National Oceanic and Atmospheric Administration

Report to Congress on Data and Information Management 2005

October 2005

NOAA's Vision

An informed society using a comprehensive understanding of the role of the oceans, coasts, and atmosphere in the global ecosystem to make the best social and economic decisions

NOAA's Mission

To understand and predict changes in the Earth's environment, and conserve and manage coastal and marine resources to meet our Nation's economic, social, and environmental needs

NOAA's Mission Goals

- Protect, restore, and manage the use of coastal and ocean resources through an ecosystem approach to management
- Understand climate variability and change to enhance society's ability to plan and respond
- Serve society's needs for weather and water information
- Support the Nation's commerce with information for safe, efficient, and environmentally sound transportation
- Provide critical support for NOAA's Mission

Foreword

It is my pleasure to present the National Oceanic and Atmospheric Administration's (NOAA) *Report to Congress on Data and Information Management, 2005*. Within the Department of Commerce, NOAA has the mission of archiving and providing access to the Nation's environmental data. The data and information products NOAA provides help policy makers implement sound economic decisions regarding our environment. Indeed, NOAA touches the lives of Americans every day.

Our environmental information products are a valuable national and international resource. We must extend our knowledge of managing commodities and supply chains to improve the management of our data and information. Modern technology brings us an array of tools we are now incorporating into our government–business operations as we continue to work to achieve societal and economic benefits. These newly established business practices will improve processing, securing, and accessing of our environmental products and services. NOAA will address increasingly complex environmental issues and expanding model requirements to support societal needs, while preparing for the challenges in managing and integrating rapidly growing data volumes. This report documents the steps we are taking to improve our data management processes.

The Department of Commerce plays a significant role in the stewardship of our natural resources. We help ensure the economic benefits of those resources are available on a sustainable basis to the Nation as a whole. NOAA applies the best of environmental science and technology to the problems our Nation faces in a changing world.

[original signed]

Carlos M. Gutierrez
Secretary, U.S. Department of Commerce

Preface

Tremendous advances in information technology and communications infrastructure over the past two decades provide the scientific community today with exciting tools and opportunities to help develop solutions to complex problems necessary to achieve societal benefits. Our performance in environmental science is also world-class. Our users are more sophisticated, more dependent on us than in the past, and their need for time critical information delivery is more essential. This Report lays out our plans to address these challenges.

Our national infrastructure capabilities and expertise contribute to our leadership role in the intergovernmental Group on Earth Observations (GEO). Understanding our global environment requires a global effort, and we have taken steps forward in the past two years in building a global network to share data and information. Management of data and information on a global scale is being addressed as part of the Global Earth Observation System of Systems (GEOSS), which is being developed by GEO.

In the wake of a second catastrophic hurricane season and last year's devastating Indian Ocean tsunami, we must improve our data management processes across NOAA, and assist our colleagues in the national and international community. Together we can employ the advances in information technology and worldwide communications to enable timely responses to threats against life and property.

[original signed]

Conrad C. Lautenbacher, Jr.
Vice Admiral, U.S. Navy (Ret.)
Under Secretary of Commerce for Oceans and Atmosphere and NOAA Administrator

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Public Law 102-567, Section 106: Data and Information Systems

(c) NEEDS ASSESSMENT FOR DATA MANAGEMENT, ARCHIVAL, AND DISTRIBUTION

(1) Not later than 12 months after October 29, 1992, and at least biennially thereafter, the Secretary of Commerce shall complete an assessment of the adequacy of the environmental data and information systems of the National Oceanic and Atmospheric Administration. In conducting such an assessment, the Secretary shall take into consideration the need to -

(A) provide adequate capacity to manage, archive, and disseminate environmental data and information collected and processed, or expected to be collected and processed, by the National Oceanic and Atmospheric Administration and other appropriate departments and agencies;

(B) establish, develop, and maintain information bases, including necessary management systems, which will promote consistent, efficient, and compatible transfer and use of data;

(C) develop effective interfaces among the environmental data and information systems of the National Oceanic and Atmospheric Administration and other appropriate departments and agencies;

(D) develop and use nationally accepted formats and standards for data collected by various national and international sources; and

(E) integrate and interpret data from different sources to produce information that can be used by decision makers in developing policies that effectively respond to national and global environmental concerns.

(2) Not later than 12 months after October 29, 1992, and biennially thereafter, the Secretary of Commerce shall develop and submit to the Committee on Commerce, Science, and Transportation of the Senate and the Committee on Science, Space, and Technology of the House of Representatives a comprehensive plan, based on the assessment under paragraph (1), to modernize and improve the environmental data and information systems of the National Oceanic and Atmospheric Administration. The report shall -

(A) set forth modernization and improvement objectives for the 10-year period beginning with the year in which the plan is submitted, including facility requirements and critical new technological components that would be necessary to meet the objectives set forth;

(B) propose specific agency programs and activities for implementing the plan;

(C) identify the data and information management, archival, and distribution responsibilities of the National Oceanic and Atmospheric Administration with respect to other federal departments and agencies and international organizations, including the role of the National Oceanic and Atmospheric Administration with respect to large data systems like the Earth Observing System Data and Information System; and

(D) provide an implementation schedule and estimate funding levels necessary to achieve modernization and improvement objectives.

Executive Summary

The Secretary of Commerce is providing this Report to Congress as directed under Public Law 102-567, Section 106: Data and Information Systems. Since the 2003 Report to Congress, the National Oceanic and Atmospheric Administration (NOAA) has made improvements to the planning, acquisition, archive, and dissemination of environmental data. NOAA has made significant changes in its business philosophy, developed an overarching strategy for integrated observation and data management, and began development of an integrated Earth observing and data management system. NOAA developed a baseline observing systems architecture and began a portfolio and strategic investment analysis. These analyses, and others, will assist decision makers within NOAA to prioritize and target investment and program development. Efforts to develop integrated data management strengthen NOAA's leadership role in the United States Group on Earth Observations and the intergovernmental Group on Earth Observations.

NOAA reviewed the state of its data management practices. This assessment focused on an holistic, end-to-end observation and data management approach, addressing the five data management, archive, and distribution areas identified in Section (1) of the Public Law. NOAA is doing a better job of delivering timely data in appropriate formats, and has made significant improvements in corporate planning for observations and data management. NOAA still faces data stewardship challenges in several key areas, including: managing the increasing volume and diversity of data; extending and filling gaps in environmental data records; improving accessibility to long-term archives; and enabling integration of quality observations and products. These activities depend on improved descriptions of data, formats, and processing steps.

NOAA's long-term objective is integrated information services delivery. NOAA has undertaken steps critical in the development of a comprehensive plan to address the challenges identified in its assessment. The comprehensive plan addresses the four items identified in Section (2) of the Public Law in a manner consistent with NOAA's Strategic Plan and business practices. Corporate-wide processes set the stage for modernization and improvement across NOAA. The near-term data management goals are: identify and address integration gaps; create interoperability across NOAA; develop and adopt standards for information exchange; integrate data and information products; and examine future requirements.

Excellent data management is a major focus of NOAA. NOAA is committed to collecting and providing the highest quality environmental data, delivered in an efficient manner. NOAA maintains a stable, long-term archive for future generations. Investments must focus on the people, tools, and technology, and on an integrated approach to observation and data management. NOAA's lifeblood is the more than 300 environmental observations acquired through its numerous observing systems. NOAA serves a diverse set of users and contributes to a wide range of benefits for the Nation, its economy, and the planet on which we live.

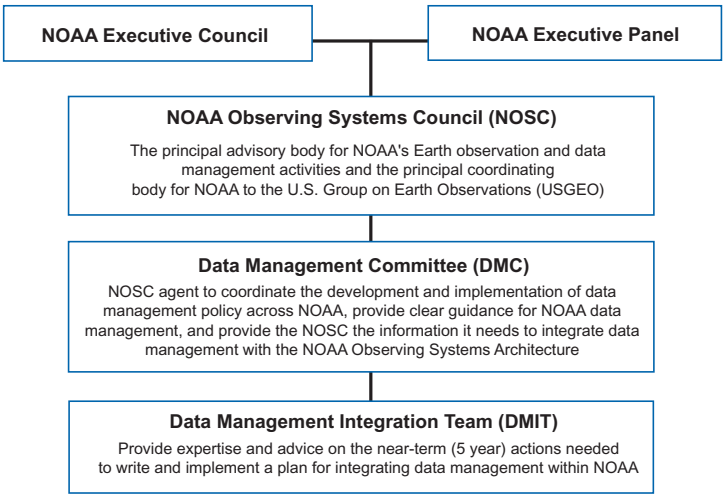
Introduction

Since the 2003 Report to Congress, the National Oceanic and Atmospheric Administration (NOAA) has made significant improvements to the planning, acquisition, archive, and dissemination of environmental data. NOAA made changes to its business philosophy, established an overarching strategy for integrated observation and data management, and began development of an integrated Earth observing and data management system.

NOAA adopted a program-oriented structure consisting of four Mission Goals and a Mission Support Goal around which the agency plans and organizes all of its work. The domains of the four Mission Goals are interrelated, sharing common data, science and technology challenges, and stakeholder interest. NOAA created an enterprise-wide method for planning and evaluating observation and data requirements, and established the NOAA Observing Systems Council (NOSC) to oversee observing systems, data, and information management and planning (Figure 1). The NOSC formed the Data Management Committee (DMC) to coordinate the development and implementation of data management policy across NOAA. The DMC addresses issues and opportunities requiring coordination among NOAA's Goals and Line Offices. The NOSC, through the DMC, sponsored this Report.

In 2005, NOAA conducted an end-to-end assessment of current data management capabilities and established additional resources focused on corporate-wide data management and development of a single "system of systems" for accessing NOAA environmental data. A robust and secure Information Technology (IT) Architecture is an essential component of NOAA's integrated data system. NOAA developed an IT Architecture, which provides a policy basis for the acquisition and use of IT resources, maximizing the benefits of IT protection across NOAA.

Figure 1. NOAA Data and Information Management Reporting Structure.



NOAA developed a baseline observing systems architecture and is analyzing strategic investments. These efforts will assist decision makers and Mission Goal Managers to prioritize and target investment and program development in the Planning, Programming, Budgeting and Execution System (PPBES) process. NOAA is establishing a baseline data management architecture and will subsequently conduct portfolio analysis as part of the development of target data management architecture.

NOAA's leadership role in the United States Group on Earth Observations (USGEO) and the intergovernmental Group on Earth Observations (GEO) is strengthened by its internal efforts to develop an integrated data management system. NOAA has extensive cooperative efforts with other federal agencies, with international partners, and with private industry. Future efforts are expected to take place under the umbrella of cooperation being facilitated by USGEO and GEO, using complementary tools and processes to share environmental information.

Assessment of Current Capabilities

NOAA conducted an assessment of the current state of its data management practices. Based on criteria from Public Law 102-567, NOAA assembled 12 survey questions focused on an holistic, end-to-end observation and data management approach, addressing the five data management, archive, and distribution areas identified in the Public Law. The survey was organized around broad data and information management themes: (1) observation acquisition and transmission; (2) scientific data management; and, (3) archive and access. The survey also addressed contingency planning. NOAA assessed end-to-end data and information management capabilities for 44 of the 45 programs in the NOAA program structure. The 45th program, addressing tsunamis, was established in June 2005 and is currently completing its data management assessment.

The assessment identified common areas of success and need across NOAA Goals. Based on these results, an End-to-End Environmental Data Management Assessment Summary was created (Figure 2). The Summary presents the status of data management activities within the NOAA Goals; however, it is not normalized for differences in Program responses. No value was assigned to "significant" or "incremental" increases in resources. A green cell indicates the Program is accomplishing 100 percent of the required activity or is able to do so with current resources. A yellow cell indicates the activity is partially accomplished or an incremental increase in resources is required to reach the 100 percent level. A red cell indicates the activity is not accomplished or significant new resources are required. A fully successful Goal acquires high-quality data; analyzes, evaluates, documents, and preserves these data; and provides timely information and products to the end users of the services. The assessments, when combined with strategic planning on the enterprise level, provide NOAA with an integrated end-to-end approach for Earth environmental data and information management.

Figure 2. Data Management Assessment Summary, 2005.

	Doing with current resources / Need incremental increase / Requires sub-stantial additional resources	End-to-End Environmental Data Management Functions										
		Observation Acquisition & Transmission			Scientific Data Management				Archive & Access			
		5-Year Plan	Maintain & Monitor	Collect & Rescue	5-Year Plan	Calibrate & Validate	Appropriate Formats	Complete Metadata	5-Year Plan	Long-term Preservation	Data Discovery	Access / Disseminate
NOAA Mission Goals	Ecosystems	P			P				N			
	Climate	F			F				F			
	Weather & Water	P			P				P			
	Commerce & Trans-portation	F			P				P			

- A **green cell** indicates the Goal is accomplishing 100 percent of the required activity or is able to do so with current resources.
- A **yellow cell** indicates the activity is partially accomplished or an incremental increase in resources is required to reach the 100 percent level.
- A **red cell** indicates the activity is not accomplished or that significant new resources are required.
- **5-Year Plan columns** are F, plan completed and in place; P, partly completed; and N, no plan in place.

Successes

Compared with four years ago, NOAA is doing a better job of collecting and verifying environmental observations, and processing and transmitting these observations. Observations are generally well calibrated and validated, and the related products undergo quality review based on accepted research or statistical methods. NOAA has seen significant improvements in corporate planning for observations and data management and began developing an integrated Earth observing and data management system. In 2001, NOAA assessed its ability to plan for, collect, ingest, catalog, validate, store, access, and migrate data by major data stream. Comparing the number of red, yellow, and green cells from the 2001 assessment to 2005, one sees a decrease in the percent of red cells and an increase in the percent of yellow and green cells (Figure 3). These advances are due in part to ongoing modernization programs such as the Advanced Weather Interactive Processing System (AWIPS) and the National Weather Service (NWS) Telecommunication Gateway.

Challenges

NOAA still faces significant data stewardship challenges. The rapid pace of technological change and a greater number of users with more sophisticated requirements are both challenges and a required part of the solution. The assessment of data and information management indicates, while progress has been made across virtually all Goals, there are continuing challenges in several key areas. NOAA must continue to meet real-time responsibilities at the current high level while addressing the following challenges:

- managing the increasing volume and diversity of data;
- extending and filling gaps in environmental data records;
- improving accessibility to the long-term archive;
- enabling integration of quality observations and products; and,
- improving descriptions of data, formats, and processing steps.

NOAA will address these challenges through the modernization programs listed in Figure 10 (page 17).

NOAA has undertaken steps to develop a comprehensive plan addressing the data management challenges identified in the data management self-assessment, and in accordance with NOAA's Strategic Plan.

Figure 3. Comparison of 2001 and 2005 Assessments.

Status of NOAA data management, based on the 2001 assessment (by NOAA Line Offices) and the 2005 assessment (by NOAA Goals/Programs).

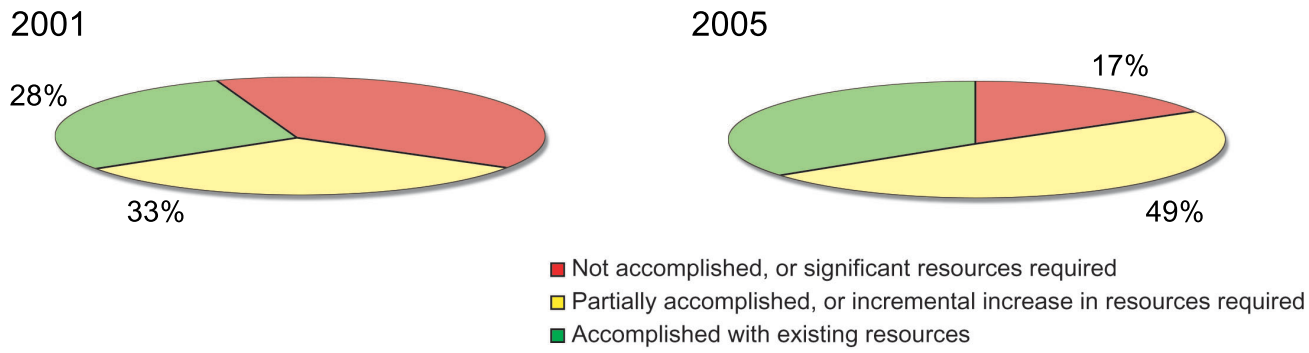
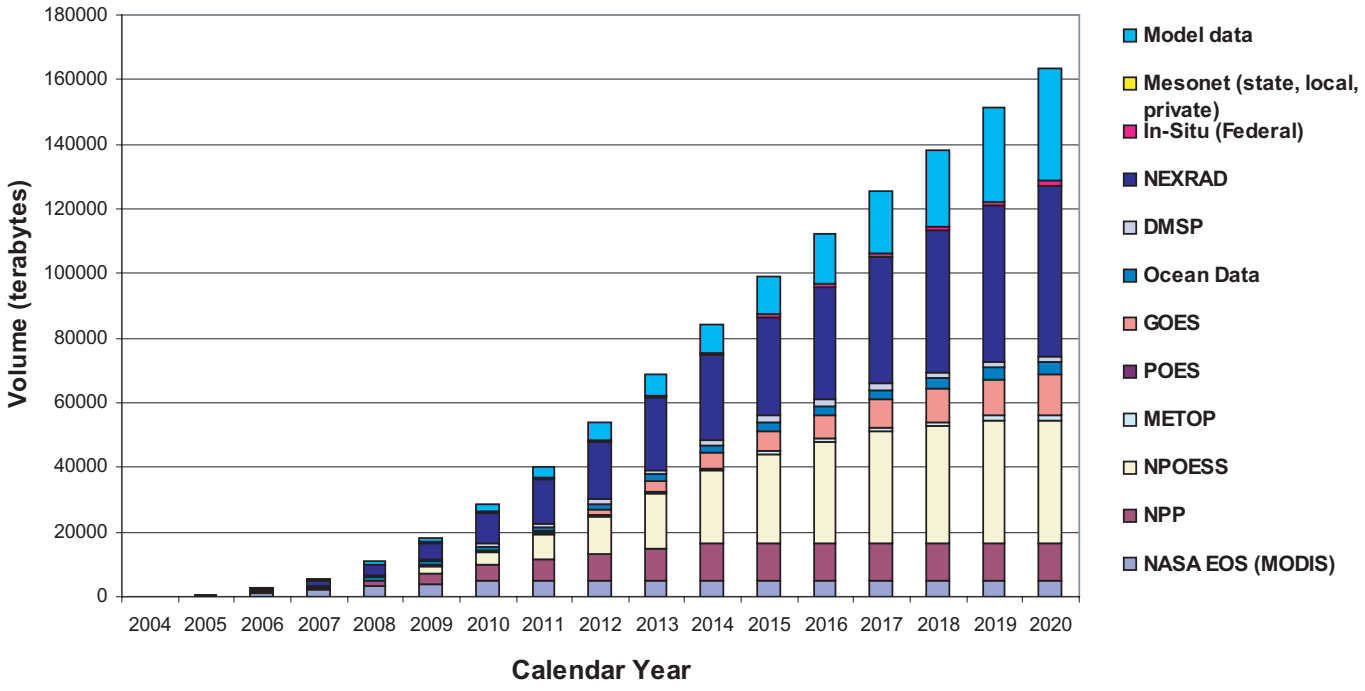


Figure 4. Large-Array Data Growth Expected Over 15 Years.



Manage Greater Data Volume and Diversity

NOAA's role in understanding, observing, forecasting, and warning of environmental events is expanding. New technologies and observing systems underpin the environmental information and products that serve society. NOAA faces challenges both from the increases in remotely sensed data brought about by instrumentation and communications technology, and from the diversity of data required to engage effectively in an ecosystem-based approach to managing the Nation's coastal and marine living resources. NOAA expects a doubling of data every year for the next several years from new environmental observing systems. Satellite operators, including NOAA, are developing more powerful instruments for remote sensing of the atmosphere, oceans, land, and space. These systems are expected to collect and transmit data at the rate of approximately 20 megabits per second (mbps), an order of magnitude increase from the current rate of data transfer (1–2 mbps). To collect, process, transmit, store, distribute, and use this increased volume of data effectively, NOAA, in concert with our partners in the private and public sector, must pursue technological improvements in communications, data compression, processing, and archiving. Current estimates from NOAA's Comprehensive Large Array-data Stewardship System (CLASS) predict data archive growth to more than 160,000 terabytes (TB) by 2020 (Figure 4). NOAA is addressing increases in the data archive with technological advances from the private sector such as high-density, robotic tape systems. However, significant challenges remain in describing, integrating, reprocessing, and enabling both real-time and archival access to these data so society can derive the full benefit of these national assets.

As shown in Figure 2, Data Management Assessment Summary, 2005 (page 3), NOAA also faces significant challenges related to acquiring, describing, and archiving the biological and ecological data required to protect, restore, and manage living coastal and ocean resources. To engage in an ecosystem-based approach to the Nation's coastal and marine resources, NOAA needs comprehensive fisheries-related environmental observations, continued research on protected species and marine mammals, and studies on

climate change and environmental variability. NOAA is working with public and private partners, including the Integrated Ocean Observing System (IOOS) Regional Associations to provide data access, transport, and delivery for the Pacific Coast Ocean Observing System (PaCOOS). PaCOOS is the ecosystem observing backbone of IOOS for the California Current Large Marine Ecosystem.

Extend the Environmental Record

In addition to managing the increasing flow of data, NOAA must ensure its data and resulting products are accurate. This includes the reprocessing of past data and identifying and filling gaps to create high-quality long-term records of our environment. NOAA faces challenges in reprocessing data—addressing changes in instrumentation and observing capabilities. In addition, much of the older data are stored on deteriorating or poorly accessible media. NOAA's Climate Data Modernization Program (CDMP) partners with the private sector for the digitization of at-risk data. In 2005, NOAA supported 51 CDMP projects. NOAA resources are required to prepare data for digitization, and to review data quality after digitization, before making data available online. Both skilled stewards and smart technology are necessary to extend the environmental record.

Improve Accessibility

To realize the full benefit of its data, NOAA must support Earth observing systems with robust data transmission and complex, but flexible, data management systems. Developments in communication technologies by the commercial sector over the last decade have led to significant gains in the ability to access national data archives and real-time observations. However, exponential future growth in observations, model guidance, and demand for real-time access to these products will require continuous technology investments to protect recent gains. NOAA faces a major challenge in enabling interoperability between legacy systems and emerging data systems. This lack of system interoperability, across NOAA and across agencies, hampers the collaborations enabled by technological gains. As super-computers enable increases in the temporal and spatial resolution of models, and demands increase for online access to large-array data, communication technologies and data management techniques must also evolve. Modernizing NOAA's data management through such programs as the Environmental Data Systems Modernization and Telecommuni-cations Operations Center (TOC) will address many of these challenges.

NOAA faces challenges from new environmental observation programs related to living marine resources, space and terrestrial weather, tsunami, and other environmental hazards. Many of these data system challenges will be addressed in the context of the national integrated ocean, surface, and upper-air observing systems. Technology and system developments will support the Federal Enterprise Architecture (FEA), and USGEO, and GEO activities. Implementing these frameworks will take time, effort, and resources.

Enable Integration

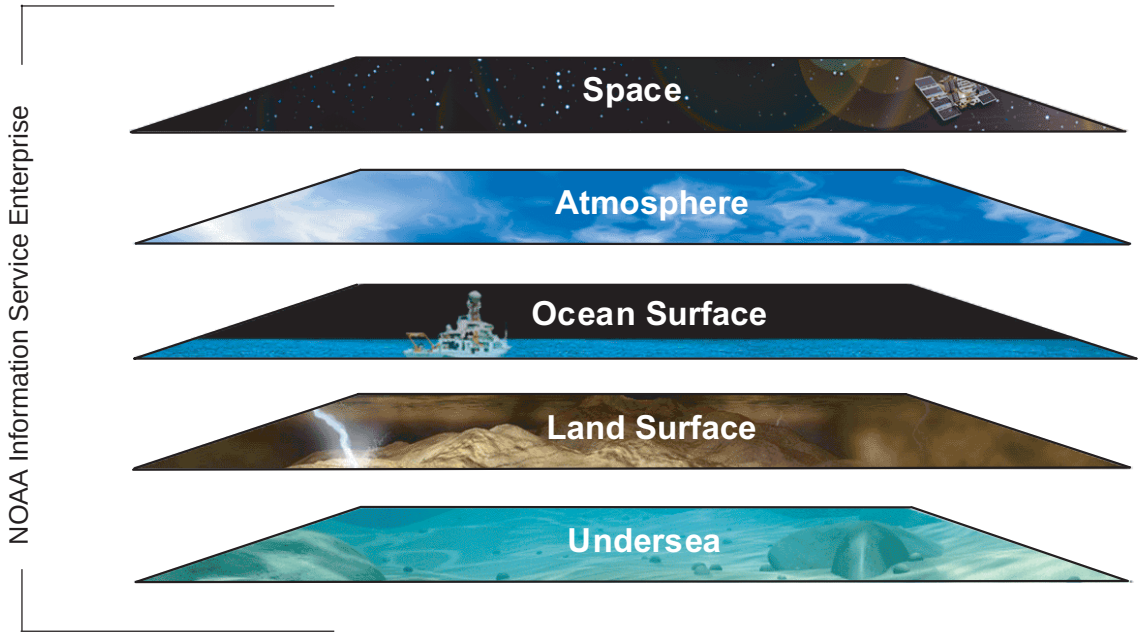
NOAA is working with local, national, and international partners to strengthen cooperation in Earth observations. NOAA must enable integration of data across its observational domains and timescales to guarantee the best coverage and quality of Earth observing data (Figure 5). Integration and interoperability will be achieved through common protocols, hardware, and software, as well as the use of data and metadata standards. NOAA has begun this process by adopting a common enterprise-wide IT architecture, but significant work remains over the next decade. One major obstacle to integration is the lack of scientific lexicons describing data and observation parameters from NOAA's diverse observing environments and disciplines. Sustained and integrated Earth observations, supported by science and technology, will lead to societal benefits.

Improve Data Description

One of the major challenges of data management is ensuring the data collected remain accessible and usable. Acquiring data is no longer the major hurdle. Managing, validating, integrating, understanding, and reprocessing data are the new challenges. Scientists and policy-makers expect ready access to online data, including data mining tools, and the documentation necessary for understanding data (i.e., the where, when, how, and why describing data and instrumentation, including limitations, processing, and calibration methods). Documenting data is critical to preserving its usefulness through time. As new sensor technologies are implemented, intercomparison of old and new technologies must be available. The data management challenge is not to store the data for history, but to keep data alive for the research community to continually exercise and apply to societal needs. Our Nation makes a large initial investment in the acquisition of data, an information asset NOAA must safeguard for current and future generations.

Based on the data management assessment, NOAA is better prepared now to ensure the reliable and efficient flow of quality data from observation source to real-time products. NOAA faces ongoing challenges in managing increasing diversity and volumes of data, enabling data integration, and addressing real-time dissemination demands. Significant challenges remain in data reprocessing and rescue, essential for extending the environmental record. NOAA is in the initial stages of developing and implementing an integrated data management system, based on common IT architecture and common processes. This will address many of the challenges identified in the assessment. However, proper data stewardship also involves an understanding of the data's scientific value and thoughtful management for future use.

Figure 5. NOAA's Observational Domains.



Comprehensive Improvement Plan

Public Law 102-567, Sec 106 (c) (2): (A) set forth modernization and improvement objectives for the 10-year period beginning with the year in which the plan is submitted, including facility requirements and critical new technological components that would be necessary to meet the objectives set forth;

A primary long-term NOAA objective is integrated information services delivery. Work in this area is underway today and will require concerted effort for the foreseeable future. Customer needs drive the integration of NOAA information across disciplines, time scales, and federal, state, and local agencies. NOAA should provide products, services, and prediction capabilities delivering specific regional and local environmental information at all time scales relevant to decision makers. In the next few years, NOAA will take steps to accomplish this goal, including addressing the data management challenges identified in the assessment. NOAA corporate-wide processes set the stage for modernization and improvement across the agency.

NOAA's near-term data management goals are:

- **Identify and address integration gaps.** NOAA is in the process of identifying technological and scientific integration gaps. NOAA will address these gaps and enable improved access to multi-disciplinary data and coupled model results so the scientific community can perform systematic comparisons.
- **Create interoperability across NOAA.** NOAA can foster interoperability by integrating key capabilities, loosely combining legacy systems while developing new ways to support access to valuable data assets. NOAA will invest in developing sustainable interoperability across the Federal Government and partner organizations.
- **Develop and adopt standards for format and terminology.** NOAA subscribes to the value of, and need for, corporate standards. NOAA will define a process for adopting standards that is open and inclusive, favoring existing information technology and scientific standards.
- **Integrate measurements, data, and products.** NOAA will provide easier and more cost-effective access to all of its data and information. NOAA will ensure data and products are collected and managed in accordance with policies, procedures, and standards that support and enhance integration.
- **Examine future data management requirements.** Data management consists of two major activities conducted in coordination: (1) data management services, and (2) data stewardship.

NOAA's internal assessment identified some significant data stewardship challenges. NOAA must continue to meet real-time responsibilities at the current high level while taking steps to address challenges in several key areas, including: managing the increasing volume and diversity of data; extending and filling gaps in environmental data records; improving accessibility to the long-term archive; and enabling integration of quality observations and products. These activities depend on improved descriptions of data, formats, and processing steps. NOAA will examine data management requirements and develop an enterprise plan for managing the Nation's environmental data assets.

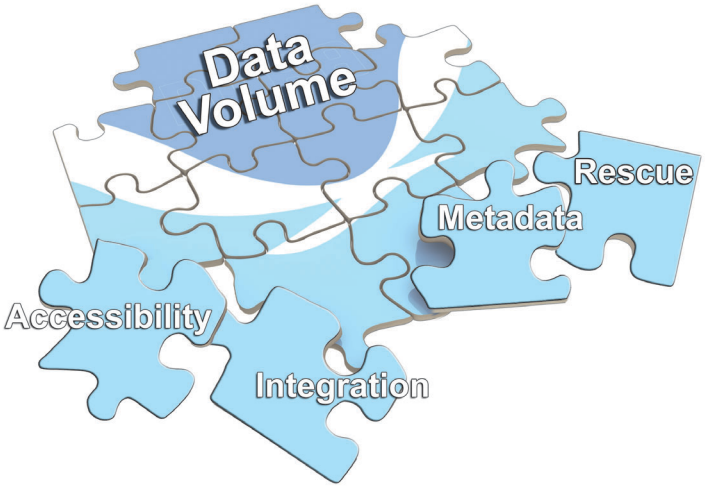


Figure 6. NOAA's Ongoing Challenges.

NOAA faces challenges in managing increasing volumes of data, its accessibility, and the need for enhanced metadata and data integration. NOAA also has ongoing challenges of data reprocessing and rescue, essential for extending the environmental record past instrumental changes and into the pre-digital era.

Specifics:

Technological components

NOAA's near-term goals address the challenges of integration and accessibility. In order to accomplish these goals and achieve the long-term objective of integrated data and information management, NOAA must also address the data volume, data gaps, and metadata challenges identified in the assessment (Figure 6). NOAA has specific programs, such as CLASS, TOC, and CDMP, to address some of these challenges, but must direct additional resources as required through the programming, planning, budgeting, and execution process.

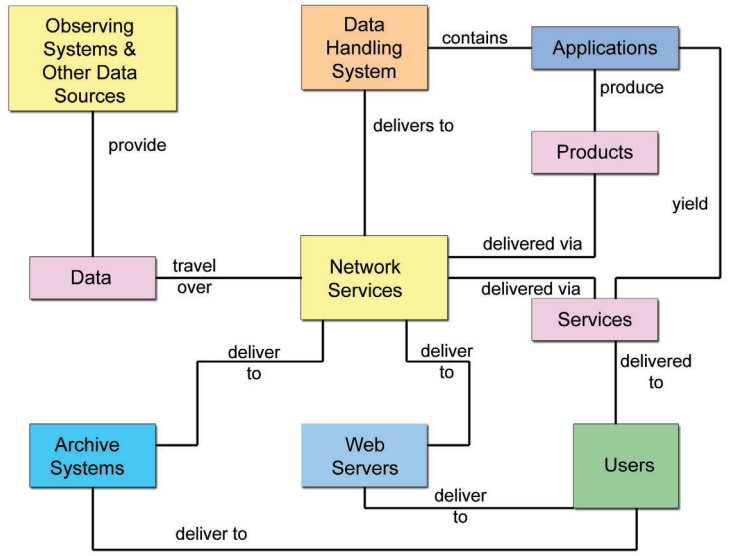
The basis of NOAA's modernization plan is a robust, secure, common IT infrastructure supporting Web-based applications to acquire, process, and deliver data and information. NOAA is developing a baseline architecture for data management systems, with agency-wide information gathering underway at the beginning of Fiscal Year (FY) 2006. Likewise, NOAA will analyze the data management systems, identify gaps and overlaps, establish priorities, and develop the data management systems target architecture.

NOAA is preparing an enterprise-wide data management plan. The plan aims to retain existing systems where practical, while building a software infrastructure linking systems together. This service-oriented software architecture loosely couples independent programs to create scalable, extensible, interoperable, reliable, and secure systems. NOAA is committed to providing easy access to integrated data and information. One method to achieve this is to provide data in common spatial formats. NOAA is working with other federal agencies to develop a geographic information system profile for FEA.

NOAA is preparing for the explosive large-array data growth expected over the next 15 years (Figure 4, page 5). Current estimates predict data volume will grow to more than 160,000 TB by 2020. Efforts to address this increase in large array data on a program-level basis include the TOC, CLASS, the Earth Observing System (EOS) Data Archive, and the National Polar-orbiting Operational Environmental Satellite System (NPOESS) Data Exploitation Project. Future NPOESS products will be developed and tested in preparation for NPOESS operations. NPOESS Preparatory Project (NPP) funding is included in the FY 2006 budget. By 2008, the NPP will provide prototypical products.

Looking toward the future, NOAA also recognizes that application of tools and processes in the near-term is critical. Initial emphasis is on improving methods to share and manage the data in our current holdings. NOAA is concurrently investing in technology components such as spatially enabled databases, Web-accessible open geographic information systems, and virtual data centers—enabling access to geographically dispersed databases through common software tools—to improve browse, visualization, and access to environmental data NOAA-wide. NOAA is also focusing on

Figure 7. NOAA's IT Enterprise Network.



improving data compression and spectral management to improve transmission of, and access to, large volumes of data in real-time. NOAA has begun the process by adopting a common, enterprise-wide IT architecture supporting data acquisition, transmission, archive, and access (Figure 7). However, significant work remains over the next 10 years.

Facility Requirements

NOAA's ability to acquire, process, disseminate, and archive data and information needed to accomplish its mission requires modern facilities. During FY 2003–2005, NOAA improved observing systems, platforms, and facilities.

As the Nation's civilian satellite agency, NOAA's orbital assets serve dual roles as platforms for observation sensors as well as communications systems linking surface-based observing systems. Continuous global satellite coverage is essential to maintain the health and safety of our Nation. NOAA satellites also provide critical environmental data fundamental to the understanding of Earth processes. In the last two years, NOAA launched two new Polar-orbiting Operational Environmental Satellites (POES), NOAA-17 and NOAA-18. Resource assessment is continual as new programs move forward.

NOAA is also responsible for the largest fleet of research and survey ships operated by a federal agency. NOAA's fleet supports a wide range of marine activities, including fisheries and coastal research; nautical charting; and long-range ocean and climate studies. NOAA aircraft provide varied research and survey capabilities, including those used for water resource management, coastal mapping, and marine mammal surveys. These aircraft are unique in their ability to support NOAA's hurricane surveillance and atmospheric research programs. NOAA's fleet, combined with chartered government, university, and private commercial sources, enables NOAA to carry out its responsibilities under the Magnuson-Stevens Fishery Conservation and Management Act, Marine Mammal Protection Act, Endangered Species Act, and Hydrographic Services Improvement Act. Since the last Report, NOAA increased ship capabilities by seven vessels. NOAA also acquired a Turbo Commander multi-use aircraft.

NOAA ships and aircraft are cost-effective and have demonstrated a sterling safety record. The fleet operates well beyond the normal service life of comparable research and survey craft. The NOAA Fleet Modernization Plan, currently under review, documents program requirements for successful continuation of NOAA's multi-disciplinary missions, including replacing aging ships and aircraft.

NOAA operations are conducted in more than 800 facilities in the United States and its Territories. Of these, 437 are NOAA-owned. In 2005, the new NOAA Satellite Operations Facility in Suitland, Maryland, was nearing completion. The Satellite Operations Control Center provides command, control and communications for Geostationary Operational Environmental Satellites (GOES), POES, and the Department of Defense's Defense Meteorological Satellite Program. Additionally, it is home to the computer facility processing satellite data supporting

meteorology, oceanography, and solar-terrestrial sciences. By the end of 2005, NOAA will have completed expansions to the Pacific Tsunami Warning Center, supporting a 24x7 operation, and expansions to the National Data Buoy Center's industrial building, providing additional floor space for the tsunami warning buoy production effort, and complete construction of a backup TOC, providing critical continuity of operations.

The average age of NOAA-owned facilities is more than 35 years. In addition, due to NOAA's overall mission, many facilities housing NOAA operations are located near the coasts, resulting in exposure to severe weather, salt, and sand. The aging of the NOAA real estate portfolio results in numerous issues including energy efficiency, hazardous materials mitigation, and the increasing cost of repairs, renovation, and reconstruction necessary to meet the demands of the current mission. These issues are addressed in the NOAA Facilities Master Plan currently under review. The plan defines a quantitative description of the current real property inventory, the 17 major projects planned or currently under construction, and a master inventory of repair and alterations. The plan identifies strategic solutions.

Modern facilities and IT infrastructure are essential for collecting and processing the environmental data required to accomplish NOAA's mission. In addition, changes and advances in IT infrastructure and facilities, including data collection platforms, impact NOAA's data management methods and capabilities. Technological improvements and NOAA's data management capabilities must advance together.

Public Law 102-567, Sec 106 (c) (2): (B) propose specific agency programs and activities for implementing the plan;

To accomplish our objectives, and as part of the President's mandate to improve management within the Executive Branch, NOAA has further refined its corporate-wide processes over the last two years. These processes set the stage for modernization and improvement across the agency. NOAA revised its Strategic Plan, established the Offices of Program Planning and Integration and Program Analysis and Evaluation, and established the PPBES process. We are linking our business processes to our programmatic decisions and investment planning. Integrated information and data management, a Cross-cutting Priority in the 2005–2010 NOAA Strategic Plan, will be a consideration in those determinations. FY 2005 and FY 2006 budgets for specific programs are shown in Figure 10 (page 17).

NOAA's process to assess required capabilities, compare them with current capabilities, and then examine the resulting shortfalls is becoming more mature. Each program carefully examines observing requirements and ranks their contribution to the achievement of NOAA's mission goals. Working with data users, NOAA has identified more than 300 unique observing environmental requirements. The users are involved directly in developing our requirements in NOAA's Consolidated Observation Requirements List. NOAA is prioritizing requirements and mapping requirements to systems. NOAA is also capturing attribute values to assist in meeting expectations of users in terms of frequency, timeliness, and accuracy—all-important factors that measure and manage information and data within an enterprise information system.

Specifics:

NOAA has several new and ongoing modernization programs focused on improving the acquisition, transmission, management, archive, and dissemination of its environmental data. These include AWIPS, TOC, Environmental Data Systems Modernization, the EOS Data Archive and Access, and CDMP, CLASS, and NPP. Under the DMC, NOAA's Data Management Integration Team is

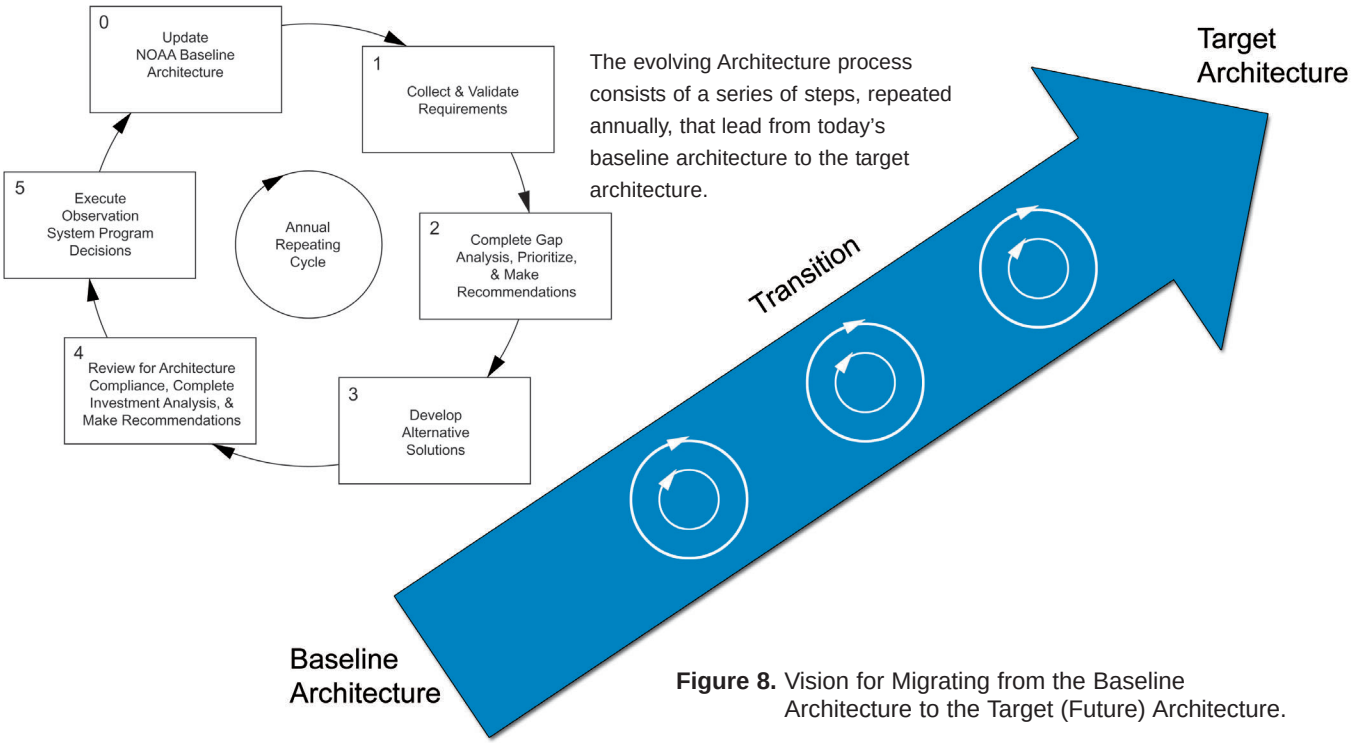


Figure 8. Vision for Migrating from the Baseline Architecture to the Target (Future) Architecture.

developing a data management plan to address key issues of integration, open formats and standards, a common data dictionary, and data flow. The systems will be consistent with, and supportive of, emerging national and international frameworks. Key criteria evaluated for compliance with these IT frameworks are change, integration, convergence, and business alignment. NOAA is making improvements in all of these areas, using common standards and components, consistent business rules, standard interfaces and information flow, high security standards, and connectivity and interoperability managed across the enterprise.

During FY 2006, NOAA will begin designing an integrated observation and data management system. The target architecture builds on existing systems, leveraging new technologies and standards-based development to integrate data across NOAA's observing environments, enabling NOAA's Mission Goals to provide timely and accurate products and information. Figure 8 depicts how the target architecture will be achieved through a series of steps, repeated annually, designed to gather, validate, prioritize, review, and execute the best options to establish a sustainable and affordable integrated observation and data management system. NOAA will take full advantage of opportunities presented by the Internet to build a service-oriented software infrastructure that will enable data sharing and application interoperability. This approach will minimize impact while enabling effective and efficient integration of NOAA's current systems, many of which are critical to the national interest and must continue to function with no interruption of essential services. This approach relies on a well-ordered, standards-based data and information infrastructure—including the supporting IT infrastructure.

Drawing on its experience in developing the IOOS Data Management and Communications (DMAC) plan, NOAA is preparing a guide on integrated information management to serve as a single point of reference for data management. The guide will include all relevant NOAA, national, and international standards. NOAA's IT Infrastructure design is intended to:

- Keep hardware and software product mix and configuration as simple as possible;

Figure 9. CLASS Achievements Over the Last Two Years.

- Completed design of CLASS architecture, including System Documentation
- Established a project-wide risk management program
- Delivered baseline systems to Suitland, Maryland, and Asheville, North Carolina, with dual-site configuration
- Established operational, test, and development environments in Suitland, Maryland
- Completed software and system upgrades
- CLASS operational with POES, DMSP, and GOES datasets, plus RADARSAT (Synthetic Aperture Radar) and SeaWiFS (Ocean Color Product)

- Make the ongoing maintenance and configuration management of security implementations as efficient as possible; and,
- Promote interoperability among implementations.

NOAA anticipates the future integrated system and evolving technology will make access to environmental data and information as easy and effective as accessing documents on the Web today. The integrated observation and data management system will be NOAA's contribution to the USGEO Integrated Earth Observation System (IEOS).

The target system will also look carefully at balanced capability across the IT enterprise such that the increases in collection capability are also complemented with related increases in assimilation, modeling, and distribution capabilities in order to address user requirements. Our integrated modeling capability development maps back to user requirements, and forward to the development or acquisition of standard toolsets and products. NOAA intends to examine toolsets and data management processes being developed for the NPOESS and GOES-R systems, and include them in the core standard toolsets and data management processes.

NOAA is developing CLASS to address the data management requirements for the estimated 160,000 TB of new environmental data expected from current and planned Earth observing systems of the next 10 years (Figure 9). CLASS is a critical capability and a key component of the infrastructure supporting NOAA's integrated observation and data system, providing permanent, secure storage, and safe, efficient Web-based data discovery to large-array data sets from systems such as GOES, POES, NPOESS, Next Generation Weather Radar (NEXRAD), and the National Aeronautics and Space Administration (NASA) Earth Observing System. NOAA faces significant challenges in describing, integrating, reprocessing, and enabling access to large array data sets so society can derive the full benefit of these national assets. NOAA will also examine the potential downstream expansion of CLASS infrastructure to include observing system data beyond its current intended use. The impact of this on modernization will be the subject of a study ordered by the Department of Commerce and NOAA.

NOAA is changing its operation and expects to learn and apply lessons from the development of baseline architectures and target architectures, from portfolio analysis and strategic investment analysis, and from the experience of other federal organizations similarly engaged in developing enterprise operations. NOAA will be preparing a detailed 10-year data management plan over the course of the next year with NOAA management approval anticipated by the end of FY 2006.

Public Law 102-567, Sec 106 (c) (2): (C) identify the data and information management, archival, and distribution responsibilities of the National Oceanic and Atmospheric Administration with respect to other federal departments and agencies and international organizations, including the role of the National Oceanic and Atmospheric Administration with respect to large data systems like the Earth Observing System Data and Information System; and . . .

As the United States premier Earth observation data agency, NOAA is a critical component of the USGEO, which is developing the U.S. IEOS. IEOS is the U.S. contribution to the Global Earth Observation System of Systems (GEOSS), being developed by GEO. Through participation and leadership in national observing efforts, including IOOS, which is the U.S. contribution to the Global Ocean Observing System (GOOS), Integrated Surface Observing System (ISOS), and Integrated Upper-air Observing System (IUOS), NOAA can further integrate its observing systems, data, and quality control with efforts of other nations to guarantee the best quality and coverage of Earth observing data. IEOS and GEOSS will benefit from these activities.

NOAA closely supports several intergovernmental and international organizations, including the World Data Center (WDC) system, World Meteorological Organization (WMO), Intergovernmental Oceanographic Commission (IOC), and International Hydrographic Organization (IHO). We will continue to work with local, national, and international partners to develop an integrated global-to-local environmental and ecological observation and data management system that will continually monitor the complex, symbiotic systems of the ocean, atmosphere, and land. NOAA relies heavily on technological advances in communications, Web-based applications, and data storage made in the private sector to accomplish its mission.

Specifics:

Using IOOS as an example, the IOOS DMAC Plan provides a technical focus on issues of interoperable metadata, data discovery, access, and archive. The DMAC also provides a development time line with associated costs. The system described in the DMAC Plan can be built with current technology. One of the major challenges is coordination among the numerous members of IOOS and its user communities.

NOAA's National Data Centers have formal federal responsibility for archive, management, and distribution of data. The Data Centers are national and world repositories of climate, oceanographic, and geophysical data and information. Stewardship of these data conforms to the rules, regulations, and procedures of the National Archives and Records Administration (NARA).

In addition, NOAA's TOC is the Federal Government's 24x7 nerve center for real-time environmental data dissemination, monitoring the

Global Telecommunication System and other national and international circuits. The TOC also maintains connectivity with the Departments of Defense and Homeland Security, and the Federal Aviation Administration.

NOAA works closely, and coordinates with, other federal organizations such as the U.S. Geological Survey's Earth Resources Observation and Science Data Center; NASA's Distributed Active Archive Center system; and the Department of Energy's Carbon Dioxide Information Analysis Center. These activities occur under the federal NARA umbrella for data preservation.

Additionally, the Climate Change Science Program Office provides a mechanism for federal coordination of climate data preservation that recognizes the National Climatic Data Center (NCDC) as the formal climate data center for federal climate programs. The Oceans.US coordinating umbrella provides a similar federal coordination mechanism for oceanographic data that recognizes the National Oceanographic Data Center (NODC) for oceanographic data.

Responsibilities for long-term preservation of atmospheric and oceanic data are addressed in a NASA–NOAA Memorandum of Understanding (MOU).[1] NASA and NOAA participate in the Interagency Working Group on Data Management for Global Change whereby participating agencies have agreed to build interoperability among their data and information systems.[2] NASA and NOAA also collaborate in the development of the Joint Center of Satellite Data Assimilation, which accelerates the research-to-operations timeline of integrating new satellite observations into operational numerical weather prediction. In conjunction with the Office of Management and Budget's guidelines for the FEA, NASA and NOAA's participation in the USGEO, along with other federal agencies, will result in increased data and information exchange and migration toward adoption of common tools and processes.

NOAA collaborates with international partners to develop and maintain global databases. This provides U.S. science and industry with convenient access to a wealth of foreign data to which they might not otherwise have access.

The WDC system, operated under the auspices of the International Council on Science, now comprises 52 Centers in 12 countries. The WDC system archives and distributes international observational data including a wide range of solar, geophysical, environmental, and human dimensions data covering time scales ranging from seconds to millennia. These data provide baseline information for research in many disciplines. There are 15 World Data Centers located in the United States, seven maintained by NOAA.

NOAA's National Data Centers cooperate with numerous other international organizations to develop, archive, and distribute global baseline data sets. These include the WMO for climate and sea ice global change monitoring; the IOC, which maintains the International Tsunami Information Centre, hosted by NOAA; and the IHO, an intergovernmental consultative and technical organization established to support safety in navigation and the protection of the marine environment.
Our data responsibilities to the WMO Global Data-processing System include managing real-time and non-real-time data involving:

- Collection and quality control of data not available from the World Weather Watch Global Observing System in real time, via mail or other means;
- Storage and retrieval of all basic observational data and processed information needed for large- and planetary-scale research and applications; and,
- Making non-real-time data available to Members or research institutes upon request.

NOAA also has a commitment to the WMO's World Weather Watch

[1] MOU Between NASA and NOAA for Earth Observations Remotely Sensed Data Processing, Distribution, Archiving, and Related Science Support, July 27, 1989.
[2] Addendum II NASA-NOAA Agreement Data and Information Exchange Activity, November 25, 1992.

Program with NOAA's Weather Service operating the World Meteorological Center (WMC)–Washington at the National Centers for Environmental Prediction. One responsibility of the WMC is to maintain a repository of collected international meteorological data and model output to support research. The NOAA's National Data Centers share this responsibility through their archive and distribution duty.

The National Geophysical Data Center (NGDC) is responsible for the IHO Data Center for Digital Bathymetry and regional mapping projects. NGDC develops, archives, and distributes global magnetic field models used as navigation standards by the North Atlantic Treaty Organization, U.S. Department of Defense, NOAA, and the Federal Aviation Administration. NGDC also leads the data management activities related to the Solar Terrestrial Energy Program sponsored by the Scientific Committee on Solar-Terrestrial Physics.

The USGEO and GEO efforts to establish an integrated network of environmental observing systems will require collaboration between NOAA's National Data Centers and corresponding data centers in participating GEO countries, as well as other federal data centers and repositories. NCDC serves as a Global Climate Observing System (GCOS) Lead Data Center. GCOS is the formal climate component of the GEO and, as such, coordinates a range of data management, data archive, and monitoring activities with data centers in many countries including Australia, Germany, Japan, and the United Kingdom.

Many of the data and system integration challenges NOAA faces will be addressed in the context of NOAA's target architecture, the national integrated observing systems (IOOS, ISOS, and IUOS), FEA, and the USGEO and GEO activities. Implementing these frameworks to realize the societal benefits will take time, effort, and resources.

Public Law 102-567, Sec 106 (c) (2): (D) provide an implementation schedule and estimate funding levels necessary to achieve modernization and improvement objectives.

NOAA relies on advanced observing systems, assimilation capabilities, and numerical models to accomplish its mission. All of these efforts require, and therefore include, data management as an integral part of their operations. For example, orbiting satellites include advanced data acquisition, transmission, and reception at ground stations, followed by data processing, product generation (often based on models), and dissemination of data products to customers. Data management is integral to the basic functionality of NOAA's observing systems, making it difficult to separate funding levels and improvements in the data management aspects from the overall system.

There are several dedicated data management modernization and improvement projects ongoing within NOAA to support the entire enterprise. These include programs in the area of improved data acquisition and delivery (e.g., AWIPS and TOC), data rescue (e.g., CDMP), data archive (e.g., CLASS and EOS), and data system interoperability and metadata (e.g., Environmental Data Systems Modernization). These various modernization efforts are in differing stages of maturity. Their budget levels are presented (Figure 10), based on the FY 2005 and FY 2006 budgets. The overall funding level for NOAA data management, if it included embedded data management functions of the observing systems, would be significantly higher.

The positive impacts of NOAA's modernization efforts are evident in the results of the internal assessment (Figure 2, page 3). For example, the Collect and Rescue effort in the Climate Goal is green, indicating adequate resource to support this

Figure 10. Funding for NOAA Data and Information Modernization Activities.

Program Name	FY 2005 Enacted Budget	FY 2006 President's Budget	FY 2006 Enacted Budget	Modernization Activity
Advanced Weather Interactive Processing System (AWIPS)	12,708K	12,894K	13,280K	Data discovery, access, dissemination
Telecommunications Operations Center (TOC)				
Legacy Systems Replacement	2,476K	500K	493K	Acquisition, transmission, formats
Backup at Mount Weather	3,042K	3,042K	3,009K	Continuity of operations
NPOESS Data Exploitation (NDE)	0	4,500K	4,437K	Data integration
Comprehensive Large Array Data Stewardship Program (CLASS)	6,448K	6,541K	8,876K	Data archive volume
EOS Data Archive and Access System Enhancement	2,958K	1,000K	2,960K	Data archive
Environmental Data Systems Modernization	8,828K	9,384K	9,256K	Data interoperability, metadata
Climate Data Base Modernization (CDMP)	22,522K	6,104K	20,810K	Data rescue

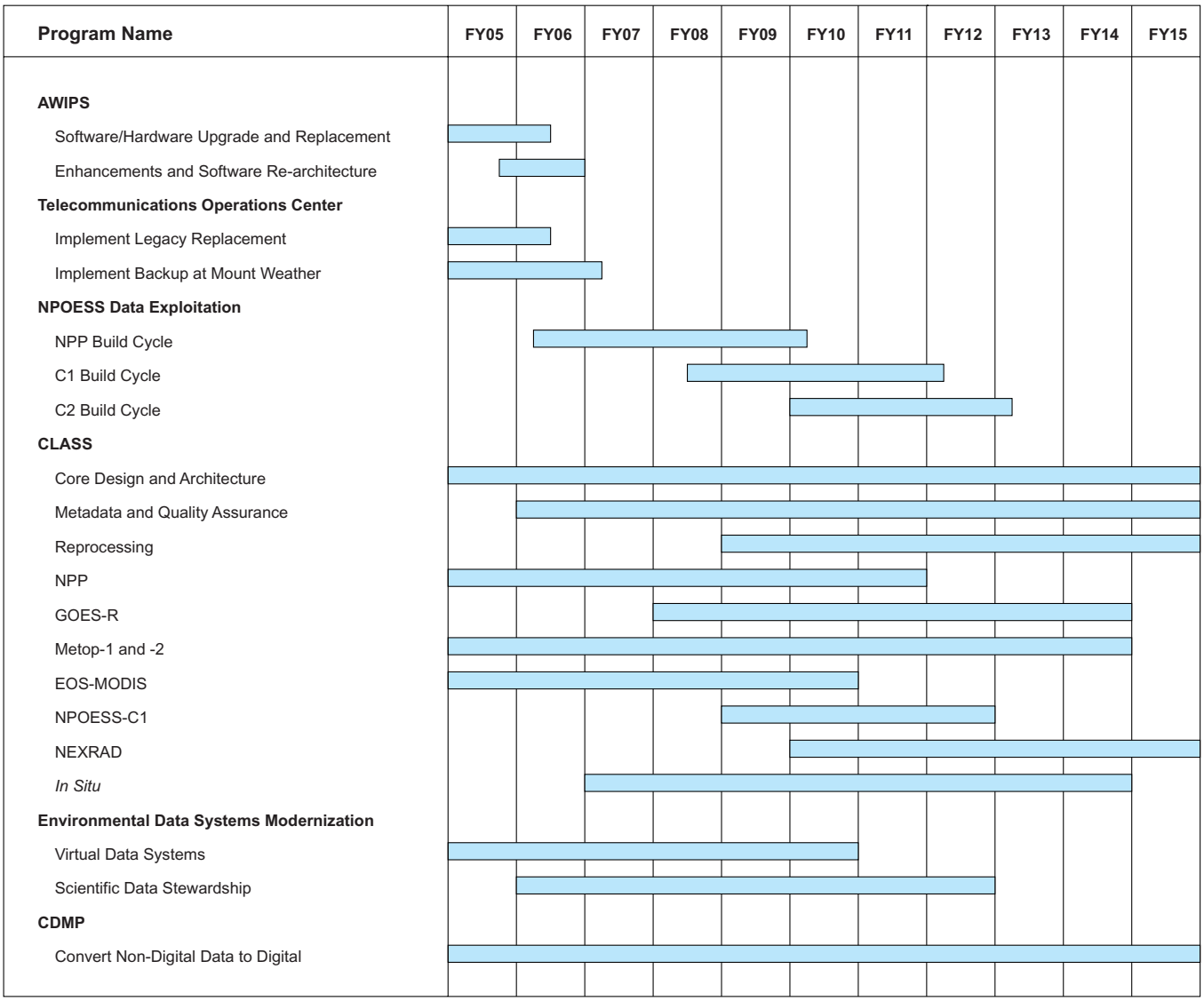
effort. This is due in large part to the impact of CDMP, which focused on the rescue of climate records. The other three NOAA Goals show yellow or red, indicating the need for additional resources to support their data rescue needs. Similarly, the Access/ Disseminate activity is green for Weather and Water, due in part to the success of the TOC and AWIPS modernization effort, while the other Goals show additional resource requirements. There are numerous other examples evident in the summary data that are more precisely delineated in the details of the assessment.

NOAA identified several projects to modernize data management from real-time acquisition, processing, distribution, and modeling to description, archive, and access, and reprocessing and rescue. These modernization projects are a critical part of the total NOAA data management effort. Figure 11 (next page) shows the major milestones and implementation dates for the modernization projects identified in the budget table (Figure 10). These capabilities support NOAA's development of a comprehensive, coordinated, and sustained Earth observation system to collect, process, disseminate, and archive improved data, information, and models.

The first step in this process is rapid, reliable acquisition, processing, and distribution of real-time data and products. The ongoing improvements to NOAA's TOC and AWIPS help address these challenges. The TOC is NOAA's 24x7 nerve center for real-time environmental data dissemination, monitoring the Global Telecommunication System, AWIPS, Wide Area Forecast System, NOAA Weather Wire Service, and NOAA Weather Radio status. In addition to these national and international circuits, the TOC also maintains connectivity with the Department of Defense, Federal Aviation Administration, and Department of Homeland Security. During FY 2006–2007, the TOC will complete the upgrade to message switch capabilities and implement a backup facility at Mount Weather, Virginia, to ensure uninterrupted operations and manage the increased flow of data. The TOC replacement is designed to meet future data volume requirements, with expansion capacity to 500 percent of the current average traffic volume.

AWIPS processes and overlays multiple data sources to allow local Weather Forecast Offices and River Forecast Centers to generate weather and water forecasts and warnings. It continually evolves to accommodate new science and technology to meet strategic goals. The ongoing AWIPS modernization efforts include increasing system performance, functionality, and improving forecasts and warning timeliness. The TOC and

Figure 11. Implementation Schedule for NOAA Data and Information Modernization Activities.



AWIPS modernization efforts will help ensure continuous acquisition and dissemination of NOAA and other domestic and foreign data and products.

The NPOESS Data Exploitation (NDE) and CLASS projects will improve the efficiency of NOAA's environmental satellite data processing, product dissemination, archive, and access capabilities. NDE is implementing a new ground system that permits sharing of databases, tools, and science across various scientific disciplines. Once established, the project's approach to data processing and dissemination will set the stage for other observing missions to share vast volumes of data across their platforms. NDE organized build cycles into phases for Customer Coordination, Design, Construction, Test, and Systems Integration. Each phase has checkpoints for review and approval of the set of deliverables for that phase. NDE will also improve metadata generation to help meet the requirement that all NPOESS metadata abide by approved standards, establish sound quality control measures of the ingest data, and to facilitate retrospective data processing for scientific research and analysis. Tools developed through NDE will support the access and archive through CLASS.

When fully operational, CLASS will manage the archive, maintain the metadata, and support access to, and requests for, retrospective environmental data assets and products, including EOS. This will be achieved through a common data access look and feel, and an efficient architecture for archive and distribution. CLASS will foster the use of advanced visualization and geospatial information systems data discovery techniques, and provide access to its own archives as well as to other data collections described in the metadata repository. Performance tasks include automated quality assurance processes on ingested data to ensure readability, detecting transmission errors, ensuring compliance with data set format agreements, and assessing record quality indicators. CLASS supports the efforts under development in the Environmental Data Systems Modernization project.

The Environmental Data Systems Modernization project planned for FY 2006–2015 focuses on developing an integrated, virtual NOAA data system and improving the scientific stewardship of NOAA data. NOAA's virtual data system, of which CLASS is a key component for the large-array data, will provide improved seamless access to data, metadata, and products. This is a first step in fulfilling the U.S. commitment to disseminate improved data, information, and models in support of USGEO and GEO. The Scientific Data Stewardship Program, a new NOAA initiative in FY 2006, will provide high-quality climatologies of the atmosphere, oceans, and Sun-Earth geophysical environment. Tasks include monitoring observing systems, generating near real-time climate records, reprocessing, and generating new products—made possible by extending the data record through reprocessed or rescued data.

CDMP focuses mainly on converting non-digital data and records (e.g., paper, microform, publications) to digital formats for online access and digital archiving, extending the data record. During FY 2006–2015, CDMP's major function is to acquire relevant data and metadata, converting around 80–110 million records per year, and making these data easily accessible via the Internet.

Over the coming years, the results of the data management assessment, along with the other tools mentioned in this report, will be used by NOAA to develop precise implementation plans to address significant data management gaps. Some of these areas can be addressed by evolving existing efforts; others will require new modernization efforts. The combination of requirements-based programming, implementation of an overarching IT architecture, and precise assessments of data management needs by program will lead to effective use of existing resources and identification of future needs.

Conclusion

NOAA is in the environmental information business. Based on a self-assessment of data management capabilities, NOAA is doing a better job of delivering timely data in appropriate formats and has made significant improvements in corporate planning for observations and data management. The assessment also indicated that NOAA faces significant challenges—from observation acquisition through archive and distribution—in managing the increasing volume and diversity of data. To maximize the benefit to society, NOAA must enable integration of data across its observing platforms and environments, improve access to its data and information products, fill gaps in, and extend, the environmental record, and adequately describe data to ensure utility to future generations.

NOAA is in the process of better integrating its observation and data management assets, building toward its vision of an integrated observation and data management system. This end-to-end system will recognize the value of operational environmental observations and address the functionality necessary to satisfy the needs of users. The system will be based on a secure, robust IT infrastructure supporting a service-oriented software architecture and open source Web-based applications.

NOAA has the strategic framework document in place for the target architecture envisioned for 2015, has developed a NOAA IT Enterprise Architecture, and is now developing a NOAA-wide data integration and management plan. Concurrently, NOAA is in the process of documenting operational requirements, addressing the functionality of our legacy observing and data management systems, and determining enterprise practices, policies, standards, and protocols in the integrated data management environment.

NOAA made improvements to the planning, acquisition, archive, and dissemination of Earth observational data by applying a systematic approach that links strategic goals through multi-year plans. These activities will ensure the data management challenges identified in the self-assessment are addressed in a coherent manner across the agency. NOAA re-evaluates progress and priorities yearly, looks for efficiencies, and takes advantage of new opportunities to improve our information, products, and services, preparing now for tomorrow's challenges.

NOAA is now a major source of Earth observational data and information for our Nation, and in the future will be a major source of data for GEOSS. NOAA is committed to collecting and providing the highest quality data, delivered in a secure and efficient manner, and maintained in a stable, long-term archive for future generations. Investments must focus on people, tools, and technology, and on an integrated approach to observation and data management. This approach will ultimately serve a diverse set of users, thereby realizing a wide range of benefits for our Nation, its economy, and the planet on which we live.

Acronyms

AWIPS
Advanced Weather Interactive Processing System

CDMP
Climate Data Modernization Program

CLASS
Comprehensive Large Array-data Stewardship System

DMAC
Data Management and Communications

DMC
Data Management Committee

DMIT
Data Management Integration Team

DMSP
Defense Meteorological Satellite Program

EOS
Earth Observing System

FEA
Federal Enterprise Architecture

FY
Fiscal Year

GCOS
Global Climate Observing System

GEO
Group on Earth Observations

GEOSS
Global Earth Observation System of Systems

GOES
Geostationary Operational Environmental Satellite

GOOS
Global Ocean Observing System

IEOS
Integrated Earth Observation System

IHO
International Hydrographic Organization

IOC
Intergovernmental Oceanographic Commission

IOOS
Integrated Ocean Observing System

ISOS
Integrated Surface Observing System

IT
Information Technology

IUOS
Integrated Upper-Air Observing System

mbps
Megabits per second

MODIS
Moderate Resolution Imaging Spectroradiometer

MOU
Memorandum of Understanding

NARA
National Archives and Records Administration

NASA
National Aeronautics and Space Administration

NCDC
National Climatic Data Center

NDE
NPOESS Data Exploitation

NEXRAD
Next Generation Weather Radar

NGDC
National Geophysical Data Center

NOAA
National Oceanic and Atmospheric Administration

NODC
National Oceanographic Data Center

NOSC
NOAA Observing Systems Council

NPOESS
National Polar-orbiting Operational Environmental Satellite System

NPP
NPOESS Preparatory Project

NWS
National Weather Service

PaCOOS
Pacific Coast Ocean Observing System

PBBES
Planning, Programming, Budgeting and Execution System

POES
Polar-orbiting Operational Environmental Satellite

TB
Terabytes—One trillion (10^{12}) bytes

TOC
Telecommunications Operations Center

USGEO
United States Group on Earth Observations

WDC
World Data Center

WMC
World Meteorological Center

WMO
World Meteorological Organization

NOAA's Mission Goals Data Management Successes FY 2003–2005

- Collaboration with private industry delivers more than 6.5 million free electronic navigational charts online.
- Physical Oceanographic Real-time System provides centralized data acquisition and dissemination for water levels, currents, and other oceanographic and meteorological data from U.S. bays and harbors.
- Improved Space Weather Solar X-ray imager data and product processing provide real-time services and near real-time archive, improving access and preventing data loss.
- National Digital Forecast Database provides 24-hour digital access to seamless gridded weather forecasts and products nationwide.
- Three new environmental satellites support regional and national nowcasting and warnings, as well as global long-range environmental monitoring.
- Online geographic information systems data and tools for critical fish habitat in southeast and Gulf of Mexico improve ability to respond to Clean Water Act, Endangered Species Act, and Coastal Zone Management Act.
- NOAA and the Federal Communications Commission extend NOAA Weather Radio to an all hazards radio network, now sending natural and environmental hazardous event warnings and national security messages.
- The Climate Data Modernization Program enters its sixth year of rescuing at-risk data, extending environmental data records, and improving access to NOAA data.
- NOAA modernizes its fleet, both ship and aircraft, to acquire mission-critical data such as tsunami monitoring data, while also addressing facility improvements to manage these data.

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