



National Aeronautics and
Space Administration

Budget Estimates

Fiscal Year 1997

Volume II

Mission Support

Inspector General

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FY 1997 CONGRESSIONAL BUDGET

MISSION SUPPORT
INSPECTOR GENERAL

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

MISSION SUPPORT

FISCAL YEAR 1997 ESTIMATES

GENERAL STATEMENT

The Mission Support appropriation provides funding for NASA's civil service workforce, space communication services, safety and quality assurance activities, and for facilities construction activities to preserve NASA's core infrastructure. These objectives are accomplished through the following elements:

Safety, Reliability and Quality Assurance: This includes funding for programs to assure the safety and quality of NASA missions, through the development, implementation and oversight of Agencywide safety, reliability, maintainability and quality assurance policies and procedures.

Space Communication Services: This includes funding for the operation of the tracking, telemetry, command, data acquisition, and communications and data processing activities that are required by all NASA projects. This includes the Tracking and Data Relay Satellite System (TDRSS), and the telecommunications system which provides for real time transmission of data, video and voice information between and among NASA installations.

Research and Program Management: This includes funding for the salaries, benefits, travel requirements and other support of the civil service workforce, and the necessary funding for all of NASA's administrative functions in support of research in NASA's field centers.

Construction of Facilities: This includes funding for the repair, rehabilitation, modification and construction of the institutional facilities, the environmental compliance and restoration program, and the advanced planning of facilities and design of future facilities.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
MISSION SUPPORT
FISCAL YEAR 1997 BUDGET ESTIMATES
(MILLIONS OF DOLLARS)

	<u>1995</u>	<u>BUDGET PLAN</u> <u>1996</u>	<u>1997</u>
MISSION SUPPORT	2,548.3	2,502.2	2,562.2
SAFETY, RELIABILITY AND QUALITY ASSURANCE	38.7	37.6	36.7
SPACE COMMUNICATION SERVICES	225.0	269.4	291.4
RESEARCH AND PROGRAM MANAGEMENT	2,149.6	2,052.8	2,078.8
CONSTRUCTION OF FACILITIES	135.0	142.4	155.3

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

PROPOSED APPROPRIATION LANGUAGE

MISSION SUPPORT

For necessary expenses, not otherwise provided for, in carrying out mission support for human space flight programs and science, aeronautical, and technology programs, including research operations and support; space communications activities including operations, production and services; maintenance; construction of facilities including repair, rehabilitation, and modification of facilities, minor construction of new facilities and additions to existing facilities, facility planning and design, environmental compliance and restoration, and acquisition or condemnation of real property, as authorized by law; program management; personnel and related costs, including uniforms or allowances therefor, as authorized by 5 U.S.C. 5901-5902; travel expenses; purchase, lease charter, maintenance, and operation of mission and administrative aircraft; not to exceed \$35,000 for official reception and representation expenses; and purchase (not to exceed 33 for replacement only) and hire of passenger motor vehicles; \$2,562,200,000, to remain available until September 30, 1998.

Note.—A regular 1996 appropriation for this account had not been enacted at the time this budget was prepared. The 1996 amounts included in this budget are based on the levels provided in three continuing resolutions: P.L. 104-91, P.L. 104-92, and P.L. 104-99.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
MISSION SUPPORT
REIMBURSABLE SUMMARY
IN MILLIONS OF REAL YEAR DOLLARS

(MILLIONS OF DOLLARS)

	<u>1995</u>	<u>BUDGET PLAN</u> <u>1996</u>	<u>1997</u>
MISSION SUPPORT	94.0	124.9	141.1
SAFETY, RELIABILITY AND QUALITY ASSURANCE	1.2	1.0	1.2
SPACE COMMUNICATION SERVICES	44.9	61.9	69.5
RESEARCH AND PROGRAM MANAGEMENT	46.5	60.2	68.6
CONSTRUCTION OF FACILITIES	1.4	1.8	1.8

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1997 ESTIMATES

DISTRIBUTION OF MISSION SUPPORT BY INSTALLATION

(Thousands of Dollars)

Program	Total	Johnson Space Center	Kennedy Space Center	Marshall Space Flight Center	Stennis Space Center	Ames Research Center	Dryden Flight Research Center	Langley Research Center	Lewis Research Center	Goddard Space Flight Center	Jet Propulsion Lab	Headquarters	
Safety, Reliability and Quality Assurance	1995	38,700	5,473	1,014	2,247	415	475	225	1,485	3,625	5,985	5,164	12,592
	1996	37,600	5,460	931	1,642	545	5,205	300	1,296	4,098	5,185	6,773	6,165
	1997	36,700	4,690	1,531	2,392	435	4,835	500	1,891	4,388	5,555	6,603	3,880
Space Communication Services	1995	225,000	0	0	65,100	0	0	0	0	500	149,600	6,100	3,700
	1996	269,400	0	0	49,600	0	0	0	0	3,200	206,000	6,900	3,700
	1997	291,400	0	17,900	43,600	0	0	0	0	0	220,200	7,100	2,600
Research and Program Management	1995	2,149,600	360,400	245,200	287,700	31,100	164,700	37,900	217,300	207,900	324,400	0	273,000
	1996	2,052,800	348,100	234,500	278,100	30,600	156,900	37,700	197,800	197,200	305,800	0	266,100
	1997	2,078,800	341,400	231,700	286,400	30,200	160,700	47,200	207,800	197,000	319,800	0	256,600
Construction of Facilities	1995	114,275	10,150	11,150	23,675	4,280	9,800	11,210	9,020	9,650	14,430	10,910	0
	1996	120,930	13,355	13,100	17,140	7,400	11,830	3,320	8,545	19,265	13,675	13,300	0
	1997	128,455	14,000	8,200	20,500	4,600	9,270	12,740	7,215	16,630	20,300	15,000	0
Undistributed and Various locations	1995	10,725											
	1996	11,470											
	1997	8,145											
Facility Planning and Design	1995	10,000											
	1996	10,000											
	1997	18,700											
Total Construction of Facilities	1995	135,000											
	1996	142,400											
	1997	155,300											
TOTAL MISSION SUPPORT	1995	2,548,300	376,023	257,364	378,722	35,795	174,975	49,335	227,805	221,675	494,415	22,174	289,292
	1996	2,502,200	366,915	248,531	346,482	38,545	173,935	41,320	207,641	223,763	530,660	26,973	275,965
	1997	2,562,200	360,090	259,331	352,892	35,235	174,805	60,440	216,906	218,018	565,855	28,703	263,080

MISSION SUPPORT
FISCAL YEAR 1997 ESTIMATES
BUDGET SUMMARY

OFFICE OF SAFETY AND MISSION ASSURANCE
OFFICE OF THE CHIEF ENGINEER

SAFETY, RELIABILITY, MAINTAINABILITY, AND
QUALITY ASSURANCE

SUMMARY OF RESOURCES REQUIREMENTS

	<u>FY 1995</u>	<u>FY 1996</u> (Thousands of Dollars)	<u>FY 1997</u>
Policy, oversight, and standards.....	15,878	15,430	14,700
Quality management	9,080	9,790	9,700
Software independent verification and validation.....	7,821	6,880	6,800
Engineering	<u>5,921</u>	<u>5,500</u>	<u>5,500</u>
Total.....	<u>38,700</u>	<u>37,600</u>	<u>36,700</u>
 <u>Distribution of Program Amount by Installation</u>			
Johnson Space Center.....	5,473	5,460	4,690
Kennedy Space Center.....	1,014	931	1,531
Marshall Space Flight Center	2,247	1,642	2,392
Stennis Space Center	415	545	435
Ames Research Center.....	475	5,205	4,835
Dryden Flight Research Center	225	300	500
Langley Research Center	1,485	1,296	1,891
Lewis Research Center	3,625	4,098	4,388
Goddard Space Flight Center	5,985	5,185	5,555
Jet Propulsion Laboratory	5,164	6,773	6,603
Headquarters.....	<u>12,592</u>	<u>6,165</u>	<u>3,880</u>
Total.....	<u>38,700</u>	<u>37,600</u>	<u>36,700</u>

MISSION SUPPORT

FISCAL YEAR 1997 ESTIMATES

OFFICE OF SAFETY AND MISSION ASSURANCE **OFFICE OF THE CHIEF ENGINEER**

SAFETY, RELIABILITY, MAINTAINABILITY, AND **QUALITY ASSURANCE**

PROGRAM GOALS

NASA's Safety, Reliability, Maintainability, and Quality Assurance (SRM&QA) program invests in the safety and success of all NASA programs. The program performs independent oversight that contributes to program safety and success throughout the Agency and develops and promulgates necessary NASA-wide safety and risk management policies, standards, and guidelines. Up-front quality management activities focus on reducing costs and improving safety and reliability and include the development and application of SRM&QA tools to support "better, faster, cheaper" programs. Software Independent Verification and Validation (IV&V) activities include the implementation of NASA's software assurance improvement program, the development of IV&V tools and techniques, and oversight for the performance of IV&V to assure critical flight, ground control, and robotics system software.

This program element also provides for the coordination of engineering support to NASA programs through development of NASA-wide engineering policy and standards, integration of advanced engineering methods in NASA practice, and validation of selected technologies critical to program success.

STRATEGY FOR ACHIEVING GOALS

NASA's Office of Safety and Mission Assurance (OSMA) provides leadership in promoting and ensuring the safety, innovation, and quality of all NASA programs. This work is performed in three programmatic areas. These are Policy, Oversight, and Standards; Quality Management; and IV&V. Targeted initiatives in each of these areas are intended to facilitate the ability of NASA's strategic enterprises to accomplish their goals in a safe and efficient manner.

The Office of the Chief Engineer (OCE) provides a focus for NASA's engineering function through oversight of practice and improvement of capabilities.

The Policy, Oversight, and Standards program activities include studies and investigations to formulate NASA safety and mission assurance policy; as well as safety oversight and flight readiness assessments for NASA programs. Documentation and analysis of NASA experience in the SRM&QA disciplines, mishap investigations, and NASA emergency preparedness help improve the safety and risk management practices of NASA programs. Guidance to the Agency's SRM&QA organizations for the conduct of self-assessments is used to augment OSMA's oversight role and enhance the implementation of SRM&QA policies. Compliance with the Occupational Safety and Health Act is supported and monitored. NASA is progressing with its transition to the international standard for quality, ISO 9000, in concert with the Department of Defense (DoD) and other Federal agencies. Support for NASA's

performance based contracting approach is provided through the NASA Engineering and Quality Audit (NEQA) program and the Advance Quality Practices program.

The focus of the Quality Management program is to support the introduction of tailored safety, reliability, and quality requirements into aeronautics and space flight systems design and manufacture in the early stages of a program. This approach is expected to result in decreased life cycle costs in NASA programs by reducing or eliminating costly redesign of systems in the latter stages of development and test. The Quality Management program provides direct assurance support to NASA robotics, aeronautics, and expendable launch vehicle programs. Studies of optimized quality assurance surveillance for Space Transportation System (STS) processing are also performed. Studies are conducted of risk factors in specific flight programs; the effectiveness of qualification test methods; and non-destructive evaluation techniques. Improved qualification methods for electrical, electronic, and electro-mechanical (EEE) parts as well as qualification of advanced EEE parts and packaging technologies for use by NASA flight programs are supported. New focus will be given to qualification of parts manufacturing processes rather than the previous focus on auditing parts quality.

NASA's software assurance program is managed through NASA's Software IV&V facility located in Fairmont, West Virginia. The program supports the development of software assurance standards, practices, and technology for evaluation of flight system, mission control, and science data processing systems software. This initiative is expected to result in enhanced performance and reliability of increasingly complex and critical software used throughout NASA facilities and systems.

The Engineering program in the OCE provides engineering oversight to the Administrator through independent evaluation of engineering technical and policy issues; identification and resolution of engineering issues is coordinated through the NASA Engineering Management Council. The OCE is responsible for development of NASA engineering standards and guidelines, and promotes increased use of industry, national, and international standards to enhance the inter-operability and reduce the cost of aerospace systems. Initiatives to improve engineering practices in systems engineering, structural analysis, and test methods will increase the reliability and effectiveness of NASA programs. Validation of critical technologies, such as space batteries, focuses on demonstrating potential for improved performance and reliability of aerospace systems.

NASA also coordinates with various external groups and agencies, such as by providing funds to the Air Force Composite Pressure Vessel Standards to develop a joint standard which meets NASA and DoD needs (at greatly reduced cost to NASA), and supporting the Federal Emergency Management Agency in emergency preparedness and response initiatives. Innovative packaging techniques for electronic systems are jointly supported by Industry, NASA, and the Advanced Research Projects Agency (ARPA). NASA also participates in the Government Industry Data Exchange Program (GIDEP), a Government-wide initiative. Japan's National Space Development Agency (NASDA) and NASA are co-funding studies and experiments on the explosive equivalence of large-quantity H₂/O₂ mixtures; and NASA, NASDA, and the European, Canadian, and Russian Space Agencies participate in an international SRM&QA working group focusing on safety, quality assurance, and electronic parts. NASA also participates in the Interagency Nuclear Safety Review Panel for issues related to NASA's use of nuclear systems, as in the case of the Cassini mission.

NASA co-chairs the Government/Industry Quality Liaison Panel (GIQLP) with the DoD. The GIQLP consists of 13 government agencies and three industry associations (Electronic Industries Association, Aerospace Industries Association, and National

Security Industrial Association). This activity demonstrates a strong partnership between government and industry, innovative approaches, cost savings, and improved efficiencies.

Through the Engineering program, NASA supports joint efforts with the Department of the Air Force for development and qualification of space batteries; with the Federal Aviation Administration for adaptation of NASA fracture control methodology to aging aircraft assessment; and with the Departments of Commerce, Defense and Energy in development and application of international product data exchange standards. NASA is also cooperating with a variety of national standards organizations to accelerate the replacement of Government standards with "voluntary" or national consensus standards; and, through the American National Standards Institute and the American Institute for Aeronautics and Astronautics, supports the development of international standards for the design, analysis, qualification, and improved interoperability of space systems.

MEASURES OF PERFORMANCE

Mishap Prevention (OSMA)

This program contributes to reducing the number of accidents at NASA facilities and the resulting loss in productivity.

Independent Assessments,
Oversight, and Reviews (OSMA)

These activities contribute to the safety and success of NASA missions by ensuring that programs have resolved all technical issues prior to flight. Also, the adequacy of NASA SRM&QA and Engineering capabilities is evaluated and independent assessment of critical NASA issues is performed.

Engineering Standards and
Practices (OCE)

These activities increase commonality and interoperability of NASA aerospace systems with both industry and internal practice.

Safety and Quality Specifications and
Standards (OSMA)

These activities will replace NASA specifications and standards, wherever possible, with U.S. industrial and international standards. Emphasis will be given to voluntary compliance and adoption of ISO 9000, the international standard of quality. These activities will reduce the cost of procuring flight and ground systems for NASA use.

Technology Evaluation (OCE)

These programs evaluate the reliability and advance the introduction of maturing technologies to improve program performance through the conduct of ground and flight demonstrations.

EEE Parts and Packaging (OSMA)

This program qualifies advanced parts and packaging technologies in order to reduce the size, weight, and power requirements of spaceflight systems; and documents EEE parts in the form of parts selection databases to facilitate the use of the most reliable components available.

Non-destructive evaluation
(NDE) Technologies (OSMA)

This program develops and certifies improved NDE methods for use in aerospace manufacturing. Manufacturing and test costs are reduced through elimination of tear downs, scrappage, and replacement that results from destructive testing.

Quality Management (OMSA)

Application of SRM&QA procedures early in the process allows NASA to conduct programs "better, faster, and cheaper."

ACCOMPLISHMENTS AND PLANS

In FY 1995, NASA continued to emphasize a strong contributing SRM&QA presence within current and future flight projects. Seven Space Shuttle missions were supported, including the historic Space Shuttle/Mir rendezvous and docking missions. SRM&QA policies, standards, and guidelines were developed and/or revised to provide clear and useful instruction, increasing safety and quality in such areas as management of major system programs and projects, risk assessment and management, operational safety for wind tunnels, fire protection in high bay areas, payload safety, and software safety. Orbital debris research and analysis was conducted to establish risk mitigation and debris reduction procedures. In mishap prevention, NASA has achieved the second lowest rate of incidents among Federal Agencies. NASA participated extensively with the Federal Emergency Management Agency in planning and executing "Response '95," the largest peacetime emergency preparedness exercise ever accomplished. NASA developed an international agreement with Japan to explore explosives characteristics for hydrogen and oxygen propellant explosions tests. The work done under this agreement will result in further understanding and better definition of safety requirements for protecting against these types of explosions. International Space Station (ISS) Independent Assessment (IA) provided 33 formal assessments to the program, resulting in technical and management improvements in such areas as end-of-life disposal, microgravity reliability, supportability/availability for microgravity, integrated test and verification planning, and configuration and risk management processes. Also, the ISS IA software independent verification and validation has found, and helped the program correct, several critical flight software issues ranging from requirements to integrated scheduling. The implementation of ISO 9000 as NASA's standard for quality management systems and the inauguration of the NASA Engineering and Quality Audit (NEQA) and Advance Quality Concepts programs established the framework to improve the way NASA does business with its industry partners. NASA continued its leadership of the GIQLP. Conservative estimates indicate that approximately \$1.5 billion will be saved through the panel's initiatives, which include advocating a single quality system within a contractor's facility which satisfies multiple government customers, promoting and implementing advanced quality practices, and streamlining government oversight activities. In December 1995, the GIQLP was awarded the National Performance Review "Silver Hammer" Award for its accomplishments.

Safety and mission assurance guidance and practices were integrated up-front into NASA's aeronautics and New Millennium space flight programs. New SRM&QA tools, such as the hand-held fire detection cameras and the Spacecraft Test Effectiveness program, and improved EEE parts qualification set the stage for further reduced costs with improved safety and reliability in NASA's flight vehicles and payloads. The NASA-wide safety, reliability, maintainability and quality assurance installation self-assessments and Headquarters spot checks continued to serve as effective assessment tools, with NASA conducting nine Center functional self-assessment reviews, seven independent spot checks and staff reviews at the NASA Centers; and an operational safety review of NASA Headquarters. NASA placed additional emphasis on safety training and professional development, and NASA's cost of quality workshops for program and system managers continued to provide value-added, practical tools for improving performance while reducing costs.

NASA's software assurance and software IV&V efforts included a comprehensive assessment of software for ISS Interim Design Review, software assessments for Space Shuttle flights and wind tunnel control systems, and the evaluation of EOSDIS IV&V tools for use in software validation for ISS. The NASA Software IV&V Facility in Fairmont, WV, established its expertise in Software IV&V and was selected to become the NASA Center of Excellence for Software IV&V.

In 1995, the OCE led special evaluations of the capabilities of current and planned EVA systems and of the Life Science Facilities planned for Space Station; the OCE actively participated in zero-basing of NASA facilities, in evaluating readiness for flight of the Tether Satellite and the Pegasus Launch Vehicle, and a NASA Advisory Council Task Force for assessing International Space Station Phase 1 mission readiness. Task team studies of engineering standards and the design review process provided specific guidance for improvement of these activities.

NASA-wide standards for structural factors of safety, load determination, vibroacoustic test, ground support equipment design, and overall spacecraft test requirements were completed in FY 1995 and will be issued in FY 1996 as the first steps in a major effort to increase the commonality of engineering practice across NASA. Commonality of materials and processes practice across the Agency was increased by implementation of a control policy for materials and processes in major systems, consolidation of standards for cleaning, welding and some commonly used materials, and establishment of a World Wide Web "homepages" to improve technical interchange.

Technology verification testing of advanced Ni-Cd and Ni-H₂ battery cells continued to support future spacecraft, and battery test data on Ni-Cd and Ni-H₂ cell designs has been incorporated into a data base available to users. Simulation of on-orbit power systems operation was successfully demonstrated in the NASA battery testbed, and a joint assessment of Russian Ag-Zn cells with the Navy resulted in modifications to domestic cells.

The flight demonstration of laser initiated ordinance successfully demonstrated their suitability for separation systems and flight termination of launch vehicles; these new pyrotechnic systems provide increased safety and reliability of critical flight systems for aerospace applications.

Software engineering process guidebooks and metrics issued in FY 1995 will enable more consistent application of proven methods to future software developments. In 1995, responsibility for software engineering programs was consolidated with software assurance programs under the OSMA.

In FY 1996, the program will continue to assure appropriate oversight of NASA programs, develop and revise SRM&QA directives, standards, and processes, and support the transition of certain critical technologies from testbed to program use. Independent assessment of NASA's Space Shuttle and ISS programs will ensure that performance goals and schedule milestones are met with acceptable levels of safety. Safety training and professional development will continue to be emphasized to promote the development, institutionalization, and improvement in SRM&QA skills and knowledge throughout NASA. Standards for software safety and for handling, use, and storage of liquid oxygen will be published. Studies of orbital debris generation and mitigation will continue. Lessons learned and preferred maintenance practices, risk analysis methods, and safety and assurance processes and practices will be developed, evaluated, and applied. ISO 9000 implementation and the NEQA process will be assessed to measure the impact of these approaches on program quality and cost.

Up-front quality management practices will continue to be integrated in NASA's programs, increasing safety and reliability and reducing costs. The Advanced Quality Concepts program will support NASA's performance-based contracting efforts by providing techniques to incorporate quality up-front in programs. NASA's test effectiveness program will continue integrating the orbital performance and reliability experience of prior spacecraft with new design processes and improved telemetry to achieve higher performance and reliability, faster, and at reduced cost. Requirements tailoring will assure that SRM&QA is given proper consideration in NASA programs. New SRM&QA tools, techniques, and processes will be developed and applied, including an electronic miniaturization program to meet small spacecraft requirements; the certification of an optically stimulated electron emission system for detecting surface contamination on solid rocket motors; an automated orbiter window inspection system to map defects (the prototype of which has significantly reduced inspection cost and time); and the development of ultrasonic non-destructive evaluation to assess the integrity and performance of composite materials. The EEE Parts and Packaging program will be restructured to provide for substantial improvements in the selection tools for electronic parts, enabling NASA programs to select the most reliable parts available. Mechanical parts selection tools will also be improved.

In FY 1996, research and demonstration of software assurance techniques for selected programs will be performed. These initiatives will explore software criticality assessment, requirements traceability, and verification process methods. The IV&V on critical software systems and support of NASA's Software IV&V Facility, which hosts several tenant NASA programs, will continue.

Designation of a Lead Center for management of engineering standards programs will accelerate consolidation of engineering standards in FY 1996, supported by augmentation of a NASA-wide Engineering Standards Data Base to better support selection, development and management of standards, and expanded support and adoption of national and international standards. The NASA Materials Selection Data Base will be upgraded to improve configuration control of data and develop missing information in critical areas. Guidelines will be issued for determination of dynamic test requirements and design of space mechanisms.

Flight of a space qualified, medium performance, fiber-optic gyroscope, delayed by scheduling to FY 1996, will complete demonstration of the capabilities of this technology to improve system performance and reliability. Test programs to determine the

possible pyrotechnic and propulsion system failures of the Mars Observer will be completed to evaluate potential causes and define design and test requirements to avoid similar failures in the future. An initial assessment of the impact of alternate cleaners (replacing ozone depleting compounds) on precision mechanical systems will be completed. Applied technology programs will be phased down in FY 1996 to a level consistent with supporting validation of Program Office initiatives.

Battery testbed simulation of on orbit power operations for the Compton Gamma Ray Observatory (CGRO), Upper Atmosphere Research Satellite (UARS), and the Ocean Topography Experiment (TOPEX) batteries will help to optimize flight battery management operations for these missions; guidelines for design and procurement of Ni-Cd and Ni-H₂ batteries will be developed. A new Lithium-ion technology initiative will support safety and reliability assessments for New Millennium. Testing will begin in a joint NASA/Air Force program for verification of advanced technology for secondary battery cells.

In FY 1997, oversight for NASA's seven planned Space Shuttle flights will be conducted. The independent assessment of Space Station will continue to evaluate the program's technical health and capability to safely achieve its program objectives. NASA will publish a standard for the handling, storage, and use of liquid hydrogen and a safety process for Expendable Launch Vehicle payloads will be published. Significant lessons learned and reliability and test best practices will be collected and distributed throughout NASA. Risk management and assessment techniques will be developed, refined, and applied. Reliability-centered maintenance techniques and processes, an orbital debris hazard and risk mitigation process, and hydrogen fire detection and smoke movement modeling for high bays will be established. NASA, government, and private sector education and training courses will be identified and integrated into NASA's SRM&QA training and professional development curriculum. New courses will be initiated to cover gaps or advancing technology. Advanced quality concepts will allow routine use of private sector best practices, principles, and metrics to achieve comparable or improved safety, reliability, and quality at less cost. ISO 9000 will be fully integrated as NASA's baseline standard for quality management systems and NEQA will be regularly employed.

Mission assurance support for New Millennium and related spacecraft and aeronautics programs such as High Speed Research Transport and Advanced Subsonics will continue. Processes will be in place to develop appropriate SRM&QA requirements tailored to cost, schedule, and risk. Emphasis will be placed on test effectiveness and correlating SRM&QA requirements with flight performance to provide real-time evaluation and feedback to the specific programs. Effective test programs will be conducted, incorporating test histories, flight performance, and flight results. Advanced EEE parts and packaging techniques will be employed to develop qualification and test methods for fiber optics, micro-electromechanical systems, micro actuators, and sensors that determine quality and reliability issues. The space radiation effects program will determine microelectronic parts radiation tolerance.

Software IV&V activity will be transitioned to a larger software validation role for the Agency in order to assure flight, ground control, and robotics system software. Research initiatives in verification and validation techniques, tools, and training development will be conducted. Verification and validation best practices will be identified and applied to mission critical software projects.

In 1997, continued consolidation of NASA standards and adoption of national and international standards will provide the basis for designation of NASA-wide preferred standards and practices to lower program cost by increasing commonality with industry and commercial practices.

Structural integrity programs will add fatigue and environmental effects analysis capability to the NASA fracture benchmark methodology, and a Space Shuttle flight demonstration will complete validation of force limited test techniques designed to significantly reduce ground testing damage to spacecraft. Completion of initial pilot projects using international Product Data Exchange Standard applications will determine their readiness and potential for vastly improving integration of design, development, and operational data for space programs.

The battery program will continue stress test and mission simulation of flight lot battery cells and begin evaluation of Ni-MH (Nickel-Metal Hydride) battery technologies to improve battery reliability for future programs. Lithium-ion battery testing will expand to determine the range of potential applications. Development of a stress test for Ni-H₂ cells will provide a capability of evaluating flight quality of cell designs.

**MISSION SUPPORT
FISCAL YEAR 1997 ESTIMATES
BUDGET SUMMARY**

OFFICE OF SPACE COMMUNICATIONS

SPACE COMMUNICATIONS SERVICES

SUMMARY OF RESOURCES REQUIREMENTS

	<u>FY 1995</u>	<u>FY 1996</u> (Thousands of Dollars)	<u>FY 1997</u>	<u>Page Number</u>
Space network.....	110,100	156,700	185,100	MS 2-4
Telecommunications	<u>114,900</u>	<u>112,700</u>	<u>106,300</u>	MS 2-9
Total.....	<u>225,000</u>	<u>269,400</u>	<u>291,400</u>	
 <u>Distribution of Program Amount by Installation</u>				
Kennedy Space Center.....	--	--	17,900	
Marshall Space Flight Center	65,100	49,600	43,600	
Lewis Research Center	500	3,200	--	
Goddard Space Flight Center	149,600	206,000	220,200	
Jet Propulsion Laboratory	6,100	6,900	7,100	
Headquarters.....	<u>3,700</u>	<u>3,700</u>	<u>2,600</u>	
Total	<u>225,000</u>	<u>269,400</u>	<u>291,400</u>	

MISSION SUPPORT

FISCAL YEAR 1997 ESTIMATES

OFFICE OF SPACE COMMUNICATIONS

SPACE COMMUNICATIONS SERVICES

PROGRAM GOALS

To enable the activities of the NASA strategic enterprises by providing telecommunications systems and services. Reliable electronic communications are essential to the success of every NASA flight mission, from interplanetary spacecraft to the Space Shuttle to aeronautical flight tests.

NASA's Office of Space Communications (OSC) manages the provision of telecommunications services needed to ensure the goals of NASA's exploration, science, and research and development programs are met, that they are met cost-effectively; and that mission operations and planning are performed in an integrated and standardized way. The OSC is committed to seeking and encouraging commercialization of NASA telecommunications capabilities and to participate with NASA's strategic enterprises in collaborative interagency, international, and commercial endeavors. As NASA's agent for operational communications and associated information handling services, the OSC exploits opportunities for more cost-effective telecommunication solutions, by optimizing design of mission systems using common tools and shared resources to advance national economic interests.

STRATEGY FOR ACHIEVING GOALS

The range of telecommunications systems and services provided by NASA's Space Communications program is necessarily very broad. Capabilities are provided to conduct mission operations, enable tracking, telemetry, and command of spacecraft and sub-orbital aeronautical and balloon research flights. Additionally, services and systems are provided to facilitate data capture, data processing, and data delivery for scientific analysis. In addition, the program provides the high speed computer networking, voice and video conferencing, fax, and electronic mail services necessary to administer NASA programs.

These strategic communications functions are provided through the use of space and ground-based antennas and network systems, mission control facilities, computational facilities to determine spacecraft orbit and attitude, command management systems to validate spacecraft commands, data capture and telemetry processing systems, and a myriad of leased interconnecting communications systems ranging from phone lines and satellite links to optical fibers. The program also provides telecommunications scheduling, network management and engineering, pre-flight communications test and verification, as well as flight system maneuver planning and analysis for selected missions. NASA's flight programs are supported through the study and coordination of data standards and communication frequencies to be used in the future.

The Space Communications program provides command, tracking and telemetry data services between the ground facilities and flight mission vehicles and all the interconnecting telecommunications services to link tracking and data acquisition network

facilities, mission control facilities, data capture and processing facilities, industry and university research and laboratory facilities, and the investigating scientists.

The program provides integrated solutions to operational communications and information management needs common to all NASA strategic enterprises and the programs formulated to execute them. The OSC is responsible for development of cost-effective communications architectures and end to end communications systems. The OSC provides integrated value-added data processing systems, applies data standards to future systems, and reduces costs through economies of scale and standardization. The program also provides the necessary research and development to adapt emerging technologies to NASA communications needs for future flight programs. New coding and modulation techniques, antenna and transponder development, and automation applications are investigated and, based on merit, demonstrated for application to future communications needs. These are all parts of the strategic approach to providing the vital communications services and systems common to all NASA programs.

Some NASA missions have unique telecommunications requirements. Specialized systems are provided to cope with these unique communications needs. The Deep Space Network (DSN) provides the super-sensitive receivers and large antennas required to communicate with the low-power transceiver spacecraft flying in the outer reaches of the solar system. The Space Network's Tracking and Data Relay Satellites (TDRS) can provide communications as required with low Earth-orbital spacecraft that provide science data, such as multi-spectral imaging of the Earth and the stars. Small, transportable systems have been developed to support sub-orbital atmospheric research rocket flights and balloon launches in remote locations where no communications support infrastructure exists. When possible, requirements are met by using commercially available leased systems and services.

Many science or exploration goals require inter-agency or international cooperation in order to be achieved. NASA's Space Communications assets are often provided through collaborative agreement to other U.S. government agencies and commercial space enterprises and international cooperative programs.

The Space Communications Services program, one part of NASA's Space Communications program, provides the nearly continuous, high data rate capabilities of the Space Network to compatible Earth orbital and selected sub-orbital missions. Services provided include tracking, spacecraft command, spacecraft health and safety monitoring, and science telemetry data acquisition. The program also provides the NASA-wide telecommunications network services to support all of NASA's operational, and administrative communications needs.

The modernization of the original White Sands Ground Terminal, Cacique, will be completed this year, and returned to operational service. With its twin, Danzante (Second TDRS Ground Terminal), these ground terminals will provide fail-safe operations of the Space Network and its TDRS spacecraft. The Space Network provides communications for the Space Transportation System, the Hubble Space Telescope astronomical observatory, and many other NASA missions. The development of the Replenishment Tracking and Data Relay Satellites is on-going. The Telecommunications program will consolidate all NASA wide area network systems in FY 1997, providing integrated services for operational and administrative communication needs at reduced costs.

Planning is underway to consolidate and streamline major support contract services in order to optimize space operations. In FY 1996, as an interim measure, a voluntary contractor partnership is envisioned between the major incumbents, AlliedSignal Technical Services Corporation and Computer Sciences Corporation. A new contract is required in FY 1998. At that time, transition to a performance-based Consolidated Space Operations Contract (CSOC) will be completed.

BASIS OF FY 1997 FUNDING REQUIREMENT

SPACE NETWORK

	<u>FY 1995</u>	<u>FY 1996</u> (Thousands of Dollars)	<u>FY 1997</u>
Space network services	13,200	6,300	5,100
Second TDRSS ground terminal.....	18,600	--	--
TDRS replacement spacecraft.....	17,200	--	--
TDRS replacement - launch services.....	15,600	--	--
TDRS replenishment spacecraft	45,000	147,200	162,100
TDRS replenishment - launch services	<u>500</u>	<u>3,200</u>	<u>17,900</u>
 Total.....	 <u>110,100</u>	 <u>156,700</u>	 <u>185,100</u>

PROGRAM GOALS

To provide reliable, cost-effective space-based tracking, command and data acquisition telecommunications services to the Human Space Flight program, other low-Earth orbital science missions including observatory-class flights, and selected sub-orbital flight missions. The Space Network program provides for the implementation, maintenance, and operation of the communications systems and facilities necessary to ensure and sustain the high quality performance of NASA flight systems, including spacecraft health and safety functions. Launch systems required to deploy the Tracking and Data Relay Satellites are also included in this program.

The Space Network program supports NASA's programs in collaborative interagency, international, and commercial enterprises; and independently provides support to other national and commercial space-faring enterprises on a reimbursable basis.

STRATEGY FOR ACHIEVING GOALS

NASA's Space Network is comprised of a constellation of geosynchronous TDRS and associated dual ground terminals located in White Sands, New Mexico. The current TDRS constellation consist of two fully operational satellites in service (TDRS-4 & 5), two

fully functional satellites stored on-orbit (TDRS-6 & 7), and a single partially functional spacecraft (TDRS-3) positioned over the Indian Ocean to increase data return from the Compton Gamma Ray Observatory (CGRO). The CGRO experienced problems with its tape recorder subsystem, requiring a remote ground terminal and dedicated data relay satellite to complete its scientific mission. A remote terminal in Australia is used to operate the TDRS-3. The TDRS-3 capability will also be used to support Shuttle MIR operations. TDRS-1 has been retired from active service due to loss of performance pending evaluation of any remaining service capability.

The Goddard Space Flight Center manages the Space Network program, including the TDRS Replenishment Spacecraft program, and the modification and/or system replacement of the ground facilities and equipment as necessary to sustain network operations for current and future missions. AlliedSignal Technical Services Corporation is the prime contractor for providing the maintenance and operations of the ground terminal facilities and orbital operations of the spacecraft. Computer Sciences Corporation provides engineering and test support. The development of Danzante, the Second TDRSS Ground Terminal (STGT), and the modification and modernization of the original ground station, Cacique, is being performed by Lockheed Martin Corporation. Hughes Space and Communications Company is the prime contractor for the development of the TDRS Replenishment Spacecraft.

The Space Network provides communication services at data rates up to 300 MBPS using its Ku-band single access services, data rates of up to three MBPS using its S-band single access services, and a low rate service of up to 50 KBPS through its multiple access service. Customer satellites are provided with command, tracking, and telemetry services via the TDRS spacecraft which relay commands and science data back to the ground terminals. The ground terminals are interconnected with flight control, data capture and processing facilities responsible for mission operations.

Communications services are provided to non-NASA customers on a reimbursable basis. A large share of the Space Network Services program that provides for the operations and maintenance of the ground terminal complex is funded with the receipts from reimbursable services. This reimbursable revenue is anticipated to continue and is taken into account in the FY 1997 budget request.

Space Network services provide the primary communications for orbital operations of the Space Transportation System and its attached payloads. Services are also provided to automated Earth-orbital missions which have communications systems compatible with the TDRS, and can provide nearly continuous, high data rate services. The Space Network will provide communication services for the International Space Station (ISS), including, on an as agreed basis, the needs of the international partners. Agreements are in place with Japan, the European Space Agency, and Canada. Negotiations are continuing with the Russian Space Agency as a participant for potential cooperative endeavors in telecommunications.

In addition to the day-to-day operations of the Space Network satellites and ground terminals, the program provides for the replenishment of the satellite assets. The Replenishment Spacecraft program will provide three TDRS spacecraft under a fixed price, commercial practices contract. The contract was awarded to the Hughes Space and Communications Company in February 1995. However, initiation of development was not commenced until July when a protest of the award was resolved by the General Accounting Office. The development is now under way with the first spacecraft launch readiness scheduled for the third quarter of

CY 1999. The program provides for spacecraft compatibility modifications of the ground facilities. The STGT development has been completed and it has been the operational terminal for the Network since March 1995. The original ground terminal, Cacique, is currently out of service while undergoing modernization conforming to the Danzante equipment design. Cacique is scheduled to return to service in May 1996.

MEASURES OF PERFORMANCE

	<u>FY 1995</u>		<u>FY 1996</u>		<u>FY 1997</u>
	<u>Plan</u>	<u>Actual</u>	<u>Plan</u>	<u>Current</u>	<u>Plan</u>
Number of hours of network service	26,500	24,900	26,900	26,200	26,400

TDRS Replacement Spacecraft

Complete Single Access Antenna Installation
 Plan: December 1994
 Accomplished: December 1994

This final step in assembly of major appendages allowed final integration and testing to begin prior to shipment of the spacecraft to Kennedy Space Center.

TDRS-7 Deployment by the STS/Interim Upper Stage (IUS)
 Plan: June 1995
 Accomplished: August 1995

Deployment was followed by on-orbit checkout and characterization testing. Spacecraft goes into storage in 1996. All TDRS assets are now on-orbit. The launch slip was due to a Shuttle readiness delay.

Second TDRS Ground Terminal

On Time Switch Over
 Plan: December 1994
 Accomplished: December 1994

STGT was declared the primary operational facility of TDRSS, allowing the level of operational support provided by that facility to grow to normal operational workloads.

Danzante becomes fully operational
 Plan: February 1995
 Accomplished: March 1995

Following a period of dual operations, Danzante assumed the full operations load and Cacique was removed from service for modernization. This was accomplished slightly behind schedule with no impact to the completing of Cacique modernization.

Complete White Sands Ground Terminal (WSGT) Level 6 Testing
 Plan: March 1996
 Accomplished: February 1996

Completion of end-to-end systems-level testing allowed the WSGT to be returned to service slightly ahead of schedule and the original goal of the STGT development program, to ensure fail-safe TDRSS operations, to be met.

Cacique returned to service
 Plan: May 1996
 Current: May 1996

The original ground terminal, Cacique, returns to fully functional service, meeting the original goal of the fail safe ground terminal operations.

TDRS Replenishment Spacecraft

Contract Award

Plan: February 1995
Accomplished: February 1995

Early design activities began in April 1995. The contract was awarded on schedule, but initiation of activity delayed due to a protest, which was resolved by GAO in July 1995.

Preliminary Design Review

Plan: August 1995 (Preliminary)
Current: July 1996

Verification that the proposed contractor design will meet NASA performance requirements. This was rephased due to the delay in contract initiation as a result of the protest.

Critical Design Review

Plan: March 1995 (Preliminary)
Current: January 1997

Verification that the development contractor is prepared to develop, including manufacture, assembly, integrate, and test, the TDRS spacecraft. This was rephased due to the delay in contract initiation as a result of the protest.

Start TDRS-H Integration and Test

Current: May 1997

Start of spacecraft assembly, electrical, environmental, and performance testing. The process begins with spacecraft and payload module level integration and test, and culminates with spacecraft level assembly and test.

Complete TDRS-H Integration and Test

Plan: December 1998 (Preliminary)
Current: January 1999

Completion of spacecraft performance and environmental tests allows final assembly and retesting to begin prior to shipment for launch. This was rephased due to the delay in contract initiation as a result of the protest.

Launch TDRS-H

Plan: 1 Qtr 1999
Current: 3 Qtr 1999

Launch within four years of contract award will be performed, ensuring the continuity of TDRSS services to user space flight systems. Launch of TDRS-I and TDRS-J is scheduled for 2002 and 2003 following the launch of the first TDRS Replenishment Spacecraft.

ACCOMPLISHMENTS AND PLANS

During FY 1995, the TDRS Replacement Spacecraft (TDRS-7) completed preparations and was launched in August 1995. The spacecraft has successfully completed its test program and will be placed in on-orbit storage in early 1996. In addition, Danzante is fully operational and has been the operational terminal for the network since March 1995. The original ground terminal, Cacique, has been out of service to undergo modernization. An agreement was signed with the U.S.A.F. to provide launch support to all Titan Centaur missions through 2001; Titan Centaur becomes the first expendable launch vehicle to receive Space Network communications support. Negotiations are underway with Lockheed Martin Corporation to provide launch support to commercial Atlas vehicles. The TDRS Replenishment Spacecraft program was awarded to Hughes Space and Communications Company in

February 1995 following the resolution by GAO of a protest. Contract negotiations resulted in a firm fixed price, commercial practices contract, to provide three data relay satellites in order to assure continuing network operations into the twenty-first century. The first launch availability is scheduled for the 3rd Qtr 1999.

In an effort to maximize the benefits of the firm fixed price contract, the Administration is proposing up-front funding for this acquisition in FY 1997. Up-front funding should also enhance any potential future opportunities to privatize or commercialize various elements of TDRSS.

During FY 1996, the development of the Replenishment Spacecraft will continue with the preliminary design review scheduled for July 1996. Also during FY 1996, the original ground terminal at White Sands, Caciue, will complete its refurbishment and be returned to service. When Caciue rejoins its twin, Danzante, in day-to-day operations, the network will no longer have a single point of failure. In addition, the ground terminal complex will have sufficient capability to continue to operate partially failed TDRS spacecraft. The previous limitation was the lack of ground capacity to operate more than three satellites. Operation of partial spacecraft will assure Space Network capability until the first replenishment spacecraft is available, by combining residual operating services from several satellites with partial failures to emulate service from a fully capable spacecraft. Both the TDRS Replacement Spacecraft and the Second TDRSS Ground Terminal programs will be completed within the total funding limitations established in response to the FY 1992 Appropriations Conference Report.

In FY 1997, the Space Network is required to operate 24 hours per day, 7 days per week, providing data relay services to a multitude of flight missions. These missions include seven planned Space Shuttle flights and their attached payloads, observatory class spacecraft in low-Earth orbit such as Hubble Space Telescope and the Compton Gamma Ray Observatory, as well as other compatible missions such as Ocean Topography Experiment, Extreme Ultraviolet Explorer, Department of Defense customers, the X-ray Timing Explorer, the Starlink research aircraft, and the Long Duration Balloon Program. The Space Network will also be the primary communications system for future flight programs such as the ISS, Tropical Rainfall Measurement Mission, and the Earth Observation System AM-1 mission.

BASIS OF FY 1997 FUNDING REQUIREMENT

TELECOMMUNICATIONS

	<u>FY 1995</u>	<u>FY 1996</u> (Thousands of Dollars)	<u>FY 1997</u>
Telecommunications	114,900	112,700	106,300

PROGRAM GOALS

To provide reliable, cost-effective telecommunications systems and services for mission control, science data handling, and program administration for NASA programs. The Telecommunications program provides for the implementation, maintenance, and operation of the telecommunications circuits, control centers, switching systems, and other equipment necessary to provide an integrated approach to NASA communication requirements.

The Telecommunications program supports NASA's programs in collaborative interagency, international, and commercial enterprises; many collaborative arrangements are performed on a reimbursable basis.

STRATEGY FOR ACHIEVING GOALS

NASA's Telecommunications program is a nationwide system of leased voice, video, data, and wide-band terrestrial and satellite circuits; control centers, switching centers, network equipment, and other communications devices. International telecommunications links are also provided to NASA's Deep Space Network (DSN) sites in Australia and Spain; Spaceflight Tracking and Data Network (STDN) sites outside the Continental U.S.; and to common telecommunications exchange points that provide interconnectivity to NASA international partners. Administrative, scientific, and mission control exchanges among NASA and its industrial and scientific partners are supported by NASA's telecommunications networks and systems. Support and participation by other U. S. agencies, universities, and research centers; and by other space-faring nations are also facilitated, including the provision of secure circuits, systems, and facilities. Domestic telecommunications circuits are leased by NASA under the FTS-2000 contract managed by the General Services Administration (GSA); international circuits are leased under separate contractual arrangements. NASA's telecommunications program maintains cooperative networking agreements for exchanging services with the European Space Agency (ESA), Canada, Japan, France, and Russia. The Computer Sciences Corporation and AlliedSignal Technical Services Corporation provide engineering and operations support for the telecommunications networks.

Currently, NASA telecommunications services are provided by two separate networks; these are the NASA Communications Network (NASCOM), managed by the Goddard Space Flight Center, and the Program Support Communications Network (PSCN),

managed by the Marshall Space Flight Center. A major NASCOM sub-switching center for overseas communications services is located at the Jet Propulsion Laboratory. Each network provides a unique set of services to all NASA Centers and to other users. NASCOM interconnects all NASA installations, including spacecraft mission control facilities, tracking and data acquisition networks, launch sites, NASA data processing centers, and scientific investigators whose support is critical to mission control and command. Command, telemetry, and voice systems are provided for NASA mission control activities. NASA aeronautical test sites and preflight verification of NASA spacecraft systems and their interconnectivity with NASA communications systems are also supported by NASCOM.

The PSCN interconnects NASA installations and national and international aerospace contractors, laboratories, scientific investigators, educational institutions, and other Government installations in support of the administration, science data exchange, and other research and analysis type activities. The PSCN provides voice and video teleconferencing, broadcast television, computer networking services as well as data handling and transfer services.

NASA's Telecommunications program provides for the improvement, operation and maintenance of NASA network systems and facilities. Telecommunications network systems include digital voice; data and video switching equipment; audio and video conferencing and bridging systems; wide band multiplexing equipment; and sophisticated network management, monitoring and fault isolation systems. Equipment and facilities of NASA Select Television are also provided by the Telecommunications program.

The Marshall Space Flight Center is conducting a pilot program to demonstrate the use of Asynchronous Transfer Mode (ATM) telecommunications switching technology for management of wide band networks; this advanced technology allows for sharing of leased circuits among NASA users. It promises to enhance the integration of NASA telecommunications requirements, providing for additional economies-of-scale, enhanced reliability through circuit diversity at reduced cost, optimization of NASA utilization of leased circuit bandwidths, and more rapid universal application of common data standards for NASA systems. The consolidation of the transmission infrastructure of the NASA telecommunications networks will incorporate this technology.

MEASURES OF PERFORMANCE

	<u>FY 1995</u>		<u>FY 1996</u>		<u>FY 1997</u>
	<u>Plan</u>	<u>Actual</u>	<u>Plan</u>	<u>Current</u>	<u>Plan</u>
Number of end user spacecraft contacts using NASCOM	87,300	87,300	96,000	96,000	105,600
Number of locations connected by PSCN	500	425	520	430	470
Number of electronic conferences supported by PSCN	2,230	2,580	2,450	2,800	3,080

The number of additional locations connected by PSCN was down due to streamlining and reductions in the program.

ACCOMPLISHMENTS AND PLANS

In FY 1995, telecommunications services and systems were provided to support all NASA operational flight systems. Services were also provided for all administrative, programmatic, and technical information exchanges required for pre-flight systems; and NASA transmission of data to NASA-supported scientists and researchers. NASCOM circuits were added to support new missions and increased requirements of ongoing missions. The missions include POLAR, international RADARSAT, Near Earth Asteroid Rendezvous (NEAR), Mars Global Surveyor and United States Microgravity Laboratory (USML-2). In addition, the PSCN was extended to new university and contractor locations in support of the scientific missions. The network backbone capacity was also increased for the aeronautics supercomputer program and the ISS development.

Also, in FY 1995 NASA extended networking services into Russia to meet the requirements of the ISS and other collaborative flight and scientific missions. This network implementation represented the first step toward a single network that satisfies both operational and programmatic requirements. Specifically, multiple wide band circuits were implemented between the U.S. and a NASA network gateway in Moscow. Connectivity was then established between the gateway and approximately 10 locations in Russia. These locations include the U.S. Embassy, the Russian Space Agency, Moscow Mission Control Center, Gagarin Cosmonaut Training Center, and the Institute of Space Research. Voice, data, video conferencing, and electronic mail services are available to customers at all locations.

The Asynchronous Transfer Mode (ATM) pilot began in FY 1995 requiring procurement of hardware and circuits for demonstration of the new switching technology at seven NASA sites. Network operations using representative telecommunications traffic loads will continue until all technical and operational issues have been addressed.

In FY 1996, NASA will develop and finalize a plan for the complete consolidation of wide area networking within the Agency. Initially, the target networks are the PSCN and NASCOM, which are the largest networks in scope and cost. Smaller program specific subnetworks will be incorporated as appropriate. It has been determined that network consolidation offers economies of scale, increased efficiency without affecting quality of service to the customers. Implementation of the consolidation will begin in late FY 1996 where feasible and will be completed in FY 1997.

During the consolidation planning activity in FY 1996, the NASCOM and PSCN networks will continue to operate as separate entities providing ongoing services to their customer base. NASCOM will add circuits for Cassini, X-ray Timing Explorer (XTE), and SOHO. The PSCN will establish connectivity and provide network services to Kiev, Ukraine. The services will support international telemedicine activities and scientific data exchange.

MISSION SUPPORT

FY 1997 ESTIMATES

RESEARCH AND PROGRAM MANAGEMENT

PROGRAM GOALS

To acquire and maintain a civil service workforce and infrastructure which reflects the cultural diversity of the Nation and is sized and skilled consistent with accomplishing NASA's research, development, and operational missions with innovation, excellence, and efficiency.

STRATEGY FOR ACHIEVING GOALS

The Research and Program Management (R&PM) program provides the salaries, other personnel and related costs, travel and the necessary support for all of NASA's administrative functions and other basic services in support of research and development activities at NASA Installations. This civil service workforce is the underpinning for the successful accomplishment of the Nation's civil aeronautics and space programs. These are the people who plan the programs; conduct and oversee the research; select and monitor the contractors; manage the various research, development, and test activities; and oversee all of NASA's operations. The salaries and benefits of this workforce comprise approximately 78% of the requested funding. Administrative and other support is 20% of the request. The remaining 2% of the request is required to fund travel necessary to manage NASA and its programs and provide the training and other supporting costs for NASA personnel.

ACCOMPLISHMENTS AND PLANS

Once again NASA exceeded all the Presidential and Congressional goals established for downsizing its workforce. Through the implementation of hiring constraints, an aggressive redeployment of Headquarters personnel and a second successful use of the Voluntary Separation Incentive Program (Buyout), NASA has reached the Workforce Restructuring Act goals established for FY 1997 by the end of FY 1995. Civilian employment has been reduced by more than 3,000 or 13% since 1993. The number of employees in Grade 14 and above positions has declined by 840 or 11% since 1993.

The Agency has also successfully met the goals established as part of the National Performance Review:

- The supervisory span of control has gone from 1:5 in FY 1993 to 1:8 in FY 1995.
- Targeted administrative staffs have declined more than 13% from FY 1993 levels.
- Headquarters employment has been reduced by more than 400 or 20% from FY 1993.

The focus of FY 1996 and FY 1997 activities are to assure the effective and efficient distribution/redistribution of a diverse and sufficiently trained post-buyout workforce to meet the highly specialized demands of NASA's research, development, and operational programs and activities in concert with National Performance Review (NPR) streamlining guidance and direction.

The FY 1997 budget estimate of \$2,078.8 million represents a continuation of the aggressive downsizing NASA has undertaken since 1993 and reflects the reduction associated with the buyout and Zero-Based Workforce Review. It also represents an increase of \$26.0 million over the FY 1996 budget plan of \$2,052.8 million. This request funds 21,030 full-time equivalents (FTEs), a reduction of 525 below the expected FY 1996 level and 1,134 below the FY 1995 actuals. Of the increase: \$7.0 million is for the full-year cost of the FY 1996 pay raises; \$30.0 million represents the cost of pay raises anticipated for January 1997; \$12.0 million is due to rising costs of health care and the increased share of government payments for the Federal Employees Retirement System; \$22.0 million to cover the costs of "normal" promotions, military detailee increases, employee transfers from Center to Center, increased workers compensation costs, lump sum, and security investigations. These increases are offset by savings of \$25.1 million associated with the reduction of 525 FTE and \$19.9 million due to overall belt tightening in the Research Operations Support Account. This request does not include costs associated with pay increases greater than 2.4% in January 1996 and 3.1% for January 1997.

In summary, the FY 1997 budget requirement of \$2,078,800,000 is to provide for 21,030 FTE civil service workyears in order to support the activities at nine NASA Installations and Headquarters.

The following describes, in detail, the cost elements within this program.

I. Personnel and Related 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 portion of this functional category.
- b. Other Than Full-Time Permanent Positions: This category includes the salaries of NASA's non-permanent workforce. Programs such as Presidential Management Interns, students participating in cooperative training, summer employment, youth opportunity, and temporary clerical support are covered in this category.
- c. Reimbursable Detailees: In accordance with existing agreements, NASA reimburses the parent Federal organization for the salaries and related costs of persons detailed to NASA.

- d. Overtime and Other Compensation: Overtime, holiday, post and night differential, and hazardous duty pay are included in this category. Also included are incentive awards for outstanding achievement and superior performance.
 2. Benefits: In addition to compensation, NASA, as authorized and required by law, makes the employer's contribution to personnel benefits. These benefits include contributions to the Civil Service Retirement Fund, the Federal Employees Retirement System, employees' life and health insurance, payments to the Medicare fund for permanent employees, and social security contributions. Payments to the civil service retirement fund for re-employed annuitants and severance pay to former employees involuntarily separated through no fault of their own are also included.
- B. Supporting Costs
1. Transfer of Personnel: Provided under this category are relocation costs required by law, such as the expenses of selling and buying a home, subsistence expenses, and the movement and storage of household goods.
 2. Investigative Services: The Office of Personnel Management is reimbursed for activities such as security investigations of new hires and revalidation of sensitive position clearances, recruitment advertising, and Federal wage system surveys.
 3. Personnel Training: Training is provided within the framework of the Government Employees Training Act of 1958. Part of the training costs are for courses offered by other Government agencies, and the remainder is for training through nongovernment sources.

II. Travel

- A. Program Travel: The largest part of travel is for direction, coordination, and management of program activities including international programs and activities. The complexity of the programs and the geographical distribution of NASA Installations and contractors necessitate this category of travel. As projects reach the flight stage, support is required for prelaunch activities including overseas travel to launch and tracking sites. The amount of travel required for flight projects is significant as it is directly related to the number of systems and subsystems, the number of design reviews, and the number and complexity of the launches and associated ground operations.
- B. Scientific and Technical Development Travel: Travel to scientific and technical meetings and seminars permits employees engaged in research and development to participate in both Government sponsored and nongovernment sponsored activities. This participation allows personnel to benefit from exposure to technological advances which arise outside NASA, as well as allowing personnel to present both accomplishments and problems to their associates and provides for the dissemination of technical results to the United States community.

- C. Management and Operations Travel: Management and operations travel provides for the direction and coordination of general management matters and travel by officials to review the status of programs. It also includes travel by functional managers in such areas as personnel, financial management, and procurement. This category also includes the cost of travel of unpaid members of research advisory committees; and initial duty station, permanent change of assignment, and related travel expenses.

III. Research Operations Support

- A. Facilities Services: Facilities Services provides basic security, fire protection, and other custodial services. It also provides maintenance of roads and grounds and of all administrative buildings and facilities. Finally, it provides rental of administrative buildings and all utility costs of administrative buildings.
- B. Technical Services: Technical Services provides the Administrative Automatic Data Processing capability that supports Accounting, Payroll, Budgeting, Procurement, and Personnel as well as all the other Administrative functions. It also funds the Graphics and Photographic support to these functions. Finally, it funds the Installationwide safety and public information programs.
- C. Management and Operations: Management and Operations funds the telephone, mail, and logistics systems, the administrative equipment and supplies, and the transportation system including the general purpose motor pools and the program support aircraft. It also funds the basic medical and environmental health programs. Finally, it funds printing and reproduction and all other support, such as small contract and purchases for the Center Directors staff and the Administrative functions.

SUMMARY OF BUDGET PLAN BY FUNCTION

	<u>FY 1995</u>	<u>FY 1996</u> (Millions of Dollars)	<u>FY 1997</u>
I. Personnel and related costs	\$1,628.9	\$1,565.1	\$1,611.0
II. Travel	\$44.9	\$45.5	\$45.5
III. Research operations support	<u>\$475.8</u>	<u>\$442.2</u>	<u>\$422.3</u>
Total.....	<u>\$2,149.6</u>	<u>\$2,052.8</u>	<u>\$2,078.8</u>

DETAIL OF BUDGET PLAN BY FUNCTION

	<u>FY 1995</u>	<u>FY 1996</u> (Millions of Dollars)	<u>FY 1997</u>
<u>I. Personnel and related costs</u>	<u>1,628.9</u>	<u>1,565.1</u>	<u>1,611.0</u>
A. <u>Compensation and benefits</u>	<u>1,577.7</u>	<u>1,533.2</u>	<u>1,583.1</u>
1. Compensation	1,280.1	1,260.8	1,299.6
2. Benefits	297.6	272.4	283.5
B. <u>Supporting costs</u>	<u>51.2</u>	<u>31.9</u>	<u>27.9</u>
1. Transfer of personnel	1.7	2.5	2.5
2. Investigative services	5.1	2.1	1.7
3. Personnel training	44.4	27.3	23.7
<u>II. Travel</u>	<u>44.9</u>	<u>45.5</u>	<u>45.5</u>
A. Program travel	30.1	30.9	30.9
B. Scientific and technical development travel	4.5	4.6	4.6
C. Management and operations travel	10.3	10.0	10.0
<u>III. Research operations support</u>	<u>475.8</u>	<u>442.2</u>	<u>422.3</u>
A. Facilities services	157.3	137.0	141.9
B. Technical services	157.3	150.6	132.4
C. Management and operations	161.2	154.6	148.0
Total	<u>2,149.6</u>	<u>2,052.8</u>	<u>2,078.8</u>

**NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
RESEARCH AND PROGRAM MANAGEMENT - FY 1997 ESTIMATES
DISTRIBUTION OF BUDGET PLAN FUNCTION BY INSTALLATION
(Millions of Dollars)**

FUNCTION	TOTAL NASA	JSC	KSC	MSFC	SSC	ARC	DFRC	LARC	LERC	GSFC	HQS
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PERSONNEL AND RELATED COSTS

FY 1995	1,628.9	272.4	161.6	229.3	14.8	132.1	31.9	184.8	169.4	266.6	166.0
FY 1996	1,565.1	273.5	153.8	220.9	14.2	129.0	31.6	173.0	162.4	258.6	148.1
FY 1997	1,611.0	280.9	155.8	228.9	14.8	130.0	40.2	180.5	166.5	275.0	138.4

TRAVEL

FY 1995	44.9	8.5	3.3	5.3	0.5	4.0	0.8	4.1	3.6	7.4	7.4
FY 1996	45.5	8.9	3.6	5.1	0.5	3.7	0.8	3.8	3.6	6.9	8.6
FY 1997	45.5	9.2	3.3	5.4	0.5	3.7	1.0	3.5	3.5	6.8	8.6

RESEARCH OPERATIONS SUPPORT

FY 1995	475.8	79.5	80.3	53.1	15.8	28.6	5.2	28.4	34.9	50.4	99.6
FY 1996	442.2	65.7	77.1	52.1	15.9	24.2	5.3	21.0	31.2	40.3	109.4
FY 1997	422.3	51.3	72.6	52.1	14.9	27.0	6.0	23.8	27.0	38.0	109.6

TOTAL

FY 1995	2,149.6	360.4	245.2	287.7	31.1	164.7	37.9	217.3	207.9	324.4	273.0
FY 1996	2,052.8	348.1	234.5	278.1	30.6	156.9	37.7	197.8	197.2	305.8	266.1
FY 1997	2,078.8	341.4	231.7	286.4	30.2	160.7	47.2	207.8	197.0	319.8	256.6

SUMMARY OF BUDGET PLAN BY INSTALLATION

	<u>FY 1995</u>	<u>FY 1996</u> (Millions of Dollars)	<u>FY 1997</u>
Johnson Space Center (JSC)	360.4	348.1	341.4
Kennedy Space Center (KSC)	245.2	234.5	231.7
Marshall Space Flight Center (MSFC)	287.7	278.1	286.4
Stennis Space Center (SSC)	31.1	30.6	30.2
Ames Research Center (ARC)	164.7	156.9	160.7
Dryden Flight Research Centet (DFRC)	37.9	37.7	47.2
Langley Research Center (LaRC)	217.3	197.8	207.8
Lewis Research Center (LeRC)	207.9	197.2	197.0
Goddard Space Flight Center (GFSC)	324.4	305.8	319.8
Headquarters (HQ)	<u>273.0</u>	<u>266.1</u>	<u>256.6</u>
TOTAL	<u><u>2,149.6</u></u>	<u><u>2,052.8</u></u>	<u><u>2,078.8</u></u>

DISTRIBUTION OF FULL-TIME EQUIVALENT (FTE) WORKYEARS BY INSTALLATION

	<u>FY 1995</u>	<u>FY 1996</u>	<u>FY 1997</u>
Johnson Space Center	3,455	3,423	3,350
Kennedy Space Center	2,283	2,202	2,190
Marshall Space Flight Center	3,214	3,096	2,985
Stennis Space Center	207	204	204
Ames Research Center	1,627	1,608	1,508
Dryden Flight Research Center	435	427	549
Langley Research Center	2,637	2,504	2,496
Lewis Research Center	2,370	2,323	2,276
Goddard Space Flight Center	3,689	3,682	3,573
Headquarters	<u>1,565</u>	<u>1,420</u>	<u>1,290</u>
Subtotal, full-time permanent FTEs	21,482	20,889	20,421
Other controlled FTEs	<u>682</u>	<u>666</u>	<u>609</u>
Total, full-time equivalents	<u><u>22,164</u></u>	<u><u>21,555</u></u>	<u><u>21,030</u></u>

DISTRIBUTION OF FULL-TIME EQUIVALENT (FTE) WORKYEARS BY PROGRAM

	<u>FY 1995</u>	<u>FY 1996</u>	<u>FY 1997</u>
Space station	1,441	1,698	1,698
U.S./Russian cooperative program	45	41	37
Space shuttle	3,038	2,882	2,680
Payload and utilization operations	1,256	1,111	1,170
Space science	2,091	2,035	2,013
Life and microgravity sciences	1,408	1,367	1,321
Mission to planet Earth	1,519	1,527	1,573
Aeronautical research and technology	3,460	3,342	3,356
Space access and technology	1,690	1,647	1,641
Mission communication services	461	440	347
Academic programs	69	69	67
Safety, reliability and quality assurance	120	119	115
Space communications services	140	134	115
Construction of facilities	<u>222</u>	<u>215</u>	<u>201</u>
Subtotal, direct full-time permanent FTEs	16,960	16,627	16,334
Center management and operations	4,489	4,229	4,054
Program management (Headquarters)	<u>33</u>	<u>33</u>	<u>33</u>
Subtotal, full-time permanent FTEs	21,482	20,889	20,421
Other controlled FTEs	<u>682</u>	<u>666</u>	<u>609</u>
Total, full-time equivalents	<u>22,164</u>	<u>21,555</u>	<u>21,030</u>

RESEARCH AND PROGRAM MANAGEMENT

FISCAL YEAR 1997 ESTIMATES

LYNDON B. JOHNSON SPACE CENTER

ROLES AND MISSIONS

SPACE STATION - Development of the International Space Station will provide an on-orbit, habitable laboratory for science and research activities, including flight and test hardware and software, flight demonstrations for risk mitigation, ground operations capability and facility construction, shuttle hardware and integration for assembly and operation of the station, mission planning, and integration of Space Station systems.

Space Station elements will be provided by the U. S. and our international partners. The U. S. elements include two nodes, a laboratory module, truss segments, four photovoltaic arrays, a habitation module, three pressurized mating adapters, a cupola, unpressurized logistics carriers and a centrifuge accommodation module. Various systems are also being developed by the U. S. including thermal control, life support, navigation and propulsion, command and data handling, power systems, and internal audio/video. The U. S. elements also include the FGB energy tug, being provided by a Russian firm under the Boeing prime contract, and pressurized logistics modules, provided by Italy.

Canada, the European nations, Japan, and Russia are also developing hardware for the international Space Station program. Laboratory elements will be provided by the Japanese and European Space Agencies. Canada will provide the remote manipulator system, vital for assembly of the station. The Russian Space Agency is providing experiment, power, life support and service modules, Soyuz crew transfer vehicle, and universal docking modules.

The Johnson Space Center (JSC) has lead management responsibility for the International Space Station program. In addition, specific JSC technical responsibilities include development of a set of facilities and systems to conduct the operations of the Space Station including on-orbit control of the Space Station.

The Center also provides institutional personnel as well as engineering and testbed support to the Space Station program. This includes test capabilities, the provision of Government Furnished Equipment (GFE), and engineering analysis support for the work of the prime contractor, its major subcontractors, and NASA system engineering and integration efforts.

U.S./RUSSIAN COOPERATIVE PROGRAM - JSC will continue to conduct management of the U.S./Russian Cooperative Program.

SPACE SHUTTLE - JSC has overall management responsibility for the Space Shuttle. In addition, JSC will provide development, integration, and operations support for the Mission Control Center (MCC), the Shuttle Mission Simulator

(SMS), and other ground facilities needed for Space Shuttle Operations. JSC will provide Space Shuttle operational flight program management including system integration, crew equipment modification and processing, crew training, flight mission planning and operations, and procurement of Orbiter hardware.

PAYLOAD AND UTILIZATION OPERATIONS - JSC will also conduct concept studies and development on flight systems and options for human transportation. JSC also provides support to Spacelab, the engineering and technical base, payload operations and support equipment, and advanced programs. JSC will continue management of the U.S./Russian Mir Cooperative Program.

SPACE SCIENCE - The Center will support the Agency's planetary science program in the area of geosciences required to support future programs, provide curatorial support for lunar materials, assist in information dissemination, and interact with outside scientists. This research focuses on the composition, structures, and evolutionary histories of the solid bodies of the universe.

LIFE AND MICROGRAVITY SCIENCES AND APPLICATIONS - The Center will evaluate human physiological changes associated with the space flight environment and develop effective countermeasures to assure crew health and optimal performance during all phases of flight. It will define and develop on-board health care systems and environmental monitoring systems; crew medical training; ground-based medical support of missions; develop a longitudinal crew health data base; and develop medical and psychological crew selection criteria. The JSC has established a center for the support of biotechnology applications in microgravity in order to study growth factors, medical chemo/immunotherapeutic, and human tissue transplantation. These activities will be consolidated into a biomedical science institute. The Center will integrate life science flight experiments for Spacelab; operate integrated payload systems; and train mission and payload specialists in the science aspect of their missions. In addition, the JSC will provide mission integration and operations functions for experiments flown on the NASA-Mir program, including Space Shuttle flights as well as those transported via Russian launch vehicle applications.

CENTER MANAGEMENT AND OPERATIONS - Provide administrative and financial services in support of Center management and provides for the operation and maintenance of the institutional facilities, systems, and equipment.

ZERO-BASED REVIEW (ZBR) ACTIONS/HIGHLIGHTS - JSC's ZBR recommended realignments are as follows: JSC will assume the consolidation of the space shuttle contract into a single prime contractor and maximize outsourcing and commercial services. The center will also assume management of communication infrastructure to be implemented in mid-1996; streamline engineering and facilities to include civil servants, new institute employees to do in-house science, research and engineering; prime center for its enterprise role. JSC's area of excellence is Human Operations in Space. Its mission is Human Exploration and Astromaterials.

DISTRIBUTION OF FULL-TIME EQUIVALENT (FTE) WORKYEARS BY PROGRAM
JOHNSON SPACE CENTER

	<u>FY 1995</u>	<u>FY 1996</u>	<u>FY 1997</u>
Space Station	780	974	1,042
U.S./Russian cooperative program	40	36	32
Space shuttle	1,225	1,219	1,121
Payload and utilization operations	509	427	412
Space science	34	32	30
Life and microgravity sciences	174	201	212
Mission to planet Earth	0	0	0
Aeronautical research and technology	0	0	0
Space access and technology	88	83	51
Mission communication services	0	0	0
Academic programs	6	6	6
Safety reliability and quality assurance	4	5	5
Space communication services	0	0	0
Construction of facilities	<u>27</u>	<u>27</u>	<u>27</u>
Subtotal, direct workyears	2,887	3,010	2,938
Center management and operations	568	413	412
Program management (Headquarters)	<u>0</u>	<u>0</u>	<u>0</u>
Subtotal, full-time permanent (FTE's)	3,455	3,423	3,350
Other controlled FTEs	<u>75</u>	<u>80</u>	<u>79</u>
Total, full-time equivalents	<u>3,530</u>	<u>3,503</u>	<u>3,429</u>

RESEARCH AND PROGRAM MANAGEMENT

FISCAL YEAR 1997 ESTIMATES

JOHN F. KENNEDY SPACE CENTER

ROLES AND MISSIONS

SPACE STATION - The Kennedy Space Center (KSC) shares responsibility for operations capability and construction with the Johnson Space Center (JSC) to develop a set of facilities, systems, and capabilities to conduct the operations of the Space Station. The KSC will develop launch site operations capabilities for conducting prelaunch and post-landing ground operations including integrated testing, interface verification, servicing, launch activities, and experiment-to rack physical integration.

SPACE SHUTTLE - KSC has responsibility for maintaining world class excellence in launch and payload processing systems, KSC will provide Space Shuttle launch preparation, including orbiter processing, and Ground Support Equipment (GSE) logistics; and operation and maintenance of GSE.

PAYLOAD AND UTILIZATION OPERATIONS - KSC will provide support for Spacelab assembly and checkout and payload experiment integration, upper stages processing, Spacelab and ground support equipment (GSE) logistics and operations and maintenance of GSE.

EXPENDABLE LAUNCH VEHICLES - Provide government oversight of all launch vehicle and payload processing and checkout activities for all NASA contracted expendable launch vehicle and upper stage launch services both at the KSC and the Vandenberg Air Force Base.

CENTER MANAGEMENT AND OPERATIONS - The Center will provide administrative and financial services in support of Center management and provides for the operation and maintenance of the institutional facilities, systems, and equipment.

ZERO-BASED REVIEW (ZBR) ACTIONS/HIGHLIGHTS - KSC's ZBR recommended realignments are as follows: KSC will participate in the consolidation of the Space Flight operations contract and award by October 1996. KSC will assume management for all Atlas class expendable launch vehicles in June 1998. KSC's Mission and Center of Excellence is Space Launch.

DISTRIBUTION OF FULL-TIME EQUIVALENT (FTE) WORKYEARS BY PROGRAM
KENNEDY SPACE CENTER

	<u>FY 1995</u>	<u>FY 1996</u>	<u>FY 1997</u>
Space station	181	195	207
U.S./Russian cooperative program	0	0	0
Space shuttle	1,018	930	930
Payload and utilization operations	433	441	441
Space science	36	43	51
Life and microgravity sciences	99	103	103
Mission to planet Earth	16	19	22
Aeronautical research and technology	0	0	0
Space access and technology	20	14	14
Mission communication services	0	0	0
Academic programs	1	2	2
Safety, reliability and quality assurance	5	12	11
Space communication services	0	0	0
Construction of facilities	<u>28</u>	<u>28</u>	<u>28</u>
Subtotal, direct workyears	1,837	1,787	1,809
Center management and operations	446	415	381
Program management (Headquarters)	<u>0</u>	<u>0</u>	<u>0</u>
Subtotal, full-time permanent (FTE's)	2,283	2,202	2,190
Other controlled FTEs	<u>77</u>	<u>68</u>	<u>62</u>
Total, full-time equivalents	<u>2,360</u>	<u>2,270</u>	<u>2,252</u>

RESEARCH AND PROGRAM MANAGEMENT

FISCAL YEAR 1997 ESTIMATES

GEORGE C. MARSHALL SPACE FLIGHT CENTER

ROLES AND MISSIONS

SPACE STATION - The Center will provide engineering and testbed support to the program including engineering analysis in support of the station system engineering and integration effort and the work of the prime and major subcontractors. It will be responsible for developing payload utilization capabilities and managing operations payload activities.

SPACE SHUTTLE - MSFC will provide for the design, development, and procurement of propulsion elements for the space transportation system. It will study future space program activities including space transportation systems, space power and energy systems, space structures, space processing, and space science and application facilities.

PAYLOAD AND UTILIZATION OPERATIONS - MSFC will continue Spacelab mission management including design, development and testing of payload carriers; payload definition; integration of science payloads into payload carriers; and operation of the payload integrated carrier systems.

SPACE SCIENCE - The MSFC will lead the development of the Advanced X-ray Astrophysics Facility (AXAF) and the Relativity Mission (Gravity Probe-B) as well as management of the Astro and Tethered Satellite shuttle payloads.

LIFE AND MICROGRAVITY SCIENCES AND APPLICATIONS - The Center will provide the fundamental science and technology for processing materials under conditions that allow detailed examination of the constraints imposed by gravitational forces. The MSFC will perform research in the areas of crystal growth, fluid physics, biophysics, solidification mechanics, chemistry and polymeric materials. The Center will integrate life and microgravity flight experiments and science and applications flight experiments for Spacelab, operate integrated payload systems, and train mission and payload specialists in the science aspects of their missions. The MSFC will also lead in the establishment of an Institute for Science including Materials Science, Biotechnology, Global Hydrology & Climate, and Astrophysics and Space Physics.

SPACE ACCESS AND TECHNOLOGY - The Center will provide propulsion and vehicle technology to reduce schedule and cost risk in the development of next generation expendable and reusable space transportation vehicles. It will develop technology in hybrid and liquid propulsion systems, advanced manufacturing processes, and vehicle materials and structures. The Center will conduct technology efforts, under cooperative agreements with the U.S. launch vehicle industry, to improve the competitiveness of current systems.

MISSION TO PLANET EARTH - The MSFC will conduct theoretical, field, and laboratory experimental research in the global weather, severe storms, and local weather areas in order to improve the understanding of severe storms, local and global scale weather systems.

MISSION/SPACE COMMUNICATION SERVICES - Manage and maintain the Program Support Communications Network (PSCN) which provides communications hardware, software, and transmission medium that inter-connects NASA Headquarters, installations, and major contractor locations for the transfer of data, voice, and video.

CENTER MANAGEMENT AND OPERATIONS - Provide administrative and financial services in support of Center management and provides for the operation and maintenance of the institutional facilities, systems, and equipment. Lead center for the development and implementation of the NASA Automation Consolidation Center (NACC).

ZERO-BASED REVIEW (ZBR) ACTIONS/HIGHLIGHTS - MSFC's ZBR recommended realignments are as follows: MSFC will establish an institute for science which will include the studies and research of hydrology. The Center will pursue plans to utilize the technology testbed for propulsion technology and other research and development activity during the FY 1996 timeframe. MSFC will also provide technical excellence in large optical systems and mirrors. As the Center of Excellence, MSFC is responsible for maintaining world class excellence in space propulsion. Their missions are Transportation Systems Development and Microgravity.

DISTRIBUTION OF FULL-TIME EQUIVALENT (FTE) WORKYEARS BY PROGRAM
MARSHALL SPACE FLIGHT CENTER

	<u>FY 1995</u>	<u>FY 1996</u>	<u>FY 1997</u>
Space station	327	376	320
U.S./Russian cooperative program	0	0	0
Space shuttle	676	629	524
Payload and utilization operations	196	125	195
Space science	432	434	400
Life and microgravity sciences	500	455	425
Mission to planet Earth	141	117	137
Aeronautical research and technology	0	0	0
Space access and technology	466	527	546
Mission communication services	0	0	0
Academic programs	9	9	9
Safety, reliability and quality assurance	4	4	4
Space communication services	14	14	14
Construction of facilities	<u>0</u>	<u>0</u>	<u>0</u>
Subtotal, direct workyears	2,765	2,690	2,574
Center management and operations	449	406	411
Program management (Headquarters)	<u>0</u>	<u>0</u>	<u>0</u>
Subtotal, full-time permanent (FTE's)	3,214	3,096	2,985
Other controlled FTEs	<u>65</u>	<u>61</u>	<u>61</u>
Total, full-time equivalents	<u>3,279</u>	<u>3,157</u>	<u>3,046</u>

RESEARCH AND PROGRAM MANAGEMENT

FISCAL YEAR 1997 ESTIMATES

JOHN C. STENNIS SPACE CENTER

ROLES AND MISSIONS

SPACE SHUTTLE - SSC will provide, operate, maintain, and manage a propulsion test center and related capabilities for development, certification, and acceptance of rocket propulsion systems and components. The Center will provide, maintain, and manage the facilities and the related capabilities required for the continued development and acceptance testing of the Space Shuttle Main Engines.

PAYLOAD AND UTILIZATION OPERATIONS - SSC will support the center's technical core laboratory operations. This support the center's capability to conduct advanced propulsion test technology research and development for government and commercial propulsion programs.

MISSION TO PLANET EARTH - SSC will conduct technology utilization, applications, and commercialization programs to support the Agency goals in environmental systems sciences and observations, remote sensing, and image processing systems and applicable products.

SPACE ACCESS AND TECHNOLOGY - The Center will conduct fundamental and applied research, develop advanced airborne sensors and data/information systems, conducts test and evaluation activities of remote sensing technology and image processing systems. It will also perform research applications for non-remote sensing, primarily in such areas as environmental system development and closed ecosystems development. The Center will participate in commercial program activities emphasizing promotion and development private sector investment in space-based technologies and promotion of industrial productivity through the transfer of technologies that derive from NASA's research and development programs and activities.

CENTER MANAGEMENT AND OPERATIONS - The Center will provide, operate, maintain, and manage the institutional base and laboratories required to accomplish and support assigned programs of NASA and other Federal and State agencies and organizations resident at the SSC.

ZERO-BASED REVIEW (ZBR) ACTIONS/HIGHLIGHTS - SSC's ZBR recommended realignments are as follows: SSC will manage all future rocket propulsion testing in cooperation with the National Propulsion Testing Alliance Initiatives. SSC's Mission and Center of Excellence is Propulsion Test Systems.

DISTRIBUTION OF FULL-TIME EQUIVALENT (FTE) WORKYEARS BY PROGRAM
STENNIS SPACE CENTER

	<u>FY 1995</u>	<u>FY 1996</u>	<u>FY 1997</u>
Space station	0	0	0
U.S./Russian cooperative program	0	0	0
Space shuttle	40	39	39
Payload and utilization operations	39	42	43
Space science	0	0	0
Life and microgravity sciences	0	0	0
Mission to planet Earth	2	1	1
Aeronautical research and technology	8	4	0
Space access and technology	26	33	38
Mission communication services	0	0	0
Academic programs	2	2	2
Safety, reliability and quality assurance	1	1	1
Space communication services	0	0	0
Construction of facilities	<u>3</u>	<u>3</u>	<u>3</u>
Subtotal, direct workyears	121	125	127
Center management and operations	86	79	77
Program management (Headquarters)	<u>0</u>	<u>0</u>	<u>0</u>
Subtotal, full-time permanent (FTE's)	207	204	204
Other controlled FTEs	12	15	15
Total, full-time equivalents	<u>219</u>	<u>219</u>	<u>219</u>

RESEARCH AND PROGRAM MANAGEMENT

FISCAL YEAR 1997 ESTIMATES

GODDARD SPACE FLIGHT CENTER

ROLES AND MISSIONS

SPACE SHUTTLE/PAYLOAD AND UTILIZATION OPERATIONS - GSFC manages flights of the Hitchhiker, a reusable carrier system which provides increased flight opportunities with reduced leadtime while maximizing Space Shuttle load factors and minimizing spaceflight costs. GSFC also manages and coordinates the Agency's Get Away Special (GAS) program.

EXPENDABLE LAUNCH VEHICLES - Technical oversight for NASA payloads of the small and medium class ELVs, such as Pegasus and Delta, used to put a wide variety of spacecraft into a broad spectrum of orbits.

SPACE SCIENCE

GSFC manages physics and astronomy activities in the following discipline areas: gamma ray astronomy, X-ray astronomy, ultraviolet and optical astronomy, infrared and radio astronomy, particle astrophysics, solar physics, interplanetary physics, planetary magnetospheres, and astrochemistry. GSFC is also responsible for conducting the mission operations for a variety of operating spacecraft. Other activities include managing NASA's sounding rocket and scientific balloon program.

GSFC also conducts planetary exploration research into the physics of interplanetary and planetary space environments. Participates in planetary mission instrument development, operations, and data analysis.

MISSION TO PLANET EARTH - Lead Center for MTPE, including the Earth Observing System (EOS). The primary objective of the EOS is to record global change and to observe regional-to-global processes. The EOS will document global change over a fifteen year period to provide long-term, consistent data sets for use in modeling and understanding global processes. This process and modeling research effort will provide the basis for establishing predictive global change models for policy makers and scientists.

Manages Earth Probes and New Millennium flight projects; manages, on a reimbursable basis, the acquisition of meteorological observing spacecraft for the National Oceanic and Atmospheric Administration (NOAA). Conducts science correlation measurements from balloons, sounding rockets, aircraft, and ground installations.

SPACE ACCESS AND TECHNOLOGY - Develops technologies targeted at improved space borne instruments, and on-board spacecraft systems and subsystems. GSFC is involved in flight test and demonstration of the integration of new technology on the Space Shuttle and Expendable Launch Vehicle (ELV) systems. Promotes private sector investment in space-based technologies through the transfer of technologies that derive from NASA's programs and activities.

AERONAUTICAL RESEARCH AND TECHNOLOGY - The Wallops Flight Facility conducts flight studies of new approach and landing procedures using the latest in guidance equipment and techniques, pilot information displays, human factors data, and terminal area navigation. As an integral partner in the Agency's High Performance Computing and Communications (HPCC) program, GSFC leads an effort to enhance the infusion of HPCC technologies into the Earth and space science community through the provision of advanced computer architectures and communication technologies.

MISSION/SPACE COMMUNICATION SERVICES - Research and technology involves the investigation and development of advanced systems and techniques for spacecraft communications and tracking, command and control, and data acquisition and processing. The primary objectives are to apply technology and develop advanced capabilities to meet the tracking and data processing requirements of new missions and to improve the costs effectiveness and reliability of flight mission support.

Although, the Johnson Space Center is designated as the Space Operations Lead Center, GSFC manages a number of critical program elements, including operation of the Tracking and Data Relay Satellite System (TDRSS); the development of the replenishment TDRSS spacecraft; mission control, data processing, and orbit/attitude computation support; operating the Space Tracking and Data Network (STDN), the NASA Communications (NASCOM) Network, and the Aeronautics, Balloons and Sounding Rocket Program.

The NASCOM Network links the stations of the Deep Space Network (DSN), STDN, TDRSS, and other tracking and data acquisition elements with control centers and data processing and computation centers.

CENTER MANAGEMENT AND OPERATIONS - Provides administrative and financial services in support of Center management and provides for the operation and maintenance of the institutional facilities, systems, and equipment.

ZERO-BASED REVIEW (ZBR) ACTIONS/HIGHLIGHTS - GSFC will continue its major role as a Center of Excellence for Scientific Research. Their missions are Earth Science ,and Physics and Astronomy. The changes at GSFC resulting from the ZBR include reductions in infrastructure at the Wallops Flight Facility, transfer of research aircraft to the Dryden Flight Research Center, limitations on in-house spacecraft development, and investigations of privatization opportunities for archiving services for Space Science data.

DISTRIBUTION OF FULL-TIME EQUIVALENT (FTE) WORKYEARS BY PROGRAM
GODDARD SPACE FLIGHT CENTER

	<u>FY 1995</u>	<u>FY 1996</u>	<u>FY 1997</u>
Space station	0	0	0
U.S./Russian cooperative program	0	0	0
Space shuttle	8	5	5
Payload and utilization operations	34	31	39
Space science	1,305	1,279	1,306
Life and microgravity sciences	0	0	0
Mission to planet Earth	948	992	990
Aeronautical research and technology	25	26	24
Space access and technology	80	93	99
Mission communication services	400	382	298
Academic programs	4	3	3
Safety, reliability and quality assurance	12	11	8
Space communication services	117	112	94
Construction of facilities	<u>65</u>	<u>65</u>	<u>60</u>
Subtotal, direct workyears	2,998	2,999	2,926
Center management and operations	691	683	647
Program management (Headquarters)	<u>0</u>	<u>0</u>	<u>0</u>
Subtotal, full-time permanent (FTE's)	3,689	3,682	3,573
Other controlled FTEs	<u>85</u>	<u>88</u>	<u>63</u>
Total, full-time equivalents	<u>3,774</u>	<u>3,770</u>	<u>3,636</u>

RESEARCH AND PROGRAM MANAGEMENT

FISCAL YEAR 1996 ESTIMATES

AMES RESEARCH CENTER

ROLES AND MISSIONS

SPACE SCIENCE

Conducts Physics and astronomy - multidisciplinary, integrated research and technology program focusing on the origin and evolution of life in the universe. Provide advanced laboratory and computation facilities for astrochemistry. Provide support for the NASA airborne astronomy program, continuing development of Stratospheric Observatory for Infrared Astronomy (SOFIA) for research to be conducted by various NASA/university teams. Provide research and development (R&D) in advanced information technologies to significantly increase the efficiency of SOFIA as it becomes operational. Provide infrared technology research program utilizing the unique capabilities of infrared astronomy to investigate the nature and evolution of astronomical systems. Begin transition of program to Astrobiology Institute.

Conducts planetary exploration - basic research and technology development in the study of the origin and evolution of life in the universe with emphasis on the formation and development of planetary systems and the history of early life on Earth. Develop basic atmospheric planetary modeling concepts and interpret spacecraft observations of planetary atmospheres in relation to the atmosphere of the Earth. Continue development of the Lunar Prospector mission and advanced studies for future Mars exploration. Conduct advanced studies of instrumentation and systems (including thermal protection systems for planetary entry) for future planetary missions. Increase emphasis on telepresence and telescience technologies which enhance robotic mission science productivity. Begin transition of program to Astrobiology Institute.

LIFE AND MICROGRAVITY SCIENCES - The Center will continue research into the effects of gravity on living systems using spaceflight experiments, ground simulation, and hypergravity facilities to understand the effects of gravity on the development, structure and function of living systems, and develop options for preventing crew health and psychophysiological problems during and following extended spaceflight. The ARC will also develop advanced technologies for physical/chemical and regenerative life support and extravehicular activity systems essential to exploration of and extended presence in space. In FY 1997, the ARC will begin transition of program Astrobiology Institute.

MISSION TO PLANET EARTH - Develop instruments and computer models for the measurement and analysis of atmospheric constituents and properties from aircraft platforms. Perform applied research and development to enhance the use of remote and in-situ sensing technology for Earth resources applications. Begin transition of program to Astrobiology Institute.

SPACE ACCESS AND TECHNOLOGY - Conduct research on thermal protection systems, and perform arc jet testing for national needs in access to space and planetary exploration. Develop infrared systems, spaceborne processors, sensor technology, robotics and artificial intelligences, technologies for humans in space, nanotechnologies, and advanced space platforms.

AERONAUTICAL RESEARCH AND TECHNOLOGY - Conduct aeronautics research in ground-based and airborne automation technologies, human factors and operational methodologies for efficient, safe and effective airspace operations. Develop an integrated set of experimental and computational technologies built around an embedded information systems backbone, to provide rapid, accurate vehicle synthesis and testing capabilities. Conduct research spanning computation through flight, for Rotocraft and Powered Lift configurations and for high performance aircraft to improve efficiency, affordability, and performance. Continue an interdisciplinary research program which provides the technology base for the development of subsonic and high speed transport aircraft. Emphasize joint research and technology projects with other NASA installations, government agencies, industry and academia.

Strengthen basic research and technology development for aerospace systems that transport humans and instrumentation to and from space and within the atmospheres of other bodies within the solar system.

SAFETY, RELIABILITY AND QUALITY ASSURANCE - Provide institutional safety and health programs and develop and integrate Safety, Reliability and Quality Assurance guidelines into program and project development.

CENTER MANAGEMENT AND OPERATIONS - Provide administrative and financial services in support of Center management and provide for the operation and maintenance of the institutional facilities, systems and equipment.

ZERO-BASED REVIEW (ZBR) ACTION/HIGHLIGHTS - ARC'S ZBR recommended realignments are: ARC will establish a science institute for astrobiology; retain core in-house aeronautics research capability; transfer aircraft to the Dryden Flight Research Center; and transfer Moffett airfield ownership and/or operation; and close or reduce operations at selected facilities. ARC, Center of Excellence, is responsible for Information Technology. Their missions are Air Space Operations Systems and Astrobiology.

DISTRIBUTION OF FULL-TIME EQUIVALENT (FTE) WORKYEARS BY PROGRAM
AMES RESEARCH CENTER

	<u>FY 1995</u>	<u>FY 1996</u>	<u>FY 1997</u>
Space station	0	0	0
U.S./Russian cooperative program	0	0	0
Space shuttle	0	0	0
Payload and utilization operations	0	0	0
Space science	140	141	120
Life and microgravity sciences	151	147	126
Mission to planet Earth	82	80	47
Aeronautical research and technology	722	714	660
Space access and technology	115	112	169
Mission communication services	9	9	0
Academic programs	0	1	1
Safety, reliability and quality assurance	14	22	22
Space communication services	0	0	0
Construction of facilities	<u>23</u>	<u>21</u>	<u>20</u>
Subtotal, direct workyears	1,256	1,247	1,165
Center management and operations	371	361	343
Program management (Headquarters)	<u>0</u>	<u>0</u>	<u>0</u>
Subtotal, full-time permanent (FTE's)	1,627	1,608	1,508
Other controlled FTEs	<u>65</u>	<u>52</u>	<u>47</u>
Total, full-time equivalents	<u>1,692</u>	<u>1,660</u>	<u>1,555</u>

RESEARCH AND PROGRAM MANAGEMENT

FISCAL YEAR 1997 ESTIMATES

DRYDEN FLIGHT RESEARCH CENTER

CENTER ROLES AND MISSIONS

SHUTTLE PROGRAMS/PAYLOAD AND UTILIZATION OPERATIONS - The DFRC will provide operational and technical support for the conduct of Space Shuttle missions, including on-orbit tracking and communications, landing support of crew and science requirements. DFRC will also provide flight test support for atmospheric tests of experimental or developmental launch systems.

AERONAUTICAL RESEARCH AND TECHNOLOGY - Develop, manage, and maintain facilities and testbed aircraft to support safe, timely, and cost effective NASA flight research and to support industry, university, and other government agency flight programs.

Conceive, formulate, and conduct piloted and unpiloted flight research programs in disciplinary technology, integrated aeronautical systems, and advanced concepts to meet current and future missions throughout subsonic, supersonic, and hypersonic flight regimes.

Conduct flight research programs in cooperation with other NASA Installations, other government agencies, the aerospace industry, and universities. Transition results, techniques, methods, and tools to industry and government users in a timely manner.

CENTER MANAGEMENT AND OPERATIONS - Provide administrative services in support of Center management and provides for the operation and maintenance of the Institutional facilities, systems and equipment.

ZERO-BASED REVIEW (ZBR) ACTION/HIGHLIGHTS - DFRC's ZBR recommended realignments are as follows: DFRC will assume flight operations management of all aircraft except those in support of the Space Shuttle. DFRC is the Center of Excellence for Atmospheric Flight Operations. Their mission is solely Flight Research.

DISTRIBUTION OF FULL-TIME EQUIVALENT (FTE) WORKYEARS BY PROGRAM
DRYDEN FLIGHT RESEARCH CENTER

	<u>FY 1995</u>	<u>FY 1996</u>	<u>FY 1997</u>
Space station	0	0	0
U.S./Russian cooperative program	0	0	0
Space shuttle	21	15	21
Payload and utilization operations	0	0	0
Space science	0	0	7
Life and microgravity sciences	0	0	4
Mission to planet Earth	0	0	81
Aeronautical research and technology	294	268	274
Space access and technology	2	13	33
Mission communication services	19	19	19
Academic programs	0	0	0
Safety, reliability and quality assurance	0	0	0
Space communication services	0	0	0
Construction of facilities	<u>0</u>	<u>0</u>	<u>0</u>
Subtotal, direct workyears	336	315	439
Center management and operations	99	112	110
Program management (Headquarters)	<u>0</u>	<u>0</u>	<u>0</u>
Subtotal, full-time permanent (FTE's)	435	427	549
Other controlled FTEs	<u>23</u>	<u>23</u>	<u>23</u>
Total, full-time equivalents	458	450	572

RESEARCH AND PROGRAM MANAGEMENT

FISCAL YEAR 1997 ESTIMATE

LANGLEY RESEARCH CENTER

ROLES AND MISSIONS

AERONAUTICAL RESEARCH AND TECHNOLOGY - Conduct advanced research in fundamental aerodynamics; high-speed, highly maneuverable aircraft technology; hypersonic propulsion; guidance and controls; acoustics; and structures and materials. Develop a technology base for improving transport, general aviation, and commuter aircraft. Conduct an aeronautical research and technology program to study current and future technology requirements and to demonstrate technology applications. Conduct theoretical and experimental research in fluid and flight mechanics to determine aerodynamic flows and complex aircraft motions.

Study critical environmental compatibility issues in order to make decisions on future high speed civil transport technology and development programs. Develop technology options for realization of practical hypersonic and transatmospheric flight.

Conduct control and guidance research programs to advance technology in aircraft guidance and navigation, aircraft control systems, cockpit systems integration and interfacing techniques, and performance validation and verification methods. Conduct research in aircraft noise prediction and abatement and wind shear avoidance.

Research activity also includes study of airbreathing propulsion systems; development of large reusable structures for aerospace vehicles; and studies to define and understand the integration of advanced technologies into a future class of horizontal takeoff and landing vehicles capable of operating to orbit and/or hypersonic cruise within the atmosphere.

MISSION TO PLANET EARTH - Conduct a peer-reviewed and selected atmospheric sciences program in support of national goals in preserving the environment and in fundamental science. Specific discipline areas of expertise are Earth radiation research, particularly the role of clouds in the Earth's energy budget; middle and upper atmospheric research; and tropospheric research. Perform innovative scientific research and technology to advance the knowledge of atmospheric radiative, chemical, and dynamic processes for understanding global change. The LaRC has been designated a Primary Data and Archival Center for Earth Radiation and Atmospheric Chemistry for the Earth Observing System.

SPACE ACCESS AND TECHNOLOGY - Conduct space technology development in areas that are synergistic with the aeronautics role in support of future space transportation systems, science mission, and human exploration missions. Conduct long-range studies directed at defining the technology requirements for advanced space systems and missions. Specific technology discipline areas of expertise are aerodynamics and aerothermodynamics, structures and materials, guidance and controls, data systems, sensor systems, and systems analysis. Facilitate private sector investment in space-

based technologies and promote industrial productivity through the transfer of technologies that derive from NASA's programs and activities.

LIFE AND MICROGRAVITY SCIENCES - LaRC will conduct space radiation exposure studies to support current and future manned space efforts in order to more accurately assess astronaut radiation exposures and body shielding factors. Perform system engineering studies and analysis in support of microgravity flight experiments program; and provide education and public communication materials for microgravity science and applications.

SAFETY, RELIABILITY, AND QUALITY ASSURANCE - The Safety, Reliability, and Quality Assurance program provides independent assessment activities which reduce program risk.

CENTER MANAGEMENT AND OPERATIONS - Provide administrative and financial services in support of Center management and provide for the operation and maintenance of the institutional facilities, systems, and equipment.

ZERO-BASED REVIEW (ZBR) ACTION/HIGHLIGHTS - LaRC's ZBR recommended realignments are as follows: LaRC will provide program analysis and evaluating function for NASA; transfer aircraft to the Dryden Flight Research Center, and will close or reduce operations at selected facilities. LaRC, Center of Excellence, is responsible for Structures and Materials. Their missions are Airframe Systems and Atmospheric Science.

DISTRIBUTION OF FULL-TIME EQUIVALENT (FTE) WORKYEARS BY PROGRAM
LANGLEY RESEARCH CENTER

	<u>FY 1995</u>	<u>FY 1996</u>	<u>FY 1997</u>
Space station	24	24	24
U.S./Russian cooperative program	0	0	0
Space shuttle	2	0	0
Payload and utilization operations	0	0	0
Space science	6	13	15
Life and microgravity sciences	18	18	17
Mission to planet Earth	175	179	164
Aeronautical research and technology	1,412	1,275	1,316
Space access and technology	388	351	318
Mission communication services	0	0	0
Academic programs	0	0	0
Safety, reliability and quality assurance	3	3	6
Space communication services	0	0	0
Construction of facilities	<u>41</u>	<u>39</u>	<u>34</u>
Subtotal, direct workyears	2,069	1,902	1,894
Center management and operations	568	602	602
Program management (Headquarters)	<u>0</u>	<u>0</u>	<u>0</u>
Subtotal, full-time permanent (FTE's)	2,637	2,504	2,496
Other controlled FTEs	<u>114</u>	<u>118</u>	<u>118</u>
Total, full-time equivalents	<u>2,751</u>	<u>2,622</u>	<u>2,614</u>

RESEARCH AND PROGRAM MANAGEMENT

FISCAL YEAR 1997 ESTIMATES

LEWIS RESEARCH CENTER

ROLES AND MISSIONS

SPACE STATION - The Lewis Research Center (LeRC) provides technology support in the areas of power systems demonstration on the Russian Space Station (MIR), engineering and analysis and technical expertise for the program office and ground based testing for selected components. This includes use of facilities, testbeds and government furnished equipment (GFE) to support the program office and contractors as required.

LIFE AND MICROGRAVITY SCIENCES - LeRC will conduct microgravity science and applied research in support of the Human Exploration and Development of Space (HEDS) Enterprise; design and develop space flight experiments; and perform ground and space flight experiments in combustion, fluid physics, and instrumentation. LeRC will also perform research on advanced design and operation of microgravity experimental flight hardware, and conduct ground-based research and flight experiments in basic science and technology associated with combustion, fluid physics phenomena, and power, propulsion, materials and communication technology.

SPACE ACCESS AND TECHNOLOGY - Conduct research to provide advancements in satellite, platform and planetary power systems; to create new propulsion options for high- and low- thrust systems; to enable new capabilities in space communications and electronics; and to provide effective means to manage cryogenic fluids in microgravity. Conduct research in propulsion to support the next generation of launch vehicles, satellites, microsatellites, and space platforms. Conduct research on enhanced micro- and full-size satellite power systems as well as power systems for deep space and planetary exploration.

Perform applied research aimed at development of advanced concepts and technologies for communication systems. Emphasis is on developing high data return from NASA missions using less mass and power and developing innovative and cost competitive commercial satellite communications services.

Conduct space materials and structures research and technology to develop improved materials, advance structural analysis and life prediction, and develop long-life, reliable space mechanisms.

Promote and develop private sector investment in space-based technologies and promote industrial productivity through the transfer of technologies that derive from NASA's programs and activities.

Conduct studies to provide long-range planning for future launch systems and spacecraft. Provide technology assessments & technology definition studies for future space operations in the areas of telecommunications and information management networks.

AERONAUTICAL RESEARCH AND TECHNOLOGY - As Center of Excellence in aeropropulsion, research will be conducted in subsonic, supersonic, hypersonic, and high performance aircraft propulsion systems as well as materials and structures, internal fluid mechanics, instrumentation and controls, interdisciplinary technologies, and aircraft icing. As Center of Excellence in turbomachinery, research in primary and auxiliary propulsion and power systems and in rotating machinery systems for pumping of fuels will be conducted.

CENTER MANAGEMENT AND OPERATIONS - Provides administrative and financial services in support of Center Management and provides for the operation and maintenance of the institutional facilities, systems, and equipment.

ZERO-BASED REVIEW (ZBR) ACTION/HIGHLIGHTS - LeRC's ZBR recommended realignments are as follows: LeRC will transfer Atlas-class expendable launch vehicle management to the Kennedy Space Center; phase out of large chemical propulsion technology and close the rocket engine test facility; transfer aircraft to the Dryden Flight Research Center; retain its Plumbrook facility based on fully-reimbursable operations; close or reduce operations at other selected facilities; and explore creation of an institute for conduct of activities in microgravity on-board propulsion and space power. LeRC, is the Center of Excellence for Turbomachinery. *Their mission is Aeropropulsion.*

DISTRIBUTION OF FULL-TIME EQUIVALENT (FTE) WORKYEARS BY PROGRAM
LEWIS RESEARCH CENTER

	<u>FY 1995</u>	<u>FY 1996</u>	<u>FY 1997</u>
Space station	95	95	71
U.S./Russian cooperative program	0	0	0
Space shuttle	0	0	0
Payload and utilization operations	0	0	0
Space science	18	18	20
Life and microgravity sciences	392	376	373
Mission to planet Earth	64	53	53
Aeronautical research and technology	932	996	1,028
Space access and technology	432	359	321
Mission communication services	4	2	4
Academic programs	14	14	14
Safety, reliability and quality assurance	5	4	4
Space communication services	0	0	0
Construction of facilities	<u>0</u>	<u>0</u>	<u>0</u>
Subtotal, direct workyears	1,956	1,917	1,888
Center management and operations	414	406	388
Program management (Headquarters)	<u>0</u>	<u>0</u>	<u>0</u>
Subtotal, full-time permanent (FTE's)	2,370	2,323	2,276
Other controlled FTEs	<u>77</u>	<u>73</u>	<u>71</u>
Total, full-time equivalents	<u>2,447</u>	<u>2,396</u>	<u>2,347</u>

RESEARCH AND PROGRAM MANAGEMENT

FISCAL YEAR 1997 ESTIMATES

NASA HEADQUARTERS

ROLES AND MISSIONS

NASA Corporate Headquarters

MISSION - The mission of Headquarters is to plan and provide executive direction for the implementation of U. S. space, science, aeronautics, and technology programs. This includes corporate policy development, program formulation, resource allocations, program performance assessment, long-term institutional investments, and external advocacy for all of NASA.

MAJOR CORPORATE ROLES - At NASA Headquarters, the broad framework for program formulation will be conducted through five Strategic Enterprises: Human Exploration and Development of Space, Mission to Planet Earth, Aeronautics, Space Science, and Space Technology. Consistent with the NASA strategic plan, the Strategic Enterprises develop program goals and objectives to meet the needs of external customers within the policy priorities of the Administration and Congress.

Corporate level enabling processes and staff functions will provide cross-cutting interfaces required to support the Strategic Enterprises in legislative affairs, public affairs, budget and financial management, equal opportunity programs, human resources, legal affairs, procurement, international affairs, management systems and facilities, information systems and technology, small business, safety and mission quality, advisory committees, and policy and plans.

The Office of Headquarters Operations provides and manages the infrastructure necessary to support the Headquarters installation.

PROGRAM MANAGEMENT - A cadre of personnel presently assigned to Headquarters provides program management for the NASA Management Office at Jet Propulsion Lab, communications stations in Spain and Australia, international representatives in France and Moscow, and shuttle management conducted at KSC, JSC, and MSFC. This new function was created to reflect the operational components that logically report directly to Headquarters due to their function but who are not located on-site.

ZERO-BASED REVIEW (ZBR) ACTION/HIGHLIGHTS - Consistent with the roles and responsibilities of Corporate Headquarters and recommendations of the ZBR, plans are being developed and executed to transfer selected program management and operations components to lead NASA Centers. Headquarters is also developing an aggressive out-

placement program to reduce on-board personnel levels. From FY 1993 through FY 1996, there has been approximately a 30% reduction in the Headquarters staffing complement.

DISTRIBUTION OF FULL-TIME EQUIVALENT (FTE) WORKYEARS BY PROGRAM
NASA HEADQUARTERS

	<u>FY 1995</u>	<u>FY 1996</u>	<u>FY 1997</u>
Space station	34	34	34
U.S./Russian cooperative program	5	5	5
Space shuttle	48	45	40
Payload and utilization operations	45	45	40
Space science	120	75	64
Life and microgravity sciences	74	67	61
Mission to planet Earth	91	86	78
Aeronautical research and technology	67	59	54
Space access and technology	73	62	52
Mission communication services	29	28	26
Academic programs	33	32	30
Safety, reliability and quality assurance	72	57	54
Space communication services	9	8	7
Construction of facilities	<u>35</u>	<u>32</u>	<u>29</u>
Subtotal, direct workyears	735	635	574
Center management and operations	797	752	683
Program management (Headquarters)	<u>33</u>	<u>33</u>	<u>33</u>
Subtotal, full-time permanent (FTE's)	1,565	1,420	1,290
Other controlled FTEs	<u>89</u>	<u>88</u>	<u>70</u>
Total, full-time equivalents	<u>1,654</u>	<u>1,508</u>	<u>1,360</u>

DETAIL OF PERMANENT POSITIONS

	<u>FY 1995</u>	<u>FY 1996</u>	<u>FY 1996</u>
Executive level II	1	1	1
Executive level III	2	2	2
Executive level V	<u>0</u>	<u>0</u>	<u>0</u>
Subtotal	3	3	3
ES-6	58	57	57
ES-5	96	94	95
ES-4	254	241	239
ES-3	44	43	44
ES-2	49	44	45
ES-1	<u>63</u>	<u>58</u>	<u>56</u>
Subtotal	564	537	536
CA	1	1	1
SL/ST	57	56	54
GS/GM-15	2,343	2,293	2,273
GS/GM-14	3,443	3,369	3,342
GS/GM-13	6,481	6,357	6,311
GS-12	2,743	2,684	2,670
GS-11	1,438	1,407	1,400
GS-10	282	276	275
GS-09	703	688	684
GS-08	302	296	294
GS-07	800	782	778
GS-06	592	579	576
GS-05	515	504	501
GS-04	76	74	74
GS-03	15	15	15
GS-02	<u>1</u>	<u>1</u>	<u>1</u>
Subtotal	19,792	19,382	19,249
Special ungraded positions established by NASA Administrator	28	27	27
Ungraded positions	<u>487</u>	<u>477</u>	<u>465</u>
Total permanent positions	<u>20,874</u>	<u>20,426</u>	<u>20,280</u>
Unfilled positions, EOY	0	0	0
Total, permanent employment, EOY	<u>20,874</u>	<u>20,426</u>	<u>20,280</u>

PERSONNEL SUMMARY

	<u>FY 1995</u>	<u>FY 1996</u>	<u>FY 1997</u>
Average GS/GM grade	12.1	12.1	12.1
Average ES salary	\$111,933	\$114,619	\$117,370
Average GS/GM salary	\$57,116	\$58,487	\$59,890
Average salary of special ungraded positions established by NASA Administrator	\$89,658	\$91,810	\$94,013
Average salary of ungraded positions	\$40,536	\$41,509	\$42,505

CENTER LOCATIONS AND CAPITAL INVESTMENT

JOHNSON SPACE CENTER - The Lyndon B. Johnson Space Center is located 20 miles southeast of Houston, Texas. NASA owns 1,618 acres of land at the Houston site and uses another 60,552 at the White Sands Test Facility, Las Cruces, New Mexico. The total replacement cost including land, buildings, structures and facilities, equipment, and other fixed assets was \$1,442,900,807 as of September 30, 1995.

KENNEDY SPACE CENTER - The Kennedy Space Center is located 50 miles east of Orlando, Florida. NASA owns 82,943 acres and uses launch facilities at Cape Canaveral Air Station and Vandenberg Air Force Base. The total replacement cost including land, buildings, structures and facilities, equipment, and other fixed assets was \$2,363,979,160 as of September 30, 1995.

MARSHALL SPACE FLIGHT CENTER - The Marshall Space Flight Center is located within the U.S. Army's Redstone Arsenal at Huntsville, Alabama. MSFC also manages operation at the Michoud Assembly 15 miles east of New Orleans, Louisiana and the Slidell Computer Complex in Slidell, Louisiana. The total replacement cost including land, buildings, structures and facilities, equipment, and other fixed assets was \$1,630,108,979 as of September 30, 1995.

STENNIS SPACE CENTER - The Stennis Space Center is located approximately 50 miles northeast of New Orleans, Louisiana. NASA owns 20,663 acres and has easements covering an additional 118,284 acres. The total replacement cost including land, buildings, structures and facilities, equipment, and other fixed assets was \$518,060,947 as of September 30, 1995.

GODDARD SPACE FLIGHT CENTER - The Goddard Space Flight Center is located 15 miles northeast of Washington, D.C. at Greenbelt, Maryland. NASA owns 1,121 acres at this location and an additional 6,176 acres at the Wallops Flight Facility in Wallops Island, Virginia. The total replacement cost including land, buildings, structures and facilities, equipment, and other fixed assets at both locations was \$1,204,707,101 as of September 30, 1995.

AMES RESEARCH CENTER - The Ames Research Center is located south of San Francisco on Moffett Field, California. The Dryden Flight Research Facility is located 65 miles northeast of Los Angeles at Edwards Air Force Base. The Dryden facility was under the operation of Ames until a decision was made in early 1994 that each facility will operate under separate management. NASA owns 447.5 acres at the Moffett Field location. The total replacement cost including land, buildings, structures and facilities, equipment, and other fixed assets at both locations was \$1,127,628,176 as of September 30, 1995.

DRYDEN FLIGHT RESEARCH CENTER - The Dryden Flight Research Center is 65 air miles northeast of Los Angeles. Dryden is located at the north end of Edwards Air Force Base on 838 acres of land under a permit from the Air Force. The

total replacement cost at Dryden, including fixed assets in progress and contractor-held facilities at various locations, as of September 30, 1995 was \$211,058,888.

LANGLEY RESEARCH CENTER - The Langley Research Center is adjacent to Langley Air Force Base which is located between Williamsburg and Norfolk at Hampton, Virginia. NASA owns 788 acres and has access to 3,276 acres. The total replacement cost including land, buildings, structures and facilities, equipment, and other fixed assets was \$1,115,590,869 as of September 30, 1995.

LEWIS RESEARCH CENTER - The Lewis Research Center occupies two sites; the main site is in Cleveland, Ohio, adjacent to Cleveland-Hopkins Airport; the second site is the Plum Brook Station located south of Sandusky, Ohio, and 50 miles west of Cleveland. NASA owns 6,805 acres and leases an additional 14 acres at the Cleveland location. The total replacement cost including land, buildings, structures and facilities, equipment, and other fixed assets at both locations was \$855,790,779 as September 30, 1995.

NASA HEADQUARTERS - NASA Headquarters is located at Two Independence Square, 300 E St. SW, Washington, D.C. and occupies other buildings in the District of Columbia, Maryland, and Virginia.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
CONSTRUCTION OF FACILITIES
FISCAL YEAR 1997 ESTIMATES

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MISSION SUPPORT

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1997 BUDGET ESTIMATES

PROGRAM GOALS

The goal of the Construction of Facilities program is to provide the facilities that are critical to achieving NASA's space and aeronautics program.

STRATEGY FOR ACHIEVING GOALS

Funding for construction is budgeted in the appropriations which require specific facilities to conduct their programs. Funds for discrete projects, that are required to conduct specific Human Space Flight or Science, Aeronautics, and Technology programs or projects are included in these two appropriations. The Construction of Facilities budget line item in the Mission Support appropriation provides for discrete projects required for components of the basic infrastructure and institutional facilities. The Mission Support appropriation also includes minor revitalization projects (repair and rehabilitation and modification of existing facilities), minor construction projects, environmental compliance and restoration activities; the design of facilities projects; and advanced planning related to future facilities needs. The narratives for all construction projects are included in this portion of the budget submission to identify the total facilities required in FY 1997. The Space Shuttle budget in the Human Space Flight appropriation includes specific facility projects as program requirements and references the narratives provided in Mission Support for detailed descriptions and justifications. No discrete projects are included in the FY 1997 budget request for Science, Aeronautics, and Technology programs.

In Human Space Flight, the FY 1997 budget request provides discrete projects for replacement of Launch Complex Pad B chillers and restoration of the Fixed Support Structure Elevator System at Kennedy Space Center; rehabilitation of the 480 volt electrical distribution system, External Tank Manufacturing Building at the Michoud Assembly Facility; and restoration of the High Pressure Industrial Water Plant at the Stennis Space Center.

In Mission Support, funding is requested in FY 1997 for discrete projects to repair and modernize utility and building systems which have reached or exceeded their normal design life. These systems include cooling, mechanical, air, and electrical distribution facilities at Ames Research Center, Dryden Flight Research Center, Goddard Space Flight Center, Jet Propulsion Laboratory, Johnson Space Center, Kennedy Space Center, Lewis Research Center, Marshall Space Flight Center, and the White Sands Test Facility. Also included is a project at the Dryden Research Center to modify the aircraft ramp and tow way to meet safety code requirements.

These facilities are critical to the development and operation of the space transportation system. In addition, they are necessary to support payloads and launch facilities, as well as our aeronautical and aerospace testing capabilities, that also support military and private industry users.

The FY 1997 construction program is required to help preserve and enhance the capabilities and usefulness of existing facilities and ensure safe, economical, and efficient use of the NASA physical plant. The minor revitalization program included in this request continues the necessary rehabilitation and modification program and a responsive repair program. The minor construction program provides a means to accomplish smaller facility projects which accommodate changes in technical and institutional requirements. The environmental compliance and restoration program is critical to ensuring that statutory environmental requirements are met and that necessary remedial actions are promptly taken.

Funds requested for facility planning and design cover advance planning and design requirements for potential future projects, master planning, facilities studies, engineering reports and studies, and the preparation of facility project design drawings and bid specifications. Since pressures continue to mount on the Construction of Facilities resources as the facility base ages, as a preventative measure, funding is also included for two initiatives (conversion to Reliability Centered Maintenance and Performance-Based Maintenance Contracting) directed at increasing the rate of return of severely constrained Agency resources while keeping the facility infrastructure safe, reliable, and available. The initial planning for these conversions has started, and the current plan is to make FY 1996 funding available to start the conversions. It is estimated that these conversions will take three years to complete agency-wide.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
CONSTRUCTION OF FACILITIES
FISCAL YEAR 1997 ESTIMATES
SUMMARY OF THE BUDGET PLAN BY LOCATION
(Thousands of Dollars)

L O C A T I O N	Fiscal Year 1995	Fiscal Year 1996	Fiscal Year 1997 Agency Request
Ames Research Center.....	31,800	18,130	9,270
Dryden Flight Research Center.....	11,210	3,320	12,740
Goddard Space Flight Center.....	27,110	26,785	12,060
Jet Propulsion Laboratory.....	10,910	13,300	15,000
Lyndon B. Johnson Space Center.....	30,350	28,155	14,000
John F. Kennedy Space Center.....	23,450	32,300	11,500
Langley Research Center.....	9,020	8,545	7,215
Lewis Research Center.....	9,650	19,265	16,630
George C. Marshall Space Center.....	23,675	31,640	23,000
John C. Stennis Space Center.....	4,280	8,800	7,100
Wallops Flight Facility.....	4,320	6,890	8,240
Various Locations.....	10,725	11,470	8,145
Facility Planning and Design.....	10,000	10,000	18,700
Reduction.....	---	-24,000 *	---
Total Construction of Facilities.....	<u>206,500</u>	<u>194,600</u>	<u>163,600</u>

*Consistent with Congressional direction, \$24 million of excess FY 1994 funding is being used to fund FY 1996 construction projects. The \$24 million results from favorable bids experienced in the marketplace, construction efficiencies realized from innovative designs, scope reductions due to efforts to downsize the Agency's physical plant as well as Zero Base Review determinations, and the design of fewer projects for future budgets due to constrained Agency resources. This funding is available from "Replacement of Central Plant Steam and Electrical Generation Equipment (\$.2M) at the Goddard Space Flight Center; Restore C-5 Substation, Launch Complex 39 Area" (\$1.5M), "Refurbish Launch Complex 39 Cooling System" (\$1.3M), "Restore Class III Landfill (\$.6M), and "Refurbish VAB/Pad Water Storage Tanks" (\$.8M) at the Kennedy Space Center; "Construction of the EOSDIS Distributed Active Archive Center" (\$.2M) at the Langley Research Center; Modifications for Composite Technology Center (\$8.0M) and "Rehabilitation of the Rocket Engine Test Facility" (\$4.0M) at the Lewis Research Center; "Restoration of High Pressure Air Compressor System (\$.8M) at the Marshall Space Flight Center; and "Facility Planning and Design" (\$6.6M) at various locations.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
CONSTRUCTION OF FACILITIES
FISCAL YEAR 1997 ESTIMATES
SUMMARY OF BUDGET PLAN BY APPROPRIATION AND PROJECT
(Thousands of Dollars)

INSTALLATION AND PROJECT	Fiscal Year 1995	Fiscal Year 1996	Fiscal Year 1997 Agency Request	Page No
<u>HUMAN SPACE FLIGHT</u>				
 <u>SPACE STATION:</u>				
Construction of Neutral Buoyancy Laboratory (JSC).....	20,200	14,800	---	
	20,200	14,800	---	
 <u>OTHER HUMAN SPACE FLIGHT:</u>				
Replacement of LC-39 Pad B Chillers (KSC).....	---	---	1,800	MS 4-12
Restoration of Pad B Fixed Support Structure Elevator System (KSC).	---	---	1,500	MS 4-15
Rehabilitation of 480V Electrical Distribution System, External Tank Manufacturing Building (MAF).....	---	---	2,500	MS 4-18
Restoration of High Pressure Industrial Water Plant (SSC).....	---	---	2,500	MS 4-22
Replace Chemical Analysis Facility (KSC).....	---	7,500	---	
Replace Space Shuttle Main Engine Processing Facility (KSC).....	---	4,900	---	
Modernize Firex System, Pads A and B (KSC).....	4,800	5,000	---	
Replace Components Refurbishment Laboratory (KSC).....	7,500	---	---	
 Total - Human Space Flight.....	 32,500 =====	 32,200 =====	 8,300 =====	

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
 CONSTRUCTION OF FACILITIES
 FISCAL YEAR 1997 ESTIMATES
 SUMMARY OF BUDGET PLAN BY APPROPRIATION AND PROJECT
 (Thousands of Dollars)

INSTALLATION AND PROJECT	Fiscal Year 1995	Fiscal Year 1996	Fiscal Year 1997 Agency Request	Page No
<u>SCIENCE, AERONAUTICS, AND TECHNOLOGY</u>				
<u>SCIENCE</u>	<u>17,000</u>	<u>20,000</u>	---	
Construction of Earth Systems Science Building (GSFC).....	17,000	17,000	---	
Construction of Addition to Microgravity Development Laboratory (MSFC).....	---	3,000	---	
<u>AERONAUTICS</u>	<u>22,000</u>	---	---	
Modernization of the Unitary Plan Wind Tunnel Complex (ARC).....	22,000	---	---	
<u>TECHNOLOGY</u>	---	---	---	
Total - Science, Aeronautics, and Technology.....	<u>39,000</u> =====	<u>20,000</u> =====	<u>0</u> =====	

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
CONSTRUCTION OF FACILITIES
FISCAL YEAR 1997 ESTIMATES
SUMMARY OF BUDGET PLAN BY APPROPRIATION AND PROJECT
(Thousands of Dollars)

INSTALLATION AND PROJECT	Fiscal Year 1995	Fiscal Year 1996	Fiscal Year 1997 Agency Request	Page No
<u>MISSION SUPPORT</u>				
Modernization of Electrical Distribution System (ARC).....	---	---	2,400	MS 4-26
Modification of Aircraft Ramp and Tow Way (DFRC).....	---	---	3,000	MS 4-30
Restoration of Hangar Building 4801 (DFRC).....	---	---	4,500	MS 4-34
Modernization of Secondary Electrical Systems (GSFC).....	---	---	1,500	MS 4-38
Restoration of Chilled Water Distribution System (GSFC).....	---	3,000	4,000	MS 4-42
Modification of Refrigeration Systems, Various Buildings (JPL)....	---	---	2,800	MS 4-46
Rehabilitation of Electrical Distribution System, White Sands Test Facility (JSC).....	---	1,100	2,600	MS 4-50
Rehabilitation of Utility Tunnel Structure and Systems (JSC).....	4,300	---	4,400	MS 4-54
Replacement of DX Units with Central Chilled Water System, Logistics Facility, (KSC).....	---	---	1,800	MS 4-58
Rehabilitation of Central Air Equipment Building (LeRC).....	---	9,000	6,500	MS 4-61
Modification of Chilled Water System (MSFC).....	---	---	6,700	MS 4-64
Rehabilitation of Condenser Water System, 202/207 Complex (MAF)....	---	---	2,100	MS 4-68
Restoration of Flight Systems Research Laboratory (ARC).....	---	6,300	---	
Replace Chillers, Various Buildings (JPL).....	---	4,800	---	
Replace Main Substation Switchgear and Circuit Breakers (JSC).....	---	4,200	---	
Replace 15kV Load Break Switches (KSC).....	---	1,800	---	
Restoration of High Pressure Air Compressor System (MSFC).....	---	4,700	---	
Restoration of Information and Electronic Systems Laboratory (MSFC)	---	6,800	---	
Restoration of Canal Lock (SSC).....	---	1,400	---	
Restoration of Primary Electrical Distribution System (WFF).....	---	2,500	---	
Seismic Upgrade of Research, Development, and Test Building (DFRC)..	8,000	---	---	
Restore Exterior/Interior Systems, Buildings 3, 13, and 14 (GSFC)..	5,000	---	---	
Modernize Condenser Water Systems, Southern Sector (JPL).....	4,300	---	---	
Modernize Payloads Hazardous Servicing Facility HVAC System (KSC)..	1,500	---	---	

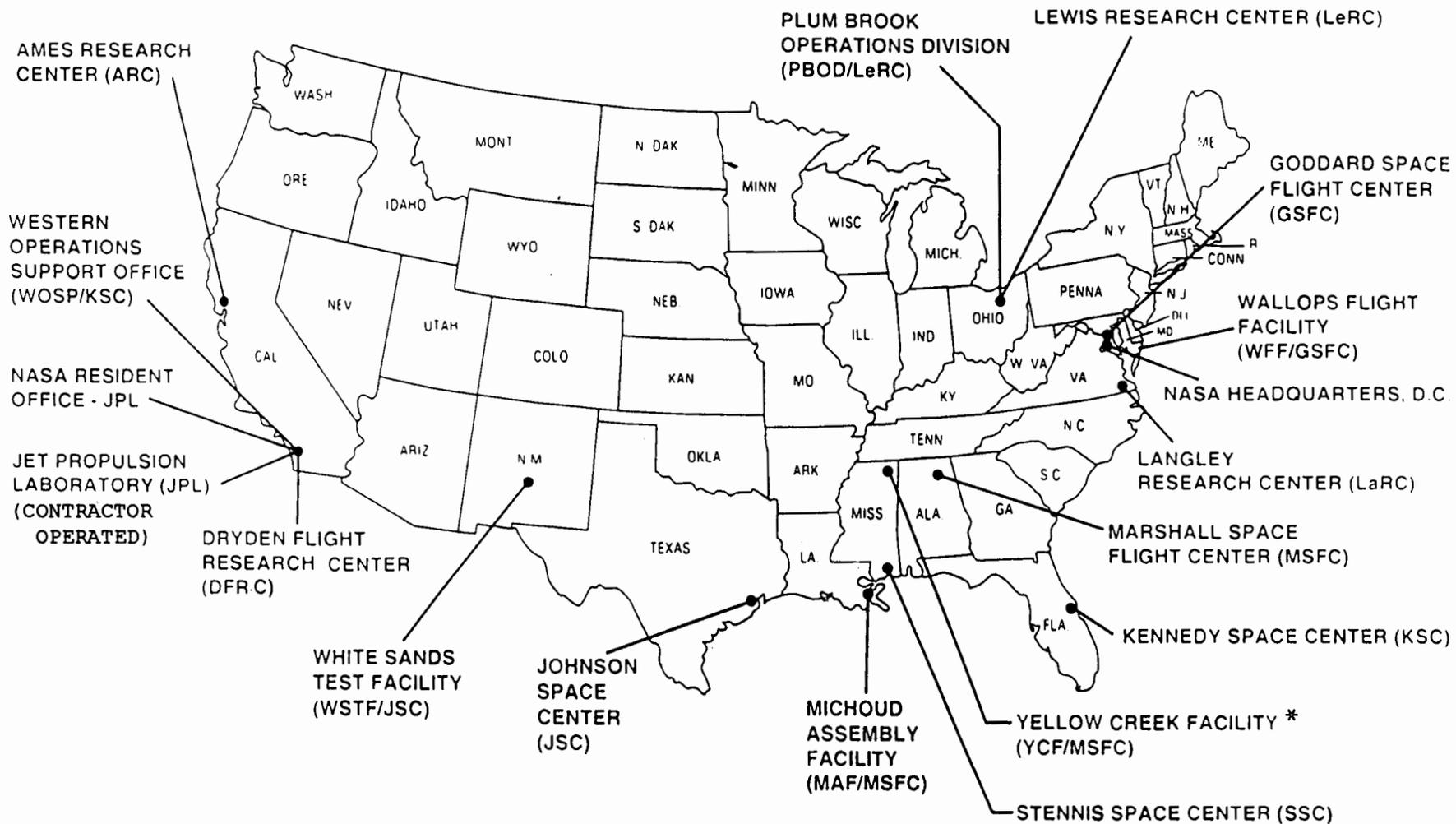
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
CONSTRUCTION OF FACILITIES
FISCAL YEAR 1997 ESTIMATES
SUMMARY OF BUDGET PLAN BY APPROPRIATION AND PROJECT
(Thousands of Dollars)

INSTALLATION AND PROJECT	Fiscal Year 1995	Fiscal Year 1996	Fiscal Year 1997 Agency Request	Page No
<u>MISSION SUPPORT (Continued)</u>				
Modernize Metrology and Calibration Facility (MSFC).....	4,900	---	---	
Minor Revitalization of Facilities at Various Locations, Not in excess of \$1,500,000 per project.....	60,000	70,000	57,900	MS 4-72
Minor Construction of New Facilities and Additions to Existing Facilities at Various Locations, Not in excess of \$1,500,000 per project.....	2,000	3,800	3,400	MS 4-101
Facility Planning and Design.....	10,000	10,000	18,700	MS 4-106
Environmental Compliance and Restoration.....	35,000	37,000	33,000	MS 4-112
Reduction.....	---	-24,000 *	---	
Total - Mission Support.....	135,000 =====	142,400 =====	155,300 =====	
Total - Construction of Facilities.....	206,500	194,600	163,600	

(Total Construction of Facilities funding included in the three appropriations)

*Consistent with Congressional direction, \$24 million of excess FY 1994 funding is being used to fund FY 1996 construction projects. The \$24 million results from favorable bids experienced in the marketplace, construction efficiencies realized from innovative designs, scope reductions due to efforts to downsize the Agency's physical plant as well as Zero Base Review determinations, and the design of fewer projects for future budgets due to constrained Agency resources. This funding is available from "Replacement of Central Plant Steam and Electrical Generation Equipment (\$.2M) at the Goddard Space Flight Center; Restore C-5 Substation, Launch Complex 39 Area" (\$1.5M), "Refurbish Launch Complex 39 Cooling System" (\$1.3M), "Restore Class III Landfill (\$.6M), and "Refurbish VAB/Pad Water Storage Tanks" (\$.8M) at the Kennedy Space Center; "Construction of the EOSDIS Distributed Active Archive Center" (\$.2M) at the Langley Research Center; Modifications for Composite Technology Center (\$8.0M) and "Rehabilitation of the Rocket Engine Test Facility" (\$4.0M) at the Lewis Research Center; "Restoration of High Pressure Air Compressor System (\$.8M) at the Marshall Space Flight Center; and "Facility Planning and Design" (\$6.6M) at various locations.

LOCATION OF MAJOR AND COMPONENT INSTALLATIONS



*The Yellow Creek Facility is being transferred to the State of Mississippi in accordance with P.L. 104-99.

**RECORDED VALUE OF CAPITAL TYPE PROPERTY
IN-HOUSE AND CONTRACTOR-HELD
AS OF SEPTEMBER 30, 1995
(DOLLARS IN THOUSANDS)**

REPORTING INSTALLATION	LAND	BUILDING	OTHER STRUCTURES AND FACILITIES	LEASEHOLD IMPROVEMENTS	TOTAL	EQUIPMENT	FIXED ASSETS IN PROGRESS	GRAND TOTAL
AMES RESEARCH CENTER	6,865	737,166	96,157	0	840,188	452,186	81,113	1,373,487
ARC MOFFETT FIELD, CA	2,928	612,164	28,942	0	644,034	334,686	68,541	1,047,261
DRYDEN FLIGHT FACILITY EDWARDS, CA	0	70,512	27,940	0	98,452	117,291	12,572	228,315
VARIOUS LOCATIONS	3,937	54,490	39,275	0	97,702	209	0	97,911
GODDARD SPACE FLIGHT CENTER	3,341	325,756	143,520	0	472,617	753,451	22,586	1,248,654
GSFC-GREENBELT, MD	1,578	221,176	39,381	0	262,135	404,968	15,758	682,861
TRACKING STATIONS NETWORK	0	39,381	11,436	0	50,817	163,346	376	214,539
WFF-WALLOPS ISLAND, VA	1,763	62,299	87,907	0	151,969	87,716	6,452	246,137
VARIOUS LOCATIONS	0	2,900	4,796	0	7,696	97,421	0	105,117
JET PROPULSION LABORATORY	1,189	209,564	119,164	666	330,583	383,799	0	714,382
JPL PASADENA, CA	1,189	209,564	119,164	666	330,583	383,799	0	714,382
JOHNSON SPACE CENTER	11,256	359,409	129,812	154	500,631	775,154	49,826	1,325,611
JSC-HOUSTON, TX	7,309	292,639	85,570	0	385,518	465,172	49,826	900,516
WHITE SANDS TEST FACILITY LOS CRUCES, NM	377	17,578	38,187	154	56,296	0	0	56,296
VARIOUS LOCATIONS	3,570	49,192	6,055	0	58,817	309,982	0	368,799
KENNEDY SPACE CENTER	73,672	712,590	588,486	0	1,374,748	898,669	109,572	2,382,989
KSC-CAPE CANAVERAL, FL	73,672	712,590	588,486	0	1,374,748	96,860	109,572	1,581,180
WESTERN TEST RANGE, LOMPOC, CA	0	0	0	0	0	3,391	0	3,391
VARIOUS LOCATIONS	0	0	0	0	0	798,418	0	798,418
LANGLEY RESEARCH CENTER	156	258,007	449,906	0	708,069	345,652	54,855	1,108,576
LARC-HAMPTON, VA	156	258,007	449,906	0	708,069	331,236	54,855	1,094,160
VARIOUS LOCATIONS	0	0	0	0	0	14,416	0	14,416
LEWIS RESEARCH CENTER	2,621	349,173	123,233	136	475,163	270,076	96,485	841,724
LERC-CLEVELAND, OH	316	269,555	101,049	136	371,056	178,555	96,485	646,096
PLUM BROOK, SANDUSKY, OH	2,305	79,618	22,184	0	104,107	79,693	0	183,800
VARIOUS LOCATIONS	0	0	0	0	0	11,828	0	11,828
MARSHALL SPACE FLIGHT CENTER	11,024	481,868	249,724	0	742,616	803,338	10,036	1,555,990
MSFC-HUNTSVILLE, AL	0	218,300	103,420	0	321,720	565,403	10,036	897,159
MICHOUD ASSEMBLY FACILITY, LA	7,162	171,272	93,324	0	271,758	77,102	0	348,860
SLIDELL COMPUTER COMPLEX, LA	0	0	0	0	0	0	0	0
VARIOUS LOCATIONS	3,862	92,296	52,980	0	149,138	160,833	0	309,971
STENNIS SPACE CENTER	18,080	136,632	249,452	0	404,164	56,758	47,899	508,821
STENNIS SPACE CENTER	18,080	136,632	249,284	0	403,996	56,758	47,899	508,653
VARIOUS LOCATIONS	0	0	168	0	168	0	0	168
NASA HEADQUARTERS	0	0	0	0	0	54,401	0	54,401
NASA-HQS, WASH, DC	0	0	0	0	0	54,401	0	54,401
VARIOUS LOCATIONS	0	0	0	0	0	0	0	0
AGENCY TOTAL	128,204	3,570,165	2,149,454	956	5,848,779	4,793,484	472,372	11,114,635

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
 CONSTRUCTION OF FACILITIES
 FISCAL YEAR 1997 ESTIMATES

SUMMARY

HUMAN SPACE FLIGHT

	Amount	Page
	-----	-----
	(Dollars)	
Replacement of LC-39 Pad B Chillers (KSC).....	1,800,000	MS 4-12
Restoration of Pad B Fixed Support Structure Elevator System (KSC).....	1,500,000	MS 4-15
Rehabilitation of 480V Electrical Distribution System, External Tank Manufacturing Building (MAF).....	2,500,000	MS 4-18
Restoration of High Pressure Industrial Water Plant (SSC).....	2,500,000	MS 4-22
Total Human Space Flight	8,300,000 =====	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1997 ESTIMATES

PROJECT TITLE: Replacement of LC-39 Pad B Chillers

INSTALLATION: John F. Kennedy Space Center

FY 1997 Estimate: \$1,800,000

LOCATION OF PROJECT: John F. Kennedy Space Center, Brevard County, Florida

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY 1996 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific Construction Funding	\$204,000	\$ ---	\$ 204,000
Capitalized Investment	<u>---</u>	<u>216,362,462</u>	<u>216,362,462</u>
Total	<u>\$204,000</u>	<u>\$216,362,462</u>	<u>\$216,566,462</u>

SUMMARY PURPOSE AND SCOPE:

The Pad B Chillers and Air Handler Units system provides a temperature and humidity controlled environment for electronic equipment located at LC-39 Pad B and the Mobile Launch Platforms. The electronic equipment provides numerous functions associated with Space Shuttle launch operations support. The critical nature of this electronic hardware requires redundancy in the Chilled Water System configuration. Pad B is required for Kennedy Space Center to perform its assigned Agency roles and missions.

PROJECT JUSTIFICATION:

The current system has been in service more than 25 years and has reached its economical life expectancy. This system is part of a critical path for launch criteria assurance. Many of the

aged components are obsolete resulting in an unreliable system. System operators continue to experience increased component failure rates and maintenance downtime. The current configuration does not provide adequate capacity for nominal load requirements. Additionally, the existing Chiller units contain chloroflourocarbon (CFC) refrigerant. Kennedy Space Center (KSC) is currently working to eliminate the use of CFC refrigerants by 1997. The new Chiller units will utilize an environmentally acceptable refrigerant.

IMPACT OF DELAY:

The cost to operate and maintain this system will continue to escalate dramatically. Downtime will increase and eventually degrade the Space Shuttle process flow. The existing system will continue to deteriorate and questionable system reliability will remain a prevailing issue for launch support.

PROJECT DESCRIPTION:

This project replaces three existing Chiller units with premium efficiency Chillers. These new units will utilize non-CFC refrigerant for cooling. Existing piping and associated valves will be replaced where necessary. The Chiller units will be sized to assure system redundancy. The associated chilled water pumps will be replaced to accommodate proper capacity flows. Condenser piping will be relocated and/or replaced where necessary. Due to the increased loads over the last several years, modifications to the Cooling Towers will be necessary to accommodate redundancy. The existing Air Handler Units will be replaced with new units. Additional requirements include a refrigerant detection system, asbestos abatement, insulation of chilled water piping, new variable speed drives for the chilled water pumps, and various electrical upgrades and control panels installation and relocation to assure reliability.

PROJECT COST ESTIMATE:

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
Civil/Structural	Lump Sum (LS)	---	---	\$ 286,000
Mechanical	LS	---	---	1,177,000
Electrical	LS	---	---	337,000
Total				<u>\$1,800,000</u>

LIST OF RELATED GRAPHICS: Figure 1-Site Plan

OTHER EQUIPMENT SUMMARY: Approximately \$35,000 is required for rental of temporary cooling unit.

FUTURE ESTIMATED CONSTRUCTION FUNDING REQUIRED TO COMPLETE THIS PROJECT: None

**JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1997 ESTIMATES
REPLACEMENT OF LC-39 PAD B CHILLERS**

SITE PLAN

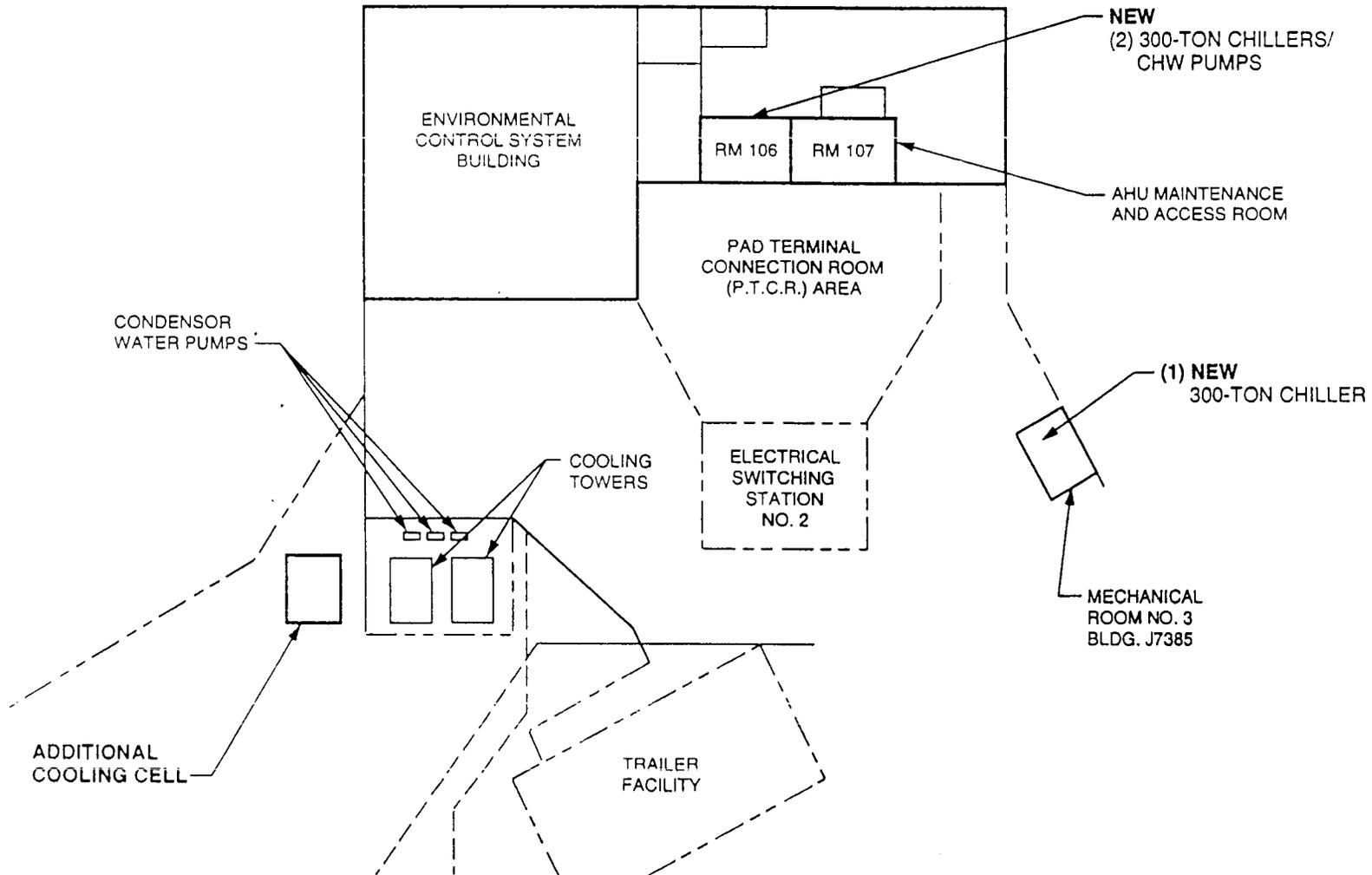


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1997 ESTIMATES

PROJECT TITLE: Restoration of Pad B Fixed Support Structure Elevator System

INSTALLATION: John F. Kennedy Space Center

FY 1997 Estimate: \$1,500,000

LOCATION OF PROJECT: John F. Kennedy Space Center, Brevard County, Florida

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY 1996 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific Construction Funding	\$120,000	\$ ---	\$ 120,000
Capitalized Investment	---	<u>216,362,462</u>	<u>216,362,462</u>
Total	<u>\$120,000</u>	<u>\$216,362,462</u>	<u>\$216,482,462</u>

SUMMARY PURPOSE AND SCOPE:

The Pad B Fixed Support Structure (FSS) elevators are used by various NASA and contractor personnel to provide access to upper levels of the Launch Structure during Shuttle maintenance and operational functions. This project will refurbish the elevator motor and control system components. Pad B is required for Kennedy Space Center to perform its assigned Agency roles and missions.

PROJECT JUSTIFICATION:

The existing Pad B FSS elevator system is over 25 years old and contains obsolete parts resulting in unreliable operations. The existing elevator cabs, hoistway rails, brackets, support beams, door, and pit hardware have been subject to excessive corrosion and damage from Solid Rocket Booster (SRB) launch residue. The elevator system continues to require excessive preventative and corrective maintenance.

IMPACT OF DELAY:

Refurbishment is required to prevent loss of Pad B FSS elevator support. Hazards to personnel and equipment increase as the cabs, rails, and hoistway components continue to corrode and weaken. Delay in refurbishing the controls will increase maintenance requirements and cause extended down-time delays.

PROJECT DESCRIPTION:

Refurbishment would include elevator cab replacement, hoistway and pit replacement, and the installation of an elevator washdown system. Control refurbishment includes replacing the motor-generators with DC (direct current) armature drives and replacing the discrete relay logic panels with modern solid state programmable logic controllers. These controllers will enhance performance, reliability, and troubleshooting capabilities.

PROJECT COST ESTIMATE:

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
Civil	LS	---	---	\$92,000
Structural	LS	---	---	966,000
Electrical	LS	---	---	133,000
Mechanical	LS	---	---	309,000
Total				<u>\$1,500,000</u>

LIST OF RELATED GRAPHICS: Figure 1: Site Plan

OTHER EQUIPMENT SUMMARY: None

FUTURE ESTIMATED CONSTRUCTION FUNDING REQUIRED TO COMPLETE THIS PROJECT: None

**JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1997 ESTIMATES
RESTORATION OF PAD B FIXED SUPPORT STRUCTURE ELEVATOR SYSTEM**

**SITE PLAN
LC-39 PAD B**

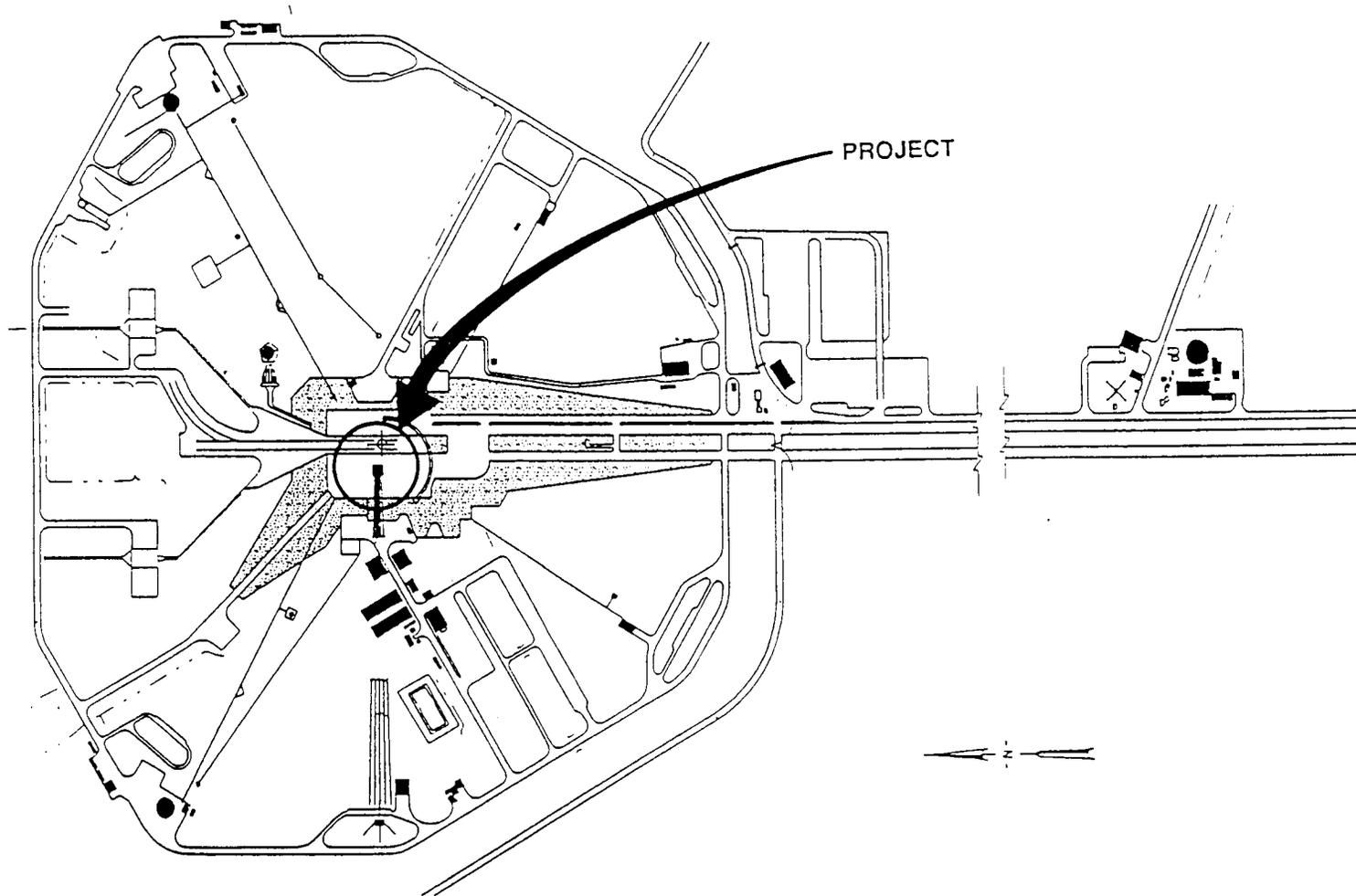


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1997 ESTIMATES

PROJECT TITLE: Rehabilitation of 480V Electrical Distribution System, External Tank
Manufacturing Building

INSTALLATION: Michoud Assembly Facility

FY 1997 ESTIMATE: \$2,500,000

LOCATION OF PROJECT: New Orleans, Orleans Parish, Louisiana

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY 1996 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific Construction Funding	\$ 200,000	\$3,245,000	\$ 3,445,000
Capitalized Investment	<u>---</u>	<u>53,552,791</u>	<u>53,552,791</u>
Total	\$ <u>200,000</u>	<u>\$56,797,791</u>	<u>\$56,997,791</u>

SUMMARY PURPOSE AND SCOPE:

This project provides for the rehabilitation and modification of the 480V electrical distribution system which supports critical External Tank (ET) manufacturing operations in the Final Assembly and Major Weld areas of the ET Manufacturing Building (103). This project replaces the electrical distribution system associated with substations 1, 2A, and 2B. It is required to restore quality and reliability to the electrical power system and avoid costly piecemeal repairs. Building 103 is required for the Michoud Assembly Facility to perform its assigned Agency roles and missions.

PROJECT JUSTIFICATION:

The 480V electrical distribution system in Building 103 was originally installed in the 1940's. Exposed distribution feeders resulting from cracked insulation and "spot" overloads combine to create potential production shutdowns. Existing bus ducts are inaccessible for maintenance. Feeder taps to fan houses lack overcurrent protection. Main distribution and sub-distribution panels and associated breakers are obsolete. Existing grounding does not meet the National Electric Code (NEC) nor current design standards. The long range electrical plan and a subsequent A/E study recommend upgrade of the 480V power distribution system. This project will provide a safe and reliable 480V electrical distribution system from substations 1, 2A, and 2B to the Final Assembly and Major Weld areas of Building 103. It continues the systematic rehabilitation of older high-voltage systems in critical production areas.

IMPACT OF DELAY:

Failure to rehabilitate exposed feeders, hot spots, and improper grounding may cause production shutdown of External Tank manufacturing operations in the Final Assembly and Major Weld areas.

PROJECT DESCRIPTION:

This project installs new main distribution and sub-distribution power panels and transformers. New electrical distribution feeders will be routed in cable trays for easy maintenance. Electrical distribution circuits will be designed to eliminate the need for bus ducts. The new distribution system will be tied into substation switchgear and the old distribution system will be demolished.

PROJECT COST ESTIMATE:

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
Electrical	LS	---	---	2,500,000
Total				<u>\$2,500,000</u>

LIST OF RELATED GRAPHICS: Figure 1 - Location Plan

OTHER EQUIPMENT SUMMARY: None

FUTURE ESTIMATED CONSTRUCTION FUNDING REQUIRED TO COMPLETE THIS PROJECT: None. However, future funding in the amount of \$6,600,000 will be required in FY 1998-2000 to rehabilitate the 480V electrical distribution system in the remaining areas of Building 103.

MICHOUD ASSEMBLY FACILITY
FISCAL YEAR 1997 ESTIMATES
REHABILITATION OF 480V ELECTRICAL DISTRIBUTION SYSTEM
LOCATION PLAN

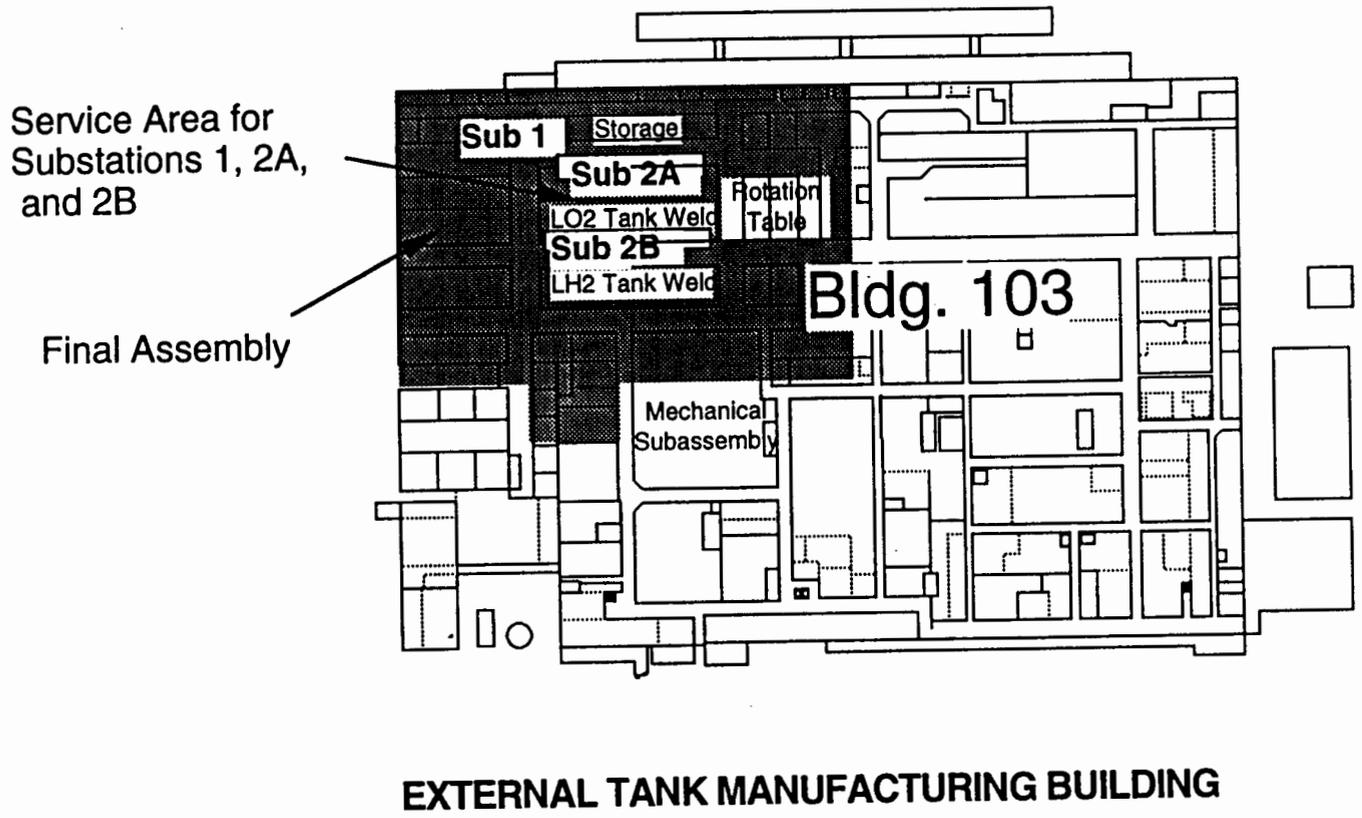


FIGURE 1

CONSTRUCTION OF FACILITIES
FISCAL YEAR 1997 ESTIMATES

PROJECT TITLE: Restoration of High Pressure Industrial Water Plant

INSTALLATION: John C. Stennis Space Center

FY 1997 Estimate: \$2,500,000

LOCATION OF PROJECT: Stennis Space Center, Hancock County, Mississippi

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY 1996 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific Construction Funding	\$188,000	---	\$188,000
Capitalized Investment	---	\$9,723,855	9,723,855
 Total	 <u>\$188,000</u>	 <u>\$9,723,855</u>	 <u>\$9,911,855</u>

SUMMARY PURPOSE AND SCOPE:

This project implements a restoration program throughout the High Pressure Industrial Water Plant (Building 4400) to ensure system reliability and maintainability in support of the Space Shuttle Main Engine (SSME) testing program. The High Pressure Industrial Water Plant is required for Stennis Space Center to perform its assigned Agency roles and missions.

PROJECT JUSTIFICATION:

The High Pressure Industrial Water Plant (Building 4400) provides deluge water and backup electrical power to the SSME test stands during test operations. Major mechanical equipment within the facility is over 30 years old and obsolete, replacements parts are virtually unavailable, and the building is experiencing rapid structural deterioration. As identified in

the Facilities Condition Assessment, this project provides for the initiation of a restoration plan throughout the facility to ensure system maintainability and reliability.

IMPACT OF DELAY:

Delaying the implementation of this project will result in progressive deterioration of the facility, a debilitating increase in maintenance requirements, and the potential for water plant system failure to impact the SSME test schedule.

PROJECT DESCRIPTION:

This project provides for the initial implementation of a restoration program planned in stand alone stages throughout the High Pressure Industrial Water Plant. The scope of work includes overhaul of the diesel engines for the deluge water system, restoration of the diesel engines for the backup electrical power supply, overhaul/replacement of the deluge pumps, and restoration of various mechanical components and structural elements.

<u>PROJECT COST ESTIMATE:</u>	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
Overhaul Diesel Engines	LS	---	---	\$2,000,000
Overhaul/Replace Pumps	LS	---	---	315,000
Mechanical Restoration	LS	---	---	185,000
Total				<u>\$2,500,000</u>

LIST OF RELATED GRAPHICS: Figure 1 - Location Plan

OTHER EQUIPMENT SUMMARY: None

FUTURE ESTIMATED CONSTRUCTION FUNDING REQUIRED TO COMPLETE THIS PROJECT: Future funding required to complete this restoration of the High Pressure Industrial Water Plant is approximately \$2,500,000.

**JOHN C. STENNIS SPACE CENTER
FISCAL YEAR 1997 ESTIMATES
RESTORATION OF HIGH PRESSURE INDUSTRIAL WATER PLANT**

LOCATION PLAN

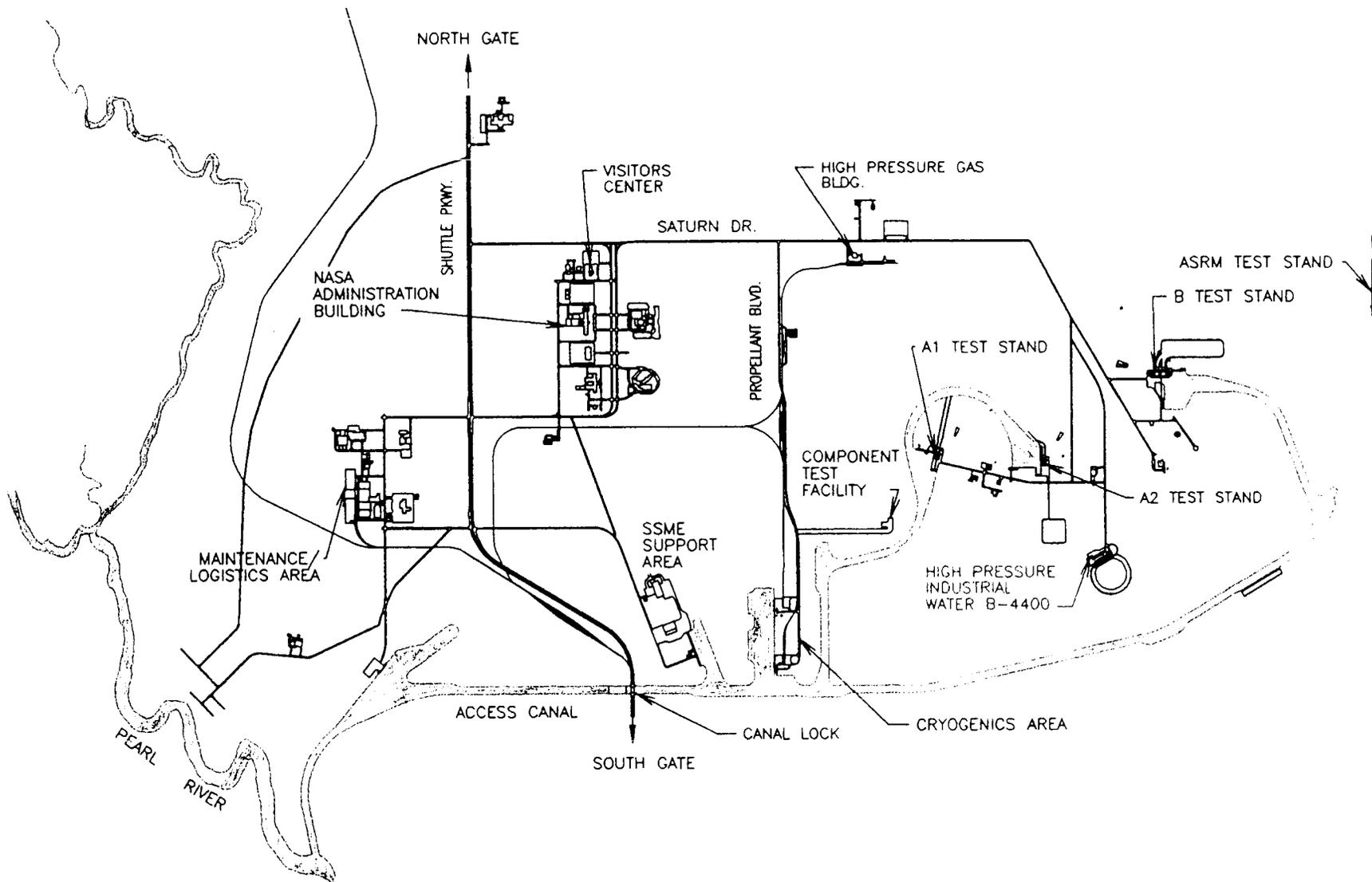


FIGURE 1

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
CONSTRUCTION OF FACILITIES
FISCAL YEAR 1997 ESTIMATES

SUMMARY

MISSION SUPPORT

	Amount	Page
	-----	-----
	(Dollars)	
Modernization of Electrical Distribution System (ARC).....	2,400,000	MS 4-26
Modification of Aircraft Ramp and Tow Way (DFRC).....	3,000,000	MS 4-30
Restoration of Hangar Building 4801 (DFRC).....	4,500,000	MS 4-34
Modernization of Secondary Electrical Systems (GSFC).....	1,500,000	MS 4-38
Restoration of Chilled Water Distribution System (GSFC).....	4,000,000	MS 4-42
Modification of Refrigeration Systems, Various Buildings (JPL).....	2,800,000	MS 4-46
Rehabilitation of Electrical Substations		
White Sands Test Facility (JSC).....	2,600,000	MS 4-50
Rehabilitation of Utility Tunnel Structure and Systems (JSC).....	4,400,000	MS 4-54
Replacement of DX Units with Central Chilled Water System,		
Logistics Facility, (KSC).....	1,800,000	MS 4-58
Rehabilitation of Central Air Equipment Building (LeRC).....	6,500,000	MS 4-61
Modification of Chilled Water System (MSFC).....	6,700,000	MS 4-64
Rehabilitation of Condenser Water System, 202/207 Complex (MAF).....	2,100,000	MS 4-68
Minor Revitalization.....	57,900,000	MS 4-72
Minor Construction.....	3,400,000	MS 4-101
Facility Planning and Design.....	18,700,000	MS 4-106
Environmental Compliance and Restoration.....	<u>33,000,000</u>	MS 4-112
 Total Mission Support	 <u>155,300,000</u> =====	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1997 ESTIMATES

PROJECT TITLE: Modernization of Electrical Distribution System

INSTALLATION: Ames Research Center

FY 1997 Estimate: \$2,400,000

LOCATION OF PROJECT: Moffett Field, Santa Clara County, CA

COGNIZANT HEADQUARTERS OFFICE: Office of Aeronautics

FY 1996 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific Construction Funding	\$185,000	---	\$ 185,000
Capitalized Investment	---	\$4,316,543	<u>4,316,543</u>
Total	<u>\$185,000</u>	<u>\$4,316,543</u>	<u>\$4,501,543</u>

SUMMARY PURPOSE AND SCOPE:

This project modernizes the electrical distribution system and provides an emergency electrical tie-line between Ames Research Center and the Moffett Federal Airfield. This project will significantly improve the quality and reliability of the electrical power supply for airfield support functions at Moffett.

PROJECT JUSTIFICATION:

Critical services including fire protection, security forces, and communications, are located in the Moffett Federal Airfield area. The electrical distribution system at Moffett is in poor condition and badly undersized to support current roles and missions. This is a serious infrastructure deficiency requiring immediate attention. This electrical project is critical to the changing tenant base of the facilities at Moffett.

The electrical cables affected by this project are paper-insulated, lead-covered conductors which are over forty years old and severely limited in capacity. Many shutdowns over the past several years can be attributed directly to the failure of these cables. Compounding this problem, Moffett currently has only one main source of electrical power located on the east side of the airfield. A very limited amount of emergency power is provided by the present tie cable from the west side of the airfield where Ames is located. Consequently, Moffett averages four or five power outages each year.

The Navy used generators to provide very limited back up power to mission-critical buildings. Many of the fuel tanks supporting these generators are being removed because they do not meet current environmental regulations for fuel storage. This exacerbates the problem of insufficient power to essential buildings in the event of a power outage and causes the airfield and other critical functions to shut down. The repairs that have to be made before power can be restored take hours, sometimes days, which is very disruptive to day-to-day operational activities. This project will provide automatic rerouting of power in the event of a failure, with no disruption in service, giving Moffett similar electrical power reliability to that experienced at Ames.

IMPACT OF DELAY:

Delay of this project will force Moffett Federal Airfield to continue to experience numerous power outages which disrupt airfield operations at Moffett.

PROJECT DESCRIPTION:

The project will upgrade the emergency power supply to Moffett Federal Airfield by replacing existing transformers, cables, and control systems. Work includes removal of existing 1MVA (million volt-amps) transformers, and installation of a new 10MVA transformer, switchgear, and control system at Substation N-225B. Existing cable from N-225B to Switchgear C in Building 104 will be replaced with new #500MCM (thousand circular mils) cable and the existing feeder #47 from

east to west side of the airfield will be replaced with new #500MCM cable in the existing 4-inch duct. The project also replaces approximately 3,000 linear meters of 15KV (thousand volt) cables and sectionalized switches in the west side of the airfield. Miscellaneous demolition and civil work, such as fences and concrete pads, will be accomplished.

PROJECT COST ESTIMATE:

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
Transformer	Lump Sum (LS)	---	---	\$ 600,000
Cables	LS	---	---	1,500,000
Switchgear and Control	LS	---	---	200,000
Misc. Civil Work	LS	---	---	100,000
 Total				 <u>\$2,400,000</u>

LIST OF RELATED GRAPHICS: Figure 1 - Site Plan

OTHER EQUIPMENT SUMMARY: None

FUTURE ESTIMATED CONSTRUCTION FUNDING REQUIRED TO COMPLETE THIS PROJECT: None

**AMES RESEARCH CENTER
FISCAL YEAR 1997 ESTIMATES
MODERNIZATION OF ELECTRICAL DISTRIBUTION SYSTEM
SITE PLAN**

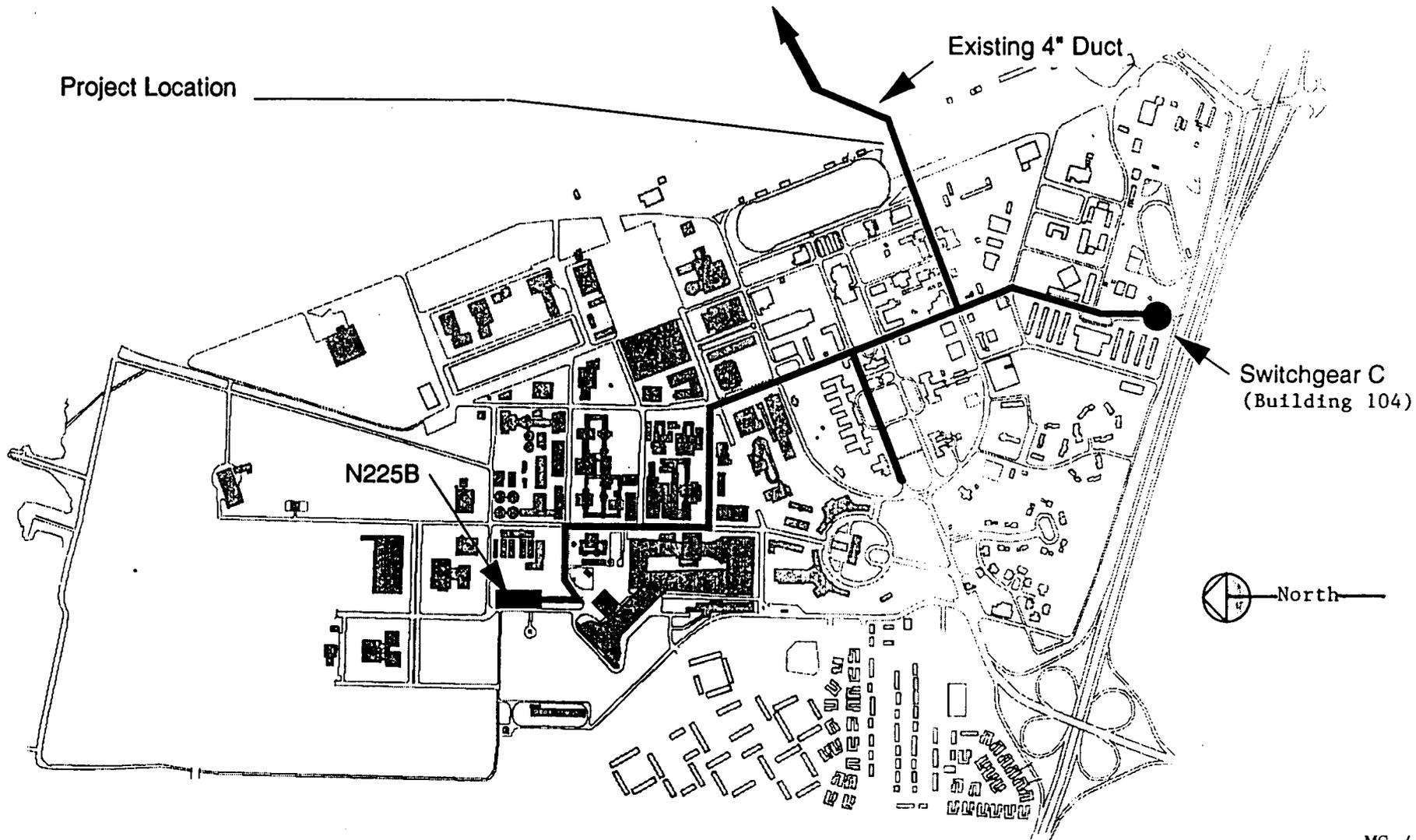


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1997 ESTIMATES

PROJECT TITLE: Modification of Aircraft Ramp and Tow Way

INSTALLATION: Dryden Flight Research Center

FY 1997 Estimate: \$3,000,000

LOCATION OF PROJECT: Dryden Flight Research Center, Kern County, CA

COGNIZANT HEADQUARTERS OFFICE: Office of Aeronautics

FY 1996 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific Construction Funding	\$240,000	---	\$ 240,000
Capitalized Investment	---	<u>\$1,238,485</u>	<u>1,238,485</u>
Total	<u>\$240,000</u>	<u>\$1,238,485</u>	<u>\$1,478,485</u>

SUMMARY PURPOSE AND SCOPE:

This project will modify Dryden's aircraft launch and recovery ramp and tow way to meet safety requirements for aircraft being flown at Dryden. The ramp will be enlarged to insure operational and ground safety during multiple aircraft operations and to alleviate possible aircraft collisions. Also, this project will enlarge the main parking apron by 12,500 square meters; widen the existing 18.3 meter tow way by 4.6 meters to produce a taxiway of 22.9 meters; and construct asphalt vehicle access roads totaling 15 meters in width to meet safety requirements. The ramp and tow way are required for Dryden to perform its assigned Agency roles and missions.

PROJECT JUSTIFICATION:

The launch and recovery apron and the tow way were constructed for use by aircraft operating in the 1950's. These aircraft were smaller, had less powerful engines, and required very little ground support equipment compared to modern aircraft. Aircraft operating at Dryden today are

larger, have more powerful engines, and require extensive ground support equipment to cool the aircraft instrumentation, provide power to operate aircraft systems, and start aircraft engines. Serious safety problems arise when two or more modern aircraft are operating on the 1950's era ramp at the same time.

Dryden's flight research capability has grown significantly with the completion of the Integrated Test Facility (ITF) in 1991. To best use the ITF's capability, all aircraft systems should be operational while taxiing from the Edwards runway to the ITF. Only an 18.3 meter tow way with no emergency vehicle access road connects the ITF to the Dryden ramp. NASA is violating safety regulations by using the tow way as a taxi way. Small aircraft have been granted a waiver pending near-term completion of this project.

IMPACT OF DELAY:

Delay of this project extends the probability of aircraft colliding and injury to personnel by jet engine blast when two or more aircraft are operating on the ramp at the same time. Delay of the tow way safety modifications sustains the risk to aircraft and personnel from inadequate access by emergency vehicles, from foreign object debris, and deprives NASA of the full benefit of the Integrated Test Facility.

PROJECT DESCRIPTION:

This project will modify Dryden's aircraft launch and recovery ramp and tow way to enable them to meet the operational safety requirements of modern aircraft currently being flown at Dryden. The modernization will include relocation of existing utilities, telecommunications, blast screens, emergency showers, regrading and backfilling, and the installation of a retaining wall. The back filled area will be covered with 40 centimeters of concrete, and a modern aircraft air starting system will be installed in this concrete apron. All ramps and safety zones for engine inlets and exhausts will be restriped. This project will include safety features for both personnel and aircraft operating on the ramp. In addition, this project includes the expansion of an existing concrete tow way (40 centimeters depth) to convert it into a functional taxi way by adding 4.6 meters to its width and providing a vehicular asphalt road for emergency vehicles.

PROJECT COST ESTIMATE:

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
Apron systems/utility relocation . . .	LS	---	---	\$ 75,000
Cut, fill, and compact apron base . . .	LS	---	---	430,000
Concrete apron	LS	---	---	1,320,000
Fill and compact tow way base	LS	---	---	175,000
Concrete tow way	LS	---	---	300,000
Fill and compact access road base . . .	LS	---	---	540,000
Asphalt road	LS	---	---	160,000
Total				<u>\$3,000,000</u>

LIST OF RELATED GRAPHICS: Figure 1 - Location Plan

OTHER EQUIPMENT SUMMARY: None

FUTURE ESTIMATED CONSTRUCTION FUNDING REQUIRED TO COMPLETE THIS PROJECT: None

**DRYDEN FLIGHT RESEARCH CENTER
FISCAL YEAR 1997 ESTIMATES
MODIFICATION OF AIRCRAFT RAMP AND TOW WAY**

LOCATION PLAN

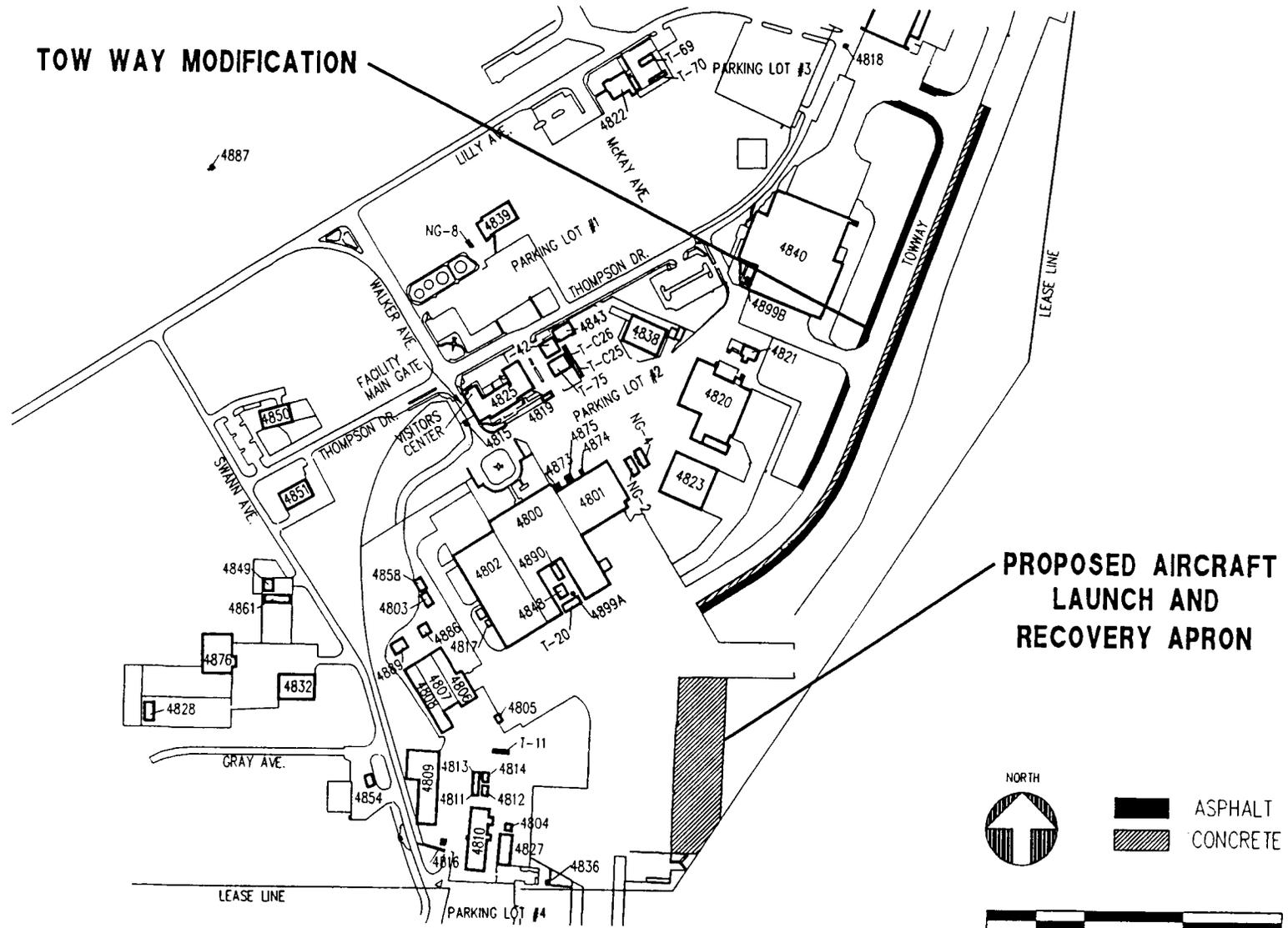


FIGURE 1

CONSTRUCTION OF FACILITIES
FISCAL YEAR 1997 ESTIMATES

PROJECT TITLE: Restoration of Hangar Building 4801

INSTALLATION: Dryden Flight Research Center

FY 1997 Estimate: \$4,500,000

LOCATION OF PROJECT: Dryden Flight Research Center, Kern County, CA

COGNIZANT HEADQUARTERS OFFICE: Office of Aeronautics

FY 1996 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific Construction Funding	\$303,223	---	\$ 303,223
Capitalized Investment	---	\$2,849,334	<u>2,849,334</u>
Total	<u>\$303,223</u>	<u>\$2,849,334</u>	<u>\$3,152,557</u>

SUMMARY PURPOSE AND SCOPE:

This project will rehabilitate Building 4801, one of the main aircraft hangars at Dryden. The project will ensure that the hangar meets current seismic safety codes; modify all hangar systems to meet operational and maintenance ground support requirements of current research aircraft; remove all environmental hazards; return previously modified portions of the building to hangar status; and upgrade lighting, heating, ventilating, and air conditioning, and other systems to meet current codes and Executive Order 12902 energy reduction goals. This hangar is required for Dryden to perform its assigned Agency roles and missions.

PROJECT JUSTIFICATION:

Dryden is located a short distance from the San Andreas fault. This hangar will not withstand a major earthquake in its current condition and needs major structural modifications to meet seismic safety code standards. The probable consequences of a major earthquake include injury or death, loss of irreplaceable aircraft with values totalling more than \$200 million, and damage to Building 4800, which is contiguous to Hangar 4801. This project will minimize these consequences.

Hangar 4801 was dedicated in 1954. It was designed to support and service aircraft which were flying at that time. Over the years, this hangar has not been modified to keep pace with the technological advances of aircraft requiring its support. A major objective of this project is to enable the hangar to support modern aircraft operational and maintenance requirements, by installing the requisite integrated systems necessary for aircraft such as the F-15, SR-71, F-18, and F-16XL. Modern aircraft are larger and need more cooling in the hangar than the aircraft Hangar 4801 was designed to support. A central 20 MPa (Million Pascals) hydraulic system, a built-in cooling system, and more hangar space are required to support modern aircraft.

Hangar 4801 was designed and constructed to the building codes of the early 1950's. It has never received a major rehabilitation in its 41 years of service. The electrical systems are outdated to the point that replacements for failed parts and components are unavailable. Rehabilitation is long overdue to meet current building codes for environmental, occupational health and safety, fire protection, disabled-employee access, and energy conservation requirements.

IMPACT OF DELAY:

Delaying this project extends the risk to building occupants and extremely high value aircraft in the event of an earthquake at or near Dryden. Programs affected could include the "Smart Actuator" research (F-18 SRA), "Fly-by-Light Closed Loop" night test (F-18), "Supersonic Laminar Flow" (F-16XL), "Near Field Sonic Boom Measurements" (SR-71), "Advanced Controls" (F-15), and "DoD System Development" (AFTI/F16 testbed).

Delaying this project causes Dryden to continue inefficient operations, perform piecemeal repairs or modifications to the hangar in order to meet the operational requirements of various aircraft, and pay more for energy and maintenance than necessary. Dynamic modeling has shown that, in a major earthquake, Hangar 4801 could collapse causing significant collateral damage to Building 4800.

PROJECT DESCRIPTION:

This project will modify the hangar structure to comply with current seismic and other life safety codes. An aircraft cooling system and a central ground support aircraft hydraulic system will be installed. Environmental hazards of lead, asbestos, and the drainage system, and a two-story mezzanine will be removed. Insulation; heating, ventilating and air conditioning system; the fire systems; lighting; and other systems will be upgraded or replaced. Access for the disabled will be provided. A bird control system will also be installed.

PROJECT COST ESTIMATE:

	<u>Unit of Measure</u>	<u>Unit Quantity</u>	<u>Cost</u>	<u>Cost</u>
Site Work & Demolition	LS	---	---	\$582,000
Concrete and Metals	LS	---	---	480,000
Doors and Windows	LS	---	---	356,000
Finishes & Specialties	LS	---	---	391,000
Mechanical	LS	---	---	1,842,000
Electrical	LS	---	---	682,000
Roofing and Insulation	LS	---	---	167,000
Total				<u>\$4,500,000</u>

LIST OF RELATED GRAPHICS: Figure 1 - Location Plan

OTHER EQUIPMENT SUMMARY:

The estimated cost to modify, replace, or relocate security and communication systems equipment as well as relocating functions and personnel during restoration and activation is \$660,000.

FUTURE ESTIMATED CONSTRUCTION FUNDING REQUIRED TO COMPLETE THIS PROJECT: None

**DRYDEN FLIGHT RESEARCH CENTER
FISCAL YEAR 1997 ESTIMATES
RESTORATION OF HANGAR BUILDING 4801**

LOCATION PLAN

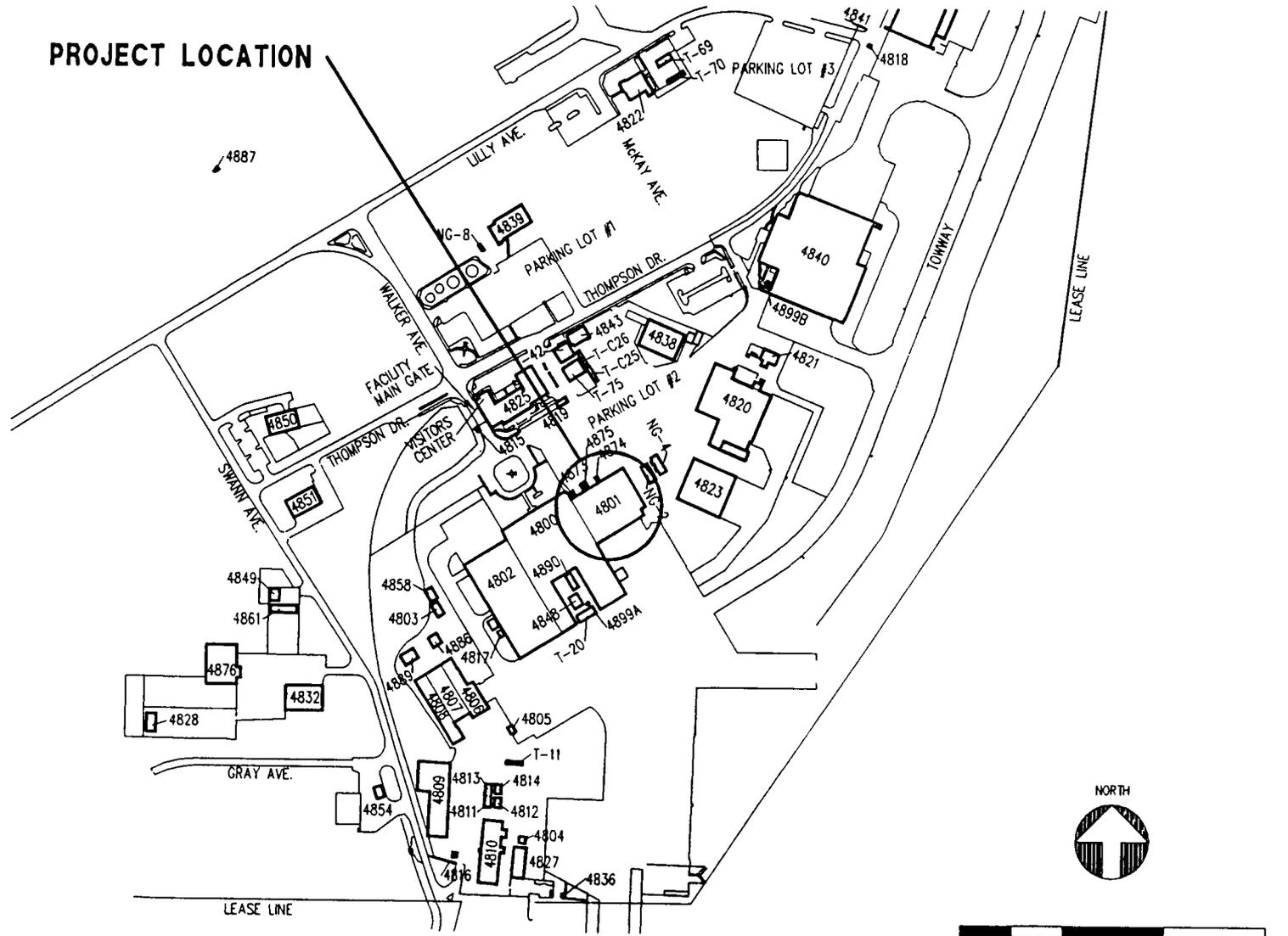


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1997 ESTIMATES

PROJECT TITLE: Modernization of Secondary Electrical Systems

INSTALLATION: Goddard Space Flight Center

FY 1997 ESTIMATE: \$1,500,000

LOCATION OF PROJECT: Greenbelt, Prince George's County, Maryland

COGNIZANT HEADQUARTERS OFFICE: Office of Mission to Planet Earth

FY 1996 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific Construction Funding	\$302,797	---	\$ 302,797
Capitalized Investment	---	<u>\$18,046,677</u>	<u>18,046,677</u>
Total	<u>\$302,797</u>	<u>\$18,046,677</u>	<u>\$18,349,474</u>

SUMMARY PURPOSE AND SCOPE:

This project modernizes the secondary electrical distribution systems by replacing aging electrical load centers, reconfiguring secondary electrical distribution systems, and providing a power monitoring and control system in Buildings 7 and 23. The project will enhance the reliability and maintainability of the electrical distribution system, and reduce operations and maintenance costs. Buildings 7 and 23 are critical mission related facilities required for Goddard Space Flight Center to perform its assigned Agency roles and missions.

PROJECT JUSTIFICATION:

This project modernizes the secondary electrical distribution systems by replacing systems in the Payload Testing Facility, Building 7 and the Data Interpretation Laboratory, Building 23. The existing electrical distribution equipment is 30 years old, obsolete, and replacement parts are difficult to obtain. Replacement will enhance system reliability and maintainability as well as reduce operations and maintenance costs. In Building 7 critical testing is done on flight hardware. In Building 23 information from various satellites is downloaded and processed before it is sent to the scientific community for research. A failure in either one of these buildings' electrical systems would have a direct impact on mission operations. A power monitor and control system will also be installed to monitor electrical loads in each building, provide the capability for manual/automatic load control in the event of a commercial power outage, and provide diagnostic information in the event of a failure.

IMPACT OF DELAY:

Delay of this project will jeopardize the reliability of the electrical distribution systems to support program operations. Also, because of the equipment age, extended delays will be encountered during repairs due to the limited availability of replacement parts.

PROJECT DESCRIPTION:

This project replaces the existing electrical distribution equipment at Buildings 7 and 23. This work includes replacing three existing double-ended load centers for Building 7 [500 KVA (thousand volt-amps), 750 KVA and 1500 KVA] and two existing load centers in Building 23 (750 KVA and 1500 KVA). Transforming switches, breakers, and associated electrical distribution equipment will also be replaced to make the buildings' electrical systems more reliable. Power monitoring meters will be installed on each load center to allow local and remote monitoring of the buildings' electrical loads.

PROJECT COST ESTIMATE:

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
Replace Electrical Equipment, Building 7	LS	---	---	\$ 750,000
Replace Electrical Equipment, Building 23	LS	---	---	750,000
Total				<u>\$1,500,000</u>

LIST OF RELATED GRAPHICS: Figure 1 - Location Plan

OTHER EQUIPMENT SUMMARY: None

FUTURE ESTIMATED CONSTRUCTION FUNDING REQUIRED TO COMPLETE THIS PROJECT: None

GODDARD SPACE FLIGHT CENTER
FISCAL YEAR 1997 ESTIMATES
MODERNIZATION OF SECONDARY ELECTRICAL SYSTEMS

LOCATION PLAN

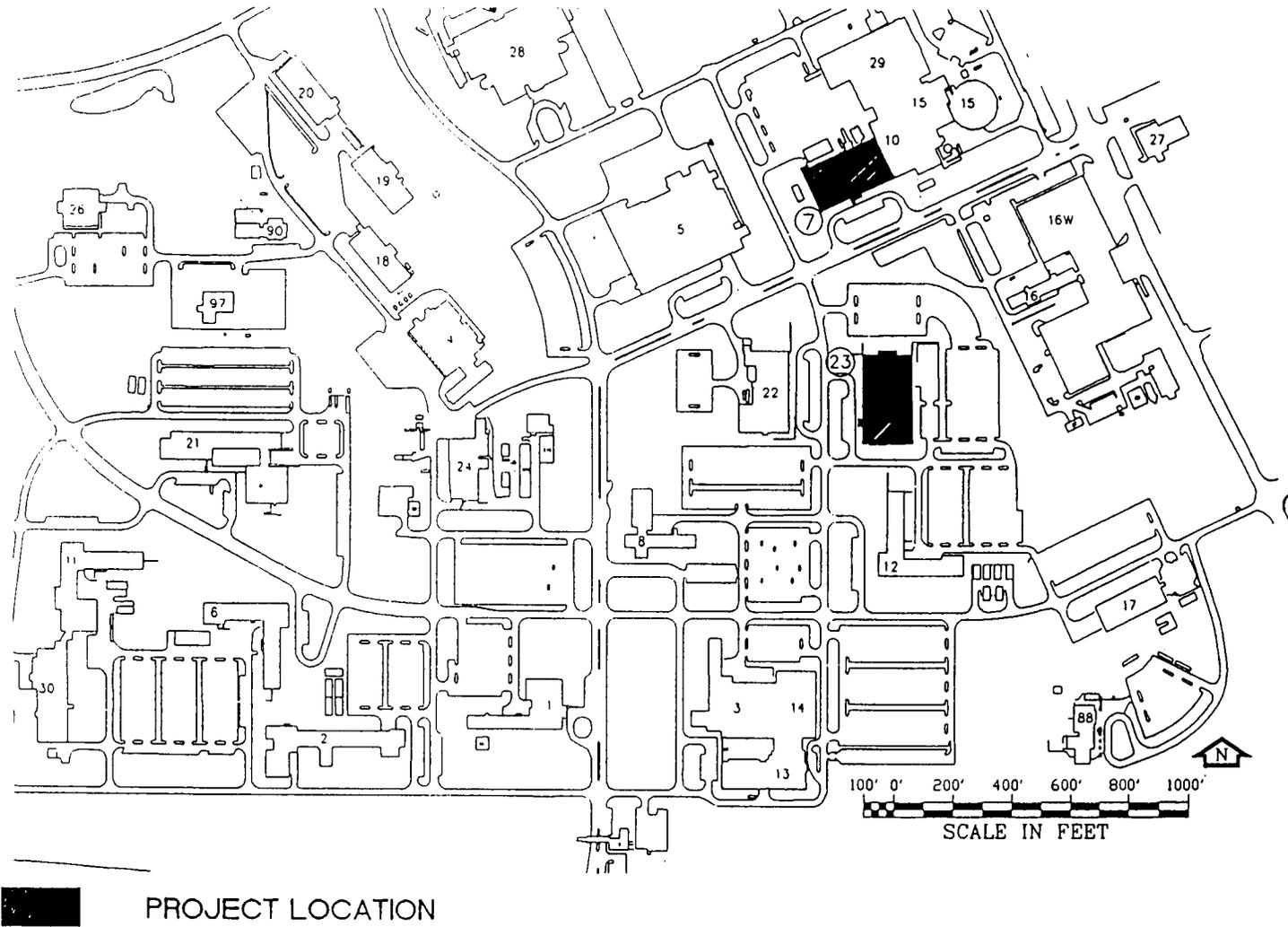


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1997 ESTIMATES

PROJECT TITLE: Restoration of Chilled Water Distribution System

INSTALLATION: Goddard Space Flight Center

FY 1997 ESTIMATE: \$4,000,000

LOCATION OF PROJECT: Greenbelt, Prince George's County, Maryland

COGNIZANT HEADQUARTERS OFFICE: Office of Mission to Planet Earth

FY 1996 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific Construction Funding	\$475,000	\$ 8,150,000	\$ 8,625,000
Capitalized Investment	<u>---</u>	<u>3,874,500</u>	<u>3,874,500</u>
Total	<u>\$475,000</u>	<u>\$12,024,500</u>	<u>\$12,499,500</u>

SUMMARY PURPOSE AND SCOPE:

This project provides for the continuing restoration of major segments of the chilled water distribution system at the Goddard Space Flight Center (GSFC). The project will replace underground piping that is aging and undersized, and install shutoff valves. This segment of the chilled water distribution system supports facilities required for GSFC to perform its assigned Agency roles and missions.

PROJECT JUSTIFICATION:

GSFC has experienced serious operational problems with the central chilled water distribution system. The underground chilled water piping to be replaced is approximately 30 years old and at the end of its expected useful service life. The pipes and valves have deteriorated and are leaking substantially. With the modernization of the central chilled water plant, the new secondary pumps will boost the pipe distribution pressure which will add even more stress to the system. Pipe sizes in several sections of the system are inadequate for existing as well as future design flow rates. Some critical buildings do not have adequate redundancy in the event of a chilled water service failure. This project will replace piping and upgrade the system. Redundant circuits will also be provided to improve reliability.

IMPACT OF DELAY:

Delay of this project will result in increasing leakage and failures due to aging piping and increasing pressures. Some portions of the system will experience flow deficiencies unless pipe sizes are increased. As a result, some buildings will have inadequate chilled water quantities and air conditioning capacity causing shutdown of mission critical and technical support operations.

PROJECT DESCRIPTION:

This project provides for the replacement and upgrading of various segments of the underground chilled water distribution piping serving Building Complexes 3, 13, 14; 7, 10, 15, 29; 18, 19, 20 and Building 28. The work will include installation of shutoff valves at connection points in the new piping, and replacing chilled water supply and return lines to various buildings up to and including the isolation valves inside the buildings. New piping will be sized to support current and future loads as well as provide redundancy for other lines. The project includes all site work required for excavation, rerouting other utilities, backfill, and resurfacing associated with piping work. Asbestos insulation on existing piping will be removed to the extent that it is necessary to perform the work.

PROJECT COST ESTIMATE:

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
Building Complex 3, 13, 14	LS	---	---	\$2,300,000
Building Complex 7, 10, 15, 29	LS	---	---	1,100,000
Building Complex 18, 19, 20	LS	---	---	400,000
Building 28	LS	---	---	200,000
Total				<u>\$4,000,000</u>

LIST OF RELATED GRAPHICS: Figure 1 - Location Plan

OTHER EQUIPMENT SUMMARY: None

FUTURE ESTIMATED CONSTRUCTION FUNDING REQUIRED TO COMPLETE THIS PROJECT: None. However, additional funding will be required in future years to restore other segments of the chilled water distribution system.

**GODDARD SPACE FLIGHT CENTER
FISCAL YEAR 1997 ESTIMATES
RESTORATION OF CHILLED WATER DISTRIBUTION SYSTEM**

LOCATION PLAN

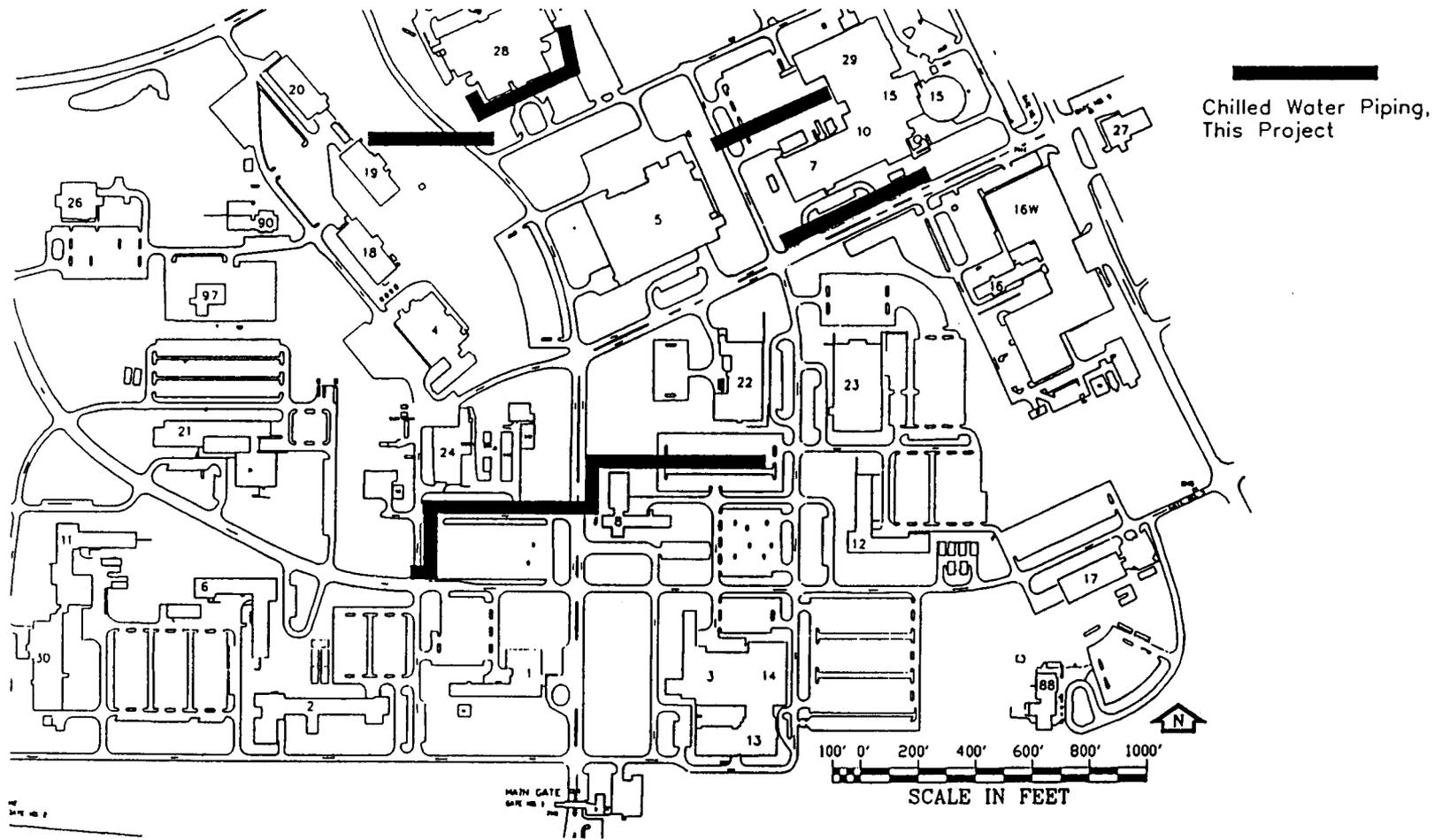


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1997 ESTIMATES

PROJECT TITLE: Modification of Refrigeration Systems, Various Buildings

INSTALLATION: Jet Propulsion Laboratory

FY 1997 Estimate: \$2,800,000

LOCATION OF PROJECT: La Canada-Flintridge, Los Angeles County, California

COGNIZANT HEADQUARTERS OFFICE: Office of Space Science

FY 1996 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project.

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific Construction Funding	\$168,000	---	\$ 168,000
Capitalized Investment	---	<u>\$66,920,917</u>	<u>66,920,917</u>
Total	<u>\$168,000</u>	<u>\$66,920,917</u>	<u>\$67,088,917</u>

SUMMARY PURPOSE AND SCOPE:

This project will modify ten water chillers in seven buildings to accept new refrigerants that are compliant with applicable environmental laws and codes. In addition, four aged chillers in Buildings 238 and 264 will be replaced with new state-of-the-art chillers that are more efficient, have lower maintenance costs, and utilize environmentally acceptable refrigerants. The buildings housing these chillers are required for the Jet Propulsion Laboratory to perform its assigned Agency roles and missions.

PROJECT JUSTIFICATION:

The four chillers require immediate replacement. They are 30 to 40 years old, beyond their economic life, and very difficult and expensive to operate and maintain. The current refrigerants used in the ten other chillers are harmful to the environment and expose JPL to potential enforcement actions. Retrofitting, which includes mechanical refurbishing, will extend the chillers lives by ten years.

IMPACT OF DELAY:

The Jet Propulsion Laboratory will continue to operate facilities inefficiently and in a non-compliant manner with the environmental requirements imposed by various County, State and Federal agencies. The cost to operate and maintain the chillers in Buildings 238 and 264 will continue to run approximately 25% more than the cost of operating and maintaining the new chillers. These new machines will also utilize the newer environmentally acceptable refrigerants. Failure to replace the refrigerant in the other ten chillers to bring them into compliance with the applicable laws and codes will subject JPL to potential enforcement actions.

PROJECT DESCRIPTION:

This project will eliminate the environmentally unacceptable refrigerants from ten refrigeration water chillers in seven major buildings. The chillers in Buildings 144, 150, 170, 183, 230, 300 and 303 which are within their economic and mechanical lives and will be retrofitted. These chillers will be modified as required to accept new refrigerants that are environmentally acceptable. In some cases the compressors and controls can be modified to utilize new refrigerants and oils, and in other cases the entire compressor will have to be changed in order to operate properly, safely, and economically. The four chillers in Buildings 238 and 264 will be replaced with new state-of-the-art chillers having much higher operating efficiencies, lower maintenance costs, and will utilize environmentally acceptable refrigerants. The chiller equipment rooms in both buildings are on the ground floor. The project will solve unique problems for the mechanical replacement of the equipment and the maintenance of utilities within these very critical buildings. Safety modifications will be performed on the chiller equipment rooms by the addition of refrigerant specific monitors and either new or modified air exhaust systems.

PROJECT COST ESTIMATE:

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
New Chillers	Each (EA)	4	450,000	\$1,800,000
Retrofit Existing Chillers . .	LS	---	---	1,000,000
Total				<u>\$2,800,000</u>

LIST OF RELATED GRAPHICS: Figure 1 - Location Plan

OTHER EQUIPMENT SUMMARY: None

FUTURE ESTIMATED CONSTRUCTION FUNDING REQUIRED TO COMPLETE THIS PROJECT: None

**JET PROPULSION LABORATORY
FISCAL YEAR 1997 ESTIMATES
MODIFICATION OF REFRIGERATION SYSTEMS, VARIOUS BUILDINGS**

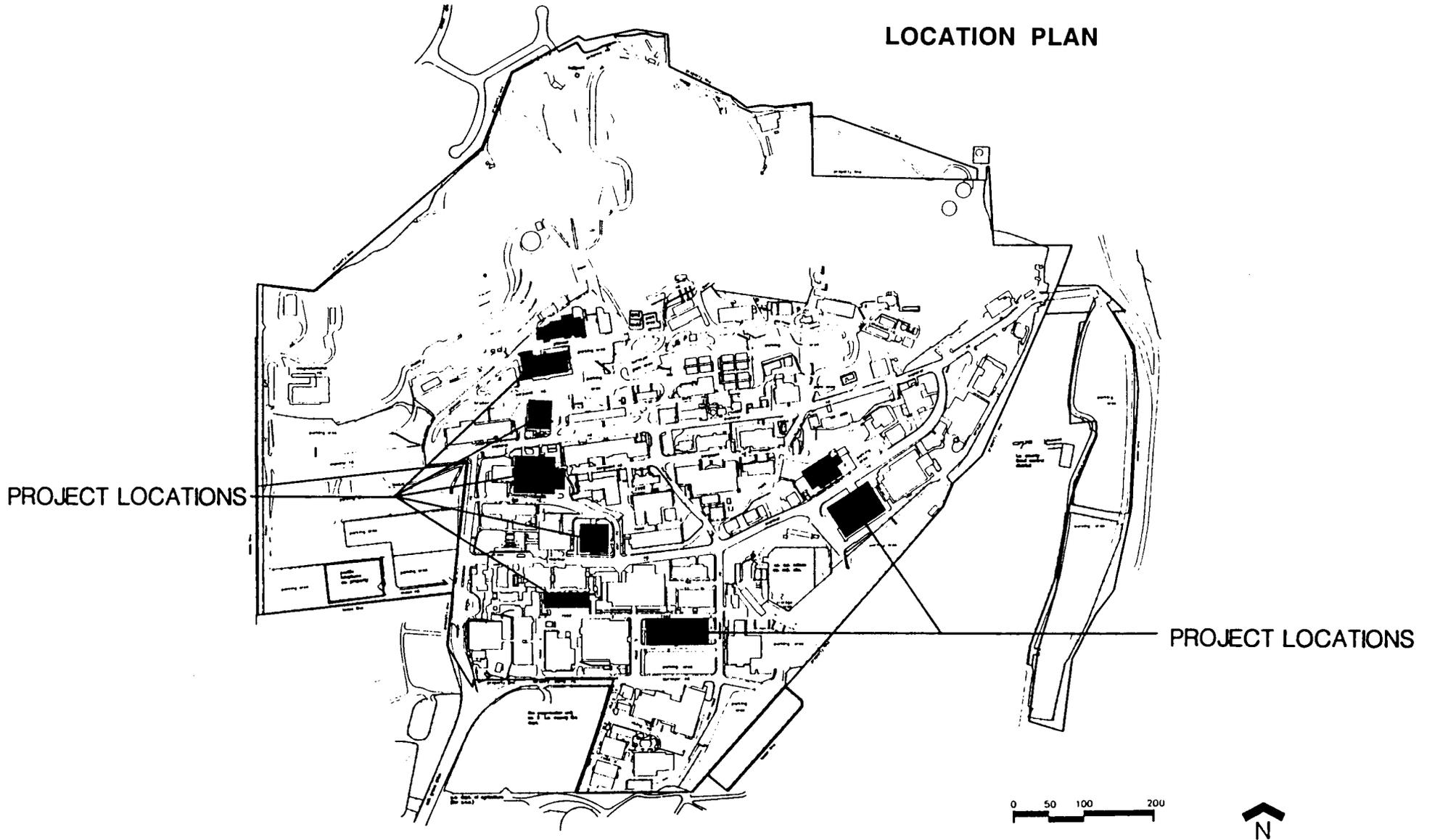


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1997 ESTIMATES

PROJECT TITLE: Rehabilitation of Electrical Substations

INSTALLATION: White Sands Test Facility

FY 1997 Estimate: \$2,600,000

LOCATION OF PROJECT: Las Cruces, Dona Ana County, New Mexico

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY 1996 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific Construction Funding	\$147,202	\$1,100,000	\$1,247,202
Capitalized Investment	<u>---</u>	<u>343,467</u>	<u>343,467</u>
Total	<u>\$147,202</u>	<u>\$1,443,467</u>	<u>\$1,590,669</u>

SUMMARY PURPOSE AND SCOPE:

This project provides for rehabilitation of the electrical substations at the 200, 400, 500, and 800 Areas of the White Sands Test Facility (WSTF). This project is required to assure continued reliable and safe electrical supply at the Laboratory Office 200 and 800 Areas, the Propulsion Office 400 Area main power center, and the 500 Area Cryogenic Storage Facility at WSTF. These substations are required for WSTF to perform its assigned Agency roles and missions.

PROJECT JUSTIFICATION:

The existing substations provide power to 40% of WSTF, are more than 33 years old, and are obsolete. High voltage transformers and related substation components have greatly deteriorated, maintenance costs are exorbitant, and the substations are not reliable. The 800 Area substation transformers do not have secondary circuit overload protection nor fault isolation capability. The life expectancy of the aging 400 Area transformer has been reduced because of high current flows during a severe short circuit fault. Without this equipment 40% of the site power would be at risk.

IMPACT OF DELAY:

Failure of any substation is likely at any time and would indefinitely disrupt testing and operations functions in the buildings powered by these substations.

PROJECT DESCRIPTION:

Work includes replacement and installation of 25-kilovolt pad-mounted distribution transformers and protective devices, switchgear, interconnecting wiring and raceway systems, and foundations. Work also includes replacement of motor control centers and associated equipment and installation of power conditioners, state-of-the-art controllers, overload devices, and transient voltage surge suppressors.

PROJECT COST ESTIMATE:

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
Transformers and Protective Devices . .	EA	7	100,000	\$700,000
Switchgear	EA	6	104,000	624,000
Interconnecting System	EA	13	32,000	416,000
Concrete Foundations	EA	8	10,000	80,000
Motor Control Centers	EA	5	140,000	700,000
Power Conditioning Devices	EA	5	16,000	80,000
Total				<u>\$2,600,000</u>

LIST OF RELATED GRAPHICS: Figure 1 - Location Plan

OTHER EQUIPMENT SUMMARY: None

FUTURE ESTIMATED CONSTRUCTION FUNDING REQUIRED TO COMPLETE THIS PROJECT: None. However, future funding may be required to rehabilitate other elements of the electrical distribution system.

LYNDON B. JOHNSON SPACE CENTER
FISCAL YEAR 1997 ESTIMATES
REHABILITATION OF ELECTRICAL SUBSTATIONS
WHITE SANDS TEST FACILITY

LOCATION PLAN

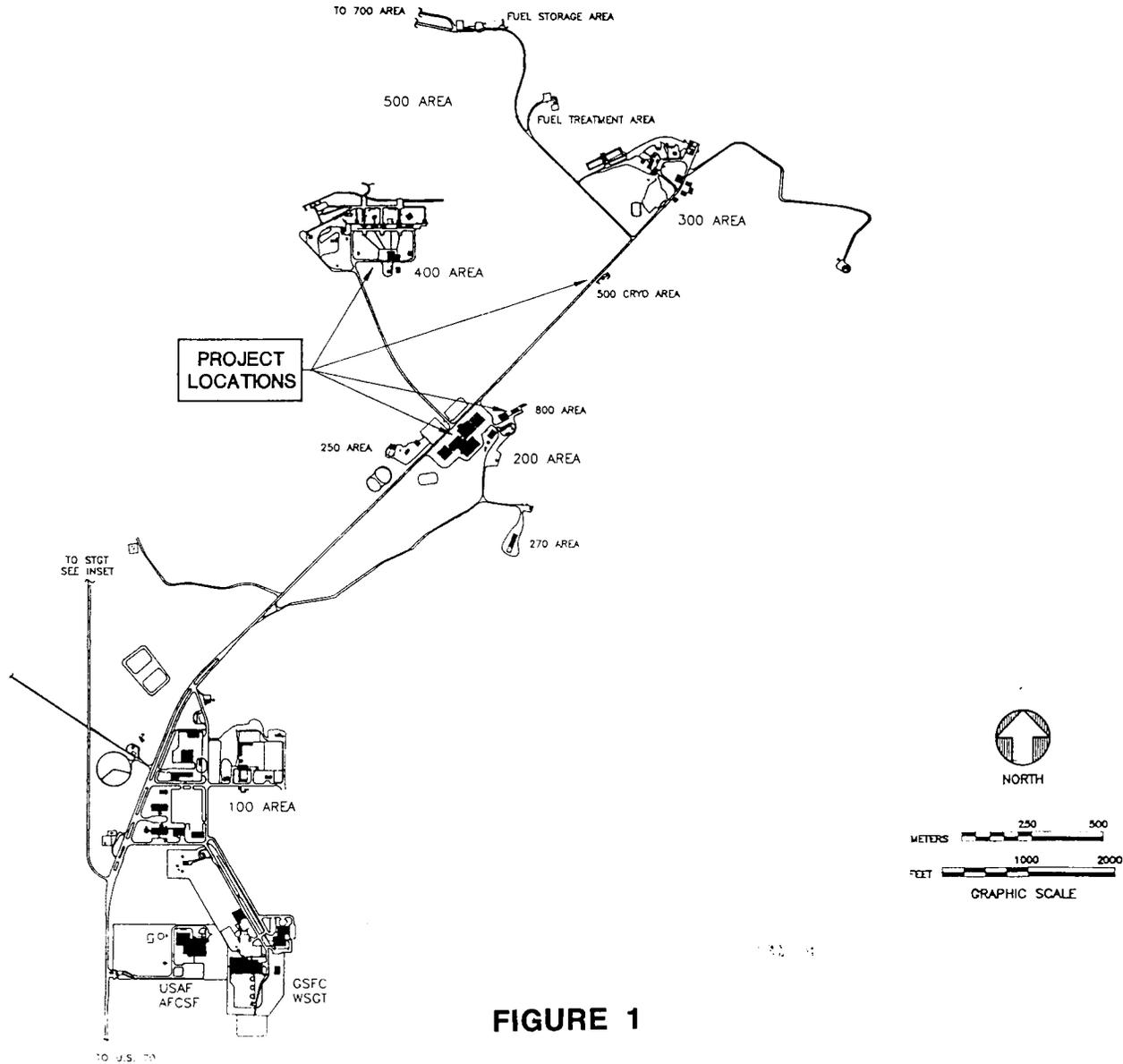


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1997 ESTIMATES

PROJECT TITLE: Rehabilitation of Utility Tunnel Structure and Systems

INSTALLATION: Lyndon B. Johnson Space Center

FY 1997 Estimate: \$4,400,000

LOCATION OF PROJECT: Houston, Harris County, Texas

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY 1996 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific Construction Funding	\$437,891	\$4,300,000	\$4,737,891
Capitalized Investment	<u>---</u>	<u>5,543,538</u>	<u>5,543,538</u>
Total	<u>\$437,891</u>	<u>\$9,843,538</u>	<u>\$10,281,429</u>

SUMMARY PURPOSE AND SCOPE:

This project is the second increment to rehabilitate the existing utility tunnel structure and systems. The work includes structural modifications, systems modifications, and provides safety features to meet Occupational Safety and Health Administration (OSHA) requirements. The utility tunnel is required for JSC to perform its assigned Agency roles and missions.

PROJECT JUSTIFICATION:

The utility tunnel system was originally constructed in 1962 to provide a protected passageway to carry utilities and services to Center buildings. The utility tunnel now requires restoration in many areas to prevent water seepage through the structural concrete and to bring the tunnels into compliance with current safety regulations. The deteriorating conditions were confirmed as critical priorities during the Johnson Space Center (JSC) Facility Condition Assessment of 1992. Water infiltration into the tunnel structure is increasing in frequency and severity; the steam return/condensate system as a whole is rapidly approaching catastrophic failure condition; numerous cable tray failures and inadequacies exist and hamper communications upgrades; many valves in the chilled water system are beginning to exhibit wall failures from over-extended usage; and tunnel accesses and ventilation are inadequate for personnel safety. Future major failures in the tunnel steam and chilled water systems are increasingly likely and would cause considerable disruption of services to buildings and potential hazard to operations personnel.

IMPACT OF DELAY:

If this project is not approved, the reliability and safety of the JSC utility tunnel and systems will continue to deteriorate and increase the risk of a catastrophic failure seriously disrupting mission operations.

PROJECT DESCRIPTION:

The work includes repair and sealing of areas of water infiltration; correction of wall-section displacements; replacement of concrete access sections; modification of substandard personnel access provisions; replacement of steam condensate piping, components, and asbestos insulation; cable and cable tray modifications; replacement of selected chilled water system valves and components; upgrade of the ventilation system; structural modifications; and provision of safety features to meet OSHA requirements.

PROJECT COST ESTIMATE:

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
Cable Tray Modifications,	LS	---	---	\$200,000
Structural Modifications	LS	---	---	852,000
Lighting Upgrades	LS	---	---	670,000
Walkway Modifications	LS	---	---	533,000
Fire Protection Upgrade	LS	---	---	373,000
Backup Power	LS	---	---	905,000
Valve, Insulation, & Piping Replacement	LS	---	---	400,000
Install New 15-kV Switches	EA	5	66,600	333,000
Demolish Existing 15-kV Switches	EA	5	26,800	134,000
Total				<u>\$4,400,000</u>

LIST OF RELATED GRAPHICS: Figure 1 - Site Location Plan

OTHER EQUIPMENT SUMMARY: None

FUTURE ESTIMATED CONSTRUCTION FUNDING REQUIRED TO COMPLETE THIS PROJECT: A third increment of approximately \$6,000,000 is planned to complete the entire tunnel system.

LYNDON B. JOHNSON SPACE CENTER
FISCAL YEAR 1997 ESTIMATES
REHABILITATION OF UTILITY TUNNEL STRUCTURE AND SYSTEMS
SITE LOCATION PLAN

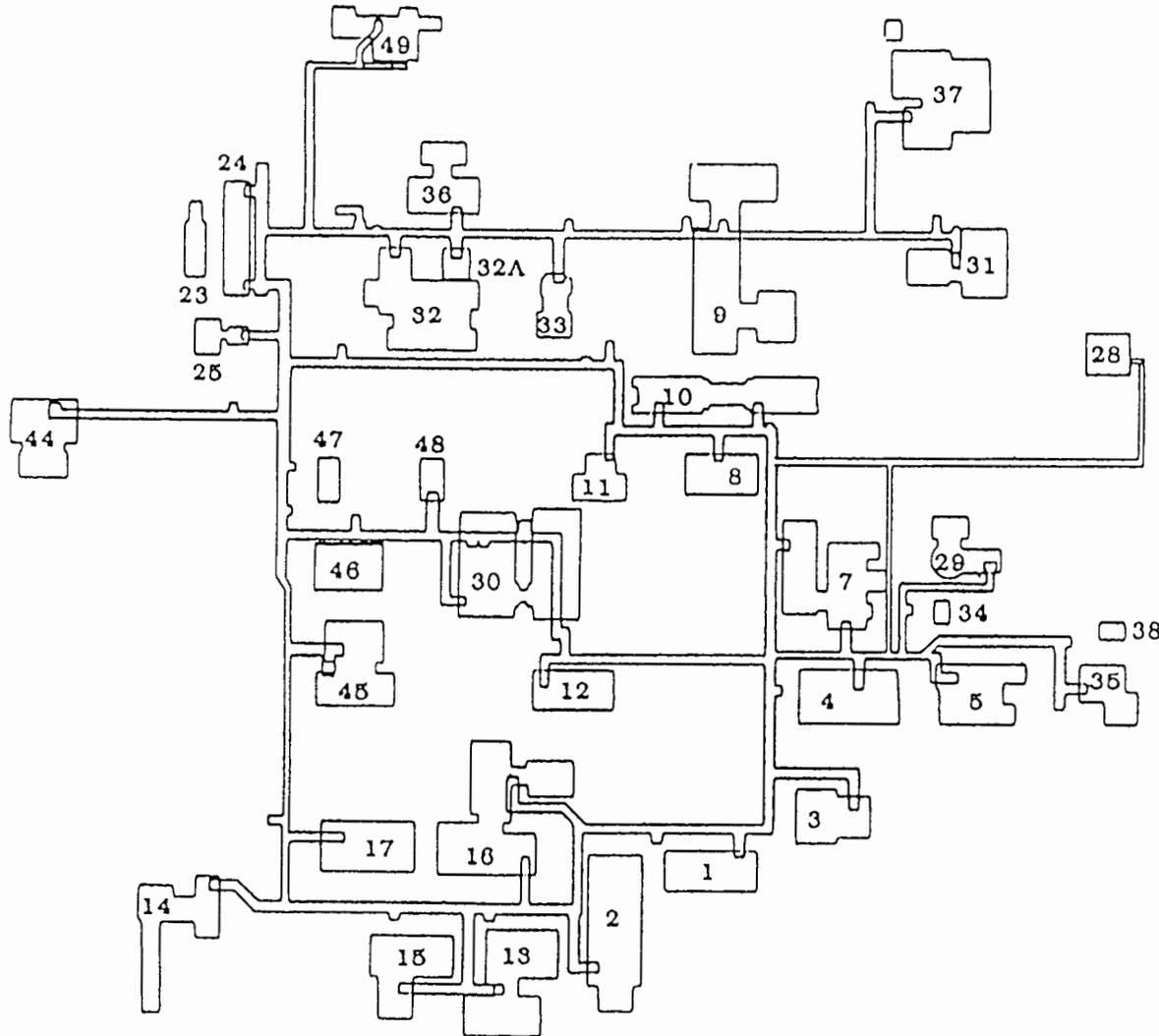


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1997 ESTIMATES

PROJECT TITLE: Replacement of DX Units with Central Chilled Water System, Logistics Facility

INSTALLATION: John F. Kennedy Space Center

FY 1997 Estimate: \$1,800,000

LOCATION OF PROJECT: John F. Kennedy Space Center, Brevard County, Florida

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY 1996 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific Construction Funding	\$180,000	---	\$ 180,000
Capitalized Investment	---	<u>\$17,964,198</u>	<u>17,964,198</u>
Total	<u>\$180,000</u>	<u>\$17,964,198</u>	<u>\$18,144,198</u>

SUMMARY PURPOSE AND SCOPE:

This project will replace the 12 existing, high maintenance, rooftop DX air conditioning units with new chilled water Air Handler Units (AHU). Chilled water for these new units will be supplied from the LC-39 Utility Annex Chilled Water System. The Logistics Facility is required for Kennedy Space Center to perform its assigned Agency roles and missions.

PROJECT JUSTIFICATION:

The existing units require extremely costly maintenance and repair efforts to keep them operating. The deteriorated condition of these units causes poor service, roof leaks, and poor

energy efficiency. Condensation leaks out of these DX units and drips on the concrete floor areas below and inside the facility. These wet surfaces create a safety hazard to personnel and automated forklift vehicle operations.

IMPACT OF DELAY:

Heating, ventilation, and air conditioning system service for personnel comfort and environmentally controlled flight hardware storage areas will continue to be unsatisfactory. Unsafe conditions for personnel will continue due to the condensation dripping from the DX units onto the concrete floor areas below. Flight hardware could be damaged when temperature and humidity levels range outside of acceptable limits resulting in extremely costly repair or replacement.

PROJECT DESCRIPTION:

This project will replace the 12 existing rooftop DX air conditioning units with new chilled water Air Handler Units. It will install a system of pumps and piping compatible with the LC-39 Utility Annex Chilled Water System. New drain pans will be installed under each new AHU and a condensate removal system will be installed for each new AHU. Air Handling Unit capacities will be verified to assure matching the AHUs to the areas they serve.

PROJECT COST ESTIMATE:

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
Construction/Structural	LS	---	---	\$ 418,000
Mechanical	LS	---	---	1,178,000
Electrical	LS	---	---	204,000
Total				<u>\$1,800,000</u>

LIST OF RELATED GRAPHICS: Figure 1 - Site Plan

OTHER EQUIPMENT SUMMARY: None

FUTURE ESTIMATED CONSTRUCTION FUNDING REQUIRED TO COMPLETE THIS PROJECT: None

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1997 ESTIMATES
REPLACEMENT OF DX UNITS WITH CENTRAL CHILLED WATER SYSTEM,
LOGISTICS FACILITY

SITE PLAN
CONTRACTORS ROAD AREA

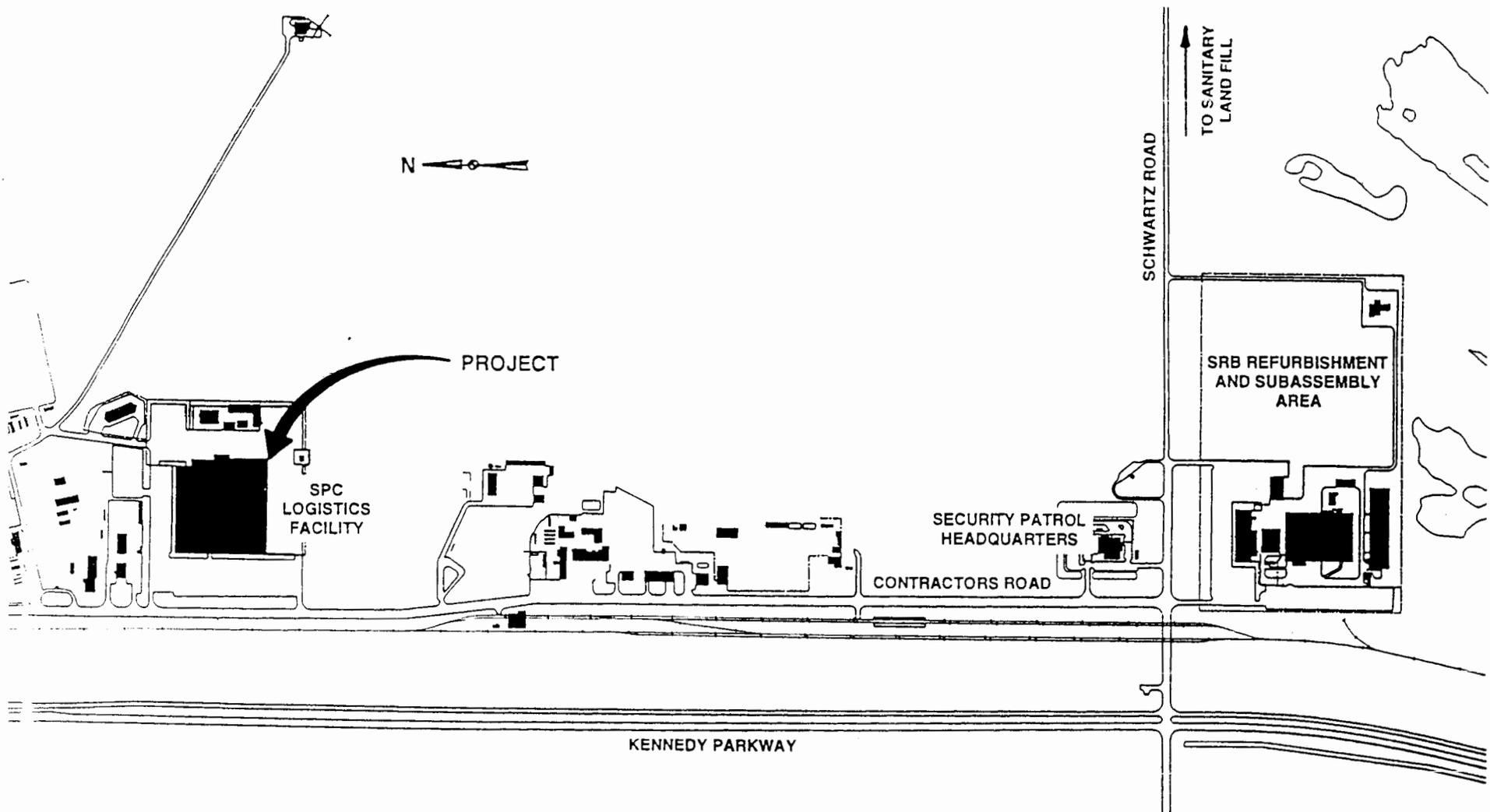


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1997 ESTIMATES

PROJECT TITLE: Rehabilitation of Central Air Equipment Building

INSTALLATION: Lewis Research Center

FY 1997 ESTIMATE: \$6,500,000

LOCATION OF PROJECT: Cleveland, Cuyahoga County, Ohio

COGNIZANT HEADQUARTERS OFFICE: Office of Aeronautics

FY 1996 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific Construction Funding	\$201,489	\$9,000,000	\$9,201,489
Capitalized Investment	<u>---</u>	<u>34,500,193</u>	<u>\$34,500,193</u>
Total	<u>\$201,489</u>	<u>\$43,500,193</u>	<u>\$43,701,682</u>

SUMMARY PURPOSE AND SCOPE:

This project provides funding for rehabilitation of the Central Air System to assure continued safe and reliable operation of major aeronautical research facilities. The Central Air System Equipment located in the Central Air Equipment Building (CAEB) has been in continual use for 40 years supporting research in the 10x10 Supersonic Wind Tunnel, 8x6/9x15 Supersonic Wind Tunnel, the Icing Research Tunnel, the Propulsion System Laboratory, Propulsion Lift Facility and various test cells in the Engine Research Building Complex. These facilities are required for Lewis Research Center to perform its assigned Agency roles and missions. The work in this project includes rehabilitation of CAEB exhausters and exhauster drive motors.

PROJECT JUSTIFICATION:

This project is required to assure safe, reliable, and continued operation of the Central Air System which is a basic institutional capability that supports: development of propulsion systems for subsonic and supersonic transports, hypersonic vehicles, other advanced systems for commercial and military applications and other various activities. The impellers of the exhauster system were fabricated more than 40 years ago. Over time the impeller vanes have acquired numerous cracks varying in size from 1.5 mm to 50 mm. The cracks can cause catastrophic failure of the system resulting in the possible loss of life and excessive downtime of the system. This project will replace existing rotors, reducing delays in vital LeRC research programs caused by excessive maintenance time. Repair of Exhauster Drive Motors is necessary to assure safe and reliable operation. Periodic observations of these motors indicate that the insulation is deteriorating, which will eventually lead to a major failure.

IMPACT OF DELAY:

Delay of this project will significantly increase the risk of unscheduled and lengthy shutdowns of the Central Air System and also one or more of the other major research facilities at Lewis. The current and planned heavily scheduled propulsion testing is dependent on a high degree of integrity and availability of the Central Air System.

PROJECT DESCRIPTION:

This project includes replacing deteriorated impellers in exhausters E-45 and E-47 located in the Central Air Equipment Building (CAEB) (Bldg. 64). Exhauster inlet guide vanes, bearings, seals, and couplings will also be replaced. Also included is the rewinding and repairing of the exhauster drive motors E-45, E-46, and E-47. New grouting will be provided for each motor. Rehabilitation of the other exhausters and exhauster drive motors in the CAEB is included in the FY 1996 project with the same title. This completes the rehabilitation of exhausters and exhauster drive motors needed at this time.

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Cost
Rehabilitate CAEB Exhauster	LS	---	---	\$4,050,000
Rehabilitate Exhauster Drive Motors	LS	---	---	2,450,000
Total				<u>\$6,500,000</u>

LIST OF RELATED GRAPHICS: Figure 1 - Exhauster/Drive Motor Perspective

OTHER EQUIPMENT SUMMARY: None

FUTURE ESTIMATED CONSTRUCTION FUNDING REQUIRED TO COMPLETE THIS PROJECT: None

LEWIS RESEARCH CENTER
FISCAL YEAR 1997 ESTIMATES
REHABILITATION OF CENTRAL AIR EQUIPMENT BUILDING

EXHAUSTER/DRIVE MOTOR PERSPECTIVE

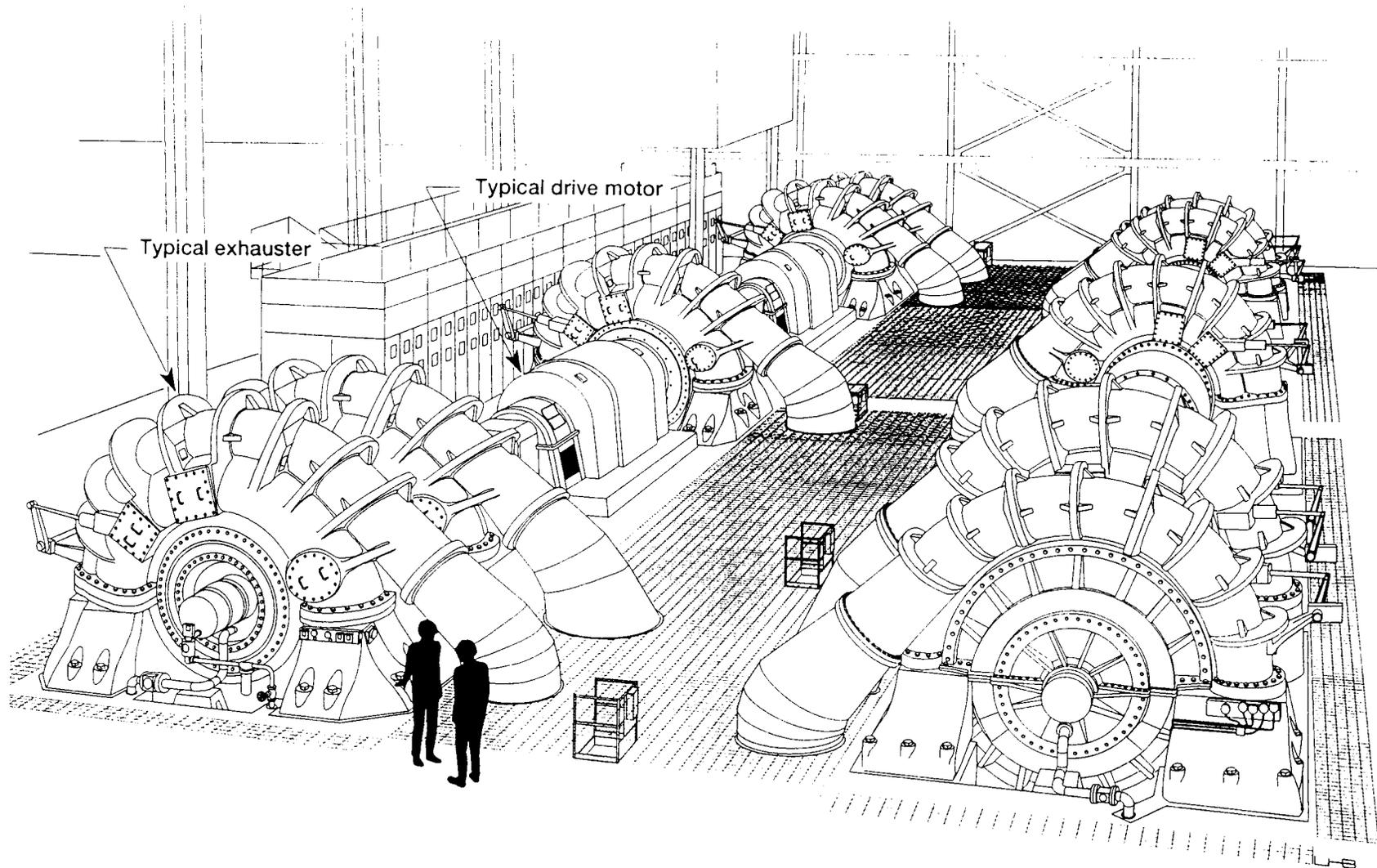


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1997 ESTIMATES

PROJECT TITLE: Modification of Chilled Water System

INSTALLATION: George C. Marshall Space Flight Center

FY 1997 Estimate: \$6,700,000

LOCATION OF PROJECT: Marshall Space Flight Center, Madison County, Alabama

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY 1996 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific Construction Funding	\$1,700,000	---	\$1,700,000
Capitalized Investment	---	---	---
Total	<u>\$1,700,000</u>	<u>---</u>	<u>\$1,700,000</u>

SUMMARY PURPOSE AND SCOPE:

This project provides for the conversion of the chilled water system in the 4200 area from individual chiller units to a central chiller plant with a chilled water (pipeline) distribution system. The 4200 area houses over 2,000 people in about 70,000 square meters of office space. The project will significantly reduce operations, maintenance, and energy costs; restore reliability to critical Agencywide communications operations; and help phase out the use of existing refrigerants which are no longer in production.

PROJECT JUSTIFICATION:

The Center presently air conditions its facilities and equipment with chilled water produced by individual chillers in each building. These chillers are often backed up with a spare chiller due to redundancy requirements. These chillers have either exceeded or are quickly approaching the end of their useful life expectancy. They all use refrigerants which are no longer in production. New chillers that are compatible with the new refrigerants require the individual chiller equipment rooms to be extensively modified, in some cases relocated, due to the toxic

nature of the new refrigerants. Conversion to a central chiller plant will eliminate the disruptions associated with piecemeal repairs and will pay for itself in seven to eight years, maybe sooner, depending on the actual failure rates of the existing chillers. Consolidating service out of a central chiller plant reduces the total capacity required and the overall cost involved in providing the same level of redundancy. This project also eliminates a \$1.2 million maintenance and repair backlog.

IMPACT OF DELAY:

Failure of the existing chillers results in downtimes for extensive repairs that are disruptive to the operation of the Center, and which requires costly workarounds such as leasing of emergency chillers. Chillers will continue to be replaced individually which is an inefficient financial investment and steals resources away from other NASA requirements. Failure to convert to the new refrigerants will require accumulation and stockpiling of the old refrigerant at premium prices.

PROJECT DESCRIPTION:

The project provides a new central chiller plant building equipped with chillers and associated mechanical equipment. This project also provides a multi-cell cooling tower, a dedicated electrical power substation, and a chilled water loop distribution system to provide chilled water service to buildings in the 4200 area. The system will be expandable so, in the future, chilled water service can be provided to additional areas of the Center where similar cost savings can be achieved.

PROJECT COST ESTIMATE:

	<u>Unit of</u> <u>Measure</u>	<u>Quantity</u>	<u>Unit</u> <u>Cost</u>	<u>Cost</u>
Civil	LS	---	---	\$ 70,000
Architectural/Structural . . .	LS	---	---	340,000
Mechanical	LS	---	---	2,090,000
Electrical	LS	---	---	2,070,000
Distribution System and Hook-up	LS	---	---	2,130,000
Total				<u>\$6,700,000</u>

LIST OF RELATED GRAPHICS: Figure 1 - Location Plan

OTHER EQUIPMENT SUMMARY: None

FUTURE ESTIMATED CONSTRUCTION FUNDING REQUIRED TO COMPLETE THIS PROJECT: None. However, future funding in the amount of \$7,000,000 in FY 1998 and \$7,700,000 in FY 1999 is planned to expand the Central Chiller Plant services to other areas of the Center.

MARSHALL SPACE FLIGHT CENTER
FISCAL YEAR 1997
MODIFICATION OF CHILLED WATER SYSTEM
LOCATION PLAN

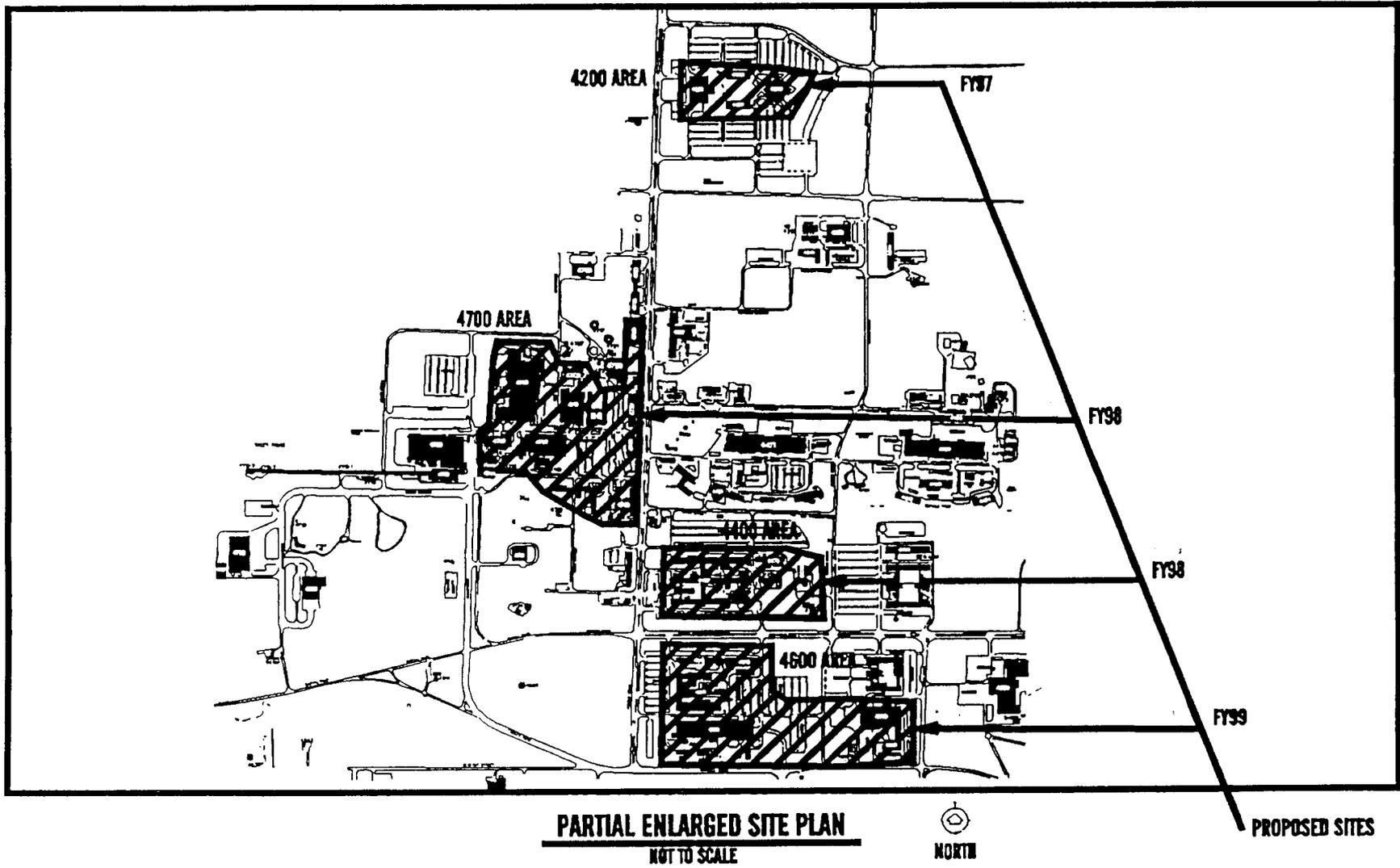


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1997 ESTIMATES

PROJECT TITLE: Rehabilitation of Condenser Water System, 202/207 Complex

INSTALLATION: Michoud Assembly Facility

FY 1997 Estimate: \$2,100,000

LOCATION OF PROJECT: New Orleans, Orleans Parish, Louisiana

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY 1996 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific Construction Funding	\$168,000	\$4,000,000	\$4,168,000
Capitalized Investment	---	<u>4,775,136</u>	<u>4,775,136</u>
Total	<u>\$168,000</u>	<u>\$8,775,136</u>	<u>\$8,943,136</u>

SUMMARY PURPOSE AND SCOPE:

This project continues the systematic replacement of major central heating and cooling plant components in the 202/207 Complex. This increment replaces the condenser water system necessary to ensure a reliable source of chilled water for External Tank manufacturing processes and for air conditioning of office and critical computer areas. The 202/207 complex is required for Michoud Assembly Facility to perform its assigned Agency roles and missions.

PROJECT JUSTIFICATION:

The 202/207 Complex is a conglomerate of facilities, including a large boiler house and two multi-cell cooling towers, that serve as a central heating and cooling plant. It primarily provides steam and chilled water for production, engineering, administration, and storage areas at Michoud Assembly Facility.

The six condenser pumps in Building 207 affected by this project were installed in 1954. They are obsolete, in very poor condition, and constantly need emergency repairs. Deficiencies include warped shafts, cracked sleeves, worn drive-end couplings, worn/pitted bearings, cracked impellers, and loss of suction. Maintenance is complicated by the non-availability of spare parts. Parts that are available must usually be special ordered at premium prices and with long lead times. These breakdowns disrupt critical External Tank production activities and other essential NASA and tenant activities. Continued corrective maintenance is no longer effective and complete replacement of the pumps and associated electro-mechanical equipment and controls is recommended. The existing supply and return chilled water pipes are in very poor condition and also need to be replaced. These pipes are located between Building 207, where the pumps are currently housed, and Building 202, the newest of the two multi-cell cooling towers. Building 208, the other multi-cell cooling tower, is obsolete and scheduled for deactivation in early FY 1996.

This project is the third discrete phase of an on-going effort to replace the major components in the 202/207 Complex. The project is necessary to ensure a reliable source of chilled water for External Tank manufacturing processes and air conditioning of office and critical computer areas. It will also reduce the cost of operating and maintaining the existing system.

IMPACT OF DELAY:

Failure to replace the condenser water system may result in production shutdowns when temperature and humidity levels range outside of acceptable limits. Continued degradation of system reliability and increases in maintenance costs will also occur.

PROJECT DESCRIPTION:

The existing 48-inch above ground condenser water return piping will be replaced with new above ground piping. The existing 48-inch underground condenser water supply piping will be abandoned and new above ground piping installed. The six existing condenser water pumps, associated piping, and other electro-mechanical components will be removed. The deactivated cooling tower, Building 208, will be demolished. A new duplex strainer, new condenser water pumps, and

associated piping and electrical controls will be installed. Pumps will be integrated with the Energy Management Control System (EMCS) to monitor and control energy consumption.

PROJECT COST ESTIMATE:

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
Architectural/Structural	LS	---	---	\$ 175,000
Mechanical	LS	---	---	825,000
Electrical	LS	---	---	1,100,000
Total				<u>\$2,100,000</u>

LIST OF RELATED GRAPHICS: Figure 1 - Location Plan

OTHER EQUIPMENT SUMMARY: None

FUTURE ESTIMATED CONSTRUCTION FUNDING REQUIRED TO COMPLETE THIS PROJECT: None. However, other components in the central heating and cooling plant may require rehabilitation in future years.

**MICHOUD ASSEMBLY FACILITY
FISCAL YEAR 1997 ESTIMATES
REHABILITATION OF CONDENSER WATER SYSTEM, 202/207 COMPLEX
LOCATION PLAN**

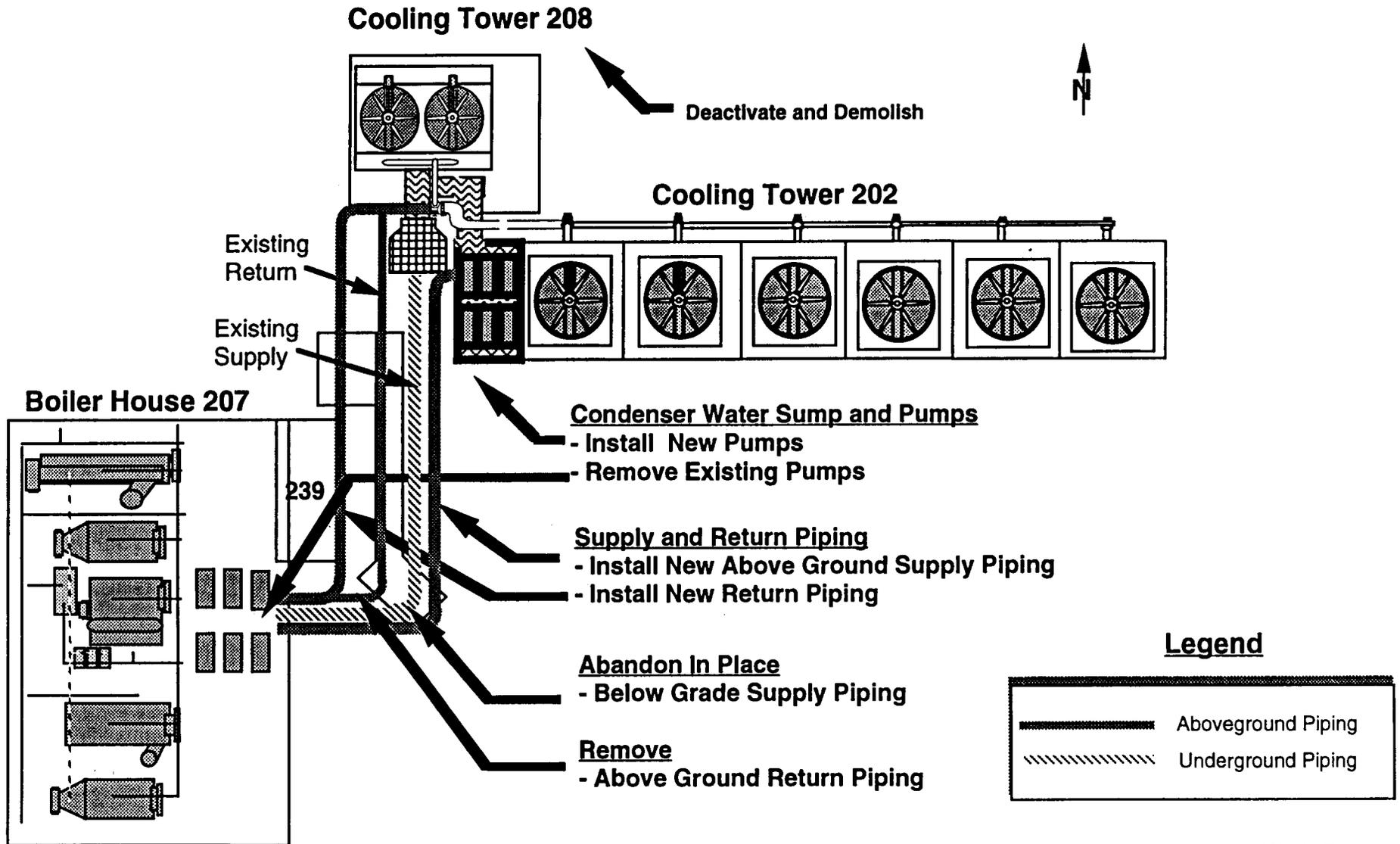


FIGURE 1

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1997 ESTIMATES

SUMMARY

MINOR REVITALIZATION

Summary of Project Amounts by Location:

	<u>Repair</u>	<u>Rehabilitation & Modification</u>	<u>Total Revitalization</u>	<u>Page No.</u>
Ames Research Center	\$2,190,000	\$3,180,000	\$5,370,000	MS 4-76; -87
Dryden Flight Research Center	1,200,000	970,000	2,170,000	MS 4-77; -89
Goddard Space Flight Center	3,050,000	2,080,000	5,130,000	MS 4-78; -89
Jet Propulsion Laboratory	2,200,000	2,950,000	5,150,000	MS 4-79; -90
Johnson Space Center	1,950,000	1,870,000	3,820,000	MS 4-80; -91
Kennedy Space Center	1,960,000	2,700,000	4,660,000	MS 4-81; -92
Langley Research Center	3,230,000	3,485,000	6,715,000	MS 4-81; -93
Lewis Research Center	2,700,000	2,630,000	5,330,000	MS 4-82; -94
Marshall Space Flight Center	1,250,000	2,150,000	3,400,000	MS 4-83; -95
Michoud Assembly Facility	2,400,000	2,400,000	4,800,000	MS 4-84; -96
Stennis Space Center	1,800,000	2,800,000	4,600,000	MS 4-85; -97
Wallops Flight Facility	2,150,000	1,050,000	3,200,000	MS 4-85; -98
Various Locations	-0-	2,900,000	2,900,000	MS 4 ; -99
Miscellaneous Projects Not in Excess of \$250,000 Each . . .	<u>420,000</u>	<u>235,000</u>	<u>655,000</u>	MS 4-86; -100
Total	<u>\$26,500,000</u>	<u>\$31,400,000</u>	<u>\$57,900,000</u>	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1997 ESTIMATES

PROJECT TITLE: Minor Revitalization of Facilities, Not in Excess of \$1,500,000 Per Project

INSTALLATION: Various Locations

FY 1997 Estimate: \$57,900,000

FY 1995: \$60,000,000

FY 1996: \$70,000,000

COGNIZANT INSTALLATIONS/LOCATIONS OF PROJECT: Various Locations

COGNIZANT HEADQUARTERS OFFICE: Office of Management Systems and Facilities

SUMMARY PURPOSE AND SCOPE:

These resources provide for revitalization of facilities at NASA field installations and Government-owned industrial plants supporting NASA activities. The request includes facility revitalization needs for FY 1997 that can be identified at the time of the submission of these estimates and are not in excess of \$1.5 million per project. The revitalization program has two components, repair projects and rehabilitation and modification projects. Repair projects restore facilities and components thereof, including collateral equipment, to a condition substantially equivalent to their originally intended and designed capability. Repair work includes the substantially equivalent replacement of utility systems and collateral equipment necessitated by incipient or actual breakdown and major preventive measures that are normally accomplished on a cyclic schedule. Rehabilitation and modification projects may include some restoration of current functional capability but also includes enhancement of the condition of a facility so that it can more effectively accomplish its designated purpose or increase its functional capability. The facilities being revitalized in this program are consistent with current Agency roles and missions.

PROJECT JUSTIFICATION:

NASA is now experiencing "block obsolescence" where a substantial portion of the agency's facilities have been in use for over 30 years. Repair costs for mechanical and electrical systems in a typical building are almost three times higher after system operations exceed 15-20 years than they are during the initial years. Many electrical and mechanical components reach the end of their serviceable or economic life at the 20 year point and should be replaced in the interest of long-term economy. Continued piecemeal repair of these components is more costly in the long run than replacement at the end of the economic life of the original components. Approximately 90 percent of NASA's physical plant has been in service for over 25 years.

The NASA physical plant has a capital investment of \$5.8 billion and has a current replacement value of more than \$15 billion. A continuing program of revitalization of these facilities is required to accomplish the following:

- a. Protect the capital investment in these facilities by minimizing the cumulative effects of wear and deterioration.
- b. Ensure that these facilities are continuously available and that they operate at peak efficiency.
- c. Improve the capabilities and usefulness of these facilities and thereby mitigate the effects of obsolescence.
- d. Provide a better and safer environment for all personnel.
- e. Avoid significantly greater future repair costs.

This program includes only facility revitalization work of such a nature and magnitude that it cannot be accomplished by routine day-to-day facility maintenance and repair activities. Projects estimated to cost more than \$1.5 million are included as separate discrete projects in the budget request.

PROJECT DESCRIPTION:

Proposed projects for FY 1997 totaling \$57.9 million are described under "PROJECT COST ESTIMATE." This program has been distilled from requests in excess of \$125 million, and thus represents a modest request in relation to the continuing backlog of this type of work. The projects that comprise this request are of the highest priority based on relative urgency and expected return on investment. Deferral of this mission-essential work would adversely impact the availability of critical facilities and program schedules. The \$57.9 million includes repair projects totaling \$26.5 million and rehabilitation and modification projects totaling \$31.4 million. Miscellaneous projects estimated to cost not in excess of \$250,000 have not been individually described or identified by Center. The total request for this category is \$655,000.

During the course of the year, it is recognized that some rearrangement of priorities may be necessary which may force a change in some of the items to be accomplished. Any such changes, however, will be accomplished within total available revitalization resources. The following broad categories of work are described further in the "PROJECT COST ESTIMATE":

a. Utility Systems	\$14,280,000
b. General Purpose Buildings	14,205,000
c. Technical Buildings/Structures	24,145,000
d. Pavements and Drainage	1,210,000
e. Building Exteriors and Roofs	750,000
f. Fire Detection/Protection Systems	3,310,000

PROJECT COST ESTIMATE:

I. REPAIR

A. Ames Research Center (ARC) \$2,190,000

1. Replace Elevator, National Full-Scale Aerodynamics Complex (N-221) 700,000

This project provides for the replacement of a personnel hoist in the National Full-Scale Aerodynamics Complex (NFAC), Building N-221. The hoist does not meet current safety and building codes and cannot be economically upgraded. The hoist is used to provide maintenance crews, with their heavy tools and bulky maintenance equipment, safe access to all levels of the fan drive assembly in the NFAC. The project also provides for an alteration to the facility to build an enclosure around the NFAC Laser Laboratory. This laboratory is located directly beneath the NFAC wind tunnel circuit and houses sensitive laser and optical equipment. The enclosure will act as a barrier to protect the laboratory against the sound and dust generated by the operation of the wind tunnel.

2. Replace Chillers, Human Performance Research Laboratory (N-262) 500,000

This project provides for the replacement of two chillers and associated mechanical equipment critical to the heating, ventilation, and air conditioning service in the Human Performance Research Laboratory, Building N-262. The existing chillers require frequent purging which releases chlorofluorocarbon (CFC) R11 refrigerant into the atmosphere. Under the Clean Air Act Amendment of 1990, it is now unlawful to knowingly vent CFC R11 into the atmosphere. The replacement of the existing chillers with non-CFC refrigerant chillers was determined to be the most cost effective way to bring the facility back into compliance with the requirements of the law.

3. Energy Efficiency Improvements, Administration Building (N-200) 400,000

This project provides for the repair and modernization of selected building systems and components critical to improving the energy efficiency of the Administration Building (N-200). Project scope includes the repair and modernization of the building's energy management control system (EMCS), and the replacement of windows, air handling units, and lighting systems with significantly more efficient ones. In addition to reducing the building's energy consumption and

operational and maintenance costs, these repairs will improve the reliability of the EMCS and the heating, ventilation, and air conditioning systems.

4. Repair Cafeteria Facility (N-235) 590,000

This project provides for the repair and modernization of selected building systems and components in the Ames Cafeteria, Building 235. Project scope includes the replacement of roof membrane and equipment supports; repair of the heating, ventilating, and air conditioning system; energy efficient lighting and fenestration upgrades; and installation of a new fire sprinkler and alarm system. Building N-235 was built in 1941 and has never undergone a comprehensive restoration effort. Its building systems and ancillary equipment have far exceeded their design life expectancy. These repairs will restore the roof system to avoid leakage, improve the reliability of the electro-mechanical systems, reduce energy consumption and operations and maintenance costs, and improve the working environment within the facility.

B. Dryden Flight Research Center \$ 1,200,000

1. Repair Central Compressed Air System 600,000

This project replaces the deteriorated steel/copper central compressed air lines and three compressors throughout the Dryden Complex (except for the shuttle operations area). New polyethylene piping will be used. The existing three compressors will be replaced with two new compressors (93 kw;125 hp each) which will be located at building 4820. The current system is over 30 years old. It is unreliable, expensive to maintain, and causes delays in meeting mission requirements. During down times, the sewage ejectors cease operations causing sewage to back up.

2. Repairs for Seismic Protection of Hangar 4826 600,000

This project will strengthen the hangar and brace utility systems and collateral equipment to withstand the maximum probable seismic event. All inadequate seismic force resistance elements will be retrofitted. Structural members will be replaced with stronger units, connections will be strengthened, additional roof diaphragm members will be installed, masonry walls will be strengthened and interfering systems will be relocated. Collateral equipment such as water piping, HVAC ducts, light fixtures and crane system will be braced to resisted seismic motion. Hangar door supports/braces will be strengthened. Lead paint and asbestos insulation will be abated. The occurrence of a major earthquake is well within the realm of possibility, the consequences of which are possible death and injury to personnel and damage to high value aircraft.

C. Goddard Space Flight Center (GSFC) \$3,050,000

1. Repair Roofs, Various Buildings 750,000

This project provides for the repair of portions of roofs on Buildings 5 and 7. The work involves the replacement of 2,600 square meters on the Instrument Construction/Installation Laboratory (5) and 700 square meters on the Payload Testing Facility (7). The work includes removal of existing roof assemblies down to the structure and their replacement with new insulation and modified membrane roof system. In addition repairs will be made to portions of roofs on Buildings 16, 18, 25 and 29. These roofs have a history of leaks and drainage problems. These repairs will remedy the defects, reduce maintenance costs, and avoid leakage.

2. Repair Switchgear Equipment, Various Buildings 800,000

This project provides for the replacement of switchgear and associated electrical equipment in Space Projects Building 1 and Research Projects Laboratory Building 2. In addition the ampere bus duct and its associated equipment will be replaced in Space Science Laboratory Building 6. The project is required to replace electrical equipment which is in poor condition due to age and excessive usage. The equipment is obsolete and replacement parts are often not available. Replacement of this equipment will improve maintainability and reliability.

3. Repair Building Exteriors and Foundations, Various Buildings 700,000

This project provides for the repairs of building exterior and foundation components at Buildings 5, 6, 11, 25, and 28. This work includes repair of window and parapet wall systems including caulking and flashing improvements, foundation drainage systems, and regrades at building perimeters to direct runoff away from foundations and footings. These buildings show numerous signs of water damage. The proposed work will restore the facility exterior walls and foundations and minimize potential loss of equipment due to water damage.

4. Repair Steam Distribution System 800,000

This project provides for the repair of the Center's steam system and will include replacement of deteriorated condensate lines and high pressure drip lines between the Central Heating and Refrigeration Plant Building 24 and Manhole 15 near the southwest corner of Building 5, and from Manhole 2 to Manhole 3 near Building 6. This project also includes manhole rehabilitation. The central steam distribution system was installed in the early 1960's and has major condensate, leaks, and failures due to deterioration. This project will minimize capacity loss, reduce maintenance costs, and restore reliability.

D. Jet Propulsion Laboratory (JPL) \$2,200,000

1. Refurbish Computer Program Facility, Building 156 750,000

This project will refurbish and upgrade 1,000 sm of corridors, laboratories, workrooms, and restrooms to bring the building up to current life-safety building codes and provide access to the disabled. Heating, ventilating, and air conditioning (HVAC) will be reconfigured to rectify a fire safety situation with air circulation and the fire rating of the corridor system will be increased. New lighting fixtures and ceiling tiles along with carpeting and additional power will be installed. Restrooms will be modified to meet accessibility requirements for the disabled, and will include new toilet fixtures and tile. Room space and circulation patterns will be reconfigured and another women's restroom will be added. The building does not meet the power or HVAC needs of the occupants. It requires asbestos abatement and is deficient in meeting restroom requirements.

**2. Replace "Z" Emergency Generator, Space Flight
Operation Facility, Building 230 950,000**

This project will replace the "Z" dual powered Emergency Generator with a clean burn diesel powered 1350 KW machine. The exciters for the two older generators will be replaced. The existing engine will be placed into storage for possible later use as spare parts for the remaining generators. The generator will be connected to the adjoining power control room. Software modifications will also be made to facilitate auto-mode operations. The generators are over twenty years old and use technology which is 10 years older than the generators. Spare parts must be special ordered which is very costly and time consuming. The existing engine produces emissions which far exceed local air pollution limitations. The new engine is much more energy efficient.

3. Repairs to Solid Propellant Engineering Laboratory, Building 197 500,000

This project will repair and refurbish the building and includes the roof, plumbing, and chemical exhaust systems. The roofing is in very poor condition and contains asbestos. Water damage to corridors and laboratories resulted from the poor condition of the roof caused by numerous metal supports penetrating the roof. It will be removed and replaced with a new roofing system. Interior water damage from the roof and walls will be fixed and painted. Laboratory sinks, eyewashes, and emergency showers will be changed from the industrial water line to new domestic lines. Fume hoods in the Grinder and Mixing Laboratory and Wet Chemistry Laboratory will be increased. A new Automatic Air Flow Control for chemical fume hoods will be added in 8 smaller laboratories. Change from industrial water lines to domestic lines will correct past code

violations. These modifications provide the building with fully functional systems which comply with applicable building codes.

E. Johnson Space Center (JSC) 1,950,000

1. Repair Mission Control Center Secondary System (30) 850,000

This project provides for the replacement of deteriorated motor control center assemblies and under floor chilled-water coils in the mission operations wing of the Mission Control Center (MCC), Building 30. Obsolete motor control centers will be replaced throughout the building. Additionally, chilled-water coils and associated piping and controls will be replaced. This project is required to replace secondary electrical and air conditioning equipment to assure continued, reliable and safe operations within the program critical MCC. Replacement will be phased to minimize impacts on mission support requirements.

2. Repair Propulsion Test Area Conduits and Bunkers, WSTF 450,000

This project provides for repair and minor modifications to existing conduits and concrete slabs in the 300 and 400 Propulsion Test Area instrumentation and control bunkers and tunnels. Work consists of re-contouring the concrete and dirt surfaces above the bunkers and tunnels and the addition of drains to eliminate water ponding, the sealing of external conduit penetrations into the bunkers, and where required the excavation and replacement of leaking underground and/or under concrete conduits. Leaking water pipes in areas of the bunkers and conduits will be excavated and replaced. This project is required to eliminate water leakage into the instrumentation and control bunkers and must be accomplished before damage to electrical equipment occurs.

3. Repair 200 Area Aerial High Voltage Lines 650,000

This project provides for replacement of aerial high-voltage conductors and components in the Technical Support Facilities (200 Area). The work includes replacement of approximately 2,500 meters of high voltage conductors, deteriorated poles, crossarms, and hardware. The project is required to assure reliable and safe provision of electrical service to the 200 area. The existing high voltage conductors and components in these areas are over 30 years old and have deteriorated from age and a corrosive environment. The replacement is necessary to insure the reliability of electrical service to these critical areas.

F. Kennedy Space Center (KSC) \$1,960,000

1. Repair Boilers 1 & 2, Central Heat Plant, Building M6595 700,000

This project will remove existing convection sections, terminate the existing firebox tubes in a new interim header, install a new modular high efficiency convection section, reconnect the existing plant high temperature hot water and safety valve piping system, install matching inlet header orifices, and replace all damaged firebox tubes. The existing convection section tubes are over 30 years old and have exceeded their useful life expectancy. Failures of the existing convection tubes have started and it is anticipated this trend will continue to spread to other tubes and parts of the boilers.

2. Repair Shuttle Landing Facility 910,000

This project replaces the aging joint seal material on portland cement concrete runway pavement at the shuttle landing facility. The area includes the runway proper, the taxiway, ramp, and apron areas. Studies indicate the joint seal is approaching its useful life expectancy of fifteen years. The hardening of the joint seal may cause corner and side spalling on the runway. Not replacing the seal will increase maintenance costs and may jeopardize runway structural integrity.

3. Repair Railway Track at Hangar AF, Building 66250, Cape Canaveral Air Station 350,000

This project will refurbish/replace the rails, steel framing in the railway track groves, and the steel framing for drain trenches in the highbay at Hangar AF. This includes the repair/replacement of warped drain covers and concrete along the railway track groves and drain trenches. Continued degradation of the steel framing could lead to a breakdown in operations and hinder Shuttle booster recovery operations and refurbishment. Safety hazards have been identified which could cause a lifting or tripping injury.

G. Langley Research Center (LaRC) \$3,230,000

1. Replace Transformer, Building 1243 830,000

This project provides for the replacement of transformer "1CA" located at Substation Building 1243. The new transformer will have a rating of 30,000/50,000 kVA, 115 kV primary, and 6600 volt secondary. The transformer provides power to the main drive equipment for the 16-Foot Transonic Tunnel and for the National Transonic Facility (NTF). The 40-year-old transformer is no longer

reliable. Failure of this transformer will result in complete shutdown of the 16-Foot Transonic Tunnel and NTF for as long as one year.

2. Replace Air Dryer for Unitary Plan Wind Tunnel, Building 1251 825,000
This project replaces the air dryer system for the Unitary Plan Wind Tunnel (UPWT), including condenser, evaporator, and associated piping, valves, and accumulators. The air dryer system controls the amount of humidity in the make-up air for the UPWT. The replacement of this 40-year-old system will reduce maintenance, downtime, freon leakage, and provide an efficient system that will operate with an environmentally safe refrigerant.

3. Replace Cooling Tower, Building 1247C 920,000
This project provides for the removal and replacement of the existing cooling tower (1247C) and associated valves and piping located between buildings 1221 and 1247C. The system is used for cooling related to research activities and air conditioning systems for 1221 and 1247 Hypersonic complexes. The existing cooling tower and associated equipment was installed in 1952 and have deteriorated to the point that frequent repairs are necessary to maintain operations.

4. Replace Electrical Systems, Building 1146A 655,000
This project provides for the replacement of the 35-year-old capacitors and two 500 kVA unit substations serving the air removal system for the 16-Foot Transonic Tunnel, Building 1146. The substation equipment includes transformers, primary switches, secondary switchgear, and drawout circuit breakers. The capacitor system includes 216 capacitors which are rated 25 reactive kVA each. The switchgear, breakers, and primary air switch for each substation are obsolete and replacement parts are very hard to obtain. The failure of these substations could result in extensive down time for the facility. The capacitors also contain polychlorinated biphenyl fluids. Failure of the capacitors will result in contamination of the environment and increased power bills.

H. Lewis Research Center (LeRC) \$2,700,000

1. Repair Water System, Cedar Point Road and West Area 900,000
This project provides for the repair of the central water distribution system. The work includes the replacement or cleaning/relining of the corroded and clogged water mains and replacement of all shutoff valves and fire hydrants located along Cedar Point Road and in West Area. This project will increase water pressure and improve water quality for the various buildings being

serviced from the water mains. Mineral deposits on the inside of the water mains have caused a general reduction in water flow and pressure throughout the Center.

2. Repair Steam Trenches, Outlying Areas III 900,000
This project provides for the repair and replacement of piping and valves at locations near Buildings 24, 34, 87, 88, 90, and 107 in the central steam distribution system. The locations will also require road excavation, trench cover replacement, drainage and manhole repairs, piping re-insulation, trench water level sensor installation, roadway resurfacing, and site restoration. Existing conditions include severe concrete deterioration due to road salts and freeze-thaw cycling; advanced corrosion of condensate piping and pipe supports; and poor condition of steam line insulation, valves, and expansion joints. This project will provide safe, reliable steam service to critical research buildings and administrative functions.

3. Repair Chiller #1, Refrigeration Building (9) 900,000
This project provides repair of Chiller #1 in Refrigeration Building (9). Work includes replacement of the existing Chiller #1 with a new 3870 kW chiller, distribution pumps, piping, power, controls, and instrumentation. Completion of this project will ensure the reliability, safety, and efficiency of the chilled water system. The new chiller will also conform to the new government regulations by installing environmentally accepted R-134A Freon.

I. Marshall Space Flight Center (MSEC) \$1,250,000

1. Repair Fire Alarm Systems, Various Locations 950,000
This project provides for the replacement of the fire alarm systems in Buildings 4200, 4201, 4202, 4481, and 4610. Project scope includes removal of obsolete fire alarm components and installation of new fire alarm reporting equipment, smoke detectors, audio-visual signaling devices, and other associated hardware. The existing systems are made up of different components, installed in different years, repaired with scavenged components, and modified with newer parts in certain areas. They are difficult and expensive to maintain and do not meet current codes. This project will provide a highly reliable and fast response system for the protection of personnel, costly equipment, and facilities. The existing equipment will be salvaged and used for spare parts where possible in other buildings at the Center.

2. Repair Paved Areas, Solid Rocket Booster Assembly and

Refurbishment Facility 300,000

This project provides for the resurfacing of all asphalt paved areas surrounding the Solid Rocket Booster Assembly and Refurbishment Facility located at KSC which is managed and funded by MSFC. Project scope includes removal of the existing pavement to subgrade, releveling, and application of new asphalt. The existing pavement is deteriorated, mostly from heavy vehicular and hardware transfer traffic. The current cracking, potholes, dips, and uneven pavement surfaces are creating storm drainage problems. These conditions must be repaired before damage to the subgrade occurs. Rough uneven surfaces also pose a threat of potential damage to flight hardware and major Solid Rocket Booster structures during transfer operations.

J. Michoud Assembly Facility (MAF) \$2,400,000

1. Repair Manufacturing Area Fanhouses (103) 950,000

This project provides for the repair of four fanhouses supporting critical areas in the External Tank Manufacturing Building 103. Project scope includes repair or replacement of steam reheat coils, pan leaks, pump leaks, drift eliminators, nozzles, duct work, control systems, insulation, and lighting. Scope also includes calibration of economizers and overall integration with the Energy Management Control System. The fanhouses are 43 years old and are obsolete, deteriorated, and unreliable. They are essential to providing heating, ventilation, and air conditioning service to critical External Tank manufacturing operations in Building 103.

2. Repair Alarm Systems (110/114) 650,000

This project provides for the replacement of the fire alarm systems in Buildings 110 and 114. Project scope includes removal of obsolete fire alarm components and installation of new fire alarm reporting equipment, smoke detectors, audio-visual signaling devices, and other associated hardware. The existing systems are made up of different components, installed in different years, repaired with scavenged components, and modified with newer parts in certain areas. They are difficult and expensive to maintain and do not meet current codes. This project will provide a highly reliable and fast response system for the protection of personnel, costly equipment, and facilities.

3. Repair Sanitary Sewer Piping (N101/W103) 800,000

This project provides for repairs to the 50 year old sanitary sewer system north of Building 101 and west of Building 103. Project scope includes relining or replacing, as required, sections of below-grade cast iron, cement, and asbestos piping. Scope also includes relining or replacing,

as required, existing manholes, and the installation of several additional manholes. The project will correct problems of deterioration, improper line sloping, ground water and chemical waste filtration, insufficient capacity, and improper discharge.

K. Stennis Space Center (SSC) **\$1,800,000**

1. Repair High Pressure Helium Gas Storage System **900,000**

This project replaces a 21,000 liter helium gas storage vessel in the "B" Test Complex. The project includes construction of structural supports for the vessel and a tie-in to the existing distribution system. The existing storage vessel has confirmed structural flaws and should be replaced. A failure could impact Space Shuttle Main Engine test support causing delays and increases in operational costs. This project will improve reliability of the high pressure gas system.

2. Repair 480 Volt Electrical Systems **900,000**

This project provides for repair/replacement of the motor control centers, panel boards, and other power distribution equipment in the Educational Development Facility, Building 1200, the Communications Building, Building 1201, and the Earth Resources Application Building, Building 1210. The existing electrical equipment is old, deteriorating and beyond its life expectancy. Spare parts are no longer available. Repair/replacement will reduce maintenance costs and significantly improve operational reliability.

L. Wallops Flight Facility (WFF) **\$2,150,000**

1. Repair Mainland Primary Distribution Systems **450,000**

This project provides for upgrading and replacing primary electrical distribution systems located on the Mainland area of the Wallops Flight Facility. The work includes removing and replacing 1500 meters of overhead primary (12,470 volt) distribution circuits with underground service, replacing 12 distribution transformers and associated ductbank, conduit, wiring, panelboards and switchgear in the U-area. The existing distribution system serves mission critical radar systems which support Space Shuttle tracking, local island launches and command-destruct functions. The existing system is over 40 years old and beyond its reliable service life. The repair work provided by this project will reduce failures of transformers and fuses, and correct practices that violate current electrical codes.

2. Repair Secondary Electrical Systems 800,000
 This project provides for the upgrade and replacement of power panels, wiring, bus distribution, substations, and switchgear and modification to electrical vaults and the 480 volt services to facilities A-1, D-10, D-49, D-101, E-7, F-1, F-2, F-3, F-4, F-5, F-6, F-19, F-160, M-15, M-Magazine Area, N-163, N-167, N-169, and W-65. These secondary distribution systems are 40 years old and beyond their serviceable life expectancy. Upgrading the systems will allow Wallops to meet current standards for power distribution and enhance reliability. It will avoid the piecemeal replacement of a worn-out system and greatly reduces maintenance and downtime.

3. Repair of Central Steam System 900,000
 This project provides for the repair of the central steam system on Wallops Main Base. The work includes the replacement of the underground condensate lines from Building F-3 to Building F-10 (750 meters) and replacement of steam and condensate lines to F-8/F-19 (180 meters), D-1 (180 meters), and under the roads at D-10 and F-1 (36 meters). The work also includes the extension of the underground steam lines from Building F-160 to Building N-159, (540 meters), the installation of steam converters and associated equipment in Building N-159 and the repair of overhead steam system valves and expansion joints. The repair of the steam valves and expansion joints in conjunction with the repair of the underground steam lines will reduce the risk of system failure and unscheduled downtime. This installation will reduce energy consumption and assist meeting energy conservation goals.

M. Miscellaneous Projects Not In Excess of \$250,000 Each 420,000

Total Repair **\$26,500,000**

FUTURE ESTIMATED CONSTRUCTION FUNDING REQUIRED:

Approximately \$30-\$40 million per year will be required for continuing repair needs.

II. REHABILITATION AND MODIFICATION

A. Ames Research Center (ARC) \$3,180,000

1. Rehabilitate and Modify Space Projects Facility for Seismic Safety (N-244 High Bay) 260,000

This project provides for the rehabilitation and modification of the Space Projects Facility, Building N-244 High Bay, to correct seismic structural deficiencies. The project will strengthen the building's resistance to earthquake forces and bring the building into compliance with the current Uniform Building Code (UBC). A study evaluating the seismic strength of several buildings at the Center was conducted following the 1989 Loma Prieta Earthquake, which registered 7.2 on the Richter scale. Elements of the main lateral force resisting systems in Building N-244 High Bay were found to be overstressed when compared to the UBC criteria. Failure to correct these deficiencies could result in loss of life and significant facility damage if an earthquake of sufficient magnitude occurs.

2. Rehabilitate and Modify Computer Facilities for Fire Safety (N-233, N-233A) 460,000

This project provides for rehabilitation and modification of the Central Computer Facility, Building N-233, and the Advanced Computational Facility, Building N-233A, to correct fire safety code deficiencies. Project scope includes installation and/or rehabilitation of fire detection and alarm systems and automatic dry type sprinkler systems. This project will bring Buildings N-233 and N-233A into compliance with National Fire Protection Association (NFPA) standards and significantly reduce the risk to personnel and costly computer equipment in the event of a fire.

3. Rehabilitate and Modify Controlled Environment Research Chamber Area (N-239A) 730,000

This project provides for the rehabilitation and modification of the Controlled Environment Research Chamber (CERC) control room and adjacent research areas in Building N-239A to enable more efficient and effective use of the space. Optimum use of the research areas will be compromised unless this space in Building N-239A is rehabilitated and modified to correct functional inadequacies and code violations. This project supports "Human Exploration and Development of Space" research activities in areas such as "Plant Biology" and "gravitational Life Sciences."

4. Rehabilitate Warehouse for Seismic and Fire Safety, Building 144 550,000

This project provides for rehabilitation of the south end of the Warehouse, Building 144. Project scope consists primarily of seismic upgrades, but also corrects fire safety and handicapped access code deficiencies. A recent study indicated Building 144 has inadequate seismic resistance and recommended seismic upgrades to ensure personnel a safe working environment. The project will strengthen the building's resistance to earthquake forces and bring the building into compliance with the current Uniform Building Code (UBC) and National Fire Protection Association (NFPA) standards. Failure to correct these deficiencies could result in loss of life and significant facility damage in the event of an earthquake or fire.

5. Restore Arc Jet Flow Control Systems (N-234) 880,000

This project provides for replacement of air and argon flow control systems for the 2' x 4' Turbulent Flow Duct (TFD) and the Aerodynamic Heating Facility (AHF) in the Thermal Protection Laboratory, Building N-234. The air and argon flow control systems have been in operation over 20 years. Equipment in these facilities has received very minor modifications over the years and has exceeded its useful life expectancy. Flow measuring devices either do not work consistently or do not work at all, critical parameters are impossible to ascertain, and repairs and calibrations have been generally unsuccessful. The equipment is obsolete and replacement parts are not available. Failure to complete this project will result in lost run time and further degradation of data collection.

6. Modify High Reynolds Channel Inlet (N-231) 300,000

This project provides for construction and installation of new flow sections for the High Reynolds Channel (HRC) I & II experimental facilities housed in Building N-231. Project scope includes the design, fabrication, and installation of flow conditioning elements in the stagnation chamber of HRC II and the redesign, fabrication, and installation of the transition sections and structural supports for HRC I and HRC II. The value of data currently acquired from these facilities is constrained by the inability to achieve flow fields with low acoustic noise levels in HRC II. This acoustic noise is the result of existing facility configurations. The reconfiguration provided by this project will allow each of these test sections to be used in acquiring reliable boundary layer data and will increase the facility's experimental efficiency by 100 percent.

B. Dryden Flight Research Center (DFRC) \$ 970,000

1. Rehabilitate and Modify Western Aeronautical Test Range, Building 4800 970,000

This project will rehabilitate and modify the Western Aeronautical Test Range (WATR) Areas of The Research Development and Test Building 4800 by seismically bracing 1,000 square meters of raised flooring; installing fire detection and suppression systems in the under floor area of a computer room; modifying the facility to enhance the mission control room capability; accommodating disabled personnel access and egress; and rehabilitating the roof, HVAC, electrical, and security systems. This project also provides a concrete slab for WATR equipment at Building 4824, replaces an aging inverter for the WATR Uninterruptible Power System at Building 4848 and provides communications duck bank between buildings 4800 and 4982. The existing systems are unreliable and experiencing failures in which missions were deferred. The systems evolved piecemeal over the past 40 years and do not comply with Life-Safety codes.

C. Goddard Space Flight Center (GSFC) \$ 2,080,000

1. Rehabilitation of Utility Control System 630,000

This project will replace obsolete portions of the existing Utility Control System (UCS) for Buildings 5, 16/16W, and 21 with a state-of-the-art Direct Digital Control UCS. Pneumatic automatic temperature controls and sensors will be replaced with new digital systems to provide reliable inputs and independent local control of air conditioning systems. This project is critical to providing effective energy conservation. The existing obsolete UCS is primarily a monitoring system and has incurred numerous operational problems such as software failures and inaccurate sensor inputs. The new digital system will provide for an efficient, reliable, and maintainable air conditioning control system.

2. Rehabilitation of Fire Detection Systems 400,000

This project provides for rehabilitation and upgrade of the existing fire detection systems in 33 buildings, Areas 100, 200, 300 and 400. Specific buildings include 1, 2, 3/13/14, 5, 6, 7, 8, 9, 10, 15, 16, 16W, 17, 18, 19, 20, 21, 23, 28, 29, 30, 79, 80, 83, 84, 86, 88, 90, 92, 97, and 99. The work will include upgrading the fire alarm control panels and all associated wire and conduit. The existing fire detection systems are obsolete and replacement parts are not available. Upgrading the fire alarm systems and replacing obsolete equipment are required to comply with current safety standards, reduce maintenance costs, and provide reliable operations.

3. Rehabilitation of Heating Ventilating, Air conditioning (HVAC)

System and Controls, Building 23 750,000

This project provides for the rehabilitation of the induction unit systems in the Data Interpretation Laboratory Building 23. Work includes replacing secondary water equipment, air compressors, isolation valves, and dielectric couplings; refurbishing induction units; modifying air handling units; and providing related control work. Asbestos will be removed as required. The components of the induction unit and secondary water systems have deteriorated. They are 30 years old and at the end of their expected useful life.

4. Rehabilitation/Modification Thermal Laboratory, Building 4 300,000

This project provides for safety and code modifications to the thermal lab areas in Building 4. Modifications include improving the ammonia detection system and exhaust ducts on the roof, replacing existing fan motors to increase capacity, modifying and rebalancing interior duct, upgrading the fire detection system, and providing fire wall separation between thermal labs and the other occupants in the building. Concerns in Building 4 include ammonia exposure, fire separation, and inadequate fire and ammonia detection systems. There is currently a risk to personnel from the spread of fire/ammonia between areas. Modifications will preclude the need to shut down the entire facility in case of an incident in the labs and will resolve health and safety concerns.

D. Jet Propulsion Laboratory (JPL) \$2,950,000

1. Rehabilitate Technical Information Facility, Building 111 900,000

This project will refurbish and reconfigure 1,000 square meters of the first and second floors in the Technical Information Facility, Building 111. Old plumbing will be replaced and the facility will be upgraded to accommodate the disabled. The work also includes new full and partial height partitions; acoustical tile ceilings; lighting fixtures and revised space layout; reconfiguration of the air ducts; replacement of significant portions of the heating, ventilating, and air conditioning (HVAC) and fire sprinkler systems; and new doors and finishes as required. The building is 45 years old and its systems are past their economic and useful life. The systems are expensive to operate, difficult to maintain, and very inefficient. Reconfiguring the floor space will more efficiently utilize the limited space available.

2. Rehabilitate Fire Alarm Systems, Various Buildings 900,000

This project will upgrade or replace the fire alarm systems and control equipment in buildings 125, 144, 150, 168, 169, 179, 180, 183, 198, 230, 238, 264, and 277. Included is the necessary

communications hardware in the fire alarm control panels for remote annunciation of the alarms in the central control console for immediate response by the fire department. The existing fire alarm systems are obsolete, unreliable, and not in compliance with current life and safety code requirements. There have been numerous false alarms and also failure to annunciate on real time situations. This project is needed to provide the required level of safety for personnel and property and to comply with appropriate life and safety code requirements.

3. Rehabilitate Third Floor, Material Services Facility, Building 171 650,000
 This project will rehabilitate 540 square meters of existing space on the third floor of the Material Services Facility, Building 171 to provide computer work stations and co-locate key discipline engineers during the development of flight hardware. It includes removal and disposal of vinyl asbestos tile, removal and replacement of partitions, upgrade of fire sprinkler system, upgrade of the lighting system, installation of raised flooring, and the addition of battery packs for the exit lighting. The power distribution, fire alarm and detection system will be ungraded and the HVAC system will be rebalanced and new finishes will be applied.

4. Rehabilitate Energy Conservation Laboratory, Building 148 500,000
 This project will upgrade lighting and air distribution on the second floor of the Energy Conservation Laboratory, Building 148. The roof mounted HVAC unit will be replaced with a higher capacity unit. A new suspended acoustical ceiling system with recessed fluorescent light fixtures will be installed and an elevator will be added to move instruments and materials to the second floor. The lighting and HVAC system are totally inadequate with only minimal air supply, no ceiling, and only pendent mounted light fixtures. A new elevator will provide a safer and more effective method to move equipment and materials to the second floor laboratory than the current practice of using a fork lift.

E. Johnson Space Center (JSC) \$1,870,000

1. Rehabilitate Water Systems, Various Buildings 950,000
 This project provides for the rehabilitation of the water systems in buildings 3, 5, 16, 16A, and 35. The work includes replacing water mains between the block valves and the mechanical rooms, replacing the hot water generators and converters, and installing double check valves on the fire water lines. Piping and insulation repairs will also be part of the project. The existing building water systems have deteriorated and are too small to accommodate future requirements. Rehabilitation of these water systems is required to improve system performance, prevent further deterioration, and prepare for future demand.

**2. Rehabilitate Laboratory Area Air Conditioning System, Laboratories Area (200),
White Sands Test Facility 920,000**

This project provides for the repair, refurbishment, and replacement of the major heating, ventilating, and air conditioning (HVAC) systems at the White Sands Test Facility (WSTF) Laboratory Areas including Buildings 200, 201, and 203. HVAC systems covered by this work include chillers, boilers, direct expansion refrigeration equipment, air distribution components, humidifiers, and control systems. New cooling towers will be installed and existing air handlers will be refurbished and supplemented as required to include upgrading of laboratory exhaust systems. New chilling equipment will meet regulatory requirements. Electrical installation will include necessary modifications to the secondary distribution system. Asbestos abatement actions are required on existing piping and duct work that is to be modified or removed. The existing air conditioning systems are 30 years old and have exceeded their useful life.

F. Kennedy Space Center (KSC) \$2,700,000

**1. Rehabilitation and Modification of Personnel and Platform Access Safety Devices,
Vehicle Assembly Building (VAB) 900,000**

This project provides for the rehabilitation and modification of personnel and platform access safety devices in the VAB to prevent hazards per Occupational Safety and Health Administration (OSHA) regulations. Safety lifelines are needed across the VAB vertical doors and lighting is needed in the VAB counterweight wells to allow for safe repairs and maintenance. This project also includes upgrading the chain guardrails at the VAB extensible platforms to meet current OSHA regulations. Platforms, ladders, handrails, and chain guardrails in other areas of the VAB also require modifications and upgrades to meet the regulations. OSHA requires personnel to be protected from falling while working within 6 feet of an exposed height of 4 feet or more. Numerous areas at KSC/LC-39 require upgrade and refurbishment of barriers, devices, and guardrails to meet current OSHA requirements.

**2. Rehabilitate Industrial Area 13.2 kV Protective Relays,
Various Buildings 500,000**

This project provides for rehabilitation of existing mechanical overcurrent relays with new solid state relays. Existing relays are twenty years old and require refurbishment or replacement. Parts for some types of the existing relays are increasingly difficult to obtain. The coordination and testing of the relay system will be considerably easier and less time consuming with this improvement.

3. Modify KSC Facilities to Accommodate People with Disabilities,

Various Buildings 600,000

This project will modify various facilities to meet Title 28, Code of Federal Regulations, Part 36, requirements for disability access. The population of people with disabilities working at KSC is increasing and the KSC disability working group has identified this building to be modified. This project will modify the building, fixtures, and surrounding area to eliminate access barriers to people with disabilities. Included are additional handicapped parking spaces; curb elimination; automatic entry doors, where applicable; lowering light switches and fire alarm pull stations; modification of restrooms, drinking fountains, and public telephones; and modification of signage, visual alarms, and audio alarms.

4. Rehabilitate Cranes and Hoists at Hangar AF, Building 66250,

Cape Canaveral Air Station 700,000

This project rehabilitates and modifies the east and west cranes in Hangar AF. It replaces electrical feed rails and rehabilitates six hoists to comply with the NASA safety standard NSS/GO 1740.9. These cranes and hoists are used to handle Solid Rocket Booster/Solid Rocket Motor SRB/SRM flight hardware. They are unreliable due to deterioration and costly to maintain. Processing operations and/or missions will be delayed if cranes are not available.

G. Langley Research Center (LaRC) \$3,485,000

1. Modifications to Building 1230 for Strain-Gage Balance Development/Calibration

Laboratory 890,000

This project provides for modifications to Room 134 in Building 1230 to allow construction of a Strain-gage Balance Development/Calibration Laboratory. The modifications include relocating an existing balance stand to Room 134, modifying the stand to provide increased pitch and new roll capabilities, and providing a thermal environmental chamber which will allow complete calibration of transducers from cryogenic temperatures to 400 degrees Kelvin. The project will also include an exhaust system, an exterior nitrogen storage vessel, and connection of all necessary utilities to provide a complete and useable facility. The heavy industry demand necessitates development of new balances with high accuracy and a fast calibration turn around time. Calibration and development of balances are currently performed with limited capability.

**2. Modifications to 8-Foot High Temperature Tunnel
for Productivity Enhancements (1265A) 860,000**

This project provides for modifications to the radiant pre-heaters, the elevator pitch carriage, the elevator control system, and the panel holders to allow for rapid connection, disconnection, and removal from the tunnel test section. The current capability to perform aerothermal loads and structures testing is limited. The proposed modifications will correct this deficiency in the facility's testing capabilities. Facility productivity will be significantly enhanced by reducing the time required to change from one test setup to another.

**3. Modifications to Building 1208 for the Structural
Acoustic Loads and Transmission Facility 815,000**

This project provides for modifications to Building 1208 to create the Structural Acoustic Loads and Transmission Facility. The work includes modifications to rooms 229 and 231 to create a new anechoic room and receiving room, modifications to the HVAC system and existing flow duct, construction of a new enclosed stairway, relocation of restroom, and modifications to utilities as required. These changes will allow both a basic and applied research capability to evaluate the response of aircraft panels and structural systems in support of the High Speed Research and Advanced Subsonic Transport Programs.

4. Optical Access Modifications for the 31-Inch Mach 10 Tunnel (1251A) 920,000

This project provides modifications to increase optical accessibility of the 31-inch Mach 10 Tunnel. The modifications include relocation of the existing, flow field survey probe (FFSP); installation of a viewing platform; fabrication and installation of a new pitot pressure probe; installation of two new ports in the test section sidewall; replacement of an existing 5-micron in line filter; and construction of a model preparation room adjacent to the test section. Relocation of the FFSP system and the addition of optical view ports will make this the Agency's premier facility for applying non-intrusive optical techniques to obtain benchmark information needed for computational fluid dynamics code calibration studies and to certify vehicles for flight. Additionally, the replacement filter will minimize facility downtime.

H. Lewis Research Center (LeRC) \$2,630,000

**1. Rehabilitation and Modification to Model Fabrication and Instrumentation
Facility (14) 900,000**

This project provides for the rehabilitation of the south area of the Model Fabrication & Instrumentation Facility (MFIF). The work includes meeting Life Safety Codes in the southwest

corner; reinforcement of roof structure to support new heating, ventilating, and air conditioning (HAVC) units; replace existing HVAC with new chillers, steam heat, duct work, and controls; replace waterlines, sprinkler system, and reconnect floor drains; and replace 120/208 volt panels, fire alarm system, and lighting. The building is 51 years old, in need of major rehabilitation, and supports critical aerospace programs.

2. Modifications to Aerospace Combustion Facility (35) 830,000

This project provides for the modification of the Aerospace Combustion Facility, Building 35-10, located within the Rocket Laboratory Complex (35). The work includes storage tanks for liquid hydrogen, liquid methane, and other fuels; fuel feed systems from the fuel tanks to the test cells; a muffler/scrubber system to serve both cells; and controls and instrumentation. This project will provide a highly reliable, fuel flexible, low operational cost support system for test cells 31 and 32, for advanced research and development aerospace propulsion subsystem technology.

3. Rehabilitation and Modification to Instrument Research

Laboratory (77) 900,000

This project provides for the rehabilitation of mechanical systems in the Instrument Research Laboratory (IRL), Building 77. The work consists of installing a hot water heating system; chilled water distribution piping; new make-up air handling unit; and new heating, ventilating, and air conditioning (HVAC) systems for the laboratories. Also included in the scope is the installation of a fire suppression system and associated electrical and architectural work. The existing HVAC systems in the IRL are 44 years old and in constant need of maintenance. The new HVAC and fire suppression systems will provide efficient, reliable, economical, and safe operating conditions for the IRL.

I. Marshall Space Flight Center (MSFC) \$2,150,000

1. Electrical Modifications to Industrial Water Pump House (4567) 300,000

This project provides for electrical modifications to the East Test Area Industrial Water Pump House, Building 4567. Scope includes relocation of the 480V electrical power switchgear and associated power distribution panels within the facility to a new enclosure adjacent to the facility. The electrical switchgear and power distribution panels are currently surrounded by high pressure water piping and pumps which create a safety hazard to personnel. This project

corrects this situation and improves the overall maintainability and reliability of the pump house.

2. Rehabilitation of Components Service Facility (4653) 950,000

This project provides for the complete rehabilitation of the west wing of the Components Service Facility, Building 4653. Project scope includes upgrading the exterior envelope by providing a new insulated wall system and a new insulated standing seam roof. Project scope also includes the restoration and upgrade of the interior architectural, mechanical, and electrical systems. Building 4653 is a 30 year old steel framed facility used to repair, refurbish, and maintain test facility components such as valves, regulators, filters, liquid oxygen loading and transfer pumps, and hydraulic and vacuum pumps. This project will bring the electrical system into compliance with current codes, eliminate recurring problems with water leaks, improve the energy efficiency of the facility, and reduce its operations and maintenance costs.

3. Rehabilitate Paint Shop, Surface Treatment and Plating Facility (4760) 900,000

This project provides for a comprehensive rehabilitation of the paint shop in the west end of the Surface Treatment and Plating Facility, Building 4760. Scope includes replacing exterior siding and doors, interior booth (sheet metal) walls, and floor grate system. Scope also includes repair or replacing the shop's mechanical, water spray, lighting, and filtering systems and reconditioning the concrete sumps and the water collection basin. The paint shop is deteriorated due to its age, interior corrosive environment, and water leak problems. This project restores a capability heavily used by multiple programs and laboratories for special coatings in support of hardware development.

J. Michoud Assembly Facility (MAF) \$2,400,000

1. Rehabilitate and Modify Cell "F" Control System (110) \$950,000

This project provides for the rehabilitation and modification of the control system for Cell "F" in the External Tank (ET) Vertical Assembly Building (110). Scope includes installation of a new control system for Cell "F" to replace the existing direct relay logic system, and the rehabilitation and modernization of associated mechanical systems. Cell "F" is used for hydrostatic testing of the ET's Liquid Oxygen Tank. This project will restore operational reliability, reduce the number of aborted operations caused by system errors, and improve control of the tank's interior environment.

2. Rehabilitate and Modify Steam and Chilled Water Piping (207/220) \$600,000

This project provides for the rehabilitation and modification of the steam and chilled water lines in Buildings 207 and 220. Scope includes replacement of piping for chilled water supply and return, steam, and condensate return inside the Boiler House, Building 207, and in between Building 207 and the Vehicle Component Supply Building (220). Scope also includes modifications to the pipe rack between the two buildings. These piping systems are deteriorated and undersized causing severe calcification, clogging, and scaling. They provide inadequate chilled water to the air handling units. The operations in Buildings 207 and 220 are critical to the production of the External Tank.

3. Rehabilitate and Modify Underground Fire Water Mains (200/300) \$850,000

This project provides for the rehabilitation and modification of underground fire water mains in the 200 and 300 areas. Scope includes restoration of the existing underground cast-iron fire protection mains for Buildings 200 and 318. Scope also includes the installation of a new fire loop around Buildings 320, 350, and 351. The existing system has far exceeded its designed life expectancy; is greatly deteriorated; suffers from widespread corrosion, leaking mains, and faulty control valves; and provides inadequate coverage. This project will bring the system into compliance with current codes and significantly reduce risk to personnel, facilities, equipment, and operations in the event of a fire.

K. Stennis Space Center (SSC) \$2,800,000

1. Rehabilitate Fire Alarm Systems, Various Facilities 700,000

This project provides for rehabilitation of the fire alarm systems in Buildings 1100, 1200, 1110, and other facilities to meet current code requirements. Detector rezoning, fire wall integrity, fire doors, and alarm zoning will be addressed. Existing fire alarm systems are old and require extensive maintenance to keep them operating. Numerous false alarms have occurred due to system failures. This lowers productivity and increases concern for safety.

2. Rehabilitate Energy Management and Control Systems 900,000

This project provides for rehabilitation of the Utility Control Systems at the Hydrosience Center (B-2101) and the High Pressure Gas Facility (B-3305). The work includes replacement of pneumatic controls and refurbishment of the air handling units. The existing heating, ventilating and air conditioning (HVAC) systems are more than 20 years old and many parts for the pneumatic controls are no longer available. Most of the HVAC systems have exceeded their useful life and require replacement to restore energy efficiency.

3. Rehabilitate Administration and Engineering Building (1100) 900,000

This project provides for the renovation of the interior and exterior of the Administration and Engineering Building (B-1100). The work includes architectural refurbishment of the original structure; interior building and fire code upgrade; ceiling replacement; energy efficient lighting; restroom upgrade to meet current codes and standards; and repair/replacement of motor control centers, panelboards, and other power distribution equipment. These systems are over 30 years old, deteriorated, and do not meet current codes and standards.

**4. Rehabilitate Uninterruptable Power Supply (UPS) Systems,
Space Shuttle Main Engine (SSME) Area 300,000**

This project provides for rehabilitation of the UPS systems that are critical to testing in the various test stands in the SSME Test Area. Work includes replacement of old systems and expanding UPS system coverage to all instrumentation and control systems required for SSME testing. In addition, all non-critical loads will be removed from the UPS. Work also includes installation of 480 volt generators. Existing UPS systems are over 30 years old, have exceeded their useful life, and are difficult to maintain because replacement parts are no longer available.

I. Wallops Flight Facility (WFF) \$1,050,000

**1. Rehabilitation of Main Administration Building at National Scientific
Balloon Facility (NSBF) 700,000**

This project provides for the rehabilitation of the existing Main Administration Building at the NSBF in Palestine, Texas. The work includes removal of roof platforms; installation of a high bay coiling door, new exterior metal siding, personnel doors, 145 square meter elevated work area, suspended acoustical tile ceiling, and insulation; interior partition wall reconfiguration; bathroom modifications; installation of new centralized heating, ventilating, and air conditioning and fire protection systems; and modifications to the concrete loading dock. This building is 34 years old, has greatly deteriorated over time, and requires major rehabilitation. This facility is vital to the mission of NSBF and provides workspace for approximately one fourth of the NSBF personnel.

**2. Rehabilitation of Heating, Ventilating, and Air Conditioning Systems (HVAC),
Various Buildings 350,000**

This project provides for rehabilitation of the HVAC systems at Buildings E-2, E-106 and F-3. The work includes the replacement of air handlers, condensers, chillers, and controls. The existing

HVAC equipment is aging and requires excessive repair. Replacement parts are difficult to obtain, which impacts operations and increases maintenance costs. Rehabilitation of controls will allow precise control and monitoring of equipment operation, resulting in reduced electric power consumption and related costs savings.

M. Various Locations \$2,900,000

1. Rehabilitate Feedcone for 70-Meter Antenna, Canberra, Australia 650,000

This project will provide a new feedcone shell to house microwave equipment, transmitter, waveguide switches, and maser. A dichroic mirror and retraction mechanism will be fabricated, tested, and installed. This project is required to expand the capability of the 70-meter antenna to provide X-band uplink and maintain downlink support to flight projects.

2. Modify Power Distribution System, Canberra, Australia 900,000

This project will convert the existing 2400 Volt radial distribution system to a loop system. This project includes the installation of cables, ducts, and trenches to complete the loop system; a new 2400 V substation; and a 480/208 V distribution panel. The power plant programmable controller and the power plant building will be modified to accommodate the equipment. The primary power system components are over 20 years old and in constant use. The loop system will allow portions of the system to be serviced without interfering with mission requirements, will improve maintainability, and provide needed redundancy.

3. Modify Power Distribution System for DSS-27 & DSS-28, Goldstone, Ca. 700,000

This project will connect the DSS-27 and DSS-28 antenna sites to the Goldstone power grid. It includes removal of a transformer and installation of power cables, control cables, and switchgear. The project will provide Deep Space Network standard power redundancy, integrate DSS-27 and DSS-28 antennas with the complex's highly-reliable power system, and improve maintainability and reliability.

4. Rehabilitate Feedcone for 70-Meter Antenna, Madrid, Spain 650,000

This project will provide a new feedcone shell to house microwave equipment, transmitter, waveguide switches, and maser. A Dichroic mirror and retraction mechanism will be fabricated and tested, and installed. This project is required to expand the capability of the 70-meter antenna to provide X-band uplink and maintain downlink support to flight projects.

N. <u>Miscellaneous Projects Not in Excess of \$250,000</u>	<u>\$235,000</u>
Total Rehabilitation and Modification	<u>\$31,400,000</u>

FUTURE ESTIMATED CONSTRUCTION FUNDING REQUIRED:

Approximately \$30-40 million per year will be required for continuing rehabilitation and modification needs.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1997 ESTIMATES

SUMMARY

MINOR CONSTRUCTION

<u>Summary of Project Amounts by Location:</u>	<u>Amount</u>	<u>Page No.</u>
Dryden Flight Research Center	720,000	MS 4-104
Goddard Space Flight Center	750,000	MS 4-104
Jet Propulsion Laboratory	450,000	MS 4-104
Kennedy Space Center	740,000	MS 4-105
Wallops Flight Facility	740,000	MS 4-105
Total	<u>\$3,400,000</u>	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1997 ESTIMATES

PROJECT TITLE: Minor Construction of New Facilities and Additions to Existing Facilities,
Not in Excess of \$1,500,000 Per Project

INSTALLATION: Various Locations

FY 1997 Estimate: \$3,400,000

FY 1995: \$2,000,000

FY 1996: \$3,800,000

COGNIZANT INSTALLATIONS/LOCATIONS OF PROJECT: Various Locations

COGNIZANT HEADQUARTERS OFFICE: Office of Management Systems and Facilities

SUMMARY PURPOSE AND SCOPE:

These resources will provide for minor facility construction at NASA field Installations. Each project in this program is estimated to cost no more than \$1.5 million and involves either the construction of new facilities or additions to existing facilities. The FY 1997 request of \$3.4 million will improve the usefulness of NASA's physical plant by changing the utilization of or augmenting the capabilities of various facilities. Included in this request are those programmatic and institutional projects that are essential to the accomplishment of mission objectives.

PROJECT JUSTIFICATION:

The configuration of NASA's physical plant necessarily must respond to changes in utilization and adaptations required by changes in technology or in mission needs. Demands are generated by research, development, testing, and similar activities. Specific justification for each minor construction project is provided under "PROJECT COST ESTIMATE."

PROJECT DESCRIPTION:

Included in the FY 1997 minor construction program are those facility projects for institutional or technical facility needs that could be fully identified at the time of submission of this budget estimate. Items of work totaling \$3.4 million are included in this resource request. Projects were selected on the basis of the relative urgency of each item and the expected return on the investment. During the course of the year, the revision of priorities may require changes in some of the items to be accomplished. Such changes will be accommodated within the total resources allocated.

These projects represent requirements that must be met in this time frame to support institutional needs and programmatic objectives. The following listing summarizes the cost distribution by category of work:

a. General Purpose Buildings	1,910,000
b. Technical Buildings/Structures	1,490,000

PROJECT COST ESTIMATE:

A. Dryden Flight Research Center (DFRC) \$720,000

1. Construct Addition to Consolidated Warehouse, Building 4876 720,000

This project provides for the construction of a 1400 square meter pre-engineered steel building with mezzanine, roll-up doors, and associated sitework adjacent to building 4876. Building systems include heating, power and lighting, evaporative cooling, fire detection, and sprinkler systems. Plumbing and bathrooms will be included in the structure. Additional on-site warehouse space is required for receiving, processing, and storing active stock items for current and future flight research aircraft. Parts are currently stored across the surrounding area ranging from 25 to 115 kilometers away. The situation contributes to delays and possible loss of inventory.

B. Goddard Space Flight Center (GSFC) \$750,000

1. Construct Addition to Power Laboratory, Building 20 750,000

This project will provide for the construction of a 350 square meter laboratory addition to the west side of Technical Support Building 20. The addition will consist of a Battery Laboratory and a Large Area Pulsed Solar Simulator (LAPSS) Facility. The Battery Lab will consist of lab space, offices, materials storage room, freezer area, test preparation area, and gas storage area. The LAPSS facility will consist of a flash chamber, solar panel preparation/storage area, and office. Separate mechanical equipment rooms will be provided for the Battery Lab and LAPSS facility. The existing Battery Lab, currently housed in an office building, does not meet health and safety standards. The LAPSS facility is presently located at a non-secure remote site which is not capable of being upgraded to a cleanroom needed to provide the level of testing accuracy required. The Power Lab addition will provide enhanced safety and additional area for the Battery Lab, and will provide secure, cleaner conditions for the LAPSS facility.

C. Jet Propulsion Laboratory (JPL) \$450,000

1. Construct North Laboratory Parking Area 450,000

This project will develop 85 new parking spaces in the area of Explorer Road between Buildings 72 and 18. Included with the paved area will be a continuous 18 meter high by 73 meter long retaining wall, area lighting, landscaping, pedestrian access way, and parking for the disabled. Also, included are the demolition of Buildings 91 and 93 (both, 1940's era) and relocation of

storage containers. This project is consistent with the master plan and is needed to alleviate a shortage of parking space even after anticipated work force reductions, personnel shifts, and car and van pool efforts are implemented.

D. Kennedy Space Center (KSC) \$740,000

1. Construct Launch Complex 39 News Facility 740,000

This project will provide a 700 square meter permanent, centralized facility with adequate space for day-to-day news media operations at the Launch Complex 39 press site. This facility will centralize the photographic library; video-tape library; publications library; four individual offices; garage for NASA Select television vans; storage and supply areas; and restrooms. The present photo, video, and print libraries are of temporary construction and inadequate size to support the multi-function news media operations. NASA Select vans are presently housed outside and need to be protected. Each of the three vans with its associated electronic equipment is estimated to be worth \$500,000.

E. Wallops Flight Facility (WFF) \$740,000

1. Construct Balloon Support Facility, National Scientific

Balloon Facility (NSBF) 740,000

This project provides for the construction of a 770 square meter building at the NSBF. The work includes a pre-engineered metal building with overhead and personnel doors; interior partitions; heating, ventilating, and air conditioning; electrical power; lighting; and fire protection systems. The construction of a Balloon Support Facility will permit the centralization of equipment maintenance, machine and electronics shops, balloon engineering and quality assurance laboratories, and facilities operations. The listed functions are currently housed in trailers, portable offices, and temporary structures. They are inefficient to operate and maintain, and costly to renovate. Consolidation in a single complex will enable engineering personnel to make effective use of the laboratories and permit them to interface with the mechanical and electronic technicians on a regular basis.

Total **\$3,400,000**

FUTURE ESTIMATED CONSTRUCTION FUNDING REQUIRED: Approximately \$4-5 million per year will be required for continuing minor construction needs.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1997 ESTIMATES

SUMMARY

FACILITY PLANNING AND DESIGN

	<u>Amount</u>	<u>Page No.</u>
Master Planning	\$ 400,000	MS 4-108
Sustaining Engineering Support	8,900,000	MS 4-108
Preliminary Engineering Reports and Related Special Engineering Support	1,600,000	MS 4-110
Final Design	<u>7,800,000</u>	MS 4-111
Total	<u>\$18,700,000</u>	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1997 ESTIMATES

PROJECT TITLE: Facility Planning and Design

FY 1997 Estimate: \$18,700,000

FY 1995: \$10,000,000

FY 1996: \$10,000,000

The funds requested in this estimate are required to provide for the following advance planning and design activities related to facilities activities and projects where not otherwise provided for:

a. The accomplishment of necessary studies, development and master planning for field installation and the provision of continuing engineering support and special engineering management and other services.

b. The preparation of preliminary engineering reports, cost estimates, and design and construction schedules. Also includes the preliminary engineering efforts required to initiate design-build projects.

c. The preparation of final designs which include construction plans, specifications, and associated cost estimates and schedules required to implement construction projects.

d. The accomplishment of facilities siting and other investigations, studies and reports.

A. Master Planning \$400,000

Provides for updating, developing and automating existing field installation master plans. This effort includes facility studies, site investigations, and analyses of utility systems. The existing utility and civil drawings will be converted into a highly detailed electronic database using a computer-aided-design (CAD) system. Topographical features from original drawings will be merged electronically to create individual area maps or an entire center map. The master plan documents will be updated to reflect as-built conditions and to graphically represent the 5-year facility plan baseline for future development.

The NASA field center master plans are periodically updated. The master plans are essential as reference documents for land use planning, identification of physical relationships of facilities, and proper orientation and arrangement of facilities. The updates reflect as-built condition of facilities and utility systems with emphasis on changes caused by recent facility construction and modifications.

B. Sustaining Engineering Support \$8,900,000

Provisions for facility studies and specific engineering support continue in importance as evidenced in recent years. These efforts are important due to changing cost trends in construction materials and fuels; the operation and maintenance costs for the physical plant; and energy conservation and efficiency.

The following items are included in the FY 1997 requirements:

1. National Research Council

Covers annual support to the Federal Facilities Council's (FFC) operations and provides for special studies that the Council will perform throughout FY 1997 to help advance the science and technology of Federal Government building and construction. The FFC is subordinate to the National Research Council, National Academy of Sciences, and its activities are supported by NASA and other Federal agencies with similar construction programs.

2. Value Engineering, Cost Validations and Analyses

Provides for engineering services to improve cost-effectiveness of facility projects by subjecting project design criteria, specifications and working drawings for specific material components and systems to detailed independent reviews by engineering specialists. Also provides services necessary to predict and validate facility costs to aid in resources planning.

3. Facility Operation and Maintenance

Provides for studies and engineering support where not otherwise provided for, at NASA field installations relative to functional management of maintenance, automated maintenance management systems, and facilities condition assessments. Included in this activity are field surveys to be conducted at selected NASA field installations to evaluate the effectiveness and efficiency of the operations and maintenance management activities, and to identify possible improvements in productivity.

NASA's facilities infrastructure is critical to achieving current and future space and aeronautics program objectives. Two initiatives are planned to keep this infrastructure safe, reliable, and available by substantially increasing the rate of return on severely constrained Agency resources. These initiatives are:

a. Conversion to Reliability Centered Maintenance - Provides for the change from a time driven and reactive/breakdown mode of maintenance to a more proactive program of Reliability Centered Maintenance (RCM). This program will focus on implementing the optimal mix of preventive, predictive, proactive, and reactive technologies which yields the required reliability at the minimum cost. It also aims to utilize system performance feedback to design potential failures out of systems. This agency-wide effort will include a detailed assessment of specific RCM opportunities and available Predictive Testing and Inspection (PT&I) technologies, the establishment of RCM processes and procedures, the establishment of responsible RCM organizations, and the acquisition of required PT&I monitoring equipment and training. This conversion to RCM will significantly reduce maintenance cost by minimizing and/or eliminating time driven shutdowns and future breakdown maintenance. This provides the additional resources needed to implement this program as NASA installations must still perform the current time-driven/breakdown maintenance in order to provide adequate mission support until the conversion is made. It is anticipated that this conversion will lead to an annual savings of \$12 million in maintenance costs within three years and thereby ameliorate the negative impact of continuing low budget levels on the facilities infrastructure.

b. Conversion to Performance-Based Maintenance Contracting - Provides for the change from "umbrella" cost reimbursement contracts to performance-based, fixed-price contracts for facilities maintenance, repair, and operations contracts. Currently about 90 percent of NASA contracts for these services are cost reimbursement contracts. It is estimated that from \$35 to \$50 million per year can be saved by successfully converting these contracts to performance-based, fixed-price contracts. This will also lessen the impact of low future budgets. This provides for the substantial up-front effort required to collect and analyze the required data,

prepare performed-based specifications that fully support mission urgency and timeliness, tailor and implement comprehensive quality assurance programs, and train personnel.

4. Facilities Utilization Analyses

Provides for the analyses of agencywide facilities utilization data covering (1) office and other types of building space; (2) designate major technical facilities; and (3) special studies comparing the utilization of technical facilities which are similar in type or capability, such as wind tunnels. Such analyses provide for (1) insights into and development of better methods of identifying underutilized facilities; (2) improved techniques to quantify level of facilities use; (3) actions to improve facilities utilization; and (4) recommendations regarding consolidation/closure of facilities to meet Agency physical plant reduction objectives. Work provides for review of each installation's inventory data base in support of the facilities utilization program. Surveys are necessary to validate the reported data in relation to a specific problem or need, and to assist in providing a credible foundation for plans to improve the use of facilities.

5. Facilities Management Systems

Provides for continued engineering support for the technical updating of NASA's master text construction specifications to reflect the use of new materials, state-of-the-art construction techniques and current references to building codes and safety standards.

6. Independent Analysis and Third Party Reviews

Provides the technical and engineering support analyses, designs, and reviews required to verify, confirm and ensure suitability of construction designs within the project cost estimates.

7. Construction Industries Institute

Covers annual support to the Construction Industries Institute (CII). NASA will actively participate in this unique, non-profit institution, established to bring together major facility owners, contractors and academia in an effort to improve the quality and cost effectiveness of construction practice for member organizations as well as the US construction industry.

C. Preliminary Engineering Reports and Related Special Engineering Support \$1,600,000

1. Preliminary Engineering Reports (PERs) (1,300,000)

This estimate provides for preparation of PERs, investigations, and project studies related to proposed facility projects in the FY 1999 and FY 2000 Construction of Facilities programs. These reports are required to permit the early and timely development of the most suitable project to

meet the stated programmatic and functional needs. Reports provide basic data, cost estimates and schedules relating to future budgetary proposals. This request provides for PERs associated with proposed construction. The estimated cost of PER support for FY 1999 construction projects is \$1,000,000, which will permit updating of PERs for \$15 to \$20 million in construction, and the development of new PERs for an additional \$40 to \$50 million in projects. An additional \$300,000 has been included in this line for the completion of new PERs for approximately \$15 to \$20 million of construction projects which will be high priority candidates for inclusion in the FY 2000 Construction of Facilities program. The activity associated with FY 2000 will be confined to the highest priority candidates.

2. Related Special Engineering Support (300,000)

This estimate provides for investigations and project studies related to proposed facility projects to be included in the subsequent Construction of Facilities programs. Such studies involve documentation and validation of "as-built" conditions, survey/study of present condition of such items as roofing and cooling towers, utility plant condition and operational modes, and other like studies. These studies are required to allow for the timely development of projects to meet the stated functional needs and to provide basic data, cost estimates and schedules for related future budgetary proposals.

D. Final Design \$7,800,000

The amount requested will provide for the preparation of designs, plans, drawings, and specifications necessary for the accomplishment of projects. Projects involved are planned for inclusion in the FY 1998 and FY 1999 programs. The goal is to obtain better facilities on line earlier at a lower cost. The request will provide for final design work associated with construction proposed for the FY 1998 program, estimated to cost \$100 to \$120 million, and for \$10 to \$20 million of high potential projects proposed for the FY 1999 program. The final design amount included for FY 1998 candidates and for residual requirements of this nature which have accumulated from prior years activities is \$6,500,000. For FY 1999 \$1,300,000 is included and design activity will be confined to the highest priority candidates.

Total **\$18,700,000**

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
 CONSTRUCTION OF FACILITIES
 FISCAL YEAR 1997 ESTIMATES
 SUMMARY

ENVIRONMENTAL COMPLIANCE AND RESTORATION

<u>Summary of Project Amounts by Location:</u>	<u>Amount</u>	<u>Page No.</u>
Ames Research Center	\$1,400,000	MS 4-115
Dryden Flight Research Center	2,000,000	MS 4-115
Goddard Space Flight Center	320,000	MS 4-116
Jet Propulsion Laboratory	6,100,000	MS 4-116
Langley Research Center	500,000	MS 4-116
Lewis Research Center	4,800,000	MS 4-117
Marshall Space Flight Center	3,500,000	MS 4-117
Wallops Flight Facility	4,300,000	MS 4-118
White Sands Test Facility	2,700,000	MS 4-119
Miscellaneous Projects Not in Excess of \$250,000 Each	480,000	MS 4-119
Remedial Investigations, Feasibility Studies, Assessments, Studies, Design, and Related Engineering	6,900,000	MS 4-119
Total	<u>\$33,000,000</u>	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1997 ESTIMATES

PROJECT TITLE: Environmental Compliance and Restoration Program

INSTALLATION: Various Locations

FY 1997 Estimate: \$33,000,000

FY 1995: \$35,000,000

FY 1996: \$37,000,000

COGNIZANT INSTALLATIONS/LOCATIONS OF PROJECT: Various Locations

COGNIZANT HEADQUARTERS OFFICE: Office of Management Systems and Facilities

SUMMARY PURPOSE AND SCOPE:

These resources will provide for environmental studies, assessments, remedial investigations, feasibility studies, design, related engineering, and remedial action and construction projects for environmental compliance and restoration measures at NASA field installations, Government-owned industrial plants supporting NASA activities, and other locations where NASA operations have contributed to environmental problems and NASA is obligated to contribute to cleanup costs. In addition, these resources will be used to provide for regulatory agency oversight costs and to acquire land if necessary to implement environmental compliance and restoration measures. The purpose of this program is to enable NASA to comply with mandatory environmental statutory requirements and standards, cleanup orders and regulatory agreements. The resources authorized and appropriated pursuant to this program may not be applied to other activities. The program includes studies or assessments to determine compliance status and options for remedial action including use of new cleanup technologies; conduct of prescribed remedial investigations and feasibility studies as required by Federal environmental laws; performance of environmental restoration, hazardous waste removal and disposal, cleanups, and closures; and environmental compliance.

PROJECT JUSTIFICATION/DESCRIPTION:

Proposed environmental compliance and restoration projects and activities for Fiscal Year 1997 total \$33 million, which has been distilled from requests of approximately \$74 million. This program represents only a modest request in relation to the total requirements for environmental compliance and restoration that must be implemented within the next several years. Based on relative urgency and potential health hazards, the following listed projects are the highest priority requirements currently planned for accomplishment in FY 1997. Deferral of these necessary compliance and remedial measures would preclude NASA from complying with environmental requirements and regulatory agreements, and jeopardize critical NASA operations. The studies, remedial investigations, feasibility studies, assessments, design, and related engineering costs are estimated to be approximately \$6,900,000. Projects estimated to cost less than \$250,000 have not been described or identified by specific location. The estimated cost of these projects is \$480,000. As studies, assessments, remedial investigations, feasibility studies, and designs progress and as new discoveries or regulatory requirements change, it is expected that priorities may change and revisions of the activities and projects may be necessary.

The following listing summarizes broad categories of effort to be undertaken with projects of an estimated cost of over \$250,000:

- a. Hazardous Waste Corrective Actions/Cleanups \$20,220,000
- b. Air Pollution Control 800,000
- c. Water Pollution Control 4,600,000

PROJECT COST ESTIMATE:

A. Ames Research Center (ARC) \$1,400,000

1. Secondary Containment of Above Ground Tanks 300,000

This project provides for secondary containment of above ground storage tanks at several locations within ARC. Tanks containing hazardous substances will be provided with secondary containment by either removal and replacement of tanks with improved double wall versions, or curbing with flow blockage devices. The project is required to comply with local county regulations, as well as recommended spill prevention measures under the federal Clean Water Act (CWA).

2. Remediate Contaminated Soil, N221 & N259 1,100,000

This project provides for the remediation of contaminated soil beneath buildings N221 and N259. The soil beneath the buildings is contaminated with petroleum hydrocarbons and volatile organics from leaking underground storage tank systems. The sites will be remediated to conform with the federal Resource Conservation and Recovery Act (RCRA), state, and local regulations.

B. Dryden Flight Research Center (DFRC) \$2,000,000

1. Soil/Groundwater Contamination Assessment 2,000,000

This project provides for the final phase of remedial site investigations and feasibility studies required at DFRC. The Center is identified as Operable Unit No. 6 under the Edwards Air Force Base (AFB) Superfund Program. The project will conclude the ongoing remedial investigations and site characterization activities to include installation of soil borings and monitoring wells, soil gas surveys, sampling, and analyses. It will provide for data evaluation and report preparation, feasibility and treatability studies, risk assessments, and proposed remedial plans. The project will also provide for interim remedial action activities as necessary during the investigations to remove and reduce the spread of site contamination. This project is required to comply with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and the Edwards AFB Federal Facilities Agreement.

C. <u>Goddard Space Flight Center (GSFC)</u>	<u>\$320,000</u>
1. Remediation of Landfills	320,000
This project provides for the second phase of a phased remediation effort to cleanup contamination from three abandoned landfills at GSFC. Site investigations have indicated soil and groundwater contamination. The project is required to bring the facility into compliance with CERCLA/RCRA and the state requirements.	
D. <u>Jet Propulsion Laboratory (JPL)</u>	<u>\$6,100,000</u>
1. Remediation of Arroyo Seco Groundwater Contamination	5,100,000
This project continues the cleanup effort of the Arroyo Seco aquifer contamination. Site investigations have demonstrated the presence of contaminants beneath the site and in nearby production wells in excess of Federal and State of California standards. This portion of the project provides funds for the initial remedial actions following the Remedial Investigation and Feasibility Study (RI/FS) recommendations and final Record of Decision. It will also provide funds for payment of oversight costs required by the Federal Facilities Agreement (FFA). The site is listed in the Environmental Protection Agency's (EPA) National Priorities List and is subject to the provisions of CERCLA, state, and local requirements.	
2. Environmental Assessment/Cleanup, Edwards Test Facility (ETF)	1,000,000
This project continues the ongoing effort to investigate and characterize site contamination as required for closure of the ETF. The Facility is a tenant of Edwards Air Force Base (EAFB) and is identified as Operable Unit No. 5 under the EAFB Superfund site. This portion will provide for continuation of ongoing investigations under the Remedial Investigation and Feasibility Study (RI/FS) process. The work will include performing risk assessment and interim remedial actions as necessary to remove site contamination. This project is required as part of the CERCLA process.	
E. <u>Langley Research Center (LaRC)</u>	<u>\$500,000</u>
1. Remediation of PCB/PCT at Tabbs Creek	500,000
This project continues the remediation efforts for Tabbs Creek, contaminated with polychlorinated biphenyls (PCBs) and polychlorinated terphenyls (PCTs). The Center is required to assess, investigate and verify, and remediate identified contamination. Tabbs Creek is located behind the Center and joins the northwest branch of Back River about a mile from the Center property line. Tabbs Creek is a tidal wetland and Back River is used for oyster harvesting. Chemicals	

were released into the creek from the Langley storm drain system. A Federal Facilities Compliance Agreement was signed with the Environmental Protection Agency (EPA). LaRC is listed on the EPA's National Priorities List (NPL). PCBs are regulated under the Toxic Substances Control Act (TSCA) and cleanup is required under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA).

F. Lewis Research Center (LeRC) \$4,800,000

1. Remediation of Contaminated Sites 4,000,000

This project continues the effort to investigate, characterize and remediate site contamination within Lewis Research Center. Preliminary assessments and site investigations have been conducted. This portion of the work will finalize site characterization and initiate remedial actions identified and recommended during the Remedial Investigation/Feasibility Study (RI/FS). The project will also provide interim remedial action activities necessary during site characterization to remove and/or minimize the spread of contamination. The work follows the CERCLA process and incorporates state requirements. Findings and orders have been issued to LeRC by the State of Ohio Environmental Protection Agency (OEPA).

2. Air Pollution Controls 800,000

This project provides for the work required to install air pollution controls at Lewis Research Center's facilities in Cleveland. Project requirements follow air emission assessments and permit requirements, and include modification of existing systems and installation of equipment to control emissions of air pollutants including carbon monoxide and nitrogen oxides. Types of controls may include afterburners, catalytic reduction units, scrubbers, and data collection systems to monitor and control sources of air pollution. The Cleveland area is a nonattainment area for carbon monoxide and ozone. This project implements requirements under the Clean Air Act Amendments (CAAA) and state regulations.

G. Marshall Space Flight Center (MSFC) \$3,500,000

1. CERCLA Investigation and Cleanup 2,000,000

This project continues the effort to assess, characterize, and remediate site contamination resulting from releases of hazardous constituents. This phase of the project will continue the remedial investigations for identified contaminated sites; provide risk assessments and feasibility and treatability studies to evaluate remedial treatment alternatives; and prepare the remedial plan for sites requiring remediation. The project will also provide for remedial actions at sites required to reduce or eliminate sources of contamination and project

documentation and activities required under CERCLA. MSFC is listed on the Environmental Protection Agency's (EPA) National Priorities List (NPL) jointly with the Redstone Arsenal Army facility. The work follows the requirements specified in the Federal Facilities Agreement signed by NASA, EPA and the State of Alabama.

2. Cleanup of Groundwater Contamination,

Santa Susana Field Laboratory (SSFL) 1,000,000

This project continues the assessment, characterization, and cleanup of groundwater, including the assessment of the hydrogeological regime at SSFL. Trichloroethylene which has been associated with rocket engine testing activities has migrated through the existing rock formation and overburden into the groundwater. This portion of the project will continue the groundwater contaminant characterization and the assessment of site conditions, to include installation of groundwater wells, soil borings, and performing sampling and analyses. The project will also provide interim remedial actions required during the investigation phase. This project is required for compliance with RCRA and the State of California regulations.

3. Resource Conservation and Recovery Act (RCRA) Investigation and Cleanup, Santa Susana

Field Laboratory 500,000

This project provides for the assessment, characterization, and cleanup of contamination at RCRA Solid Waste Management Units identified by the Environmental Protection Agency and the State of California. The sites covered include portions of Areas I and II with soil contamination from the use of hazardous constituents during rock engine testing activities. This portion of the project will continue site investigation efforts to include soil vapor extraction, soil boring installation, and sampling and analyses; provide for evaluation of corrective measures; and perform corrective action at some sites. The work is required to conform with federal RCRA and the RCRA post closure permit issued by the State of California.

H. Wallops Flight Facility (WFF) \$4,300,000

1. Upgrade of Sewage Treatment Plant 4,300,000

This project provides for modifications to the Sewage Treatment Plant (STP) and the addition of advanced treatment systems and discharge facilities at WFF. The project will rehabilitate the headworks of the existing STP, including the grit removal and comminutor processes, and will construct new advanced tertiary treatment facilities and treatment processes. The new system will consist of pump stations, piping, and treatment processes including extended aeration, sand filtration, ultraviolet disinfection, post aeration, and sludge drying beds. These processes will be supported with a control building, flow metering, drainage systems, alkalinity adjustment

system, auxiliary power supply, and miscellaneous site work. Effluent from the upgraded STP will discharge at the existing permitted discharge location. The project is required to comply with state mandated effluent discharge requirements and compliance schedules provided in the Virginia Pollutant Discharge Elimination System permit and the federal Clean Water Act (CWA).

I. <u>White Sands Test Facility (WSTF)</u>	<u>\$2,700,000</u>
1. Groundwater Contamination Assessment and Remediation	2,700,000
This project continues the effort to assess, characterize, and remediate soil and groundwater contamination at WSTF. This portion of the project provides for site remediation approaches to groundwater and soil contamination to be implemented as a result of the RCRA facility investigations and corrective measures study recommendations and federal and state of New Mexico regulatory requirements. The project is required to comply with a RCRA 3008(h) consent order.	
J. <u>Miscellaneous Projects Not in Excess of \$250,000 Each</u>	\$ <u>480,000</u>
K. <u>Remedial Investigations, Feasibility Studies, Assessments, Studies, Design, and Related Engineering</u>	\$ <u>6,900,000</u>
Total	<u>\$33,000,000</u>

FUTURE ESTIMATED CONSTRUCTION FUNDING REQUIRED:

Approximately \$40-\$50 million per year for the next few years is the current estimate for meeting Environmental Compliance and Restoration requirements. This figure will become better defined as studies are completed and remediation projects are reviewed by Federal, state, and local regulators.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1997 ESTIMATES

INSPECTOR GENERAL

The NASA Office of Inspector General (OIG) budget request of \$17.0 million for FY 1997 is based primarily on 207 Full-time Equivalents (FTE's). The personnel and related costs of the 207 FTE's represents approximately 92% of the total OIG budget request. This is the minimal staffing level that allows the OIG to effectively perform its legislated mission. At the requested level, the OIG will: provide assistance and work cooperatively with Agency management as it carries out NASA's programs and operations; maintain a balanced audit program which includes providing technical assistance in the audit of the Agency's financial statement as required by the Chief Financial Officers (CFO) Act; concentrate investigative resources on procurement fraud matters including emphasis on prevention initiatives; and work cooperatively with management by conducting inspections/evaluations of issues identified by the OIG as well as those that are of concern to management. This budget level recognizes the fiscal constraints facing the Agency and the need for the OIG to provide quality products and services that are timely and meet our customers' needs. In light of increasing budget constraints, the Inspector General has commenced a streamlining activity which will increase the mission capability of the OIG staff. Initiatives include significant reduction of administrative overhead positions and conversion to the direct mission activities of audits, investigations, and inspections. The Inspector General will also reduce levels of management and supervisory positions, streamline and simplify communication and report channels, and improve computer and telecommunications capacities to further increase staff capability.

As NASA establishes new priorities and modifies others for its programs and operations within proposed budget constraints, efforts will continue to reinvent the OIG. Throughout this process, the OIG is increasing its cooperation with NASA management while assuring that the OIG's statutory independence is maintained. The OIG will continue to concentrate staff resources on those programs and operations identified as the most critical and vulnerable to fraud and abuse. The OIG will make these determinations based on funding levels, program needs, Congressional and Administration concerns, and results of OIG research and findings.

The OIG's mission is to conduct audits, investigations, and inspections and assessments of NASA's programs and operations while working cooperatively with NASA management and program managers. Audits will be prioritized and selected to evaluate programmatic, operational and financial management concerns, problems, and vulnerabilities. The investigations program will remain focused on complex procurement fraud matters, both criminal and noncriminal; fraud against the Government by contractor and government employees; product substitution; procurement irregularities; unethical and improper conduct; and waste and mismanagement. Investigative matters will be approached on a programmatic, priority basis to identify preventive initiatives. Inspections and assessments will be conducted which support management's interests and concerns in achieving NASA's programmatic objectives more efficiently and effectively, issues of Congressional concern, and matters of high Agency vulnerability as identified by the OIG.

OBJECTIVES AND STATUS

This request represents the resources (FTE's) needed at NASA Headquarters and the field offices to fulfill the OIG mission. Recognizing that the identified audit, investigative, and inspections and assessments workload significantly exceeds the available resources, continuous adjustments of priorities will be necessary to ensure that balanced coverage of NASA's programs and operations is maintained; that critical and sensitive matters are promptly evaluated and investigated; and that all OIG customers receive timely, accurate, and complete responses.

The OIG audit and the inspection and assessment programs set priorities for internal and external audits and evaluations to maximize the return on available staff resources. These priorities are established and contained in strategic plans for each of NASA's strategic enterprises - space technology, space science, aeronautics, mission to planet Earth, human exploration and development of space, and supporting activities that include, financial management, management systems and facilities, and procurement. The OIG uses a formal, comprehensive process to identify, review, prioritize, and select the audits and evaluations to be performed.

The OIG audit and the inspection and assessment workloads and assignments are derived from: (1) working closely with management and program managers to determine programmatic concerns and vulnerabilities; (2) selecting audits using a structured approach encompassing NASA's programs and operations and an external universe comprised of NASA's prime contractors, their subcontractors, and grantees; (3) addressing issues required by laws and internal regulations; and (4) responding to management's requests for independent evaluations of programmatic concerns. The audits and the inspections and assessments identified from these sources are prioritized and compared to available resources and published in the annual OIG plan. The OIG will continue its implementation of the program manager concept to obtain greater visibility and awareness of issues related to NASA's major programs and initiatives.

The defined audit workload far exceeds available staff. This will require continuous adjustment of priorities to provide balanced coverage of programs and operations most vulnerable to abuse and mismanagement. Further, program and project change, growth, delay, and termination increase the need for OIG oversight of contractor/subcontractor/grantee cost, schedule, and performance effectiveness. NASA's continued reliance on contractors and grantees (about 88% of the Agency's total obligations are for procurement) requires direct OIG involvement and oversight of Defense Contract Audit Agency (DCAA) and Health and Human Services (HHS) OIG audits of NASA contractors and grantees, to ensure effective contract and grant execution and administration. NASA was billed approximately \$18.8 million during FY 1995 for contract audit services.

The OIG plans to continue implementing its internal program manager concept to ensure visibility and awareness of significant issues related to major NASA programs/projects. During FY 1997, the OIG will focus attention and provide support to program managers on issues relating to: Space Station, EOS, shuttle, spacelab, space science projects, etc. The functional areas to be evaluated will include procurement and contract administration, technology transfer, financial management, IRM, and facilities and equipment.

The OIG will continue to monitor and assess NASA's high risk areas, material weaknesses and areas of significant concern to ensure that corrective actions are implemented timely. Areas of emphasis will include: financial systems-accounting; procurement and environmental programs; institutional contracting practices; contract management; contractor-held property; contractor cost reporting; allotment and budgetary controls; and financial reporting/general ledger. Financial management's significance increased with the passage of the CFO Act which requires the OIG to select auditors to render an opinion on the Agency's annual financial statements, its internal control structure, and its compliance with laws and regulations. Our financial audits will concentrate on accounting controls, information systems, and required performance measurements.

Agency vulnerabilities are determined by taking into consideration the following: (1) whether program and project objectives are accomplished in the most cost effective manner; (2) completeness of safety and mission quality activities; (3) management's actions to correct internal control weaknesses reported under the Federal Manager's Financial Integrity Act (FMFIA); (4) whether NASA's annual expenditure on information technology is providing expected programmatic and financial information needed to make sound decisions (NASA is the top ranked civilian Agency in information technology spending); (5) improvements in financial management systems, practices, controls, and information; (6) effectiveness of the audit follow up system in enabling management to maintain the status of corrective actions; and (7) the adequacy of Agencywide corrective actions addressing environmental concerns. These identified vulnerabilities are then evaluated, prioritized, and included in our plans for further action.

The OIG investigative workload of both criminal and noncriminal cases continues to exceed the availability of investigative resources. The workload of the investigative program has caused the OIG to be primarily reactive with emphasis given to the more serious criminal allegations. (Historically, criminal allegations represent about 85% of our total investigative caseload.) The FY 1997 investigative staffing level will require OIG management to effectively manage the complex workload of both criminal and civil fraud matters. As the number of complex procurement fraud cases continues to increase, and with such cases taking longer to resolve, our flexibility to improve and expand the program is reduced. Also, the quantity of investigative allegations received requires a preliminary evaluation to determine their potential impact and, if serious, opening an investigation. This further adversely affects the timely completion of ongoing cases. To help us address all substantive allegations received, we will work with management to refer more routine administrative matters to them for their resolution and request that they keep the OIG advised of the action taken. The investigative program managers are assessing the allegations and cases on a programmatic basis to determine their seriousness and impact to the programs in meeting their objectives. By referring matters to Agency managers to resolve as management issues, we can reserve our resources to address the more serious allegations made to the OIG.

In summary, the OIG will collaborate with Agency management to address issues of joint concern and to improve the scope, timeliness, and thoroughness of its oversight of NASA programs and operations, identify preventive measures, and enhance its capability to assist NASA management to efficiently and effectively achieve program and project goals and objectives.

MEASURES OF PERFORMANCE

	<u>FY 1995</u>	<u>FY 1996</u>	<u>FY 1997</u>
<u>Office Staff Ceiling</u>			
Full-Time Permanent	191	210	207
<u>Investigations</u>			
Cases pending beginning of year	364	356	371
Opened during year	345	315	310
Closed during year	353	300	290
Cases pending end of year	356	371	391
<u>Audits</u>			
Audits pending beginning of year	70	59	61
Opened during year	77*	56*	57*
Closed during year	88	54	58
Audits pending end of year	59	61	60

* Emphasis on programmatic audits

**INSPECTOR GENERAL
FISCAL YEAR 1997 ESTIMATES
BUDGET SUMMARY**

OFFICE OF INSPECTOR GENERAL

SUMMARY OF RESOURCES REQUIREMENTS

	<u>FY 1995</u>	<u>FY 1996</u> (Millions of Dollars)	<u>FY 1997</u>
I. Personnel & related costs	13.6	15.0	15.8
II. Travel.....	0.6	0.6	0.7
III. Operation of installation.....	1.6	0.4	0.5
A. Facilities services.....	(--)	(--)	(--)
B. Technical services	(1.5)	(0.2)	(0.3)
C. Management & operations...	<u>(0.1)</u>	<u>(0.2)</u>	<u>(0.2)</u>
Total	<u>15.8</u>	<u>16.0</u>	<u>17.0</u>

	<u>FY 1995</u>	<u>FY 1997</u> (Full-Time Equivalents - FTE's)	<u>FY 1997</u>
Full-time permanent.....	184	200	202
Other controlled FTE's.....	<u>7</u>	<u>10</u>	<u>5</u>
Total	<u>191</u>	<u>210</u>	<u>207</u>

BASIS OF FY 1997 FUNDING REQUIREMENT

	<u>FY 1995</u>	<u>FY 1996</u> (Millions of Dollars)	<u>FY 1997</u>
I. PERSONNEL AND RELATED COSTS	<u>13.6</u>	<u>15.0</u>	<u>15.8</u>
A. Compensation & Benefits.....	<u>13.2</u>	<u>14.8</u>	<u>15.4</u>
1. <u>Compensation</u>	<u>10.9</u>	<u>12.3</u>	<u>12.8</u>
a. Full-time permanent.....	10.4	11.9	12.3
b. Other than full-time permanent .	0.2	0.2	0.2
c. Overtime & other compensation .	0.3	0.2	0.3
2. <u>Benefits</u>	<u>2.3</u>	<u>2.5</u>	<u>2.6</u>
B. Supporting Costs.....	<u>0.4</u>	<u>0.2</u>	<u>0.4</u>
1. Transfer of personnel.....	0.1	0.1	0.2
2. Personnel training	0.3	0.1	0.2

	<u>FY 1995</u>	<u>FY 1996</u> (Millions of Dollars)	<u>FY 1997</u>
II. TRAVEL.....	<u>0.6</u>	<u>0.6</u>	<u>0.7</u>

Travel funding is required to carry out audit, investigation, inspection and assessment, and management duties. Our budget allows for increases in per diem, airline costs, and workloads. We anticipate increased travel by inspections and assessments personnel.

III. OPERATION OF INSTALLATION.....	<u>1.6</u>	<u>0.4</u>	<u>0.5</u>
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Operation of Installation provides a broad range of services and equipment in support of the Inspector General's activities.

A. Technical services.....	1.5	0.2	0.3
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This estimate provides for all equipment, including the lease, purchase, maintenance, programming and operations of automated data processing (ADP) equipment. NASA provides common services items such as office space, communications, supplies, and printing and reproduction at no charge to the OIG. The funding for technical services will cover the cost of providing an EDP (electronic data processing) upgrade, equipment to employees, and replacing equipment that has become outdated or unserviceable. As funding permits, the OIG will continue our transition from an antiquated computer system to the basic NASA electronic data processing standards. In FY 1997, we will purchase hardware and software associated with our transition plan to comply with NASA standards.

B. Management and operations	0.1	0.2	0.2
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Included in this category are miscellaneous expenses within the OIG i.e., GSA cars, the Inspector General's confidential fund, miscellaneous contracts, and supplies not provided by NASA. The increase in Installation Common Services will primarily allow for audit and investigative contractor support and other specialized activities which the OIG cannot perform internally.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

PROPOSED APPROPRIATION LANGUAGE

OFFICE OF INSPECTOR GENERAL

For necessary expenses of the Office of Inspector General in carrying out the Inspector General Act of 1978, as amended, \$17,000,000.

Note.—A regular 1996 appropriation for this account had not been enacted at the time this budget was prepared. The 1996 amounts included in this budget are based on the levels provided in three continuing resolutions: P.L. 104-91, P.L. 104-92 and P.L. 104-99.