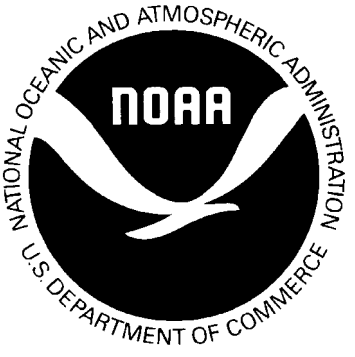
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

STRATEGIC INFORMATION TECHNOLOGY PLAN

FY 2001 - FY 2005



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This plan was produced in part as input to NOAA's FY 2002 Strategic Planning/Budget Process. As such, information in it may require revisions upon completion of that process. An electronic version is available at "http://www.rdc.noaa.gov/~irm/index.html".

PREFACE

The National Oceanic and Atmospheric Administration (NOAA) Strategic Information Technology (IT) Plan establishes a vision for how information technology contributes to NOAA's ability to accomplish the seven strategic goals identified in the NOAA Strategic Plan. It presents NOAA's requirements for IT systems in terms of these strategic goals and identifies the IT actions necessary to reach those objectives. It has a close relationship with NOAA's 5-Year Implementation Plans. This linkage in turn supports the NOAA, DOC, and OMB budget-development processes by showing how specific IT initiatives are part of an overall strategy that is essential to attain NOAA's programmatic goals. The plan integrates information on NOAA's IT programs, requirements, and issues, providing a useful management tool for tracking the general status and direction of IT management within the agency. Finally, the plan responds to Congressional and Office of Management and Budget (OMB) direction that agencies must develop strategic IT plans to ensure the sound management of this resource so crucial to Government operations.

The NOAA Strategic IT Plan identifies how NOAA is using IT to achieve its strategic goals. NOAA also prepares a more specific annual Operational IT Plan that documents NOAA's accomplishments with its prior use of IT resources and its short-term plans for further actions and accomplishments. Budget Initiatives with substantial IT components are supported with additional documentation detailing specific life-cycle system plans. At the lowest level of planning, an analysis of alternative solutions to a specific IT requirement is prepared for any proposed major acquisition.

This Strategic IT Plan supports the development of NOAA's 5-Year Implementation Plans. Information on NOAA's strategic systems has been supplied by the individual system managers through their Line Office's Chief Information Officer or Information Technology Coordinator. The strategic issues addressed in this plan were selected for inclusion by NOAA's Information Technology Board, chaired by the Deputy Under Secretary and comprised of Deputy Assistant Administrators and Program Office Directors. The Board is also responsible for reviewing the contents of this plan and recommending endorsement to the Deputy Under Secretary.

As NOAA's 5-year Implementation Plans are revised and budget decisions are made, some of the contents of the Strategic IT Plan will need adjustment. Readers should be aware that this document reflects NOAA's plans at this point in the process – the other parts of the NOAA IT planning system will document changes that would affect NOAA's specific budget requests.

Submitted by: Scott B. Gudes
Deputy Under Secretary

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NOAA'S MISSION AND INFORMATION TECHNOLOGY ENVIRONMENT

Agency Mission

The mission of the National Oceanic and Atmospheric Administration (NOAA) is to describe and predict changes in the Earth's environment, and to conserve and manage wisely the Nation's coastal and marine resources to ensure sustainable economic opportunities. The NOAA Strategic Plan provides a framework for articulating program goals, and it establishes two mission areas: (1) Environmental Assessment and Prediction and (2) Environmental Stewardship. NOAA's mission is also described on NOAA's home page on the World-Wide-Web (http://www.noaa.gov).

NOAA's Information Technology Environment

NOAA is a science-based service agency. In support of its missions, it collects, processes, evaluates, disseminates, and archives vast quantities of information and information products. The effective use of information technology (IT) is a critical success factor in NOAA's ability to accomplish its mission, and the use of IT is integrated into almost all aspects of NOAA's work. NOAA's Strategic Plan recognizes the critical role of environmental data and information services.

IT allows NOAA to vastly increase the amount and quality of environmental data collected. IT is an integral part of environmental data-collection systems, including radar, sonar, and satellite systems. Once collected, the data are evaluated and processed to create useful products. NOAA uses advanced computing technology, for instance, to make weather and climate forecasts. IT resources are also essential tools that NOAA uses to produce information products such as nautical and aeronautical charts and management tools such as quotas for specific species of fish.

Once produced, these information products are disseminated to the public. IT allows NOAA to provide its products to the public in a timely manner. In the case of a weather warning, "timely" means immediately through systems such as the NOAA Weather Radio system or through links to emergency management offices. Other products are disseminated in "real- time" to allow the preparation of forecasts. NOAA also serves the research community that needs reliable and responsive access to NOAA data covering extended periods of time.

NOAA uses IT to create and preserve the Nation's long-term environmental record. The Nation's ability to make informed decisions affecting the environment and the economy hinge on the integrity and completeness of environmental datasets. As NOAA collects and processes a larger volume of environmental data, the systems that archive and preserve the data for posterity must keep pace.

NOAA is a large and diverse organization linked together with a common mission. IT provides one of the links that allows the organization to operate effectively. Internal communication and collaboration are done through electronic mail and video conferencing. In addition, numerous day-to-day operations are conducted through the use of common administrative systems.

The management and use of IT are and will always be key components of NOAA's work.

NOAA's Current Information Technology Infrastructure

NOAA's IT infrastructure is too complex to easily summarize. Supercomputers are used to develop and use models of the environment to make predictions. Scientific workstations are often used for computationally-intensive tasks and as servers, although the increased power of PCs is leading to some change in the mix between scientific workstations and PCs. The basic desktop unit within NOAA is the PC. With the exception of efforts to plan for the use of supercomputers within the agency, decisions about the mix of computing equipment are decided by the program offices.

NOAA depends heavily on the Internet and internal networks to accomplish its goals and to disseminate information to the public. As a scientific agency, NOAA has been a government leader in the use of World-Wide-Web sites for a variety of purposes. NOAA sites are routinely accessed by the public in very large numbers, and in special situations such as hurricanes the numbers grow even larger.

NOAA is slowly moving away from internally-developed software to commercial off-the-shelf software when such a move is a viable and affordable option.

Vision for the Future

NOAA's overall mission, as expressed in the NOAA Strategic Plan, is stable and is not expected to significantly change over time. NOAA is rapidly improving the products and services provided to the public by using IT resources effectively. Thus, NOAA's IT vision focuses on finding ways to continue to use IT to accomplish NOAA's strategic goals.

In an era of stagnant or falling budgets, this vision requires that financial and staff resources be allocated carefully. Planning and decision-making must be conducted thoroughly and analytically so that resources can be directed so as to maximize the benefits to the country. Identifiable and measurable goals must be established.

NOAA has established an IT Board with senior management representation from each of NOAA's Line Offices. The role of the IT Board is to develop policy, oversee efforts to address enterprise-wide technical issues, and to review investment proposals and recommend priorities.

Once investment decisions are made, NOAA's program officials must have the ability to quickly and cost-effectively implement these decisions and acquire the needed resources. Given the rate of technological change, time is of the essence when acquiring modern technology. Lengthy

delays during the procurement process are burdensome and potentially costly. Where appropriate, NOAA strives to share or leverage existing resources for the common good. This includes the development of common standards-based architectures.

Managers responsible for developing new systems must have the benefit of lessons learned from past experiences. The use of "best practices" for project management and software engineering techniques for system design and implementation must be emphasized.

Finally, the performance of operational IT systems must be measured and evaluated. The goal must be continuous improvement, not the status quo.

NOAA-WIDE INFORMATION TECHNOLOGY STRATEGIC ISSUES

NOAA's leadership recognizes the importance of IT as an enabler that allows NOAA to accomplish its mission. IT is critically important to NOAA's ability to accomplish each of its seven strategic goals. The individual systems being planned, deployed, or operated to accomplish these goals are described later in this plan. However, IT also needs to be managed at the enterprise level. Over-arching issues and management requirements exist and must be addressed for the organization as a whole.

This section of NOAA's Strategic IT Plan describes these management issues, provides a status report on NOAA's progress in dealing with them, and outlines NOAA's plans for dealing with each issue.

Information Technology Architectures

Description: An Information Technology Architecture (ITA) describes the relationships between the work a Federal Agency does, the information the agency uses, and the Information Technology that an agency needs. It includes standards and principles that guide the procurement and design of new and upgraded systems. An ITA makes it easier to share information internally (e.g. enterprise-wide E-Mail) and to reduce the number of information systems that perform similar work. An ITA is comprised of an Enterprise IT Architecture and a Technical Reference Model and Standards Profile.

The Clinger-Cohen Act of 1996 (Public Law 104-106) mandates that Federal agencies must develop and maintain an Enterprise IT Architecture. Specifically, the Clinger-Cohen Act assigns the Chief Information Officer the responsibility of developing, maintaining, and facilitating the implementation of the ITA. OMB Memorandum 97-02, "Funding Information Systems Investments" (October 25, 1996) requires that agency investments in major information systems be consistent with Federal, agency, and bureau ITAs. OMB Memorandum 97-16, "Information Technology Architectures" (June 18, 1997) establishes minimum criteria for an agency ITA required by the Clinger-Cohen Act. A proposed revision to OMB Circular A-130 implements the Clinger-Cohen Act and further defines ITA.

A Department of Commerce Chief Information Officer (CIO) memorandum dated May 28, 1999 requires that all Operating Units have IT Architectures approved by the Department's IT Architecture Affinity Group by June 1, 2000, and that the ITAs be based on ITA Guidance prepared by the Affinity Group.

Status: NOAA is actively and aggressively striving to submit an IT Architecture Plan to the ITA Affinity Group by the end of June, 2000.

NOAA created an IT Architecture Working Group (AWG) in August, 1999. The NOAA AWG Charter was formally accepted on November 15, 1999. The AWG serves as the principal forum for NOAA's Line and Staff Offices to address issues relating to NOAA IT Enterprise Architecture. The NOAA IT AWG is a resource to help develop ITAs throughout the organization and to promote the adoption and improvement of IT architectural practices throughout NOAA. The purpose of the NOAA AWG is to:

- Guide and assist the NOAA IT Architecture domain (cross-cutting) and segment (Line Office) teams in the development of ITAs.
- Serve NOAA's CIO and IT Board in a technical capacity on ITAs.
- Review ITA domains and segments for technical adequacy and compatibility with other ITA domains and segments.
- Monitor the update of the ITA domains and segments.
- Develop and maintain a NOAA IT Technical Reference Model and Standards Profile.

The NOAA ITA is comprised of twelve domains (cross-cutting) and segments (Line Offices). The NOAA ITA segments and domains are:

- Shared telecommunications and networking
- Messaging/directory services
- IT Security
- Administrative systems
- Archiving/access
- High performance computing
- Marine and aviation operations
- National Environmental Satellite, Data and Information Service (NESDIS)
- National Marine Fisheries Service (NMFS)
- National Ocean Service (NOS)
- National Weather Service (NWS)
- Office of Ocean and Atmospheric Research (OAR).

Over 200 NOAA people worked on one or more segment and domain teams to complete the initial phases of NOAA's ITAs by June, 2000.

NOAA contracted with the META Group in January 2000 to provide two one-day on-site training sessions on Information Technology Enterprise Architecture and IT Best Practices. The first session was held on NOAA's Boulder, CO campus on February 1, 2000. The second session was held in NOAA's Auditorium in Silver Spring, MD on February 16, 2000 in a training room. Approximately 250 people attended one of the two training sessions. The Department's IT Architecture Affinity Group and staff from the Office of CIO were invited to attend the session in Silver Spring. The Department's CIO, Roger Baker, provided introductory remarks at the Silver Spring session. In addition, NOAA will be holding telephone and in-person meetings with the META Group IT Architecture analyst to discuss architecture issues and critiques to improve the quality of the in-house IT Architecture work that is being accomplished.

To enhance communications between NOAA AWG members and the various IT Architecture domain and segment teams, an Internet Listserv and a NOAA AWG Home Page have been established. The URL for the NOAA AWG Home Page is www.hpcc.noaa.gov/noaaita (access is restricted).

Draft first-year IT Architecture plans were due to the NOAA AWG on April 17, 2000. Revisions to the plan were due in the second half of May, 2000. The IT Architecture Plans will be forwarded to the NOAA IT Review Board for approval and concurrence before the architecture documents will be forwarded to the Department as required. As a minimum, each domain and segment team architecture plan will include an IT Architecture vision, objectives, principles, and requirements, and a start on the baseline and target architectures and/or gap analysis. An IT Architecture omnibus document will integrate the high-level IT Architecture requirements of all twelve domains and segments.

Future Direction/Actions: NOAA will update and revise all twelve NOAA Segment and Domain IT Architecture Plans on an annual basis.

NOAA will strive to continuously improve its IT Architecture Plans in accordance with the Department of Commerce IT Architecture Maturity Model (currently in development by Department of Commerce ITA Affinity Group).

NOAA will align its ITA with NOAA's Strategic Plan and the Department of Commerce's Digital Department

Milestones	FY Goal
Charter NOAA Architecture Working Group	FY 99/FY 99
Present NOAA ITA Plan to Dept. of Commerce ITA Affinity Group	2nd Q, FY 00/ 2nd Q, FY 00
Hold two "NOAA IT Enterprise Architecture 'Boot Camp' and Best Practices" Workshops (Boulder, CO & Silver Spring, MD)	2nd Q, FY 00/ 2nd Q, FY 00
Twelve Draft NOAA Segment and Domain IT Architecture Plans to NOAA AWG	3rd Q, FY 00/ 3rd Q, FY00
NOAA IT Architecture Plans Approval by NOAA IT Board	3rd Q, FY00
NOAA IT Architecture Plans Submitted to Dept of Commerce ITA Affinity Group	3rd Q, FY 00
Draft NOAA Technical Reference Model and Standards Profile to NOAA AWG	3rd Q, FY 01
NOAA Technical Reference Model and Standards Profile to NOAA AWG	3rd Q, FY 01

Milestones	FY Goal
Revised and updated NOAA IT Architecture Plans submitted to Dept of Commerce CIO	3rd Q, FY 01

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Information Technology Security

NOT YET SUBMITTED

Chief Information Officer Organization

NOT YET SUBMITTED

Government Paperwork Elimination Act/Digital Department

NOT YET SUBMITTED

Telecommunications (FTS 2001)

NOT YET SUBMITTED

Office Software

NOT YET SUBMITTED

The Use of IT to Reduce Public Reporting Burden

(This may be merged under the GPEA issue)

Description: NOAA's implementation of the Paperwork Reduction Act has led to the examination of the use of IT to reduce the burden on the public from responding to NOAA information requirements or requests. NOAA has also pursued the use of IT because it can reduce agency costs for handling the information submitted, can provide more timely information, and can provide other benefits in addition to reducing the time it takes the public to provide the information.

A primary new factor that NOAA must consider is the Government Paperwork Elimination Act (GPEA) and the related OMB regulation, which require agencies to systematically review their dealings with the public and when practicable to provide the public with electronic options for dealing with the agency. The impact of this extends beyond the concerns of the Paperwork Reduction Act, since it extends to product orders and other activities that may not be subject to the clearance requirements of that act.

In recognition of the importance of the GPEA and the difficulties involved in meeting its requirements, this Plan has identified the GPEA as a strategic issue of its own and a discussion of related plans is provided there.

Status: NOAA has continued to pursue a number of efforts to use IT to reduce public reporting burden. Most of the following is an update of activities described in last year's NOAA Strategic IT Plan.

Forms on the Web - NOAA continues to make more forms necessary for application or reporting requirements available to the public from NOAA's World-Wide-Web (WWW) sites. Although the public cannot usually complete and submit the forms on-line yet, the effort to obtain the forms has at least been reduced. During the Paperwork Reduction Act review process we have placed increased emphasis on getting offices to provide electronic forms to their customers.

The next step is to make it possible to fill out and submit forms on-line. The primary hindrance to greater progress in this is the lack of a standard agency software approach to creating the forms. If and when the Department of Commerce (DOC) or NOAA reaches a decision on an electronic forms package, NOAA will more aggressively pursue this goal. A related problem has been that many forms require signatures, and limited resources make it difficult to implement the electronic signature systems that would be necessary. At least in part in response to the GPEA, there are active efforts underway in DOC and NOAA to help provide solutions to this problem. While we cannot be sure exactly when systems will be implemented, they are certainly part of NOAA's future.

Forms Electronically Pre-completed - There is an alternative to having the public fill out forms electronically, and it is one that actually results in greater reductions in public and agency burden. NOAA requires annual fishing permits in many regulated fisheries, and much of the annual information does not change from year-to-year. Rather than having the respondents repeat this information every year, and requiring NOAA to re-enter information it already has, in many cases NOAA sends the permit holder a renewal application form that has already been filled out by computer with the existing application information on record. The applicant only has to review the data to ensure that it is still accurate, make any changes needed, sign the application, and mail it in. By eliminating the need to complete address, vessel, and other information fields that have not changed, NOAA has reduced the response time by 50%. NOAA will continue to examine renewal procedures that do not use this technique, and when it is feasible will bring more processes under this system.

Vessel Monitoring Systems **-** Previous NOAA Strategic IT Plans have described the use of Vessel Monitoring Systems (VMS). A VMS is a piece of equipment that can be placed aboard commercial fishing vessels and automatically report the location of the vessel. Some systems also provide e-mail capability that allows electronic submission of time-sensitive catch data from the vessels.

The use of VMS can benefit the public in a number of ways. The system can reduce reporting burden since location reports do not require any action on the part of the vessel operator – the action takes seconds rather than minutes. The system also allows NOAA to reduce restrictions on how close vessels can operate near fishing grounds that are temporarily closed or where fishing is prohibited; the VMS can be relied on to provide accurate location information, reducing the chances of illegal entries into areas. There are issues concerning the cost of this equipment, so it is not appropriate for all situations. The potential use of the systems is analyzed on a fishery-by-fishery basis.

Up to this point VMS requirements and systems have varied on different regions of the country. The result has been inconsistencies in data handling and costs, and duplication of systems receiving reports. To make the use of these systems more effective and to better protect the confidentiality of the data submitted, NOAA is pursuing an initiative to develop a national VMS system for receiving reports. Hardware and software have been procured and tested over a Local Area Network. After further tests over the NMFS WAN, an initial deployment is expected by the end of FY 2000. NOAA has additional funds in the President's FY 2001 budget request to further expand the system.

Electronic Dealer/Processor Reporting **-** In the Alaska Region a system allows fishery dealers and processors (including processing vessels) to provide NOAA with data output from their existing computer systems, rather than responding on a NOAA-required paper reporting form. These efforts reduce the burden on the respondents and provide data that can be entered into NOAA's data bases more easily. Software can be downloaded from NOAA to prepare and submit a number of required reports. This reduces the burden on this segment of the fishery while making NOAA's job of processing the data much easier.

Electronic Fishing Vessel Logbook Projects **-** In many commercial fisheries the operators of participating vessels are required either by a state or by NOAA to maintain catch and effort logbooks. In most cases fishermen would maintain some form of logbook for their own use, so the Federal burden imposed involves the use of additional data fields and the actual submission of the logbooks to the government agency involved. NOAA currently has two projects underway that seek to develop electronic logbooks. Both projects involve the automatic entry of some data from sensors in addition to information entered on a PC. If successful, an electronic logbook would reduce the burden on the fishermen while producing better data more quickly and in a readily-usable form. The project in the Northwest Region has progressed to Stage 3, the prototyping of the system.

Telephone Reporting **-** NOAA has a number of requirements that involve the respondent telephoning information to the agency. Two of the more recent requirements involve more

innovative uses of this approach. Certain fisheries dealers in the Northeast will be required to report purchases weekly via an interactive voice response system. While this does not reduce burden on the dealers, it allows NOAA to obtain and analyze the data more quickly, thereby improving the management of these fisheries. The other requirement, already in place, is that recreational fishermen landing medium or large-sized Atlantic bluefin tuna must call in catch information to an automated system. This involves relatively little burden on the respondent, while quickly providing NOAA with information needed for management.

Grants Management **-** NOAA offices are coordinating on electronic means for grant recipients to submit required information.

Future Direction/Actions: NOAA will be continuing with the efforts described in the Status section above, especially placing more forms on the Web, pursing a national Vessel Monitoring System reporting system, completing the development of electronic fishing vessel logbooks, and improving grants management reporting. The primary changes in future direction will be the result of the GPEA efforts to be reported on elsewhere.

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Electronic and Information Technology Accessibility

Description: The degree of accessibility of technologies to people with disabilities is becoming more significant as governmental functions become increasingly dependent upon computers and other technology. When computers first became a standard feature in the American workplace, people with disabilities were generally able to use the new technology with relative ease, using the assistance of adaptive or assistive technology. For instance, people who were blind could function well in the DOS environmental by using a "screen reader" – technology which reads aloud, in an artificial voice, the words and punctuation marks that appear on a computer monitor. Since a computer mouse was not used in the DOS environment, people who were blind and had screen readers could use computers very effectively because everything on the screen and all commands necessary to interact with the software were discrete, text-based commands such as "control P to print." Additionally, very few technology applications contained auditory features, so that most people who were deaf or hard of hearing had no trouble using the technology.

The transition from a DOS environment to a graphical user interface (GUI) environmental meant that many people with disabilities who were previously capable of functioning fully were now locked out due to technology advances. Software applications and Internet pages often require users to "point-and-click" – using a computer mouse to click on an icon to accomplish a task. Many people with disabilities cannot work in a "point-and-click" environment unless it contains redundant features, such as a software application that allows the user to choose between clicking on a printer icon or hitting "control P" to print a document. Screen readers cannot read images – icons, buttons, or graphics – unless there is text associated with them. Similarly, multimedia environments tend to screen out people who are deaf or hard of hearing unless important audio information is also conveyed visually.

Congress responded to this unintended consequence of the evolution in technology by passing Section 508 of the Rehabilitation Act of 1986. The amendment, entitled "Electronic Equipment Accessibility" required the Administrator of the General Services Administration and the National Institute on Disability and Rehabilitation Research (NIDRR) of the U.S. Department of Education to develop guidelines for the Federal Government's procurement of accessible electronic equipment. Although the original 1986 version of Section 508 had required each federal agency to comply with these guidelines, little progress was made.

Twelve years later, when Congress revisited the Rehabilitation Act in the context of the Workforce Investment Act of 1998, it acknowledged the need for new legislation to strengthen Section 508. On August 7, 1998, the President signed a law that significantly expanded and strengthened the technology access requirements in Section 508.

The old version of Section 508 established non-binding guidelines for technology accessibility, while the new version will create binding, enforceable standards and will incorporate these standards into Federal procurement regulations. The law directs the Architecture and Transportation Barriers Compliance Board (Access Board) to develop access standards. Federal agencies will use these standards in all their electronic and information technology acquisitions. Consistent government-wide standards will make it easier for Federal agencies to meet their existing obligations to make their technology systems accessible to people with disabilities, and will promote competition in the technology industry by clarifying the Federal market's requirement for accessibility in general products. The new version of Section 508 also establishes procedures and reporting requirements, which further strengthen the law.

Section 508 prohibits Federal agencies from procuring, developing, maintaining, or using electronic and information technology that is inaccessible to people with disabilities, subject to an undue burden defense. Agencies must comply with Section 508 regardless of whether they have employees with disabilities or serve members of the public with disabilities. Section 508 does not require the retrofit of electronic and information technology procured prior to August 7, 2000; internally-developed technology should be made compliant according to an agency-developed plan.

The General Services Administration and the Architecture and Transportation Barriers Compliance Board (Access Board) share statutory authority to provide Section 508 technical assistance.

Status: NOAA has responded to the accessibility requirements by taking actions in the following areas.

Awareness: The existing NOAA Section 508 Home Page, Access Ability, at http://www.rdc.noaa.gov/~irm/index.html#4 has been updated to provide a one-stop source for issues related to the new Section 508 and its implementation.

Compliance review and reports: In April, 1999 NOAA completed an initial self-evaluation survey of the accessibility of NOAA's electronic and information technology environment to individuals

with a disabilities. Section 508 requires the Department of Justice (DOJ) to lead all Executive agencies and departments in conducting self-evaluations to determine the extent to which their electronic and information technology is accessible to individuals with disabilities. DOJ sent out detailed self-evaluation material for agencies to evaluate their procurement policies and practices, telecommunications products and systems, the most commonly-used Web pages, software applications, information kiosks, and other electronic office equipment such as fax machines, copiers, and printers. NOAA has very IT-competent individuals with disabilities. A NWS employee with a visual disability tested, with his assistive technology (screen reading software), the 20 NOAA Web sites that have the greatest traffic volume. He found that most sites were accessible and that the problems that did exist could be fixed with only minor modifications.

On April 17, 2000, DOJ sent to the President the first Executive Branch-wide Section 508 evaluation report. This report with its findings and recommendations to the President is a baseline against which progress can be measured. In August 7, 2001, and every 2 years thereafter, there will be Executive Branch-wide Section 508 evaluation reports to the President and Congress. These subsequent reports will discuss improvements in the degree of accessibility of Federal electronic and information technology and will also report on the resolution of section 508 Complaints filed against Federal agencies.

Section 508 Standards: In May 2000 the Access Board published a Notice of Proposed Rulemaking containing draft accessibility standards to implement Section 508. Once final, these standards will be incorporated into the Federal Acquisition Regulation (FAR).

Future Direction/Actions: NOAA will be working in the following areas to introduce accessibility features into mainstream electronic and information technology products purchased, reducing the need for individual, customized accommodations and to make accommodations efficient and easier to implement.

Awareness: NOAA will establish a Section 508 working group to initially focus on promoting Section 508 awareness and developing an inventory to determine the magnitude of the problem. NOAA will also provide training on the Electronic and Information Technology Accessibility Standards to IT personnel, procurement staff, help-desk personnel, and Web masters. All will have to understand the new features to perform their assigned tasks.

Assessment: Web sites will be inventoried for compliance to accessibility standards.

Procurement Policy Revision: NOAA procurement policies need to be revised to incorporate the new FAR requirement for Section 508 Standards. The contract clause for Accessibility of Electronic and Information Technology will be inserted into all solicitations for and evaluations of electronic and information technology.

Validation: NOAA will set up procedures to test in-house information technology development efforts for Section 508 compliance.

Implementation: NOAA will integrate accessibility reviews into the earliest stages of design, development, and procurement of IT. As of August 7, 2000, the Federal government must procure electronic and information technology that is accessible to people with disabilities.

Performance Measures	FY 99	FY 00	FY 01
Self Evaluation Reports to DOJ	1/1	0	1
Training procurement officers and Webmasters on Section 508 standards - % completed		50%	75%

Milestones	FY Goal
Initial Section 508 Report - Self-Evaluation assessment to DOJ	FY 99/FY 99
NOAA's procurement policy and regulations revised to incorporate the new FAR regulations for Section 508 standards	FY 00
Procure **only** electronic and information technology that is accessible to people with disabilities.	FY 00
Renovation of NOAA Web sites for Section 508 accessibility	FY 01
Second Section 508 Report - Degree of Accessibility of electronic and information technology and the resolution of Section 508 complaints filed against NOAA	FY 01
Training on Section 508 applicability	FY 01
Bi-annual Section 508 Report - Degree of Accessibility of electronic and information technology and the resolution of Section 508 complaints filed against NOAA	FY 03

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NOAA INFORMATION TECHNOLOGY PLANS ORGANIZED BY NOAA'S STRATEGIC PLAN GOALS

The following section is arranged by the goals established by NOAA's Strategic Plan. Under each goal individual information technology systems are addressed. These systems were selected for one or more of the following reasons: (1) they are major information technology systems essential for meeting a strategic goal, (2) they are expected to be the focus of a budget initiative, (3) they are major systems or systems development projects at or near a key decision point in their life cycle, and/or (4) they are major systems with outside interest. Some systems support more than one goal. In these cases they will be addressed in the primary goal being supported and cross-referenced under the other goal(s).

For each system this plan provides a general description of the system, its role in achieving the NOAA strategic goal, and its general plans. Performance measures for the system's support of the program and milestones for key future actions are included. Budget estimates are provided at the end of each goal's section. These estimates are for only the IT portion of the system, and reflect the money necessary for the related hardware, software, maintenance, services, support services, and personnel costs (as defined by OMB Circular A-11). Both base funding and proposed budget initiative funding are included. The figures for FY 2001 are from the President's budget, while the figures for later years are ones to be included in NOAA's FY 2002 budget request to the Department of Commerce.

STRATEGIC GOAL: ADVANCE SHORT-TERM WARNING AND FORECAST SERVICES

The Programmatic Goal and Objectives: NOAA's vision for 2003 is to provide significantly improved short-term warning and forecast products and services that will enhance public safety and the economic productivity of the Nation. NOAA will enhance its ability to observe, understand, and model the environment, and effectively disseminate products and services to users. The four major objectives of this goal are: to maintain National Weather Service (NWS) Modernization Operations, to maintain satellite continuity, to enhance observations and predictions, and to improve service communication and utilization. Forecasts of environmental conditions depend upon the acquisition of massive amounts of data and the ability to quickly run prediction models using these data. Advances in these areas are dependent upon improvements in information technology and its use. The modernization and restructuring of NWS is dependent upon the successful implementation of information technology systems. The primary Line/Program Offices involved in this goal are NWS; the National Environmental Satellite, Data, and Information Service (NESDIS); the Office of Oceanic and Atmospheric Research (OAR); the National Ocean Service (NOS); the Coastal Ocean Program Office; and the Systems Acquisition Office (SAO).

Performance Measures: The IT systems described in this chapter collectively contribute to the accomplishment of the performance measures set for this strategic goal. While additional measures will be shown for specific systems, it is impossible to separate the contributions of individual systems towards achieving the overall goals. The overall measures are provided here to show how modernization investments will benefit the public.

Advance Short-Term Warning and Forecast Services Performance Measures*	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03
Tornado warning lead time (in minutes)	11/10	11	12	13	13	14
Tornado warning accuracy (%)	67/65	70	72	74	75	76
Severe thunderstorm warning lead time (in minutes)	18/18	19	20	21	22	23
Severe thunderstorm warning accuracy (%)	84/84	84	85	86	87	88
Flash flood warnings lead time (in minutes)	52/40	42	44	45	45	45

Advance Short-Term Warning and Forecast Services Performance Measures*	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03
Flash flood warning accuracy (%)	83/83	85	86	86	87	88
Severe Coastal Event warning accuracy of landfall (km) w.24 hour lead time	140/ 140	135	130	130	125	125
Precipitation forecasts lead time for 1" precipitation (days in advance)	2.3/2.3	2.3	2.4	2.4	2.5	2.5

* When two numbers are presented and divided by a "/", the first number represents the achieved FY 98 performance measurement or the revised measure for future years. The second number represents the measure presented in the FY 98 Strategic Information Technology Plan.
**This is based on a small number of events (1) so this number may not be representative of the accuracy that can be routinely achieved.

Advanced Weather Interactive Processing System (AWIPS): The Advanced Weather Interactive Processing System (AWIPS) is a technologically-advanced information processing, display, and telecommunications system that is the cornerstone of the NWS modernization and restructuring. AWIPS is an interactive computer system that integrates all meteorological and hydrological data, and all satellite and radar data, and enables the forecaster to prepare and issue more accurate and timely forecasts and warnings. Through the implementation of AWIPS, the NWS will meet its mission "to provide weather and flood warnings, public forecasts, and advisories for all of the United States, its territories, adjacent water and ocean areas, primarily for the protection of life and property" more efficiently and effectively. It is a key element of the "maintain NWS Modernization Operations" objective under the "Advance Short-Term Warning and Forecast Services" goal of NOAA's Strategic Plan.

AWIPS is a key element of the modernization of the Weather Service. Deployment of all AWIPS systems and development through Release 4.2 was completed by June 1999. Commissioning of AWIPS systems has commenced. Final commissioning of all AWIPS systems is scheduled for completion in August, 2000.

AWIPS consists of an integrated suite of automated data-processing equipment that is deployed to field offices and National Centers (the National Centers for Environmental Prediction, the Office of Systems Operations, the Hydrologic Information Center, the National Operational Hydrologic Remote Sensing Center, and the NWS Training Center) to support complex analysis, interactive processing, display of hydro-meteorological data, and the rapid dissemination of warnings and forecasts in a highly reliable manner. A Wide-Area-Network connects sites for

multi-point-to-point and point-to-point communications. NOAAPORT provides the communications capability, via a satellite broadcast network, to afford internal and external users open access to much of NOAA's centrally collected and produced real-time environmental data. Efforts have been undertaken to ensure the AWIPS hardware platforms and supporting communications infrastructure can accommodate planned future development.

The AWIPS program is capitalizing on recent advances made in relevant technologies. The AWIPS development and deployment employ an incremental, evolutionary build approach where functionality is developed and implemented in multiple stages, thus allowing more frequent integration and evaluation of system components and realization of benefits as rapidly as possible. The initial increment was fielded with the target architecture, and formed the basis upon which future increments necessary to replace the aging Automation of Field Operations and Services (AFOS) system and streamline program operations will be integrated.

The AWIPS site architecture is an Open System implementation. The use of open systems has been a key aspect of the AWIPS design and will continue to influence design and implementation decisions. This approach has resulted in a standards-based, client-server system that provides isolation of applications, data, and system-level functions from hardware implementation and software services to eliminate dependency on vendor-unique products. The system architecture emphasizes the use of commercial-off-the-shelf (COTS) hardware and software, and functional independence of components to deliver a system that is flexible, expandable, and portable. This approach maximizes the intended long-term life of the system.

AWIPS benefits the operations of the NWS by:

- Providing computational and display functions for operational NWS sites;
- Providing open access, via NOAAPORT, to extensive NOAA datasets that are centrally collected and/or produced;
- Acquiring and processing data from an array of sensor systems (e.g., the WSR-88D radars, ASOS, and GOES) and local sources;
- Providing an interactive communications system to interconnect NWS operational sites and to broadcast data to NWS sites;
- Disseminating warning and forecasts in a rapid, highly reliable manner; and
- Making the transition from the existing AFOS and to restructured operations.

In particular, AWIPS provides several service-related capabilities and integration of data at a level not now available through current systems. AWIPS provides:

- Collection, processing, and display of data via one system;

- Integration of all critical data sources, e.g., radar, satellite, observations, and models;
- Single, integrated forecast operations with interactive analysis of data and forecast preparation;
- The ability to "drive" the NOAA Weather Wire Service and local dissemination circuits and automated NOAA Weather Radio;
- The ability for one Weather Forecast Office (WFO) to back up a second WFO that experiences system failure;
- The capability to acquire directly local data sets;
- Access to WSR-88D data from non-associated radars in order to not miss events; and
- The capability to ensure consistency of warnings and forecasts over multi-WFO areas.

System Status and Plans - Deployment of all AWIPS systems and development through Release 4.2 was completed by June 1999 and within the cap. Commissioning of AWIPS systems has commenced. Release 4.2.3 provides functionality sufficient to commission operations. Final commissioning of all AWIPS systems is scheduled for completion in August, 2000.

To realize the greatest benefit from the investment in NWS modernization, and to fully realize significant performance improvements in short term warning and forecast services, AWIPS must continue to evolve to provide effective integration with other NWS systems; to provide forecasters with the full range of data sets available from NWS modernization systems (e.g., WSR-88D, ASOS, satellites, and guidance forecasts from the Class VIII supercomputers); and to enable forecasters to effectively and efficiently interpret the wealth of data available. Activities planned for FY 2000-2005 include:

- Capabilities planned for Build 5, as verified in an independent assessment conducted in FY 1998, will be developed and fielded in a series of releases to be completed in FYs 2000-2003. Key capabilities included in AWIPS Build 5 are decision support through the System for Convection Analysis and Nowcasting, initial National Center and non-CONUS WFO unique functionality, interactive forecast preparation tools, and the inclusion of full NEXRAD Principle User Processor (PUP) functionality on AWIPS.
- AWIPS hardware changes will be supported in order to maintain currency, both in technology and mission support, of the nationwide AWIPS hardware platform. Specific items designated for replacement or upgrade between FY 2001-2005 are initially deployed applications servers, LAN Hubs, data server storage, workstation storage, and local interface connection support.
- Beginning in FY 2001, the program will put in place facilities to provide protection of the AWIPS network against catastrophic failure from the loss of an identified single point of

failure, as recommended in the 1997 NRC assessment of AWIPS. This will include providing an alternate Network Control Facility, alternate satellite Master Ground Station, a back up for the satellite transponder, and redundant access circuits in the terrestrial communications system.

- Development plans for FY 2001-2005 include providing for more efficient methods of data transmission, storage, and retrieval on AWIPS. These efficiencies are critical in order to address the tremendous and ever-expanding quantity of data produced by NOAA/NWS observing systems and numerical forecast models, and to minimize software maintenance costs. Plans include implementation of the results of existing AWIPS data-modeling studies to develop an integrated database of static and dynamic and hydrometeorological data; incorporation of commercial data management and storage solutions (e.g., Geographic Information Systems); and implementation of new data-compression technologies.

- Between FY 2000-2003, the AWIPS program will design, develop, test, and implement a hardware/software solution to connect the AWIPS and WSR-88D LANs at each NWS site. This will enable each site to provide high-speed, large-volume data transfers in a secure manner, allowing NWS to take advantage of rich spatial and temporal information embodied in the radar base data. This capability will provide the necessary communications infrastructure to allow advanced radar information derived from new capabilities, such as dual-polarization (which uses signals polarized into alternating horizontal and vertical orientations and compares the returns to provide better discrimination of precipitation type and size), to be used on AWIPS and by other government and external users.

- Continued evolution of AWIPS includes building on common software used by all NWS sites (e.g., WFOs and River Forecast Centers) and creating unique extensions required by National Centers and non-continental U.S. (off-CONUS or OCONUS) offices. A study conducted in FY 1998 has shown that the current AWIPS architecture can support an effort that unifies the design for all AWIPS sites. Development in FY 2001-2003 will accommodate additional data sources, enable display of data over larger domains and at higher resolutions, and provide a suite of graphical editing tools and grid-editing functions. Development in FY 2003-2005 would incorporate advanced data visualization displays and model editing tools.

- AWIPS initiatives beginning in FY 2001 will provide for the design, development, and testing of a suite of applications that will implement decision assistance tools for WFOs and National Centers and extend the AWIPS software architecture and design to accommodate capabilities for unique National Centers and OCONUS site requirements. There is a critical need for applications that allow NWS forecasters to sift through the tremendous volume of data available on AWIPS and focus attention on the most critical existing or developing weather events. In FY 2001, activities will begin to implement a suite of decision-assistance tools for aviation and marine hazards similar to the successful prototype System for Convection Analysis and Nowcasting (SCAN) package that has

been developed for application to severe weather and flash floods with the short-term forecasting function.

! In FYs 1999-2001 increases to the communications bandwidth on the AWIPS communications network will be made and sustained on a recurring basis. Changes include an increase in bandwidth of the AWIPS Wide-Area-Network (WAN), an increase in bandwidth of the AWIPS Satellite Broadcast Network (SBN), and establishment of connectivity of Department of Defense (DOD) radar sites to NWS. The increase in SBN bandwidth will allow output from advanced numerical models (run on new Class VIII supercomputers) to be made available to NWS field forecasters. WAN bandwidth increases will allow more radar and gridded forecast coordination data to be shared among NWS field sites and support the central collection of radar data. Connection of DOD radar to NWS will provide equal access to data from these critical radars.

Performance Measures - AWIPS contributes to the accomplishment of the performance measures set for the strategic goals of the NWS. The overall performance measures shown for the NWS show how the modernization investments will benefit the public. The performance measure shown below is for field release of AWIPS Build 5.

AWIPS Performance Measure*	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04
AWIPS installed	92/92	0/0				
AWIPS Build 5			5.0	5.1	5.2	

* When two numbers are presented and divided by a "/", the first number represents the achieved FY 99 performance measurement or the revised measure for future years. The second number represents the measure presented in the FY 99 Strategic Information Technology Plan.

AWIPS Milestones*	FY Goal
Complete Nationwide deployment	FY99/FY 99
Complete development/test of commissionable software	FY99/FY 99
Complete WAN upgrade	FY 00/ FY 99
Complete development of AWIPS Build 5	FY 02/FY 01
Complete implementation of catastrophic backup protection	FY 03/FY 01
Complete SBN bandwidth upgrade	FY 02/ FY01
Complete implementation of LAN interface to Open RPG	FY 03
Complete implementation of marine weather decision assistance tools	FY04

AWIPS Milestones*	FY Goal
Completer implementation of aviation weather decision assistance tools	FY05
Complete implementation of winter weather decision assistance tools	FY06

* When two years are presented and divided by a "/", the first year represents the FY 99 accomplishment or the revised goal for future years. The second year represents the goal presented in the FY 99 Strategic Information Technology Plan.

The National Centers for Environmental Prediction: The National Centers for Environmental Prediction (NCEP) serve as America's primary source for information on the future behavior of our physical environment, including changes in the weather, oceanic conditions, climate variations, and fluctuations in the near-space environment. The NCEP uses sound scientific techniques to convert environmental observations into projections of future conditions that affect our society. In doing so, the NCEP leads the Nation in combining scientific and technological advances to provide the best possible forecasts of our physical environment to meet the daily needs of the American people.

NCEP produces environmental forecasts and warnings. The Class VIII supercomputer has been procured. Periodic upgrades will be needed to improve the ability to assimilate more data and integrate improved models.

NCEP is comprised of nine centers, and while each center has a specific responsibility for a portion of the NCEP products and services suite, they all work together. Seven of the centers provide direct products to users, while two of the centers provide essential support through the development and operational use of complex computer models of the atmosphere. The task of developing and running these models to make timely environmental predictions requires enormous computing power, so the IT resources of NCEP include supercomputers and powerful scientific workstations. NOAA periodically upgrades the NCEP high-end computing capabilities to improve its capacity to assimilate increasingly higher-resolution data from satellites, radar, and other sources; to run more detailed, higher-resolution models; and to implement an operational integrated suite of climate and weather forecasts. All of this effort is directed toward improving the accuracy of the Nation's environmental predictions.

The activities associated with the use of high-performance computing at NCEP support NOAA's strategic goals to "Advance Short-Term Warning and Forecast Services" and to "Implement Seasonal to Interannual Climate Forecasts". One of the implementation objectives under these goals is to strengthen prediction systems. In order for the public to capitalize on the investment in the modernization of the NWS, NCEP needs IT resources that can handle the increasing quantity of environmental data and integrate the improvements in meteorological and climate research in a way that results in better forecasting. Increased prediction accuracy for hurricanes, severe thunderstorms, floods, winter storms, seasonal-to-interannual climate changes, etc., has a significant economic impact on the Nation.

The IT architecture at NCEP is fully described in the NCEP Information Technology Plan (March, 1995). Essentially, that architecture is open, heterogeneous, and multi-tiered. Within it, systems employ a common UNIX operating system, communicate via TCP/IP Ethernet, and exchange information using standard data formats. The network system at NCEP's Camp Springs location permits scientists to connect to the NWS high-performance computing resource directly from their desktop scientific workstations. This same network connects PC-based office automation systems, output devices, and all UNIX/Linux systems. Internet access is universally available and security services are provided by dedicated staff members.

System Status and Plans - In the year since the last edition of the Strategic IT Plan much has transpired at NCEP. High Performance Computer (HPC) code conversion tasks continued during the spring and summer of 1999 to ready the IBM RS/6000 SP system for operations. However, continuing environmental problems in Federal Building 4 at the Suitland Federal Center caused the NWS to reassess its position and to seek quarters better suited to a leading- edge HPC system. This decision caused the NWS to require that the SGI Cray C90 continue in service at least until December 1999. The month-by-month lease rate charged to NWS by SGI was $300,000. In June, SGI offered to sell the C90 to the NWS for $600,000 and charge $100,000 per month for support services. NWS accepted this offer and acquired ownership in July. On September 27 the C90 was effectively destroyed in a fire and numerical model operations were put into a backup mode. The IBM system was not available because it was being prepared to move to the Census Bowie Computer Center. Backup computational resources were organized around NCEP's two Cray J90 servers and the models run by several organizations including the U.S. Navy and Air Force, and NOAA's FSL. The backup production schedule was subject to delays and certain products were modified (reduced resolution, reduced outlook period) in order to accommodate the limited backup resources at NCEP's disposal. Overall, forecast accuracy was acceptable, although degraded, for the backup period, Sep. 27 - Nov. 23, 1999 due to the excellent collaborative efforts of the above organizations. The normal production schedule was resumed as soon as the IBM SP was available and ahead of its formal declaration as the operational system. Final IBM system check out and operational acceptance was completed on January 18, 2000. Shortly after acceptance (January 24, 2000), NCEP began upgrading its global weather forecasting model, an upgrade that had been delayed for over six months.

NCEP acquired a 32-processor SGI Origin 2000 HPC system in July 1999 to host several multi-year research and development projects. This system was selected by a group composed of a large number of NCEP staff, including users, technical support staff, and management, after careful consideration of the alternatives. The Origin 2000 system offered an excellent performance/price ratio and provided NCEP with an HPC architectural alternative to the IBM SP. This system was funded entirely from "soft money" sources and will not be used for operations.

In order to implement an operational, integrated suite of climate forecast products, NCEP submitted an initiative designed to augment the high-performance computer system (NCEP High Performance Computer for Implementation of Operational Integrated Suite of Climate Forecasts). Climate forecasting computational capabilities were sought for FY 2001 and beyond. The initiative was approved. Funding was reduced in the first year of performance ($2M in FY 2001) but full funding was approved for succeeding years ($5M). In order to meet climate forecasting

goals, NCEP consulted with the NOAA Procurement office and the Office of the General Counsel to devise a plan whereby the IBM RS/6000 SP system could be augmented in FY 2001 and the entire Class VIII system contract could be extended for one year, to end in September 2003. Management approval was obtained through consultations with the DoC Chief Information Officer, Roger Baker, and the NWS Assistant Administrator, Jack Kelly. NCEP expects to use FY 2002 funds earmarked for HPC operations to obtain a technical refreshment to carry the Class VIII through September 2003. A full and open competition for the next HPC system will be conducted during FY 2002 with award scheduled for August 2002. NCEP expects to restructure its HPC contracting model to provide a longer period of performance and to include a greater degree of flexibility, particularly with regard to HPC support services.

The latest high-performance computing initiative includes several critical subsystems, communications, interactive systems, and maintenance/support. NCEP anticipates that these subsystems will be acquired through both standard procurement techniques and by utilizing new contracting vehicles that allow for some flexibility in providing a service to NCEP through either hardware, software, services, or a combination.

An upgrade to NCEP's current communications system will be required to support the enhanced suite of products expected from the next generation high-performance computing system and to support collaborative scientific research projects. The next HPC system will produce an entirely new suite of operational forecasting products that must be transmitted to forecasters, in particular to the NCEP National Centers, in order to realize the full benefits of climate predictions. Climate research and development projects will be conducted with the assistance of HPC centers operated by other agencies such as the Department of Energy, various Universities, and other NOAA offices. These projects require massive amounts of data for completion and NCEP scientists need high-speed communications in order to efficiently conduct climate model research and development at distant HPC sites.

The cost estimates associated with communications were derived from preliminary discussions with FTS 2001 vendors. The TCP/IP network, established about 10 years ago at NCEP, will make future network interface straightforward since major communications vendors have stated their intention to move to completely IP-based networks in the near future. Networking hubs and other equipment will be required, especially during FY 2002, when the climate forecasting system is fully functional and product dissemination becomes critical. Recurring costs reflect cost estimates for ATM service provided by FTS 2001 vendors. This scalable service should prove to be the most cost-effective way for NCEP to communicate with other HPC centers and its operational centers at the National Hurricane Center, Storm Prediction Center, and Aviation Weather Center.

Interactive systems include the entire range of UNIX/LINUX systems, desktop workstations, workgroup servers, and larger application/communication servers. NCEP embarked on a UNIX system acquisition program about 10 years ago in an effort to provide its scientists with direct access to its HPC resource from their desktops. That program accomplished its goal and HPC access has been widely available. NCEP requires new systems to replace those that have become obsolete and a limited number that run the same UNIX version as the HPC system. Wherever

possible, low-cost LINUX systems are being used to replace expensive UNIX workstations. NCEP continues to replace systems so old that manufacturer support is no longer available. In addition to HPC connectivity, NCEP's UNIX systems perform other critical functions, such as producing graphic products for operational forecasting from HPC model output, reformatting data and products for dissemination within the NWS and for external users, handling data flow and reformatting for communication networking, and scheduling the job flow on the NCEP HPC system, to name just a few. These systems have completely replaced and perform all the critical functions supported by the mainframe computer systems used by NCEP several years ago. The cost for interactive systems is expected to increase with the advent of the Next Generation system in order to support the additional climate prediction products. The majority of interactive systems funds will be expended on application servers to host codes that cannot use HPC resources efficiently but are too large for desktop systems. Each operational application server system (computer and associated RAID disk array) costs about $250,000 and requires a maintenance contract and support. NCEP will require one or two of these servers each year; the remainder of the funds will support desktop system replacement, workgroup server acquisition, smaller disk and tape storage systems, output devices, and maintenance contracts.

Support services have become essential in supporting NCEP's business plan. Contracts to augment the Government's capabilities in the areas of UNIX system administration, network administration, software development, and software implementation are critical elements. In the future, NCEP expects these support contracts to expand in scope as the agency continues to become more efficient. NCEP is actively assessing its functions, seeking opportunities to establish outsourcing contracts, if practical.

NCEP Performance Measures*	FY 99	FY 00	FY 01	FY 02	FY03	FY 04
Hurricane Prediction System: 24 hour position accuracy (miles)	81/84	81	81	78	78	78
Mesoscale Eta Precipitation Forecasting over N. America: 0-48 hr. threat score difference (x100) compared to NGM	7.4/7.4	7.7	8.0	8.3	8.6	8.6
Global Prediction System: 12 mo. running mean, 500 Mb NH Anomaly Correlation, 5 day fcst	77.1/ 77.1	77.8	78.5	79.2	79.7	79.7

*The performance measure associated with Seasonal Climate Forecasts, was intentionally eliminated. NCEP's Climate Prediction Center determined that this particular measure was not suited to a general audience. An easier to interpret measure will be used in the future when climate forecasting becomes an operational product.

The numbers above must be considered with some sophistication. In most cases there is a great deal of inter-annual variability (or noise) that interferes with one's ability to note trends or improvements in these statistical performance measures over the short term. Also the atmosphere is more predictable in some years than in others.

The Eta Model is named for the Greek letter used as the symbol for its vertical coordinate. All Eta Model runs use the new 32 km resolution version of the model with 45 levels in the vertical. The threat score is a very strict measurement of forecast performance. It can be expressed in terms of both the false alarm ratio and the probability of detection. A correct forecast is defined as a forecast of an event with a matching observation of that event. A wrong forecast is defined as either a false alarm for the event or the occurrence of the event without it having been forecast. Using this terminology, the threat score may be defined as the ratio of the number of correct forecasts of an event (detections) to the number of wrong forecasts plus the number of correct forecasts for that event. The number of accurate forecasts of the non-occurrence of the event is not involved in the calculation. The threat score takes into account the fact that a certain number of correct forecasts can be expected by chance. The higher the threat score, the better the performance. The threat score based performance measurement used here compares two models, the new Eta to the older NGM. The higher the number, the better the performance of the Eta model.

The Global Prediction System Anomaly Correlation is used here as shorthand for correlation coefficient - a number ranging from -1 (or -100%) through zero to 1 (100%) which indicates how closely the variations in one quantity are related to variations in another quantity. The anomaly is defined as the departure from some long-term average or normal. In the case of weather, normal is simply what we call climate. The anomaly correlation of two weather-related quantities is simply the correlation between the departures of these quantities from climate. Thus the forecast doesn't get credit merely by telling us that it will be warm near the equator and cold near the poles. This performance measure is based on the predicted height of the 500 MB surface five days in advance, the anomaly correlation insures that simple climatologically correct forecasts are not given much credit.

NCEP High-Performance Computing Milestones	FY Goal
Implement direct utilization of GOES radiance data in regional model	Aug FY 00/Oct FY 99
Procure and install Class VIII IBM SP supercomputer system	Nov FY 99/Sep FY 98
Complete test and evaluation of Mesoscale Advanced 4D Data Assimilation	Sep FY 02/Jun FY 02
Class VIII IBM SP supercomputer fully operational	Jan FY 00/Nov FY 99
Initiate Class VIII IBM SP augmentation and extension process	Feb FY 00
Install Class VIII, Phase 2 supercomputer system	Oct FY 00
Install Class VIII Climate forecasting augmentation	Mar FY 01
Next Generation (Class IX) supercomputer full and open competition, contract award	Aug FY 02
Implement 10 km Eta (Mesoscale) Model	Nov FY 01
Implement integrated suite of operational climate forecasts (T62)	Sep FY 01/Jun FY 01
Implement Global Advanced 4D Data Assimilation	Dec FY 03/May FY 97
Implement T254, 60 level global model	Mar FY 02/Dec FY 01
Implement T126, 42 level climate forecast suite	Dec FY 04/Dec FY 03

With the acquisition and installation of the Class VIII and Next Generation supercomputers, NCEP will be able to operationally run numerical weather prediction models at a finer grid spacing, at more atmospheric levels, and look further into the future. Some models will be run more frequently. Here are some milestones relative to those scientific improvements.

Prediction Model Improvement Milestones	FY Goal
Hurricane Prediction System: 2/day, 18 km, 78 hr fcst	FY 99/FY 99
Hurricane Prediction System: 3/day, 18 km, 78 hr fcst	FY 00
Hurricane Prediction System: 3/day, 12 km, 120 hr fcst	FY 02
Hurricane Prediction System: 4/day, 8 km, 120 hr fcst	FY 03
Hurricane Prediction System: integrated into Weather Research and Forecast Model	FY 04
Mesoscale Eta Prediction System (North America): 2/day, 32 km, 48 hr fcst	FY 99/FY 99
Mesoscale Eta Prediction System (North America): 2/day, 22 km, 72 hr fcst	FY 00
Mesoscale Eta Prediction System (North America): 4/day, 10 km, 72 hr fcst	FY 02
Mesoscale WRF Prediction System (North America): 4/day, 8 km, 72 hr fcst	FY 04
Nested Mesoscale Eta Predictions (small domain): 1/day, 10km, 60 level west→4/day, 4km, 90 level, multiple	FY 98 - FY 03
Global Ensemble Forecasting System: 1/day, 225 km, 384 hr fcst	2nd Qtr FY 00
Global Ensemble Forecasting System: 1/day, 105 km, 0-84 hr fcst 1/day, 225 km, 84-384 hr fcst	4th Qtr FY 00
Global Ensemble Forecasting System: 1/day, 80 km, 1 month fcst	FY 03
Regional Ensemble Forecasting System: 48/day, 40 km	FY 01

Prediction Model Improvement Milestones	FY Goal
Regional Ensemble Forecasting System: 2/day, 15 km, 120 hr fcst	FY 03
Global (AVN/MRF) Prediction System: T126, 4/1 day, 105 km, 78/168 hr fcst	FY 99/FY 99
Global (AVN/MRF) Prediction System: T170, 4/1 day, 75 km, 78/168 hr fcst T62 (MRF), 1/day, 225 km, 168-384 hr fcst	2nd Qtr FY 00
Global (AVN/MRF) Prediction System: T254, 4/1 day, 60 km, 120/168 hr fcst T126 (MRF), 1/day, 105 km, 168-384 hr fcst	2nd Qtr FY 01
Global Prediction System: 4/day, 80 km, 168 hr fcst	2nd Qtr FY 03
Climate GCM 1/month, T40/300 km, 12 mo. fcst	FY 99/FY 99
Climate GCM 1/month, T62/225 km, 12 mo. fcst	FY 00
Climate GCM 1/month, T62/225, 12 mo. fcst	FY 01
High Resolution (T126) Operational Integrated Suite of Climate Forecasts	FY 03
Weather Research and Forecast Model	FY 04
Coupled Ocean-Atmosphere System for Medium Range (5-15 day) Forecasts	FY 04
Coupled Ocean-Atmosphere-Land Data Assimilation System	FY 04
Forecast input to Hydrology	FY 04
Regional Climate Forecast Model (15 km)	FY 04

NWS Telecommunications Gateway: The timely, reliable, and accurate dissemination of weather observations and guidance products is the critical mission of the NWS Telecommunication Gateway (NWSTG) operations facility. Delayed or garbled messages can result in the loss of life and property. The mission of the Gateway supports the NOAA strategic goal to "Advance Short-Term Warning and Forecast Services" and that goal's objective "to effectively disseminate products and services to users". Delayed or garbled information also negatively impacts the Department of Commerce mission of "...safeguarding the nations's economic infrastructure".

The NWS Telecommunications Gateway disseminates weather observations and guidance. Future improvements will be needed to increase capacity and reliability.

The Gateway provides message-switching services to a national and international community of customers. Flood and storm watches and warnings, weather forecasts, observations, and short-range climate forecasts are distributed to NWS field locations, U.S. Government agencies (FAA, DOD, FEMA, DOA), foreign governments, and private commercial users. The Gateway services a national and international customer base in a near-real-time operational environment.

The operational system continues to evolve to a network-centric architecture which will accommodate the legacy channel-connected structure. The higher capacity switch-engine and servers were implemented to permit the Gateway to collect the ever-increasing volume of observations from new observing systems and to disseminate the more frequent, larger-volume, finer-scale centralized forecasts from the National Centers for Environmental Prediction (NCEP).

In the past few years, data set sizes have experienced explosive growth. This growth is due, in part, to observations from new, automated, observing systems, and the new, finer-scale centralized forecast products from the meteorological centers such as the NCEP and the European Center for Medium Range Weather Forecasting (ECMWF). This increased volume of observations and the improved forecast products are required for achieving the NWS modernization and restructuring and for improved national weather and climate forecasts.

NWSTG's legacy systems were designed to handle data sets in the multi-Kilobyte-size. The NWSTG is now required to accommodate multi-Megabyte-size data sets routinely, a thousandfold increase. File Transport Protocol (FTP) is the method of choice for the efficient transfer of these large datasets, but requires the TCP/IP protocol which runs on networks. The NWSTG has been required to adopt an architecture that accommodates WAN and Internet-like connectivity to keep the NWSTG evolution in step with the systems of customers who are adopting these architectures as the standard medium of data exchange. Without this investment, the NWSTG will not be able to support our customers and take advantage of efficiencies in current and emerging communication technologies.

The installation in FY 1995 - FY 1997 of new higher-capacity switch engines and servers now permits the NWSTG to collect and distribute this ever-increasing volume of data. The Systems Operations Center (SOC) continues to move the NWSTG design toward a modular approach for

collecting and distributing data. The modular approach will allow the NWSTG to support current operations while embracing future information technologies. A major shift toward this modular approach occurred as a result of the FY 1995 - 1997 funding initiative.

An allied trend is the adoption of the Internet as the communication system of choice by many NWSTG customers to obtain current information. The NWSTG first began providing information on the World-Wide-Web in 1994. By the Spring of 1999, the data volume had risen to nearly 3,500,000 HTML pages of information retrieved from NWSTG servers each day; more than 20 Gigabytes of current information are stored on the server each day; and more than 100 Gigabytes of information are provided each day to Intranet customers using IP-based protocols (including DOD, FAA, and other Federal, State, and local government agencies). Extrapolating these exponential growth trends is hazardous at best, but NCEP anticipates model output alone will grow from 10 GB to 90 GB per day in FY 2000. Without a continuing investment in new telecommunications technology, the nation will not realize the maximum return on their investment in the NWS modernization.

The NWSTG has assumed many responsibilities previously done by military and other civilian Government agencies as they outsourced functions better done by other agencies. During the United Nations and NATO activities in the Balkans, the NWSTG was a primary source of meteorological data to the U.S., United Nations, and NATO operations. The NWS has also assumed the responsibility as the U.S. agent for the operations of the World Area Forecast System (WAFS). WAFS is a satellite broadcast of observations, forecasts, model data, and facsimile charts to support aviation operations. The NWSTG manages the operation of the satellite broadcast for the FAA, the U.S. representative charged with aviation support. Because of this assumption of responsibility by the NWSTG, military and other Government agencies are no longer capable of assuming responsibility for providing back-up telecommunication and processing for the functions of the NWSTG. The NWS has become the principal Government provider of domestic and international meteorological information to other Government users.

System Status and Plans - IBM RISC 6000 systems were introduced into the NWSTG for applications processing, data storage, and as Web servers. These systems were necessary to meet the data-distribution load experienced with the new, expanded, NCEP models and increased public use of the NWS Headquarters Web services. Other uses for the server systems included the creation of an expanded backup capability for products from NCEP, Fleet Numerical Meteorological Oceanographic Center, and Air Force Weather Agency and the implementation of FTP capability for data exchange.

Starting in mid-1990 with the growing popularity of the Internet and the ever-increasing ability of NCEP to produce an even greater volume of new products, it became imperative that the NWSTG increase its data processing and Web capability. Additional disk storage for the NWSTG central switching system also has been modernized with high-speed cable interfaces.

A new function for centralized distribution of radar data and products is now in development within the NWSTG. This process will utilize multi-casting technology. Implementation of this

technology will allow the decommissioning of legacy systems in FY 2000. It is being done by a contractor and the Office of System Operations will support the flow of products.

Increases in the capabilities of the NWSTG are also necessary to accommodate changes due to the increase in time and spatial resolution of the meteorological models created by NCEP. The upgrade was accomplished in FY 2000 and the DASD will also be upgraded in FY 2001. Another significant impact on the NWSTG memory and performance will be the requirement to increase the number of unique bulletins in the NWSTG tables from the current approximately 100,000 to nearly 200,000. This change is necessitated by the migration from the current technology, AFOS, to new technology, AWIPS.

During 1999, a networked file system was installed in the Gateway. The Andrews File System (AFS) provides data commonality across systems, providing high availability and supporting a clustered-server architecture. Firewalls were improved to provide high availability, security, and automated system failover.

As a result of these increases in capability and increased user demand, the service provided by the Gateway was significantly improved during FY 1999 as demonstrated by the following metrics:

Measure	End of FY 99 Figure	Increase from FY 98
Average daily log-ins to FTP Server	65,000	10%
Average daily data downloaded from FTP Server	48.9 GB	20%
Average daily data uploaded to FTP Server	13 GB	44%
Daily median number of hits to IWIN Server	1.4 million hits	12%
Average non-IP Data Traffic Input/day into the NWSTG	1.8 GB	50%
Average non-IP Data Traffic Output/day from the NWSTG	1.6 GB	0*
Increase in overall server (Internet and FTP) storage capability	140 GB	100%
Increase in overall server (Internet and FTP) processing capacity	0	0

*Traffic migration from non-IP connection to FTP exchange resulted in negligible increase in non-IP traffic output from the NWSTG.

NWSTG Performance Measures	FY99	FY00	FY01	FY02	FY03	FY04
Total volume of data handled through the Gateway per day (MB)	950/950	1,050	2,000	2,000	2,000	2,500
Total volume of data placed on the servers per day (GB)	100/100	150	300	500	1,000	1,500
Total volume of data retrieved from the servers per day (GB)	600/600	650	1,000	1,500	3,000	3,500

Gateway Milestones*	FY Goal
Implementation of Multi-casting Technology	FY00/FY 99
Implementation of additional DASD	FY01/FY 00
Implementation of additional network servers	FY01/FY 00
Implementation of Wind Profiler Monitoring	FY 00
Increase capacity and reliability of communication infrastructure	FY 03
Implement load balancers controlling server group	FY 03
Increase capacity of servers and routers	FY 03
Implement MQ-series Integrator	FY 02
Implement Advanced Data Delivery Technology (Socket-streaming) for Global Telecommunication System (GTS)	FY 02
Demonstrate High-Speed Data Delivery Utilizing Next Generation Internet	FY 02
Implement Advanced File Delivery System for Delivery of Data to NCEP	FY 02

* When two years are presented and divided by a "/", the first year represents the FY 99 accomplishment or the revised goal for future years. The second year represents the goal presented in the FY 99 Strategic Information Technology Plan.

Next Generation Weather Radar (NEXRAD) System:

NOT YET SUBMITTED

NEXRAD is NOAA's Doppler weather radar system. Upgrades to processing subsystems are needed to increase the benefits being obtained from the system and to reduce its costs.

Geostationary Operational Environmental Satellites (GOES) Ground System:

The GOES program supports the NOAA strategic goal to "Advance Short-Term Warning and Forecast Services" through meteorological monitoring of the Earth. Real-time data from GOES satellites, combined with data from doppler radars and Automated Surface Observing Systems, have greatly aided forecasters in the prediction of hurricanes, tornadoes, thunderstorms, winter storms, flash floods, and other severe weather. Early warning systems like GOES contributes to saving lives, preserving property, and protecting commercial interests. To ensure proper coverage, two GOES satellites must be in operational status at all times - one each at an eastern and western continental United States viewing longitude. Replacement satellites are launched based upon launch facility availability as well as economic factors, and placed in standby or storage orbits until needed. The last of the present GOES I-M series of spacecraft is scheduled for launch in FY 2002. In FY 2002, the first of the next GOES series, N-O-P-Q, is also scheduled for launch. The table below shows the number of satellites maintained and launches. The revised numbers reflect changes in the satellite launch schedule as well as the program's intent to maintain the degraded satellites in an non-operational orbit or "spinner" status until all instruments are unusable. The three spinners presently in inventory are scheduled to be transferred via a memorandum of agreement to NSF and NTIA in FY 2000. Only minimal telemetry analysis support will be required after the transfer.

The GOES ground system monitors and controls NOAA's geostationary environmental satellites. Upgrades are underway for future satellites.

GOES Satellite Counts	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04
# of satellites in operational status	2/2	2	2	2	2	2
# of satellites in standby/storage orbit status	1/2	2/1	2	2/1	2	2
# of satellites in "spinner" status	3/3	3	0	0	2	2
# of satellite launches	0/1	1/0	0	0/2	2/0	0

NESDIS is responsible for the operation and maintenance of the GOES ground systems. Primary responsibilities fall into three categories: satellite health and safety; meteorological data reception and dissemination; and data archiving. The NESDIS Satellite Operations Control Center (SOCC) in Suitland, MD monitors and controls the spacecraft via the sixty-foot antennas located at the Wallops Command and Data Acquisition Station (CDAS) in Wallops, Virginia. SOCC is equipped with just receive-only antennas. Raw meteorological data is received and processed at the Wallops CDAS for retransmission via the GOES satellites to primary end users like the National Weather Service (NWS) Field Service Stations. The Wallops facility is also equipped to perform many of SOCC's functions in case of a SOCC failure. In case of a transmitting antennae failure, a Wallops backup facility is located at Goddard Space Flight Center in Greenbelt, MD which is capable of operating a single satellite.

The GOES ground system IT architecture basically consists of three parts: Telemetry and Command Transmission System (TACTS); the GOES I-M Telemetry and Command System (GIMTACS); and the Operations Ground Equipment (OGE). TACTS is collocated with the antennas and converts satellites RF signals into digital data for the ground system computers, and converts ground station commands to RF for upload to the satellite. GIMTACS handles all spacecraft health and safety checks, and commanding of the spacecraft. The OGE monitors the quality of processed instrument data; determines spacecraft location and attitude; provides instrument calibration data; and provides navigational inputs. The OGE consists of five subparts: the OGE data acquisition and patching system (ODAPS); sensor processing system (SPS); product monitor (PM); orbit and attitude tracking system (OATS); and OGE input simulator (OIS).

The GOES ground system physical IT architecture is a mixture of DEC Alpha and VAX servers, and a Sun Solaris server in a DEC hub arrangement. Workstations for controllers, schedulers, programmers, and engineers are also connected to the DEC hub. SOCC and the CDAS are connected via a Wide-Area-Network.

System Status and Plans - The GOES L and M launches are delayed due to NASA revising the launch schedule because of a launch vehicle failure investigation. The replacement product monitor procurement award was protested after award. Development could not commence until this was resolved. The Wallops backup at Goddard is delayed due to antenna gearing mechanism difficulties. The percentage of data that was sent by the satellites recovered by the GOES ground system was 98%, which met the base goal of 98%. No catastrophic failures occurred so downtime was negligible, lasting only a few minutes due to equipment redundancy.

To support the increasing satellite load, the SOCC and CDAS plan to automate the telemetry function. The network for connecting the OGE components to the GIMTACS system must be upgraded from the outdated X.25 protocol to TCP/IP. The antiquated mainframe-based DAPS system must be updated to a distributed system via the DAPS II procurement. The GOES simulator must be rehosted to a new server to avoid using the backup server for development. The telemetry data archive, the GOES Engineering Analysis System (GEAS), will be replaced by

the Common Engineering Analysis System (CEAS), which has enhanced functionality and standardizes the SOCC telemetry archives around one application.

The ground system must be prepared for the GOES-M as well as the next generation of GOES satellites, N-O-P-Q. If the ground system is determined by NOAA and NASA to be inadequately prepared to support launch and operation of the new satellite series, NASA will postpone launches, incurring satellite storage expenses and risking the loss of meteorological data due to failed satellites not replaced in a timely fashion. Additional GOES ground system procurements required for GOES N-O-P-Q are the GOES N Telemetry Acquisition and Command Transmission Subsystem (NTACTS); GOES Telemetry and Command System (GTACS) ; and OGE software enhancements to the SPS, PM, and OATS. NTACTS and GTACS will be delivered under the NASA GOES N-O-P-Q spacecraft contract. The NESDIS Office of Systems Operations (OSO)/Office of Satellite Division (OSD) will acquire the remaining OGE software enhancements in the current Professional Support Services (PSS) contract and the pending PSS N-O-P-Q procurement (formerly referred to as Post Engineering Installation Support (PIES) procurement). After NTACTS delivery, OSO/OSD will also be acquiring software development services for an enhanced version of NTACTS for the Wallops backup site at Goddard Space Flight Center that will be capable of operating with either GIMTACS or GTACS. This will be part of the pending PSS N-O-P-Q procurement.

NESDIS has system engineering support contracts with CSC, Mitretek, and Allied Signal. These are not IT contracts, but subtasks that occasionally involve planning for IT systems.

The SOCC facility is currently located in Federal Building (FB) 4 at the Federal complex in Suitland, MD, but NESDIS plans to relocate the SOCC facility to FB-5 after it is constructed. Planning is in its early stages, but significant IT dollars will be required for the relocation to FB-5.

Performance Measures*	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04
Data Recovery Rate (%)	99/98	98	98	98	98	98
Maximum continuous downtime (hours)	0**/6	6	6	6	6	6

** This system previously used the number of satellites and launches supported for performance measures. This year the performance measures were changed to better capture the IT performance of the system.*

*** Very little downtime due equipment redundancy. No major failures. Downtime minutes rounded down to zero hours.*

GOES Ground System Milestones	FY Goal
GOES L launch	FY 00/FY99
Replacement OGE product monitor becomes operational	FY 01/FY99
Wallops Backup at GSFC becomes operational	FY 01/FY99
Upgrade GIMTACS workstations	FY 00
GOES N-O-P-Q ground systems development begins	FY 00
GOES simulator rehost complete	FY00
Telemetry archive complete	FY00
Replacement GIMTACS TACTS becomes operational	FY 01
DAPS replacement complete	FY02
TCP/IP Implementation complete	FY02
GOES M launch	FY 03/FY02
GOES N-O-P-Q ground system - installation and test	FY 03
GOES N-O-P-Q launches	FY 03 - FY 10
SOCC CDA 3C telemetry automation complete	FY08

Forecast Systems Laboratory (FSL) High Performance Computing System (HPCS): As NOAA moves into the next decade, it will require substantial increases in computing resources in order to address its mission of describing and predicting the physical, chemical, and biological makeup of the earth and its environment. Commodity-based cluster computers promise to provide the most cost-effective computer power available to meet requirements. Although many of NOAA's applications are ideally suited to the cluster architecture, a substantial effort is still required to develop applications and procedures to make this transition.

FSL's newly acquired HPCS (called "JET") is one of the first commodity-based cluster computers, with 276 nodes of COTS Compaq Alpha systems with 667 MHz processors and 512 MB of memory. JET will use the LINUX operating system..

The laboratory's Advanced Computing Branch (ACB) guarantees continued progress toward higher-resolution analyses and forecasts by porting FSL and NCEP models to commodity-based clusters, the supercomputers of the future. To achieve the ports, the ACB developed the Scalable Modeling System (SMS), which significantly enhances the ability to develop parallel

finite-difference weather models and provides source-code portability between a large subset of existing MPPs.

Currently, SMS has four components: the Nearest Neighbor Tool (NNT), the Scalable Runtime System (SRS), the Parallel Preprocessor (PPP), and the Scalable Spectral Tool (SST). NNT is a high-level library that can be used to parallelize regular grid weather prediction models. The requirements that were followed in the design and implementation of NNT are: portability of source codes and data files from workstations to massively-parallel computers; ease of programming; minimizing development costs; minimum impact to code appearance; fast performance on a wide variety of machines; and fast I/O operations. SRS is a support subsystem that provides scalable I/O and other system services. PPP is a Fortran source-to-Fortran-source translator that brings the features of NNT into directive (Fortran comment) form. SST provides support for numerical weather prediction models based upon spectral transforms.

To date, SMS has been ported to the HPTi ACL (commodity-based Compaq Alpha cluster), Intel Paragon; IBM SP2; Silicon Graphics Challenge, Origin; Sun Multiprocessor, Enterprise 10000; Hewlett-Packard Multiprocessor, Exemplar; Network of Unix workstations; DEC Alpha-based SMPs; Fujitsu VPP; and Cray T3E, YMP, C90, and J90.

FSL has acquired a commodity-based cluster with peak speed of approximately 0.34 teraflop and a 10-20% sustainable performance for running finite-difference models of the atmosphere and ocean. By FY 2001, the peak speed will be greater than .8 teraflop, increasing to a peak speed greater than 4 teraflops by FY 2003. This system, with significantly improved processing speed, will be made available as a resource to all of NOAA for developing and testing high-resolution models capable of depicting the detailed nature of weather systems, climate change, and ocean circulations. The system will serve as the technology platform for major NOAA developmental activities. Utilizing this new computer resource, FSL will:

- Support the North American Observing System (NAOS) Program, taking the lead role in the scientific assessment of current and proposed future observing systems to work toward a more cost-effective mix of observing systems;

- Continue the development of the high-level software library, SMS, to ease the conversion process of software routines from the traditional shared-memory machine to massively-parallel scalable architecture; and

- Continue to collaborate with NCEP and other organizations and university groups on developing the next-generation state-of-the-art mesoscale weather prediction model that will be used in both operations and research (the Weather Research and Forecasting (WRF) model).

System Status and Plans - Using the Department of Commerce's CONOPS (Concept of Operations) acquisition approach, which focuses on dramatically streamlined processes, high performing and empowered work teams, early involvement and partnerships with vendors, and new uses of technology, FSL formed a cross-functional team to conduct the FY 1998-99

acquisition of the HPCS, which includes requirements for a mass storage system (MSS), storage area network (SAN), applications and systems software, on-site training, on-site technical support, and hardware/software maintenance support. Core and associate team members include modelers, technical support staff, FSL senior managers, and contracting and legal staff.

In September 1999, a 5-year contract was awarded to High Performance Technologies, Inc. (HPTi) for the delivery of an HPCS consisting of a 256-node Alpha Linux cluster, a 100 TByte robotic Mass Store System (MSS), and a 500 GByte fibre-channel connected Storage Area Network (SAN). The Compaq nodes use the Myrinet interconnect fabric.

The HPCS was delivered in November, 1999 and was conditionally accepted at the end of January, 2000. It became operational for FSL development in April, 2000 and will be available for other users soon after. Upgrades will occur in November, 2000 and July, 2002.

The process for the procurement for the follow-up HPCS will begin in Spring, 2002. As before, the CONOPS process will be followed.

In FY 1999, the Rapid Update Cycle 2 (RUC2) model was implemented on FSL resources to serve as a backup to NCEP. RUC2 is part of the suite of operational weather models run by the National Weather Service at NCEP. The RUC2 backup was operational a few days after a fire in the primary NCEP computer in late September. The RUC2 backup was ported to the new HPCS in April, 2000.

During the past two years, FSL has participated in a test of a NAOS hypothesis, which says that rawinsonde soundings and nearby ascent/descent soundings provided by commercial aircraft are essentially redundant for the purposes of numerical weather prediction. The test was made possible by NASA's donation of computer time on a Cray J-90. Unfortunately competition for resources on this machine resulted in slow progress. The arrival of the HPCS at FSL will greatly accelerate progress, especially because 40% of the HPCS resource is dedicated to NAOS testing.

FSL is actively participating with NCEP, NCAR, the Center for the Analysis and Prediction of Storms at the University of Oklahoma, and other universities in the development of the Weather Research and Forecast (WRF) model. Another 40% of the HPCS at FSL is dedicated to model development, thereby reserving substantial computing resources for early WRF model testing.

Product improvements to SMS continued in FY 1999. SST was more tightly integrated into PPP. The need for processors dedicated to I/O was made optional. Continued efficiency enhancements were made throughout SMS.

During FY 1998, in concert with the FSL HPCS and Central Weather Bureau of Taiwan acquisition efforts, four new architectures are now supported by SMS. These architectures are the Sun E10000 server using Sun's implementation of MPI, the HP Exemplar using HP's implementation of MPI, clusters of Compaq (formerly) DEC Alpha-based SMPs using Compaq's implementation of MPI, and the Fujitsu VPP series using Fujitsu's implementation of MPI.

During FY 1998, two new models were parallelized using SMS. The Global Forecast System (GFS) from the is the first model to make use of the Scalable Spectral Tool (SST). This model was used by the Central Weather Bureau of Taiwan as a benchmark during their procurement. The in-house development of the Quasi Nonhydrostatic model was parallelized to enable testing at higher resolution and support FSL's HPCS acquisition.

FSL's acquisition of a HPCS will provide benefits in three major areas. The continued development of the SMS will enable scientists to better utilize MPP computers. SMS provides a programming environment that simplifies the porting of numerical models to the MPP environment. This should allow scientists to concentrate on the science of improving prediction systems.

Second, the HPCS will provide a development platform for FSL and collaborators elsewhere in NOAA, at NCAR, and in the universities to enhance NOAA's environmental prediction systems. Foremost among these is the WRF model, which is expected to provide operational, nonhydrostatic, mesoscale predictions at a gridpoint spacing of less than 10 km within 5-6 years. Due to the experimental and collaborative nature of the WRF model, the demonstration of its success is based more on milestones (as represented in the FSL HPCS Milestone table below) than on empirical measurements.

Third, the HPCS guarantees substantial resources for testing NAOS hypotheses. Tests on Hypothesis 2, regarding the efficacy of radiometric and wind-drift observations from the GOES satellite in numerical forecasts, will begin almost as soon as the HPCS is fully operational. Given the expenditure of hundreds of millions of dollars on observing systems, it is vital that computing resources be dedicated to answer the central NAOS question: are we fully exploiting existing observing systems and getting the most for our dollars when we deploy new systems?

The development of better environmental prediction models will provide the basis for improved weather prediction products for the nation. With the HPCS, FSL will be able to continue its multi-faceted developments toward that goal.

FSL HPCS Performance Measures	**FY 99**	**FY 00**	**FY 01**	**FY 02**	**FY 03**	**FY 04**	**FY 05**
SMS Improvements							
Annual # of new features released to the public domain	2/1	2	2	2	2	1	1
Annual # of new computer architectures supported	1/1	2	1	2	1	1	1
Annual # of efficiency improvement	-	10	10	10	-	10	-
NAOS Observing System Improvements							

FSL HPCS Performance Measures	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04	FY 05
Annual # of observing system configurations evaluated	-	2/4	3/6	3/5	3/5	3	3
Develop (with others) a high-resolution non-hydrostatic community mesoscale model							
Annual # of additional applications capable of utilizing the new HPCS	1/1	1	1	2	2	2	2

* When two numbers are presented and divided by a "/", the first number represents the achieved FY 99 performance measurement. The second number represents the measure presented in the FY2000 -FY2003 Strategic Information Technology Plan.

FSL HPCS Milestones	Status	Start Date	Completion Date
Form CONOPS team	Complete	2/98	3/98
RFI call	Complete	3/98	8/98
RFP call	Complete	8/98	3/99
Receive offer or proposals	Complete		8/99
Live test demonstrations	Complete	7/99	8/99
Receive final proposals (for offerors in competitive range)	Complete		8/99
Contract award	Complete		9/99
Installation	Complete	11/99	12/99
Acceptance test	Complete	12/99	1/00
RUC2 backup ported	Complete	2/00	4/00
Full operation	Planning	12/99	
Begin extensive numerical modeling assessment activities for NAOS		6/00	
Port initial version of WRF model		10/00	
Interim upgrade		11/00	
Begin procurement process for followup		5/02	

FSL HPCS Milestones	Status	Start Date	Completion Date
Quasi-operational runs of WRF model		10/02	
Final upgrade		10/02	

National Space Weather Information System (NSWIS): To accomplish its mission, the Space Environment Center (SEC) must (1) conduct research to better understand the solar-terrestrial environment; (2) help develop and deploy new instrumentation and techniques for measuring and describing this environment; (3) make the transition from this research and development into operations; (4) ingest, process, and verify numerous real-time data streams; (5) assimilate and analyze numerous sources of information and real-time data streams to produce and disseminate the nation's official alerts and warnings; (6) disseminate real-time data and products to partners, other government agencies, civilian organizations, vendors and the general public; and (7) prepare data for archiving by NOAA National Geophysical Data Center. These tasks are carried out through partnerships, cooperation, and the exchange of data and information with a number of national and international organizations, including the USAF, NASA, and the International Space Environment Services (ISES). Much of this is accomplished through SEC's NSWIS, a complex collection of diverse, heterogeneous, distributed data ingest, processing, display, and dissemination systems, which must continue to evolve with changing requirements, constraints, and new technologies. NSWIS is an operational system that must be supported 24 hours a day and 7 days a week. Now that SEC has become a NWS National Center Environmental Prediction (NCEP), NSWIS must become more integrated with NWS's Advanced Weather Information Processing System (AWIPS) and other components of the NWS and NCEP IT architectures.

The National Space Weather System supports the monitoring and prediction of solar and geophysical events. Predictions need to be better integrated with AWIPS and other architectures.

System Status and Plans - Although SEC's Rapid Prototype Center (RPC) efforts were scaled back from original plans due to a lack of funding and a breakup of the initial Cooperative Research And Development Agreement (CRADA), the Magnetospheric Specification Model (MSM) was successfully placed into operation during FY 1999. Two new models, the Geomagnetic Activity Index model, which predicts Geomagnetic Activity, and a predictive version of the MSM, are currently in final testing and will be made operational during FY 2000. Although this progress exceeds expectations, it will not be possible to achieve performance measures starting in FY 2001 without additional resources. Progress beyond FY 2001 assumes additional resources will be made available through SEC's FY 2002 budget initiative.

For several years SEC has been developing its Information Dissemination System (IDS), a distributed object architecture that utilizes CORBA (Common Object Request Broker

Architecture). The goals of this project are to convert the SEC solution-based distributed architecture to a more robust, easier-to-maintain, and evolved framework-based distributed architecture; and to better process, display, and disseminate the large variety of space weather data. Development of this system has been slower than initially projected due to funding delays and resources limitations. However, SEC has developed and deployed initial builds of two main servers and is now servicing internal and USAF clients. Companion projects, which utilize this architecture, have also progressed. The initial build of the Java/CORBA-based Data Display System (DDS) has been developed and will replace SEC's current Real Time Monitor (RTM) systems over the next two years. A proof-of-concept Data Simulation System (DSS) has demonstrated how the IDS servers can be reused to disseminate simulated data to any IDS clients for test, validation, training, and demonstration purposes. Build 2 of the IDS and DDS, and build 1 of the DSS are planned for late FY 2000 through early FY 2001. Follow-on builds are planned at 6 month intervals into FY 2002. These builds will address performance issues, make additional data available, and add agents and services to enhance the systems functionality and robustness. However, progress will depend on the availability of NASA funding and SEC's FY 2001 budget initiative.

NSWIS's current primary database is a proprietary database developed in 1980, known as the DMS (Data Management System). Replacement of this database with a commercially available database is a high priority. The task of replacing the DMS is made difficult because of the tight coupling between the DMS and NSWIS's data ingest subsystems and numerous client applications. The DMS replacement project will begin in FY 2000, initial operation of the new database is expected in FY 2001, with complete replacement and decommissioning of the DMS scheduled in FY 2002.

SEC's external Web site has grown tremendously in size and usage over the years and is currently experiencing over 1.5 million hits per week. In FY 2000 SEC will undertake a project to modernize and redesign its Web site to make it easier for customers to use.

Other NSWIS technology enhancement and refreshment efforts will be carried out on a routine basis as the need arises, and funding and resources permit. Current plans are to investigate and correct issues with IT security and to analyze NSWIS's ingest system architecture. These analyses will help determine further actions.

Although GEOSTORM funding never materialize, SEC will continue efforts to obtain and make available to forecasters and customers valuable new real-time space weather data sources from research mission spacecraft and other non-NOAA sources. SEC's involvement in these projects includes helping to determine necessary spacecraft and telemetry modifications, securing tracking resources, and developing data ingest, processing, and assimilation methods to make use of the data streams regardless of their origin and format. Through this effort auroral oval images from NASA's IMAGE satellite will be available in FY 2000. Likewise, there are plans to receive and make available real-time upstream solar wind data from Triana in FY 2002.

NSWIS must also accommodate several new NOAA operational satellite data streams over the next several years. Algorithm development, processing, and dissemination of data and products

for the new Space Environment Monitors (SEM's) aboard NOAA/TIROS 15, launched in FY 1999, will be made available in FY 2000. NSWIS must also accommodate the tracking; data ingest, processing and verification, and display; product generation; and dissemination for GOES L SEM data in FY 2000. GOES M, which includes the first Solar Xray Imager (SXI), is scheduled for launch in FY 2001. In order to accommodate the new GOES SXI data stream, a new SXI image database and ingest, processing, display, dissemination, and instrument control capabilities must be added to the NSWIS. GOES spacecraft beginning with GOES N will also carry new SEM's and utilize a different telemetry channel. Currently two SXI follow-on have been authorized for GOES N-Q. GOES N launch is currently planned for FY 2003.

In FY 1999 numerical guidance upgrades were made to improve flare and geomagnetic activity forecasts and to update NSWIS's proton prediction model. The addition of several operational numerical models to the NSWIS is planned starting in FY 2002. The implementation of these models will require additional IT funding and resources and are included as a critical components of SEC's FY 2002 initiative to "Execute Space Weather Research and Development".

SEC also has a FY 2002 initiative to "Integrate Space Weather Forecast into the National Weather Service Operational Product Suite". At this point the integration of SEC's operations into the NWS could take several different routes with significantly different impacts to the NSWIS. At the very least NSWIS will have to adapt to new data streams and dissemination systems.

Performance Measures*	FY 99	FY 00	FY 01	FY 02	FY 03	FY04
Total # of product types distributed via the NOAA Weather Wire Service	13 / 12	14	14	15	16	18
Annual # of new R & D products making the transition to operations	1 / 1	1	2	2	2	2
Annual # of major new data streams	2 / 1	1	1	0	0	1

*(Note to clear up possible misunderstandings some performance measures were reworded and measured differently from previous plans). When two numbers are presented and divided by a "/", the first number represents the achieved FY 99 performance measurement or the revised measure for future years. The second number represents the measure presented in the FY 99 Strategic Information Technology Plan.

NSWIS Milestones*	FY Goal
Complete the core of the RPC software (Build 3)	FY 02/FY 99
Move all operations and systems to new building	FY 99/FY 99
Upgrade National Space Weather Information System to allow analysis and numerical guidance to forecasters and customers	FY99/FY 99

NSWIS Milestones*	FY Goal
Implement modernized data acquisition, analysis, display and dissemination system (Build 2)	See note.
Ready to ingest, process, display and disseminate data from GOES L	FY 00
Implement Build 2 of DDS	FY 00
Begin project to replace DMS	FY 00
Upgrade SEC's external Web site	FY 00
Ingest, process, and display real-time images of aurora from NASA's IMAGE satellite	FY 00/FY 00
Begin program to develop mission (GEOSTORMS) to follow NASA's ACE in partnership with NASA and USAF	Initiative not funded/FY 00
Acquire real-time solar wind data from Triana	FY 02/FY 00
Issue global maps predicting ionospheric variability for communicators and navigators	FY 02/FY 01
Forecast radiation belt particle enhancements with improved lead-time	FY 02/FY01
Co-operate with USAF to implement ingest and processing of new solar x-ray data from GOES satellite	FY 02/FY 01
Ready to ingest, process, display and disseminate SEM and SXI data from GOES M	FY01
Implement Build 2 of IDS	FY 01
Implement Build 1 of DSS	FY 01
Complete analysis of NWSIS security and make initial corrections	FY 01
Complete analysis of NWSIS ingest system architecture.	FY 01
Achieve initial functionality of DMS replacement	FY 01
First data from GEOSTORMS	Initiative not funded/FY 02
Complete final builds of IDS, DDS & DSS	FY 02
DMS is completely replaced and decommissioned	FY 02
Ready to ingest, process, display and disseminate data from GOES N	FY 03
Issue region maps, at higher resolution, predicting ionospheric variability with data assimilation	FY 04

*Note - last year's milestone to "Implement modernized data acquisition, analysis, display and dissemination system (Build 2)" was replaced by two milestones "Implement Build 2 of IDS" and "Implement Build 2 of DDS" to clear up possible confusion. When two years are presented and divided by a "/", the first year represents the FY 99 accomplishment or the revised goal for future years. The second year represents the goal presented in the FY 99 Strategic Information Technology Plan.

Central Environmental Satellite Computer System (CEMSCS): CEMSCS, operated by the NESDIS Office of Satellite Data Processing and Distribution, is NOAA's primary data-processing system for the Nation's environmental satellite data. CEMSCS ingests environmental data from NOAA's polar and geostationary spacecraft, and produces environmental products and parameters such as vertical atmospheric measurements (soundings), low-level wind vectors, and sea-surface temperatures. These data and products are critical inputs to NWS analyses and forecast models. The system is also used for satellite image production and serves as the host system for the digital satellite data archive (see the chapter on "Implement Seasonal to Interannual Climate Forecasts"). Although the primary uses for NESDIS polar-orbiting satellite products are as inputs to the forecasts and warnings provided by NWS, these satellite data are also used in many other environmental information contexts by numerous Federal agencies, state governments, and the public and private sector. These uses include analyzing climate change; detecting volcanic eruptions and wilderness fires and tracking associated dust clouds; and monitoring the health of vegetation, the growth of deserts, and deforestation. CEMSCS also ingests and processes data from non-NOAA satellites to produce products to support protection, restoration, and sustainable use of coastal and oceanic ecosystems.

CEMSCS is the central processing system for environmental satellite data. Upgrades will be needed to support requirements from new satellites and instruments.

CEMSCS has established a modern distributed-processing architecture to support the many different types of products that will be generated from the datasets created by new satellite systems (NOAA K-L-M-N-N', METOP, GOES I-M, ADEOS, Radarsat, and EOS). The CEMSCS architecture consists of powerful alternative platforms (i.e. servers and workstations) attached to an enterprise server in a client/server configuration. The enterprise server acts as a clearinghouse or traffic cop for data transfer to alternative processing platforms, as well as data and product distribution to a wide range of customers in the environmental studies, climatic research and meteorological communities world-wide. The primary computing platform is the Amdahl GS732 enterprise server using the Open Systems/390 (OS/390) operating system. An example of one of the alternate platforms is a Cray J916 processor that produces the Advanced TIROS Operational Vertical Soundings (ATOVS) from the advanced suite of instruments on the NOAA-15 satellite.

This activity supports the NOAA strategic goal to "Advance Short-Term Warning and Forecast Services" by providing products from polar and geostationary satellites, enhancing the capabilities to meet the objectives of a modernized NWS, and to aid forecasters in providing more precise and timely forecasts.

System Status and Plans - The CEMSCS remains a viable operational production architecture for the current base-lined requirements. The Advanced TIROS Operational Vertical Soundings (ATOVS) product development for the new instruments on board NOAA-15 was completed ahead of schedule. With the successful launch of the NOAA-15 satellite on May 13, 1998, operational implementation of ATOVS was completed April 27, 1999, 7 months ahead of original estimates. A new soundings system, the Advanced Microwave Sounding Unit B (AMSUB) is scheduled to become operational on March 27, 2000. The FY 1999 performance measures were projected at 500 (M) Satellite-derived Atmospheric Moisture Profiles, however zero were produced due to problems with the instruments on the spacecraft. In addition, the performance measures beginning in FY 2003 have been reduced to zero since the AMSUB data will be incorporated into ATOVS during FY 2003.

Development continues on a system to process and distribute, in near real-time, Moderate Resolution Imaging Spectroradiometer (MODIS) data from NASA's Earth Observing System (EOS) satellite. The EOS satellite was launched in December 1999, 24 months behind schedule. The performance measures for Global Temperature and Water Vapor Profiles have been significantly reduced since the National Weather Service does not want MODIS data used as input to Soundings products. As of February 2000, EOS is producing level 1B products with first light data. This system will also be used for processing data from future launches of this satellite series.

The QuickSCAT Mission is a quick response mission to the loss of the NSCAT instrument on the NASDA ADEOS spacecraft. It was launched on June 19, 1999 and is now processing SeaWinds scatterometer data as of February 2000 from the QuikSCAT system using the processing modules developed by JPL. The SeaWinds data is available in BUFR format to the user community. The performance measures for the Global Ocean Surface Winds Profiles were zero generated for FY 1999 since the launch was delayed until FY 2000.

The NOAA-N satellite is scheduled to be launched in December 2003 and the NOAA/EUMETSAT Meteorological Operational (METOP-1) satellite in June 2003. Satellite Processing will have the capability of processing all instruments from NOAA-N and METOP-1 to Level-1 at day-one launch. In addition, the METOP instrument GOME will be taken to Level-2 (ozone products). Requirements need to be identified and refined for products from the following instruments: Infrared Atmospheric Sounding Interferometer (IASI), Global positioning system Receiver for Atmospheric Sounding (GRAS), and Advanced Scatterometer (ASCAT).

CEMSCS Performance Measures*	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04
% successful product delivery	96/90	90	90	90	90	90

CEMSCS Performance Measures*	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04
Total annual # of Global Temperature and Water Vapor Profiles collected ATOVS,RTOVS, SSMT1, SSMT2 (M)	174/ 1430	321/ 3500	321/ 3500	222/ 3500	222/ 4500	222/ 4500
Total annual # of Global Ocean Surface Winds products (B/M)	0/ 268	1.2/268	1.2/268	1.2/268	1.2/268	1.2/268
Total annual # of Satellite-derived Low -Level Winds Profiles (M)	1.2/1.3	1.3	1.3	1.3	1.3	1.3
Total annual # of Satellite-derived Atmospheric Moisture Profiles AMSUB(M)	0/ 500	390/ 500	1000/ 500	1000/ 500	0/500	0/500
Total annual # of Global Ozone Measurements collected (M)	1/1	1	1	1	1	1
Total annual # of Global Cloud Cover Images collected (K)	37/40	40	40	40	40	40
Total annual # of Satellite-derived Ocean Products (AVHRR Coast Watch) (K)	286/ 178	178	178	178	178	178

* When two numbers are presented and divided by a "/", the first number represents the achieved FY 99 performance measurement or the revised measure for future years. The second number represents the measure presented in the FY 99 Strategic Information Technology Plan.

CEMSCS Milestones*	FY Goal
ATOVS software operational for NOAA-K	FY99/FY 99
NASA EOS AM-1 products operational	FY00/FY 99
Second New Generation Satellite (NOAA-L) products operational	FY 00
NASA EOS PM-1 products operational	FY 00
ADEOS II products operational	FY 01
CEMSCS upgrades for METOP processing	FY 02
Cooperative European METOP Satellite products operational	FY 03
Next Generation NOAA-N' products operational	FY 03

CEMSCS Milestones*	FY Goal
METOP Instrument products operational (non-NOAA)	FY 04

* When two years are presented and divided by a "/", the first year represents the FY 99 accomplishment or the revised goal for future years. The second year represents the goal presented in the FY 99 Strategic Information Technology Plan.

Polar-orbiting Operational Environmental Satellites (POES) Ground System:

Through meteorological monitoring of the Earth, POES supports the NOAA strategic goal to "Advance Short-Term Warning and Forecast Services." NOAA polar-orbiting satellites provide global and local coverage for collecting meteorological data used in predicting, monitoring, and observing trends of weather. Polar satellites provide real-time weather data used to develop short-term weather forecasts and to provide a continuous data archive for long-term climate studies ranging from the vegetation index to monitoring the ozone layer, as well as providing search and rescue services.

The POES ground system monitors and controls NOAA's polar-orbiting environmental satellites. System changes are needed to support convergence with other polar environmental satellite systems.

On May 5, 1994, President Clinton made the decision to merge the United States military and civil operational meteorological polar satellite systems into a single, national system. The Defense Meteorological Satellite Program (DMSP) and the NOAA satellite program will be converged into the unified National Polar-orbiting Operational Environmental Satellite System (NPOESS) with a first launch scheduled for 2007. At present, two DMSP satellites are maintained in an operational orbit. In a first step toward the NPOESS convergence, special-purpose components of the DMSP telemetry and command system have been relocated to SOCC and incorporated into a new telemetry and control system paralleling the Polar Acquisition and Command System (PACS). The new DMSP system is named Integrated Polar Acquisition and Command System (IPACS). A similar IPACS configuration is installed at Schriever Air Force Base in Colorado as backup for the SOCC's IPACS system.

Capitalizing upon the existing POES program, an agreement is in place between NOAA and EUMETSAT (European Organization for the Exploitation of Meteorological Satellites) on the Initial Joint Polar System (IJPS). This program will include two series of independent but fully coordinated NOAA and EUMETSAT satellites, exchange of instruments and global data, cooperation in algorithm development, and plans for real-time direct broadcasts. Under terms of the IJPS agreement, NOAA will provide the satellites for flight in the P.M. orbit and EUMETSAT will provide the satellites for flight in the A.M. orbit. All satellites will have a common core set of meteorological instruments. The METOP (Meteorological Operational) satellite will serve as the A.M. satellite for the U.S. civilian polar orbiting mission. The first of the IJPS satellites, METOP-1, is scheduled for launch in FY 2003.

NESDIS is responsible for the operation and maintenance of both the NOAA and DMSP ground systems. Primary responsibilities fall into three categories: satellite health and safety;

meteorological data reception and dissemination; and data archiving. Since the NESDIS Satellite Operations Control Center (SOCC) in Suitland, MD is equipped with just receive-only antennas, SOCC monitors and controls the spacecraft via antennas located at the Wallops Command and Data Acquisition Station (CDAS) in Wallops, Virginia and the Fairbanks CDAS in Fairbanks, Alaska. The Wallops facility is also equipped to perform many of SOCC's functions in case of a failure.

The POES ground system physical IT architecture is a mixture of DEC Alpha and VAX servers, and a Sun Solaris server in a DEC hub arrangement. Workstations for controllers, schedulers, programmers, and engineers are also connected to the DEC hub. SOCC and the CDASs are connected via a Wide-Area-Network.

Launches are scheduled to replace aging satellites in order to maintain two operational polar satellites in orbit at all times - the A.M. satellite crossing the equator at a morning local time, and the P.M. satellite crossing the equator at an afternoon time. Operational satellites are replaced by newly launched satellites when their instruments degrade to a substandard state or the orbit has drifted to an unacceptable nodal crossing time. The degraded satellites are left in orbit to provide SARSAT (Search and Rescue Satellite Aided Tracking) and transponder services plus any other working instruments readings as needed. At present, five POES satellites are maintained in orbit, of which two are considered operational. DMSP satellites are operated in a similar manner with operational satellites considered the "primary satellite" and partially-operational satellites considered the "secondary satellites." Currently, two primary and three secondary satellites are in orbit. The table below shows the number of satellites maintained and launches. The revised numbers reflect changes in the satellite launch schedule as well as the program's intent to maintain degraded satellites in an non-operational orbit until all instruments are unusable.

Polar Satellite Counts	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04
# of NOAA satellites in operational status	2/2	2	2	2	2	2
# of NOAA satellites in partially operational status	3/3	4	5	5	6	7
# of primary DMSP satellites	2/2	2	2	2	2	2
# of secondary DMSP satellites	3/3	4	4	5	5	6
# of METOP satellites in orbit	-	-	-	-	1	2
# of satellite launches	0/0	2/1	1	1/0	1/0	2

System Status and Plans - The mission planning and scheduling subsystem is operational. The SOCC was able to reduce the number of schedulers necessary by a third (from three schedulers to two schedulers). The Fairbanks DMSP-NOAA integrated system Initial Operational Capability milestone is also completed. The percentage of data that was sent by the satellites and recovered by the POES ground system was 98%, which exceeded the base goal of 95%. No catastrophic

failures occurred so downtime was negligible, lasting only a few minutes due to equipment redundancy.

To support the increasing satellite load, the SOCC and CDAS plan to automate the telemetry function. An Intranet is under development to facilitate internal communications. A development rail for PACS is in development so that software development work will no longer be performed on the PACS backup server.

The ground system must be prepared for both NPOESS and METOP. To support NPOESS convergence, a new Mission Planning and Scheduling Subsystem is under development for the operation of DSMP satellites. A new ground system will need to be developed to support NPOESS satellites. To support METOP, the Fairbanks and Wallops CDAS will require new communications, archiving, and RF equipment peculiar to the METOP data format and RF band. The Suitland SOCC will require new communications equipment to forward the METOP data streams to the data processing systems.

NESDIS has system engineering support contracts with Aerospace Corporation, CSC, Mitretek, and Allied Signal. These are not IT contracts, but contain subtasks that occasionally involve planning for IT systems.

The SOCC facility is currently located in Federal Building (FB) 4 at the Federal complex in Suitland, MD, but NESDIS plans to relocate the SOCC facility to FB-5 after it is constructed. Planning is in its early stages, but significant IT dollars will be required for the relocation to FB-5.

Performance Measures*	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04
Data recovery rate (%)	98/95	95	95	95	95	95
Maximum continuous downtime (hours)	0**/6	6	6	6	6	6

** This system previously used the number of satellites and launches supported for performance measures. This year, the performance measures were changed to better capture the IT performance of the ground system.*
*** Very little downtime due equipment redundancy. No major failures. Downtime minutes rounded down to zero hours.*

Milestones	FY Goal
Mission Planning and Scheduling Subsystem operational	FY 99/FY 99
Fairbanks DMSP-NOAA integrated system initial operational capability	FY 99/FY 99

Milestones	FY Goal
Fairbanks DMSP-NOAA integrated system final operational capability	FY 00
Operations Intranet operational system development	FY 01
PACS Isolated System Development Test Bed study	FY 00
NOAA-L launch	FY 00
NOAA-M launch	FY 01
Fairbanks and Wallops METOP initial operational capability	FY 02
METOP-1 launch	FY 03
NOAA-N launch	FY 04
NPOESS Ground System development contract award	FY 04
METOP-2 launch	FY 06
NPOESS launch	FY 07
NOAA-N' launch	FY 08
SOCC - CDA 3C telemetry automation complete	FY 08

Satellite Environmental Processing System (SATEPS) - NESDIS is responsible for the civilian operational remote sensing of the Earth, which includes the Geostationary Operational Environmental Satellites (GOES)and the associated data receiving, processing, and distribution functions. The Office of Satellite Data Processing and Distribution (OSDPD) Satellite Services Division (SSD) also integrates new products and data sources into the distributed computing environment known as the Satellite Environmental Processing System (SATEPS). The SSD serves as the primary interface between NESDIS and geostationary environmental satellite data users. SSD is responsible for providing data, analyses, and interpretations for geostationary and polar data. Some NOAA/ATN and the European and Japanese geostationary weather satellite data are also distributed through the SATEPS network, but the majority of these data are processed outside of the SATEPS.

SATEPS is a client/server workstation/PC platform environment which supports the continuous (24 hours per day and 7 days per week) flow of data for the highly visible NESDIS mission of protecting life and property. This facilitates the real-time processing and file transfer to server systems of raw data and remapped areas, which may be accessed within one to three minutes of the end of the transmission, even for the large, full disk, one kilometer-resolution visible data. Volcano hazard alerts and flash flood analyses are issued faster due to earlier available raw data and faster product processing.

The flow of geostationary satellite data from the SSD feeds the essential NWS processes that forecast life and property weather events and warnings to United States citizens and to individuals around the world. The satellite data is essential for NWS forecasts and safeguarding life and property of citizenry against tornadoes, flash floods, hurricanes, winter storms, and volcanos, and as a primary source of satellite data used in climatic analysis, in support of the NOAA strategic goal of "Advance Short-Term Warning and Forecast Services."

System Status and Plans - SSD requires a complex network of dedicated communications lines and associated equipment to facilitate the receipt and relay of the large volumes satellite data, products, and services. In accordance with our IT architecture of a PC-based environment, we replaced the McIDAS Tower and WideWord Workstations purchased as part of the mainframe computer system in 1986. In 1986 there were no desk-top workstation able to handle to large volumes of data that was necessary to interactively display weather patterns. These aged systems are composed of proprietary custom-built workstations which have become nearly impossible to repair or replace. Replacement systems were installed and the functions are being ported to the new systems. All new systems have been implemented in the production environment, thus meeting schedule, cost, and system performance goals and supporting the redesign and simplification of our work processes.

This client/server environment has allowed for several new-high priority products and services that were developed and implemented during 1998 to meet mission requirements of the NWS. The GOES High Density Wind Product, the ASOS Satellite Cloud Product (SCP), and an operational AVHRR Normalized Difference Vegetation Index (NDVI) product were among those added, improved, or upgraded.

During the next five years, OSDPD will continue to implement additional weather products at the request of the NWS and further improve the existing products. The launch of new NOAA satellites and the acquisition of improved data streams from foreign satellites (e.g., Japan's GMS, Europe's METEOSAT, China's FY2, Russia's GOMS, etc.) will also augment the SATEPS environment.

Technology refreshments and routine equipment and software upgrades are required as additional satellites are made available. If no more satellites are launched or otherwise come available, the SSD would have no need to upgrade its SATEPS environment, and therefore maintain status-quo. Developmental costs will cover preparation for new satellites and new weather products only.

SATEPS Performance Measures *	FY 00	FY 01	FY 02	FY 03	FY 04
GOES - 8 Imager Band 2 - Full Disk Images	67,159	67,159	67,159	-	-
GOES - 10 Imager Band 2 - Full Disk Images	67,159	67,159	67,159	-	-
Meteosat 7 IR Band Imagey	17,155	17,155	17,155	-	-

SATEPS Performance Measures *	FY 00	FY 01	FY 02	FY 03	FY 04
GOES - 8 Imager ASOS Products	8,760	8,760	8,760	-	-
GOES - 10 Imager ASOS Products	8,760	8,760	8,760	-	-
GOES - 8 Northern Hemisphere High Density Winds Product	5,840	5,840	5,840	-	-
GOES - 8 Southern Hemisphere High Density Winds Product	5,840	5,840	5,840	-	-
GOES - 10 Northern Hemisphere High Density Winds Product	5,840	5,840	5,840	-	-
GOES - 10 Southern Hemisphere High Density Winds Product	5,840	5,840	5,840	-	-
GOES - 8 Moisture Soundings	9,609	9,609	9,609	-	-
GOES - 10 Moisture Soundings	9,648	9,648	9,648	-	-
GOES - 8 ASOS Satellite Cloud Products	8,760	8,760	8,760	-	-
GOES- 10 ASOS Satellite Cloud Products	8,760	8,760	8,760	-	-
GOES - 8 Imager Derived Precipitation Imagery	8,760	8,760	8,760	-	-
GOES - 10 Imager Derived Precipitation Imagery	8,760	8,760	8,760	-	-

* New entry. Was not in last year's plan.

SATEPS Milestones	FY Goal
Upgrades to SATEPS hardware and software for receiving data from new Satellite.	FY 01
Upgrade to SATEPS telecommunications to receive and distribute data from new Satellite.	FY 01
Prepare new satellite products	FY 01
Upgrades to SATEPS hardware and software for receiving data from new Satellite.	FY 02

SATEPS Milestones	FY Goal
Upgrade to SATEPS telecommunications to receive and distribute data from new Satellite.	FY 02

Budget Estimates ($K): Includes all hardware, software, operational, and support costs associated with the system. Also includes personnel costs for individuals whose primary task is system development, operations, or support. In accordance with the reporting format required by OMB, the budget estimates are divided into two categories: "development/enhancement" and "steady state". The first category is used for expenditures for developing a new IT system or enhancing an existing system. The second category is used for expenditures for just maintaining a current system.

System		FY 00	FY 01	FY 02	FY 03	FY 04	FY 05
AWIPS	Development/ enhancement	15,139	17,300	17,300	9,645	8,700	8,653
	Steady state[1]	32,028	38,642	38,642	38,642	38,642	38,642
NCEP	Development/ enhancement	0	5,720	7,405	7,185	7,450	7,700
	Steady state	31,623	31,531	31,540	31,755	32,000	32,400
NEXRAD	Development/ enhancement						
	Steady state						
GOES Ground System	Development/ enhancement	3,280	8,761	6,069	11,980	12,193	11,810
	Steady state	3,795	3,082	2,723	2,317	4,816	2,519
NWS Gateway[2]	Development/ enhancement	100	100	5,050	2,650	2,250	2,250
	Steady state	6,352	6,352	6,352	6,352	6,352	6,352

System		FY 00	FY 01	FY 02	FY 03	FY 04	FY 05
FSL MPP	Development/ enhancement	3,500	3,500	3,500	3,500	3,500	3,500
	Steady state	400	400	400	400	400	400
Space Weather	Development/ enhancement	939	1,136	3,694	2,945	2,860	2,902
	Steady state	518	560	596	1,034	1,336	1,588
CEMSCS	Development/ enhancement	3,720	5,855	6,250	6,350	7,366	8,544
	Steady state	13,521	12,774	13,899	14,638	15,413	16,229
POES	Development/ enhancement	3,545	2,155	3,387	5,582	6,758	7,605
	Steady State[3]	2,271	2,468	2,468	2,574	2,683	2,798
SATEPS	Development/ enhancement	860	886	913	940	968	997
	Steady state	4,357	4,488	4,623	4,762	4,905	5,052

[1] FY 01-05 entries are based on the FY01 budget request
[2]A budget deficiency justification, documentation, and investment analysis has been proposed beginning in FY 02. The amounts shown for Development/Enhancement beginning in FY 02 are dependent on funding that initiative.
[3]This year's POES Ground System budget estimate includes ten IT personnel cost. Last year's summary did not include personnel cost. These numbers also reflect any canceled projects.

Future Investments: Consideration is being given to the following as possible IT budget initiatives for the FY 2002 Budget Cycle:

Technology Infusion Program –- This initiative will enable NOAA to acquire equipment and pay for the Federal salaries, contracts, and grants necessary to develop, on an evolutionary path, PC-based NWS informational systems, such as AWIPS and the WSR-88D (NEXRAD) radar dissemination and processing systems. The objective of this initiative is to develop, test, and work with the NWS Office of Science and Technology to implement the next-generation NWS field and radar systems to keep pace with the availability of new technology, implement new techniques based on improvements in the science, and upgrade obsolescent technologies. Activities include the OAR and NWS cooperative exploratory development, selective demonstrations, and tests of improved software and hardware for informational systems, including C hardware architecture

running a LINUX operating system, gigabit Local and Wide-Area-Networks, and advanced dissemination using the Internet. In addition, OAR and NWS will perform exploratory development and demonstration of new field system technology, including the Advanced Warning Decision Support System (WDSS), dual polarization for the WSR 88D (NEXRAD) system, and phased-array weather radar. By 2005 this would include interactive forecast preparation, full volume radar, improved remote determination of precipitation type and amount through dual polarization, high-volume satellite and model data, advanced hydrology for improved flood forecasts, and advanced decision support for improved forecasts of hazardous weather.

Climate Database Modernization and Utilization Program (CDMP) –- This initiative will allow NOAA to continue with and expand the rescue of paper and microform archive data. The goals of CDMP are to preserve the meteorological, climatological, geophysical and oceanographic data archives stored by the NOAA National Data Centers and throughout NOAA and to make this information more accessible to researchers and the general public. This program was initiated by Congress to assist the National Climatic Data Center (NCDC) in modernizing and improving access to the nation's climate history as well as its current climate data and information. The major objective of this program is to acquire, digitize, and provide access to the climate data held in the national archive at NCDC. Under the program, climate data and information will be made available from the NCDC databases in a consistent digital format through digital communications systems. This not only benefits NCDC by modernizing its activities, but more importantly it will directly benefit the researchers, global change scientists, and the general public. Improved metadata are also a critical aspect of the CDMP effort, adding value to the data by providing answers to many of the questions concerning the data and how they were collected and processed. The scope of the work involves both operational and developmental activities, but is limited to data conversion and IT technology development. Included within these tasks are subscription management, metadata, information technology development, imaging, indexing, and data entry services.

Critical Single Point Failure –- This initiative supports the continuity of critical operational satellite products and services during a catastrophic outrage by providing a backup capability at an alternate site for all critical products and services. This backup capability also includes additional communications links, as needed, to connect the backup locations in the NOAA Science Center in Camp Springs, MD. The Federal Office Building 4 (FOB4) in Suitland, MD is potentially a single point of failure for every operational NOAA satellite product and service upon which the National Weather Service and other users rely. Critical polar-orbiting products and services include POES products, such as ozone, temperature and moisture sounder products, and non-NOAA satellite products from NASA, DOD, Europe, and Japan. FOB4 is also the single entry point for all raw satellite data received at the NOAA Science Center in Camp Springs, MD for the production of geostationary critical products and services. These include all GOES AWIPS remapped imagery, high-density winds, precipitation estimates, sounder products, and non-NOAA satellite data and products from NASA, Europe, Japan, and India.

Advanced Hydrologic Prediction Service (AHPS) –- This initiative meets the NWS Vision 2005 Flood Forecasting and Water Management Goals, and supports NOAA's five-year strategic goals to "Advance Short-Term Warning and Forecast Services" and to "Implement Seasonal to

Inter-annual Climate Forecast"s. It provides for the translation of weather and climatic forecasts into critical user-requested streamflow forecast products and services. The initiative provides enhanced hydrologic forecasting for NOAA's PREWICS (**PR**edict and **R**educe **W**atershed **I**mpacts of **C**oastal **S**torms) initiative, and implements the flood and flash-flood forecasting component of the Natural Disaster Reduction Initiative (NDRI). In addition, the initiative supports recommendations made in 1996 in the National Research Council's assessment of NWS modernization requirements. The FY 2002 AHPS initiative is segmented into requirements for software infrastructure, data, science, implementation, and verification. This initiative will expedite the implementation of proven technologies at all NWS River Forecast Centers; refresh the National Weather Service River Forecasting System (NWSRFS) software infrastructure to current IT standards, becoming the Integrated Hydrologic Forecast System (IHFS); provide a National Airborne Snow Survey Program (NASSP) for near real-time snow water equivalent data used by nine River Forecast Centers in the Eastern, Central, Western, and Alaska Regions; adopt modern hydrologic science technologies recommended by NOAA's Science Advisory Board; and provide river forecast verification statistics in forms easy to access and understand. Funding at the proposed AHPS FY 2001 budget level ($1.0 million) will delay National implementation of AHPS beyond 2005 and does not address needed improvements to NWS hydrologic science and systems. In FY 2000 and 2001, the NWS will continue implementation of AHPS in the Mississippi and Ohio River Basin, focusing on high priority flood prone areas.

U.S. Weather Research Program/Data Assimilation & Modeling –- All NWS products and services regarding forecast ranges beyond six hours depend on data assimilation and numerical modeling. This initiative provides for the necessary expansion of these NWS numerical forecast system capabilities, including improved atmospheric analysis techniques, expanded capability to accelerate the use of advanced space-borne sounder data, implementation of targeted observing strategies, enhanced use of WSR-88D Doppler Radar and Profiler observations, improved use of satellite data over land, advanced techniques for initialization of clouds and precipitation in models, and improved use of conventional observations. In addition, coastal and global ocean data assimilation is enhanced, including implementation of a Coastal Ocean Forecast System (COFS) and four-dimensional data assimilation and forecast modeling, and improved salinity analysis, optimal use of satellite altimetry data, and operational global ocean analyses to support climate research and applications.

The initiative includes the expansion and improvement of the existing weather, water, and product and service line hurricane landfall forecast lead times, winter storm detection, coastal flooding and seven-day forecasts, and probabilistic guidance; increased quantity of precipitation forecast accuracy; more accurate West Coast forecasts; improved airport warnings (ceiling, visibility, icing, turbulence); improved wind and wave forecasts to seven days; reduction of unnecessary warnings for coastlines; enhancing products to the marine community; improved AHPS forecasts; all aspects of use, integration, quality, and cost effectiveness of observations including working toward the optimal mix of observations; expanded cooperation with the entire research community by linking NOAA research and development to NWS improvement goals; developing a multi-year research plan and process involving the NWS and its research partners; reducing the time required to implement proven research and technology into operations by increasing cooperative alliances; establishing a test bed; improving data assimilation systems and numerical

forecasts by developing the WRF; accelerating use of new satellite data; and improving operational use of WSR-88D data.

Aviation Weather Services –- The goal of this initiative is to develop and implement new and improved products and services to reduce the impacts of weather on aviation safety and the costs of airspace operations. This initiative will address the top priorities of the Joint Safety Implementation Team of the FAA's Safer Skies Initiative in response to the Vice President's call for an 80% reduction in aviation accidents. Priorities include: real-time graphical forecast of hazards (icing, turbulence, and thunderstorms), increased accuracy and geographical precision of weather products, improved weather information for air traffic controllers, and better meteorological training for hazardous weather decision-making. In order to develop and implement the required products and improvements, this initiative calls for investments in improved observations, meteorological techniques development, and training. The immediate benefits of this initiative are more accurate and geographically-precise graphical depictions of weather hazards for aviators, aviation controllers, and air transport planners. Icing, turbulence, and thunderstorm conditions, which produce the majority of weather-related delays, will be more accurately identified. Improved forecasts of critical low clouds and visibility around air terminals will help commercial airlines reduce weather-dependent delays and safety risks to general aviation. Identification of icing conditions aloft enabled by new radar technology will yield better forecasts, which in turn will produce fuel savings and other economies from more efficient route planning. Earlier and more accurate identification of volcanic ash clouds will reduce flight risks. Finally, general aviation safety, which hinges on weather forecasts and pilot understanding of weather, will improve with pilot training.

Predict and Reduce Impacts of Coastal Storms (PREWICS) –- This initiative will improve operational observations, analyses, warnings, forecasts, products, and dissemination for the coastal ocean and atmosphere. More than 53% of our population lives in the coastal zone - a narrow strip of land comprising only 17% of the contiguous U.S. land area. To meet these objectives, NOAA strives to establish integrated cross-disciplinary approaches to coastal research, service provision, and management. As a first step, this initiative focuses on the critical problems of predicting and reducing watershed impacts of coastal storms by demonstrating how improved products and services can address specific state/local decision-maker needs in three regional pilots. These are: the St. John River Region of Florida (plethora of hurricane impacts), the Southern California Bight (Pacific storm impacts on water resources), and the Columbia River Region of the Pacific Northwest (Pacific storm impacts on erosion and fisheries habitat). The overarching goal of PREWICS is to achieve an enhanced and seamless observation-to-user capability across NOAA that provides readily-accessible data and information, forecasts, value-added tools, and training for users regarding coastal storm impacts within coastal watersheds. This goal will be met by integrating and enhancing coastal observations, improving coastal forecasting of the atmosphere and ocean, especially the impact of extreme events on coastal ecosystems, and improving the information available to decision-makers wrestling with ecosystem and resource management issues. The initiative builds on existing studies, programs, and activities such as the U.S. Weather Research Program (USWRP), the Coastal-Global Ocean Observing System (C-GOOS), the Clean Water Action Plan Coastal Research and Monitoring Strategy, the Committee on the Environment and National Resources (CENR) Integrated Science

for Ecosystem Challenges, the Advanced Hydrological Prediction Service (AHPS), and the joint NOAA/U.S. Geological Service (USGS) report to Congress on the Risks and Costs Associated with Coastal Hazards. It fosters cooperation across Federal agencies and forms a foundation for partnerships with regional and local interests to provide maximum benefit to the end-users of coastal information.

STRATEGIC GOAL: IMPLEMENT SEASONAL TO INTERANNUAL CLIMATE FORECASTS

The Programmatic Goal and Objectives: NOAA, working with academic and multi-national partners, will provide one-year lead-time forecasts of precipitation and surface temperature distributions. These forecasts will increase society's ability to mitigate economic losses and social disruption. The objectives set to accomplish this goal are to implement prediction systems, maintain and improve observing and data delivery systems, conduct research for improved climate predictions, deliver climate services, and assess socio-economic impacts. The primary Line/Program Offices involved in this goal are OAR, NWS, NESDIS, and the Office of Global Programs.

Satellite Active Archive: The NOAA Satellite Active Archive (SAA) is a digital library of near-real-time and historical satellite data from NOAA's Polar-orbiting Operational Environmental Satellites (POES) and other non-NOAA satellites. Data from the SAA support a broad range of environmental monitoring applications including weather analysis and forecasting, climate research and prediction, global sea-surface temperature measurements, atmospheric soundings of temperature and humidity, ocean dynamics research, volcanic eruption monitoring, forest fire detection, and global vegetation analysis. The system allows users to search an inventory database and browse selected datasets, preview sub-sampled Earth images of that data, and order the data for electronic delivery on the Internet or on computer-compatible media for further processing and analysis. The SAA services a wide user-base (other Government agencies, the private sector, academia, the secondary educational community, and the general public), thereby significantly improving NOAA's delivery of products and services to its customers. The SAA provides interoperability with the Internet (worldwide), the prototype NOAAServer, and Level 3 interoperability with the National Aeronautics and Space Agency's Earth Science EOSDIS (Earth Observing System Data and Information System) systems.

> The SAA is a digital library of near-real-time and historical satellite data. The system is operational. The amount of data available will be doubled and software will be upgraded.

The SAA supports NOAA's strategic goal to "Implement Seasonal to Interannual Climate Forecasts" by providing data for research in this area. Given the planned additional datasets, the SAA will also support most of the other six goals, especially to "Predict and Assess Decadal-to-Centennial Change" and to "Sustain Healthy Coasts".

The current SAA IT open systems architecture is based on scientific workstations and near-line robotic storage coupled to an enterprise server, the robotic storage being necessary to manage 48 terabytes of satellite data and imagery on digital tape media with an ongoing planned expansion to 80 terabytes. NOAA's goal for the next ten years is to expand robotic storage to make 400 terabytes of data available electronically to customers. The workstations operating the system

will also have to be continually upgraded to handle this increasing volume and complexity of data. The open-systems architecture allows incremental additions to be made and the system to be located on one or several different processors at one or more locations.

System Status and Plans - The SAA is a fully operational system within the NOAA Office of Satellite Data Processing and Distribution (OSDPD) Information Processing Division (IPD). In calendar year 1999 the SAA electronically distributed over 7.1 terabytes of polar satellite data and derived data products to customers. In 1999 IPD completed major upgrades to its hardware architecture that included the replacement of the central mainframe computer with a state-of-the-art enterprise server; the upgrade of the SAA robotic tape storage and retrieval system; and the replacement of outmoded SAA UNIX servers with state-of-the-art IBM SP/2 processors "closely coupled" to the enterprise server. Additionally, the SAA increased on-line storage capacity by 180 gigabytes with the acquisition of a high-capacity magnetic disk array for the daily distribution of satellite data.

In FY 1999 the SAA completed the implementation of new software systems which couple commercial off-the-shelf (COTS) relational database software with SAA-developed, object-oriented (OO) code to replace the then existing client-server operations. System Releases 1.7, 2.0, and 2.1 were the middle phases of the OO implementation. Release 2.0 integrated the new IBM SP clustered processor architecture to form the basis for polar satellite data distribution through 2003.

The IBM SP hardware architecture features high-capacity disk caching and networked data storage. The current configuration is scaled to 8 central processors and may be expanded to 32 processors. This increased processing and data-sharing capacity reduces end-to-end processing and I/O time (over 1998 capacities) significantly, thus reducing the time between customer data requests and actual data delivery. Additionally, the CPUs are configured to provide total operational processing redundancy, thus eliminating any system downtime, providing uninterrupted customer access.

The near-term future of the SAA includes the expansion of near-line robotic storage to allow for the entire (1978-to-date) U. S. POES archive to be available for electronic distribution; an increase in processing capacity to keep pace with customer data demands; and the increased use of client-side software, including interactive JAVA applets, to allow more customer flexibility in data search, display, and distribution. Two major data drivers will occur over the next two years: the launch of NOAA-L in 2000 and the integration of the SAA Historical Information Processing (HIP) system in 1999-2000. HIP will populate the SAA near-term robotic tape system with NOAA POES data spanning the 1978 to 1994 era.

SAA Performance Measures*	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04
% of Satellite Active Archive operational	68/50	75	85	100	100	100
Annual # of datasets added	4/4	4	4	4	4	4

SAA Performance Measures*	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04
Monthly average data granules distributed	8,600/ 4,600	10,000	14,000	18,000	20,000	24,000
Total # of NOAA Pathfinder products processed annually	1/1	2	3	3	3	3

* When two numbers are presented and divided by a "/", the first number represents the achieved FY 99 performance measurement or the revised measure for future years. The second number represents the measure presented in the FY 99 Strategic Information Technology Plan.

SAA Milestones*	FY Goal
NOAA-K, AVHRR (1982-94), & TOVS (1978-95) data on-line	FY 99/FY 99
Robotic archive expansion to 200 terabytes	FY 01/FY 99
Robotic archive expansion to 400 terabytes	FY 03/FY 00
Workstation upgrades	FY 97 - FY 04
NOAA-L data on-line	FY 00
EOS Terra operational data on-line	FY 01
RADARSAT follow-on data on-line	FY 01
NOAA-M data on-line	FY 01
EOS Aqua operational data on-line	FY 02
METOP-1 NOAA data on-line	FY 03
NPP data on-line	FY 04

* When two dates are presented divided by a "/", the first number represents the actual year the milestone was accomplished; the second number represents the original milestone year in the FY 99 Strategic Information Technology Plan.

Comprehensive Large Array-data Stewardship System (CLASS): The CLASS project, formally known as the National Environmental Data Archive and Access System (NEDAAS), is replacing the NOAA Virtual Data System (NVDS) project that was previously reported on as a major system.

CLASS is a revised name for the NEDASS project. The system will implement efficient management of high volumes (petabytes) of data and automate the means of data ingest, quality control, and access.

NOAA spends almost a billion dollars each year collecting environmental data in support of its mission. NOAA's vast data holdings are collected and stored in various facilities, some of which are responsible for the perpetual stewardship, archiving, and dissemination of

environmental data. Today there are demands on virtually all of NOAA's programs to provide information on the health of the environment in real-time. For the 21st century, NOAA envisions that its data and information products will be available as part of a national decision-support system for the purpose of: (1) saving lives and protecting property; (2) promulgating public policy; (3) managing and conserving living marine resources; and (4) enhancing the economic prosperity and quality of life in the United States.

The CLASS concept is a suite of information services linking NOAA's archives with databases at NOAA's laboratories, Regional Climate Centers, State Climate Centers, and other information systems of NOAA's Line Offices. The NOAA National Data Centers (NNDC) have the ultimate responsibility for the long-term management and stewardship of the bulk of NOAA's data, in addition to environmental data collected by other Federal agencies, countries, and research programs. The NNDC is made up of the National Climatic Data Center (NCDC), the National Oceanographic Data Center (NODC), and the National Geophysical Data Center (NGDC). It contains holdings representing the chronology of the Nation's environmental history and records from many other regions of the world. In addition, numerous Centers of Data in NOAA's Line Offices are responsible for management of data sets developed while fulfilling their environmental missions and operational responsibilities.

A large portion of the Nation's archive of environmental data is stored and maintained by NCDC, NODC, NGDC, and the Satellite Active Archive (SAA). Throughout the 1990s, the NOAA archives have experienced a steady growth in digital data, more than quadrupling in volume by 1998 to more than 630 terabytes. By 2005 NOAA's holdings will be nearly eight times this amount, and growing to almost 25 times the 1998 volume over the next 15 years. This massive influx of environmental data and information far exceeds NOAA's archive and access capabilities. The sources of the vast volumes of new data are existing and planned NASA, DoD and NOAA observing systems. To prepare, NOAA must increase the data-handling capacity and capabilities of its Data Centers. It must expand its current NASA/NOAA short-term archive project into a CLASS which is fully operational and managed at the enterprise level. This CLASS will afford efficient management of high volumes (petabytes) of data critical to the United States Global Change Research Program and scientific community. The target data originate from the National Polar-orbiting Operational Environmental Satellite System (NPOESS), the Department of Defense Meteorological Satellite Program (DMSP), the Department of Commerce/NOAA Next Generation Weather Radar (NEXRAD), the Polar-orbiting Operational Environmental Satellites (POES), the NPOESS Prototype Platform (NPP), the Geostationary Operational Environmental Satellite (GOES) Next, the Meteorological Operational (METOP) satellites, and the Earth Observing Satellites (EOS), plus numerous *in situ* observation programs. In FY 2000, NOAA will provide permanent archive and access to NASA's heritage satellite datasets [Upper Atmosphere Research Satellite (UARS), Total Ozone Mapping System (TOMS), Solar Backscatter Ultraviolet (SBUV), etc.]. Management of these data requires a rapid expansion in storage capacity at the Data Centers and automating the means of data ingest, archive, quality control, and access.

With the World-Wide-Web, a global market has been created nearly overnight for NOAA's data and information services. The number of individuals accessing NOAA's information services has

increased two orders of magnitude in the past five years, extending far beyond NOAA's traditional user community. Electronic commerce (e-commerce) is a key objective of the Secretary of Commerce and the mode of doing business via the Web. Users, no longer content to wait days for their data or information, are demanding on-line ordering, search, and browse capabilities with electronic file transfer for data delivery. New user groups require near-real-time access to data to support decision-making and rapid response needs. Scientists and advisors have a critical need for long time-series of historical and recent environmental data to assess long-term trends, evaluate current status, and predict future conditions and events. The timeliness and completeness of the environmental records are crucial.

The Data Centers are migrating to a client/server architecture, moving away from legacy site-specific IT environments. The CLASS Concept of Operations objectives are to focus on open-systems architecture, extensive use of commercial off-the-shelf (COTS) software, rapid adaptation and upgrading to new technologies (data storage and retrieval systems) and procedures, Web interfaces for on-line access, emerging telephony technologies, reduction in staffing, use of hardware and software rather than staff talents for routine administrative matters, and optimal targeting of fiscal resources.

NOAA strategic goals directly supported by the CLASS initiative are to "Predict and Assess Decadal to Centennial Change" and to "Implement Seasonal to Interannual Climate Forecasts", along with support for the development and enhancements to "Advance Short-Term Warning and Forecast Services." It also supports all NOAA Line Offices and other government agencies that have and use environmental data. The CLASS initiative will work with NOAA Line Offices to provide them with CLASS archive capabilities. This initiative will expand the capability to ingest data coming to NOAA Data Centers and to archive the data in a controlled and accessible system for straightforward, easy access by a widely diverse, worldwide clientele.

System Status and Plans - Much of the NVDS project funding was diverted to support the NESDIS Year 2000 conversion effort, leaving NVDS only partially completed. This requires NVDS systems and legacy systems to continue operating and calls for substantial resources in FY 2000 to maintain them. There are no additional FY 2000 funds to complete these systems. A security evaluation is being conducted on the Customer Order Management Processing System (COMPS) which, along with the operational wide-area-network, will lead to initial operating capability for NVDS. Users will be accessing remote databases through the single NNDC Server thread. The standardization of metadata elements will ensure that all related datasets and products can be accessed. Data storage and retrieval systems were upgraded to support effective and efficient access with special focus on Web interfaces. Significant progress was made in installing the IT upgrades at the Centers. Many of the most popular datasets were placed on-line. Finalizing existing systems will allow NOAA to avoid costs involved with the growth of data and information. Progress was made in developing an On-Line Store capable of handling large array data sets and the NNDC Server projects.

The most important decisions under consideration for FY 2001 - FY 2002 are centered on building a plan and architecture that will support requirements for new satellite data and new datasets. Using the DOC acquisition approach (dramatically streamlined processes; high-

performing, empowered work teams; early involvement and partnerships with vendors; and new uses of technology), NESDIS will be able to prepare for the new satellite job streams and data. The infrastructure improvements required are: (1) high-bandwidth telecommunications infrastructure to convey data from database computers to backbone Internet telecommunications networks; (2) highly-capable enterprise computers to service expanding user demand, including library services and e-commerce; (3) high-capacity storage systems capable of providing rapid data retrieval; and (4) an efficient e-commerce access system. The project will be accomplished in several phases. The planning and system architecture phase is underway.

CLASS will include the development and implementation of a standardized archive system, which will be integrated with a robust, large-volume, rapid-access storage and retrieval system that is capable of receiving a user's on-line data request, automatically processing the request, and providing the requested data on the most appropriate media. This system will provide standardization in media, interfaces, formats, and processes for the very large data sets produced by satellites and radars. Additionally, the system will facilitate ongoing migration to new technology and media. This system is modular in design, built to integrate with automated real-time or near-real-time systems that deliver data. Transaction processing will be implemented to enable an essentially "hands-off" operation and, where appropriate, the system will allow users to pay for data or services through credit card or automated billing. The initial system will build upon the NVDS, extending the system to the large-volume centers of satellite data. As CLASS is developed and implemented, the requirements for the NASA EOS data will be integrated. This will provide risk-reduction for the systems planned to go on-line over the next 10 years (e.g., NPP, NPOESS, etc.). CLASS will be the prime component of the Polar Orbiter Data Management System to provide access to and distribution of Climate Data and Services.

CLASS-NVDS Performance Measures*	**FY 99**	**FY 00**	**FY 01**	**FY 02**	**FY 03**	**FY 04**
% Complete - Data Centers IT upgrades (NVDS)	75/75	85	-	-	-	
% Complete - COMPS implementation @ all Centers (NVDS)	75/75 (Build 2)	80	-	-	-	
Number of datasets for all Centers placed on-line (direct Web access by customers) (NVDS)	34/34	34	-	-	-	
NVDS Wide-Area-Network (% Complete)	90/90	100	-	-	-	
% Complete - Data Centers' IT upgrades for CLASS	-	-	15	45	60	75
% Complete - CLASS COMPS	-	-	15	50	90	100

CLASS-NVDS Performance Measures*	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04
Number of datasets for all Centers placed on-line for direct access by customers	-	30	80	120	150	200
% Complete - CLASS Wide-Area-Network	-	10	20	40	60	90

*The NVDS initiative is only funded through FY 00. The CLASS initiative will take over from that point. When two numbers are presented and divided by a "/", the first number represents the achieved FY 99 performance measurement. The second number represents the measure presented in the FY 99 Strategic Information Technology Plan.

NEDASS/NVDS Milestones*	FY Goal
NVDS Implemented	FY00/FY99
Complete CLASS Target Architecture planning	FY 01
Complete COMPS Web Integration	FY 02
Complete satellite planning for CLASS	FY 02
Implement Integrated Management Information Systems for CLASS	FY 04
CLASS Data Management Policy System	FY 04
Complete IT upgrade for new access to environmental data holdings	FY 05
Complete On-line Store upgrade for new satellite data	FY 05
Complete unified archive management	FY 06
Complete software conversion to open systems	FY 07
Complete Target Architecture opportunities implementation	FY 08
Complete NNDC Server satellite delivery system upgrades	FY 08

* When two years are presented and divided by a "/", the first year represents the FY 99 accomplishment or the revised goal for future years. The second year represents the goal presented in the FY 99 Strategic Information Technology Plan.

Budget Estimates ($K): Includes all hardware, software, operational, and support costs associated with the system. Also includes personnel costs for individuals whose primary task is system development, operations, or support. In accordance with the reporting format required by OMB, the budget estimates are divided into two categories: "development/enhancement" and "steady state". The first category is used for expenditures for developing a new IT system or enhancing an existing system. The second category is used for expenditures for just maintaining a current system.

System		FY 00	FY 01	FY 02	FY 03	FY 04	FY 05
SAA	Development/ enhancement	250	400	500	500	500	500
	Steady state	1,250	1,400	1,500	1,600	1,700	1,800
CLASS	Development/ enhancement	0	4,000	9,500	9,300	9,100	8,900
	Steady state	0	0	500	1,500	1,500	2,000

Future Investments: Consideration is being given to the following as possible IT budget initiative for the FY 2002 budget:

Comprehensive Large Array-data Stewardship System (CLASS) – With the beginning of the new Millennium, NOAA finds itself at a critical juncture with respect to its information services mission. Preserving the Nation's environmental record now means managing a data volume that increases in one year by the equivalent of all the data NOAA has had to handle from over the past 100 years. At the same time, with the advent of the World-Wide-Web, NOAA's user community has expanded by over two orders of magnitude. The CLASS concept is a system suite of information services based on linking NOAA's archives with databases at NOAA's laboratories, Regional Climate Centers, State Climate Centers, ongoing process studies, and other information systems of NOAA's Line Offices. This system will afford efficient management of high volumes (petabytes) of data that is critical to the U.S. Global Climate Research Program (USGCRP) and the scientific community. The target data originates from the National Polar-orbiting Environmental Satellite System (NPOESS), the Defense Meteorological Satellite Program (DMSP), the Department of Commerce Next Generation Weather Radar (NEXRAD), and the Polar-orbiting Operational Environmental Satellite (POES). Building on work conducted under NOAA Virtual Data System (NVDS) and other information system modernization efforts in NOAA, the goal is to make all data available on-line or near on-line through the Internet (within practical limits). The early implementation of this archive and access system will pave the way to accommodate additional massive data volumes from the EOS satellites. Management of these data can be accomplished only through a rapid expansion in storage capacity at the Data Centers and automating the means for data ingest, quality control, and access through a phased system buy. NOAA has advanced a plan which has several phases: a planning and system architecture phase; software acquisition (COTS and GOTS) and build phases divided into several deliverable elements; and a hardware design and data farm phase.

A fuller description of CLASS is provided in the Chapter above.

STRATEGIC GOAL: PREDICT AND ASSESS DECADAL TO CENTENNIAL CHANGE

The Programmatic Goal and Objectives: NOAA will provide science-based options to support international policy and management decisions affecting the future of our global environment. A long-term climate record and a new generation of climate models are needed to predict and assess the climate impact of greenhouse gases trends and forcing agents, ozone-layer depletion and rehabilitation, and air-quality detection and improvement. Specific objectives will be to: characterize the forcing agents of climate change; understand the role of oceans in global change; guide the rehabilitation of the ozone layer; provide the scientific basis for improved air quality; and furnish prediction, assessment, and human-impact information. The primary Line or Program Offices involved in this goal are OAR, NESDIS, and the Office of Global Programs.

GFDL High-Performance Computing: Geophysical Fluid Dynamics Laboratory (GFDL) scientists are working at the forefront of the climate and weather research community in the development and use of sophisticated numerical models to predict and understand atmospheric and oceanic phenomena. These research activities, which are critical to the Nation and to NOAA's ability to predict weather and climate behavior, rely on state-of-the-art computing capabilities. GFDL has nearly 40 years of experience in acquiring, managing, and utilizing large-scale computing systems which are central to the success of the Laboratory's research mission.

GFDL's budget initiative, entitled "Attacking Computational Challenges in Climate and Weather Research," was approved by Congress at a level of $5 million for FY 2000. This includes funds to support the acquisition of a very large, scalable computer system and necessary IT support capabilities.

GFDL's high-performance computing plans address the laboratory's growing scientific computing needs through a strategy of continued incremental growth in computational and archival storage capacity. As GFDL's recent benefit/cost analyses of FY 1993 and FY 1998 indicate, increased system capacity produces important additional societal benefits that result from enhanced GFDL research capabilities, which include more sophisticated models and model physics, more comprehensive modeling experiments, and higher-resolution simulations. Recent GFDL accomplishments have translated into important breakthroughs in hurricane prediction, understanding of climate change, and simulation of the complex ocean-atmosphere system.

Recent concern about climate change and the 1997-98 El Niño event have spurred interest around the world, including the United States, in the development of national programs to improve climate prediction capabilities. However, the success of these efforts will depend heavily on physics-based climate modeling and fundamental climate science, two areas in which NOAA/GFDL scientists are among the world's leaders. A sharp increase in computing and archival capabilities is the remaining ingredient required to allow the Laboratory to attack the very difficult problems confronting the climate research community and to support on-going and

developing research collaborations within NOAA as well as with other government agencies, academic institutions, and research centers around the world. Much of this requirement for additional computing and archival resources will be addressed by the current GFDL procurement activities to acquire a balanced high-performance computer system (HPCS), together with additional support for software development and technical support (SDTS). Both of these related projects are partially funded by the successful FY 2000 budget initiative under the "Information Technology for the 21st Century" Initiative (referred to as IT^2), also referred to as the "National Information Technology Research and Development" Program.

While mission-critical results from GFDL high-performance computing are realized in the laboratory's research accomplishments, the performance measures provided herein are a mechanism for tracking the lab's computing and model-development activities that are critical to the continued progress of the GFDL's research mission. The milestones indicate important procurement events and major research goals that provide some indicators of the success of the proposed computational initiative.

System Status and Plans - The Laboratory's production facility consists of multiple systems that now make up the production computing environment of the Laboratory. The evolution of this computing environment from the single 26-processor T932 system of last year is driven by several factors: (1) the continued deterioration of the reliability of the T932 system in general, an effect that was exacerbated by hardware damage in August 1999; and (2) the need for the Laboratory's scientists to gain experience running their experiments on distributed memory systems to prepare for the new system's arrival late in the summer. The archival storage system consists of 2 StorageTek silos with a nominal capacity of 240 TB (trillion bytes or terabytes). Data management is provided by SGI's Data Migration Facility that uses the four-processor T94 system for data serving. A conservative estimate of the actual total capacity for this archive is approximately 180 TB.

As indicated in previous reports and mentioned above, the reliability of the T932 system continued to degrade over the past year. This trend started following the February 1997 upgrade and is a pattern that appears to be typical of all large-chassis T90 systems. In September 1999, during one remedial repair procedure, major damage was done to one of the communications boards that is a part of the T90 system chassis. The effect of this damage was to make it impossible to access more than 24 of the 26 central processor units (CPUs) that are required to be available under the contract. Repair would have required the vendor to ship the entire system to its factory in Wisconsin, with a estimated loss of availability of 2-3 months.

An alternative solution was negotiated with Silicon Graphics/Cray Research in which the 40-processor air-cooled T3E system would be upgraded to a 128-processor water-cooled T3E, and the memory provided for each processor would be doubled from 128 million bytes to 256 million bytes. In return, the number of CPUs in the T932 system would be officially reduced from 26 to 22, although 24 CPUs are potentially available. Using a very conservative estimate of 15 T3E processors as being equivalent to one T90 CPU, GFDL estimates that the upgrade of the T3E provides an increase in performance equivalent to nearly 6 additional T90 CPUs, while the T90 CPU count was reduced by four. The effect of this has been to provide GFDL scientists with

a large-memory production T3E system that has allowed ocean modelers to initiate an important high-resolution ocean experiment a year ahead of schedule.

Unfortunately, however, the T932 reliability continues to operate well below its full complement of 24 CPUs. The number of CPU-hours per month for the T932 for the past year (March 1999 - February 2000) was 14,800 hours. The average per month for the period prior to the damage event was 16,200 hours compared to an average of only 13,400 hours after the event. As a result, the average CPU-hours for both T90s for the past year was only 16,700 hours per month, which is indicated in the Table of Performance Measures below. On the other hand, the T3E processor hours used increased from 23,000 hours prior to the upgrade to 71,800 hours following the upgrade; This increased computing resources more than offsets the loss in computing power of the T90 systems.

The T94 continues to function as both the Lab's data server for the archive storage system and its primary analysis server. This new system has been much more reliable than the T932 with an uptime percentage of 95.9% for the past year, compared to 87.5% for the T932. This difference is largely due to the less complex communications network and much lower parts count of the T94. This increased stability of the T94 provided GFDL users with more reliable access to the data archive; it also has served as an effective interactive and analysis platform, which has a side benefit of reducing the I/O workload on the T932, thereby increasing the T932's compute efficiency. The T94 is covered by an extended warranty through September, 2001, and is expected to continue as the data server for the current archive during FY 2001 and to provide a legacy T90 platform to assist GFDL staff with any remaining code conversion activities during that period.

Analysis and visualization are critical components of GFDL's computational research process, since it is through these mechanisms that researchers gain understanding of their model results. This requires effective access by scientists to model data, which in turn requires substantial bandwidth to desktop workstations. As an important step to providing this access, GFDL replaced its current network with a new high-speed local-area-network in October 1998. The new network consists of a 2000-Mbps full-duplex Gigabit Ethernet backbone and switched 10/100 Mbps Fast Ethernet to each workstation. This network provides a substantial increase in potential bandwidth to the desktop, while permitting the Laboratory to continue to support standard Ethernet connections to current workstations without the immediate need for a wholesale replacement of desktop systems.

GFDL's desktop environment consists of 115 desktop workstations and servers ranging from SGI Indigo's and Indigo2's to SGI 4D/25's that are connected to each other and to the centralized high-end systems through the ethernet backbone. Even the newest of these platforms is significantly less powerful than the latest Intel-based personal computers (PCs). Given the cost-effectiveness of commodity PCs, the Laboratory is actively investigating the viability of a transition to a desktop environment based on such PCs running Linux, as an alternative to more expensive RISC-based systems. GFDL is currently evaluating the Linux environment on a test Intel-based workstation purchased for this purpose. Development of transition strategies for GFDL's desktop workstations, as well as high-end visualization, will be key elements in the plans

for the future analysis and visualization infrastructure that will be critical to the lab's developing computational program.

GFDL is also investigating possible options for upgrading its access to the Internet based on the needs of its outside users to access data at the Laboratory and the requirements of GFDL's internal users to access large data sets at other sites. This need, along with the requirements for an improved desktop environment, are critical objectives toward the goal of providing the Laboratory's user community with the balanced computing environment that they require in order to carry out their research.

GFDL personnel have been key participants in NOAA's year-long effort to investigate its current use of and future needs for high-performance computing within its research and operational programs. The resulting report, which was presented to NOAA senior management in February, provides an important first step in the agency's efforts to develop a vision, not only for high-end computing, but for the entire range of scientific computing in NOAA, from desktop workstations to supercomputers. To this end, GFDL will also be actively involved in the development of a NOAA-wide IT architecture plan that will occur over the next several years. As this agency-wide plan develops, GFDL will need to revise its own IT architecture plan accordingly.

GFDL's budget initiative, entitled "Attacking Computational Challenges in Climate and Weather Research," was approved by Congress and the Administration at a level of $5 million for FY 2000. This includes funds to support the acquisition of a very large, scalable computer system and necessary IT support capabilities for GFDL that will be needed to provide critical computing, storage, analysis, and software capabilities. To this end, GFDL is now carrying out the procurement of a High Performance Computing System (HPCS), using the CONOPS process, under a project agreement that was approved by OAR Management in September 1999 and updated in January 2000 (http://www.gfdl.gov/hpcs/RevisedProjectAgreement.html). A Request for Information was issued in September, followed by vendor discussions in November. GFDL is now preparing to release the Request for Proposals and expects considerable vendor interest in this solicitation.

A critical and very time-consuming part of the preparations for this procurement has been the development of a suitable benchmark suite that reflects the anticipated future workload of the Laboratory's modeling research programs. The resulting model suite reflects the combined efforts of a number of Lab scientists to develop version 3 of the Modular Ocean Model (MOM3), as well as grid-point and spectral versions of the atmospheric Flexible Modeling System (FMS). Message-passing versions of these models were developed for the benchmarks, along with a model interface to couple the atmosphere and ocean models. In addition, the benchmark team developed a representative group of analysis codes that reflect the future analysis workload that is a key part of GFDL's research activities.

The magnitude of the above efforts highlights another critical need of the Laboratory for Software Development and Technical Support (SDTS) capabilities, which is the second principal emphasis of the project agreement. The transition to the new scalable, cache-based architecture systems from current parallel-vector systems will present a substantial challenge to GFDL's computational

efforts, as it has for other organizations facing similar transitions. To address this challenge, the Lab has hired two expert consultants to assist in the procurement and to provide software development support, not only for the benchmark codes but also for the broader software transition effort. In addition, the Lab plans to set up one or more additional contract mechanisms to acquire IT services to assist in this transition. Finally, funds will also be used to support software research and development activities in support of the Lab's research programs, including substantial university research support.

During FY 2000, GFDL will accelerate its development of a common modeling system for its global atmosphere and ocean models under the framework of the Flexible Modeling System, in preparation for the installation of the new system. Current versions of these models, using a generic message-passing format, comprise the major models of the benchmark suite that will represent the future workload of the Lab. Each of GFDL's research groups have committed a substantial portion of their resources to aspects of this very complex development effort, which involves not only new production models, but also more flexible capabilities for analyzing model results and comparing them with observations. A lab-wide management structure has been put in place to oversee and direct this program. In addition, options are being investigated that may allow coordination of this program with other development programs, within NOAA as well as other research organizations in other agencies and the university community. Because GFDL has made a corporate decision to drastically limit the number of models which will be moved to the next system, the FMS development program has critical importance to the Lab's future.

GFDL modeling accomplishments in FY 2000 will focus on the maturation of several modeling efforts that have been underway since last year. The GFDL Hurricane Dynamics Group has spent the past year converting the GFDL Hurricane Prediction System to run efficiently on NCEP's IBM SP system as well as on other distributed-memory computers. The conversion required a drastic redesign of the entire code in order to properly manage the very complex movable-mesh design that is central to the model. This redesign resulted in a far more manageable code for use in this year's hurricane season. The FMS core models continue to mature along with the development of a number of physics modules that will make up the future coupled model. A key element of this is the coupling interface, a version of which was implemented in the benchmark suite. A high-resolution parallel MOM3 production experiment has been running on the enlarged T3E system since late fall as part of the new "Modeling Eddies in the Southern Ocean" Experiment. This would not have been possible on either the T932 or the initial 40-processor T3E system.

GFDL Performance Measures*	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04
Total user CP hours per month (in units of 1000 T90-CPU hours) on production system	18/18	16.7/ 18	80	130	180	300
Total usage of archive storage (in terabytes)	73/73	95/ 100	150/ 175	250/ 300	400/ 440	600

GFDL Performance Measures*	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04
Total available archive storage (in terabytes)	120/ 120	180/ 120	200	350	500	800
Annual # of additional production-capable parallel applications implemented on the production system (Both T932 and T3E)	2/2	2	2	2	2	2
Annual # of additional major or support applications converted to the scalable development (T3E) system	3/3	3/2	–	–	–	–

* When two numbers are presented and divided by a "/", the first number represents the achieved FY 2000 performance measurement or the revised measure for future years. The second number represents the measure presented in the FY 99 Strategic Information Technology Plan.

GFDL Milestones*	FY Goal
Perform market survey of industry, including release for vendor comment of early versions of possible benchmark codes.	Q1 FY 00/Q4 FY 99
Evaluate progress of the conversion of GFDL's major model codes to run on new scalable architecture systems.	Q1 FY00/Q1 FY 00
Award contract for scalable high performance computer system.	Q4 FY 00
Complete site preparation and install initial systems.	Q4 FY 00
Final lease payment under current supercomputer contract.	Q4 FY 00
Evaluate the capabilities of a more advanced GFDL Hurricane Prediction System for providing improved track forecasts as well as predicting other storm features, such as wind and precipitation fields and changes in storm intensity.	FY 01
Demonstrate progress in improving the capabilities of the next-generation GFDL coupled research model for predicting seasonal-interannual climate and for elucidating some of the processes that control El-Niño-Southern-Oscillation events.	FY 02
Scheduled mid-life system upgrade to enhance performance of the scalable high-performance computer system	FY 02

GFDL Milestones*	FY Goal
Isolate sources of climate "drift" and define a strategy for reducing their effect on long-running, higher resolution coupled climate models.	FY 03

* When two years are presented and divided by a "/", the first year represents the FY 99 accomplishment or the revised goal for future years. The second year represents the goal presented in the FY 99 Strategic Information Technology Plan.

Budget Estimates ($K): Includes all hardware, software, operational, and support costs associated with the system. Also includes personnel costs for individuals whose primary task is system development, operations, or support. In accordance with the reporting format required by OMB, the budget estimates are divided into two categories: "development/enhancement" and "steady state". The first category is used for expenditures for developing a new IT system or enhancing an existing system. The second category is used for expenditures for just maintaining a current system.

System		FY 00	FY 01	FY 02	FY 03	FY 04	FY 05
GFDL	Development/ enhancement	10,861	12,930	13,831	13,842	13,855	13,870
	Steady state	3,658	3,123	3,223	3,262	3,302	3,343

STRATEGIC GOAL: PROMOTE SAFE NAVIGATION

The Programmatic Goal and Objectives: In order to achieve the benefits envisioned under the "Promote Safe Navigation" strategic goal, NOAA will need to continue investing in information technology. Desired benefits include reduced marine navigation risks, enhanced environmental protections, and heightened competitiveness of the U.S. shipping industry. Investments in information technology are encompassing all of the objectives of "Promote Safe Navigation" including: to build, maintain and deliver a digital nautical charting database to underpin new electronic navigation systems and which integrate satellite positioning, tidal heights and currents, radar and sonar, and navigational aides; to update nautical surveys of the Nation's coastal areas using full-bottom coverage technologies; to define the national shoreline in an accurate and consistent manner using state-of-the-art technology to serve the Nation's navigational and coastal managers; to provide mariners with real-time observations and forecasts of water levels, tides and currents, and weather conditions in ports; and to transform the obsolete geodetic reference frame into a GPS-based system of monumented marks and continuously-operating reference stations to support the digital revolution in mapping, charting, and surveying. The primary Line Office involved in achieving this goal is NOS.

Nautical Charting and Surveying System: To support NOAA's strategic goal to "Promote Safe Navigation", NOS must (1) update nautical surveys of the coastal areas using full-bottom coverage technologies and (2) maintain and deliver the navigational charts to support commercial and recreational use of the Nation's waterways.

The Nautical Charting and Surveying System meets the demand for more current nautical information, greater protection of life, property, and the environment, as well as significantly improving the efficiency of maritime commerce. System objectives are to upgrade acquisition technology; optimize hydrographic data transfer on computer systems; build, maintain, and deliver a digital nautical database to underpin new electronic navigational systems as well as maintaining the existing raster nautical charts; and to improve the productivity of the chart-making process for safe and efficient marine navigation.

The Nautical Charting and Surveying Program is moving towards Print-On-Demand technology for meeting chart requests. Users will be able to quickly obtain up-to-date charts. The program also is continuing efforts to complete a vector electronic navigational chart database.

NOS is creating a vector Electronic Navigational Chart (ENC) in the internationally-accepted S-57 format to produce the vector electronic chart data. The vector chart can be used in conjunction with raster data in electronic navigational systems. Clearly these actions depend upon the use of information technology and the achievement of these goals will be delayed by budget limitations.

The information technology architecture being used to support NOAA's nautical charting and surveying program is desk-top computer systems and commercial off-the-shelf software, with relatively low-risk internal software development.

System Status and Plans - The Raster Chart Database is completely built and currently provides, on a weekly basis, updates of 100% of the Raster Charts, including information from the Notice to Mariners. The Notice to Mariners is a periodical or casual notice issued by Hydrographic Offices or competent authorities regarding changes in aids to navigation, dangers to navigation, important new soundings, and in general, all such information that affects nautical charts, sailing directions, light lists, and other nautical publications. Notice to Mariners corrections, as well as other corrections critical to navigation, are now released through our CRADA (Cooperative Research and Development Agreement) partner as raster patches to update existing Raster charts.

The Nautical Charting and Surveying System is in the process of finalizing a CRADA to exploit Print-on-Demand technology to provide the most up-to-date nautical charts to the mariner. Print-on-Demand (POD) is the use of large format inkjet or electrostatic plotters to produce NOAA nautical charts. POD technology is one way to provide mariners with more up-to-date charts. To use Print-On-Demand, NOS updates digital files of all charts each week for all Notice to Mariner items. Charts would then be printed when ordered using these updated files.

Further development of a S-57-compliant seamless vector database, as the basis for Electronic Navigation Charts (ENC), continues. The production of ENCs for release to the public has proven to be exceptionally labor intensive for maintaining the data currency, resulting in somewhat overall delayed production statistics. In FY 1999, the anticipated production level was the release and continual maintenance of 90 new ENC's per year. The United States Hydrographic Office, Office of Coast Survey (OCS)/National Ocean Service, is experiencing the same difficulties being experienced in all international hydrographic offices. The usage of the internationally-accepted S-57 format is proving to be difficult to both enter into the databases, as well as to maintain the data with current information. As OCS proceeds through finalization of the development and implementation of this new product line, some delays and problems are to be expected. The Performance Measure chart below indicates the results of the delayed production schedule from the encountered problems.

In the hydrographic surveying arena, the system has completed approximately 24% of the backlog of critical area surveys. The reconfiguration of NOAA's ship RUDE's multi-beam data acquisition processing system is complete. The reconfiguration of RUDE's shipboard hydrographic data acquisition and processing systems is complete also (ahead of schedule).

Year 2000 issues were addressed and completed in 1998 and 1999.

The Nautical Charting and Surveying System performance measures have been modified. The chart suite was divided into two categories, ENCs and Raster Charts, to better reflect the strategic goals for "Promote Safe Navigation". The initial load of data into the databases for both the original number of ENC Charts is complete. The Raster Chart database had been completed

in a previous year. [In the case of the ENC database, management decisions have been made to expand the suite of available ENCs from the original number of 195, which covered the major port and harbor areas of the U.S., to an expanded suite covering transit areas as well. A final number of ENCs is not currently available.] However, the maintenance and availability for the ENCs from these databases is an on-going performance measure for the future.

In FY 2000 and beyond NOS will continue to improve and refine nautical charting production processes and services. The focus will be on the following areas: (1) to fully implement continuous maintenance of the digital raster nautical charting database, keeping all 1000 nautical charts in a constant state of currency; (2) to continue the delivery of a raster electronic chart product through a partnership with the private sector; (3) to make the transition from lithographic offset printing to "print-on-demand"; (4) to incrementally expand the vector chart database as appropriate and as required by the user in the internationally-accepted S-57 format for the Nation's priority ports and harbors, and for the subsequent production of ENCs; and (5) to complete a major redesign and recompilation of the entire set of Coast Pilot Volumes. Other possible efforts would involve the production of inland waterways charts and customized charting products.

Nautical Charting and Surveying System Performance Measures	**FY 99**	**FY 00**	**FY 01**	**FY 02**	**FY 03**	**FY 04**
% of initial data load into digital database for Electronic Nautical Charts (ENC)**	100					
% of digital DB maintained & available for Electronic Nautical Charts (ENC)**	25/33					
Number of ENCs (new per year/maintained in continual maintenance and field verified		65	70	90	90	90
% of digital database built and in continual maintenance for raster charts	100/100	100	100	100	100	100
% of Print-on-Demand charts updated ***						
% of Raster Charts updated for on a weekly basis (CD format)	100/100	100	100	100	100	100
% of backlog of critical area surveys completed (cumulative)	20.7/18	24	26	30	33	36

* When two numbers are presented and divided by a "/", the first number represents the achieved FY 99 performance measurement or the revised measure for future years. The second number represents the measure presented in the FY 99 Strategic Information Technology Plan.
** The first two Performance Measures on ENC's have been modified to a more meaningful outcome measure indicating the number of new ENC's released, maintained in Continual Maintenance, and Field Verified per year.
***Performance measure is no longer applicable until the final CRADA is signed and the systems are tested.

Nautical Charting and Surveying System Milestones	FY Goal
Complete the development of hydrographic smooth sheet production and SCARS workstation processing	FY 99/FY 99
Accomplishing 50% of Print-On-Demand Charts updated for Notice to Mariners **	
100% of ENC S-57 database completed	FY 00
100% of ENC S-57 database maintained, and available***	Beyond FY 05

* When two years are presented and divided by a "/", the first year represents the FY 99 accomplishment or the revised goal for future years. The second year represents the goal presented in the FY 99 Strategic Information Technology Plan.
**The milestone is no longer applicable until the final CRADA is signed and the systems are tested.
***This Milestone is modified to represent new numbers of available ENC's.

Real-Time Observations and Forecasts of Water Levels, Tides, and Currents:

A Physical Oceanographic Real-Time System (PORTS) provides real-time environmental observations and forecasts for a specific U.S. port as needed by the marine transportation community and other users requiring operational oceanographic information. Each PORTS is designed to meet local user requirements.

A PORTS provides real-time oceanographic data for port operators and mariners. The focus now is to ensure that the data is quality-controlled and can be used for decision-support.

PORTS plays an important role in NOAA's strategic goals to "Promote Safe Navigation" and "Sustain Healthy Coasts". It is a decision-support tool that provides real-time environmental information for a given U.S. port needed to establish the navigation parameters for safe travel within the port; to determine appropriate cargo transport load information; and to define both present and future oceanographic conditions at the given location.

The benefits derived from PORTS include a reduction in maritime transportation risks; mitigation of damages should an accident occur; increase cargoes able to move safely and efficiently into and out of the Nation's ports and harbors; and support to coastal planners and researchers in order that safe and efficient development of our coastal and ocean resources can be achieved.

PORTS systems come in a variety of sizes and configurations. The largest existing installations comprise over 26 separate instruments. The smallest consist of a single water-level gauge and

associated meteorological instruments, and are referred to as "PORTS Lite". Each PORTS system acquires oceanographic instrument data and disseminates observations through digital and voice modes. Each system has a PC for data acquisition, a PC for a voice host, and a PC to serve as a gateway to the Internet. Each PORTS is monitored through the Continuous Operational Real-Time Monitoring System (CORMS). The CORMS provides 7-day a week, 24-hour a day monitoring and quality control of instruments and data in order to ensure the availability, accuracy, and quality of the real-time environmental observations. The CORMS combines the use of real-time communications, data analysis, system monitoring, and electronic reporting and notifications techniques to perform its tasks.

System Status - A full PORTS is operational in Tampa Bay, Florida; New York Harbor, New York; San Francisco Bay, California; Houston/Galveston, Texas; and Chesapeake, Virginia. A PORTS Lite is installed in Anchorage, Alaska; Nikiski, Alaska; Seattle, Washington; Tacoma, Washington; Baltimore, Maryland; Hampton Roads, Virginia; and Soo Locks, Michigan. The installation of the PORTS Lite in Soo Locks, Michigan, occurred during the past year.

The PORTS program was not funded as expected for Fiscal Year 2000. As a result, there is a freeze on the implementation of any additional PORTS beyond Narragansett, Rhode Island. The implementation of the Narragansett PORTS, which was already scheduled for this year, is being completed.

During the past year, the experimental system known as the Chesapeake Area Forecasting Experiment (CAFÉ), aimed at providing improved predictions of water level in the Chesapeake Bay, was implemented as an operational system and renamed the Chesapeake Bay Operational Forecast System (CBOFS). CBOFS is the first of its kind, providing water level nowcasts and forecasts in U.S. estuarine waters in order to provide increased safety and efficiency of maritime commerce through such waters.

During the past year, the National PORTS Database (NPDB), a repository for all PORTS data, was established. The NPDB is a SQL-based relational database that provides the foundation for all PORTS data access and provides a means by which the data and information can be organized and managed. Also implemented was a mechanism for populating the database on a continuous basis. This data ingestion system is referred to as the Operational Platform for the Acquisition of Currents (OPAC). It is a Silicon Graphics workstation that ingests the data collected from the various PORTS sites.

During the past year, a new CO-OPS (Center for Operational Oceanographic Products and Services) operational product called the PORTS InfoHub went on line. The InfoHub provides one-stop shopping for all PORTS products. It also includes a "partner" area for contributing applications and site links from local PORTS organizations, both public and private, for each of the PORTS. The InfoHub uses standard SQL interfaces and therefore provides a format-independent environment for developers. All PORTS data is retrieved from the National PORTS Database.

During the past year, the Rensselaer Polytechnic Institute (RPI) completed a requirements analysis for the next generation of CORMS, referred to as CORMS II. The analysis addressed the implementation of a knowledge-based system that employs the use of embedded intelligence and levels of user decision-aiding.

System Plans - As part of the IT strategic planning process, CO-OPS will work towards positioning itself to respond to: (1) clear market signals; (2) established trends in the industry; and (3) forecasted technological events. As new technologies come along, CO-OPS will actively assess the technology and determine its impact and potential use. CO-OPS exists in an ever-changing world of real-time processes such as PORTS and demands for high performance computing such as nowcast/forecast modeling. CO-OPS must continually work to position itself strategically within this environment to respond to: (1) an increased number of PORTS; (2) an increased number of water level gages and associated sensors; (3) an increased number and complexity of model applications in real-time; and (4) an increased demand for real-time products. The following are some of the activities planned to keep CO-OPS on the strategic path for 2002 and beyond.

CO-OPS has a new initiative to develop operational forecast systems for estuaries and PORTS. CO-OPS currently maintains operational observing systems and provides real-time information on water levels and currents. However, to meet the increasingly stringent demands of the marine navigation community, forecasts of marine variables must be developed. The objective of this initiative is the implementation of numerical models with data assimilation capabilities for nowcasting and forecasting water levels, currents, solidities, and temperatures for estuaries and lakes and for ellipsoidal (common datum) modeling. This initiative will ensure a stable operational infrastructure (24-hour a day, 7-day a week) needed to implement and operate the forecast systems and to provide quality-controlled forecast products in a user-friendly form to the customer. The model applications will assist commercial navigation in controlling traffic entering and leaving the ports and harbors of U.S. waters in a safe and economical manner, while assisting the port operators in optimizing loading/off-loading operations. It will provide the maritime community with forecasted water levels based on non-tidal and tidal forcing influences, as well as provide water quality indicators and effects for hazardous spills, storm surge, and flooding.

Due to the current lack of funding for PORTS, as well as uncertainty whether or not there will be funding for PORTS in the future, it is difficult to determine other future plans. However, it is anticipated that even without additional PORTS installations, the following capabilities are required in order to support the historical data as well as the data being received from existing PORTS.

In order to enhance the availability of data via the National PORTS Database, CO-OPS recognizes the need for an interface for populating the National PORTS Database with metadata rather than depending on the current insertion of data via ad-hoc methods. This interface is under development and is expected to be completed in the coming year.

The CORMS system, which provides 24-hour-a-day, 7-day-a-week monitoring of PORTS data, has rapidly achieved high levels of performance, along with heightened expectations about what it

should do. CO-OPS acknowledges that in order to continue to provide the required levels of monitoring without compromising data quality, additional capabilities need to be employed. During the coming year a prototype system, called CORMS II, will be implemented. CORMS II will work in concert with CORMS. CORMS II will provide appropriate levels of decision-aiding and embedded intelligence in order to allow for better data quality determinations to be made as well as ensure consistency in actions taken. A project team has been formed within CO-OPS to research and select a rules-based Commercial Off-the-Shelf (COTS) software package upon which CORMS II will be built. The team will then employ a contractor to implement the CORMS II prototype using the COTS selected.

CO-OPS recognizes the need for continual development and enhancement of its software systems in order to improve and revolutionize products and services for meeting the demand for more accurate and up-to-date marine environmental information. To ensure the delivery of quality software systems that meet the cost and schedule commitments, and the functionality and quality expected, CO-OPS will implement a software quality assurance process to improve the ability to manage and control the software design, development, testing, maintenance, and implementation of software systems. The process selected for implementation by CO-OPS is called the Capability Maturity Model for Software (CMM) and provides a clearly defined, evolutionary and disciplined path for software developers to follow. CMM is used throughout industry and is recognized as an accepted and proven model to adopt when defining the software process. CO-OPS will establish a CMM architecture for the PORTS software systems. It will implement the appropriate organizational policies in order to satisfy CMM Level II certification by FY 2002. It will implement the project software development and maintenance procedures in order to satisfy CMM Level III certification by FY 2003.

Currently, the NPDB organizes and manages incoming data. Methods and procedures for analyzing this data need to be developed, as well as a database in which to store the results of the analysis. The ability to analyze PORTS data will take the data to a new level of standards and integrity so as to provide the most complete and quality-controlled information that the PORTS can provide. CO-OPS will gather the requirements to support data analysis and then develop a database model to satisfy these requirements. This analysis database will complement and interact with the NPDB. The development and implementation of this database is expected to be completed in FY 2002. The implementation of procedures for performing the data analysis is expected to be completed in FY 2003.

At some point in time, the ability to remove data from the on-line database to an off-line database is required in order to provide the best performance access to the most requested data, which for PORTS is the most recent data. CO-OPS will develop and implement a short and long-term archive strategy for PORTS data. This development process will include determining methods for collecting, combining, and storing all the data on state-of-the-art media with efficient and reliable access to the data both on-line and off. The development and implementation of the data archive strategy is expected to be completed by FY 2004. All applications will be modified to go beyond the on-line data sources and have access to the additional off-line sources of data by FY 2005.

PORTS Performance Measures*	FY 99	FY 00	FY 01	FY 02	FY 03	FY04
Total PORTS & PORTS Lites implemented	12/13	13/15	15	17	19	19
% of PORTS data quality controlled	100/100	100	100	100	100	100

* When two numbers are presented and divided by a "/", the first number represents the achieved FY 99 performance measurement or the revised measure for future years. The second number represents the measure presented in the FY 99 Strategic Information Technology Plan.

PORTS Milestones*	FY Goal
Implement Chesapeake Bay regional forecast system	FY 00/FY 99
Install Narragansett Bay and Soo Locks PORTS	FY 00/FY 99
Install Delaware Bay and Los Angeles/Long Beach PORTS**	
Implement National PORTS Database	FY 00/FY 00
Implement an operational National PORTS Information Hub	FY 00/FY 00
Implement National PORTS Database Metadata interface	FY 01
Implement CORMS II	FY 01
Install Charleston and San Diego PORTS**	
Implement PORTS Analysis Database	FY 02
Implement CMM organizational policies for PORTS	FY 02
Install Boston and Nikiski PORTS**	
Implement PORTS analysis capabilities	FY 03
Implement CMM software processes for PORTS	FY 03
Implement data archive strategy for PORTS	FY 04
Implement accessibility to the PORTS data archive	FY 05

* When two years are presented and divided by a "/", the first year represents the FY 99 accomplishment or the revised goal for future years. The second year represents the goal presented in the FY 99 Strategic Information Technology Plan.

** The PORTS program was not funded as expected for Fiscal Year 2000 and future funding is unknown. As a result, the date for the implementation of the specified PORTS has been removed.

The National Water Level Observation Network Data Management System (formerly DPAS): The National Water Level Observation Network (NWLON) provides the foundation for the tidal and Great Lakes vertical water-datum control for the nation. A key IT support system for NWLON is the NWLON Data Management System (DMS) that processes data acquired from NWLON sites, performs quality-control functions, and makes the data available to users.

The NWLON Data Management System processes and quality-controls tide and water-level data, and makes it available to users. The system is now operational.

The NWLON DMS plays an important role in NOAA's strategic goals to "Promote Safe Navigation" and "Sustain Healthy Coasts". It provides tide and water-level information needed to establish and maintain the vertical water level reference required to support nautical chart production; to determine state and federal boundaries; and to define setbacks from high-water lines.

The benefits derived from this system include a reduction in maritime transportation risks, which thereby heightens the competitiveness of the U.S. shipping industry, and support to coastal zone planners and researchers in order that safe and efficient development of our coastal and ocean resources can be achieved.

NWLON DMS uses a client-server architecture that relies upon RISC-based workstations as the servers and PCs as the clients. It includes a data acquisition platform, which is a Silicon Graphics workstation that continuously receives data via the Internet from NOAA's Command and Data Acquisition ground station at Wallops Island, Virginia, through the National Weather Service (NWS) Gateway. The workstation then decodes the data and checks the quality. The initial data checks provide preliminary quality assurance. The data is then loaded into a database from which data processing is done before making the data available to users. Much of the NWLON DMS software was developed for its specialized functions of quality control and quality assurance, and for its specific applications.

System Status - The NWLON DMS system is fully operational. During the past year, the modernization of the NWLON sites that acquire data for the NWLON DMS was completed. Approximately $350K was spent to replace obsolete equipment with new Vitel gauges. In addition, several infrastructure changes and software changes were made at CO-OPS headquarters in order to support this new equipment. Together, these tasks bring to completion the IT component of the NWLON modernization activity.

During the past year, the NWLON DMS database server was upgraded from a Digital Equipment Corporation Unix-based system to a Silicon Graphics Origin 2000 Unix-based system that offers improved performance. In addition, a new data acquisition platform for the NWLON DMS was implemented. The new system, referred to as the Operational Platform for the Acquisition of Water Levels (OPAWL), is a Silicon Graphics workstation and replaces the outdated OS/2 PC platform previously used to support data ingestion. The primary source from which the data acquisition platform receives data was changed. OPAWL receives the data from the ground

station at Wallops Island, Virginia, through the NWS Gateway rather than through hourly phone calls to Wallops, as used in the previous system. Phone calls are now used as backup to the NWS Gateway. The switch to the NWS Gateway allows CO-OPS to receive and process data every 5 minutes.

During the past year CO-OPS implemented the capability for NWLON gauges to transmit data every 18 minutes, rather than the typical one to three hour intervals, whenever water level values at a gauge site exceed predetermined upper or lower limits for that site or the site is flagged by CORMS as being along the projected path of a storm. In order to provide access to this data by the public, as well as special access for organizations such as FEMA, a special Web page referred to as Tides OnLine was implemented. Tides OnLine provides users with immediate graphical and tabular displays of this water level and meteorological data.

System Plans - As part of the IT strategic planning process, CO-OPS will work towards positioning itself to respond to: (1) clear market signals; (2) established trends in the industry; and (3) forecasted technological events. As new technologies come along, CO-OPS will actively assess the technology and determine its impact and potential use. CO-OPS exists in a ever-changing world of processes such as the NWLON DMS and demands for high performance computing. CO-OPS must continually work to position itself strategically within this environment to respond to: (1) an increased number of water level gages and associated sensors; (2) an increased number and complexity of applications; and (3) an increased demand for products. The following are some of the activities planned to keep CO-OPS on the strategic path for 2002 and beyond.

To improve the necessary infrastructure required to support the NWLON DMS, the final phase of the NWLON DMS client migration will be completed during this year. A significant amount of progress has been made in the process of moving NWLON DMS client-server applications, which provide client software services, files services, and print services, from an OpenVMS-based system to a Windows NT-based system. Once done, this will complete the NWLON DMS client migration to a single operating environment.

CO-OPS will continue to focus on improved data acquisition. During the coming year, new software will be implemented to modernize the methodology being used to perform preliminary quality control on incoming data. The existing software is aging, cumbersome, unstable, and inefficient, and will be replaced. There are additional techniques for determining data quality that need to be implemented. Currently, database procedures are being used to perform intensive calculations that could be better performed outside the database. The existing software does not take advantage of new features provided with more recent versions of the client-server software that provides the interface between an application and the database. These new features will improve performance and provide better methods for handling errors.

Consistent with CO-OPS policy and strategy to constantly provide increased functionality through the use of current technology, an assessment of the manual processing activities being performed by the NWLON data analyst will be made. A list of candidate tasks will be targeted for automation. The appropriate software will be written/modified in order to automate these tasks.

Once automated, some of the opportunities for human error will be removed and a more consistent analysis of data from station to station will be secured.

CO-OPS recognizes the need for continual development and enhancement of its software systems in order to improve and revolutionize products and services for meeting the demand for more accurate and up-to-date marine environmental information. To ensure the delivery of quality software systems that meet the cost and schedule commitments, and the functionality and quality expected, CO-OPS will implement a software quality assurance process to improve the ability to manage and control the design, development, testing, maintenance, and implementation of software systems. The process selected for implementation by CO-OPS is called the Capability Maturity Model for Software (CMM) and provides a clearly defined, evolutionary, and disciplined path for software developers to follow. CMM is used throughout industry and is recognized as an accepted and proven model to adopt when defining the software process. CO-OPS will establish a CMM architecture for the NWLON DMS software systems. It will implement the appropriate organizational policies in order to satisfy CMM Level II certification by FY 2002. It will implement the project software development and maintenance procedures in order to satisfy CMM Level III certification by FY 2003.

An emerging need by CO-OPS is the ability to perform data entry from remote sites. Several possibilities will be considered, such as developing an independent application from which data can be entered and then downloaded to the database, or providing remote access to existing applications at CO-OPS headquarters that could interact with the database directly. Requirements will be obtained from CO-OPS remote offices and a solution that satisfies those requirements will be implemented by FY 2002.

At some point in time, the ability to remove data from the on-line database to an off-line database is required in order to provide the best performance access to the most requested data. CO-OPS will develop and implement a short and long-term archive strategy for NWLON DMS data. This development process will include determining methods for collecting, combining, and storing all the data on state-of-the-art media with efficient and reliable access to the data both on-line and off. The development and implementation of the data archive strategy is expected to be completed by FY 2004. All applications will be modified to go beyond the on-line data sources and have access to the additional off-line sources of data by FY 2005.

NWLON DMS Performance Measure*	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04
% increase in processing rate of monthly water level station data through NWLON DMS	25/35	35	35	45	45	45

* When two numbers are presented and divided by a "/", the first number represents the achieved FY 99 performance measurement or the revised measure for future years. The second number represents the measure presented in the FY 99 Strategic Information Technology Plan.

NWLON DMS Milestones	FY Goal
Complete modernization of all NWLON sites	FY 99/FY 99
Complete modernization of NWLON DMS Data Collection Platform	FY 00/FY 00
Complete VMS to Windows NT server migration	FY 00
Complete modernization of NWLON DMS Database Server Platform	FY 00/FY 00
Implement Tides OnLine	FY 00/FY 00
Complete modernization of preliminary quality control of data	FY 01
Implement additional automated data processing capabilities	FY 01
Implement CMM Organizational Policies for NWLON DMS	FY 02
Implement data entry capability via remote sites	FY 02
Implement CMM software processes for NWLON DMS	FY 03
Implement Web-based NWLON DMS client interface	FY 03
Implement data archive strategy for NWLON DMS	FY 04
Implement accessibility to the NWLON DMS Data Archive	FY 05

* When two years are presented and divided by a "/", the first year represents the FY 99 accomplishment or the revised goal for future years. The second year represents the goal presented in the FY 99 Strategic Information Technology Plan.

Geodetic Support System: The Geodetic Support System performs functions necessary for NOAA to attain its objective to "Develop the National Spatial Reference System (NSRS)", which is part of NOAA's strategic goal to "Promote Safe Navigation". The NSRS provides a common geographic framework and is the foundation for the National Spatial Data Infrastructure (NSDI), which is a critical component of the "information superhighway" and is essential for mapping, charting, navigation, boundary determination, property delineation, resource evaluation surveys, and scientific applications. NSDI facilitates data sharing by organizing and providing a structure of relationships between producers and users of spatial data and thus ensures consistent and reliable means to share spatial data. The System acquires data from Global Positioning System (GPS) Continuously Operating Reference Stations (CORS) and other sources, runs GPS and geoid reduction software, and performs other functions that require high computational speeds. The GPS satellite tracking data is processed to determine satellite orbits and to establish, maintain, and monitor a national GPS network. The National Geodetic Survey (NGS) collects

The Geodetic Support System processes data for the National Spatial Reference System and geoid models. Plans are to expand to 1,000 Continuously Operating Reference Stations (CORS).

and distributes GPS observational data from a nationwide network of permanently operating GPS receivers. The Federal Base Network (FBN), the foundation of the NSRS, comprises both horizontal and vertical positions of monumented stations. The NSRS is complemented by a geoid model, enabling users to determine elevations accurately and efficiently. All data is managed by the NGS Integrated Data Base (NGSIDB) System, which is the source of all products supplied to the user community.

The primary objective of CORS is to provide local users with ties to NSRS for post-processing position determination. NSRS provides a consistent national coordinate system that defines latitude, longitude, height, scale, gravity, and orientation throughout the United States, and how these values change with time. As the basis for mapping, charting, navigation, boundary determination, property delineation, infrastructure development, resource evaluation surveys, and scientific applications, NSRS plays a critical role in ensuring the Nation's public safety, economic prosperity, and environmental well being. The system provides geodetic data to a variety of users, including surveyors, universities, state highway departments, and large engineering firms. Observational data is made available to the user community within 24 hours. CORS consists observation stations and a central data facility, made available over the Internet. The observational data comes from a network of about 150 GPS receivers.

The Geodetic Support System is based on an architecture of scientific workstations used as servers and PCs used for analysis and other functions. The system provides its products to the general public through FTP services, the Internet, and on CD-ROM.

System Status and Plans - NGS's long-term goal is to improve the accuracy and timeliness of this information in the NSRS. There are three major steps in obtaining this goal. First, to increase the coverage of CORS so that multiple sites can accurately cover one position. This will increase the accuracy by providing a cross-reference of data and by reducing the distance, and therefore the chance of error, to any one receiver. The extra sites will also provide a level of system reliability. This will be accomplished by the planned increase in the number of CORS sites.

Second, NGS must decrease the sampling time for all CORS data. By providing CORS data sampling in 5-second intervals instead of the 30-second intervals, public and private users will be able to obtain more accurate data and get that data more quickly. This will provide increased productivity in both public and private sectors, with an associated reduction in consumer and taxpayer cost. NGS plans to provide this improved data through improvement in data transmission capability and increased computing power.

Finally, NGS plans to enhance its customer service. All services are planned for Web access and NGS is also working to provide a NGS liaison officer in every state.

The CORS system is operational, with 180 CORS sites and 1454 FBN stations. In FY 2000 NGS deployed 10 new CORS sites, bringing the total number of sites to 180. NGS will continue to add 30 new sites every year until the full network is complete. Additional sites will increase system density and therefore provide greater data accuracy and system reliability. Data accuracy diminishes as one moves more than 100 km from a CORS, and currently only 33% of the U.S. is

within this range, with 15% of the nation over 300 km from a site. Increasing CORS to 1,000 stations will place at least 2 CORS within 100 km of any point in the U.S. This decision will require deployment of 100 new CORS sites in each of the next 8 fiscal years. Current funding only provides for 30 per year. In-house funding to reach the 1,000 site level does not exist. Additional sites will be brought on line, if possible, through co-operative efforts with the private sector and other Government entities. CORS will also continue to improve the accuracy of its data by increasing the periodicity of readings from the stations. This will increase data storage requirements for CORS.

NGS continued to cycle out older RISC and Intel-based workstations incapable of supporting the current Operating System (OS). The latest OS's are needed to run the current versions of the COTS production software used by NGS. All PCs now run on Intel Pentium chipset and use Microsoft NT 4.0 SP 5. Additional RAID systems were purchased to provide better customer access to CORS data. All new systems were Y2K-compliant prior to January 2000. NGS plans to replace 30% of its PCs each year in order to keep up with increased load-put onto the system by new development in software. NGS will work with NOS to comply with the NOS enterprise architecture.

The telecommunication backbone was upgraded to 100 Mbs and is being integrated into the NOS secure network. Additional efforts may be directed towards the development and distribution of additional geospatial data for use with GIS systems and the improvement of global positioning system (GPS) measurements to support three-dimensional positioning within an hour of observing the GPS data. The first would aid persons involved in environmental management, planning, research, and navigation, while the improved GPS measurements would aid in positioning activities, the monitoring of crustal deformation, and in ionospheric measurements. Finally, consideration is being given to modernizing the national height system by integrating horizontal, vertical, and gravity control networks into a unified positioning system, which would support determinations of erosion rates and flood plain boundaries, under-keep clearances for large marine vessels, and storm surge and pollution trajectories. It would also assist in disaster preparedness and produce savings in the cost of field surveying.

NGS will continue to improve the accuracy of the North American Vertical Datum (NAVD). This will require the resurvey of 146 of the FBN monuments and 63 of the National Water Level Observation Network (NWLON) monuments in FY 2002 through FY 2006. The FBN vertical data began to be supplemented with data from CORS. This Height Modernization Program is funded in the Presidential budgets.

In FY 2000 NGS will continue to expand its co-operative efforts with the States. Currently 27 states have NGS advisors. This number is planned to increase by 2 states per year until all states have a Geodetic advisor. Each new advisor will require access to a PC for office automation and geodetic research.

Geodetic Support Performance Measures	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04
CORS stations operational (goal 1000)	171/ 171	180/ 200	210/ 300	240/ 400	270/ 500	300/ 600
Accuracy of gravimetric geoid model (cm)	8.0/8.0	7.0/7.5	6.5/7.0	6.0/6.5	5.5/6.0	5.0
% of FBN completed (horizontal)	100/ 100	100	100	100	100	100
% of FBN complete (vertical)	69/69	76/70	87/81	95/92	100/ 100	100/ 100
% of NWLON complete (vertical)	na	na	na	33	67	100
% of State Advisors	54/54	58	62	66	70	74

* When two numbers are presented and divided by a "/", the first number represents the achieved FY 99 performance measurement or the revised measure for future years. The second number represents the measure presented in the FY 99 Strategic Information Technology Plan.

Geodetic Support System Milestones	FY Goal
Expand CORS to 150 stations	FY99/FY99
Complete and publish new geoid model	FY99/FY99
Expand CORS to 200 stations	FY01/FY00
Perform network adjustment of entire NSRS and populate NGSIDB	FY00/FY00
Add two State Advisor positions	FY00
Add two State Advisor positions	FY01
Expand CORS to 300 Stations	FY04/FY 01
Survey 63 NWLON Stations	FY02
Survey 146 FBN Stations	FY02
GEOID '02 (New Geoid Model)	FY02
Expand CORS to 400	FY07/FY02
Add two State Advisor positions	FY02
FBN Total Vertical Stations 911	FY03
Survey 63 NWLON Stations	FY03

Geodetic Support System Milestones	FY Goal
Survey 146 FBN Stations	FY03
Expand CORS to 500	FY10/FY03
Add two State Advisor positions	FY03
Survey 63 NWLON Stations	FY04
Survey 146 FBN Stations	FY04
Add two State Advisor positions	FY04

* When two years are presented and divided by a "/", the first year represents the FY 99 accomplishment or the revised goal for future years. The second year represents the goal presented in the FY 99 Strategic Information Technology Plan.

Search and Rescue Satellite Aided Tracking (SARSAT): The SARSAT program and system of the United States are managed by the Direct Services Division of the Office of Satellite Data Processing and Distribution, NOAA/NESDIS. The SARSAT program and system are part of the international COSPAS-SARSAT program and system. NOAA is the lead U.S. agency for the COSPAS/SARSAT program. In this program, instruments flown on NOAA and Russian satellites receive signals from ships and aircraft in distress. The signals are processed in the ground system to identify the geographical location of the distress. The SARSAT ground system of the United States is comprised of the United States Mission Control Center (USMCC) located in Suitland, MD, and 14 ground stations called Local User Terminals (LUTs). Two LUTs are located in Alaska, California, Guam, Hawaii, Maryland, Puerto Rico, and Texas.

SARSAT plans to implement a new generation of ground stations, to develop a target architecture for the SARSAT ground system that will incorporate security considerations, and to identify and analyze issues involved with electronic registration via the Internet.

The LUTs receive, process, and distribute emergency distress data from federally-mandated maritime Emergency Position Indicating Radio Beacons (EPIRBs), aeronautical Emergency Locator Transmitters (ELTs), and experimental Personal Locator Beacons (PLBs). The distress data is downlinked by NOAA TIROS and Russian Nadezhda satellites to the LUTs. The LUTs in turn forward the data to the USMCC. The USMCC performs the automated processing functions of matching, merging, and geographically sorting distress alerts received from both the NOAA LUTs and international COSPAS-SARSAT Mission Control Centers. The USMCC disseminates distress alerts to the U.S. Coast Guard and the U.S. Air Force via a packet network provided by SPRINT. The distress alerts are used to effect the search for and rescue of those in distress. A packet network provided by MCI is utilized for international data communications.

An important component of the USMCC is the 406 Registration Data Base (RDB). It is a federal requirement to register with NOAA any 406 MHz emergency beacon that is used in the United States. The 406 RDB is the depository of the registration information and currently contains the information for more than 58,000 beacons. Information is extracted from the 406 RDB for a particular beacon after the satellite detection of that beacon. The registration information is appended to the alert data message that is sent to the search and rescue authorities of the U.S. Coast Guard and U.S. Air Force.

As described above, the mission of the SARSAT ground system is the delivery of distress alerts to search and rescue authorities to effect the search for and rescue of those in distress. Since the beginning of the international program in 1982, the saving of more than 10,000 people in distress has been attributed to COSPAS-SARSAT and nearly half have been saved in the United States.

The USMCC relies on IT to perform its mission. The USMCC is comprised of PCs, LANs, data bases, proprietary and non- proprietary applications software, COTS software, and interfaces to the packet networks for data communications. The USMCC is operated and maintained by contractor staff 24 hours per day, 7 days per week. The current LUTs are not considered IT. However, IT will be an integral portion of the next generation of ground stations for which implementation will begin in FY 2001.

This activity supports the NOAA strategic goal to "Promote Safe Navigation" by operating and maintaining the SARSAT mission control center plus seven ground receiving sites for effecting search and rescue.

System Status and Plans - To carry out the mission of the SARSAT ground system in the United States to provide the messages for search and rescue authorities to effect search and rescue for those in distress, the SARSAT ground system must be reliable, available, and timely. The system adheres to the metric of providing a message to a rescue co-ordination center within 90 minutes of a distress signal being detected by a satellite. The USMCC also adheres to international COSPAS-SARSAT standards. In addition, the USMCC must be effective in its handling of information from its ground stations. On a daily basis, the USMCC receives more than 400 locations from its ground stations. Obviously, not all these locations are real distress but are mostly false alerts or false emitters. The USMCC thus continues to maintain its effectiveness even though less than 1% of information that enters the system are for real distress situations.

In calendar year 1999 in the United States, the saving of 291 people was attributed to SARSAT. Also, in FY 1999 there was the transition from an AT&T network to a SPRINT network for domestic data communications which was necessary because AT&T was terminating its network. There was also operational implementation of the final application elements of the Government owned USMCC. The SARSAT transition to the Year 2000 occurred without problem due to extensive planning and work.

In the next fiscal year and beyond, there are plans: (1) to award a new re-competed contract for the operations and maintenance of the USMCC, an action necessary because the current contract is scheduled to expire; (2) to implement a new generation of ground stations (LUTs), an action

necessary because the current LUTs are approaching obsolescence; (3) to develop a target architecture for the SARSAT ground system that will incorporate security considerations; and (4) to identify and analyze issues involved with the electronic registration via the Internet of 406 MHz beacons.

Performance Measures: As described above, for each of the past several years, the USMCC has sent the messages that resulted in the saving of hundreds of lives. For example, in 1997 the USMCC sent the messages that resulted in the rescue of 562 people; 316 people were rescued in the United States in 1998 because of COSPAS-SARSAT; and 291 people were rescued in the United States in 1999.

SARSAT* Performance Measures	FY 00	FY 01	FY 02	FY 03	FY 04
Emergency locator signals collected from aircraft and ships	22,300	23,400	24,600	25,800	27,000
Emergency beacons in service at end of year	839,000	875,000	910,000	946,000	984,000

* This is a new entry and was not presented in the FY 1999 Strategic Information Technology Plan.

SARSAT Milestones	FY Goal
Effective date of re-competed USMCC O&M contract	FY 01
Complete installation of new generation LUTs	FY 02
Complete definition of Target Architecture	FY 01
Identify issues related to electronic registration of 406 beacons via Internet	FY 01

Budget Estimates ($K): Includes all hardware, software, operational, and support costs associated with the system. Also includes personnel costs for individuals whose primary task is system development, operations, or support. In accordance with the reporting format required by OMB, the budget estimates are divided into two categories: "development/enhancement" and "steady state". The first category is used for expenditures for developing a new IT system or enhancing an existing system. The second category is used for expenditures for just maintaining a current system.

System		FY 00	FY 01	FY 02	FY 03	FY 04	FY 05
Nautical Charting and Hydrographic Surveying	Development/ enhancement	1,603	1,812	2,050	2,318	2,618	2,951
	Steady state	632	703	785	873	970	1,076
Real-Time Observations and Forecasts	Development/ enhancement	1,683	1,559	1,516	1,756	1,806	1,850
	Steady state*	367	490	717	828	910	1,038
DPAS	Development/ enhancement	569	726	458	538	588	620
	Steady state	206	281	371	376	402	430
Geodetic Support System	Development/ enhancement	117	124	130	136	143	150
	Steady state	506	531	558	584	612	640
SARSAT	Development/ enhancement	790	3,420	3,400	1,350	1,400	1,400
	Steady state	1,040	1,570	2,080	2,140	2,200	2,200

*The reduction in these figures from the previous Plan reflect a correction of an error (last year's "Steady State" figures were a total cost figure).

STRATEGIC GOALS: BUILD SUSTAINABLE FISHERIES AND RECOVER PROTECTED SPECIES

The Programmatic Goals and Objectives: NOAA's "Build Sustainable Fisheries" strategic goal seeks to increase the Nation's wealth and quality of life by ensuring sustainable fisheries that can provide safe seafood, a healthy fishing industry, and recreational opportunities. Objectives for helping to meet these goals are: assessing the status of fishery resources, advancing fishery predictions, managing for economic growth, ensuring adequate compliance, and providing research and services for fishery-dependent industries. The primary Line/Program Offices involved in this goal are NMFS, OAR, and the Coastal Ocean Program Office.

Through the "Recover Protected Species" strategic goal, NOAA will conserve marine species and recover those in danger of extinction. By 2004, NOAA will be on the road to recovering marine species at risk and maintaining the healthy coastal ecosystems upon which they depend. To accomplish this goal, NOAA's objectives are to conserve species by implementing recovery and conservation plans and to monitor, assess, and predict the status of protected species and their ecosystems. The budget estimates shown may undergo significant revision as a result of the business process re-engineering taking place in NMFS.

Since the same IT systems support both of these goals, as well as the NMFS portion of the Sustain Healthy Coasts goal, they will be dealt with together.

National Marine Fisheries Service (NMFS)/NOAA Fisheries: Information Technology (IT) capabilities provide the key tools for NMFS to accomplish its mission, *"Stewardship of living marine resources for the benefit of the nation through their science-based conservation and management and protection of the health of their environment"*. IT is interwoven through all aspects of NOAA Fisheries' business processes which strive to advance the vision that *"The American people are able to enjoy the wealth and benefits of diverse and self-sustaining living marine resources"*. To implement its mission and vision, NOAA Fisheries' business processes support the following three NOAA Strategic Planning Goals: *"Build Sustainable Fisheries", "Recover Protected Species", and "Sustain Healthy Coasts."*

The NMFS System supports the management and protection of living marine resources. NMFS is implementing a Fisheries IT architecture which will provide a framework for integrating new acquisitions with exiting capabilities.

The *NOAA Fisheries Strategic Plan* includes *"Improving our information systems"* as one of its foundation performance elements in recognition of the importance of IT within NMFS. In order to effectively manage IT within its nationally dispersed organizational structure, NMFS established the Fisheries Information Technology for the 21st Century (FIT21) as its target architecture. FIT21 provides a principle-centered framework, with associated best practices, for

incorporating IT into the daily operations which support NOAA Fisheries' ability to successfully fulfill its mission, vision, and the objectives of its strategic goals.

The process to create a Fisheries IT architecture was initiated in response to: (1) recommendations generated during an internal reorganization, which occurred several years ago; and (2) requirements of the Government Performance and Results Act, the Clinger-Cohen Act, the Government Paperwork Elimination Act, and Office of Management and Budget (OMB) directives such as OMB Circulars A-11, A-130, and "Raines Rules". The June 1995 Final Report of the NMFS Information Management (IM) Charter Team identified the IM vision of *"Having the Right Information in the Right Place at the Right Time, Empowering the Workforce to Fulfill the NMFS Mission"*. Subsequently, this vision was adopted as the vision for the Fisheries IT target architecture, FIT21.

System Status and Plans

Migration to the Target Architecture

NOAA Fisheries' strategic IT goals include migrating to its IT Architecture (FIT21) and helping to achieve the goal of a "Digital Department". The initial emphases of FIT21 are to: (1) make a transition towards conducting business processes as a Web-based agency, (2) establish a more secure IT environment for business processes, and (3) provide tools to foster a well-informed and trained workforce. Development and migration to FIT21 will continue, as resources become available, along with coordination with NOAA and DOC on agency-wide and Department-wide architecture efforts.

An initial migration plan has addressed the gaps between NOAA Fisheries' existing technology and the target architecture. Many small and medium-scale projects were identified and organized into plateaus or phases with implementation over the following three to five years. Recent migration activities include deploying enterprise-wide Web-based training; conducting a pilot project to gain experience in multi-site collaboration and PKI; and identifying necessary steps to bring NMFS in compliance with the NOAA Security Directive. These projects, described below in greater detail, are consistent with the Department of Commerce's goals to create a "Digital Department" and improve program service delivery. Budget restrictions are preventing full scale migration to the target architecture, FIT21.

IT Infrastructure

The NOAA Fisheries' infrastructure strategic IT objective is to continue coordinating with NOAA and DOC to provide more efficient and effective IT infrastructure capabilities at reduced cost, focusing primarily on greater bandwidth, improved security and information assurance for data transmission, and increased Internet access for Fisheries staff located at remote locations. Specific near-term plans for moving towards this goal, and recent related accomplishments, are detailed below.

Enterprise Electronic Messaging: NOAA Fisheries, along with the other NOAA Line Offices, is migrating to Netscape Messenger as its e-mail platform. To more efficiently provide e-mail services for its 2,500 employees nationwide, NOAA Fisheries deployed two messaging servers, one each at its highest population centers in Silver Spring, MD and Seattle, WA. This deployment scheme represents a significant cost savings in hardware, software, and maintenance from the previous cc:Mail environment of 36 servers nationwide. Currently 600 users are online at the Seattle site and migration is underway at the Silver Spring site. All NMFS mail users will be migrated to Netscape Messenger by June 30, 2000.

Wide Area Network (WAN): In September 1999 NOAA Fisheries, along with the other NOAA Line Offices, began working with the FTS2001 vendor to migrate its existing WAN to the new contract. Through the migration NMFS is eliminating redundant links and re-routing connection paths to better reflect the agency business requirements. The reduced connection costs in the lower 48 states also are enabling NMFS to increase the available bandwidth at those sites. NOAA Fisheries will continue to coordinate with NOAA and DOC in any future enterprise-wide efforts to further improve efficiencies and reduce costs.

Information Assurance/IT Security: NOAA Fisheries, along with the other NOAA Line Offices, is conducting a comprehensive information assurance program which involves security planning, infrastructure support, and security awareness training. In accordance with OMB Circular A-130, NOAA Fisheries identified 34 IT systems to be accredited. Recently, security plans for all 34 systems were completed and approved by NOAA. NMFS also is writing a security policy for distribution to its staff by July 2000. Additionally, NMFS will provide training to its systems administrators on risk assessment and contingency planning in order to present a full accreditation package to NOAA by March 2001.

Having implemented all reasonable security measures for system assets that are identified as essential to accomplishing its mission, NOAA Fisheries is in compliance with PDD-63 requirements. To address infrastructure security issues, NMFS identifies existing vulnerabilities within its networks, provides a comprehensive patch distribution system, and is developing a firewall policy. Applications developers are encouraged to integrate IT security mechanisms into the design of all new systems. NOAA Fisheries also works closely with the NOAA IT Security Office to disburse security awareness training to its end users and system administrators. NMFS established an information assurance Web page to ensure that staff have easy access to such information.

As a participant in the creation of a NOAA IT security architecture, NMFS will implement appropriate security elements as they are identified. In addition, a NOAA Fisheries representative participates in the Federal Computer Security Program Manager's Forum and the DOC Public Key Infrastructure Affinity Group in order to identify additional security measures for potential implementation within NMFS.

Corporate Web Presence: NOAA Fisheries is establishing a "corporate look and feel" for its multitude of Web pages via a support services contractor. Requirements for a consistent structure for Internet, Intranet, and Extranet Headquarters Office Web sites are under

development to ensure that all sites meet a minimum standard. Currently, the quality of content and presentation of these pages ranges from very good to minimal.

Improved Program Service Delivery

The NOAA Fisheries' strategic IT goal for program service delivery is to continue improving its responsiveness to its employees, partners, and stakeholders via the development and implementation of primarily Web-based solutions for more effective and efficient business processes. These efforts are consistent with DOC's goals for a "Digital Department" as well as with the mandates to reduce reporting burden on the public as required by the Paperwork Reduction Act and the Government Paperwork Elimination Act. Using relatively small IT investments, NOAA Fisheries is streamlining its business processes and improving the services it provides to the public.

Short-term emphases are likely to be in the following areas: improving fishery data collection activities in cooperation with the interstate fish commissions; establishing data collection and analysis activities for the social/economic effects of regulatory actions; and conducting stock assessments for the over 400 commercially and/or recreationally targeted species for which the status of the fisheries is unknown. Long-term emphases will likely be related to developing ecosystem-based management techniques to ensure the stewardship of our living marine resources. Recent successes and short-term plans are given below.

Internal Customers

HelpDesk/User Services: NOAA Fisheries is pilot testing a Web-based, off-the-shelf software package that enables its staff to enter their own trouble tickets, i.e., requests for help. This commercial product also provides status monitoring of requests and access to an integrated knowledge base by NMFS' technical support contractors. The pilot project is expanding to include nationwide assistance for the recent "roll-out" of the Web-enabled NMFS financial reporting system, FRS. An automated scheduling capability for video conferencing also will be installed shortly. Enabling staff in all Regional Offices and Science Centers to schedule and start their own video conferences, this capability will significantly decrease the required level of staff support at Headquarters.

Virtual IT Training Campus: NOAA Fisheries staff now can access a Web page to receive "one-stop-shopping" for available IT training. The site links to a commercial vendor which is offering 20 end-user classes for 1,500 NMFS employees nationwide as well as 20 end-user classes for 100 IT professionals. Classes range in complexity from Internet/Intranet skills to network administration. Courses also may be taken from home computers. Online reference materials provide additional documentation. Upcoming seminars and brown bags at Headquarters are listed at the Web site which soon will include similar activities at regional sites.

Administrative Systems: The NOAA Fisheries' *Financial Reporting System (FRS)* is a Web-based system which enables tracking and reporting of financial and personnel resources. FRS

reports are used by NMFS' nationwide staff to reconcile its financial data with that in the official NOAA Financial Management (FIMA) system.

Within NOAA, NMFS is in the forefront for implementing the integrated *Travel Manager* system. This CAMS-sponsored client/server application is in use at the Silver Spring and Annapolis sites with field deployment underway. To avoid redundant data entry, NOAA Fisheries developed an application that automatically extracts travel authorization data from the Travel Manager database and posts it in FRS. Travel Manager has the potential to standardize and expedite travel authorizations and vouchers NOAA-wide. The CAMS Project Office is evaluating a Web-based version of Travel Manager which will greatly enhance its usefulness.
The *Travel Document Numbering System* is a Web-based capability that enables issuing domestic and foreign travel order numbers in a controlled and centralized manner. This function was quickly developed and deployed nationwide at the request of administrative staff for a simple and consistent system.

Nationwide deployment of the Web-based *Fisheries Grants Management Data Base (FGMDB)* is underway. Since grants represent almost a third of NMFS' total budget, the FGMDB will be a significant aid to NMFS program officers as they manage over 300 grant awards to Indian tribes, academia, non-profit organizations, and city, county, and state governments. Capabilities include: data exchange with FRS; linkage of proposals and awards to NMFS Strategic Objectives; and eventual Web search capabilities for the general public. NOAA and the National Ocean Survey (NOS) are working with NMFS to further develop the system, and NOS plans to implement the FGMDB.

NOAA Fisheries is developing a *Constituents Database (CDB)* which will serve as a centralized, NMFS-wide repository of information on constituents including their name, address, and areas of interest. This effort is expected to save resources by consolidating a multitude of existing systems and eliminating paper collections. The CDB will enable NOAA Fisheries to provide proactive communication to its regulated constituencies and comprehensive outreach to the general public. The CDB is expected to be deployed in October 2000.

External Customers

Collaborative Extranet Web Site: Using commercial off-the-shelf (COTS) software, NOAA Fisheries developed a prototype collaborative Extranet Web site for members of the Marine Fisheries Advisory Committee (MAFAC). Appointed by the Secretary of Commerce, MAFAC consists of 15 to 21 geographically-dispersed members who provide the Secretary with recommendations on issues and priorities of national importance with regard to the stewardship of living marine resources. The "Teamware" allows members to securely share documents, gather input, discuss ideas, schedule meetings, and collaborate from their own computers at any time and from any location. To ensure the privacy of their "discussions", all communications or transmissions among participants are encrypted using PKI capabilities. The MAFAC members are using the prototype and evaluating the current COTS selection.

One Stop Permit/Registration Shop: The newly available Web-based NOAA Fisheries Permit Shop allows fishermen to renew or order new Atlantic tuna permits over the Web and either print it on their own printer after an approved credit card purchase, or use normal mail delivery. Sponsors of sportfishing tournaments involving Atlantic highly migratory species such as Atlantic tunas, sharks, and swordfish also can register their event on this Web site. Sponsors of such events are required to notify NMFS of the purpose, dates, and locations of the tournament prior to the event and report landings by species after the event. Reporting of recreationally- landed bluefin tuna also may be reported via this Web site. Using this Web site reduces the "reporting burden" on sponsors of tournaments and sports fishers.

Mandatory Ship Reporting System: Developed as an interagency project between the U.S. Coast Guard and NOAA Fisheries, the Mandatory Ship Reporting System reduces the threat of collision of vessels with right whales. Operational as of July 1, 1999, all commercial ships of 300 gross tons and greater are required to report to a shore-based station when entering two defined areas off the east coast of the United States. In return, the vessels receive automated messages that locate the most recent right whale sightings; this information is used by the vessel operators to implement avoidance procedures and prevent collisions.

Vessel Monitoring System (VMS): NOAA Fisheries is developing a national VMS system which will replace several regional, stand-alone systems. COTS hardware and software recently were purchased and tested over a LAN. Plans are to test the system over the NMFS WAN during the third quarter of FY 2000. Initial deployment of the system is scheduled for late FY 2000 at several NOAA Fisheries Offices nationwide. The President's FY 2001 budget requests an additional 1.3 million dollars and 5 positions to expand deployment of the system. Benefits of deploying the national VMS include: (1) promoting consistent IT infrastructure requirements for hardware, software, and security/information assurance; (2) providing economies of scale and coordination across NMFS regions and offices; and (3) ensuring consistent policies for providing confidentiality of data collected from the commercial fishing industry.

National Fishing Vessel Registration and Fisheries Information System: As required by Section 401 of the Magnuson-Stevens Act, the Secretary of Commerce submitted a proposal to Congress for implementing a National Fishing Vessel Registration and Fisheries Information System. The President's FY 2001 budget requests 2 million dollars to begin this cooperative effort between NOAA Fisheries; the Atlantic, Gulf, and Pacific States Marine Fisheries Commissions; relevant states; Regional Fishery Management Councils; and the recreational and commercial fishing industries. Deployment of the vessel registration portion of the system would reduce the reporting burden on vessel owners who currently often must register their vessels several times through separate processes, depending on the fisheries and geographic locations where the vessels will be active.

The proposed system also would improve the accuracy and effectiveness of existing data collection programs by establishing common data collection, information technology, and quality standards for regional programs, and integrating the results into unified WEB-enabled information system. The proposal would fill critical information gaps through initiation of new data collection programs that would subsequently reduce the risk and uncertainty of living marine resource

policy decisions. Research and application of electronic data collection technologies would reduce the burden on individuals and groups who submit data. By coordinating the techniques used to gather and disseminate data on a nationwide basis, the collaborative program would efficiently bring into balance the demands for timely and credible data with the need to thoroughly evaluate, choose, and monitor state and federal public resource management policies.

Building upon FY 2001 efforts, the following activities would be implemented in FY 2002: data base integration ($1.8 M), wide-area-network ($1.6 M), electronic reporting ($3.0M), and institutional arrangements ($1.6 M). In FY 2003 funding for missing recreational data ($1.2 M), and commercial trip ticket implementation ($6.87 M) would be needed, and additional activities and funding would be added each year if the 5-year roll-out of $25.2 M described in the Report to Congress was followed.

National Marine Mammal Stranding and Sample Database: Required by Title IV of the Marine Mammal Protection Act, a National Marine Mammal Stranding and Sample Database is in the planning stages. The Web-based system will provide members of Congress, NMFS' constituents, and the general public easy access to the answers to often-asked questions regarding nationwide stranding statistics and trends. Deployment is expected late in FY 2001.

Electronic Fishing Vessel Logbook Projects: NOAA Fisheries is coordinating with the Pacific Marine Fisheries Commission (PMFC) to develop catch reporting software which will enable electronic reporting of fish ticket information in a manner compatible with the systems currently operated in various regulatory and monitoring agencies as well as in private industry. Building upon the efforts of two prototype systems, NOAA Fisheries will provide the PMFC with catch data standards for establishing guidelines on the content of the information required by NMFS and the format for transmitting it.

IT Planning and Capital Investment Review

To more fully meet the requirements of the Clinger-Cohen Act and the Government Performance and Results Act (GPRA), NOAA Fisheries is developing an IT planning process which will incorporate identification of IT requirements into its Annual Operating Plans for programmatic activities and its budget initiatives. Regional and Headquarters IT staff are expected to participate in programmatic planning activities, identify relevant IT requirements, and update the target IT architecture and its migration/implementation plans to reflect those requirements. To facilitate this process, the Deputy Assistant Administrator of Fisheries recently recommended establishing the position of Office Information Technology Coordinator (OITC) in each NMFS Headquarters Office. These positions will complement those of the Regional Information Technology Coordinators (RITCs) in the field offices. The NMFS CIO, members of the National Information Management Board (NIMB), the RITCs, and the OITCs will work together to ensure that the IT requirements are adequately addressed for all programmatic functions and activities.

NOAA Fisheries is creating a mechanism, via its FRS system, to track IT expenditures in the following categories: desktop/LAN operations, WAN operations, other telecommunications, database and scientific computing servers and support, applications development support, and

video conferencing. Its full implementation is expected in FY 2001. In addition, a contract to evaluate NMFS' IT planning and management processes and to provide recommendations for improvement will be awarded shortly. The study will concentrate on the following areas: linking NMFS' IT resources with programmatic strategic planning; managing IT assets as a "corporate" resource; and developing performance measurements and returns on investments that are specific to the mission, strategic goals/objectives, and business processes of NOAA Fisheries.

NMFS/NOAA Fisheries IT Performance Measures *	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04
** # of databases shared within NMFS and/or with other government agencies/Councils	46/46					
** # of interoperable, geographically dispersed NMFS information systems	4/4					
% integration IT planning with Programmatic planning		15	60	85	100	

* When two numbers are presented and divided by a "/," the first number represents the achieved FY 99 performance measurement or the revised measure for future years. The second number represents the measure presented in the FY 99 Strategic Information Technology Plan.
** Represent performance measurements prior to implementing the FIT architecture and are no longer active.

NMFS/NOAA Fisheries IT Milestones	FY Goal
Nationwide deployment of Web-based Fisheries Grants Management Data Base	FY 00
Information Assurance Accreditation of 34 IT Systems	FY 01
Establish corporate Web presence	FY 01
Internet access provided to all remote locations	FY 03
Refreshment of technologies to keep pace with industry advances	ongoing

Budget Estimates ($K): Includes all hardware, software, operational, and support costs associated with the system. Also includes personnel costs for individuals whose primary task is system development, operations, or support. In accordance with the reporting format required by OMB, the budget estimates are divided into two categories: "development/enhancement" and "steady state". The first category is used for expenditures for developing a new IT system or enhancing an existing system. The second category is used for expenditures for just maintaining a current system.

System		FY 00	FY 01	FY 02	FY 03	FY 04	FY 05
NMFS System	Development/ enhancement*	0	3,500	7,900	6,500	6,500	6,500
	Steady state	20,915	21,760	27,250	27,865	28,000	28,000

*Represents FIS and VMS FY 2001 Budget Initiatives; FIS and Technology Refreshment Initiatives in FYs 2002-2006.

Future Investments: Consideration is being given to the following as possible IT budget initiatives for the FY 2002 budget:

Environmental Stewardship Information Technology Refreshment for Science Program: If funded, this initiative would result in a continuous process of technology refreshment which would be implemented to support the computational requirements of biologists, economists, and modelers and keep pace with the increasing information flow created by the deployment of new sensors, platforms, and data collection activities across "Build Sustainable Fisheries" initiatives. This investment, equivalent to 3% of the total $50M Sustainable Fisheries Requirement initiative, supports the NMFS IT infrastructure that many of the observational data elements obtained from new sensors, observers, Fishing Research Vessels, and survey and census data collection programs will rely on for all or part of their life cycle. The cumulative effect of rising costs, no adjustments to base, and expanding requirements have created an erosion of base program functionality. In addition, rescissions, various executive branch taxes and specific Congressional earmarks, most recently in FY 2000, have reduced the NMFS' ability to refresh the technology infrastructure within the information technology line of the NMFS budget. Because of this, much of the existing computer infrastructure base in NMFS will be over 8 years old in FY 2002 with no funds available in the reduced base budget for replacement or upgrading.
Fisheries Information System: See discussion above.

STRATEGIC GOAL: SUSTAIN HEALTHY COASTS

The Programmatic Goal and Objectives: NOAA's goal to "Sustain Healthy Coasts" is based on the following supporting objectives: to protect, conserve, and restore coastal habitats and their biodiversity; to promote clean coastal waters to sustain living marine resources and ensure safe recreation, healthy seafood, and economic vitality; and to foster well-planned and revitalized coastal communities that sustain coastal economies, are compatible with the natural environment, minimize the risks from nature's hazards, and provide access to coastal resources for the public's use and enjoyment. The primary Line/Program Offices involved in this goal are NOS, OAR, NMFS, NESDIS, and the Coastal Ocean Program Office. In order to meet the objectives, investments in scientific and coastal resource management are required.

Information Technology Support: Information technologies have an increasingly important role in providing scientists and managers with tools to improve their ability to understand and manage our Nation's coastal resources. This goal, however, is not supported by any individual major systems. Most of the IT needs of the scientists and resource managers involved are satisfied by common computing, networking, and mid-level workstation equipment, and by commercially-available Geographic Information Systems (GIS), database management systems, statistical analysis, and related analytical software. The Internet and CD-ROMs also play important roles in disseminating information to coastal management users. Five of NOAA's Line and Program Offices have activities under this goal, with seventeen individual programs involved, and these IT resources are distributed throughout these organizations.

IT support is based mainly on PC, scientific workstation, and Internet resources. Primary IT needs for the future relate to model development, information sharing, and administration/management tools.

Much of the effort in meeting this goal's objectives involve resource management and protection supported by scientific research, monitoring, and assessment; scientific field and process studies and monitoring; information coordination; data management; archiving; and national-scale assessments. A need for grants administration, project management, and an information-sharing system to improve sustainable coastal communicates may be the focus of a future initiative. A seamless database of geo-referenced coastal information is needed to support the many NOAA efforts related to coastal environmental monitoring, assessment, management, and restoration.

Additional efforts may be directed toward developing new scientific processes to deal with harmful algal blooms and hypoxia, ensuring the proper use of science in coastal zone management decisions, developing restoration plans, and promoting coastal zone management activities such as habitat restoration and protection in the National Marine Sanctuaries and the National Estuarine Reserve System. Improving the ability to respond to natural and technological events including oil and chemical spills will require investments in integrated local/Federal planning, improvement

of scientific assessment tools, evaluating spill mitigation measures, and refining models used to estimate threats from spills and natural hazards.

Sustain Healthy Coasts IT Support Milestones	FY Goal
To be determined	

NOAA-WIDE INFRASTRUCTURE CAPABILITIES

NOAA has initiatives underway that serve NOAA as a whole. These are not directed at accomplishing any single strategic goal, but at providing the underlying infrastructure or improving the administrative services that allow NOAA to efficiently operate as a unified organization and to support collaboration and teamwork.

Commerce Administrative Management System (CAMS): CAMS is a Department-wide effort to modernize and integrate its financial and administrative management systems and streamline related business processes. The goal of CAMS is to employ modern technology to provide managers with standardized, accurate, and timely information to manage their resources while at the same time reducing administrative costs. Additionally, CAMS will be compliant with the Joint Financial Management Improvement Program (JFMIP) requirements for financial systems.

Due to funding levels, final implementation of CAMS will be delayed until FY 2002.

The supporting system architecture for CAMS is an increasingly Open Systems Environment that provides for interoperability (i.e., linkage or inter-connectivity) of hardware/software as well as portability of data and applications across diverse computing environments. Inter-connectivity of the systems will evolve to become seamless; financial data will be administered by the program managers; and distributed data processing will support bureau-unique, program-unique "business cultures".

The CAMS concept of operations is to use standard financial management software across hardware platforms, maintain that software centrally, ensure a single-entry source capture of financial data at point-of-origin, and implement paperless processing using electronic forms, routing, and approvals. Furthermore, CAMS will provide for the automatic validation of funds availability and commitment/reservation; "embed" intelligence that improves data integrity and reduces the need for reconciliations/corrections; and make available up-to-date official financial data on-line.

Tangible benefits that will be realized from CAMS are cost and personnel position savings, improved productivity, elimination of "cuff" systems, Electronic Commerce/Electronic Data Interchange, and Prompt Payment Act compliance. Other benefits include improved timeliness, accuracy, and reliability of financial data; improved services/products (mission support); new state-of-the-art systems; increased capability; more efficient database manipulation; productivity increases; better user-interfaces; and improved stewardship.

System Status and Plans: The implementation of the Accounts Payable module continued in the Washington area and in the Administrative Support Centers (ASC's). Similarly, the Commerce Small Purchase System (CSPS) module is continuing its successful deployment at headquarters and the ASC's.

Travel Manager has been successfully implemented at the client level for Washington area OFA offices, parts of NMFS, and 90% of EASC end-users. Travel Manager has also been completely implemented at the functional office level for Germantown and ASC Finance offices.

Major hardware upgrades have been performed to the Alpha 4100 (development and training) and the 8400 (production), improving technology and the common operating environment by converting from VMS to Unix. The production database was migrated from the Alpha 7760 (legacy machine) to the GS140 and performance improvements of 400 % have since resulted.

Lastly, NOAA CAMS has not been granted the requested level of funding for FY 2000. Final CAMS implementation will be extended another year until FY 2002. Deployment/Implementation plans are currently being revised to reflect this change.

CAMS Performance Measures	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04
Accounts Payable						
# of days for reimbursement of expenses to employees	8/6	6	1	1	1	1
Reduce/Eliminate reliance on current legacy systems	31%/ 30%	50%	100%	100%	100%	100%
Reduce Prompt Payment Act interest payments	10%/ 10%	25%	50%	50%	50%	50%
Eliminate duplicate key entry	10%/ 10%	30%	60%	60%	60%	60%
Increase electronic file transfer (EFT) payments	90%/ 50%	100%	100%	100%	100%	100%
Reduction in Rejects	3%/5%	10%	20%	30%	50%	50%
Increase in Transactions Processed	30%/ 20%	50%	100%	100%	100%	100%
Accounts Receivable						
# of days for recording deposits (Lockbox)	3/3	3	2	1	1	1
# of days to create billings	35/35	35	35	5	5	5

CAMS Milestones	FY Goal
CFS: General Ledger (closing); Full deployment of Accounts Payable; Limited deployment of Accounts Receivable; Set up Budget Execution and Cost Accumulation. CAMS: Full deployment of Procurement (to DPA level), Travel, and Bankcard.	FY 01/FY 00 FY 02/FY 01
CFS: Full deployment of General Ledger, Accounts Receivable, Reimbursables, Budget Execution, and Cost Accumulation, and T&A.	FY 02/FY 01
CAMS: Enhance CAMS to 100%.	FY 03/FY 02
CAMS: Production Support	FY 04

* When two years are presented and divided by a "/", the first year represents the FY 99 accomplishment or the revised goal for future years. The second year represents the goal presented in the FY 99 Strategic Information Technology Plan.

Planned Activities for Budget Year FY 00-01	
Module	**Sub-Activities Associated with Major Milestones**
Accounts Payable	Roll-out remaining manual document types to ASCs
Travel	Roll-out to Headquarters clients Limited ASCs roll-out to end-users
Small Purchases	Implement improved functionality Delegated procurement point roll-out
Accounts Receivable	Design/code, test, documentation Train/Deploy approp. refunds/sales
Reimbursables	Analyze, design, and functional test Limited analysis and testing progress
Budget Execution	Business Rules resolution Limited analysis and testing progress
Cost Accumulation	Analysis, design, and functional test Limited analysis and testing progress
Purchase Card	Analyze, code, test, document, train Headquarters and ASCs, limited client roll-out Limited roll-out to end-user level
T&A/Labor	System test

Planned Activities for Budget Year FY 00-01	
Module	**Sub-Activities Associated with Major Milestones**
Interfaces:	Motor pool Telecommunications Grants Cost Transfer

Information Technology Center (ITC):

NOT YET SUBMITTED

High Performance Computing and Communication Program (HPCC):

NOT YET SUBMITTED

Budget Estimates ($K): Includes all hardware, software, operational, and support costs associated with the system. Also includes personnel costs for individuals whose primary task is system development, operations, or support. In accordance with the reporting format required by OMB, the budget estimates are divided into two categories: "development/enhancement" and "steady state". The first category is used for expenditures for developing a new IT system or enhancing an existing system. The second category is used for expenditures for just maintaining a current system.

System		FY 00	FY 01	FY 02	FY 03	FY 04	FY 05
CAMS*	Development/ enhancement	6,380	6,860	6,500	2,000	0	0
	Steady state	11,720	12,240	13,100	13,500	13,700	13,800
ITC	Development/ enhancement						
	Steady state						

System		FY 00	FY 01	FY 02	FY 03	FY 04	FY 05
HPCC/IT[2]	Development/ enhancement						
	Steady state						

Future Investments:

Grants Electronic Commerce – FY 2002 funding of this initiative will allow NOAA to modify two pilot systems, currently in limited operation in NOS and NMFS, and the existing 7 year old NOAA Grants System (NGS), currently being modified from a character-based environment to a Graphic User Interface (GUI). Funds are requested to normalize and integrate the systems into one system that can be deployed NOAA-wide and be used by our recipient community and Federal Grant Managers. An electronic grants system will improve the efficiency of NOAA in providing Federal dollars for basic and applied research, and the management of the Nation's resources. This is a cross-cutting initiative because it will serve all facets of NOAA by supporting the "Environmental Assessment and Prediction" and "Environmental Stewardship" missions. Not only will this initiative support NOAA, but it falls directly in line with the goals of the Department of Commerce and the President. The President has placed this as a Priority Management Objective (PMO) in his FY 2001 budget. Failure to provide funds for integration will perpetuate separate systems and non-compliance with Public Law 106-017. Funding will also ensure that the design, training, and maintenance of the system remains intact. Continuous funding will be required for all out-years for use and maintenance of the system.

Facilities Information Management System – The Facilities Office manages several information management systems in order to meet its mission. These are used to manage NOAA's real and personal property assets ($3B) and environmental compliance and safety information and Capitol Improvement Projects ($61M). These systems were originally designed as stovepipe configurations. A lack of Enterprise Architecture planning in the past, as now required by the Clinger-Cohen Act, continues to inhibit customer access to timely and accurate information. The lack of interoperability between these legacy systems, due to incompatibility and disparate technologies, has resulted in a large amount of redundant data and automated systems which are difficult to maintain and manage over the life cycle. A well-planned information systems architecture, namely, the Facilities Information Management System (FIMS), is critical to ensure that current deficiencies are fully addressed both for the near and long-term needs of NOAA's Facilities Office. FIMS is based on automated business processes that would eliminate 90% of the manual, paper-based business practices. One of the primary objectives of FIMS is to comply with the GPEA. The investment is needed in the acquisition of COTS solutions and to support the software development of those applications where no other sources are able to meet the requirements. In addition, the implementation of a cohesive information architecture requires integration and interfacing of the various systems. This integration effort is critical to ensure that all systems are accessible in providing total facilities information to its users.

CONCLUSION

The contents of this plan have shown how NOAA's ability to maintain and improve its service to the Nation depends upon the wise and successful use of IT resources, and that NOAA is using technology both to re-engineer vital business processes and to significantly improve specific services. The plan has also shown that in a diverse agency like NOAA, a wide range of IT actions are needed; NOAA's challenge is to conduct this wide range of activities while maintaining sufficient coordination so that NOAA's IT systems work in an efficient and integrated way. IT is a tool, and it should now be clearer how the tools are to be used and for what purpose. The plan has provided both a comprehensive view of the critical systems and a means for achieving consensus about NOAA's future IT strategy. Management endorsement of this strategy provides direction for NOAA's future IT-related activities.

As stated in the Preface, this document is part of an annual planning and budgeting cycle. As NOAA's planning moves through the next steps in this cycle, and implementation actions start to be taken, there will be adjustments and changes in the plans. Within available resources, and considering changing needs, decisions will have to be made as to which programs and initiatives have the greater priority. These changes will be reflected in the subsequent IT planning activities – the NOAA Operational IT Plan and the supporting documentation for budget initiatives. The Strategic IT and Operational IT Plans, used in conjunction with NOAA's 5-Year Implementation Plans and NOAA Line and Program Office Operating Plans, provide a framework for future tracking of progress and measuring the accomplishments of IT systems. By preparing these plans and documenting the "return on investment" that NOAA is achieving through its IT systems, NOAA is working to implement the management approach mandated by the Government Performance and Results Act.

ACRONYM LIST

AC	Anomaly Collation
ACE	Advanced Composition Explorer
AFOS	Automation of Field Operations and Services
AHPS	Advanced Hydrographic Prediction System
ASOS	Automated Surface Observing System
ATOVS	Advanced TIROS Operational Vertical Sounding
AVHRR	Advanced Very High Resolution Radiometer
AWG	Architecture Working Group
AWIPS	Advanced Weather Interactive Processing System
CAC	Computer-Assisted Compilation
CAMS	Commerce Administrative Management System
CEMSCS	Central Environmental Satellite Computer System
CDAS	Command and Data Acquisition Station
CFS	Core Financial System
CIO	Chief Information Officer
CIP	Critical Infrastructure Protection
CIRT	Computer Incident Response Team
COADS	Comprehensive Ocean-Atmosphere Data Set
COMPS	Customer Order Management Processing System (Data Centers)
CONOPS	Concept of Operations
CONUS	Continental United States
COOP	Continuity of Operations
CO-OPS	Center for Operational Oceanographic Products and Services
CORBA	Common Object Request Broker Architecture
CORMS	Continuous Operational Real-time Monitoring System
CORS	Continuously Operating Reference Stations
COTS	Commercial-off-the-shelf
CY	Calendar Year
DMSP	Defense Meteorological Satellite Program
DOA	Department of Agriculture
DOC	Department of Commerce
DOD	Department of Defense
DPAS	Data Processing and Analysis Subsystem (for NWLON)
E-Commerce	Electronic Commerce
ENSO	El Niño-Southern Oscillation
EOSDIS	Earth Observing System Data and Information System
EPA	Environmental Protection Agency
ERL	Environmental Research Laboratories
ESDIM	Environmental Services Data and Information Management
EUMETSAT	European Organisation for the Exploitation of Meteorological Satellites
FAA	Federal Aviation Administration
FBN	Federal Base Network
FEMA	Federal Emergency Management Agency

FIMA	Financial Management System
FIT	Fisheries Information Technology (Architecture)
FSL	Forecast Systems Laboratory
FTP	File Transport Protocol
GAO	General Accounting Office
GFDL	Geophysical Fluid Dynamics Laboratory
GIMTACS	GOES I-M Telemetry and Command System
GIS	Geographic Information System
GOES	Geostationary Operational Environmental Satellites
GPEA	Government Paperwork Elimination Act
GPRA	Government Performance and Results Act
GPS	Global Positioning System
GSA	General Services Administration
GSFC	Goddard Space Flight Center
GTACS	GOES Telemetry and Command System
HPC	High Performance Computing Capabilities
HPCC	High Performance Computing and Communications Program
HPCS	High Performance Computing System (FSL)
IBM	International Business Machines
IDS	Intruder Detection System
IJPS	Initial Joint Polar System
ISO	Information Systems Office (of Office of Finance and Administration)
IT	Information Technology
ITA	Information Technology Architecture
ITC	Information Technology Center (within the ISO)
JFMIP	Joint Financial Management Improvement Program
LAN	Local Area Network
LUTs	Local User Terminals
MEI	Minimum Essential Systems
METOP	Meteorological Operational satellite (EUMETSAT/ESA)
MPP	Massively-Parallel Processor
NAOS	North American Atmospheric Observing System
NARB	Network Advisory Review Board
NASA	National Aeronautics and Space Administration
NASIRC	NASA Automated Security Incident Response Capability
NCEP	National Centers for Environmental Prediction
NEDASS	National Environmental Data Archive and Access System
NESDIS	National Environmental Satellite, Data, and Information Service
NEXRAD	Next Generation Weather Radar
NFC	National Finance Center
NGS	National Geodetic Survey
NGSIDB	NGS Integrated Data Base System
NIC	Network Information Center
NMFS	National Marine Fisheries Service
NNDC	NOAA National Data Center

NNT	Nearest-Neighbor Tool
NOAA	National Oceanic and Atmospheric Administration
NOC	Network Operations Center
NOE	Network Operating Environment
NORC	NOAA Operations and Research Center
NOS	National Ocean Service
NPOESS	National Polar-orbiting Operational Environmental Satellite System
NSA	National Security Agency
NSRS	National Spatial Reference System
NSSL	National Severe Storms Laboratory
NSWIS	National Space Weather Information System
NSWP	National Space Weather Program
NTACS	GOES-N Telemetry, Acquisition, and Command Transmission Subsystem
NVDS	NOAA Virtual Data System
NWLON	National Water Level Observation Network
NWR	NOAA Weather Radio
NWS	National Weather Service
NWWS	NOAA Weather Wire Service
OAR	Office of Oceanic and Atmospheric Research
OFA	Office of Finance and Administration
OGE	Operations Ground Equipment
OMB	Office of Management and Budget
ORPG	Open Radar Product Generation (for NEXRAD)
OSTB	Office of Science and Technology Policy
PDD	Presidential Decision Directive
PIP	Product Improvement Program (for NEXRAD)
PMEL	Pacific Marine Environmental Laboratory
POES	Polar-orbiting Operational Environmental Satellites
PORTS	Physical Oceanographic Real-Time System
PPP	Point-to-Point Protocol
PUP	Principle User Processor (for NEXRAD)
RDA	Radar Data Acquisition
RFI	Request for Information
RFP	Request for Proposals
RPC	Rapid Prototyping Center
RPG	Radar Product Generation (for NEXRAD)
SAA	Satellite Active Archive
SARSAT	Search and Rescue Satellite-Aided Tracking
SATEPS	Satellite Environmental Processing System
SBN	Satellite Broadcast Network
SCARS	Super Computer-Assisted Revision System
SEC	Space Environment Center
SELDADS	Space Environment Laboratory Data Acquisition and Display System
SMS	Scalable Modeling System
SOCC	Satellite Operations Control Center

SRS	Scalable Runtime System
SST	Sea Surface Temperature
STARS	Standard Terminal Replacement System
TCP/IP	Transmission Control Protocol/Internet Protocol
USAF	United States Air Force
USCG	United States Coast Guard
USMCC	United States Mission Control Center
VA	Vulnerability Assessment
VPN	Virtual Private Network
WAN	Wide Area Network
WFO	Weather Forecast Office
WITS	Washington Interagency Telecommunications System
WSR	Weather Surveillance Radar
WWW	World-Wide-Web
Y2K	Year 2000