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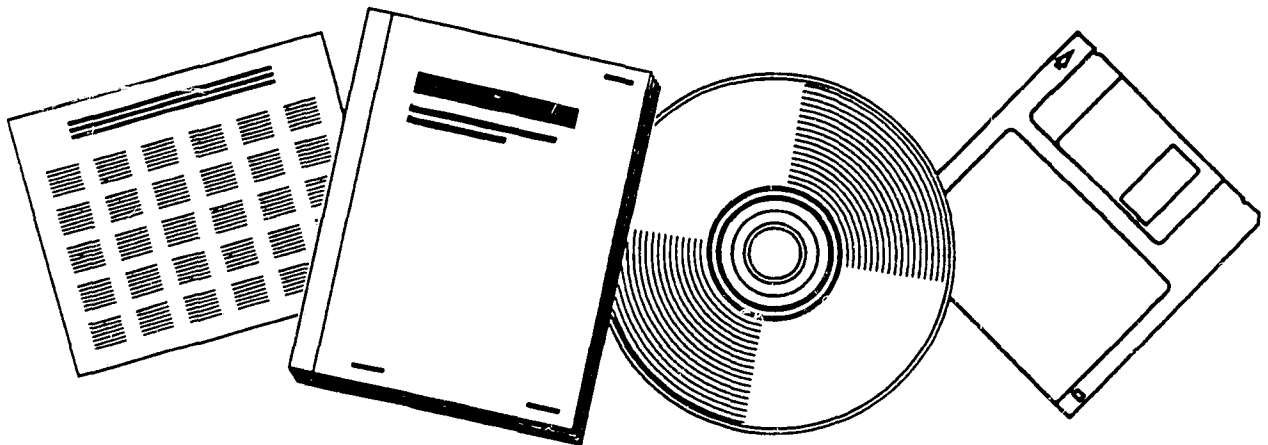INFORMATION AS POSSIBLE

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INFORMATION RESOURCES MANAGEMENT LONG RANGE PLAN, FY 1995-1999

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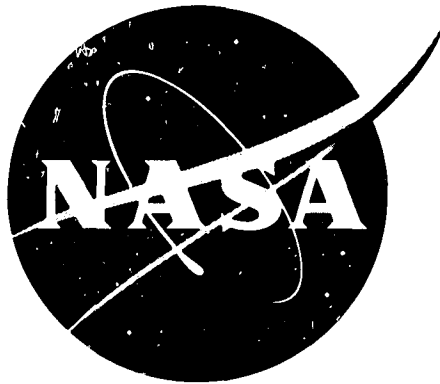WASHINGTON, DC

JUN 94

INFORMATION RESOURCES MANAGEMENT LONG RANGE PLAN

National Aeronautics and Space Administration

June 1994

PREFACE

The National Aeronautics and Space Administration (NASA) is striving to become an organization that "works better and costs less." NASA's strategic planning is responding to mandates from the Administration, feedback from its customers, and the reality of declining budgets. Effective planning for information resources is essential to assure that the required capabilities are available for accomplishment of NASA's strategic missions. Major themes in this Information Resources Management (IRM) Long Range Plan are streamlining, interoperability and consolidation. The FY 1995-1999 resource projections shown are based on estimates made in August 1993, but possible budget reductions can have an impact on implementation of planned activities.

Information regarding this plan may be obtained by contacting:

> *Information Resources Management Division*
> *NASA Headquarters, Code JT*
> *Washington, D.C. 20546*

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LIST OF EXHIBITS

1. INTRODUCTION

The Information Resources Management (IRM) Long Range Plan reports the IRM plans of the National Aeronautics and Space Administration (NASA) for FY 1995 through FY 1999. This section of the Plan describes the overall NASA IRM program and strategic direction.

1.1. NASA IRM STRATEGY

Recent years have been challenging ones for the United States' aerospace and science community. Sweeping changes in the national defense arena have created demands to re-examine the size, scope and capabilities of the aerospace and science industry. As the defense sector shrinks, industry is increasingly looking to NASA for assertive leadership in maintaining the United States' technological preeminence. However, NASA-sponsored activities are also receiving intense scrutiny as policy leaders seek to redefine the agency's strategic enterprises for the twenty-first century. In addition, initiatives to "reinvent government" have the potential to radically change how NASA works. The general public is increasingly looking to government to accomplish its missions "better, faster, and cheaper."

The state of the aerospace and science community creates new challenges for managing NASA's information resources. Current and emerging NASA programs are highly dependent on information technology to collect, analyze, disseminate and store vast amounts of scientific and engineering (S&E) information. The aerospace and science industry is seeking more efficient methods to use NASA information and technology to maintain global competitiveness. Planned international programs will require the integration of diverse information and technology on a global basis.

Information resources, which include information, computing and telecommunications hardware and software, and related support services, are a critical enabler and catalyst for NASA programs, and will play a key role as the agency adapts to a resource constrained environment. As the NASA work force shrinks, managers will look to information technology to maintain and increase efficiency. Process re-engineering will be a key technique used to examine and potentially reformulate the way NASA accomplishes its scientific, engineering, and management functions. Process re-engineering will precede the effective application of information technology. Effective information resources are focused on the needs of the agency mission and customers.

1.1.1 NASA IRM Vision

NASA envisions an Agency transformed by a blend of information policies, practices, techniques, and technology that maximizes available resources and optimizes the accomplishment of NASA's strategic enterprises. Streamlined operations, including areas such as efficient and effective data capture, easy access to high speed networks, massively parallel processing, and other innovations will dramatically improve the way we work. We envision an environment that permits the

greatest transfer of information within NASA and between NASA and the outside world (other agencies, U.S. industry, educational institutions, the public, and international partners). This environment will facilitate NASA's support of, and service to, U.S. industry through the transfer of advanced technology, access to technical and scientific information, and provision of advanced computing capabilities. NASA believes that information resources are critical enabling capabilities for accomplishing its strategic enterprises and performing its business functions.

Several significant themes play prominent parts in the agency's vision for the future of information resources:

Global Integration -- NASA enterprises are increasingly calling on the capabilities of multiple field installations and contractors. There is also increasing emphasis on incorporating the capabilities of international partners. NASA's information infrastructure will be called on to integrate diverse locations, technologies and information repositories.

Process Re-engineering -- The administration has initiated a multitude of actions to reinvent government to make it work better, cost less, and be more responsive to needs of customers. NASA's information resources will play a vital part in enabling the agency process redesign efforts in a resource constrained environment.

Tighter Linkage To Mission -- Future investments in information resources must be explicitly based on the needs of NASA's strategic enterprises. Historically, information resources were managed at the installation or program level. Future investments must place greater emphasis on leveraging experiences, approaches, and capabilities across traditional boundaries to address NASA's total mission.

Service To Industry -- The dissemination of information and technologies that were originally developed for NASA is important in terms of global competitiveness of the United States. NASA needs to develop processes and tools for transferring vital information and technology to United States' industry to ensure national competitiveness in a growing global market.

Technological Leadership -- Sweeping changes in the national defense arena have increased the need for NASA's leadership in technological innovation. NASA will play an increasingly important role in sponsoring industry activities to develop new technology. NASA will also continue to maintain unique computational facilities for use by United States researchers.

1.1.2   NASA IRM Mission and Goals

NASA's mission is to: explore, use, and develop space for human enterprise; advance scientific knowledge of the Earth, the Solar System, and the Universe; use the environment of space for research; and research, develop, verify, and transfer advanced aeronautics, space, and related technologies. NASA has defined five Strategic Enterprises that are collectively charged with achieving the agency mission:

Mission to Planet Earth -- provide the information needed to understand complex environmental questions and to understand the effects of humankind on Earth's environment.

Aeronautics -- pioneer the identification, development, validation, transfer, application, and commercialization of high-payoff aeronautics technologies.

Human Exploration and Development of Space -- open the space frontier through the exploration, use, and development of space.

Space Science -- explore the Solar System and the Universe beyond, and study the space environment and its effect on biological and physical processes.

Space Technology -- develop and transfer space technology.

IRM is among the Strategic Functions that NASA has identified as critical to providing the Enterprise capabilities required to meet external customers' needs. The expansion of knowledge, the advancement of technology, the ability to explore and operate in space, and the need to develop and deploy advanced technology to American industry are all highly dependent on properly managed information and information technology. NASA's enterprises are more data intensive then ever and require the contributions of multiple organizations, technical disciplines, and cross-functional information systems. This environment is characterized by increasing rates and volumes of data transmission, increasingly complex research analyses, new emphasis on wide spread information access, rapid advances in data management technologies, and a growing commercial need for aeronautics and space information. Thus the IRM mission is to:

Ensure that information resources are acquired, managed, and used effectively and efficiently to enable successful accomplishment of NASA's mission.

NASA's information resources goals are fundamentally driven by NASA's mission and enterprises. Four agencywide IRM goals have been defined for providing capabilities required by NASA's Strategic Enterprises.

Foster sharing and accessibility of information.

Implement a life cycle process for managing information resources.

Assure the continued capability of the workforce to manage and employ information resources.

Establish an information resources planning process that is integrated with, and across, program planning and budgeting processes.

1.2.   NASA IRM ORGANIZATION AND STRUCTURE

This section describes NASA's IRM structure and how it is managed, including oversight and policy management responsibilities.

1.2.1   IRM Oversight

Oversight of NASA's IRM program is organized in a 3-tiered structure to best support the agency's overall mission and broad spectrum of research and development programs. Exhibit 1-1 provides a graphic representation of this structure.

At level 1 is the Agency's Designated Senior Official (DSO) for IRM, the Associate Administrator for Management Systems and Facilities. Level 2 includes Senior Program IRM Officials (SPIOs) representing the Program Offices. And, level 3 includes Senior Installation IRM Officials (SIIOs) for the Field Installations and NASA Headquarters.

The DSO is responsible for agencywide oversight of IRM activities. SPIOs are responsible for oversight of IRM activities within their Headquarters organization. SPIOs with institutional management responsibilities are also responsible for oversight of IRM activities within their respective installations. SIIOs are responsible for oversight of IRM activities within their respective installations.

1.2.2 IRM Policy Management

Responsibilities for agencywide IRM policy and functional management for IRM are shared by the DSO and other Headquarters offices. The organizations responsible for establishment of agencywide policies, standards, and guidelines, as well as coordination, overview, and guidance of agencywide IRM activities are described below.

Office of Management Systems and Facilities: The DSO has assigned responsibility for functional management of specific IRM areas to two Divisions and one Office within the Office of Management Systems and Facilities: the Information Resources Management Division; the Security, Logistics and Industrial Relations Division; and the Resources and Management Controls Office.

The Director of the Information Resources Management Division is responsible for the following IRM areas:

> IRM Planning and Evaluation
> IRM Policy
> Forms Management
> Records Management
> Reports Management and Information Collection Budget
> Information Technology Standards
> Delegations of Procurement Authority for Information Technology Acquisitions
> Printing Management
> Library Management
> Privacy Act Compliance Oversight
> Mail Management
> Correspondence Management.

The Director of the Security, Logistics and Industrial Relations Division is responsible for Automated Information Security (AIS).

The Resources and Management Controls Office is responsible for NASA directives and internal management control. This Office also acts as the NASA liaison to the General Accounting Office and the Office of the Inspector General.

Office of the Chief Financial Officer/Comptroller: The Chief Financial Officer develops and maintains integrated accounting and financial information systems and associated internal controls.

Office of Safety and Mission Assurance: The Associate Administrator for Safety and Mission Assurance develops policies, standards, guidelines, tools, and techniques related to software management, software engineering, and software assurance with an emphasis on independent verification and validation (IV&V) throughout the life cycle.

Office of Advanced Concepts and Technology: The Assistant Administrator for Advanced Concepts and Technology develops policies and guidelines related to disseminating information that concerns new NASA-developed technologies to external organizations, including the non-aerospace community.

Office of Space Communications: The Associate Administrator for Space Communications develops policies, standards, and guidelines related to general telecommunications.

Office of Public Affairs: The Associate Administrator for Public Affairs develops policies, standards, and guidelines related to public information audiovisual products and ensures compliance with the Freedom of Information Act.

Office of Human Resources and Education: The Associate Administrator for Human Resources and Education develops policies, standards, and guidelines related to educational information products developed by NASA.

Office of Procurement: The Assistant Administrator for Procurement develops policies, procedures, and regulations related to the procurement of Federal Information Processing (FIP) resources under Delegations of Procurement Authority received from the General Services Administration through the DSO. Additionally, the Assistant Administrator oversees reviews and conducts FIP resource procurements after redelegation to the appropriate NASA procurement organization.

Delegated IRM responsibilities are summarized in Exhibit 1-2.

NASA IRM OVERSIGHT

LEVEL 1
DSO

LEVEL 2
SPIO

LEVEL 3
SIIO

Associate Administrator
Management Systems and
Facilities

Safety and
Mission
Assurance

Space
Communications

Advanced
Concepts and
Technology

Space Flight

Aeronautics

Space Science

Mission to
Planet Earth

Life and
Microgravity
Sciences and
Applications

Headquarters

Johnson
Space Center

Kennedy
Space Center

Marshall Space
Flight Center

Stennis
Space Center

Ames
Research
Center

Langley
Research
Center

Lewis
Research
Center

Dryden
Research
Center

Jet Propulsion
Laboratory
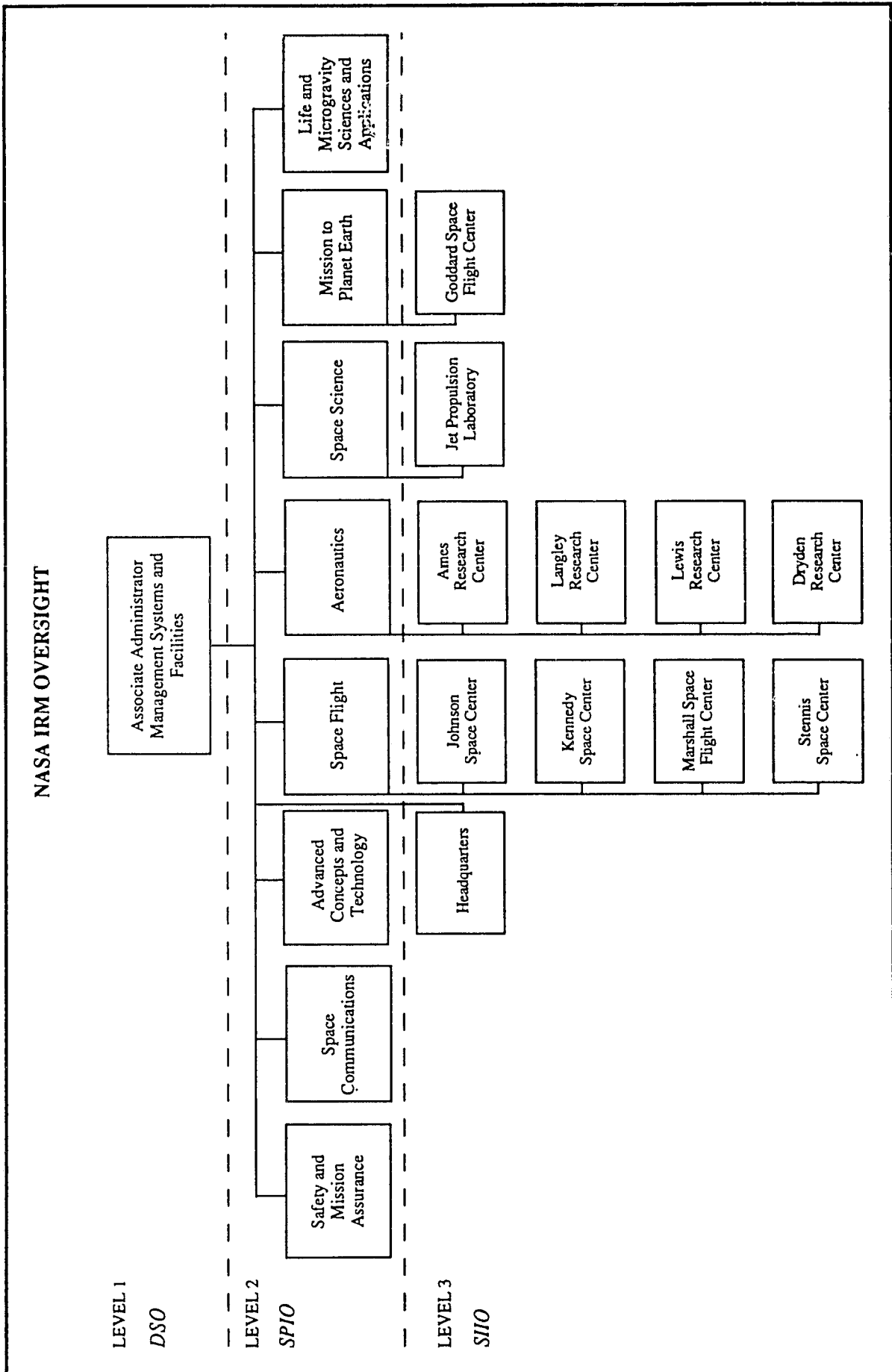
Goddard Space
Flight Center

Exhibit 1-1. NASA IRM Oversight.

NASA OFFICE	DELEGATED RESPONSIBILITIES
IRM Division	FIRMR implementation, Delegation of Procurement Authority management, IRM planning and policy, privacy of records, records management, information dissemination, and IRM Review and Evaluation Program implementation.
Security, Logistics and Industrial Relations Division	Automated Information Security (AIS).
Resources and Management Controls Office	NASA directives and Federal regulations, NASA internal management control, General Accounting Office and Office of the Inspector General liaison.
Office of Procurement	Conduct of FIP resource procurements.
Office of the Chief Financial Officer/ Comptroller	Financial systems and associated internal controls.
Office of Space Communications	General telecommunications.
Office of Safety and Mission Assurance	Software management, software engineering, and software assurance with an emphasis on independent verification and validation.
Office of Advanced Concepts and Technology	Information dissemination (from the STI database and other sources) concerning new technologies developed by NASA to the non-aerospace community.
Office of Public Affairs	Public information audiovisual products, compliance w .., the Freedom of Information Act.
Office of Human Resources and Education	Educational information products developed by NASA.
Program Offices	Missions and programs.

Exhibit 1-2. NASA IRM Policy Management Organizations.

1.3.   ORGANIZATION OF THIS PLAN

The remainder of this plan is organized into six sections.

Section 2, AGENCY 5-YEAR IRM INVESTMENT PROJECTIONS, presents NASA's projected investment in IRM as reported by Program Offices and IRM staff offices.

Section 3, PROGRAM SPECIFIC IRM ACTIVITIES BY PROGRAM OFFICE, demonstrates the integration of strategic planning with the 5-year information technology planning process and provides missions and goals consistent with overall Agency plans, 5-year investment projections, and major Information Technology (IT) initiatives for each NASA Program Office.

Section 4, MAJOR IRM PROGRAM ACCOMPLISHMENTS FOR FY 1993, discusses the major IRM accomplishments of Program Offices and IRM Staff Offices during FY 1993.

Section 5, INFORMATION COLLECTION BUDGET, describes NASA's program to collect information from the public (e.g., reporting, recordkeeping, regulatory monitoring where information is collected) as part of its overall IRM program. This information is provided in response to the requirements of the Office of Management and Budget (OMB) Bulletin 94-05, Appendix B.

Section 6, SUMMARY OF COMPUTER SECURITY PLANS, provides a brief overview of NASA security plans.

Section 7, APPENDIX, provides an acronym list.

2. AGENCY 5-YEAR IRM INVESTMENT PROJECTIONS

NASA IRM 5-year investment projections are presented in Exhibit 2-1 and Exhibit 2-2 uses FY95 projections to show the relative size of NASA Programs. The total amount displayed is the sum of the planned investments for the agency reported in its FY94 budget request. Planned investments are presented in $K (thousand dollars).

	FY95	FY96	FY97	FY98	FY99
Space Flight	$713,500	$703,900	$708,600	$685,200	$686,500
Space Communications	262,900	305,300	319,000	304,800	285,000
Safety and Mission Assurance	5,400	6,000	6,200	6,000	6,000
Aeronautics	262,900	252,800	268,900	277,400	283,100
Advanced Concepts and Technology	36,100	37,100	38,200	38,900	39,400
Space Science	80,300	72,100	62,500	60,200	56,900
Mission to Planet Earth	297,000	361,000	380,000	353,000	316,000
Life and Microgravity Sciences and Applications	14,300	15,900	18,800	12,000	8,400
Management Systems and Facilities	89,100	89,800	80,500	77,400	72,700
TOTAL	$1,761,500	$1,843,900	$1,882,700	$1,814,900	$1,754,000

Exhibit 2-1. 5-Year IRM Investment Projections.
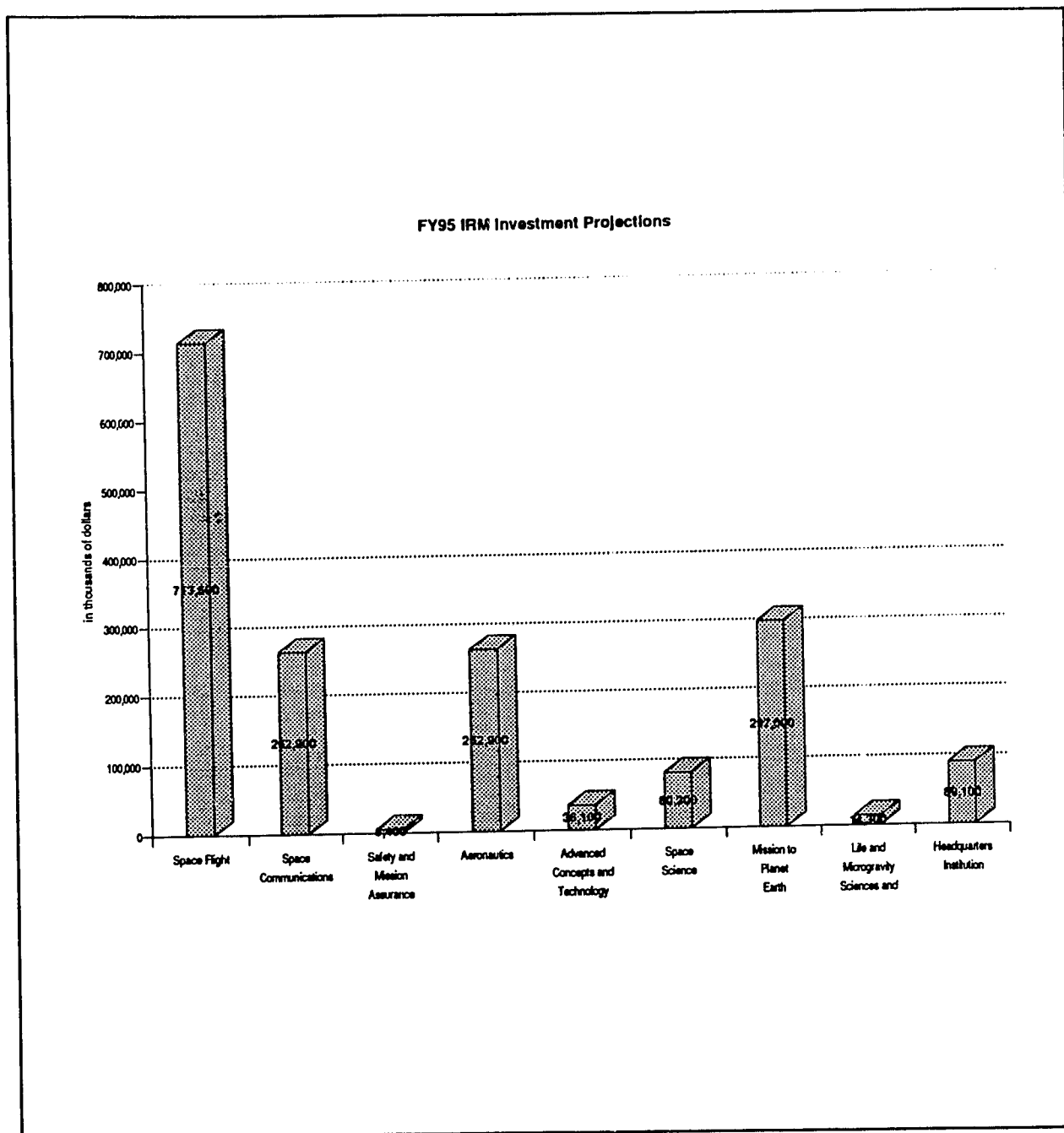
FY95 IRM Investment Projections

Exhibit 2-2. Comparison of Program IRM Investments.

3. PROGRAM SPECIFIC IRM ACTIVITIES BY PROGRAM OFFICE

This section demonstrates the integration of strategic planning with the 5-year IT planning process and provides missions and goals consistent with overall Agency plans, 5-year IT investment projections, and major IT initiatives for each major NASA Program Office with IRM expenditures.

3.1. OFFICE OF SPACE FLIGHT

The Office of Space Flight (OSF) provides safe, assured, and economic transportation to and from space for people and payloads, and develops and operates habitable space facilities to enhance scientific knowledge, support technology development, and enable commercial activity. The OSF also ensures that the United States maintains a national infrastructure sufficient to support the advancement of human exploration and development of space. The OSF consists of an executive headquarters office in Washington, D.C., the Johnson Space Center (JSC), Kennedy Space Center (KSC), the Marshall Space Flight Center (MSFC), and the Stennis Space Center (SSC).

3.1.1 Mission/Goals Description

OSF is responsible for all operational aspects of human space transportation within NASA and for leading development of the capability for permanent human presence in space. In particular, OSF's mission is to:

> Operate and maintain the Space Shuttle, the primary means of access to Earth orbit for personnel and payloads, to expand human presence in space, launch and repair spacecraft, and return objects to Earth.

> Operate and maintain Spacelab, a versatile, reusable laboratory flown in the Space Shuttle orbiter's payload bay, to conduct a large variety of scientific experiments in the unique environment of space.

> Contribute to development, deployment, operation, and maintenance of the International Space Station, an Earth orbiting research facility where people will live and work continuously in the microgravity environment of space. This effort combines technologies of the European Space Agency, Japan, Canada, Russia and the United States. NASA, jointly with these partners, will develop the capability to accomplish complex programs in a multinational structure, leveraging the participating nations' contributions for large-scale exploration missions. This facility will enable significant long-duration space research in materials and life sciences and the technology and engineering base necessary for building and operating advanced space systems.

Conduct engineering research programs that define and enable improved capabilities for humans in space.

Manage institutional capabilities to enable space program activities at the OSF field centers.

The programmatic and fiscal environment plays a key role in defining OSF's four major goals:

Provide reliable and cost-effective access to space.
Develop, maintain, and enhance capabilities and operations to allow humans to live and work continuously in space.
Provide effective and efficient enabling and supporting capabilities.
Contribute to the national community.

IT advances have greatly improved the OSF's ability to access and process information. The challenge is to provide a universally accessible IT and management infrastructure. IT systems and improved development, operations and maintenance processes will provide quality support and, through integrated long-range planning, assure continuity into the future. This challenge will be accomplished with sound project management principles to fulfill budget, schedule, and content requirements. These factors frame the following OSF IRM goals:

Provide an Integrated IRM Program -- This program will ensure that standards are developed for interoperability; provide for a capital investment program with an annual budget; and migrate Space Shuttle, Space Station, and other OSF programs to common IRM tools/systems, e.g. Engineering Drawing Repository.

Consolidate Automated Data Processing (ADP) Operations -- In 1994, OSF began an aggressive program to consolidate mainframe and Class VI computer platform operations across all OSF Centers and Programs. The OSF ADP Consolidation is considered a NASA initiative by the Federal Data Center Consolidation Committee of the National Performance Review and is viewed as an agency pilot by senior management.

3.1.2 Five Year IT Investment Projections

To meet both budgetary and program commitments, OSF is revising the existing operational structure and processes, and will continue to develop better-suited planning and program management guidelines. In essence, the Space Shuttle program restructure will follow the example set by the International Space Station program as nearly as possible; the operational management of both programs will then be integrated and combined. OSF will consolidate and share comparable Space Shuttle and Space Station operations, functions, and common IT systems wherever feasible as part of the cost reduction objectives.

IT is a major segment of the OSF mission. Five year investment projections are presented below along with OSF program commitments. Investments are presented in $K (thousand dollars).

Office of Space Flight

FY95	FY96	FY97	FY98	FY99
713,500	703,900	708,600	685,200	686,500

Space Shuttle and Spacelab

FY95	FY96	FY97	FY98	FY99
285,500	289,800	296,700	298,500	298,500

While maintaining flight safety, aggressive 30% cost reduction targets were realized in FY95, compared to an FY92 baseline, for the Space Shuttle program. For the next several years, OSF will continue to strive for reductions. The Program will achieve these reductions and maintain safety by continuing to lower the work load on vehicles, retaining support personnel for longer periods, making best use of past investments, restructuring for the longer term, and tightening business practices with our contractors.

Cost reductions for Spacelab are also planned for the next several years, estimated at 30% from FY95 through program termination in FY98. Reductions will be realized by improving process efficiency and eliminating hardware/software systems in consonance with reduced manifest requirements.

Space Station

FY95	FY96	FY97	FY98	FY99
244,800	226,900	221,200	192,600	192,600

OSF will build the International Space Station within budget and on time. As determined at the March 1994 System Design Review, its assembly is planned to begin with the launch of a Russian FGB vehicle in November 1997, with first element launch by the U.S. in December 1997. Assembly will be complete in June 2002, after a total of 13 Russian, 16 U.S., and one European Space Agency flight. Total cost for the U.S. contribution to the Station is estimated to be $17.4 billion from FY94 until assembly completion.

The International Space Station, as the world's premier orbiting laboratory, will provide unparalleled opportunities for long-duration research in space. OSF is currently working with the user community to provide opportunities for access to the Space Station for academic and research institutions as well as for the commercial sector. An initial capability for conducting long-duration science and technology research will be provided by 1998, with full utilization

capability expected by 2000. By gradually building up to a long-duration laboratory capability in space, the United States will be able to push to and investigate the limits of human performance, expand human experience in living and working in space, and provide the capability to understand whether there are additional opportunities for longer range, larger scale, commercial development of low Earth orbit.

Institutions

FY95	FY96	FY97	FY98	FY99
183,200	187,200	190,700	194,100	195,400

OSF maintains and operates the infrastructure necessary to support current and future programs at the OSF field Centers. This responsibility covers all IT, on-site or near-site facilities, equipment, workforce (Civil Service and contractor), utilities, supplies and materials, and other related procurement and services in support of the agency's programs. OSF manages facilities at nine different locations with an aggregate replacement value of almost $7.5 billion and major equipment components with an original value of $4.7 billion. OSF institutions and programs acquire and use 50 percent of NASA's information technology capability. Other institutional responsibilities include facility maintenance and restoration, institutional environmental compliance, and energy conservation and liaison for functional reviews.

3.1.3   Major IT Initiatives/Procurement

The OSF has four major IT initiatives or acquisitions, including major modifications, that are planned or currently under development. A major IT initiative is an undertaking for which the cost of system development and acquisition from concept definition through implmentation will exceed $25 million, or the cost in any one year will exceed $10 million. These initiatives do not include normal operations of existing systems.

OSF will improve its safety record, reduce the cost of space flight, and enhance selected systems performance capabilities in response to customer needs. OSF will identify, select, plan and implement the consolidation of as many possible IT segments across OSF and within its assigned centers. These consolidations can affect all OSF programs and their infrastructure (business administration) or be confined to a center or a specific program area. Opportunities include mainframe consolidation, mission support consolidations, and intercenter consolidations.

All but one of the following major systems are undergoing major modifications. One new major system, the Space Station, Test, Control, and Monitoring System, is under development.

OSF Automatic Data Processing Consolidation System

The OSF ADP Consolidation System is consolidating OSF administrative and selected program mainframe information systems at the MSFC. Systems included are the External Tank Computer Aided Productivity, Payload Data Services System, MSFC Shuttle & Mainframe Activities, General Business Legacy Systems, the OSF segments of the NASA Accounting Financial Information System, Shuttle Manifest System, Shuttle Processing Data Management System, and International Space Station Alpha System. The OSF supercomputing functionality is being considered for a similar reconfiguration.

The strategy migrates hardware and merges support services to realize cost savings. Support for applications hosted by these machines will remain under the purview of the applications' original hosts. The first step of this consolidation is to move the designated systems to MSFC while maintaining existing hardware configurations; these moves will be transparent to the users and provide equal or better service.

Benefits realized through the efficient use of existing mainframes and packaging administrative workloads on a single platform include the following:

> Reduced software license, hardware maintenance, and utility costs.
> Additional capacity.
> Growth and flexibility to the entire program office.

The first system was successfully installed and became operational in April 1994; remaining systems should be installed by February 1995. Systems outside of the OSF will also be included; NASA Headquarters administrative systems are the first such systems. The newly designated Dryden Flight Research Center (DFRC) is also considering joining the consolidation venture.

Program Information Systems Mission Services

The Program Information Systems Mission Services contract was awarded in the spring of 1994 at MSFC to consolidate two previously existing MSFC systems: Computational Mission Services (CMS) and Program Support Communications (PSC). CMS included computer services, for administrative/institutional systems, data reduction systems, agency systems, Space Shuttle mission operations (e.g., Huntsville operations support center), and the Space Shuttle payload crew training center. PSC included telecommunications for local area networks, data services, telephone services, and NASA Communications Network (NASCOM) distribution, and the PSC network for agencywide teleconferencing, messaging, and data services. The new system will continue to provide equipment, maintenance, software, support, and related supplies for the continued operation and evaluation of MSFC and agencywide telecommunications and MSFC computation services.

Information Systems Contract

The Information Systems Contract (ISC) provides FIP resources support for the non-mission-capabilities of JSC-supported programs. The ISC supports most data systems, networks, user workstations and telecommunications systems and provides maintenance, operations, software development, engineering and customer support functions.

ISC included cost savings initiatives, which are considered major modifications. For instance, as a result of reorganizing, redesigning, and moving the Space Station management to JSC, ISC has extended services to include Space Station, subsequently eliminating duplicate services formerly provided by the Space Station program and achieving cost savings.

ISC's Integrated Network System will integrate existing, divergent JSC networks into one system, thereby eliminating redundant connections and achieving cost reductions in sustaining engineering, maintenance, and operations.

Space Station Test, Control and Monitoring System

The Space Station Test, Control and Maintenance System at KSC is OSF's only major system under development. The system will provide real-time command and control at 12 locations and 3 facilities for Space Station elements and payloads processed at KSC. Its modular design will use commercial off-the-shelf equipment, and existing standards and has a projected life of 30 years. The equipment that makes up the system includes display processors, applications processors, database processors, recording processors, and software configured to support Space Station ground test, control, simulation, and monitoring operations. Delivery of the Serial Zero equipment set began in CY92. Production of the first on-site equipment began in CY93 and will continue through CY95. Operational evaluation using the initial equipment set began in CY93.

3.2.   OFFICE OF SPACE COMMUNICATIONS

The Office of Space Communications (OSC) provides long haul and space based communications services for NASA programs and installations.

3.2.1   Mission/Goals Description

The mission statements of OSC's three programs are stated below:

Space Network Program -- provide tracking and data relay services for spacecraft in low-Earth orbit and associated ground-system elements.

Ground Networks Program -- provide tracking and data acquisition for launch vehicles and high altitude and deep space orbit spacecraft.

Communications and Data Systems Program -- provide operational and administrative communications, unmanned spaceflight scheduling and control, flight dynamics, data acquisition and processing, and telecommunications management.

The OSC has established the following strategic goals for information systems to support these missions:

Provide a robust multi-mission information access infrastructure with appropriate security.

Complete and enhance capabilities for acquisition and utilization of scientific data and information.

Ensure capabilities for system evolution.

Ensure a balance between scope and budget.

These goals result in the following specific objectives:

Provide the capability necessary to support effective science operations and analysis of growing volumes of space observation data.

Provide flexibility and capacity in information systems to adapt to scientific opportunities and evolving needs.

Ensure new systems readily incorporate new technology.

Lower cost per bit of information processed, distributed, analyzed, and archived.

Concentrate on infrastructure of services, functions, and systems required to serve multi-mission and multi-discipline needs.

Evolve future systems from those now in place or under development.

As a result of these missions, goals, and objectives, the OSC anticipates moving the NASA communications infrastructure technology in the following directions:

Higher volumes of data gathered and transmitted.

Less time required for data gathering and transmission.

Decreased cost of data gathering and transmission.

Increased usefulness of data gathered.

Greater availability of data.

Modular system architecture.

Increased use of workstations and data archives.

Availability of standardized software tools, common system utilities, and international networks.

Increased international interaction.

Scientist/spacecraft instrument interaction.

3.2.2   Five Year IT Investment Projections

The OSC's projected total IT investments for the next five years are presented below. Investments are presented in $K (thousand dollars).

FY95	FY96	FY97	FY98	FY99
262,900	305,300	319,000	304,800	285,000

Space and Ground Network, Communications and Data Systems

FY95	FY96	FY97	FY98	FY99
260,400	302,800	316,500	302,300	282,500

Space Network provides tracking and relay services for spacecraft in low-Earth orbit and associated ground-system elements. Ground Network provides tracking and data acquisition for launch vehicles and high altitude and deep space orbit spacecraft. Communications and Data Systems provides operational administrative communications, unmanned space flight scheduling and control, flight dynamics, data acquisition and processing, and telecommunications management.

Nonprogrammatic Operating Account

FY95	FY96	FY97	FY98	FY99
2,500	2,500	2,500	2,500	2,500

Nonprogrammatic Operating Account provides administrative support for the Space and Ground Network, Communications and Data Systems.

3.2.3 Major IT Initiatives/Procurement

The OSC has no major IT initiatives or acquisitions, including major modifications, that are planned or currently under development. A major IT initiative is an undertaking for which the cost of system development and acquisition from concept definition through implementation will exceed $25 million, or the cost in any one year will exceed $10 million. These initiatives do not include normal operations of existing systems.

3.3.   OFFICE OF SAFETY AND MISSION ASSURANCE

The Office of Safety and Mission Assurance (OSMA) develops and promulgates policies and guidelines to ensure the integration of safety and the assurance disciplines into all NASA programs and projects; provides leadership in the implementation and optimization of safety and mission assurance strategies, techniques, and technologies; and sponsors initiatives to improve the Agency's risk management capabilities.

3.3.1   Mission/Goals Description

The OSMA requires IT to support its overall mission and a wide variety of information to support independent assessments, trend analyses, risk management, and oversight activities. The OSMA's mission comprises the areas and objectives described below:

Systems Engineering -- Establish NASA-wide standards, practices, and processes to support the design, manufacture, and testing of flight systems. Develop systems engineering practices and tools.

Software Assurance and IV&V -- Develop improved IV&V tools and techniques with emphasis on applications throughout the life cycle. Develop software policy, standards, procedures, and metrics to improve the software process. Develop practice and tools to evaluate the quality of software used in NASA's critical flight and ground systems and to ensure that software meets program demands.

Quality Assurance -- Develop an integrated NASA-wide Quality Assurance program. Program elements include supplier quality assurance, mechanical parts, workmanship standards, nondestructive evaluation, and measurement assurance.

Program Safety and Mission Assurance -- Develop and manage the safety and product assurance program for space flight programs. Review and assess implementation of assurance requirements. Improve quality in NASA payload programs through more effective implementation of Safety, Reliability, Maintainability, and Quality Assurance disciplines in the early phases of the project life cycle.

Safety and Risk Management -- Develop and implement policy to assure safety in the workplace and to protect all NASA resources. Oversee compliance with NASA and federal safety regulations. Establish and manage Reliability Engineering Program, Software Safety Program, Lessons Learned Program, Trend Analysis Program, NASA Safety Reporting System, and Safety and Risk Management Training Program.

Following are specific IT goals that support the OSMA mission and objectives:

Develop software policy, standards, procedures, guidelines, and metrics.

Develop integrated information systems that support OSMA internal and programmatic activities.

Develop improved verification and validation tools and techniques for use throughout the software life cycle.

Develop improved software assurance processes through implementation of improved tools and methods.

Develop and maintain Information Systems Plan.

3.3.2   Five-Year IT Investment Projections

OSMA's projected total IT investments (rounded to nearest $K) for the next five years are presented below.

FY95	FY96	FY97	FY98	FY99
5,400	6,000	6,200	6,000	6,000

3.3.3   Major IT Initiatives/Procurement

The OSMA has no major IT initiatives or acquisitions, including major modifications, that are planned or currently under development. A major IT initiative is an undertaking for which the cost of system development and acquisition from concept definition through implementation will exceed $25 million, or the cost in any one year will exceed $10 million. These initiatives do not include normal operations of existing systems.

3.4. OFFICE OF AERONAUTICS

The Office of Aeronautics (OA) conducts NASA's research and technology development programs in support of national aeronautics goals. OA consists of a Headquarters program office and four field centers: Ames Research Center (ARC), Langley Research Center (LaRC), Lewis Research Center (LeRC), and DFRC.

3.4.1 Mission/Goals Description

OA's overarching mission specifies a dual role for the organization. OA will continue as a world class Aeronautics organization by promoting NASA and U.S. leadership in aeronautics through the advancement of science and technology. OA is also working in concert with U.S. industry in the development of advanced technologies and concepts that will ensure U.S. industrial competitiveness in world markets through improved aircraft and aviation system productivity and environmental quality.

Within OA, specific areas of responsibility direct the activities that support the achievement of programmatic and national goals and missions. In each of these areas, S&E computing is a critical element in the strategy to achieve program objectives, as described below.

> **The Hypersonics Research Program** -- develops critical technologies to support ground and flight demonstration of the X-30 National Aerospace Plane and future hypersonic vehicles. This program performs unique flight research experiments for the purpose of validating computational fluid dynamic codes (used to simulate the forces on and performance of aircraft body components during flight) and utilizes data acquisition systems (DAS) to obtain critical data not attainable through current ground facilities.

> **The Critical Technologies area** -- performs fundamental research in the critical disciplines including instrumentation, controls, acoustics, human factors, human engineering, and computer science. The fundamental research also includes development of interdisciplinary capabilities and research into innovative, advanced concepts.

> **The Advanced Subsonics Program** -- works in cooperation with the U.S. aviation industry and the Federal Aviation Administration to develop the technology for a new generation of superior subsonic transports, civil tiltrotor, and general aviation aircraft that are not only fuel efficient and environmentally compatible but also cheaper to build and own and convenient and safe to operate. The program also seeks to establish uncongested global air transportation for these aircraft.

> **The High-Performance Aircraft and Flight Projects area** -- focuses on high performance aircraft technology development and flight research in support of NASA's Aeronautics research and technology and U.S. industrial competitiveness base. Computer

assisted design and simulated flight testing of future aircraft are integral parts of these efforts. Flight validation of promising future aircraft designs are performed on both scale models and full-size aircraft.

The High Speed Research Program -- is a major initiative in civil aeronautics focused on critical air frame and propulsion technology development to help assure U.S. manufacturers future competitiveness in the global market for long-range transport aircraft.

OA's S&E computing capabilities support these programs through data acquisition systems that gather and analyze data gathered from physical test facilities (e.g., wind tunnels, acoustic, and propulsion testing facilities) and supercomputers that electronically simulate vehicle flight characteristics coupled with S&E workstations that provide high resolution visual presentations of the results. Efficiencies and productivity increases are achieved by providing researchers with predictive capabilities and design tools that allow them to quickly narrow the range of possibilities to a viable set of design alternatives. This results in a high payoff rate for those designs that are modeled and subjected to time consuming testing in physical test facilities, and validated by flight tests of full-size aircraft.

OA's S&E computing strategy is to provide the capability presently needed, investigate and demonstrate new technology, and manage technical migration to ensure continued U.S. leadership in computational techniques required by the Aeronautics Program. This strategy is implemented through three interrelated activities; High Performance Computing and Communications (HPCC), Numerical Aerodynamic Simulation (NAS), and the Research Centers' Central Computing Facilities (CCF).

HPCC works with industry to develop, test, and evaluate new computing technology testbeds for the purpose of identifying promising architectures and computing techniques. NAS has a dual mission. First, it acts as a pathfinder in the development of state-of-the-art large-scale computer systems based on technology shown to be viable by HPCC. Second, it provides a national computational capability to NASA, industry, DoD, Universities, and other Government Agencies. The Research Center CCFs, using proven technology, provide researchers with stable and effective S&E computing and communications systems to accomplish programmatic and Agency goals and missions.

3.4.2 Five Year IT Investment Projections

The OA's projected total IT investments for the next five years are presented below. Investments are presented in $K (thousand dollars).

FY95	FY96	FY97	FY98	FY99
262,900	252,800	268,900	277,400	283,100

Over the next 5 years, the OA Research Centers will explore ways of providing expanded high-end supercomputing capabilities and more cost effective architectures to support low-end requirements. Through the HPCC Program and other development efforts, OA will initiate the highly parallel processing and high speed communications capabilities necessary to achieve the computer processing speeds required for multi-disciplinary research and development. At the same time, growth in conventional supercomputing capability will be scaled back at each of the Centers. Any future growth in conventional supercomputing will occur at a single consolidated supercomputer site located at ARC.

OA is also experimenting with the use of clusters of high-end workstations, operating cooperatively, as a means of providing processing capability akin to low-end supercomputing. Workstation clusters have the potential for absorbing much of the low run-time, low memory requirement work currently performed on OA's supercomputers. The success of this strategy would effectively free up supercomputing resources for use on larger, more sophisticated computations. Because of the relatively low cost per unit of processing power and the ease of scaling clusters to meet requirements, this architecture holds particular promise for NASA and its industry partners.

This strategy is designed as a cost effective means of ensuring the continuation of current capabilities while creating an infrastructure to support increasingly complex problems. Other infrastructure investments will continue to be made in mass storage devices, S&E workstations, data acquisition/analysis systems, and networks.

The remainder of this section presents a summary of projected IT investments ($K) and benefits for each of the three OA program areas: Aeronautical Research and Technology, Transatmospheric Research and Technology, and Research and Operations Support.

Computing resources that support these program areas are categorized by OA management as follows:

> **Central S&E Computing** -- Includes large supercomputers, mid-range computers, mass storage, software, and support of a Research Center's general purpose large-scale S&E computational, data reduction, and simulation tasks.

> **Distributed S&E Computing** -- Includes S&E workstations, host minicomputers, and software that are generally dedicated to a specific research program and used to perform small scale simulations, visualization, and code debugging.

> **Facility Dedicated Computing** -- Includes the hardware, software, and support services necessary for the acquisition and analysis of test data produced by the research facilities.

Communications -- Includes all inter-·and intra-Center telephone and data communications networks and related equipment.

Business Data Processing -- Includes mainframes, minicomputers, PCs, software, and support services associated with Research Center administrative ADP activities such as personnel, payroll, equipment/supply, resources management, office support systems, and library functions.

Aeronautical Research & Technology

FY95	FY96	FY97	FY98	FY99
195,800	182,700	197,400	204,600	209,700

Central S&E Computing investments include:

Continuing the NAS supercomputing capability to provide advanced high-speed processors with the computational speed and memory size necessary to solve problems requiring high-speed visualization, time-dependent, and interdisciplinary solutions.

Acquiring highly parallel processing systems that will advance the state-of-the-art in high-speed processing with the goal of achieving a machine capable of sustaining at least one trillion floating operations per second (TeraFLOPS) essential for computational design of complete aerospace vehicle systems.

Maintaining the current base of conventional production supercomputing capability as a stable tool supporting computational research.

Implementing a consolidated conventional supercomputing capability at ARC to provide expanded capabilities in high-speed processing, utilizing commercially available vector processors that are appropriately balanced with supporting software, archival mass storage hardware, internal memory, and networks.

Implementing distributed mass storage systems utilizing large-scale mass storage media directly connected to a high-speed network to provide unlimited system growth and allow the use of workstations, rather than supercomputers, as file servers.

Enhancing mini-supercomputer capability for interactive development of scientific programs.

Upgrading advanced computational concepts and visualization labs with state-of-the-art hardware and software systems for the analysis and visualization of large S&E data bases

that result from numerical simulations on distributed and central computers, and from experimental tests performed in ground and flight facilities.

Distributed Computing investments include:

Upgrading distributed S&E workstations utilized by researchers for displaying high-quality surface and volume grids and supercomputer generated animations of time varying phenomena.

Acquiring CAD/CAM workstations for wind tunnel modeling and project hardware design.

Enhancing VAX Cluster Central Processing Unit capability for general purpose S&E computing.

Facility Dedicated Computing IT initiatives include:

Upgrading computer hardware to provide data acquisition and analysis for wind tunnel test facilities.

Replacing obsolete computer generated imaging system to support real-time flight simulation.

Communications investments include:

Upgrading network bandwidth to support rapid network expansion and growing researcher requirements for high-resolution interactive graphics, image processing, full-motion video, CAD/CAM, and Center wide mass storage access.

Installing networking hardware to provide mainframe computer access, LANs and WANs, out-of-Center network access, personal computing services, and office support capability.

Transatmospheric Research & Technology

FY95	FY96	FY97	FY98	FY99
60	70	70	70	70

The Transatmospheric Research and Technology (TAV) budget is small relative to the other projects. A percentage of the TAV budget supports central scientific computing at the Centers commensurate with the benefit received by the program. Other TAV funds are used to procure S&E workstations that directly support the program.

Research Operations Support

FY95	FY96	FY97	FY98	FY99
67,100	70,000	71,500	72,700	73,400

Business Data Processing investments include:

Upgrading aging personal computers and configuring them for a client server environment to allow for more efficient and effective use of administrative data.

Upgrading administrative mainframe computers to provide the necessary capacity to support NASA's agencywide business systems.

3.4.3 Major IT Initiatives/Procurement

A major IT initiative is an undertaking for which the cost of system development and acquisition from concept definition through implementation will exceed $25 million, or the cost in any one year will exceed $10 million. These initiatives do not include normal operations of existing systems.

The predominant IT initiatives over the next five years are products of the HPCC and NAS programs. A goal of HPCC is to extend U.S. technological leadership in high-performance computing through the development of scalable TeraFLOPS computing systems, with associated software. This goal will be approached through the procurement of highly parallel computational testbeds that provide incremental improvements in processor performance:

10 - 50 GigaFLOPS sustained testbed (scalable to 100 GigaFLOPS)
50 - 100 GigaFLOPS sustained testbed (scalable)
100 - 250 GigaFLOPS sustained testbed (scalable to TeraFLOPS)

To demonstrate the capability of these testbeds, HPCC will develop applications for multidisciplinary modeling and simulation in support of the Advanced Subsonics, High-performance Aircraft, and High Speed Research programs. Such applications are computationally unrealistic with current computing technology.

Communications between these advanced computing resources and the scientists and engineers in the HPCC program will require network connectivity at significantly higher and ever increasing speeds. To meet these needs, NASA, in partnership with the National Science Foundation, Department of Energy, and the Advanced Research Projects Agency is developing and implementing the National Research and Education Network. The approach is to combine existing and emerging state-of-the-art technologies to achieve controlled growth in performances to meet HPCC objectives, while maintaining the operational stability of existing NASA science

and research networks. Over the next five years, NASA will make substantial investments in communications technology to achieve incremental increases in bandwidth; 45, 155, and 622 megabits per second.

NAS capitalizes on HPCC capability demonstrations by systematically incorporating state-of-the-art improvements in computer hardware and software technology into large scale computational systems. During the next five years, NAS will replace its High Speed Processor (HSP) 3, currently providing 3 GigaFLOPS sustained performance, with a HSP 4 having a sustained speed of 12 - 15 GigaFLOPS. This will enable NAS to provide an early stage multidisciplinary computational aerosciences capability to a broadened userbase.

3.5.   OFFICE OF ADVANCED CONCEPTS AND TECHNOLOGY

The Office of Advanced Concepts and Technology (OACT) was created in 1993 by merging the Space Research and Technology Division of the Office of Aeronautics and Space Technology with the Commercial Programs Office. In 1994, is is currently being merged with elements of the Office of Space Systems Development.

3.5.1   Mission/Goals Description

Completed mission and goals are not yet available for the new OACT.

3.5.2   Five Year IT Investment Projections

In 1993, the projected total IT investments for the OACT are presented below. Investments are presented in $K (thousand dollars). Projected budgets for the new OACT are not yet available.

FY95	FY96	FY97	FY98	FY99
36,100	37,100	38,200	38,900	39,400

3.5.3   Major IT Initiatives/Procurement

The existing OACT currently has no major IT initiatives or acquisitions, including major modifications, that are planned or currently under development. A major IT initiative is an undertaking for which the cost of system development and acquisition from concept definition through implementation will exceed $25 million, or the cost in any one year will exceed $10 million. These initiatives do not include normal operations of existing systems.

3.6.   OFFICE OF SPACE SCIENCE

The Office of Space Science (OSS) plans, directs, executes, and evaluates NASA programs that use space-based and ground-based techniques to further understanding of the origin and evolution of our Sun, the solar system, and our Universe. The OSS is also responsible for applying this understanding to solve practical problems on Earth and for providing scientific and technical research as a basis for the expansion of human presence beyond Earth orbit into the solar system. The OSS maintains contractual oversight of the IRM activities of the Jet Propulsion Laboratory (JPL).

3.6.1   Mission/Goals Description

The scope of the OSS efforts ranges from the study of the geospace environment to the most distant of galaxies.   The pursuit of these objectives results in the development of tools, techniques, and procedures which contribute to America's economic growth.

The OSS consists of three major program areas: Astrophysics, Solar System Exploration, and Space Physics.   Each area is responsible for the overall administration of its own data management activities in accordance with OSS program directives.   All OSS programs are involved in developing a central Data Archive facility for the preservation of data collected from space and/or Critical Ground Studies and in making this data available to the scientific community world-wide.

The OSS' three program areas and their goals are as follows:

Astrophysics

Study the origin and evolution of the universe and the fundamental physical laws of nature using high sensitivity and resolution instruments across the entire electromagnetic spectrum.

Solar System Exploration

Study the present nature of the solar system, its planets, moons, and primitive bodies (asteroids and comets).

Conduct research to identify and locate other planetary systems in various stages of formation to understand how our solar system was formed and evolved.

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Space Physics

Study the physical behavior of the Sun as a star, an influence on Earth, and the dominant source of energy, plasma, and energetic particles in the solar system.

Study the interactions between the solar wind and solar system bodies.

Collecting data and transforming it into knowledge and discovery are fundamental activities of the space science community. As such, enabling activities in data storage, transmission, and scientific computing are critical to the success of space science. OSS-wide information systems needs in these areas for the above mentioned programs are coordinated by the Technology and Information Systems Office.

3.6.2   Five Year IT Investment Projections

The OSS's projected total IT investments for the next five years are presented below. Investments are presented in $K (thousand dollars)

FY95	FY96	FY97	FY98	FY99
80,300	72,100	62,500	60,200	56,900

Planetary Exploration

FY95	FY96	FY97	FY98	FY99
25,300	21,700	21,100	19,800	18,700

Major networking activities performed at JPL for the planetary science community make the exchange of data collected from various planetary missions possible.

Physics and Astronomy

FY95	FY96	FY97	FY98	FY99
43,800	38,700	30,300	28,800	27,200

Major networking activities performed at GSFC for the astrophysics community (including universities, scientists, and all of NASA) make contemporaneous observations across the entire electromagnetic spectrum possible.

JPL Institutional Systems and Support

FY95	FY96	FY97	FY98	FY99
11,200	11,700	11,100	11,600	·11,000

Provides computing support for administrative and mission support functions such as personnel, finance, procurement, inventory control, and work management. Also provides hardware and software maitenance, training, and technical consulting for the Laboratory's microcomputer users. Funding is included for upgrades of existing intra-lab voice and data networks.

3.6.3   Major IT Initiatives/Procurement

The OSS has no major IT initiatives or acquisitions, including major modifications, that are planned or currently under development. A major IT initiative is an undertaking for which the cost of system development and acquisition from concept definition through implementation will exceed $25 million, or the cost in any one year will exceed $10 million. These initiatives do not include normal operations of existing systems.

3.7. OFFICE OF MISSION TO PLANET EARTH

The Office of Mission to Planet Earth (MTPE) plans, directs, executes, and evaluates the collection and analysis of scientific information about global environmental change. The MTPE is a comprehensive program of satellite measurements, ground-based observations, a data and information system, modeling, and interdisciplinary process studies to understand how the Earth's climate works, and in particular, how human activities are affecting it. MTPE has IRM oversight for the Goddard Space Flight Center (GSFC) located in Greenbelt, Maryland.

3.7.1 Mission/Goals Description

MTPE studies the Earth and its environment as a unified system, including its interactive processes--both natural and anthropogenic. MTPE has been structured to address issues determined to be of highest priority by the international science community. These are:

> The role of clouds, radiation, water vapor, and precipitation.
> The productivity of the oceans, their circulation and air-sea exchange.
> The sources and sinks of greenhouse gases, and their atmospheric transformations.
> Changes in land use, land cover, primary productivity, and the water cycle.
> The role of polar ice sheets and sea level.
> The coupling of ozone chemistry with climate and biosphere.
> The role of volcanoes in climate change.

Science objectives for MTPE have been established with these key uncertainties in mind.

3.7.2 Five Year IT Investment Projections

MTPE's projected total IT investments for the next five years are presented below. Investments are presented in $K (thousand dollars).

FY 95	FY 96	FY 97	FY 98	FY 99
297,000	361,000	380,000	353,000	316,000

3.7.3 Major IT Initiatives/Procurement

The MTPE has three major IT initiatives or acquisitions, including major modifications, that are planned or currently under development. A major IT initiative is an undertaking for which the cost of system development and acquisition from concept definition through implementation will exceed $25 million, or the cost in any one year will exceed $10 million. These initiatives do not include normal operations of existing systems.

Earth Observing System Data Information System (EOSDIS)

Information is the key to the MTPE. The EOSDIS will make data quickly and easily accessible to scientists and other users in the U.S. and throughout the World. Standard, reliable, calibrated data products provided by EOSDIS will be essential to accomplish our overriding goal-- understanding, assessing, and predicting global change. The EOSDIS includes components for Core System and Data Operations. These components are discussed below.

A contract for the EOSDIS Core System (ECS) was awarded to Hughes Applied Information Systems, Inc. in March 1993. Major deliveries for ECS begin in 1995 with increasing capabilities that will lead to an operational system supporting the EOS-AM1 spacecraft in mid 1998. The ECS, a Trail Boss procurement, is a system that includes centralized mission and instrument command and control; product generation, information management, and data archive and distribution functions that are common to all Distributed Active Archive Centers; systems engineering; and operations.

The EOS Data and Operations System (EDOS) is part of the EOSDIS program and is the interface between the Space Network and EOSDIS information centers. The system will capture spacecraft data, provide communications processing, distribute data to at least eight Distributed Active Archive Centers, and maintain a backup archive.

National Center for Computational Sciences (NCCS)

The mission of the Space Data and Computing Division is to enable NASA-supported scientists to increase their understanding of Earth and its environment, the Solar system, and the Universe through the computational use of spaceborne observations and computer modeling. To help assure the research success of NASA and GSFC - related projects and programs, we are committed to providing the science community with access to state-of-the-art high-performance computing, leading edge mass storage technologies, advanced information systems, and the computational science expertise of a staff dedicated to supporting that community. In the conduct of this mission we will:

> Provide, operate and manage the NCCS, a comprehensive computational environment where NASA-supported science researchers can have access to computing resources on the scale, and in the performance range, that fully meet their requirements.

> Facilitate the use of computational resources for scientists to model, assimilate and derive improved data products from spaceborne observations.

The NCCS performs supercomputing activity that accommodates both Space and Earth Science research. This is a Class II system that extends world-wide through the NASA Science Internet (NSI). Research endeavors, such as ozone layer simulation over the Arctic, are conducted on this

system. Plans cover the lease of ADP hardware, lease of software, automated data processing equipment maintenance, and analysis/programming in support of multiple projects for the next five years.

High Performance Computing and Communications (HPCC) Program.

The Space Data and Computing Division also makes available specialized information systems and computational tools to enable scientists to model, analyze, and visualize the complex multi-dimensional nonlinear processes governing simulated and real physical, chemical, and biological computational systems. The intent of the HPCC Program is to assist the space and earth science users in meeting the Grand Challenge problems.

3.8.   OFFICE OF LIFE AND MICROGRAVITY SCIENCES AND APPLICATIONS

3.8.1   Mission/Goals Description

The vision of the NASA Office of Life and Microgravity Sciences and Applications (OLMSA) is to lead the nation's efforts in laboratory research using the environment of space to improve the quality of human life in space and on Earth.

OLMSA sponsors high-quality, peer-reviewed science and technology investigations carried out by researchers in academia, industry and government to challenge and expand our knowledge of gravity's role in fundamental biological and physical phenomena.   Applied knowledge and advanced technology developed by OLMSA flight and ground-based research contributes to improving the quality of health care for people on Earth, and enhances US. competitiveness in fields such as materials science, combustion research, fluid physics, biotechnology, waste management, environmental monitoring, and biomedical research.

The primary goals of the OLMSA are to:

Develop a high quality, peer-reviewed research program in the life and microgravity sciences.

Enable flight research through the development of an appropriate infrastructure of flight facilities, ground based facilitates, and flight opportunities.

Cooperate and collaborate with all of our international partners, including the former Soviet Union countries by fostering an interdisciplinary community to promote synergism in carrying out NASA research programs.

Provide for and stimulate the transfer of research and technology to the benefit of the American public.

Develop the scientific and technological foundations for safe, productive human presence in space for extended periods and in preparation for exploration.

Promote healthy workforces on Earth and in Space.

Develop and conduct a robust outreach program to inform the general public, the Congress and the Administration of the objectives, techniques and results of their investment in OLMSA.

Institutionalize equal opportunity, equity and diversity in all OLMSA activities.

Assure that OLMSA policy and practices reflect the high value it places on its workforce.

3.8.2 Five Year IT Investment Projections

The OLMSA's projected total IT investments for the next five years are presented below. Investments are presented in $K (thousand dollars).

FY95	FY96	FY97	FY98	FY99
14,300	15,900	18,800	12,000	8,400

Microgravity Sciences and Applications IT Projections

The OLMSA Microgravity Sciences and Applications Division (MSAD) is establishing an Archive System to help ensure that appropriate information from MSAD investigations is made available to an extensive microgravity research community and the American public. This Archive System will provide a secure repository for selected data products, provide convenient and reliable data access by a broad scientific community, provide a capability for investigators to familiarize themselves with the NASA research system and provide a capability to review information on past microgravity research to minimize potential duplication of microgravity science efforts.

MSAD payload operations will require, on an almost continuous (and often simultaneous basis) pre-increment planning, real-time replanning, simulations, ground and on-orbit training, real-time experiment control, and ongoing science data management, analysis and archiving. MSAD plans to establish User Operations Facilities at three MSAD Payload Development Centers: LeRC, MSFC, and JSC. Operating from the Development Centers will promote interaction between the science and engineering teams, allow real time comparisons of experiment results to ground-based studies, and permit use of ground engineering units to facilitate troubleshooting.

Flight Systems IT Projections

The OLMSA Flight Systems Division plans the following initiatives for the Kennedy Space Center Partial Payload Checkout Unit (PPCU), a payload checkout system used to perform experiment, functional and subsystem testing for non-spacelab payloads by simulating the orbiter: upgrade the timing distribution system, implement a demand data system, upgrade the application processor, archival and retrieval and database subsystems, upgrade various peripherals and upgrade the data acquisition modules.

MSFC initiatives include the Mission Support Services and Payload Crew Training Complex. The Mission Support Services System provides electronic management information system functions in support of Spacelab, Space Shuttle, AXAF and Space Station programs. The Payload Crew

Training Complex provides real-time man-in-the-loop simulation for Spacelab payload crew and Payload Operations Control Center cadre.

JSC initiatives include hardware and software upgrades of the Simulated Payload Operations Control Center (SIMPOCC). The SIMPOCC facility is used to train the spacelab operations console personnel. New requirements for training and simulation exceed current SIMPOCC processing power. In addition, information resources will continue to be required to support the Launch Site Support Office at KSC.

Life and Biomedical Sciences and Applications IT Projections

Life and Biomedical Sciences and Applications Division (LBSAD) IT resources support the full range of flight-based and ground-based life sciences mission activities. This includes Phase A/B analytical support, design and engineering activities required to integrate life sciences payloads, mission operations support and post-flight data analysis by researchers within NASA and the external research community.

The Biocomputation Center, established at ARC in 1991, will continue to provide centralized simulation and modeling services to a distributed user community of internal and external life sciences researchers. LBSAD will use various outreach strategies to ensure the widest possible access to this facility by outside investigators and students. In addition, virtual instrumentation projects at ARC and the JSC will be initiated to develop electronic processing devices in order to emulate multiple physical instruments and research facilities. Virtual instrumentation at both Centers should reduce the requirements for hardware/facilities engineering, development, testing, and integration.

3.8.3 Major IT Initiatives/Procurement

The OLMSA has no major IT initiatives or acquisitions, including major modifications, that are planned or currently under development. A major IT initiative is an undertaking for which the cost of system development and acquisition from concept definition through implementation will exceed $25 million, or the cost in any one year will exceed $10 million. These initiatives do not include normal operations of existing systems.

3.9. OFFICE OF MANAGEMENT SYSTEMS AND FACILITIES

The Office of Management Systems and Facilities (OMSF) provides overall coordination for agencywide functional management of the various IRM areas described in Section 1. NASA's IRM organization continues to emphasize process re-engineering and consolidation as approaches to improving services in an environment of declining budgets.

3.9.1 Mission/Goals Description

In addition to overall coordination of IRM policy, OMSF provides direct support of NASA's missions and programs through management of the Headquarters institution and operation of the Scientific and Technical Information (STI) and the Automated Information Management (AIM) Programs. The mission and goals for each of these programs are stated below.

STI Program

The STI Program was established, as a result of the Space Act of 1958, to provide the widest appropriate dissemination of NASA research and development results, and to preserve the role of the United States as a leader in aeronautical and space science technology. The STI Program's mission is to ensure maximum possible access to information resulting from NASA's programs; identify worldwide sources of scientific, technical, engineering, and related information; develop related policies; and manage delivery of this information to NASA and its customer base. The STI Program collects STI from many sources including NASA technical reports and patents, NASA contractor final reports, and a variety of open literature sources; other U.S. Government organizations through cooperative agreements; and other countries and international organizations through exchange agreements.

Automated Information Management Program

The AIM Program directly supports the NASA strategic thrust to strengthen its business and technical management systems and use state-of-the-art information technology to improve systems and processes. The mission of the AIM Program is to improve the delivery of NASA-wide administrative support through the identification, analysis, design, development, implementation, and maintenance of standard agencywide automated administrative information systems.

The AIM Program supports two of the NASA IRM strategic goals which relate to business/institutional management systems:

> Foster sharing and accessibility of information.

> Implement a life cycle process for managing information resources.

The supporting goals of the AIM Program include:

Develop and maintain an optimal set of agencywide automated institutional information management system capabilities consistent with sound management and technical practice.

Define and establish an infrastructure (an information architecture composed of data, application, and technical components) that allow the designated set of AIM systems to be centrally developed and operated in standard decentralized locations with appropriate data sharing and interoperability.

Define and implement a systems development lifecycle methodology that incorporates an information engineering approach and addresses the NASA functional and institutional environment.

To ensure optimal data sharing and application maintainability, the AIM Program has implemented a data administration effort addressing top level data and process models for all NASA business areas, and including appropriate data standards. The information engineering concept incorporated into the AIM lifecycle methodology promotes the effective use of techniques, methodologies, principles, and tools in a cohesive, rigorous approach to ensure that business functions of the agency are successfully supported through the developed AIM systems.

3.9.2 Five Year IT Investment Projections

The OMSF's projected total IT investments for the next five years are presented below. Investments are presented in $K (thousand dollars).

FY95	FY96	FY97	FY98	FY99
89,100	89,800	80,500	77,400	72,700

The three OMSF programs with IRM expenditures are Headquarters Institution, the STI Program, and the Automated Information Management Program. One other Headquarters program with IRM expenditures is also included from the Office of Human Resources and Education. Projected investments for each program are provided below.

Headquarters Institution

FY95	FY96	FY97	FY98	FY99
62,200	62,800	53,400	51,600	46,800

Local administrative and operational programs required to support each of the institutional systems, including business systems, general office automation, and FIP resources supporting Headquarters administrative operations. Also includes headquarters personnel and facilities costs.

STI Program

FY95	FY96	FY97	FY98	FY99
10,600	10,600	10,500	10,500	10,300

Provides funding for ongoing operations and upgrades to existing information infrastructure for the acquisition and dissemination of STI to private industry and for use by NASA scientists and engineers.

Automated Information Management Program

FY95	FY96	FY97	FY98	FY99
16,000	16,000	16,300	15,100	15,300

The AIM Program requires significant IT investments for the development and maintenance of application systems; the definition of data, application, and technical architectures; and the development of a standard lifecycle methodology. The NASA Field Installations separately provide funding for the standard technical environments that host the AIM systems.

Academic Programs

FY95	FY96	FY97	FY98	FY99
300	300	300	300	300

Education products provided by the Office of Human Resources and Education to educational institutions.

3.9.3   Major IT Initiatives/Procurement

This section presents a summary of major initiatives that are planned or are currently in development by OSMF to achieve its IRM oversight and program goals. A major IT initiative is an undertaking for which the cost of system development and acquisition from concept definition through implementation will exceed $25 million, or the cost in any one year will exceed $10 million. These initiatives do not include normal operations of existing systems.

STI Program Modernization

During the next 5 years, the STI exchange partners will move to an electronic document processing environment. To meet the STI mission-critical agreements with these partners effectively, the STI Program must position itself to receive and process information in standard electronic formats. The upgrade strategy that was approved in February 1993 relies on standard

evolutionary acquisition and development methods, emphasizing the gradual selection and integration of proven commercial and government off-the-shelf IT.

Accordingly, the IT initiatives being pursued by the STI Program in FY95-FY99 include network upgrades for the existing information infrastructure, full text and image retrieval, electronic document exchange, machine translations, graphical user interface, and gateway applications, optical imaging, management information software implementation, expert search assistant, data manipulation tools, and planning, simulation, and integration tools.

NASA Accounting and Financial Information System (NAFIS)

NASA initiated the NAFIS project to standardize its accounting systems Agencywide, achieve potential cost savings, and meet the Office of Management and Budget mandates for financial systems improvement. This project includes the development of a standardized Installation-Level Accounting System, which is to operate at each of NASA's eight Field Centers and Headquarters, and the redevelopment of the existing Agencywide Reporting System that will be used by NASA Headquarters to consolidate and report financial data received from the Field Installations. The software development is underway. Testing by the alpha and beta test sites will begin in calendar year 1995.

AIM Information Architecture

NASA is establishing an Integrated Systems Engineering Environment under the AIM Program to provide integrated, automated tool support across all phases of the system lifecycle. Tools have been identified and procurement is underway.

AIM Technical Architecture

The AIM Program is expanding the AIM Technical Architecture to include an agencywide client server infrastructure. Standards for the infrastructure have been defined and prototyping of hardware and software platforms is underway. The initial application will be a commercial off-the-shelf environmental management system.

Electronic Commerce Infrastructure Program

The OMSF initiated an Electronic Commerce Infrastructure Program (ECIP) to provide the management focus and process for implementation of NASA-wide standard systems, which will provide a wide range of electronic commerce services (e.g., security, digital signatures, electronic data interchange, messaging, and electronic records management) to existing NASA applications. Installations, Program Offices, and Functional Offices are key participants in the ECIP process. The ECIP approach will result in the provision of needed services to a NASA-wide environment,

at significant cost savings, by eliminating the costs of developing, maintaining, and operating duplicate systems.

Headquarters IRM Support Contract Consolidation

NASA is consolidating all Headquarters contracts for FIP support services to gain efficiencies in contract administration and eliminate duplication of services by multiple Headquarters organizations. At least 18 separate contracts will be consolidated in the new Information Resources and Management Support Contract. The scope of this new contract includes requirements analysis, application and database development and maintenance, local area networks, and user services. The goal is to establish an integrated and interconnected network and set of products and services within Headquarters. The infrastructure products and services will be compatible with the infrastructures of other NASA installations to allow timely and cost-effective exchange of information.

4. MAJOR IRM PROGRAM ACCOMPLISHMENTS FOR FY 1993

4.1. OFFICE OF SPACE FLIGHT

OSF's major accomplishments for FY93 are in the area of communications-computer consolidation. The major thrust of OSF, particularly its IT endeavors, is to seek and implement reduction opportunities. The MSFC mainframe consolidation, JSC network consolidation, and MSFC center computer operations and agency telecommunications merger are representative of ongoing consolidation accomplishments described in section 3.1.3, Major IT Initiatives/Procurements.

Another major activity affecting OSF IRM was the merger of the Space Shuttle and Space Station under OSF in late 1993, following a complete reorganization and redesign of Space Station Freedom. OSF is working with international partners to implement the new Space Station design, management, and processes and significantly reduce cost and complexity while meeting national and international customer requirements by the fall 1994. This reorganization and redesign, which included a change of contractor and relocation of NASA Space Station management from NASA Headquarters to JSC, was a major IRM coordination and implementation activity. Smooth equipment moves, reorganization of the FIP resource support services, reprogramming and reinstallation of software application, and new development activities are just a few accomplishments following the creation of the new International Space Station Alpha at JSC.

A third major accomplishment for OSF is in the field of IRM Management. Embracing continual improvement, this program has been significantly strengthened and refined over the last four years. The program employs representatives of each OSF organization to plan and implement IRM principles by using a team approach, continuous enhancement of management, and improving the FIP resource budget process and agency level IRM activities. OSF sponsored and participated in a number of Process Action Teams (PATs) which focused on the OSF Council's approach to FIP resource management, streamlined Information Technology System Data requirements (in response to directives from the Office of Management and Budget), further defined internal FIP resource budget analysis, and identified consolidation and standardization opportunities.

Standardization examples from the refinement of OSF's IRM organization and discipline include MSFC's overall data administration plan, central data dictionary and data naming standards; JSC, MSFC, and SSC's software standardization and manual development; SSC's consolidated site licenses for their PC software, which resulted in significant cost savings; and JSC's standardization and documentation guidance for their Mission Operations Directorate Systems and their Safety, Reliability and Quality Assurance data processing installation. JSC also created an expert system which generates the FIP Resources Decision Document (FRDD) and reduces

overall preparation time of the FRDD by 35% (from three weeks to hours). Other installations throughout NASA have implemented the system and its use is encouraged throughout the agency.

4.2. OFFICE OF SPACE COMMUNICATIONS

NASA completed negotiations with the General Services Administration and AT&T for acceptance of the Network Service Assurance Plan, Alternate Network Connectivity, and Special Routing contract modification. NASA is currently transferring all domestic operational telecommunications services to the FTS-2000 service provider. Implementation is scheduled for completion by the end of the 1994 calendar year. The contract modifications provide network users a guaranteed level of service and reliability, including fewer failures, less restoration time, easier network access, flagging and tagging to establish restoration priority to critical circuits, spare equipment delivery to the user's site, redundant circuits, circuit reconfiguration, extended maintenance hours, on-site AT&T technicians for mission critical coverage, satellite and terrestrial connectivity, and diverse routing.

4.3. OFFICE OF SAFETY AND MISSION ASSURANCE

In September 1993, NASA opened the IV&V facility in Fairmont, West Virginia. During FY94, the OSMA developed a plan to transfer all software program activities and most IRM activities to the IV&V facility in the next fiscal year.

Notable IT-related accomplishments include:

Deployment of 4 information systems under the common user interface known as the NASA Assurance System:

- EEE Parts Information Management System
- Mechanical Parts Information Management System
- NASA Alerts Reporting System
- Lessons Learned Information System

Establishment of Software Process Action Team

Completion of Strategic Information Systems Plan

Completion of the following documents:

- Software Safety Standard (Draft December 1993)
- NASA Software Engineering Standard (Draft December 1993)
- Software Measurement Guidebook (Draft December 1993)
- Software Process Improvement Guidebook (December 1993)

- Software Engineering Technology Transfer Guidebook (December 1993)
- Software Configuration Management Guidebook (Draft September 1993)

4.4. OFFICE OF AERONAUTICS

The OA achieved two major accomplishments in FY94 in line with the OA S&E Computing Strategy.

To hasten the introduction of advanced computer technology, OA has begun using an innovative procurement method, the Cooperative Research Agreement (CRA), to establish High Performance Computing and Communications (HPCC) demonstration testbeds. The CRA encourages the formation of collaborative teams to propose HPCC testbeds to meet NASA's technical specifications. Joint use of the machine by NASA and the winning proposal team promotes technology sharing between NASA and U.S. industry. Through this procurement vehicle, OA has chosen to place an IBM SP-2 parallel computer testbed at ARC.

OA's current strategy for providing effective large-scale computing capability is to constrain overall conventional supercomputing capacity and consolidate future conventional supercomputing capability at a single shared facility located at ARC. During FY94, OA began to implement this strategy through an acquisition that replaced ARC's Cray YMP with an 8 processor Cray C-90. This increased supercomputing capability will provide the basis for a CCF that is shared by the three Research Centers. Pilot operations began in FY94. Full-scale production operations are expected to begin in FY95. At this time, OA intends to forgo planned upgrades of the Cray YMP supercomputers at both LRC and LeRC.

OA's S&E Computing Strategy is currently under review and will be revised to reflect imposed budgetary constraints, technological advancements, and more effective architectural designs.

4.5. OFFICE OF ADVANCED CONCEPTS AND TECHNOLOGY

The Office of Advanced Concepts and Technology is currently being merged with the Office of Space Development. Information for the new organization is not currently available.

4.6. OFFICE OF SPACE SCIENCE

The OSS, despite budgetary pressures, established some exciting new projects. The JPL entered into a joint agreement with Cray Computers on multiple parallel processing, which could triple the computing speed of existing Cray computers greatly improving research capabilities. The NASA Science Internet (NSI) program is providing computer hardware to assist in the establishing a network architecture for the Russian Space Resarch Institute.

4.7.   OFFICE OF MISSION TO PLANET EARTH

MTPE continued requirements analysis and design of the Earth Observing System Data Information System (EOSDIS). Its major component, the EOSDIS Core System (ECS), is one of the largest Trail Boss procurements in existence. Several major ECS reviews were completed during the past year, including the Program Management Review in June 1993 and the ECS System Requirements Review in September 1993. In addition, a very successful progress review was held in December to address feedback from the scientific community regarding the overall system requirements, system architecture, and evolvability of the system design. The ECS System Design Review is scheduled for June 1994.

MTPE successfully demonstrated the ability for a science user to electronically search for data sets across the aggregate holdings of the EOSDIS Distributed Active Archive Centers as a first step in implementing a "one stop shopping" capability for EOSDIS. This capability will be available in working prototype form as part of EOSDIS Version 0 in the summer of 1994.

MTPE initiated a major architectural revamping of the ECS, based on science community feedback, placing significantly more emphasis on implementation of a distributed, extensible computing architecture, incorporating evolvability more deeply into the design of the system, and enhancing the interoperability of the ECS with other computing resources available to the EOS scientific community.

MTPE selected TRW, Inc., for negotiating a contract to develop the EOS Data and Operations System (EDOS). EDOS is the part of EOSDIS that processes uplink and downlink telemetry data and provides a backup archive of raw (Level 0) science data from the EOS instruments. MTPE awarded a contract to Intermetrics, Inc. to perform IV&V within EOSDIS.

MTPE's ECS contractor provided its first formal software delivery, the Product Generation System (PGS) Toolkit to the EOS user community in April 1994. Delivered electronically following testing by the Earth Science Data and Information System project, the PGS Toolkit is intended to support smooth transition and integration of science software into the Distributed Active Archive Centers and to provide an interface between science and software and the PGS.

The MTPE continued the Scientific and Engineering Workstations Procurement, a Trail Boss program for NASA with 10% of the $751 million procurement reserved for use by other Federal agencies. This procurement was initiated in 1990 with a core of technical procurement, and IRM members, employing a highly unusual strategy and structure for this mass buy. It resulted in nine contracts with consolidated requirements for seven classes of scientific and engineering workstations. These workstations are being used in almost every facet of work and support a wide diversity of programs and experiments in NASA.

4.8.   OFFICE OF LIFE AND MICROGRAVITY SCIENCES AND APPLICATIONS

A new Data Simulation Module became operational in FY 1994, allowing full simulation capability for deginated interfaces for the Partial Payload Checkout Unit (PPCU) at the Kennedy Space Center. The PPCU is a payload checkout system used to perform experiment, functional and subsystem testing for non-spacelab payloads by simulating the orbiter.

4.9.   OFFICE OF MANAGEMENT SYSTEMS AND FACILITIES

Accomplishments for the STI program, the AIM program, and other IRM functions are provided in the following subsections.

4.9.1   STI Program

The NASA STI Program continues to employ Total Quality Management methods to evaluate and improve the process of acquiring and disseminating STI. International bilateral and tripartite exchange agreements are continuously reviewed to ensure that relationships remain beneficial to NASA.

Achieved completion of the NASA Access Mechanism (NAM) "Lessons Learned" document and decided to proceed with the development of a production version designated NAM-LITE.

The NASA STI Information Infrastructure Upgrade Plan to modernize the STI Program is in its first year of implementation. Under this plan, the first IBM mainframe will be replaced by a client/server by July 1995 and the second by January 1996. The majority of network upgrades within the STI Program are now in place and resulted in a more efficient input processing work flow.

As part of the NASA Electronic Publishing System project, an Electronic Document Interchange prototype is in its early planning stages between participating NASA Centers. This prototype will provide a platform for the development of NASA guidelines in the transfer, storage, retrieval, and print on demand of technical documents

4.9.2   Automated Information Management Program

The AIM Program implemented the NASA Training and Development System at all NASA Installations. Development and alpha test of the NASA Property Disposal Management System is complete and the system is proceeding well in beta test. Progress continued on all development projects, including the NAFIS, and the Time and Attendance Labor Collection/Labor Distribution System.

4.9.3 Other IRM Functions

NASA continues to improve the management of information resources by updating its processes and policies.

IRM Policy

To improve its policy guidance, the IRM Division: updated and reorganized NASA Handbook 2410.1f, Information Resources Management, which provides overall policy for the acquisition and management of information resources; published the first NASA Mail Management Guide, which provides guidance to mail management personnel throughout NASA and promotes consistency in program operations; and culminated a two-year review and inventory of the Agency's records by updating (April 1994) NASA Handbook 1441.1R NASA Records Retention Schedules, which modernizes the agency disposition schedules.

IRM Planning and Evaluation

NASA updated its IRM Strategic Plan to be responsive to the recently published NASA Strategic Plan. The update was accomplished through interactive planning sessions involving representatives from all major programs.

In March 1994, NASA published its Government Open System Interconnection Profile (GOSIP) Transition Plan to document the Agencywide GOSIP transition strategy. The strategy focuses on the transition of lower-layer protocols used on NASA Wide Area Networks.

NASA chartered an agencywide Process Action Team (PAT) to improve its process for collecting IRM budget data which is used to respond to the Office of Management and Budget's (OMB) annual Circular A-11 call. The team not only recommended improvements for NASA's internal budgeting process, but also presented recommended process improvements to OMB. The NASA PAT's recommendations and benchmark findings were later used by an interagency team tasked by OMB to recommend ways of streamlining the reporting requirements it levies on agencies. The task team recommended a dramatic streamlining of the requirements in OMB Circulars A-11 and A-130. Presently, OMB is updating both circulars to include the team's recommendations.

NASA accomplished its first agencywide IRM self-assessment and documented its results in the first Agencywide Integrated Program Assessment: IRM Summary Analysis. The integrated assessment represents the achievement of a more comprehensive analysis and report on the state of IRM functions, successes, deficiencies, and recommendations for improvement than any previous, Headquarters conducted, onsite functional management review.

Information Resources Acquisition Management

NASA is promoting the use of consolidated contracts across the agency. At Headquarters, an agencywide Apple software license was acquired and a consolidated acquisition of office workstations is in progress for the Headquarters and the GSFC.

5. INFORMATION COLLECTION BUDGET

The majority of NASA's public information collection is involved in the procurement function. The NASA Federal Acquisition Regulation Supplement establishes agencywide uniform policies and procedures that implement and supplement the Federal Acquisition Regulation.

NASA will concentrate on two major areas within the procurement function for current and future reductions. One area will center around the continued use of consolidated contracts in order to reduce the solicitation and contract reporting burden on the private sector. The second area will concentrate on reducing reporting requirements associated with contracts awarded under the NASA Procurement Regulation. NASA will continue to emphasize the elimination of any redundant and/or obsolete contract reporting requirements.

Data on NASA's information collection budget are included in an attachment, entitled "NASA Information Collection Budget". These data are provided in response to OMB Bulletin 94-05, Appendix B.

6. SUMMARY OF COMPUTER SECURITY PLANS

6.1. BACKGROUND

NASA formally implemented its Automated Information Security (AIS) Program in 1979 and established a full-time NASA AIS Program Manager position in 1985. NASA has conducted many management reviews, extensively refined its AIS policies and procedures, and published more than 10 AIS guidelines. AIS is successfully integrated throughout NASA's functional management processes using a total systems engineering approach, management points-of-contact, intra-agency working groups, councils, and committees. AIS management and coordinating authorities include IRM and security senior management committees, Program Office AIS Managers, Field Center AIS Managers, local Data Processing Installation AIS Officials, and AIS Coordinators at the application, hardware, and end-user levels.

6.2. IMPROVEMENTS IN THE SECURITY OF NASA SYSTEMS

In FY91, the AIS Program reviewed over 100 plans for sensitive/critical systems to determine the status and quality of AIS implementation; additional, comprehensive, follow-up reviews of these systems were conducted in FY92, FY93, and FY94. Although many system configuration changes, system deletions and system additions occurred in this time period, analysis of over 25 major AIS control categories related to these sensitive/critical systems indicated important improvements at the system level and major improvements in AIS reporting accuracy and management understanding of significant AIS issues. NASA continues to make significant strides in improving AIS for sensitive/critical systems. New vulnerabilities and risk exposures are continually being identified and monitored through an ongoing program of threat assessment and risk management.

6.3. COMPUTER SECURITY AWARENESS AND TRAINING PROGRAM

In FY93 and FY94, NASA continued its integrated and multi-faceted approach (e.g. top-down and bottom-up, internal and external sources) for providing continuous Computer Security Awareness and Training (CSAT). This approach realizes that an effective training program must offer more to personnel than just an hour of annual classroom training. As such, NASA includes CSAT sessions in not only in new employee activities (e.g., orientation, annual mandatory ethics training, technical learning center training activities) but also in training for Contracting Officers, Contracting Officer's Technical Representatives, and Computer/Network Systems Administrators. AIS topics are also integrated into many internal management and technical conferences, seminars; workshops, and meetings. CSAT effectiveness is monitored using ongoing, internal, management and compliance review processes, and independent external sources. For example, after a thorough review of NASA's CSAT program in FY92, a National Institute of Standards and Technology (NIST) report confirmed NASA's solid commitment to assuring continuous, effective, and high quality CSAT.

6.4.   NASA-WIDE IMPLEMENTATION ACTIVITIES RESULTING FROM REVIEWS

In February 1991, a management team with members from the Office of Management and Budget, NIST, and the National Security Agency met with many NASA senior functional program managers to discuss the status of AIS implementation issues. This meeting served to focus additional management attention on NASA AIS and reinforced the importance of AIS to the Federal government. As a result, resources were available in FY92/93/94 to further enhance AIS policies, procedures, tools, and techniques for combating threats associated with rapidly advancing computing and telecommunications technologies. Increased emphasis was placed on:

> integrating AIS requirements into IRM systems engineering and life-cycle development processes, ADP procurements, software quality assurance, and personnel screening of non-Federal ADP personnel;

> assuring implementation of adequate computer virus scanning capabilities;

> performing risk assessment and penetration testing for all major sensitive/critical systems; and

> establishing an agencywide incident response capability (high priority).

7. APPENDIX: ACRONYM LIST

ADP   Automated Data Processing
AIM   Automated Information Management
AIS   Automated Information Security
ARC   Ames Research Center

CAD   Computer-Aided Design
CAM   Computer-Aided Manufacturing
CCF   Central Computer Facility
CMS   Computational Mission Services
CRA   Cooperative Research Agreement
CSAT   Computer Security Awareness and Training

DAS   Data Acquisition System
DoD   Departmant of Defense
DFRC Dryden Flight Research Center
DSO   Designated Senior Official

ECF   Engineering Computational Facility
ECIP   Electronic Commerce Infrastructure Program
ECS   EOSDIS Core System
EOSDIS   Earth Observing System Data Information System

FIP   Federal Information Processing
FIRMR   Federal Information Resources Management Regulations
FLOPS   Floating Operations per second
FRDD FIP Resources Decision Document

GSFC   Goddard Space Flight Center
GOSIP   Government Open System Interconnection Profile

HPCC High Performance Computing and Communications
HSP   High Speed Processor
HST   Hubble Space Telescope

IRM   Information Resources Management
IT   Information Technology
IV&V   Independent Verification and Validation

JPL   Jet Propulsion Laboratory
JSC   Johnson Space Center

KSC	Kennedy Space Center
LAN	Local Area Network
LaRC	Langley Research Center
LBSAD	Life and Biomedical Sciences and Applications Division
LeRC	Lewis Research Center
Mbps	Megabits per second
MSAD	Microgravity Sciences and Applications Division
MSFC	Marshall Space Flight Center
MTPE	Office of Mission to Planet Earth
NAFIS	NASA Accounting and Financial Information System
NAM	NASA Access Mechanism
NAS	Numerical Aerodynamic Simulation
NASCOM	NASA Communications Network
NASA	National Aeronautics and Space Administration
NCCS	NASA Center for Computational Sciences
NIST	National Institute of Standards and Technology
NREN	National Research and Education Network
NSI	NASA Science Internet
NSSDC	National Space Science Data Center
OA	Office of Aeronautics
OACT	Office of Advanced Concepts and Technology
OLMSA	Office of Life and Microgravity Sciences and Applications
OMB	Office of Management and Budget
OMSF	Office of Management Systems and Facilities
OSC	Office of Space Communications
OSF	Office of Space Flight
OSMA	Office of Safety and Mission Assurance
OSS	Office of Space Science
PAT	Process Action Team
PC	Personal Computer
PPCU	Partial Payload Checkout Unit
RMMS	Remote Maintenance Monitoring System
S&E	Scientific and Engineering
SED	Systems Engineering Division
SEWP	Scientific Engineering Workstation Program

SIIO   Senior Installation IRM Official
SIMPOC   Simulated Payload Operations Control Center
SPIO   Senior Program IRM Official
SR&QA   Safety, Reliability, and Quality Assurance
SSC   Stennis Space Center
STI   Scientific and Technical Information
STL   Science and Technology Laboratory

TAV   Transatmospheric Research and Technology

WAN   Wide Area Network