essentially the 1981 level before training necessary for the Civil Service Reform Act.

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11. TRAVEL.....	**3,187**	**3,236**	**3,627**	**3,949**
Summary of Fund Requirements				
A. Program Travel.....	1,789	1,713	2,206	2,486
B. Scientific and Technical Development Travel..	449	323	351	393
C. Management and Operations Travel.....	949	1,200	1,070	1,070
Total, Travel.....	3,187	3,236	3,627	3,949

Explanation of Fund Requirements

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
	(Thousands of Dollars)			
A. Program Travel	1,789	1,713	2,206	2,486

Program travel funds are used in support of NASA's research and development programs, such as the Space Shuttle, Space Flight Operations, Aeronautics and Space Technology, Space and Terrestrial Applications, Space Science, and other direct Research and Development (R&D) projects. This category represents approximately 63 percent of the Headquarters travel requirements for 1982. The increases in the current 1981 and 1982 estimates are a result of increased costs and travel associated primarily with Space Shuttle development and preparation for space transportation systems operations.

B. Scientific and Technical Development Travel	449	323	351	393

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 convened to solve certain problems for the benefit of the Government. The increase in the 1981 current estimate over the 1981 budget estimate reflects an attempt to align 1981 travel in this category more closely with 1980 actual experience. The increase in 1982 only partially offsets anticipated cost increases and results in a slight decline in the number of trips from the 1981 level.

C. Management and Operations Travel	949	1,200	1,070	1,070

Management and operations travel is for the direction and coordination of general management matters, travel by senior officials to review Center requirements and operations. 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; local transportation; and Congressional travel. The 1981 current estimate was reduced from the 1981 budget estimate due to budgetary constraints. The level of travel is further reduced in the 1982 estimate due to escalating costs.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
III. FACILITIES SERVICES	**5,790**	**5,804**	**5,783**	**6,326**

NASA Headquarters involves a complex of buildings in the District of Columbia, Maryland and Virginia. These are Government-owned and leased buildings for which NASA must provide reimbursement to GSA in accordance with P.L. 92-313. The leased facilities in Virginia will be given up in the fourth quarter 1981 upon completion of the move of the Headquarters warehouse to the Goddard Space Flight Center. The current complex encompasses 556,656 gross square feet of building space including six buildings. This complex of primary office space supports an average daily Headquarters population of 2,000 personnel.

Summary of Fund Requirements

A.	Rental of Real Property	4,868	5,011	4,994	5,005
B.	Maintenance and Related Services	717	598	536	1,043
	1. Facilities	717	598	536	800
	2. Equipment	---	---	---	243
C.	Custodial Services	205	195	253	278
	Total, Facilities Services	5,790	5,804	5,783	6,326

Explanation of Fund Requirements

A.	Rental of Real Property	4,868	5,011	4,994	5,005

Public Law 92-313 requires that agencies be charged for space and related services provided by the General Services Administration (GSA) at approximate commercial equivalent rates. The amounts provided here cover the cost of office and warehouse space utilized by NASA Headquarters personnel. However, the warehouse space will be given up in the fourth quarter 1981, which is the cause of the decrease between the 1981 budget estimate and current estimate. The 1981 current and the 1982 budget estimate reflects increased rental rates as projected by GSA.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
	(Thousands of Dollars)			
B. Maintenance of Related Services	717	598	536	1,043
1. Facilities	717	598	536	800

This estimate includes maintenance, repair and alterations of buildings such as partition changes, telephone changes and general buildings maintenance. The decrease in the 1981 current estimate from the 1981 budget estimate reflects deferral of maintenance and repair to 1982. The 1982 estimate reflects increased requirements associated with anticipated changes in the utilization of office space.

2. Equipment	---	---	---	243

This funding provides for purchase and installation of additional air-conditioning capacity for the Headquarters Computer Facility. The current air-conditioning capacity is inadequate and has caused equipment failure in the summer months.

C. Custodial Services	205	195	253	278
1. Security guard service	202	190	248	273

These funds cover security guard service in the various Headquarters buildings. The increases in the 1981 current estimate and the 1982 budget estimate reflects increased rates by GSA.

2. Security alarm systems	3	5	5	5

This estimate includes reimbursement to GSA for the installation and maintenance of the security alarm systems and equipment in the NASA Headquarters buildings.

		1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
			(Thousands of Dollars)		
IV.	**TECHNICAL SERVICES**	**14,851**	***16,878***	**17,717**	***19,942***
	Summary of Fund Requirements				
A.	Automatic Data Processing	5,297	5,404	5,319	6,186
	1. Equipment	1,067	1,095	1,088	1,441
	2. Operations	4,230	4,309	4,231	4,745
B.	Scientific and Technical Information	9,082	10,987	11,817	13,047
	1. Library	265	223	291	339
	2. Education and Information	8,817	10,764	11,526	12,708
C.	Shop Support and Services	472	487	581	709
	Total, Technical Services	14,851	16,878	17,717	19,942
	Explanation of Fund Requirements				
A.	Automatic Data Processing	5,297	5,404	5,319	6,186

This estimate provides for the lease, purchase, maintenance, programming and operations services of ADP equipment.

1.	Equipment	1,067	1,095	1,088	1,441

This funding provides for the maintenance and lease of **ADP** equipment. The decrease between the 1981 budget estimate and the current estimate reflects savings due to purchase of leased equipment. The increase in 1982 is due to increased costs of leasing equipment, increase in maintenance costs, and rental of additional peripheral equipment.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
2. Operations.....	4,230	4,309	4,231	4,745

This funding provides for the programming and operating services for payroll, accounting, procurement, personnel, and contracts reports. The decrease in the 1981 current estimate from the 1981 budget estimate is due to a reduction in time sharing services partially offset by a six workyear increase in contracts. The increase in the 1982 estimate is due to cost escalation and increased effort to apply ADP to the areas of procurement, legal research and litigation support, and institutional resources management.

B. Scientific and Technical Information.....	9,082	10,987	11,817	13,047
1. Libraries.....	265	223	291	339

The technical libraries provide reference acquisition, cataloging, translating and dissemination services to all NASA employees. The increases in the 1981 current estimate from the 1981 budget estimate and the 1982 estimate are due to increased costs for books and periodicals as well as a three workyear contract for library services initiated in 1981.

2. Education and information.....	8,817	10,764	11,526	12,708

Two major activities are contained in this subfuction: educational-informational programs and the NASA Headquarters scientific and technical information activity. The increase in the 1981 current estimate from the 1981 budget estimate reflects increased costs of support contracts. The 1982 estimate reflects full funding of essentially the same level of services as in 1981.

a. Education and information program..... 2,543

The education and information programs provide for the gathering and dissemination of 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 (with over 30,000 teachers participating); and participation in science fairs. The largest single program is the Aerospace Education Science program, a touring space science education lecture demonstration unit. This program also provides for Equal Employment Opportunity exhibits and films to relate the key roles that women and minorities have in the U.S. Space Program to high schools, colleges and the public.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
b. Scientific and technical information				10,165

The scientific and technical information activity includes the cost of the NASA Scientific and Technical Information Facility (STIF), documentation and publication services, systems development, and translation services. The largest requirement is the NASA STIF, with an estimated cost of $4.7 million in 1982. The cost of all other information services is estimated at approximately $5.5 million in 1982. These costs are for the documentation of worldwide aerospace journal and report literature; monographs and technical reviews; analyzing, evaluating, and testing new methods and systems in the field of scientific communications to increase the effectiveness of the technical information program; and translating foreign language technical books, reports, and journal articles required to meet the needs of NASA and its contractor scientific personnel to keep abreast of world developments in the space science and related fields.

C. Shop Support and Services	472	487	581	709

These funds provide for the continuation of studies on reliability, cost evaluations and NASA-wide Safety, Reliability and Quality Assurance Standards. They also provide for graphic and photo processing services. The increase in the 1981 current budget over the 1981 budget estimate is due to the initiation of fire safety studies. The increase in the 1982 budget is due to increased costs of graphics and photographic supplies and materials and to a revision of, and the addition of new commodities to, the NASA standard parts application documentation.

		1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)			
V.	**MANAGEMENT AND OPERATIONS**	**6,944**	**7,674**	**8,621**	**11,097**
	Summary of Fund Requirements				
A.	Administrative Communications	1,272	1,417	1,462	1,681
B.	Printing and Reproduction	1,352	1,002	1,173	1,277
C.	Transportation	352	435	422	1,954
D.	Installation Common Services	3,968	4,820	5,564	6,185
	Total, Management and Operations	6,944	7,674	8,621	11,097
	Explanation of Fund Requirements				
A.	Administrative Communications	1,272	1,417	1,462	1,681

Included in this category are the costs of leased lines, long distance tolls, telephone exchange services, and other communications. The increase from the 1981 current estimate to the 1982 budget estimate is due to rate increases for FTS, local telephone and exchange services, and long distance tolls.

1.	Long distance telephone service	975
	Covers cost of leased lines and long distance tolls.	
2.	Nontelephone communications (includes TWX) services	72
3.	Other communication services	634
	Includes cost of operation of telephone exchange services.	

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
B. Printing and Reproduction	1,352	1,002	1,173	1,277

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 increases from the 1981 budget estimate to the 1981 current estimate and in the 1982 budget estimate are due to an increase in the cost of paper, supplies and materials.

C. Transportation	352	435	422	1,954

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, but funded through NASA Headquarters. The 1982 estimate includes the cost of replacing an 18-year-old Queen Air aircraft with a more modern fuel efficient, turbine powered, reliable aircraft. This replacement is in keeping with the requirement to upgrade the Queen Air aircraft within NASA, as other agencies have, with newer aircraft that will provide long-term dependability. The replacement aircraft will also increase reliability, safety, maintainability, and performance in satisfying NASA's continuing needs.

D. Installation Common Services	3,968	4,820	5,564	6,185

This function includes those services which support the Headquarters generally, such as: patent services, maintenance and repair of office equipment and vehicles; minor Government services; contract histories; trucking and laboring services; medical services; international support services; contractor incentive awards; Equal Opportunity community relations and fellowships; Administrator's representation allowance; NASA management training facility study; overseas administration support and documentation; postage, and administrative supplies, materials and equipment. The increases from the 1981 budget estimate to the 1981 current estimate and to the 1982 budget estimate are due to further development effects on medical monitoring criteria procedures, environmental health studies, monitoring systems for occupational health and safety, General Counsel support and on supplies and materials management systems.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
1. Installation support services				3,291

Included in this category, specifically, are such services as Administrator's representation allowance, contract histories, minor government services, labor and traveling services, overseas support, contractor incentive awards, Headquarters Equal Employment Opportunity community relations and fellowships, patent fees and services and Aerospace Fellowships.

2. Medical services *694*

This funding provides for the services and required supplies of the medical health unit and includes the cost of the staff examinations support service contract as well as providing funds to implement environmental health studies, the monitoring systems for occupational health and safety, and the medical monitoring criteria and procedures.

3. Supplies, materials and equipment 2,200

This funding provides for the purchase and rental of office equipment and the supplies and materials required for the operation of NASA Headquarters.

ORGANIZATION AND STAFFING

NASAHEAWUARTERS

HEAWUARTERS

SUMMARY STAFFING

	FY 81	FY 82
EXCEPTED & SES	232	232
GS-18	1	1
GS-16	1	1
GS-15	306	306
GS-14	273	273
ALL OTHER GS	765	765
WAGE BOARD	8	8
TOTALPERM	1,586	1,586

ADMINISTRATOR

	FY 81	FY 82
EXCEPTEDLSES	9	9
GS-16		
GS-15		
GS-14		
WAQETHERGS	14	14
TOTALPERM.	23	23

CHIEF SCIENTIST

	FY 81	FY 82
EXCEPTED6 SES	1	1
GS-16		
GS-15		
GS-14		
ALL OTHER GS WAGE BOARD	1	1
TOTALPERM.	2	2

CHIEF ENGINEER

	FYOI	FY 82
EXCEPTED & SES	4	4
GS-16		
GS-15	9	9
GS-14	4	4
ALL OTHER GS	6	6
WAGE BOARD		
TOTAL PERM.	23	P

EOUAL OPPORTUNITY

	FY 81	FY 82
EXCEPTED & SES	4	4
GS-16		
GS-15	1	1
GS-14	4	4
ALL OTHER GS WAGE BOARD	14	14
TOTALPERM.	23	23

PROCUREMENT

	FY 81	FY 82
EXCEPTED & SES	4	4
GS-16		
GS-15	16	18
GS-14	18	18
ALL OTHER GS WAQE BOARD	Sa	Sa
(TOTALPERM.	88	88

LEGISLATIVE AFFARS

	FY 81	FY 82
EXCEPTED & SES	3	3
GS-16		
GS-15	2	2
GS-14		
ALLOTHERQS	19	19
WAQE BOARD	1	1
TOTALPERM.	25	25

SMALL & DISADVANTAGED BUSINESS UTILIZATION

	FY 81	FY 82
EXCEPTED & SES		
GS-16		
GS-15	1	1
GS-14	1	1
ALL OTHER GS WAQE BOARD	2	2
TOTALPERM.	4	4

STAFF ADVISORS
AEROSPACE
SAFETY ADVISORY PANEL
PUBLIC AFFAIRS
INTERNATIONALAFFARS

INSPECTOR GENERAL

	FY 81	FY 82
EXCEPTED & SES	6	6
GS-16		
GS-15	17	17
GS-14	2 3 2 3	
ALL OTHER GS WAGE BOARD	69	69
TOTALPERM.	114	114

QENERAL COUNSEL

	FY 11	FY 82
EXCEPTED & SES	7	7
GS-16		
GS-15	13	13
GS-14	2	2
ALLDTHERQS WAQE BOARD	17	17
TOTALPERM.	39	39

COMPTROLLER

	FY 81	FY 82
EXCEPTED & SES	11	11
GS-16		
GS-15	21	21
GS-14	33	33
ALLOTHERQI WAOE BOARD	104	104
TOTAL PERM.	169	169

MANAQEMENT OPERATIONS

	FY 81	FY 82
EXCEPTED & SES	18	18
GS-16	1	1
GS-15	1	1
GS-14	40	40
GS-14	53	53
ALLOTHERQS	179	179
WAQE BOARD	7	7
TOTAL PERM.	299	299

EXTERNAL RELATIONS

	FY 81	FY 82
EXCEPTED & SES	21	21
GS-16		
GS-15	19	19
GS-14	23	23
ALL OTHER GS WAGE BOARD	65	65
TOTAL PERM.	128	128

AERONAUTICS AND SPACE TECHNOLOGY

	FYOI	FY 8
EXCEPTED & SES	29	29
GS-16		
GS-15	35	35
GS-14	7	7
ALL OTHER GS WAGE WARD	63	63
TOTAL PERM.	134	134

SPACE SCIENCE

	FY 81	FYOZ
EXCEPTED & SES	34	34
GS-16		
GS-15	26	26
GS-14	18	16
ALL OTHER GS WAQE WARD	36	36
TJTALPERM.	114	114

SPACE AND TERRESTRIAL APPLICATIONS

	FY 81	FY 82
EXCEPTED & SES	26	26
GS-16		
GS-15	36	35
GS-14	19	19
ALLOTHERQI WAQE BOARD	34	34
TOTALPERM.	114	114

SPACE TRANSPORTATION SYSTEMS

	FY11	FY12
EXCEPTED & SES	24	24
GS-16		
GS-15	37	37
GS-14	22	18
ALLOTHERQS WAGE BOARD	66	59
TOTALPERM.	138	138

SPACE TRANSPORTATION OPERATIONS

	FYOI	FY 82
EXCEPTED & SES	16	16
GS-16		
GS-15	23	23
GS-14	32	36
ALLOTHERQS WAQE BOARD	21	17
TOTALPERM.	92	92

SPACE TRACKING AND DATA SYSTEMS

	FY 81	FY 82
EXCEPTED & SES	16	16
GS-16		
GS-15	11	11
GS-14	16	18
ALLOTHERGS WAGE BOARD	14	14
TOTALPERM.	57	57

SPECIAL
ANALYSES

RESEARCH AND PROGRAM MANAGEMENT

FISCAL YEAR 1982 ESTIMATES

JET PROPULSION LABORATORY

DESCRIPTION

The Jet Propulsion Laboratory (JPL) is located in Pasadena, California, approximately 20 miles north of downtown Los Angeles. Subsidiary facilities are located at Goldstone, California (tracking and data acquisition), Edwards Air foece 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. 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, 1980 was $401,337,000.

The Jet Propulsion Laboratory is a Government-owned installation of NASA, but it is also an operating division of the California Institute of Technology staffed with regular Caltech employees. Contract NAS7-100 between NASA and Caltech governs research, development, and related activities at the Laboratory, with facilities being provided under a separate facilities contract NAS7-270(F). The entire cost of operating the Laboratory is borne by the Research and Development appropriation, except for the lease or purchase of administrative aircraft and the purchase of passenger motor vehicles, which costs are funded from the Research and Program Management appropriation and are included in the NASA Headquarters budget presentation. Accordingly, the Research and Program Management type costs presented in this Special Analysis for JPL are for purposes of comparison only and are not a part of the NASA Research and Program Management budget.

MISSION

The Jet Propulsion Laboratory has been assigned primary responsibility for the conduct of NASA programs concerned with scientific exploration of the planets and interplanetary space using automated spacecraft.

The Laboratory is also assigned the conduct of selected automated Earth-orbital missions. 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 scientific justification and following with spacecraft design, development, testing, and flight operations.

2. The development and operation of the Deep Space Network which provides tracking and data acquisition services for all NASA projects involving flights of automated spacecraft beyond near-Earth orbits.

3. Continuing programs of scientific investigation and supporting research and technology.

In more specific terms, Laboratory activities in support of NASA can be categorized as follows:

Solar System Exploration - Since the very beginning of the nation's space activities the Jet Propulsion Laboratory has devoted a major part of its effort to exploration of the solar system. The Mariner series of spacecraft was designed and developed by JPL, and the Laboratory has had project management responsibility for all Mariner missions, including the functions of integration, assembly, and testing of the spacecraft. The two most recently completed missions in the Mariner series are those of Mariner 9, which returned scientific data for nearly a year from an orbit around Mars, and Mariner 10, which gathered data in a close flyby of Venus followed by three separate encounters with Mercury.

The Laboratory has been a major participant in the Viking project, carrying out among other assignments the development of the two Orbiters which, with the two Landers, reached Mars during the summer of 1976. The Viking mission operations were repeatedly extended as the spacecraft far out-lived their design lifetimes. Orbiter 2 ceased operations in mid-1978, and Lander 2 in early 1980, but Orbiter 1 remained operational until August 1980 when it finally exhausted its attitude control gas. Lander 1 continues to function in an automatic mission mode and is programmed to transmit data to Earth at intermittant intervals for years into the future, barring an equipment failure.

In the continuing series of planetary missions, the Jet Propulsion Laboratory has management responsibility for the Voyager Jupiter-Saturn missions. Two spacecraft were launched on August 20 and September 5, 1977, during a time period when the relative positions of Jupiter and Saturn were uniquely favorable for the utilization of gravity-assist techniques at Jupiter to shorten flight times to Saturn.

The spacecraft encountered Jupiter in close flybys of the planet and its major satellites on March 5 and July 9, 1979. The closest approach of Voyager 1 to Saturn was on November 12, 1980. Voyager 1 is now on a

cruise trajectory which will take it out-of the solar system at a steep angle to the plane of the ecliptic. The spacecraft is continuing to collect data on the space environment as it proceeds to investigate the outer limits of our solar system. Voyager 2 will not reach Saturn until August 1981. After Voyager 2 encounters Saturn, it will continue on to Uranus. The three planetary encounters to date were extraordinarily successful in obtaining high resolution color photographs and other scientific data. The spacecraft for these missions make maximum use of previous Mariner and Viking Orbiter designs and technology, consistent with the requirements of long-range communications, solar independent power, and the required flight times.

The Jet Propulsion Laboratory also has project management responsibility for the Galileo mission, which was a new project start in FY 1978. This mission is designed to orbit the planet Jupiter and send an instrumented probe into the planet's atmosphere. The atmospheric probe will make direct measurements of physical and chemical properties and will be designed to survive to a considerable depth. The orbiter will have a lifetime in orbit of some 20 months during which it will observe Jupiter and several of its major satellites at close range. JPL is the management center for the total project and will develop the orbiter. The Ames Research Center is responsible for managing the systems contracts involved with the probe development. Galileo is scheduled for launch in 1985, which was a recent slip from 1984 due to Inertial Upper Stage development difficulties.

The Internetional Solar Polar Mission **(ISPM)** is a cooperative effort with the European Space Agency (ESA). JPL has mission management responsibility as well as responsibility for the **U.S.** spacecraft development. ESA has responsibility for the European spacecraft development. The two spacecraft are scheduled to be launched in 1985. The gravitational force of Jupiter will be used to swing the two spacecraft on mirror image courses (North and South) back around the Sun to solar latitudes as high as 80°.

Scientific Satellites - The Laboratory has responsibility for the management of the Infrared Astronomical Satellite (IRAS) project. This project also involves international cooperation with the spacecraft bus being designed and built in the Netherlands. Development activities are in progress, and launch is scheduled for 1982.

The Laboratory also is the project manager for an atmospheric explorer satellite, named the Solar Mesosphere Explorer (SME), which is scheduled for launch in 1981 into a Sun-synchronous polar orbit. The spacecraft module is under contract, and the science instruments are being developed by the Laboratory for Atmospheric and Space Physics at the University of Colorado.

Space Applications - In support of the NASA Space Applications program, JPL is one of the principal Centers for work in oceanographic applications of space technology. The Laboratory also conducts significant activities in upper atmospheric research; in the planning, development, and implementation of remote sensing techniques to observations of the Earth; and in the development of a strong geodynamics research program.

Supporting Research and Technology - The Jet Propulsion Laboratory maintains a strong program of supporting research and advanced technical development designed 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, electronics, information systems technology, and basic research in such fields as fluid physics, polymer materials, and applied mathematics.

Science Program - 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, and earth and ocean physics. These activities involve broad collaboration with the scientific and academic communities and with staff members from other NASA field installations.

Spaceflight Operations - The Jet Propulsion Laboratory is responsible for the design, development, maintenance, and operation of NASA's worldwide Deep Space Network and a Mission Control and Computing Center. Tracking stations are located in California, Spain, and Australia. These facilities provide support not only to JPL-managed flight missions, but also to projects such as Pioneer and Helios managed by other NASA installations and involving flights beyond near-Earth orbits. The Mission Control and Computing Center is located in Pasadena. The JPL is managing the Network Consolidation program which will collocate the residual STDN near Earth tracking stations (after the TDRSS becomes operational and eight STDN stations are closed) with the DSN stations located in California, Spain, and Australia. These consolidated facilities will be managed by JPL and will provide a more efficient, technically advanced and cost effective means of operation by the mid-1980 period.

Distribution of Permanent Positions by Program

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
Direct Positions				
Space Transportation Systems and Operations	5	---	3	4
Space shuttle	3	---	3	4
Space flight operations	2	---	---	---
Space Science	1,137	1,160	1,170	1,199
Physics and astronomy	221	202	244	232
Planetary exploration	888	931	903	940
Life sciences	28	27	23	27
Space and Terrestrial Applications	242	233	238	267
Space applications	231	227	232	266
Technology utilization	11	6	6	1
Aeronautics and Space Technology	279	299	273	283
Aeronautical research and technology	11	5	5	1
Space research and technology	252	265	249	257
Energy technology	16	29	19	25
Space Tracking and Data Systems	409	415	436	432
Tracking and data acquisition	409	415	436	432
Subtotal, direct positions	2,072	2,107	2,120	2,185

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
Direct Support	569	582	589	591
Center Management and Operations Support	1,147	1,110	1,149	1,150
Total, permanent positions	3,788	3,799	3,858	3,926

Summary of Fund Requirements

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
I. Personnel and Related Costs	126,679	126,855	142,750	146,357
II. Travel	5,584	5,572	6,793	8,150
III. Facilities Services	15,091	15,272	18,137	20,896
IV. Technical Services	4,460	3,319	5,007	5,557
V. Management and Operations	8,661	6,850	9,822	11,073
Total, fund requirement	160,475	157,868	182,509	192,033

SIMULATED RESEARCH AND PROGRAM MANAGEMENT BUDGET

EXPLANATION OF CHANGES

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
I. Personnel and Related Costs.....	126,679	126,855	142,750	146,357

The increase from the 1981 budget estimate to the 1981 current estimate is attributable to the cost of pay increases and associated employee benefits. The increase in 1982 is primarily due to a pianned increase of 68 workyears that will be required to support program milestone commitments in 1982.

II. Travel.....	5,584	5,572	6,793	8,150

Travel remains at approximately the same level of effort with increases associated with estimated higher airfares, lodging rates, and rental car costs.

III. Facilities Services.....	15,091	15,272	18,137	20,896

The increases from the 1981 budget estimate to the 1981 current estimate, as well as the increase in the 1982 budget estimate, are required to cover higher rates for utilities and the continuation of upgrading laboratory equipment.

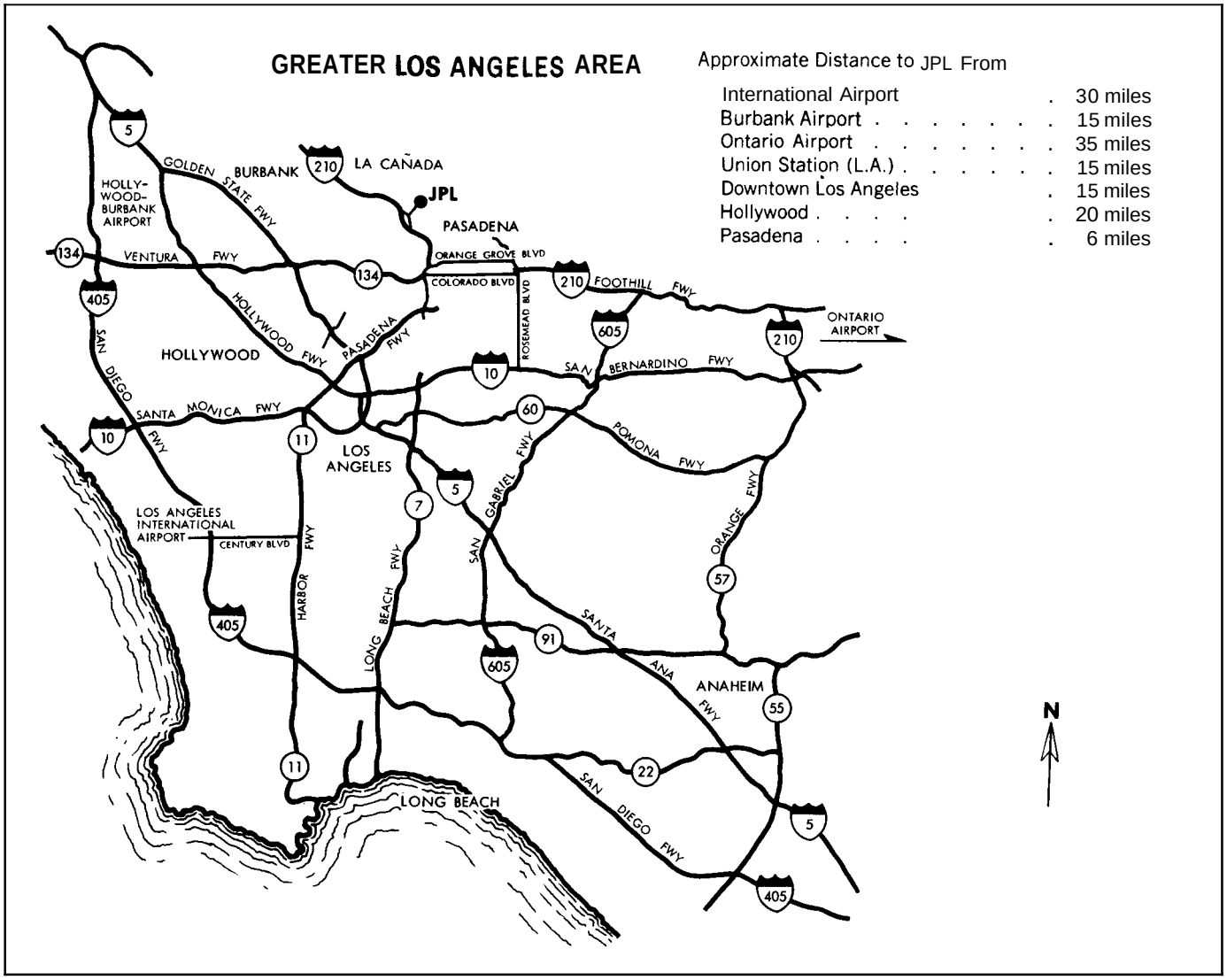
IV. Technical Services.....	4,460	3,319	5,007	5,557

The increase is based on normal inflation anticipated for the same level of services now available.

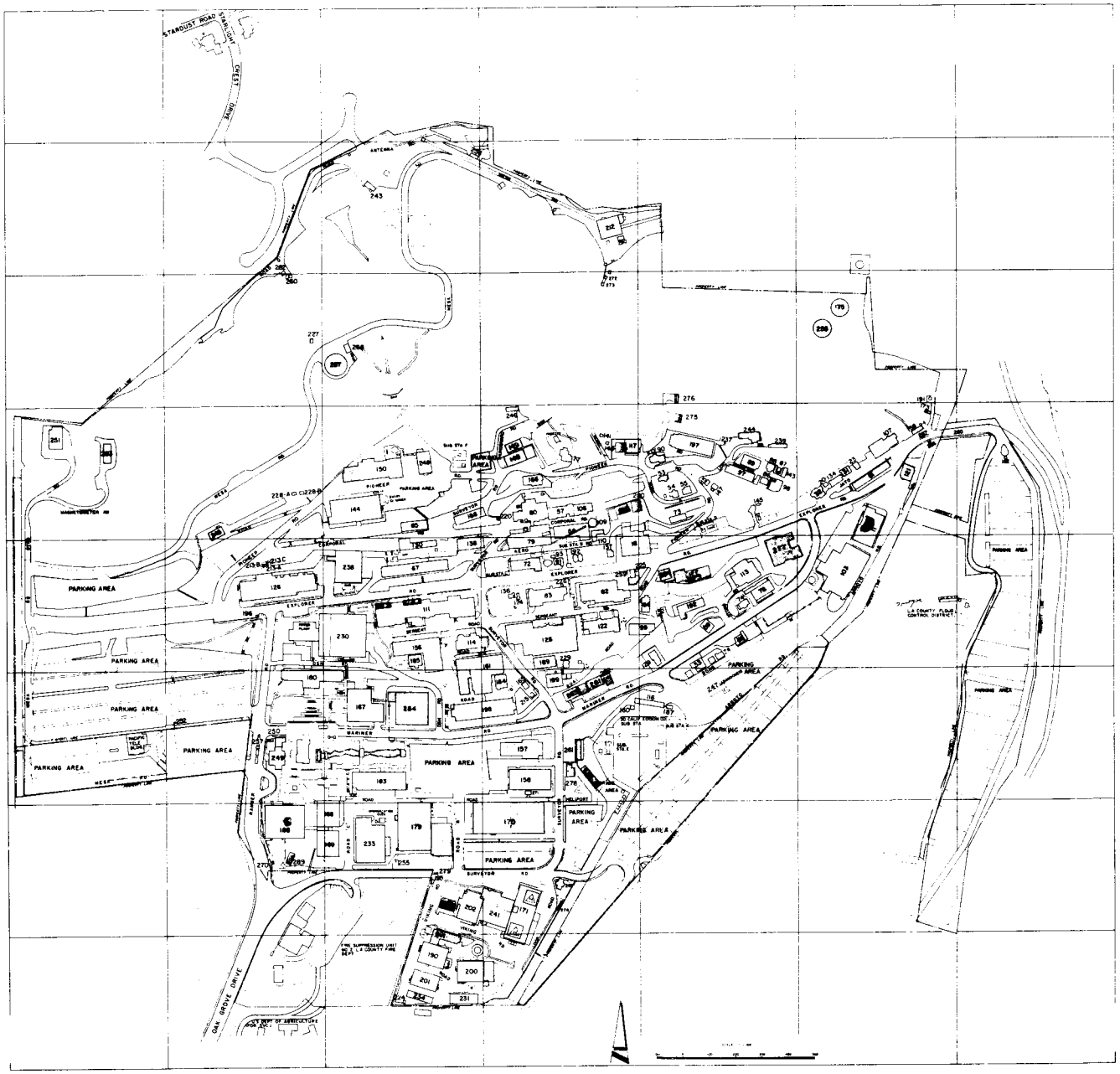
V. Managment and Operations.....	8,661	6,850	9,822	11,073

Rate increases and an increase in communications activity and normal inflation in printing and documentation, transportation and all other administrative services account for the increases in 1981 and 1982.

JET PROPULSION LABORATORY



JET PROPULSION LABORATORY
LOCATION PLAN



JET PROPULSION LABORATORY
LEGEND

Bldg. No.	Title	Location
11	Space Sciences Lob	E-2
13	Offices. Lob & Shop	D-3
18	Structural lest Lob	D-2
20	Shop Test Cell No. 2 (Liq)	D-2
23	Shop Test Cell No. 12 (Liq)	E-2
31	Test Cell (Liq)	E-?
32	Test Cell (Liq)	D-2
33	Test Cell (Liq)	D-3
34	Shop Test Cell No. 33 (Liq)	D-3
35	Mag Flux Tonk Shelter	B-1
41	Hi-Temp Lob	D-3
42	Test Cell (Liq)	D-3
46	Shop Test Cell No. 42 (Liq)	D-3
47	Plant Protection	D-2
53	Conditioning Lob (Solid)	D-3
54	Blending lob (Solid)	D-2
55	Mixing Lab (Solid)	D-2
57	Test Cell (Air Fuel)	C-2
58	Compressor Bldg	C-2
59	Chemistry Lab	D-3
65	Materials Lob	D-3
67	Microbiology Facility	8-2
71	Mechonics Stores	D-2
72	Engineering Offices	C-2
73	Utilities Area Storage	D-2
74	lest Cell (Chemistry)	D-3
77	Soil Science Lob	c-2
78	Hydraulics lob	D-3
79	Wind Tunnel (20 inch)	C-2
BO	Wind Tunnel (21 inch)	C-2
81	Battery Laboratory	E-2
82	Environmental Test Lob	C-2
83	Electronic Ports 6 Engineering	C-2
84	Test Cell 6 Solid Chemistry	D-2
85	Business Systems Office	C-2
86	Oxidizer Grinding (Solid)	D-2
87	Ovens (Solid)	D-2
88	Mixing Lob (Solid)	D-2
89	Processing Lob (Solid)	D-2
90	Shop lest Cell No. 51	D-2
91	Air Dryer (Wind Tunnel)	C-2
92	Cnoling lower (Wind Tunnel)	C-2
93	Vaporizer (Wind Tunnel)	C-2
97	Development Lob & Offices	D-2
98	Preparation Shop (Solid)	D-2
99	Chemistry Lab (Solid)	D-3

Bldg. No.	Title	Location
103	Fabrication Shop	E-3
106	Test Cell (Air Fuel)	C-2
107	Test Cell	E-2
109	Cooling Tower (Wind Tunnel)	C-2
110	Fuel Stor Tank	C-2
111	General Offices Bldg	B-2
114	Cafeteria & Offices	C-3
115	Heoting Plant (Solid)	D-2
116	Propellant Storage Dock	D-3
117	Test Cell (Solid)	D-2
118	Cooling Tower	C-3
120	Cooling Tower	D-2
121	Employment Development Ctr	E-2
122	Eginecring Offices	C-3
125	Combined Electronics	C-3
126	Systems Div Office Bldg	B-2
129	Test Cell (Chemistry)	D-3
130	Engineering Offices	C-2
133	Service Dock	C-2
134	Shop Test Cell	E-2
135	Guord Shelter	A-2
136	Cooling Tower	C-2
137	Cooling Tower	C-2
138	Engineering Offices	C-2
140	Magazine X Temp	c-2
141	Magazine X Temp	C-2
145	Magazine Propellant	D-2
147	Cooling Tower	D-2
148	Energy Conversion Lob	C-2
150	25-fr Space Simulator	8-2
152	Hazardous Chemical Stor	C-3
156	Computer Program Office	B-3
157	Engineering 6 Mechanics Bldg	c-3
158	Material Research Proc Lob	C-3
159	Pump House (Water)	E-2
160	Sewage Lift Station	c-3
161	Telecommunications Lob	C-3
165	Cooling lower	C-3
166	tooling Tower	c-2
167	Cafeteria	B-3
168	Spoce Sciences Instrmft Sys Lob	B-3
169	Engineering Office Bldg	B-3
170	Fabrication Shop	C-3
171	Materials Service Bldg	C-4
173	Test Shelter	E-2
174	Cooling Tower	C-2
175	Water Reservoir	E-2

Bldg No.	Title	Location
177	Transportation Garage	D-2
179	Spacecraft Assy Facility	8-3
180	Central Engineering Bldg	8-3
182	Bus Stop Shelter	E-2
183	Physicol Science Lob	B-3
184	Electronic Stores	C-3
185	Progromrning Office	B-3
186	Space Sciences Div Bldg	A-3
187	Chemical Storage	D-3
188	Engineering Facilities Bldg	C-2
189	Electronics Lab Annex	C-3
190 – 190A	Procurement Offices	8-4
191	Hazardous Test Bay	E-2
192	Propulsion Engineering	D-3
195	Guord Shelter	B-3
196	Guord Shelter	8-2
197	Solid-Propellant Process Lob	D-2
198	Guidance Lob	C-3
199	Celestial Simulotor Bldg	C-3
700	Plant Engineering Services	B-4
201	Carpenter Shop	B-4
202	Procurement Offices	8-4
209	Illuminator Tower	D-1
210	Blaine Track	D-1
212	Antenno Lob	D-1
213	Cooling Tower 'A','B'&'C'	B-2
218	Credit Union	B-3
220	C.R S. Terminal Bldg	C-2
224	Sewer Lift Station	B-4
225	Guord Shelter Mew	C-1
226	Solvent Storage Bldg	C-2
227	Guord Shelter	B-1
228	Cooling Tower (A 6 B)	B-2
229	Shielded Room Bldg	C-3
230	Space Flight Operations Facility	B-2
231	Point Shop	8-4
233	Spocecroft Development Bldg	B-3
234	Lumber Stor Bldg	B-4
237	Cooling Tower	D-2
238	Telecommunications Lab	B-2
239	Low-Temp Solid Prop Mag	D-2
241	Shipping 6 Receiving	B-4
243	Remote Antenno Range Contr	B-1
244	Hi-Temp Stor Mag	D-2
245	Spectroscopy Lab	8-2
246	Soils Test Lob	C-2
248	10-ft Space Simulotor	c-2

Bldg. No	Title	Location
249	Visitor Reception Bldg	B-2
250	Guard Shelter	A-2
251	Gyro Lob	A-2
253	Low-Mag Interference Lob	A-2
255	Sewage Lift Station	B-
256	Model Range Control Bldg	B-1
257	Guord Islond	B-3
258	Water Reservoir	c-2
259	Liquid Nitrogen Bottling Stor	D-2
260	Illuminator Equipment Bldg	B-1
261	Material Storage	C-3
262	Radiometer Bldg	B-1
263	Protective Services Bldg	C-3
264	SFOF Sys Dev Lob	B-3
267	Water Reservoir	B-2
268	Pump House	B-1
269	Grounds Maintenance Bldg	C-4
270	Sewage Metering Station	A-3
271	Oil Barrel Stor	C-3
272	Eost Illuminator Bldg	C-1
273	East Illuminotor Tower	C-1
274	Cooling Tower	C-3
275	Chernicol Stor Prop Bldg	D-2
276	Chemicol Stor Prop Bldg	D-2
277	Isotope Thermoelectric lob	D-2
278	Helicopter Moint Hongor	C-3
279	Guord Islond	8-3
280	Static Test Tower	D-2
281	Fireman / Guord Station	C-3
283	Metal Storage Building	C-3
284	Transportation Office Sldg	D-2
285	Arroyo Bridge	E-2
286	Guord Bldg, Arroyo	E-2
287	Island Guord Bldg	E-2
288	Project Equipment Storage	C-2
	'A' Gote	A-3
	'B' Gote	A-3
	'C' Gate	B-2
	'D' Gote	E-2
	'E' Gate	8-2
	'F' Gote	B-2
	'G' Gotc	A-2

JET PROPULSION LABORATORY

SUMMARY OF AERONAUTICAL RESEARCH AND TECHNOL
OFFICE OF AERONAUTICS AND SPACE TECHNOLOGY

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
	(Millions of Dollars)			
Research and development	308.3	275.3	276.2	323.6
Construction of facilities	62.5	45.3	43.3	42.3
Research and program management	189.0	204.9	208.3	217.4
Total	559.8	525.5	527.8	583.3
Number of direct positions (end of year) associated with aeronautical research and technology	3,745	3,772	3,759	3,762

The objectives of the Aeronautical Research and Technology program are to provide the Nation with the necessary technology for safer, more economical and efficient, and environmentally acceptable air transportation; to maintain a strong U.S. competitive position in the international aviation marketplace; and to support the Department of Defense in maintaining the superiority of U.S. military aircraft.

The 1982 program supports these objectives by stressing the technology areas judged to be the most critical by special assessments, advisory groups, and by industry and other users of technology within and outside the Federal Government. The 1982 activities are designed to maintain a strong research and technology base position in the various technology disciplines. Strength in this fundamental research and technology is essential to the future development of new, improved aeronautical products. Emphasis will be placed on improving aircraft energy efficiency and performance; reducing noise and pollution; improving safety and terminal area operations; and on advancing long-haul and short-haul air transportation concepts. A significant new activity is the Numerical Aerodynamic Simulator which will permit the United States to maintain a superior aerodynamic computational design capability and enhance the evolution of advanced computer technology.

Among the vehicle classes, transport aircraft technology will continue to reduce aircraft noise and emissions, improve terminal area safety and aircraft operations, and evaluate the suitability of broad specification jet fuels for use in current and future commercial jet engines. Major emphasis will be on aircraft energy efficiency technology efforts, including further testing of individual components to validate the technology for use in high-bypass turbofan engines as part of the energy efficient engine program and the evaluation of active control technologies in the energy efficient transport program. Rotorcraft activities will continue to address rotor aerodynamics, structures, avionics, flight dynamics, terminal operations, engines and drive systems and rotor system design with new emphasis in FY 1982 on rotor system design methodology and large-scale testing. General aviation activities will emphasize the reduction of noise and emissions, improved crashworthiness, and an expanded stall/spin data base. In vertical take-off and landing technology, broad based technology for future military and civil aircraft applications will be continued. Supersonic cruise research will place emphasis on the interactions between the airframe and propulsion system, long-life structural tests, aerodynamic performance in all speed regimes and the development and demonstration of critical low-speed technologies unique to variable cycle engines. Also, efforts in the area of high performance aircraft will continue on configuration aerodynamics and flight testing of highly manewerable aircraft technology concepts.

The construction of facilities program for FY 1982 in support of aeronautical research and technology objectives includes modification of the 12-foot pressure wind tunnel at the Ames Research Center, Moffett Field, California; modifications of the enhanced 20-inch supersonic wind tunnel, the Mach 19 nitrogen tunnel and the transonic dynamics tunnel at the Langley Research Center, Hampton, Virginia; and modifications of the high pressure turbine corrosion and thermal fatigue testing facility and of the small engine component testing facility at the Lewis Research Center, Cleveland, Ohio.

The research and program management funding provides for the civil service salaries, travel, electric power for wind tunnel operations, and other general installation costs necessary to conduct the aeronautics program.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

RESEARCH AND DEVELOPMENT

ESTIMATED FY 1982 OBLIGATIONS FOR EQUIPMENT TO BE PLACED AT NASA INSTALLATIONS

Program Budget Line Item	1982 (Thousands of Dollars)
Space Transportation Systems	71,719
Space Shuttle	(46.145)
Space Flight Operations	(25.574)
Expendable Launch Vehicles	(---)
Space Science	5.351
Physics and Astronomy	(4,430)
Planetary Exploration	(770)
Life Sciences	(151)
Space and Terrestrial Applications	4,365
Aeronautics and Space Technology	38.052
Aeronautical Research and Technology	(28.762)
Space Research and Technology	(7,150)
Energy Technology	(2,140)
Tracking and Data Acquisition	33,600
GRAND TOTAL	153,087

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SUMMARY OF MAJOR EQUIPMENT ACQUISITION OBLIGATIONS INCLUDED IN FY 1982 BUDGET

PROGRAM BUDGET LINE ITEM	RECEIVING INSTALLATION, BUILDING LOCATION, AND EAD CONTROL NUMBER	EQUIPMENT DESCRIPTION	PROGRAMMATIC PURPOSE	FY 1982 OBLIGATIONS ($ IN THOUS.)	RELATED FACILITY PROJECT
Space Shuttle	Johnson Space Center Bldg. 35, 72-76-01	Guidance and Navigation (G&N) Simulator	Simulator/computer complex that provides support to STS Ops traffic model.	4,548	
Space Shuttle	Johnson Space Center Bldg. 12, 72-81-03	1108 Replacement Central Computing Facility	Increases capacity to cover current requirements and eliminate reliability problems.	850	
Space Shuttle	Johnson Space Center Bldg. 12, 72-82-33	1100/81 Hardware Lease/ Purchase Central Computing Facility	Augments Central Computing Facility and increases capabilitv to meet user requirements.	1,425	
Space Shuttle	Johnson Space Center Bldg. 30 Admin. Wing, 72-82-04	Software Production Facility	Provides mission reconfiguration of Orbiter onboard software for STS.	2,862	
space Shuttle	Johnson Space Center Bldg. 16, 72-82-05	Shuttle Dynamics Simulator (SDS)	Upgrades present analog computers of the SDS, which supports the SAIL, facility.	295	
Space Shuttle	Johnson Space Center Bldg. 16, 72-82-06	Test Support System (TSS)	Replaces TOC META-4 computers of the TSS, which is a ground data processing system that supports the SAIL facility.	285	
Space Shuttle	Johnson Space Center White Sands Test Facility 300 and 400 Test Areas, 72-82-07	Data Acquisition and Control System	Replaces propulsion test data acquisition and control system computers.	892	

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SUMMARY OF MAJOR EQUIPMENT ACQUISITION OBLIGATIONS INCLUDED IN FY 1982 BUDGET

PROGRAM BUDGET LINE ITEM	RECEIVING INSTALLATION, BUILDING LOCATION, AND EAD CONTROL NUMBER	EQUIPMENT DESCRIPTION	PROGRAMMATIC PURPOSE	FY 1982 OBLIGATIONS ($ IN THOUS.)	RELATED FACILITY PROJECT
Space Shuttle	Kennedy Space Center LCC, LC-39, 76-81-03	Multi-Test/Multi-Flow and Software Production Facility	Supports the mission model reaching 24 missions per year (2 per month)	18,826	
Space Shuttle	Kennedy Space Center SRB Processing/Storage Facility, 76-82-02	SRM Facility Transportation	SRM segment pallets and segment transporter that supports an SRB facility, including transportation of SRM from the facility to the VAB.	782	
Space Shuttle	Kennedy Space Center Pad B, 76-82-03	Operaticnal Television (OTV) System	Launch pad equipment for remote viewing and recording of operations of equipment that is inaccessible or too hazardous for on-the-scene observation.	3,105	
Space Shuttle	Kennedy Space Center MLP, 76-82-04	RTG Cooling Unit	Provides coolant fluid at required rates to Radio-isotope Thermoelectric Generators (RTG's) to be utilized on some payloads.	681	
Space Shuttle	Kennedy Space Center CIF Bldg., 76-82-05	635 Computer Replacement	Supports interactive and batch activation for a variety of engineering and technical user requirements.	4,096	
Space Shuttle	Kennedy Space Center LC-39 Pad B, 76-82-06	Payload Ground Handling Mechanism	Routine removal and replace-ment of payload on pad.	1,588	

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SUMMARY OF MAJOR EQUIPMENT ACQUISITION OBLIGATIONS INCLUDED IN FY 1982 BUDGET

PROGRAM BUDGET LINE ITEM	RECEIVING INSTALLATION, BUILDING LOCATION, AND EAD CONTROL NUMBER	EQUIPMENT DESCRIPTION	PROGRAMMATIC PURPOSE	FY 1982 OBLIGATIONS ($ IN THOUS.)	RELATED FACILITY PROJECT
Space Flight Operations	Johnson Space Center Bldg. 30, 72-77-01	Shuttle Data Processing Complex	Replacement of computers in real-time complex to accommodate Shuttle data handling requirements.	679	
Space Flight Operations	Johnson Space Center Bldg. 30, 72-77-04	Network Interface Processor (NIP)/ Hardware	Interfaces the Orbiter Multi-Rate Data Systems from the STDN/TDRSS network to the Mission Control Center.	385	
Space Flight Operations	Johnson Space Center Bldg. 30, 72-77-05	Master Interface Timing	Provides Central Timing System for the Mission Control Center.	110	
Space Flight Operations	Johnson Space Center Bldg. 30, 72-78-01	Wide Band Recorder/ Switch	Provides capability for switching and recording all data input to the Mission Control Center.	305	
Space Flight Operations	Johnson Space Center Bldg. 30, 72-78-02	Display Control/ Shuttle Data Processing Complex Interface.	Provides information reauired by flight control team and Mission Control Center and network teams.	4,974	
Space Flight Operations	Johnson Space Center Bldg. 30, 72-78-05	Digital Voice	Converts digital voice from onboard Shuttle to normal analog output and converts digital uplinks.	411	
Space Flight Operations	Johnson Space Center Bldg. 30 Admin. Wing, 72-79-05	Flight Planning System III	Increases design capability to 60 flights/year.	450	

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SUMMARY OF MAJOR EQUIPMENT ACQUISITION OBLIGATIONS INCLUDED IN FY 1982 BUDGET

PROGRAM BUDGET LINE ITEM	RECEIVING INSTALLATION, BUILDING LOCATION, AND LAD CONTROL NUMBER	EQUIPMENT DESCRIPTION	PROGRAMMATIC PURPOSE	FY 1982 OBLIGATIONS ($ IN THOUS.)	RELATED FACILITY PROJECT
Space Flight Operations	Johnson Space Center Bldg. 30, 72-79-06	Hard Copy Unit	Provides hard copy of Digital Data Display from the SDPC.	750	
Space Flight Operations	Johnson Space Center Bldg. 30, 72-79-07	Payload Operations Control Center (POCC) Decommutator	Provides capability to process, command, and control parameter's from several payload data streams simultaneously.	100	
Space Flight Operations	Johnson Space Center Bldg. 30, 72-79-08	Wide Band Interface Equipment	Brings independent pavload high rate data streams into the POCC.	2,021	
Space Flight Operations	Johnson Space Center Bldg. 30, 72-79-09	Payload Data Interleaver (PDI) System	Processes and displays digital data from Shuttle PDI.	214	
Space Flight Operations	Johnson Space Center Bldg. 30, 72-79-10	Text and Graphics System	Provides uplink of text and graphics information to the Shuttle.	930	
Space Flight Operations	Johnson Space Center Bldg. 30, 72-81-01	Reconfiguration Data Collection system	Collects reconfiguration data and constructs tables for reconfiguration of Mission Control Center.	464	
Space Flight Operations	Johnson Space Center Bldg. 30, 72-81-02	POCC Display Control	Provides display monitoring capability for experiment systems data.	37	
Space Flight Operations	Johnson Space Center Bldg. 30, 72-81-04	FR 80 Microfiche upgrade	Provides flight control mission and Shuttle Development Lab products.	500	

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SUMMARY OF MAJOR EQUIPMLNT ACQUISITION OBLIGATIONS INCLUDED IN FY 1982 BUDGET

PROGRAM BUDGET LINE ITEM	RECEIVING INSTALLATION, BUILDING LOCATION, AND EAD CONTROL NUMBER	EQUIPMENT DESCRIPTION	PROGRAMMATIC PURPOSE	FY 1982 OBLIGATIONS ($ IN THOUS.)	RELATED FACILITY PKOJECT
Space Flight Operations	Johnson Space Center Bldg. 30, 72-81-05	NASA Encryption	Provides communication security for NASA's Shuttle missions.	630	DOD FY 80 CoF Project 7290 and FY 80 CoF Project 9370.
Space Flight Operations	Johnson Space Center Bldg. 4, 72-82-01	Mission control Center (MCC) Console Training Upgrade.	Training facility for consoles in the MCC.	492	
Space Flight Operations	Johnson Space Center Bldg. 4, 72-82-02	Training Planning System (TPS) and Flight Operations Planning Schedule (FOPS) Computer System.	TPS optimizes the use of crew training facilities; FOPS manages flight operations readiness products.	475	
Space Flight Operations	Kennedy Space Center Operations and Checkout Bldg., 76-82-01	Multi-Mission Support Equipment (MMSE) Second Set.	Transports payloads from payload processing facilities to Orbiter Processing Facility to Pad and return.	2,700	
Space Flight Operations	Marshall Space Flight Center Bldg. 4487, 62-82-02	EAI 8900 Hybrid Computer Replacement (Sys EAI 80)	Replaces existing digital and mainline analog computer portions of the EAI 8900 hybrid computer (EAI 80).	600	
Space Flight Operations	Marshall Space Flight Center Bldg. 4487, 62-82-03	EAI 8900 Hybrid Computer Replacement (Sys EAI 90)	Replaces existing digital and mainline analog computer portions of the EAI 8900 hybrid computer (EAI 90).	49	

NATIONAL. AERONAUTICS AND SPACE ADMINISTRATION

SUMMARY OF MAJOR EQUIPMENT ACQUISITION OBLIGATIONS INCLUDED IN FY 1982 BUDGET

PROGRAM BUDGET LINE ITEM	RECEIVING INSTALLATION, BUILDING LOCATION, AND EAD CONTROL NUMBER	EQUIPMENT DESCRIPTION	PROGRAMHATIC PURPOSE	FY 1982 OBLIGATIONS ($ IN THOUS.)	RELATED FACILITY PROJECT
Physics and Astronomy	Goddard Space Flight Center 51-81-01	Science and Applications Computing Center (SACC) Upgrade	Upgrade to meet the computing requirements of Space Science and Space and Terrestrial Applications programs.	4,425	
Planetary Exploration	Johnson Space Center Bldg. 31, 72-82-09	Ion Microprobe Mass Analyzer	Replacement of ion microprobe in the Planetary and Earth Sciences Division laboratory.	770	
Life Sciences	Johnson Space Center Bldg. 36, 72-80-04	Life Sciences Payloads Science Monitoring Area, Support Data Systems and Display Equipment	Supports the real-time monitoring of Life Sciences Shuttle/Spacelab experiments.	151	
Space Applications	Goddard Space Flight Center Bldg. 22, 51-82-10	Goddard Modeling Activity Advance Computer System	Supplants and extends capability of existing Amdahl 470V/6 computer system.	3,580	
Space Applications	Johnson Space Center Bldq. 17, 72-82-08	Earth Observations Division Laboratory System	Process Landsat data used in the AgRISTARS Program.	785	

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SUMMARY OF MAJOR EQUIPMENT ACQUISITION OBLIGATIONS INCLUDED IN FY 1982 BUDGET

PROGRAM BUDGET LINE ITEM	RECEIVING INSTALLATION, WILDING LOCATION, AND EAD CONTROL NUMBER	EQUIPMENT DESCRIPTION	PROGRAMMATIC PURPOSE	FY 1982 OBLIGATIONS ($ IN THOUS.)	RELATED FACILITY PROJECT
Aeronautical Research and Technology	Dryden Flight Research Center, Bldg. 4838, 24-82-01	Central Computer Replacement	Replaces current computer equipment with an interactive computer system that includes peripherals, terminals and processor.	500	
Aeronautical Research and Technology	Dryden Flight Research Center, Bldg. 4820, 24-82-02	Refurbishment and upgrading the Thermal and Mechanical Loads Control System	Replaces obsolete system that performs thermal and mechanical load tests on aircraft and components of aircraft.	1,700	
Aeronautical Research and Technology	Dryden Flight Research Center, Bldg. 4801, 24-82-03	Simulation and RPRV Computer System	Updates simulation and augmentation systems for remote piloted research vehicles.	3,250	Funding also supported by OSTS.
Aeronautical Research and Technology	Lewis Research Center Bldg. 5, 22-82-01	Two spot LDV system, W-8	Measures detailed internal measurement flow within centrifugal blade rows.	250	
Aeronautical Research and Technology	Lewis Research Center Bldg. 5, 22-82-02	Fast Fourmier Transform Equipment, W-7	Provides analysis of unsteady flow phenomenon within compressor blading.	250	
Aeronautical Research and Technology	Lewis Research Center Bldg. 49, 22-82-03	Scanning Transmission Electron Microscope (Stem)	Provides higher voltage for higher resolution using thicker materials.	300	

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SUMMARY OF MAJOR EQUIPMENT ACQUISITION OBLIGATIONS INCLUDED IN FY 1982 BUDGET

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Aeronautical Research and Technology	Lewis Research Center Bldq. 106, 22-82-04	Portable High Pressure Mass Spectrometer Sampler	Determines combustion products present in burner rigs.	300	
Aeronautical Research and Technology	Lewis Research Center Icing Tunnel, 22-82-05	Icing Research Tunnel Force Balance System	Measures aerodynamic characteristics of-aircraft wings and tails subiected to atmospheric icing.	300	
Aeronautical Research and Technology	Lewis Research Center 9x15 Wind Tunnel, 22-82-06	9x15 Force Balance System	Measures forces of thrust, lift, and moment on engine nacelles for V/STOL.	700	
Tracking and Data Acquisition	Goddard Space Flight Center, Bldg. 14, 51-82-01	Space Telescope Operations Control Center Data System	Required to conduct the real-time operation of the Space Telescope Observatory with planned mission life of 17 years. The data system will require new space area of 5,000 square feet.	7,400	Space available.
Tracking and Data Acquisition	Goddard Space Flight Center, Bldg. 14, 51-82-02	POCC Pilot Model (POCCNET). This acquisition is the continuation of the design and procurement of several mini/midi computers and peripherals to be used as a nucleus for the new POCCNET pilot model POCC. The pilot model will demonstrate the concept of distributed processing, virtual peripherals common software, shared resources and computer networking.	Required to support the mission control workload in the 1980's and beyond in order to meet quick turnaround, increased support requirements and to minimize the develop-ment and recurring costs associated with each new mission. The POCCNET concept is envisioned as very cost effective in the TDRSS/STS/Spacelab/MMS era.	2,100	Space available

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SUMMARY OF MAJOR EQUIPMENT ACQUISITION OBLIGATIONS INCLUDED IN FY 1982 BUDGET

PROGRAM BUDGET LINE ITEM	RECEIVING INSTALLATION, BUILDING LOCATION, AND EAD CONTROL NUMBER	EQUIPMENT DESCRIPTION	PROGRAMMATIC PURPOSE	FY 1982 OBLIGATIONS ($ IN THOUS.)	RELATED FACILITY PROJECT
Tracking and Data Acquisition	Goddard Space Flight Center, Bldg. 23, 51-82-03	Computers, video, audio analog, high density recorders, and time code converters needed to capture data up to 50 MBPS peak rate for Spacelab missions.	Equipment is to build the Input Processing System to capture, quality check, and pre-process Spacelab data.	3,500	
Tracking and Data Acquisition	Goddard Space Flight Center, Bldg. 23, 51-82-04	Univac 1100/82 computer to replace the aging and unreliable Univac 1108 machine.	To edit, time correct, generate fill data, decomm science data and produce experimenter data tapes for free flyer spacecraft. Also to serve as the output processor for Spacelab data processing.	2,100	
Tracking and Data Acquisition	Goddard Space Flight Center, Bldg. 14, 51-82-05	Mission Operations Computing Facility (MOCF). Required to replace obsolete Flight Dynamics System (FDS).	Provides mission analysis and attitude computing capability to GSFC's POCC's as required.	3,400	Space available.
Tracking and Data Acquisition	Goddard Space Flight Center, Bldg. 14, 51-82-06	Mission Operations Computing Facility (MOCF). Required to replace the obsolete Command Management Systems (CMS).	Provides on-board management support computing capability to GSFC's POCC's as required.	1,900	Space available.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SUMMARY OF MAJOR EQUIPMENT ACQUISITION OBLIGATIONS INCLUDED IN FY 1982 BUDGET

PROGRAM BUDGET LINE ITEM	RECEIVING INSTALLATION, BUILDING LOCATION, AND EAD CONTROL NUMBER	EQUIPMENT DESCRIPTION	PROGRAMMATIC PURPOSE	FY 1982 OBLIGATIONS ($ IN THOUS.)	RELATED FACILITY PROJECT
Tracking and Data Acquisition	Goddard Space Flight Center, Bldg. 14, 51-82-07	Mission Operations Computing Facility (MOCF). Required to replace obsolete Orbit computing system (OCS).	Provides mission operations orbit support computing capability to GSFC's projects.	3,300	Space available.
Tracking and Data Acquisition	Goddard Space Flight Center, Bldg. 14, 51-82-08	Mission Operations Computing Facility (MOCF) general purpose system support.	Provides management tools and aids and MOCF security.	1,900	Space available.
Tracking and Data Acquisition	Goddard Space Flight Center, Bldg. 23, 51-82-09	Computer and special data capture equipment.	Provides institutional capability to handle packetized data from free flyer spacecraft.	4,700	Space available.
Tracking and Data Acquisition	Wallops Flight Center, 53-82-01	Impact Prediction System - Computer with peripherals.	Provide real-time impact prediction of sounding rockets launched from WFC.	3,300	Space available.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1982 ESTIMATES

Y OF CONSULTING SERVICES ESTIMATES

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
	(Thousands of Dollars)			
Research and Program Management				
Consultants Employed by NASA	628	600	510	653
Contractual Services	409	552	500	550
Subtotal, R&PM Funds	1,037	1,152	1,010	1,203
Research and Development				
Contractual Services	2,666	3,781	3,640	4,404
Total, NASA	3,703	4,933	4,650	5,607

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. The management controls established 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 and the major programmatic areas requiring these services are as follows:

RESEARCH AND PROGRAM MANAGEMENT

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
Consultants Employed by NASA.....	628	600	510	653

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 outsiders, in addition to NASA civil service personnel, provides the agency with an independent view that assures that selections represent those 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.

Consultant Services.....	409	552	500	550

NASA contracts with consulting firms for studies of functional processes on a selected basis. In FY 1982 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.....	2,666	3,781	3,640	4,404
Future Program Evaluation.....				2,739

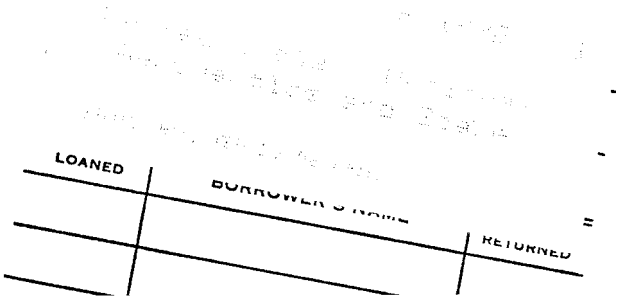
In consonance with its legislative charter, NASA seeks to use the advice from many sources in the private sector on what would be the most productive future programs to assure that before any program or project is presented to the President or the Congress for approval, the widest review of that programmatic thrust is available. In FY 1982, the majority of the funds will be used to support analyses conducted by the National Academy of Sciences in the Space Sciences, Space and Terrestrial Applications, and Aeronautics and Space Technology program areas.

	1980 Actual	1981 Budget Estimate	1981 Current Estimate	1982 Budget Estimate
		(Thousands of Dollars)		
Studies of Future Operational Modes				1,340

These funds will continue the contractual support of two major studies of the organizational structure for the transition to future operational modes: STS operations beyond DDT&E, and Tracking and Data Acquisition operations with TDRSS. The changes in each of these areas will represent major departures from the way we have been doing business in the launch vehicle and tracking functions. The consulting services contracts provide independent evaluation of various options.

Other Consulting Studies				325

From time to time the use of outside consultant firms provides a valuable input to decision making. These studies are in the area of management structure, and program evaluation and effectiveness. The specific studies are not defined in advance, but are approved based on demonstrated need.



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