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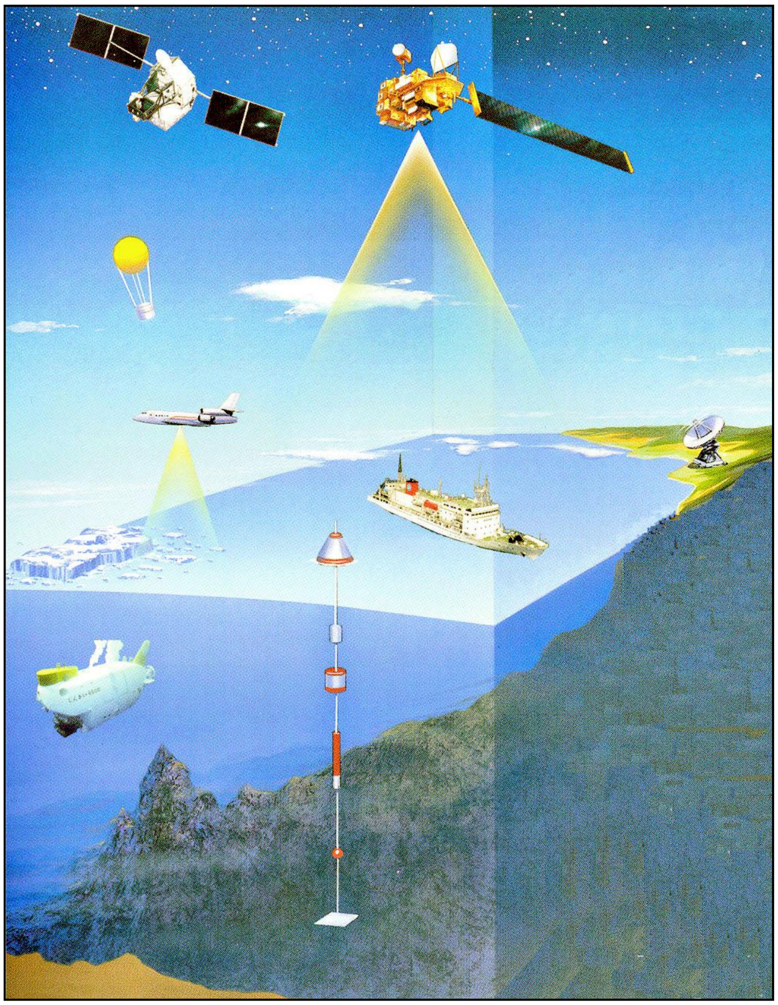
Version 3.2

National Oceanic and Atmospheric Administration

NOAA's Integrated Environmental Observation and Data Management System



February 2004

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Washington, D.C. 20230

Contents

NOAA's Vision

Move NOAA into the 21st Century scientifically and operationally, in the same interrelated manner as the environment that we observe and forecast, while recognizing the link between our global economy and our planet's environment.

NOAA's Mission:
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:

1. Protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management.
2. Understand climate variability and change to enhance society's ability to plan and respond.
3. Serve society's needs for weather and information.
4. Support the Nation's commerce with information for safe, efficient, and environmentally sound transportation.

Forward

Earth observations have been at the heart of NOAA's mission for more than 40 years. In fact, environmental information is our lifeblood. Yet, intensifying national and international needs (related to the economy, the environment, and public safety) have placed a new urgency on Earth observations—and we must respond accordingly.

NOAA has joined national and international partners in placing top priority on Earth observations. As described in our Strategic Plan, NOAA has called for an Integrated Global Environmental Observation and Data Management System as its top crosscutting priority for the 21st Century. In the summer of 2003, NOAA joined other U.S. agencies in an international effort to develop a comprehensive, coordinated and sustained Earth observation system. This effort began at the first-ever Earth Observation Summit, held in Washington, D.C. in July 2003. At the Summit, ministers from 34 participating countries formed an *ad hoc* intergovernmental Group on Earth Observations to direct the development of a 10-Year Implementation Plan for this comprehensive Earth observation system. I am honored to represent the U.S. as one of the four Co-Chairs of this group.

This document describes the beginning of NOAA's journey on the road to developing our integrated observation and data management system, based on user requirements and an integrated architecture, in concert with our local, regional, national, and international partners. I'm enthusiastic about, and committed to, NOAA's priority on Earth observations. I encourage you to contribute to, keep aware of, and take advantage of our agency's progress in environmental observations and data management.

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

Preface

In my role as Chair of the NOAA Observing Systems Council it is my pleasure to transmit the following document, which describes the early shape of NOAA's observing systems and future plans. NOAA is in the midst of exploring ways of achieving more value through its observing program. This evaluation includes examining various end-to-end architecture options that will more effectively integrate user needs, through the identification of requirements, with observations, data collection, products, and archival and access systems.

We have started down this path with the creation of this document which provides an overview of the process being used to examine requirements and prioritize observations, describes how NOAA is addressing several challenges associated with this effort, and presents an initial observing system inventory. This document fulfills the Observing Systems Council requirement to develop an Integrated Global Environmental Observation and Data Management System Strategic Plan as specified by the NOAA Strategic Plan.

It is our hope that we in NOAA can set the example for the U.S. Government through the shaping of our observation program and can leverage our work with the White House Committee on Environment and Natural Resources' Interagency Working Group on Earth Observations. This is the next step in the process of working with local, state, regional, national, and international partners to develop global to local environmental and ecological observation and data management systems for comprehensive, continuous monitoring of Earth's environment.

Gregory W. Withee
Chair, NOAA Observing Systems Council
Assistant Administrator for Satellite and Information Services

NOAA and Earth Observations

The 21st Century presents complex challenges for the National Oceanic and Atmospheric Administration (NOAA). Every aspect of NOAA's mission—ranging from managing coastal and marine resources to predicting changes in Earth's environment—faces a new urgency, given intensifying national needs related to the economy, the environment, and public safety. As the new century unfolds, new priorities for NOAA action are emerging in the areas of climate change, freshwater supply, ecosystem management, and homeland security.

Observations of the environment are intrinsic to NOAA's mission. NOAA envisions an integrated, global observing system that will bring together all aspects of environmental monitoring on common platforms, to ensure data quality, to manage data efficiently for the long-term, and to make these data easily and readily accessible. NOAA will continue to work with our national and international partners to develop these global-to-local environmental observations, continually monitoring the coupled ocean/atmosphere/land systems. This activity will maximize the mutual benefits of national and international data exchange.

NOAA has been working with national and international partners to strengthen cooperation in Earth observations. NOAA's vision, and the vision of many nations, is of an Integrated Global Observation and Data Management System. Recent political initiatives, building on decades of technical work and successes, demonstrate the unique opportunity now available to build this Integrated Global Observation and Data Management System. These political initiatives, with an Earth observation system focus, include:

- International Global Ocean Observing System Office established under the auspices of the Intergovernmental Oceanographic Commission, World Meteorological Organization, United Nations Environment Programme and International Council for Science (1991)
- U.S. GOOS Steering Committee established (regional component facilitator of the international Global Ocean Observing System (GOOS); initiated assessment of users and products needed by U.S. regional coastal observing systems (1998)
- World Summit on Sustainable Development (August 2002)
- G-8 agreement on Cooperative Action on Science and Technology for Sustainable Development (June 2003)
- National Strategic Plan for Climate Change (June 2003)
- Earth Observation (EO) Summit (first ever held), joining 33 other nations and the European Union in adopting a declaration (**Appendix 2**) for the development of a "comprehensive, coordinated, and sustained Earth Observation system or systems" (July 2003)

- In association with the EO Summit, an *ad hoc*, intergovernmental Group on Earth Observations (GEO) was formed to develop a 10-Year Implementation Plan for this comprehensive Earth observation system or systems (August 2003)
- National Science and Technology Council, Committee on Environment and Natural Resources established an Interagency Working Group on Earth Observations (IWGEO) to develop a U.S. 10-year plan and to coordinate U.S. input into the intergovernmental process (August 2003)

NOAA will play an active role in the development of these GEO and IWGEO activities while continuing to build its Information Service Enterprise, in itself a formidable task. We will benefit from our engagement in the development of our corporate processes while becoming knowledgeable and contributing knowledge in these national and international processes. NOAA is working with National Teams and International Sub-groups in the following areas:

- User Requirements and Outreach
- Architecture
- Data Utilization
- Capacity Building
- International Cooperation

NOAA is also working with our partners to develop a prioritization process that will be critical to the success of the operations of our future systems within the GEO and IWGEO architectures.

NOAA's primary mechanism for developing an integrated ocean observing system (IOOS) is through the NORL-established Ocean.US office (2002). Ocean.US is an interagency office facilitating the design and implementation of the IOOS. IOOS is the name given to the U.S. contribution to the Global Ocean Observing System and consists of a global component and a coastal component. By collaborating with other Federal agencies through the NORLC and Ocean.US. NOAA is working to implement a sustained and integrated system.

The initial design of the IOOS has been completed and endorsed by the NORLC. The IOOS will develop as a partnership among Federal and State agencies and regional associations that represent both users and operators of the system. Recognizing that IOOS activities should be represented by one Federal agency for administrative purposes. NOAA will perform this function, including the preparation of a consolidated multi-agency annual budget request for the IOOS.

Architecture Overview

NOAA is focused on building "an integrated global environmental observation and data management system"—an Earth observation system that is comprehensive and sustained. We believe we are in a new era where human ingenuity must be more rigorously applied to develop a deeper understanding of the complex systems of Planet Earth.

Three imperatives frame our concept for this Earth observation system: ***social, economic, and scientific.***

The ***social imperative*** recognizes population growth and redistribution trends that will impact crucial Earth resources like air, water, and food. Sustainable development captures the range of ***economic imperative*** issues that arise from these demographic population changes and the impact on economic well being of Earth's stewards. The ***scientific imperative*** is critical in helping us understand and manage these precious resources of Planet Earth.

Today, NOAA operates a complex network of observing systems. These systems include satellites, ships, and aircraft, and an extensive network of buoys, balloons, radar towers, and human observers. Yet today, that complex network is insufficient to meet all dimensions of these social, economic, and scientific imperatives. The increased complexities of tomorrow will require all of us to do more.

NOAA has begun to address the challenge of determining the configuration of tomorrow's more complex network of observing systems and the associated information processes necessary to translate those environmental observations into actionable information. NOAA's architecture development uses a structured architecture process with four main components:

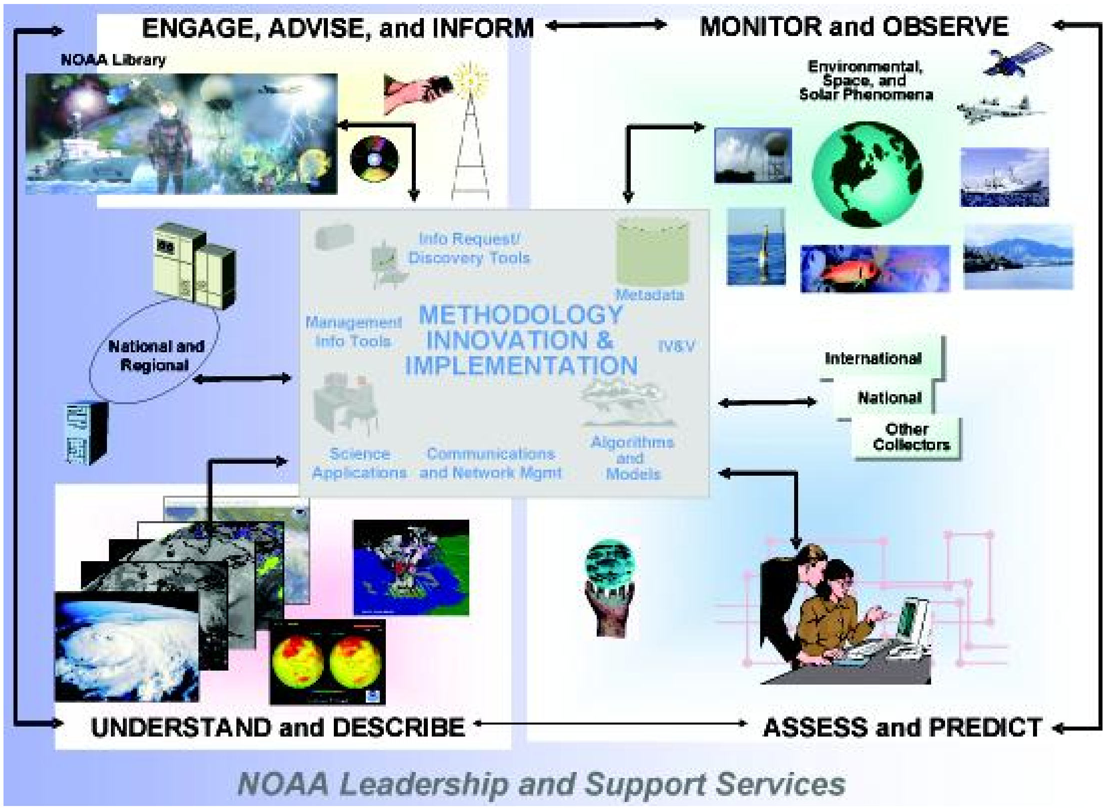
- ***Our existing structure as foundational***—documented in NOAA's Baseline Observing System Architecture.
- ***The Builder***—the NOAA observing systems architect leads the architecture development process.
- ***The Toolset***—the set of software collaboration and visualization tools used by the NOAA architect, the architecture development team, and NOAA personnel to build the architecture.
- ***The Plan***—the structured process that transitions user requirements into concepts for future systems. The plan will also include a reassessment of current systems against future requirements and may result in decommissioning some systems and developing new systems.

Since the summer of 2002, NOAA has aggressively pursued building the enterprise architecture. The NOAA Information Service Enterprise (ISE) is that future NOAA enterprise architecture supporting the NOAA missions (Ecosystems, Climate, Weather and Water, Commerce and Transportation). The NOAA Information Service Enterprise recognizes the "lifeblood" of NOAA is the environmental information provided by the enterprise to the users.

The NOAA Information Service Enterprise is an end-to-end system that recognizes the value of environmental observations and addresses all of the essential functionality necessary to satisfy the future needs of users.

As our users' future operations will change over time, NOAA's internal concepts of operation (CONOPS) must also change to support our users and their new ways of conducting business. The CONOPS for the ISE captures those internal changes for our future.

Figure XX. NOAA Information Services Enterprise.



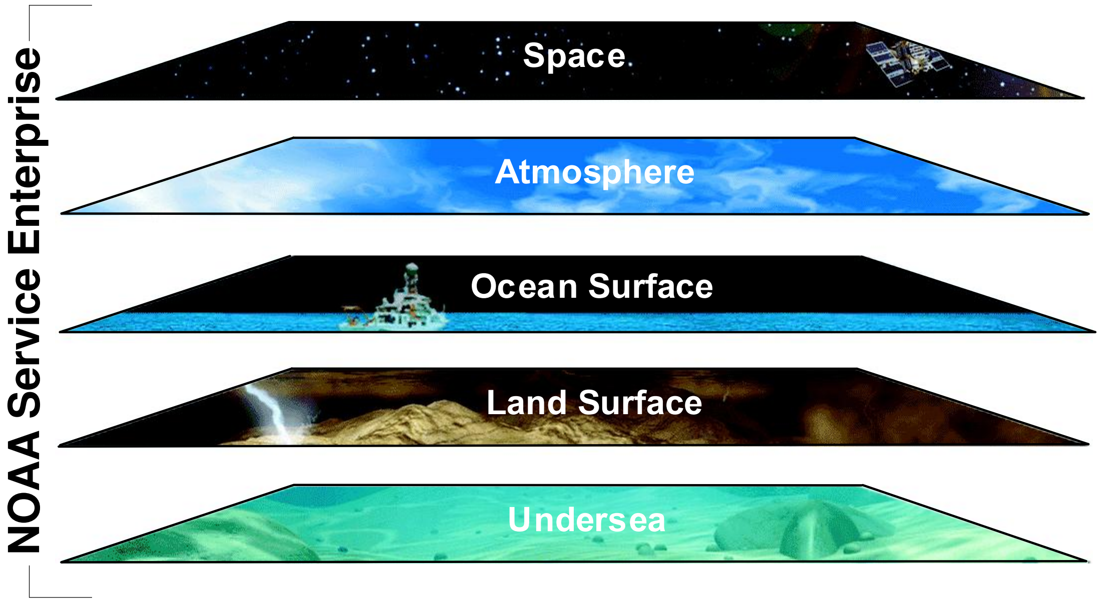


Figure XX. The NOAA Service Enterprise data model allows data collection and organization from all observational domains.

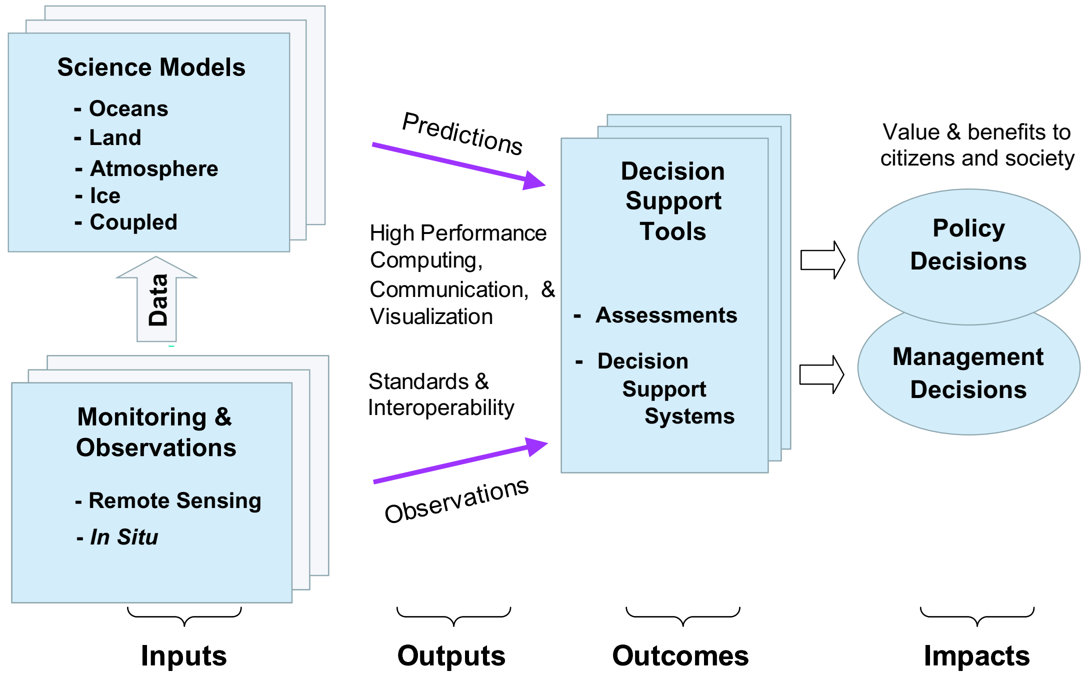
The environmental observations cover all domains that affect Planet Earth. Figure XX presents a construct for an observations data model within the NOAA Information Service Enterprise and would include observations collected from space, atmosphere, oceans, land, and for undersea. To maximize our efficient use of the data in our enterprise, we must organize the data. A data model is a method to assist us in that organization.

Milestones (and progress) in the development of the NOAA enterprise architecture include:

- Concepts of Operation (Draft)
- Requirements process, including our new responsibility to collect requirements of the other Federal agencies and NOAA external partners (Refined)
- Baseline Observing System Architecture (Established)
- Integrated Planning Process for the Target (Future) Observing Systems Architecture (Established)
- NOAA Observing Systems Council (Established)
- NOAA Observing System Architect Office (Established, along with the architecture development team and toolsets)

Figure XX illustrates the interrelationships between Earth observations and decisions benefitting society. The Integrated Systems Architecture is a broader view of the important role of the environmental observations within a more complex and complete systems architecture construct. Our environmental observations have no intrinsic value but accrue value through their use in scientific models and decision support tools—and result in value to society through policy and management decisions.

Figure XX. Integrated Systems Architecture.

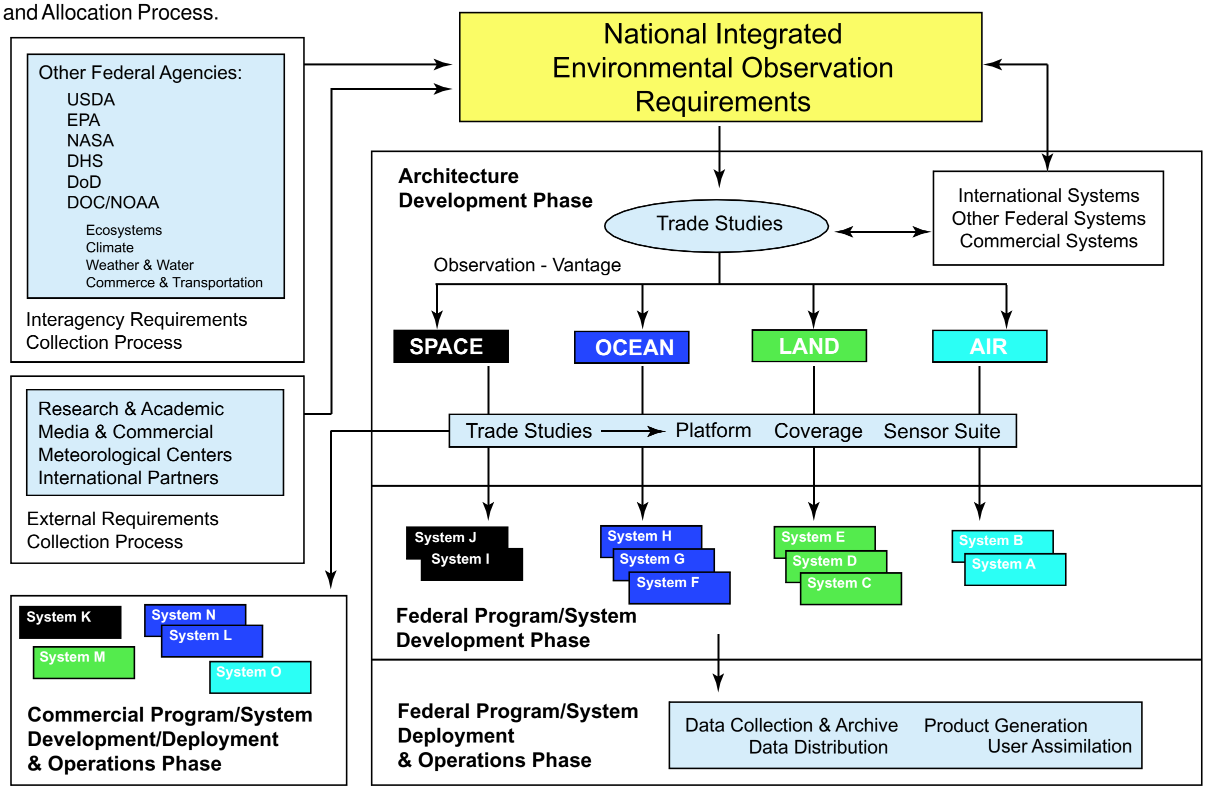


Translating Requirements into Observations

Fundamental to the success of any architecture ***in operation*** is the degree to which it satisfies the users' needs or requirements. NOAA has improved its requirements definition and collection processes and has increased substantially its dialogue with users to better understand future requirements. Figure XX depicts the NOAA Requirements Collection, Assessment, and Allocation Process.

Improvements to the requirements process also include making the requirements process more generic. Past efforts to canvas users occurred when NOAA was developing a specific system solution. Now, NOAA is developing a National Integrated Environmental Observation Requirements repository (or "deck"). This allows users to define their needs for environmental observations by environmental parameter—independent of potential future system solutions. Additionally, NOAA is working closely with the other Federal agencies to capture their future environmental observation requirements.

Figure XX. Requirements Collection, Assessment, and Allocation Process.



NOAA is working with these users to translate their mission needs into environmental observation requirements. NOAA will then conduct trade studies at several levels to determine how and where to best collect that observation, also giving consideration to the users' needs for attributes such as accuracy, frequency of information, timeliness, etc. Requirements for environmental observations will be allocated to programs and then to systems. Included within the solutions space will be NOAA internal programs, other Federal government programs, international programs, and commercial programs.

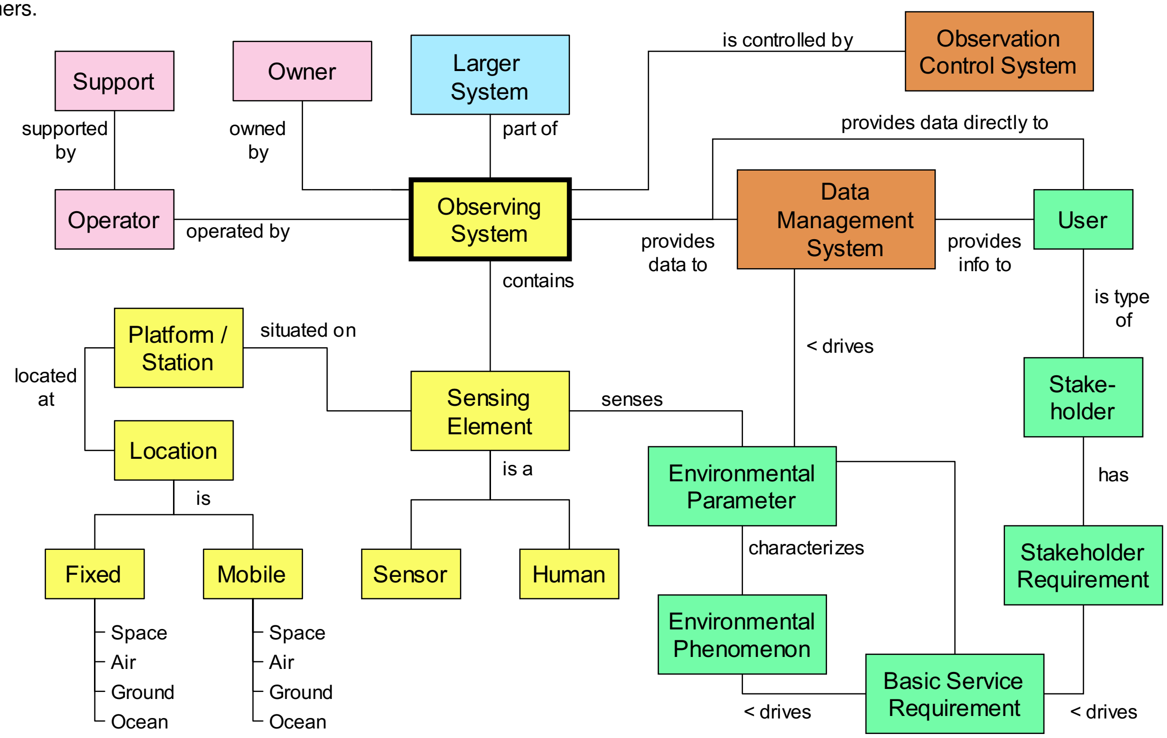
Another important linkage for the National Integrated Environmental Observation Requirements deck is with our research programs and their objectives. This important linkage will more clearly focus our research initiatives toward those high priority user requirements. Technology initiatives will be linked similarly to our users' high priority user requirements. These linkages will not only assist us in developing our research and technology investment plans, but also improve our focus on transition research into our operations.

Implementing the NOAA Integrated Observing System

For more than 40 years, NOAA has been the U.S. leader in operational environmental observing. However, prior to 2002, NOAA did not have a comprehensive architectural description of all its observing systems (remote and *in situ*). Now, as mentioned in the Architecture Overview, NOAA has a four-component observing systems architecture development process: a foundation, a builder, a toolset, and a plan.

In August 2002, NOAA initiated its first-ever comprehensive review of all its observing systems and their interrelationships. This activity was termed the baseline NOAA Observing Systems Architecture (NOSA). The first phase was completed in January 2003 and formed the basis of the NOAA observing systems architecture development process. The baseline NOSA was constructed with the assistance of all observing system managers, research and operational, within NOAA. Using a series of Web-based survey forms based on Figure XX, NOAA identified 99 separate observing systems measuring over 500 different environmental parameters. Of the 99

Figure XX. NOAA Observing Systems Architecture Relationship Diagram. Green refers to the user requirements process. Yellow is the observing system; brown is the data management system. Pink is the observing system operations and maintenance; blue is the link to larger systems and partners.



observing systems, 40 were termed “operational” by their program managers—see **Appendix 5** for a description of each of those baseline systems. The principal purpose of the baseline architecture was to allow NOAA leaders to accurately respond to queries for a variety of information, including (but not limited to):

- Descriptions of NOAA’s observing systems, including purpose, intended use (operational or research), life cycle phase, schedule, and system quantities (currently deployed, programmed, or needed)
- Costs for each observing system, including initial acquisition cost (or replacement cost), subsequent upgrade costs, and operations and maintenance costs
- Environmental parameters measured by the observing system
- Applications of NOAA observing systems to NOAA’s mission goals
- Location maps of observing platforms or stations that can be overlaid and compared

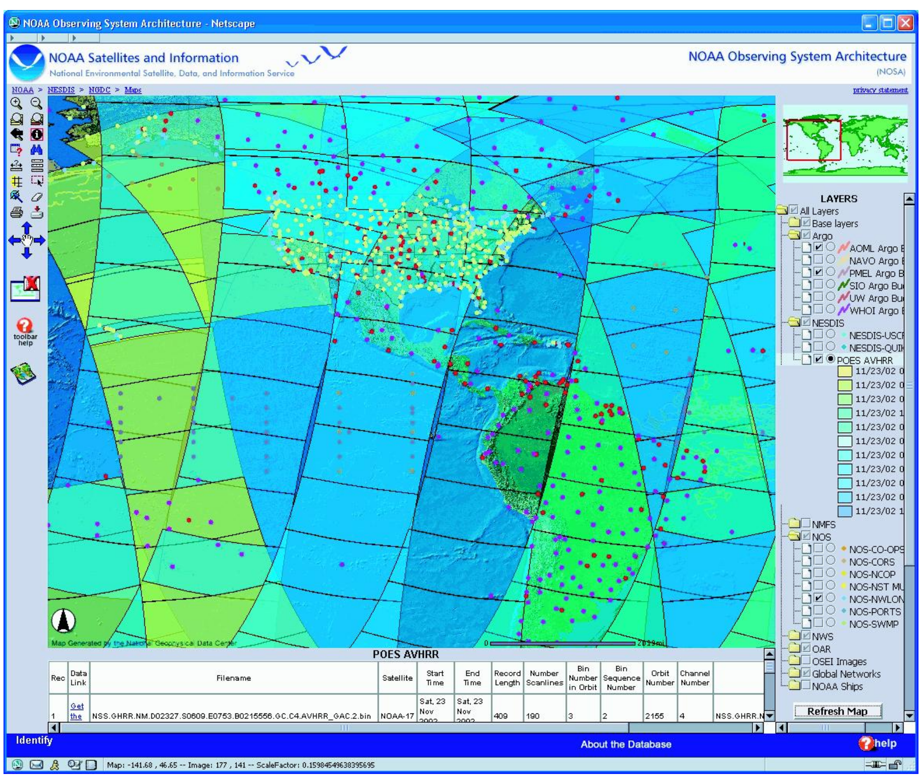


Figure XX. Geospatial view of selected NOAA observing systems locations.

Some of these queries are business-related and can be depicted using tables, charts, spreadsheets, or by other enterprise architecture visualization tools. However, other queries are geospatial by nature and require GIS tools to properly visualize NOAA observing capabilities. Figure XX is one example of the geospatial views available through decision support tools supporting the baseline NOSA.

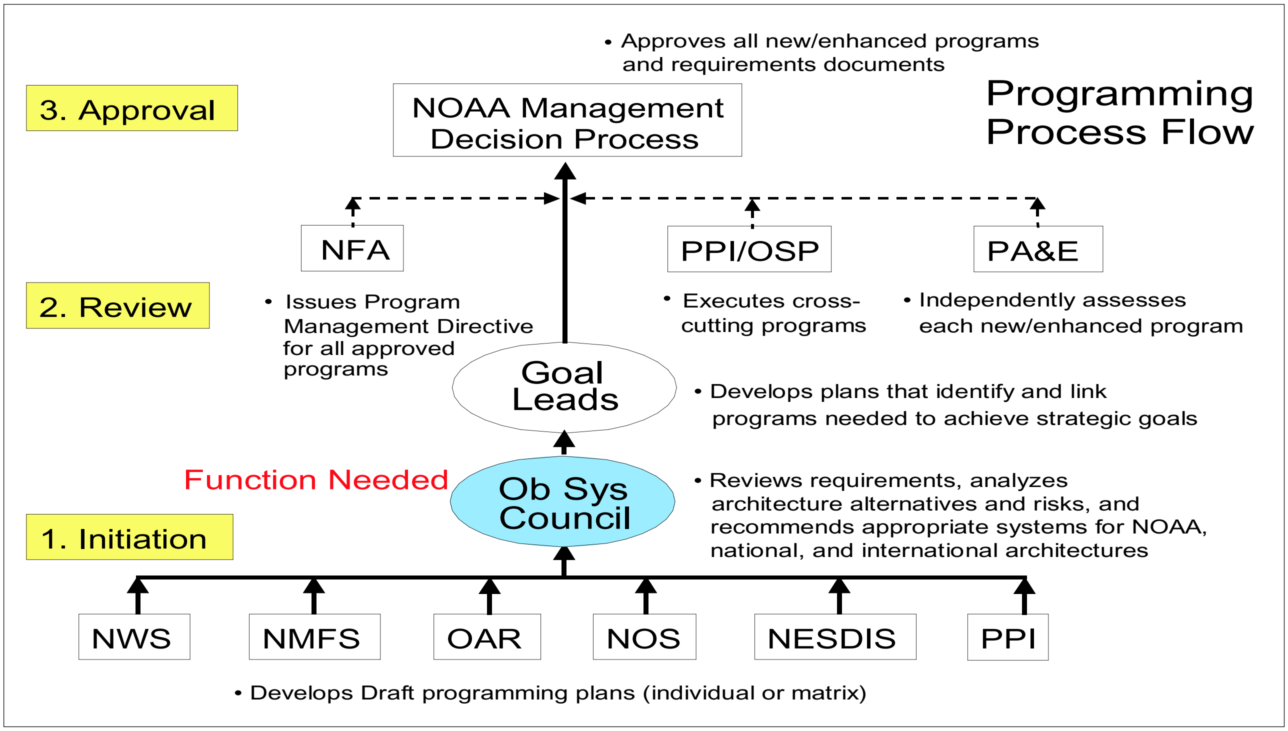
Building on the foundation of the baseline NOSA, NOAA developed an implementation plan for its Observing Systems Architecture. Besides maintaining the baseline NOSA and the architecture toolset, the implementation plan included:

- Establishing a NOAA Observing Systems Architect office
- Establishing a NOAA Observing Systems Council (NOSC)
- Developing a target NOSA

The NOAA Observing Systems Architect dual-reports to the Assistant Administrators for Satellite Information and Services and Program Planning and Integration. The architect has the principal responsibility for maintaining the baseline NOSA, developing the target NOSA and developing and maintaining the NOSA decision support toolset.

The NOAA Observing Systems Council (NOSC) provides corporate oversight of the NOAA Observing Systems Architect office. The NOSC is comprised of a team of senior representatives from all NOAA Line Offices, with participation from selected offices and other Councils. The Assistant Administrator for Satellite and Information Services chairs the NOSC. A Terms of Reference (presented in **Appendix 3**) defines the activities of the NOSC, which includes:

Figure XX. NOAA Observing Systems Council (NOSC) role.



- Review observing system requirements
- Identify gaps in NOAA observations
- Review architecture alternatives
- Review observing system acquisition alternatives
- Maintain cognizance over all NOAA observing system activities while coordinating NOAA participation in national and international Earth observation efforts
- Identify activities and specific coordination to be proposed for existing NOAA councils, line offices, and program managers

Figure XX (previous page) illustrates the role the NOSC plays in the programming process. Line offices and program managers work with the NOSC on integrated observing and data management system issues throughout the planning and programming phases of NOAA's PPBS process.

In addition to the NOSC, the NOAA Ocean Council (NOC) is working toward an effective role in defining NOAA's investments and strategies associated with ocean observing and observing systems. In doing so, it is critical that the relationship between the NOC and the NOSC is well understood and consistent with each Council's objectives and terms of reference. The NOC Terms of Reference is presented in **Appendix 4**.

As seen above, the NOSC will focus largely on two fundamental issues associated with observations and observing systems: integration and architecture. More specifically, the NOSC intends to address the issues of standardization in data, metadata, communications protocols etc., that are critical to ensuring the ability to integrate the full spectrum of observing systems (i.e., terrestrial, atmospheric, ocean). Additionally, the NOSC will focus on concepts and policies associated with developing the procedures and frameworks common to NOAA's observing systems. A strong working relationship between the NOC and the NOSC is essential to successfully implementing NOAA's integrated observing system.

In July 2003, the NOAA Observing Systems Architect office initiated the first phase of the target NOAA observing systems architecture development. Figure XX depicts the proposed planning process for that development. The purpose of this process is to provide a "living" target architecture, linked to NOAA's planning, programming, and budgeting system. The planned output of this process is a NOAA Observing Systems Architecture Master Plan, which will allow NOAA leaders to determine what future observing and data management systems NOAA needs to

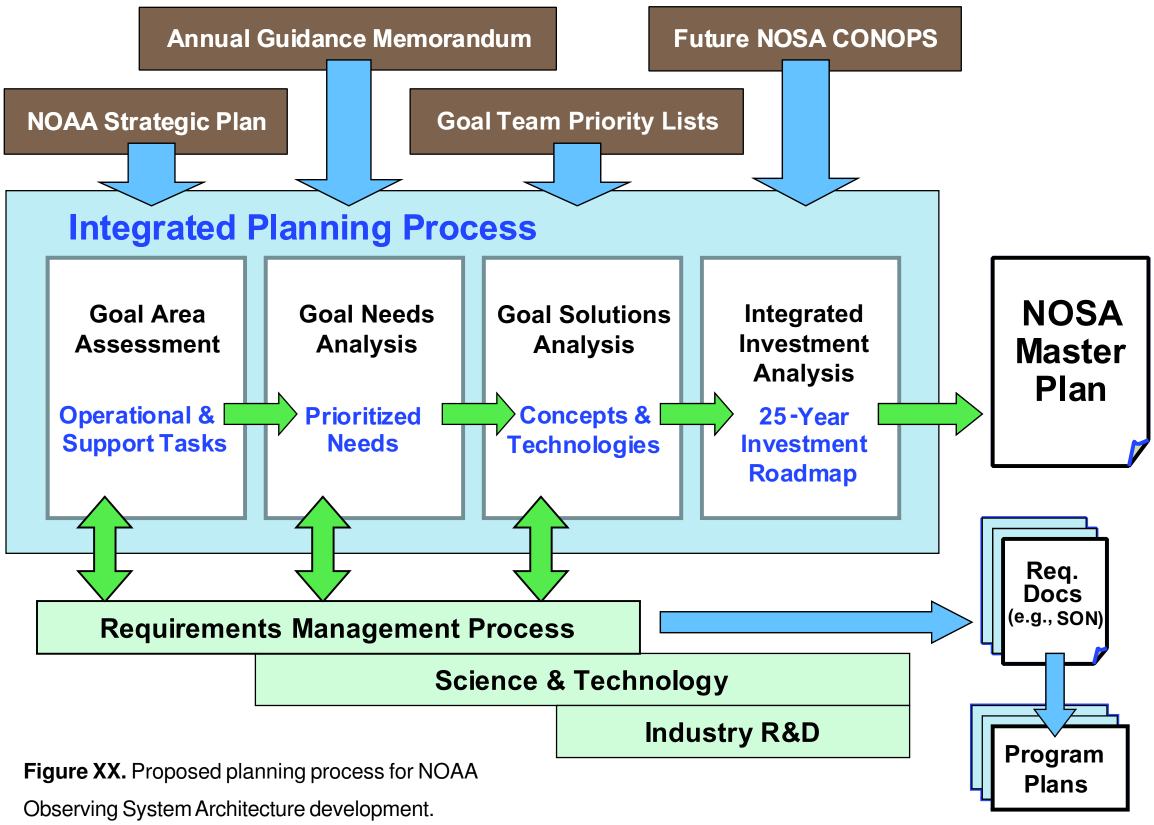


Figure XX. Proposed planning process for NOAA Observing System Architecture development.

meet our users' current and evolving environmental information requirements. The Master Plan will be routinely updated during NOAA Program Planning and Integration-directed program review cycles to account for new policy guidance, new user requirements and new technological capabilities.

NOAA Observing System Data Management

It is critical that data management be implemented as an end-to-end system in developing a baseline NOAA Observing Systems Architecture. End-to-end data management typically includes data acquisition, processing, distribution, and archiving. NOAA is taking a more comprehensive view starting with the observing systems requirements and planning and ending with user services. (See Figure XX, below.)

NOAA will need to assess current data management capability for a full understanding of the current state of integration between observing systems and data management systems. NOAA's data management systems form the underlying foundation for integrating diverse observational data to address complex environmental problems. The required data management system encompasses elements of literally hundreds of existing data systems that have been developed throughout NOAA over the last several decades. These systems serve the full spectrum of users from the research scientists who designed and built many of them, to the general public trying to protect themselves from severe weather or understand the impacts of the environment on their livelihoods.

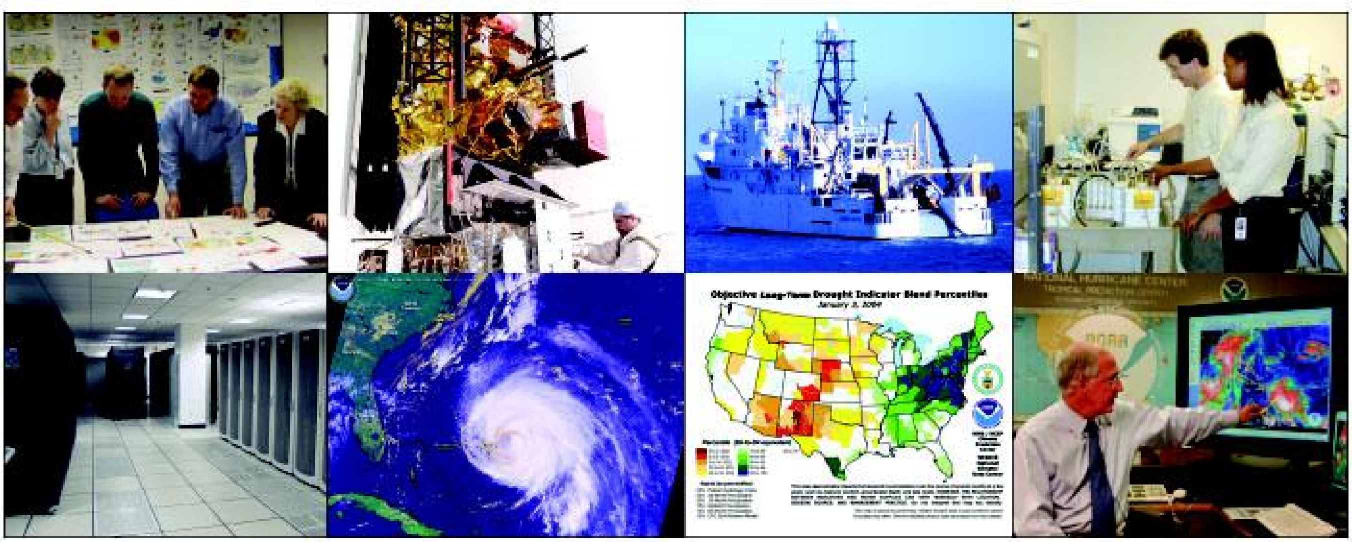


Figure XX. End-to-end data management in NOAA.

Evolving NOAA's collection of data systems into an integrated whole is the most critical challenge that NOAA is now facing. That evolution will be guided by several essential principles.

- **Preservation of Data Products**
  Understanding subtle long-term changes in the environment requires data collected consistently and preserved for long-time periods. Metadata must also be generated and preserved in order to ensure that the data remain usable and understandable.

- **Maximize Data Utilization**
  The data management system must enable users to easily access data at any stage of its life, regardless of who collected the data, and when and why it was originally collected. Data has to be interoperable; users must be able to seamlessly access the data they need from a wide variety of analysis and visualization platforms.

- **Partnerships**
  Many groups in the United States and around the world are in the initial stages of developing integrated observing systems. NOAA is involved in many of these projects and must remain involved throughout the development and implementation of the NOAA Data Management System.

- **Use of Standards**
  The goal of data access and interoperability can only be achieved by building the NOAA Data Management System using well known standards for metadata and data. In some cases, these standards emerge from the scientific data community, i.e. the netCDF and HDF file formats and the OPeNDAP data transfer standard. In others, they emerge from broad consortia that includes all sectors, i.e. the Open GIS Consortium. Finally, standards emerge from Federal and international standards groups, i.e. the Federal Geographic Data Commission (FGDC), the International Standards Organization (ISO), or the Consultive Committee for Satellite Data Systems (CCSDS).

- **Effective User Feedback**
  The data management system must be built with the goal of integrating feedback from users at all levels. Scientists must be able to examine the quality of the data and record their

findings for future users. Users must be able to determine how the data they receive from the system has been processed and by whom.

- **Reliable, Sustained, Efficient Operations**
  The NOAA Data Management System must be reliable and efficient, for the task is considerable. The data must be available when it is needed and secure at all times.

- **Data Quality**
  Information quality is composed of three elements—utility, integrity, and objectivity. Data quality will be ensured and established at levels appropriate to the nature and timeliness of the information to be disseminated. Utility means that disseminated information is useful to its intended users. Data integrity refers to security—prior to dissemination, NOAA information, independent of the specific intended distribution mechanism, is safeguarded from improper access, modification, or destruction, to a degree commensurate with the risk and magnitude of harm that could result from the loss, misuse, or unauthorized access to, or modification of, such information. Objectivity ensures that information is accurate, reliable, and unbiased, and that information products are presented in an accurate, clear, complete, and unbiased manner.

The recent, Congressionally-mandated International Ocean Observing System (IOOS) is taking a similar approach to NOAA planning for data management. IOOS will consist of three subsystems: the Observing Subsystem (measurements and transmission of measurements from platforms); the Modeling and Analysis Subsystem (evaluation and forecast of the state of the marine environment based upon measurements); and the Data Management and Communications subsystem (DMAC—the integrating component). DMAC provides the links within and among the other subsystems. DMAC will also provide the means to connect IOOS to international ocean data management systems and to significant data management systems in other disciplines, such as atmospheric and terrestrial sciences.

DMAC will be a data and communications infrastructure that consists of standards, protocols, facilities, and software. DMAC will support: (1) IOOS-wide descriptions of data sets (Metadata, which will be FGDC compliant); (2) the ability to search for and find data sets, products, and data manipulation capabilities of interest (Data Discovery); (3) the ability to access measurements and data products from computer applications across the Internet (Data Transport);

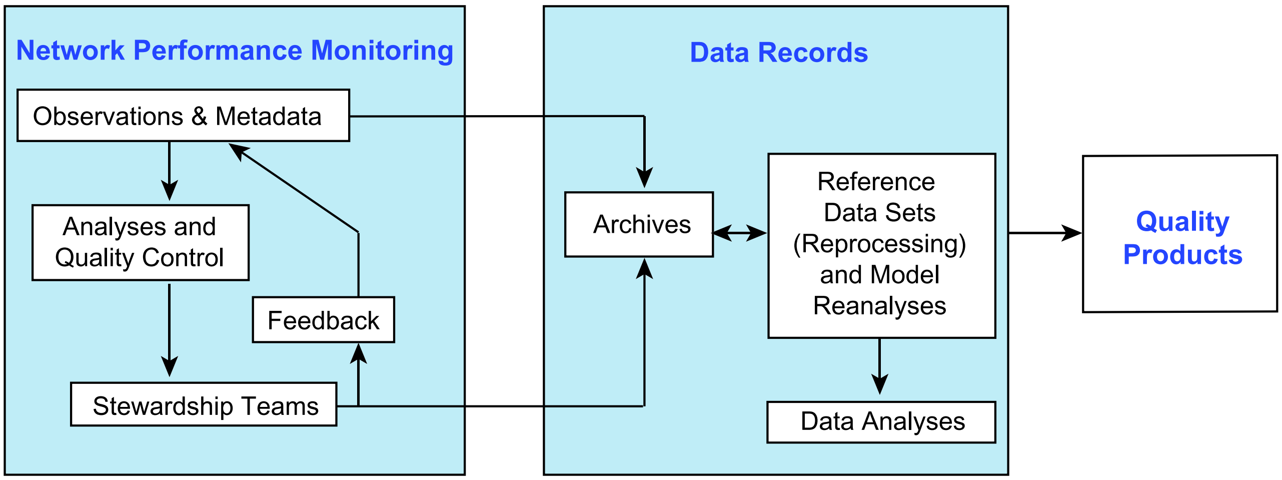


Figure XX. Scientific Data Stewardship (SDS). Real-time and retrospective management of data.

(4) the ability to quickly evaluate the character of the data through common Web browsers (On-line Browse); and (5) secure, long-term data storage (Data Archive). These IOOS data management concepts are very similar to the NOAA data management principles noted above.

An important activity that NOAA will emphasize is the scientific stewardship of its data. NOAA's Scientific Data Stewardship (SDS) will ensure the long-term preservation of its data from its observing systems. SDS functions are: careful monitoring of observing system performance for long-term applications, generation of authoritative long-term records, assessment of the state of the environment, data archeology, and archive and access to data, products, and metadata. This integrated suite of functions preserves and exploits the full scientific value of NOAA's environmental data. Successful implementation of scientific data stewardship will ensure maximum use of NOAA's environmental data, now and in the future.

While real-time operational products from NOAA's observing systems meet or exceed the short-term forecast goals, some, notably those derived from satellite data, have generally failed to become authoritative long-term records. Long-term records are needed to address important environmental monitoring and prediction issues such as atmospheric and oceanic climate change, terrestrial change, detection in response to climate changes, space and solar variability, and ecosystem and coastal management. SDS provides an end-to-end system that will address many data problems identified by the scientific community. SDS products will focus on NOAA's environmental stewardship mission, which is a major contributor to economic and social issues.

In the near term, NOAA is expanding the data management function of the Comprehensive Large Array-data Stewardship System (CLASS) in preparation for the forty-fold increase in environmental data volume projected over the next decade. The flood of data will come from environmental satellites and *in situ* observing systems from various U.S. Government agencies (including NOAA, NASA, and DOD) and international partners (including EUMETSTAT, GCOS, and WMO). The challenge in the future will be how to efficiently and effectively manage the storage, retrieval, and distribution of "petabytes" (i.e., millions of gigabytes) of data. NOAA's National Data Centers (NNDC) and their worldwide clientele of customers look to CLASS as the sole NOAA IT infrastructure project in which all current and future large array environmental data sets will reside. CLASS provides permanent, secure storage, and safe, efficient access between NNDCs and the customers.

> Responding to the direction of President Bush that the best available scientific information be developed to support decision making on global climate change issues, the U.S. Climate Change Strategic Plan has developed its strategic planning and public review processes to facilitate "credible fact finding" on . . . comprehensive, high quality climate and ecosystem observing and data management systems . . .
>
> Dr. James Mahoney
> Assistant Secretary of Commerce, and Deputy Administrator, NOAA

Next Steps

NOAA is, and will continue to be, in the environmental information "business." The nations of the world are increasingly aware of the need for an effective global environmental observation system that puts science to work not only for environmental and scientific benefits, but also for crucial social and economic needs as well.

NOAA has made substantial progress in its journey to develop an integrated global environmental observation and data management system, but has a tremendous amount of work ahead. The main challenges fall into five areas:

- Documenting environmental observation requirements
- Determining gaps and overlaps
- Interfacing with national and international partners
- Deploying the most effective and efficient systems
- Building a corporate data management system

In the baseline NOAA Observing Systems Architecture development, NOAA focused primarily on observing systems, with a secondary emphasis on data management systems tied to those observing systems. An effective integrated observing and data management system requires an Information Services Enterprise effort by NOAA. NOAA's new long-term environmental requirements development task, emanating from the Commercial Remote Sensing Policy Act of 2003 (**Appendix 1**), will require keen oversight by NOAA senior leaders.

NOAA is very active in the national (IWGEO) and international (GEO) development efforts to develop a 10-Year Implementation Plan for a "comprehensive, coordinated, and sustained Earth observation system or systems" by December 2004. The schedule is aggressive and the workload is heavy, but the potential benefits are immense.

Over the past year and a half, NOAA has organized and equipped itself to address these challenges in its cross-cutting goal to develop an integrated global environmental observation and data management system. By working effectively with our national and international partners and by working within established and effective corporate business processes, NOAA is poised for success in this critical endeavor.

Appendix 1:
U.S. Commercial Remote Sensing Policy

Date Released: Tuesday, May 13, 2003
Source: Office of Science and Technology Policy
Title: U.S. Commercial Remote Sensing Policy Fact Sheet; April 25, 2003; Fact Sheet

The President authorized a new national policy on April 25, 2003 that establishes guidance and implementation actions for commercial remote sensing space capabilities. This policy supersedes Presidential Decision Directive 23, U.S. Policy on Foreign Access to Remote Sensing Space Capabilities, dated 9 March 1994. This fact sheet provides a summary of the new policy.

I. Scope and Definitions
This policy provides guidance for: (1) the licensing and operation of U.S. commercial remote sensing space systems; (2) United States Government use of commercial remote sensing space capabilities; (3) foreign access to U.S. commercial remote sensing space capabilities; and (4) government-to-government intelligence, defense, and foreign policy relationships involving U.S. commercial remote sensing space capabilities.

For the purposes of this document:

- "Remote sensing space capabilities" refers to all remote sensing space systems, technology, components, products, data, services, and related information. In this context, "space system" consists of the spacecraft, the mission package(s), ground stations, data links, and associated command and control facilities and may include data processing and exploitation hardware and software; and

- "Commercial remote sensing space capabilities" refers to privately owned and operated space systems licensed under the Land Remote Sensing Policy Act of 1992, their technology, components, products, data, services, and related information, as well as foreign systems whose products and services are sold commercially.

No legal rights or remedies, or legally enforceable causes of action are created or intended to be created by this policy. Officers of the United States and those agents acting on their behalf implementing this policy shall do so in a manner consistent with applicable law.

II. Policy Goal
The fundamental goal of this policy is to advance and protect U.S. national security and foreign policy interests by maintaining the nation's leadership in remote sensing space activities, and by sustaining and enhancing the U.S. remote sensing industry. Doing so will also foster economic growth, contribute to environmental stewardship, and enable scientific and technological excellence. In support of this goal, the

United States Government will:

- Rely to the maximum practical extent on U.S. commercial remote sensing space capabilities for filling imagery and geospatial needs for military, intelligence, foreign policy, homeland security, and civil users;
- Focus United States Government remote sensing space systems on meeting needs that can not be effectively, affordably, and reliably satisfied by commercial providers because of economic factors, civil mission needs, national security concerns, or foreign policy concerns;
- Develop a long-term, sustainable relationship between the United States Government and the U.S. commercial remote sensing space industry;
- Provide a timely and responsive regulatory environment for licensing the operations and exports of commercial remote sensing space systems; and,
- Enable U.S. industry to compete successfully as a provider of remote sensing space capabilities for foreign governments and foreign commercial users, while ensuring appropriate measures are implemented to protect national security and foreign policy.

III. Background

Vital national security, foreign policy, economic, and civil interests depend on the United States ability to remotely sense Earth from space. Toward these ends, the United States Government develops and operates highly capable remote sensing space systems for national security purposes, to satisfy civil mission needs, and to provide important public services. United States national security systems are valuable assets because of their high quality data collection, timeliness, volume, and coverage that provide a near real-time capability for regularly monitoring events around the world. United States civil remote sensing systems enable such activities as research on local, regional, and global change, and support services and data products for weather, climate, and hazard response, and agricultural, transportation, and infrastructure planning.

A robust U.S. commercial remote sensing space industry can augment and potentially replace some United States Government capabilities and can contribute to U.S. military, intelligence, foreign policy, homeland security, and civil objectives, as well as U.S. economic competitiveness. Continued development and advancement of U.S. commercial remote sensing space capabilities also is essential to sustaining the nation's advantage in collecting information from space. Creating a robust U.S. commercial remote sensing industry requires enhancing the international competitiveness of the industry.

IV. Licensing and Operation Guidelines for Private Remote Sensing Space Systems

The Secretary of Commerce, through the National Oceanic and Atmospheric Administration (NOAA), licenses and regulates the U.S. commercial remote sensing space industry, pursuant to the Land Remote Sensing Policy Act of 1992, as amended, and other applicable legal authorities. The Secretary of Defense and the Secretary of State are responsible for determining the conditions necessary to protect national security and foreign policy concerns, respectively. NOAA, in coordination with other affected agencies and in consultation, as appropriate, with industry, will develop, publish, and periodically review the licensing regulations and associated timelines governing U.S. commercial remote sensing space systems.

To support the goals of this policy, U.S. companies are encouraged to build and operate commercial remote sensing space systems whose operational capabilities, products, and services are superior to any current or planned foreign commercial systems. However, because of the potential value of its products to an adversary, the operation of a U.S. commercial remote sensing system requires appropriate security measures to address U.S. national security and foreign policy concerns. In such cases, the United States Government may restrict operations of the commercial systems in order to limit collection and/or dissemination of certain data and products, e.g., best resolution, must timely delivery, to the United States Government, or United States Government approved recipients.

On a case-by-case basis, the United States Government may require additional controls and safeguards for U.S. commercial remote sensing space systems potentially including them as conditions for United States Government use of those capabilities. These controls and safeguards shall include, but not be limited to: (1) the unique conditions associated with United States Government use of commercial remote sensing space systems; and (2) satellite, ground station, and communications link protection measures to allow the United States Government to rely on these systems. The United States Government also may condition the operation of U.S. commercial remote sensing space systems to ensure appropriate measures are implemented to protect U.S. national security and foreign policy interests.

V. United States Government Use of Commercial Remote Sensing Space Capabilities

To support the goals of this policy, the United States Government shall utilize U.S. commercial remote sensing space capabilities to meet imagery and geospatial needs. Foreign commercial remote sensing space capabilities, including but not limited to imagery and geospatial products and services, may be integrated in United States Government imagery and geospatial architectures, consistent with national security and foreign policy objectives.

With regard to the national security remote sensing space architecture, the Secretary of Defense and the Director of Central Intelligence, in consultation with industry as appropriate, shall:

- Determine which needs for imagery and geospatial products and services can be reliably met by commercial remote sensing space capabilities;

- Communicate current and projected needs to the commercial remote sensing space industry;

- Competitively outsource functions to enable the United States Government to rely to the maximum practical extent on commercial remote sensing space capabilities for filling imagery and geospatial needs;

- Establish the National Imagery and Mapping Agency (NIMA) as the agency of primary responsibility for acquiring and disseminating commercial remote sensing space products and services for: (1) all national security requirements; and, (2) in consultation with the Secretary of State, all foreign policy requirements.

With regard to civil remote sensing space capabilities, the Secretaries of Commerce and the Interior, and the Administrator of the National Aeronautics and Space Administration (NASA), in consultation with other United States Government agencies, and with industry, as appropriate, shall:

- Determine which civil needs can be met by commercial remote sensing space capabilities; and

- Communicate current and projected needs to the commercial remote sensing space industry.

United States Government civil agencies acting individually, or when beneficial, together, shall:

- Competitively outsource functions to enable the United States Government to rely to the Maximum practical extent on commercial remote sensing space capabilities for filling civil imagery and geospatial needs;

- Acquire and operate United States Government systems that collect data only when such data (1) are not offered and will not be made available by U.S. commercial remote sensing space systems; or (2) require collection, production, and/or dissemination by the United States Government due to unique scientific or technological considerations or other mission requirements; and

- Coordinate with NIMA procurement of all U.S. commercial remote sensing data and the products that are restricted to United States Government-approved users pursuant to NOAA license conditions due to U.S. national security or foreign policy concerns.

Agencies shall allocate the resources required to implement these objectives within the overall policy and resource guidance of the President and available appropriations. Civil agencies may acquire commercial remote sensing space products and services directly, through cooperative arrangements with other civil agencies, or through NIMA. When procuring through another agency, civil agencies will reimburse the procuring agency, consistent with the Economy Act.

VI. Foreign Access to U.S. Commercial Remote Sensing Space Capabilities
It is in U.S. national security, foreign policy, and economic interests that U.S. industry compete successfully as providers of remote sensing space products and capabilities to foreign governments and foreign commercial users. Therefore, license applications for U.S. commercial remote sensing space exports shall be considered favorably to the extent permitted by existing law, regulations, and policy when such exports support these interests.

The United States Government will consider remote sensing exports on a case-by-case basis. These exports will continue to be licensed pursuant to the United States Munitions List or the Commerce Control List, as appropriate, and in accordance with existing law and regulations. The following guidance will also apply, when considering license applications for remote sensing exports:

- The United States Government will take into account exports' potential contribution to achieving the goals of this policy, the overall relationship, particularly the existing defense and defense trade relationship with the proposed recipient nation, and broader U.S. national security, foreign policy, and economic objectives;

- As a general guideline, remote sensing exports that are currently available or are planned to be available in the global marketplace also will be considered favorably;

- Exports of sensitive or advanced information, systems, technologies, and components, however, will be approved only rarely, on a case-by-case basis. These items include systems engineering and the systems integration capabilities and techniques, or enabling components or technologies, i.e., items with capabilities significantly better than those achievable by current or near-term foreign systems. The Secretary of State, in consultation with the Secretary of Defense and the Director of Central Intelligence, shall maintain a Sensitive Technology List that includes these items. This list shall be made available to U.S. industry, consistent with national security and foreign policy concerns. The Department of State shall use the list in the evaluation of requests for exports; and

- Sensitive or advanced remote sensing exports, including but not limited to a subset of items specifically identified on the Sensitive Technology List, will be approved only on the basis of a government-to-government agreement or other acceptable arrangement that includes, among other things, end-use and retransfer assurances that protect U.S. controlled and technical data, and broader national security and foreign policy needs. Such agreements also may include protections for intellectual property and economic interests. To facilitate timely implementation, the disposition of export license applications will be expedited after completion of such agreements or arrangements.

VII. Government-to-Government Intelligence, Defense, and Foreign Relationships

The United States Government will use U.S. commercial remote sensing space capabilities to the maximum extent practicable to foster foreign partnerships and cooperation, and foreign policy objectives, consistent with the goals of this policy and with broader national security objectives. Proposals for new partnerships regarding remote sensing that would raise questions about United States Government competition with the private sector shall be submitted for interagency review. In general, the United States Government should not pursue such partnerships if they would compete with the private sector, unless there is a compelling national security or foreign policy reason for doing so.

VIII. Implementation Actions

Implementation of this directive will be within the overall policy and resource guidance of the President and subject to the availability of appropriations. Agencies have been directed to complete a series of specific implementation actions within 120 days from the date of this directive.

President Bush looks at photographs and listens to advisors during a briefing on the strength and track of Hurricane Isabel, September, 2003. At right is Michael Brown, Undersecretary for Emergency Preparedness and Response, Department of Homeland Security. NOAA Administrator Vice Admiral Lautenbacher is to the right of Mr. Brown. (AP Photo: J. Scott Applewhite.)

Appendix 2:
Declaration of the Earth Observation Summit

We, the participants in this Earth Observation Summit held in Washington, DC, on July 31, 2003:

Recalling the World Summit on Sustainable Development held in Johannesburg that called for strengthened cooperation and coordination among global observing systems and research programmes for integrated global observations;

Recalling also the outcome of the G-8 Summit held in Evian that called for strengthened international cooperation on global observation of the environment;

Noting the vital importance of the mission of organizations engaged in Earth observation activities and their contribution to national, regional, and global needs;

Affirm the need for timely, quality, long-term, global information as a basis for sound decision making. In order to monitor continuously the state of the Earth, to increase understanding of dynamic Earth processes, to enhance prediction of the Earth system, and to further implement our environmental treaty obligations, we recognize the need to support:

1. Improved coordination of strategies and systems for observations of the Earth and identification of measures to minimize data gaps, with a view to moving toward a comprehensive, coordinated, and sustained Earth observation system or systems;

2. A coordinated effort to involve and assist developing countries in improving and sustaining their contributions to observing systems, as well as their access to and effective utilization of observations, data and products, and the related technologies by addressing capacity-building needs related to Earth observations;

Representatives of 34 nations attended the Earth Observation Summit. (Photo: Bill Ingalls.)

3. The exchange of observations recorded from in situ, aircraft, and satellite networks, dedicated to the purposes of this Declaration, in a full and open manner with minimum time delay and minimum cost, recognizing relevant international instruments and national policies and legislation; and

4. Preparation of a 10-year Implementation Plan, building on existing systems and initiatives, with the Framework being available by the Tokyo ministerial conference on Earth observations to be held during the second quarter of 2004, and the Plan being available by the ministerial conference to be hosted by the European Union during the fourth quarter of 2004.

To effect these objectives, we establish an *ad hoc* Group on Earth Observations and commission the group to proceed, taking into account the existing activities aimed at developing a global observing strategy in addressing the above. We invite other governments to join us in this initiative. We also invite the governing bodies of international and regional organizations sponsoring existing Earth observation systems to endorse and support our action, and to facilitate participation of their experts in implementing this Declaration.

President Bush's Statement on Earth Observation Summit

The United States is pleased to host more than 30 nations at the Earth Observation Summit. The Summit participants will discuss plans for achieving the goal of building a better integrated earth observation system in the next 10 years, an objective established by the G-8 Heads of State in Evian, France, in June 2003. An integrated earth observation system will benefit people around the world, particularly those in the Southern Hemisphere. Working together, our nations will develop and link observation technologies for tracking weather and climate changes in every corner of the world, which will allow us to make more informed decisions affecting our environment and economies. Our cooperation will enable us to develop the capability to predict droughts, prepare for weather emergencies, plan and protect crops, manage coastal areas and fisheries, and monitor air quality.

Appendix 3:
NOAA Observing Systems Council—Terms of Reference

Purpose:

- Mission:
  1. Principal advisory body to the Under Secretary for NOAA's Earth observation and data management (end-to-end) activities.
  2. Principal coordinating body for NOAA to the White House Committee on Environment and Natural Resources (CENR) Subcommittee on Earth Observations in developing an international, comprehensive, coordinated and sustained Earth observation system
- Specific Tasks:
  1. Provide recommendations to the NOAA Executive Council (NEC) and NOAA Executive Panel (NEP) on requirements, architectures, and acquisitions to meet NOAA, national, and international observing needs.
  2. Oversee the work of the NOAA Observing Systems Architect, providing guidance in the development of the NOAA Integrated Global Environmental Observation and Data Management System architecture.
  3. Work with local, state, regional, national, and international partners to develop global-to-local environmental and ecological observation and data management systems for comprehensive, continuous monitoring of coupled ocean/atmosphere/land domains.

Membership:

- Chair: Gregory W. Withee (NESDIS), 301-713-3587, Greg.Withee@noaa.gov
- Executive Secretariat and Contact Person: Michael Crison (NESDIS), 301-713-2789 ext 140, Michael.Crison@noaa.gov
- Members
  1. Principals
     a. Assistant Administrator for Program Planning and Integration (PPI)
     b. Director, Office of Science and Technology, National Marine Fisheries Service (NMFS)
     c. Director, National Weather Service Western Region (NWS)
     d. Chief, Marine Sanctuaries Division, National Ocean Service (NOS)
     e. Office of Global Programs, Office of Oceanic and Atmospheric Research (OAR)
     f. Chief, Program Services and Outsourcing Division, NOAA Maritime and Aviation Operations (NMAO)
     g. NOAA Chief Information Officer (OCIO)
  2. Advisor: NOAA Observing Systems Architect
  3. Staff: NOAA Observing Systems Architect Office
  4. Committees: Standing committees and working groups will be established as necessary to support Council concerns/decision making and any analysis in support of its recommendations.

Roles and Responsibilities:

- Council
  1. Provide corporate oversight of the NOAA Observing Systems Architect
  2. Review observing systems requirements
  3. Identify gaps in NOAA observations
  4. Review architecture alternatives
  5. Analyze architecture alternatives and risks
  6. Recommend acquisition of appropriate observing systems to meet NOAA, national, and international architecture requirements
  7. Maintain cognizance over NOAA observing systems activities while coordinating NOAA participation in national and international Earth observation efforts (e.g. Ad Hoc Group on Earth Observations)
- Members
  1. Attend council meetings
  2. Identify line office points of contact for interaction with NOAA Observing Systems Architect.
- Meeting Frequency: Monthly or on an as-neede basis.

Decision Making Process:

- Decisions will be normally reached by consensus. The Chair will strive for consensus on every issue, but maintains 51% of the vote. Therefore, the Chair makes the final decision when consensus is not achieved.

Charter:

- Created by the NOAA Executive Council on May 21, 2003
- Requirements Drivers
  1. NOAA Strategic Plan direction to develop a NOAA Integrated Global Environmental Observation and Data Management System Strategic Plan.
  2. NOAA Program Review Team direction to develop a baseline and target NOAA Observing Systems Architecture.
  3. NOAA participation in national and international efforts to develop a 10-Year Implementation Plan for a comprehensive, coordinated, and sustained Earth observation system or systems.

Appendix 4: NOAA Ocean Council—Terms of Reference

Purpose: The NOAA Ocean Council (NOC) is established as the principal advisory body to the Administrator and focal point for the agency's ocean activities and interests, including open ocean, near shore, coastal, estuarine, and Great Lakes activities. Specific tasks of the Council include, among others deemed as appropriate:

- Coordinate ocean activities across NOAA, including with other NOAA councils.
- Propose priorities and investment strategies for future NOAA ocean-related initiatives (both internal and external).
- Identify NOAA's ocean and coastal programs that have the greatest potential to benefit from integration via a matrix management approach.
- Coordinate NOAA's participation in the interagency National Oceanographic Partnership Program (NOPP).

Membership:

- Rick Spinrad, NOAA Oceans and Coasts Assistant Administrator (Chair)
  301-713-3074; Richard.Spinrad@noaa.gov
- Lee Dantzler, NOAA Satellites and Information (Vice Chair)
  301-713-3270, ext. 200; Lee.Dantzler@noaa.gov
- Carl Gouldman, NOAA Oceans and Coasts (Executive Secretariat)
  301-713-3074; Carl.Gouldman@noaa.gov
- William Fox, NOAA Fisheries (Principal)
- Mary Glackin, NOAA Program Planning and Integration (Principal)
- Louisa Koch, NOAA Research, NOPP Interagency Working Group (Principal)
- Paul Moersdorf, NOAA Weather Service (Principal)
- Beth White, NOAA Marine and Aviation Operations, NOAA Platform Allocation Council (Principal)
- Brook Davis, NOAA Legislative Affairs (ex officio)
- Jordan St. John, NOAA Public Affairs ex officio)
- Marlene Kaplan, NOAA Education Council (ex officio)
- John Pereira, NOAA Observing System Council (ex officio)
- Don Scavia, NOAA Research Council (ex officio)
- Susan Ware-Harris, NOAA International Affairs Council (ex officio)
- Erika Wilson, NOAA Finance and Administration (ex officio)
- Dave Rathbun, NOAA Oceans and Coasts (ex officio Council Point of Contact)
  301-713-3074, ext. 177; David.J.Rathbun@noaa.gov
- Committees Reporting to this Council:
  - Committee on U.S. Commission on Ocean Policy
  - Committee on Inventory of Interagency Contacts

Roles and Responsibilities:

The NOAA Ocean Council shall provide recommendations to the Administrator through the NOAA Executive Panel. Meetings will be held monthly. The Assistant Administrator of NOAA Oceans and Coasts will chair the Council. The Vice Chair shall be rotated on an annual basis among NOAA Research, NOAA Fisheries, NOAA Weather Service, and NOAA Satellites and Information. The Council will:

- Provide the NOAA strategy for leadership on ocean issues at both the national and international levels.
- Serve as a cross-line office advisory committee on the management of ocean programs and activities within NOAA and with external partners.
- Improve coordination of ocean activities within NOAA through mechanisms such as partnerships and matrix programs.
- Develop recommendations to improve customer service and product delivery, both nationally and through enhanced local and regional coordination and communication.
- Develop performance measures for NOAA's ocean and coastal activities that are linked to the NOAA Strategic Plan performance measures. This will include the responsibility to develop and state the expected outcomes and/or benefits of NOAA's investment in ocean activities.
- With respect to NOPP, the NOAA Ocean Council will be specifically responsible for the following:
    - Maintain cognizance over all NOAA interests in NOPP activities and coordinate NOAA preparations for participation in the National Ocean Research Leadership Council (NORLC) and its associated efforts (e.g., the Interagency Working Group, the Ocean.US Executive Committee, the Ocean Research Advisory Panel (ORAP), and the Federal Oceanographic Facilities Committee (FOFC).
    - Identify activities and fund to be proposed for NOPP consideration, including, where appropriate, the use of NOPP for proposal solicitations by NOAA Line Offices and the coordination of these solicitations with partner agencies.
- Establish subordinate bodies as needed, on either a permanent or ad hoc basis. Responsibilities of existing committees include:
    - The Committee on the U.S. Commission on Ocean Policy focuses NOC activities and responsibilities on the NOAA response to recommendations from the Commission.
    - The Committee on Inventory of Interagency Contacts creates lists of NOAA points of contact with a variety of external organizations.

Decision Making Process:

Decisions will be accomplished by informed consensus. The Chair will strive for consensus on every issue. The Chair maintains 51% of the vote, therefore the final decision is made by the Chair when consensus is not achieved.

Charter:

Authority of the NOC was established with the concurrence of the NOAA Administrator with NOAA Program Review Recommendation #31:

"I concur with the PRT goal to create a focal point for oceans in NOAA. I am directing a cross-line office group, chaired by NOS , to represent recommendations to the NOAA Executive Council (NEC) to achieve a more robust and integrated framework for oceans, including, but not limited to, and operational oceanography capability."

Appendix 5: Catalog of NOAA's Observing Systems

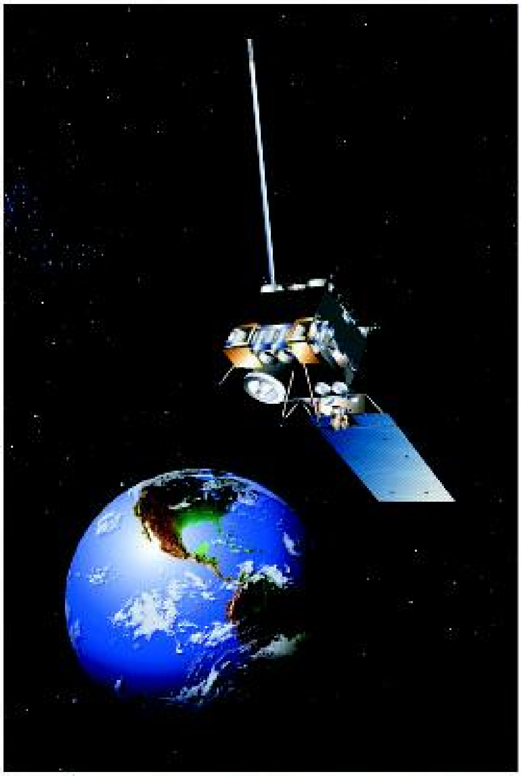
NOAA's Observing System Architecture (NOSA) Database began with an inventory of all NOAA observing systems. Principal investigators for each observing system entered information into common fields. This methodology has allowed for cross-referencing, information sharing, and a concise record of environmental parameters. Appendix 4 is a brief introduction to the vast information contained within the NOSA database. In the following catalog, the observing systems are divided into three sections:

1. **NOAA Operational Observing Systems,** organized by NOAA Mission Goals
2. **NOAA Research Observing Systems,** organized alphabetically

Each observing system is presented with a small picture (where available), its acronym in the NOSA Database, the observing system name, and a brief description. In some cases, additional pictures are used to illustrate the wide variety of NOAA programs, and the scientists who are dedicated to their success.

NOAA Operational Observing Systems

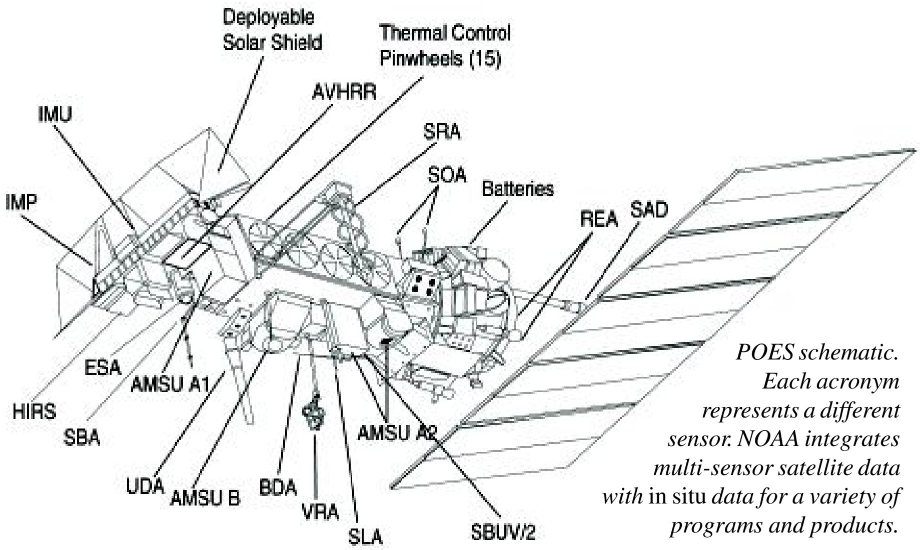
NOAA's satellites provide a wide range of data and information, crosscutting all NOAA mission goals. Satellite observations drive weather and climate forecasting models and research, and contribute to the Nation's preservation of marine and coastal habitats, navigation safety, and search and rescue. Operational satellite sensing systems, integrated with in situ systems, provide critical data and information needed to support NOAA and national programs.



Artist conception of GOES by Allan Kung.

NESDIS- GOES I/M, N/P
Geostationary Operational Environmental Satellite, I-M, N-P
GOES move in geo-synchronous orbits at an altitude of approximately 35,800 km. They provide a constant vigil for the atmospheric "triggers" for severe weather conditions such as tornadoes, flash floods, hailstorms, and hurricanes. When these conditions develop, these satellites are able to monitor storm development and track storm movements. GOES satellite imagery is also used to estimate rainfall during thunderstorms and hurricanes for flash flood warnings, as well as estimate snowfall accumulations and overall extent of snow cover. Such data help meteorologists issue winter storm warnings and spring snowmelt advisories. Satellite sensors also detect ice fields and map the movements of sea and lake ice, and monitor the space environment around the satellite.

NOAA Operational Observing Systems



POES schematic. Each acronym represents a different sensor. NOAA integrates multi-sensor satellite data with in situ *data for a variety of programs and products.*

NESDIS - POES
Polar-orbiting Operational Environmental Satellite
The POES satellite mission provides polar orbiting platforms to support the environmental observations for imaging and measurement of Earth's atmosphere, it's surface, and cloud cover. This includes Earth radiation, atmospheric ozone, aerosol distribution, sea surface temperature, vertical temperature and water profiles in the troposphere and stratosphere; measurement of proton and electron flux at orbit altitude; remote platform data collection; and Search and Rescue Satellite-Aided Tracking (SARSAT) system. Additionally, POES Satellite systems support dedicated microwave instruments for the generation of temperature, moisture, surface, and hydrological products in all weather conditions.

NESDIS-NPOESS-NPOESS
National Polar-orbiting Operational Environmental Satellite System
NPOESS is a low Earth orbit spacecraft remote sensing platform, hosting up to 14 sensors. It will acquire meteorolgical, environmental, and associated data, including information on cloud imagery, atmospheric profiles of temperature and moisture, and other speicalized meteorological, terrestrial, oceanographic, climatic, and solar-geophysical data. It will also provide support to a international search and rescue mission.

NESDIS-NPOESS-NPP
NPOESS Preparatory Project
Environmental remote sensing system used for passive remote sensing of visible, infrared, and microwave radiation. First Availability: March 2007 First Launch: October 2006 Satellite Mission Duration: 7 years.

NOAA-M (polar-orbiting operational environmental satellite) from artist conception to first image received after launch.

NOAA Operational Observing Systems

NOAA's Mission Goal 1: Ecosystems

Protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management.

NMFS - Commercial Statistics
Fishery Dependent - Commercial Statistics
This system tracks harvesting of renewable marine resources by U.S. commercial fishing fleets operating throughout the world. Landed weight and value is recorded on a vessel trip basis.

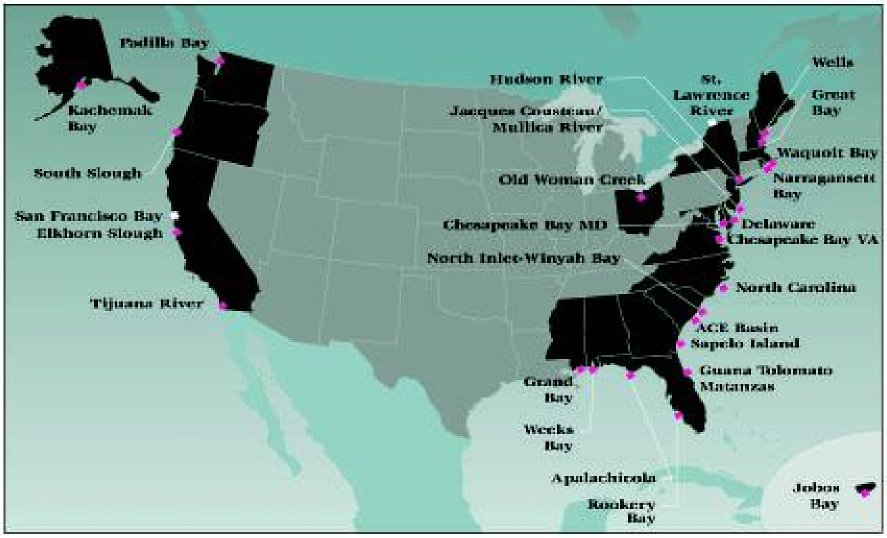
NMFS - National Observer Program
National Observer Program
NOAA deploys fishery observers to collect catch data from U.S. commercial fishing and processing vessels. Approximately 20 different fisheries are monitored by NOP annually. NOP works toward mprovements in data collection, observer training, safety, outreach, and the integration of observer data with other research.

NMFS - MRFSS
Marine Recreational Fisheries Statistics Survey
The MRFSS is a multi-phase national survey of saltwater recreational fishing to provide data for use in building sustainable fisheries.

OAR - ETL - Fish LIDAR
Fish LIDAR
This airborne system uses green light to profile distributions of scatterers such as plankton and fish in the upper ocean.

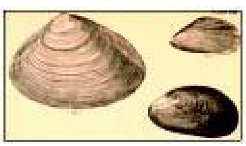
NMFS - CREWS
Coral Reef Early Warning System
Moored buoys, subsurface platforms, and drifting buoys provide oceanographic and meteorological observations in and around the tropical coral reefs of the U.S. Pacific Islands. The drifting and moored buoys telemeter their data near real-time. The data is used for monitoring conditions and alerting researchers to high stress levels at coral reefs.

NOAA Operational Observing Systems



Map shows locations (red dots) of SWMP locations, and future sites (white dots). Currently SWMP is in operation at 25 estuarine reserves.

NOS - SWMP
National Estuarine Research Reserve System-Wide Monitoring Program
The National Estuarine Research Reserve System (NERRS) System-Wide Monitoring Program (SWMP) tracks short-term variability and long-term changes in coastal ecosystems represented in the reserve system. The initial phase of the program began in 1996. This phase focuses on monitoring a suite of water quality and atmospheric information. Future phases will monitor organisms and the changes in land use/habitats. The reserves represent nearly 1,000,000 acres of protected estuarine waters, wetlands and uplands from the five major coastal regions in the United States (West Coast, Northeast and Great Lakes, Mid-Atlantic Coast, Southeast Coast and the Gulf of Mexico and Caribbean Sea).



NOS - NS&T MUSSEL
National Status and Trends Mussel Watch
NS&T's Mussel Watch has monitors chemical contaminants in sediments and bivalve mollusks (e.g., mussels and oysters). Data can be used to determine which coastal regions are at greatest risk in terms of environmental quality. Presently, bivalves are collected every other year and sediments about every fifth year at a network of over 250 U.S. coastal and estuarine sites.

NMFS - Protected Resources Surveys
NMFS Protected Resources Surveys
NOAA collects biological and ecological information to identify populations of protected species and to assess the status of each population and the impacts of human activities upon protected species.

NMFS - LMF Surveys
Living Marine Resource and Ecosystem Surveys
NOAA Fisheries conducts ship-based surveys to provide information on the abundance and distribution of living marine resources and their ecosystems in the U.S. Exclusive Economic Zone.

NOAA Ship David Starr Jordan *is one of several NOAA ships which participates in living marine resource and ecosystems surveys.*

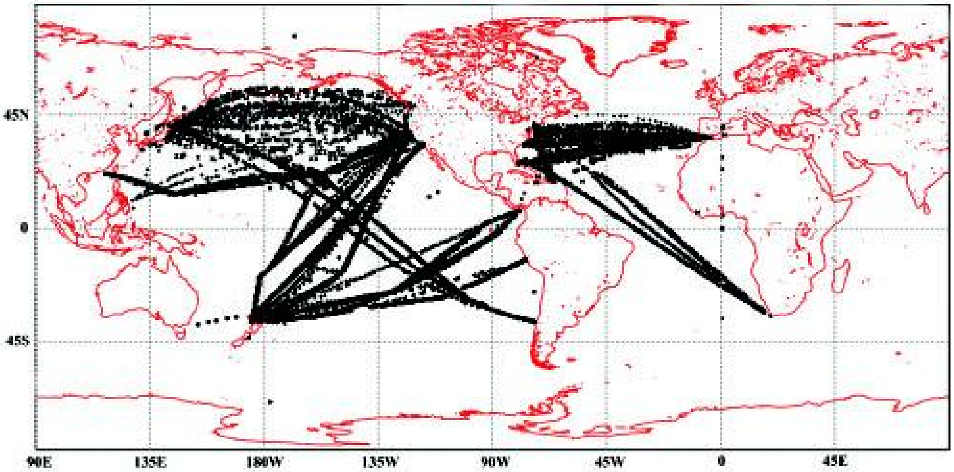
NOAA Operational Observing Systems

NOAA's Mission Goal 2: Climate

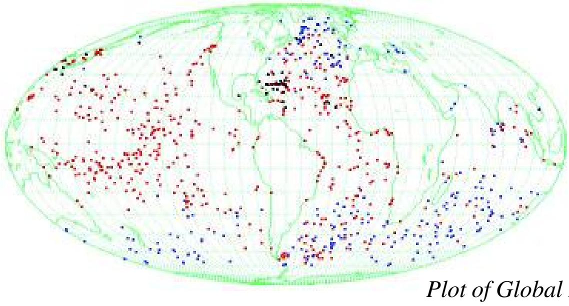
Understand climate variability and change to enhance society's ability to plan and respond.

OAR - SEAS - ENSO OS
GOOS/VOS/XBT
Real time Expendable Bathythermograph (XBT) observations are collected from Voluntary Observing Ships in support of the El Niño Southern Oscillation (ENSO) Observing Network and global climate change research.

ENSO OS VOS/XBT
ENSO OS VOS/XBT Network
Maintenance and support of the global Low Density and Frequently Sampled XBT transects utilizing the Voluntary Observing Ship (VOS) network.



SEAS - ENSO OS platforms, with more than 11,100 observations in 2002.



Plot of Global Drifter Array; includes 848 buoys in 2003.

OAR - ENSO OS Drifting Buoys
ENSO OS Drifting Buoys
Maintain and support the Global Drifter Array and GDC Data Assembly Center.

OAR - TAO
Tropical Atmosphere Ocean Array
The array is a major component of the El Niño Southern Oscillation (ENSO) Observing System, the Global Climate Observing System (GCOS) and the Global Ocean Observing System (GOOS). Support is provided primarily by the United States (NOAA) and Japan (Japan Marine Science and Technology Center) with additional contributions from France (Institut de recherche pour le developpement).

NOAA Operational Observing Systems

OAR - CMDL - DOBSON
Measurement of Total Column Ozone using the Dobson Ozone Spectrophotometers
The Dobson Ozone Spectrophotometer has been used to study total ozone since its development in the 1920's. The observations of total ozone, the total amount of ozone in a column from the surface to the edge of the atmosphere, by this instrument is one of the longest geophysical measurements series in existence.

Taking measurements at sunrise, Amundsen South Pole Station, September, 2003.

OAR - CMDL - AERO
AEROSOL System
Measures aerosol optical properties as a function of size and wavelength at baseline and regional stations

Aircraft provide platforms for various NOAA observing systems. This Cessna is used in an aerosol sampling program, Ponca City, Oklahoma.

OAR - CMDL - HATS
Halocarbons and other Atmospheric Trace Species
Quantifies the spatial and temporal distributions of nitrous oxide and halogen containing compounds in the atmosphere and the magnitudes of their sources and sinks.

Trans-Siberian Observations Into the Chemistry of the Atmosphere (TROICA). Scientists from NOAA, the Max Planck Institute for Chemistry, and the Russian Institute of Atmospheric Physics created a mobile laboratory to measure halocarbon and greenhouse gases along the trans-Siberian railway.

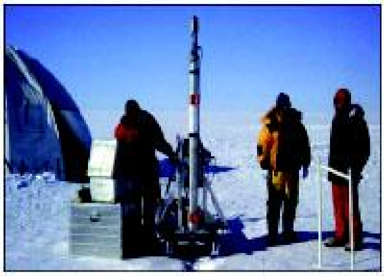
NOAA Operational Observing Systems

STAR, Kwajalein Atoll.

OAR - CMDL - STAR
Solar and Thermal Atmospheric Radiation Surface Measurements
This system quantifies upwelling and downwelling solar and thermal atmospheric radiation as it relates to climate variability. Observations are made at globally remote and climatically diverse locations around the world.

ISIS, Seattle, Washington.

OAR - ARL - ISIS
Integrated Surface Irradiance Study
A national network of surface solar irradiance stations representing differing climates of the United States.



OAR - CMDL - CCGG
Carbon Cycle Greenhouse Gases
The NOAA Carbon Cycle Greenhouse Gases group makes ongoing discrete measurements from land and sea surface sites and aircraft, and continuous measurements from baseline observatories and tall towers. These measurements document the spatial and temporal distributions of carbon-cycle gases and provide essential constraints to our understanding of the global carbon cycle.

Carbon-cycle measurements are compiled from land, sea, and air. NOAA scientists are involved in many international, cooperative programs in these studies. Left to right: Air sampling instrument that flies on research aircraft; planes readied at Raratonga, Cook Islands; sampling over Fortaleza, Brazil. Above, left: Firn gas collection in Greenland.

NOAA Operational Observing Systems

OAR - Profiling Radar-Cooperative Agency Profilers (CAP)
Cooperative Agency Profilers
Measures vertical profiles of horizontal wind speed and direction (and temperature in many cases) in the lower troposphere to

OAR - Profiling Radar - NOAA Profiler Network (NPN)
NOAA Profiler Network
Measures vertical profiles of horizontal wind speed and direction from near the

NWS - Profiling Radar - Alaska Network
Alaska Wind Profiler Network
Measures vertical profiles of horizontal wind speed and direction from near the earth's surface to above the tropopause.

Three of the NOAA Profiler Network sites: Ledbetter, Texas; Platteville, Colorado; and, Syracuse, New York.

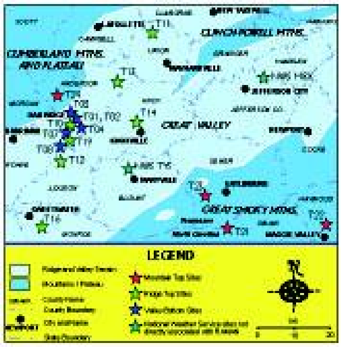
OAR - ETL - BAO
Boulder Atmospheric Observatory
300m research tower measuring winds, temperature and RH at 5 levels.

OAR - Wind Profiling Radars UHF (AL)
Wind Profiling Radar - UHF, NOAA Aeronomy Lab
915-MHZ Doppler radars used to measure vertical profiles of horizontal wind speed and direction in the lower troposphere.

NESDIS - USCRN
U.S. Climate Reference Network
The USCRN Program addresses the climate community's requirements regarding long-term (50+ years) high quality, well documented climate-related surface air temperature and precipitation observations free of time-dependent biases. This is the first "climate driven" observing network designed for the specific purpose of climate quality observations.

OAR - ETL - 449 Radar
449 MHz Wind Profiling Radar
This is a Wind Profiling and Acoustic Sounding System Radar operating at 449 MHz. The radar can be positioned to observe either in a horizontal or vertical direction. The radar can provide remote sensing anywhere in the world because it is mobile and very powerful.

NOAA Operational Observing Systems



OAR - ATDD - RAMAN Network
Regional Atmospheric Measurement and Analytical Network
A tower network providing meteorological data from mountain top, ridge top, and valley bottom locations in the complex terrain surrounding Oak Ridge, Tennessee.

NWS - RAWINSONDE
Upper-air Rawinsonde
The NOAA Rawinsonde network provides profiles of pressure, temperature, relative humidity, and winds from the surface to over 30 km high. These data are collected from balloon-borne radiosondes.

(no picture)

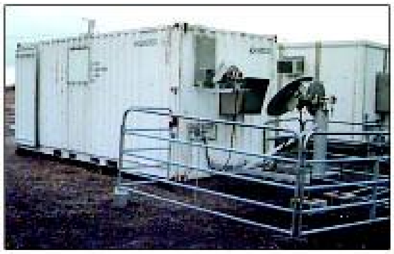
NWS - MDCRS
Meteorological Data and Reporting System
A data set from commercial aircraft providing detailed information on the vertical structure of winds and temperature during aircraft ascent, descent, and en-route. The data provides high resolution spatial and temporal atmospheric soundings and enroute data.

(no picture)

OAR - Profiling Radar - Tethered Aerostat Radar System
Tethered Aerostat Radar System
This is a wind and temperature profiling Radar operating at 449 MHz.

(no picture)

OAR - FRD Mesonet
INEEL Mesoscale Meteorological Network
A network of 36 meteorological data collection stations located inside and near the U. S. Department of Energy Idaho National Engineering and Environmental Laboratory.



OAR - ETL - RadiometerContainer
Radiometer Container
This is a container fitted with microwave and infrared radiometers for the study of clouds.

OAR - GPS Water Vapor Sensor
Global Positioning System Integrated Precipi-table Water Sensor
Integrated (total atmospheric column) precipitable water is retrieved under all weather conditions from excess delays in the GPS radio signals caused by water vapor in the lower atmosphere. The cooperative effort among NOAA and other federal, state, local, and private sector entities provides detail that improves NOAA short-range weather forecasts.

OAR - Argo
Profiling Floats
Argo, an international program to deploy a global array of 3,000 profiling floats to observe the ocean's upper layer in real time. Along with satellites, the Argo array will initiate the oceanic equivalent of today's operational observing system for the global atmosphere.

NOAA Operational Observing Systems

NOAA's Mission Goal 3: Weather and Water

Serve society's needs for weather and water information.

Instrumentation, and COOP volunteer.

NWS - COOP - Observing
Cooperative Observer Program
The Cooperative Weather Observer Network (COOP) is the Nation's largest and oldest weather network. It was established under the Organic Act of 1890 to formalize the collection of meteorological and climate observations in the U.S. COOP observations are collected by nearly 12,000 volunteer citizens and institutions.

Norman, Oklahoma, Doppler radar installation.

NWS - NEXRAD
Next Generation Weather Radar
WSR-88D systems acquire and process Doppler weather radar data. Forecasters and hydrologists use these data to prepare weather and flood forecasts, watches, warnings. NEXRAD is also used to aid the safety of public and military aviation operations.

NWS - ASOS
Automated Surface Observing System
The ASOS is a fully automated weather observing system. The system provides meteorological information to a wide variety of users.

NWS - LTG
Lightning Detection
A network of sensors detects cloud to groud lightning strikes over the conterminous U.S. and 250 km off shore.

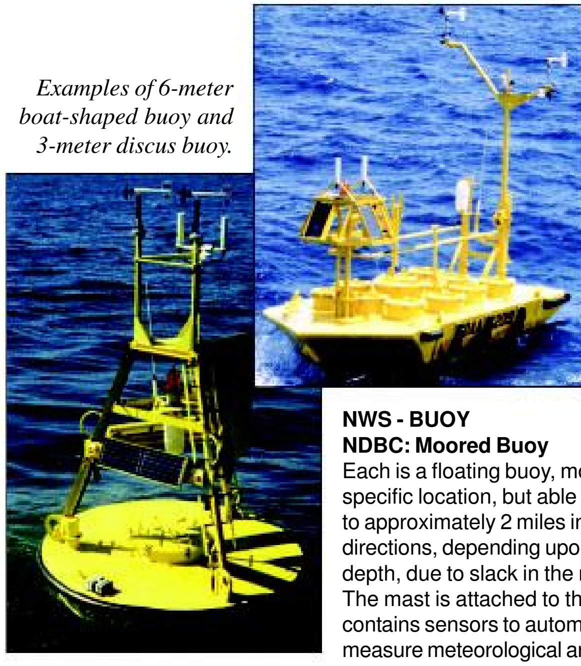
(no picture)

NWS - REGIONAL
Regional Surface
These are a compliation of various observing systems or sensors that support various goals of the NWS. The purpose of this is to identify the locations of observing systems. In most cases the basic paramaters such as temperature, winds precipitation are available.

NOAA Operational Observing Systems

NWS - VOS
Voluntary Observing Ship Program
The VOS Program obtains weather observations from vessels and ships traveling all over the world in the normal course of their business. The program relies on volunteer observers and operates at no monetary cost to the vessel. As an international program under World Meteorological Organization (WMO) auspices, the VOS Program lists 49 countries as participants. The U.S. program is the largest in the world, with approximately 900 vessels actively participating each quarter.

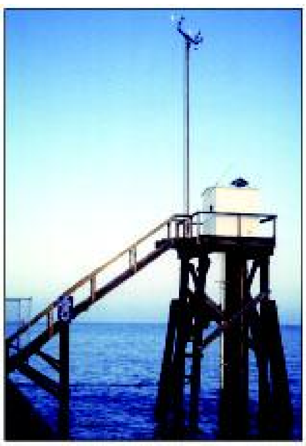
Examples of 6-meter boat-shaped buoy and 3-meter discus buoy.



NWS - BUOY
NDBC: Moored Buoy
Each is a floating buoy, moored at a specific location, but able to drift up to approximately 2 miles in all directions, depending upon water depth, due to slack in the mooring. The mast is attached to the deck contains sensors to automatically measure meteorological and oceanographic parameters; and antennas and power panels to provide power and communications capabilities via NOAA's GOES system.

NWS - CMAN
Coastal-Marine Automated Network
C-MAN stations are fixed platforms in the coastal zone (land-based or in the water) that measure and report marine weather observations in real-time at least once per hour. C-MAN stations may be mounted near piers, on light houses, and other platforms with good exposure.

C-MAN station, Dauphin Island, Alabama.



DART buoy, NOAA Ship Ronald H. Brown *in background.*

NWS - DART
Detection, Assessment and Reporting of Tsunamis
The DART system consists of a bottom pressure recorder (BPR) located on the sea floor capable of detecting a tsunami as small as 1 centimeter high on the ocean surface. A discus-shaped buoy, 2.5 meters in diameter is moored at a position close enough to receive data via acoustic link from the BPR. After receiving data from the BPR, the surface buoy relays the information via the NOAA's GOES system to ground stations. The ground stations demodulate the signals and disseminate information to NOAA Tsunami Warning Centers (TWC) and the Pacific Marine Environmental Laboratory. TWCs use the data in real time to decide what U.S. coastal communities need to be warned of impending danger from a tsunami.

NOAA Operational Observing Systems

(no picture)

NWS - ARC
Automated Remote Collector
The ARC collects data in near real time from a point deemed important by a service hydrologist. A Handar 540 data logger collects a specified set of hydrometeorological parameters from colocated instruments and transmits the data using GOES telemetry. These data support short-term forecast and warning operations.

(no picture)

NWS - FNP
Fischer and Porter Gage
The Fischer and Porter gage is used to collect and record precipitation data.

(no picture)

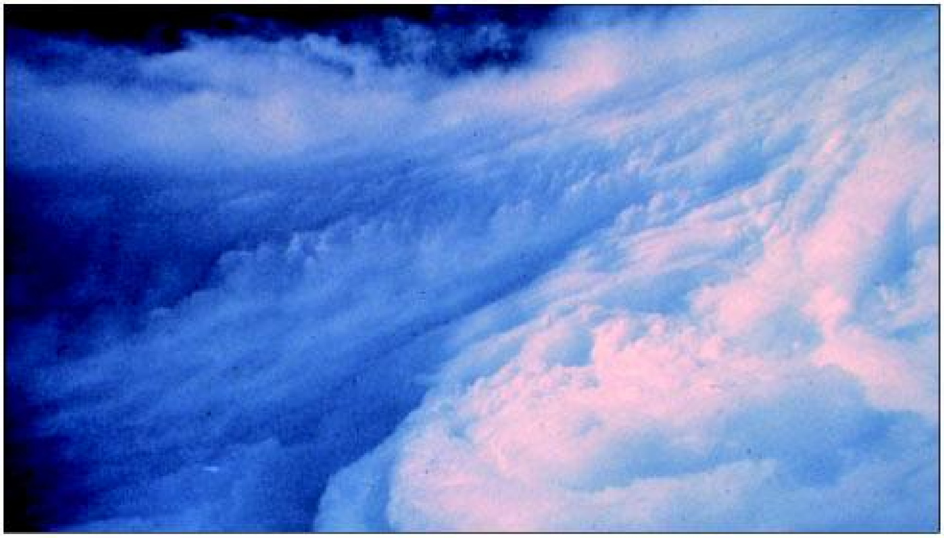
NWS - LARC
Limited Automated Remote Collector
The LARC acquires data from stage and/or precipitation sensors. The LARC is interrogated via telephone and data is made available to users.

(no picture)

NWS - HMISC
Unknown
Unknown. This information will vary from station to station. The purpose is to meet various requirements

(no picture)

NWS - METXX
Sierra Misco
The equipment is listed as Sierra Misco. Sierra Misco manufactures several instruments and data loggers. This information will vary from site to site.



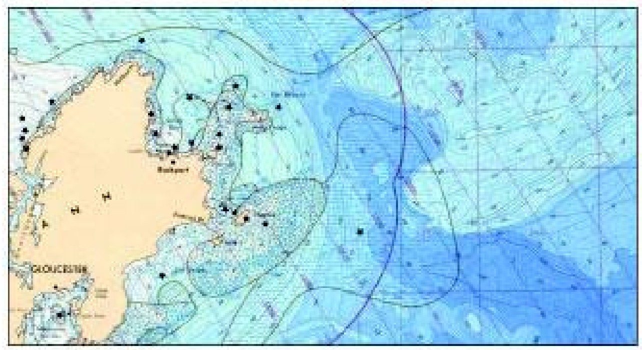
Eye of hurricane; photo taken from NOAA WP-3D Orion turboprop (P-3) aircraft.

NOAA Operational Observing Systems

NOAA's Mission Goal 4: Commerce and Transportation

Support the Nation's commerce with information for safe, efficient, and environmentally sound transportation.

NOS - HYDRO
Hydrographic Surveying
The principle objectives of hydrographic surveys are data collection and compilation for nautical charts. Hydrographic survey data support a variety of maritime functions including port and harbor maintenance (dredging), coastal engineering, coastal zone management, and offshore resource development. The primary data associated with all hydrographic surveys is water depth; however, there is also considerable interest in sea-floor composition due to implications for anchoring, dredging, structure construction, pipeline and cable routing, and fisheries habitat.



Portion of a hydrographic survey chart showing bathymetry in the region of Gloucester, Massachusetts.

NOAA Ship Ferrel *in an intracoastal waterway north of Charleston, South Carolina.*

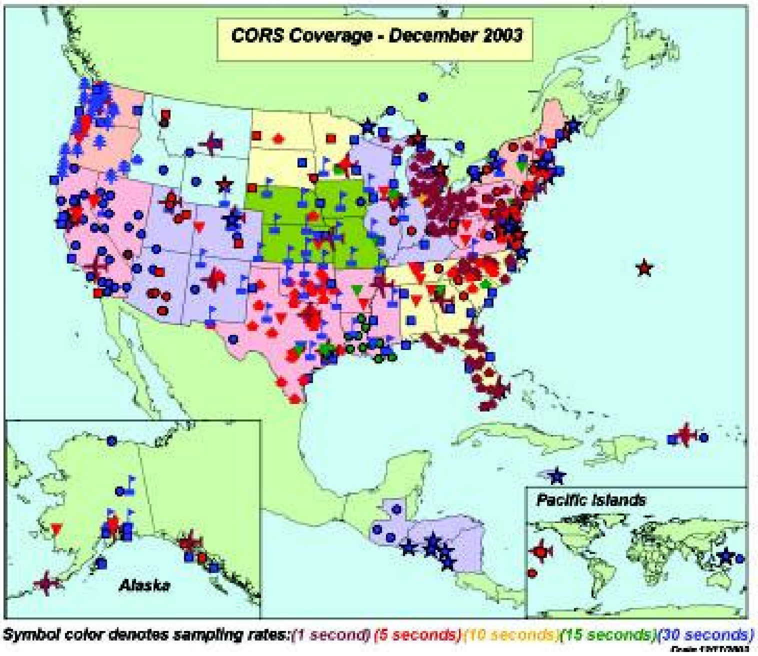
NOS - PORTS
Physical Oceanographic Real-Time System
PORTS® is a program of that supports safe and cost-efficient navigation by providing ship masters and pilots with accurate real-time information required to avoid groundings and collisions. This technological innovation has the potential to save the maritime insurance industry from multi-million dollar claims resulting from shipping accidents. PORTS® includes centralized data acquisition and dissemination systems that provide real-time water levels, currents, and other oceanographic and meteorological data from bays and harbors to the maritime user community. PORTS® provides nowcasts and predictions of these parameters with the use of numerical circulation models.

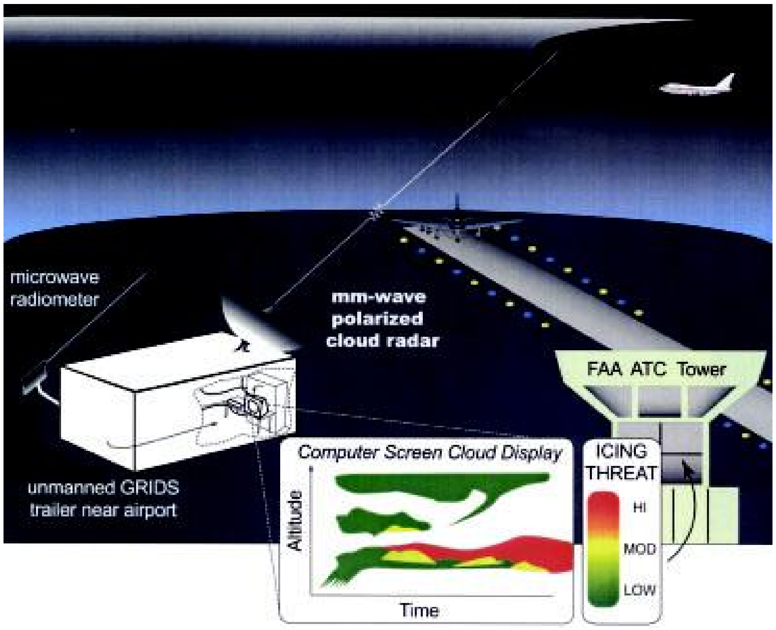
NOS - NWLON
National Water Level Observation Network
The NWLON is a coastal observing network of 175 stations nationwide, including the Great Lakes and Pacific as well as Atlantic Ocean Island Territories and Possessions. The primary purpose is to collect continuous long-term water level observations to a known vertical reference. Data are used for computing tide and water level datums, creating tide prediction tables, and estimating sea level trends. The observations are used in real-time for the PORTS® programs as well as for storm surge and tsunami events. Ancillary meteorological and water temperature data are also provided from several locations.

NOS - NCOP
National Current Observation Program
The National Current Observation Program updates the tidal current prediction tables and products provided by NOAA to the public. The current tables contain predictions for more than 2,700 locations throughout the country.

NOAA Operational Observing Systems

NOS - CORS
Continuously Operating Reference Stations
NOAA coordinates a network of continuously operating reference stations (CORS) that provide Global Positioning System (GPS) carrier phase and code range measurements throughout the U.S. and its Territories. Surveyors, GIS/LIS professionals, engineers, scientists, and others can apply CORS data to position points at which GPS data have been collected. The CORS system enables positioning accuracies that approach a few centimeters relative to the National Spatial Reference System, both horizontally and vertically. New sites are evaluated for inclusion according to established criteria.



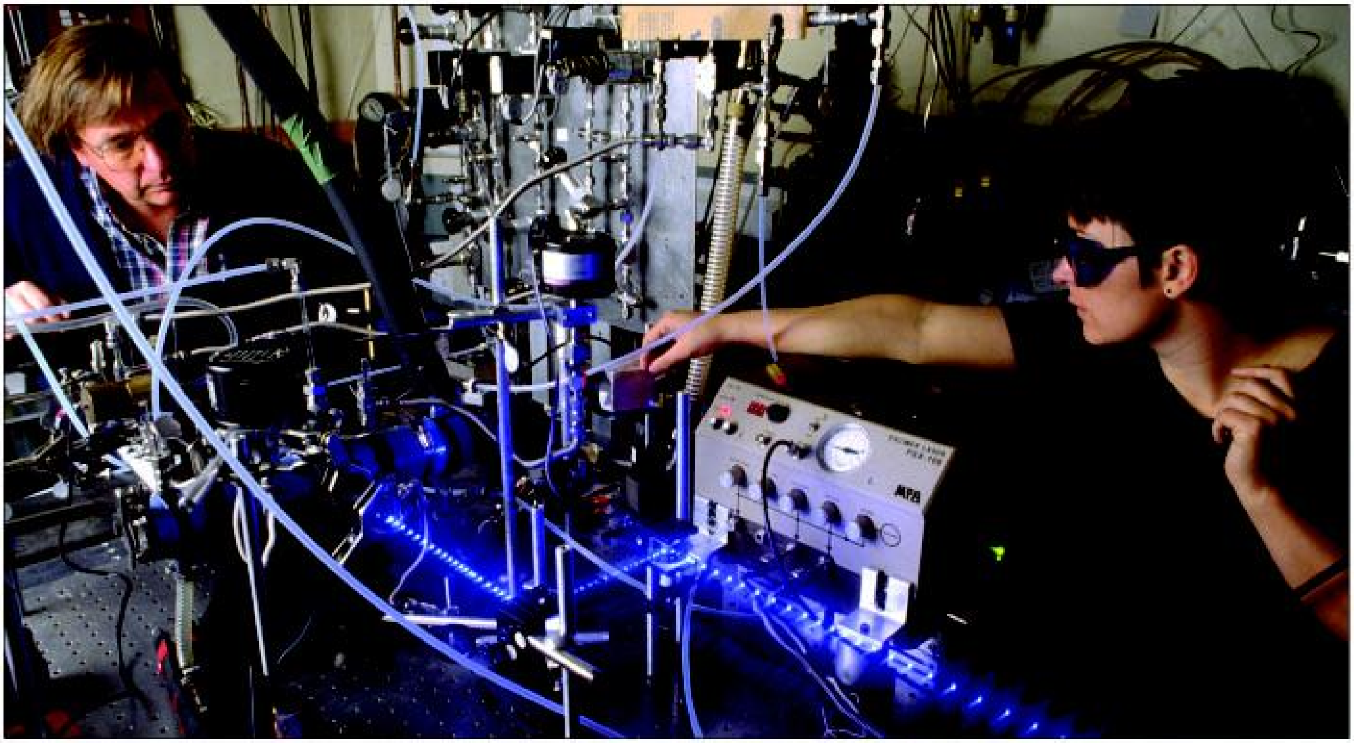


OAR - ETL - GRIDS
Ground-based Remote Icing Detection System
GRIDS is a multi-sensor observing system, developed for the detection of supercooled liquid that would cause icing on aircraft. This system also has applications for cloud physics and climate research, model parameterization and verification, and calibration/validation activities in support of other NOAA activities.

NOAA Research Observing Systems

NOAA's research observing systems are presented **alphabetically**, as listed in the NOAA Observing System Architecture Database.

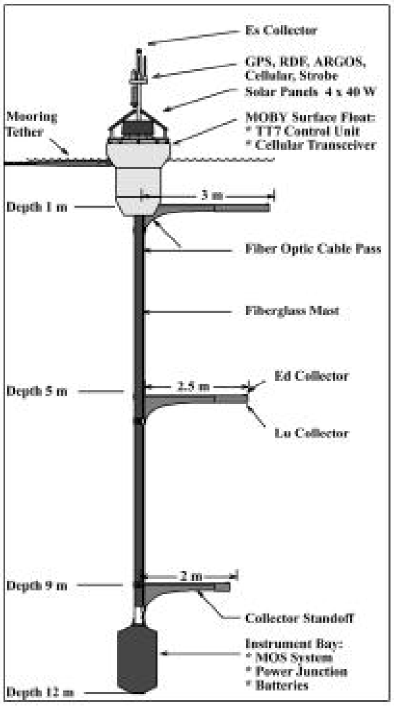
NOAA scientists apply lasers in investigations of chemical reactions and processes that are important in atmospheric issues such as air quality, climate, and ozone-layer depiction.



...Not a day passes that we do not reap the benefits of satellite, aircraft, and ground-based measurements that document environmental changes across the globe.

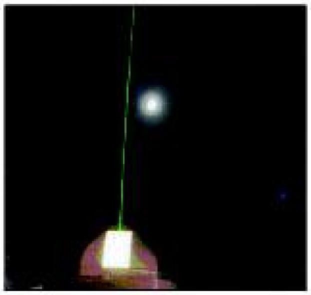
Vice Admiral (Ret.) Conrad C. Lautenbacher Jr., U.S. Navy
NOAA Administrator
2003 WMO Congress, Geneva, Switzerland, 2003

NOAA Research Observing Systems



NESDIS - MOBY
Marine Optical Buoy
Moored bio-optical buoy that measures downwelling irradiance and upwelling radiance in the ocean's surface waters. Measurements are collected coincident with ocean color satellite overpasses on a daily basis.

OAR - AL- Precipitation Profiling Radars
Precipitation Profiling Radars
An S-Band (2835 MHz) Doppler radar system using backscatter from hydrometeors in the atmosphere to remotely study precipitation parameters.



NESDIS - Doppler Wind Lidar
Doppler Wind Lidar
System designed to measure accurate global horizontal wind measurements to improve global and regional numerical weather prediction models and forecasts.
Since 1998, NESDIS has sponsored an effort led by the University of New Hampshire to develop and assess the potential of a class of Doppler wind lidars that employ novel optics, high efficiency detectors, and a fiber optic “light recycler” to increase sensitivity and accuracy toward that which would be needed to measure winds from space.

OAR - AL - Wind Profiling Radars VHF
Wind Profiling Radar - VHF
50-MHZ Doppler radars used to measure vertical profiles of horizontal wind speed and direction in the troposphere and lower stratosphere.

(no picture)

NMFS - Habitat Assessment
Habitat Assessment
Characterization and mapping of coastal habitats important to NOAA trust re-sources by NOAA vessels and other means.

(no picture)

OAR - ARL - Atmos. Dispersion Measurement System
Atmospheric Dispersion Measurement System
Mobile dispersion measurement system that uses intentionally realeased, harmless tracer gases to directly measure dispersion. The system includes release, sampling, and analysis equipment.

NOAA Research Observing Systems

NOAA conducts sustained measurements for environmental research at global, baseline observatories and other locations. The five observatories pictured are (top to bottom): Mauna Loa, Hawaii; Barrow, Alaska; American Samoa; South Pole, Antarctica; and Tinidad Head, California.

(no picture)

OAR - ATDD - AIRMoN
Atmospheric Integrated Research and Monitoring Network
The AIRMoN has two distinct subnetworks, AIRMoN-wet and AIRMoN-dry. AIRMoN-wet monitors the wet deposition of certain key air pollutant species, and AIRMoN-dry does the same for dry deposition. Both have been in operation since the 1980s.

(no picture)

OAR - ATDD - ETOS
East Tennessee Ozone Study
ETOS is comprised of a seasonal network of ozone monitors and tower-based met systems to determine local time-varying ozone concentrations at mountain top, ridge top, and valley bottom sites throughout eastern Tennessee. Data are collected by telemetry.

SURFRAD instruments at Desert Rock, Nevada station. Closeup of tower at Sioux Falls, South Dakota.

OAR - ARL - SURFRAD
Surface Radiation Budget Network
A national network of surface radiation budget stations representing differing climates of the United States.

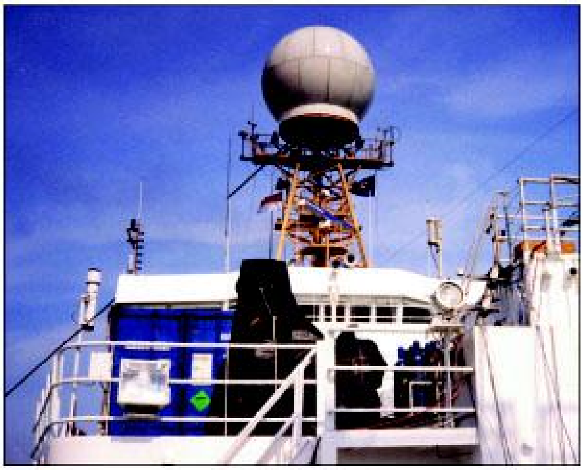
OAR - ETL - 5mmScanningRadiometer
5mm Scanning Radiometer
The 5-mm Scanning Radiometer scanns rapidly (every 1 sec) in a vertical plane to derive boundary layer temperature profiles. When operated from a ship,air-sea temperature differences can also be derived.

NOAA Research Observing Systems

OAR - ETL - ABAEL
Airborne Aerosol Lidar
Backscatter lidar for aerosol detection on aircraft platforms.

OAR - ETL - Airborne Ozone Lidar
Airborne Ozone Lidar
This system is a laser-based active remote sensor (LIDAR system) for measuring ozone concentration and aerosol optical backscatter in the lower troposphere.

OAR - ETL - DABUL
Depolarization and Backscatter Unattended Lidar
All-weather lidar (laser radar) for cloud and aerosol detection, including backscatter and depolarization profiles.



OAR - ETL - Cband Radar (Ron Brown)
NOAA R/V Ronald H. Brown C-band Doppler Radar
This C-band Radar is a 5.6 GHz Doppler radar on board the NOAA research vessel, *Ronald H. Brown*. The radar's 4.3 meter antenna is mounted atop the ship's main mast within a protective radome and is designed for operations in heavy weather up to sea state 8.

NOAA Research Observing Systems

OAR - ETL - HughesRadiometer
Hughes Radiometer
This is a Liquid/Vapor radiometer system with added surface met information.

OAR - ETL - LIDAR - HRDL - ost
High resolution Doppler lidar
HRDL is a scanning atmospheric Dopper lidar that provides range-resolved measurements of radial wind speed and backscatter intensity. It is designed to make higher spatial and temporal resolution measurements in the atmospheric boudary layer.

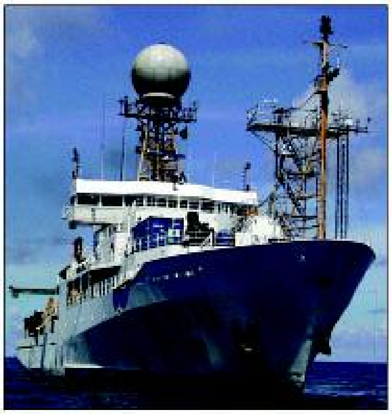
OAR - ETL - INFRASOUND
Infrasonic Observatory
This is a system designed to measure atmospheric infrasound primarily in the 0.5 to 10 Hz frequency range.

OAR - ETL - IRadiometer
IR Radiometer
Infrared radiation sensor for measuring temperature.

OAR - ETL - LIDAR - MOPA -ost
Dual Wavelength Doppler Lidar
Mini-MOPA is a scanning Doppler lidar used in field campaigns to study atmospheric phenomena in the boundary layer.

OAR - ETL - LIDAR - TEACO -ost
High Power Doppler Lidar
TEACO2 is a scanning atmospheric Dopper lidar that provides range-resolved measurements of radial wind speed and backscatter intensity.

NOAA Research Observing Systems



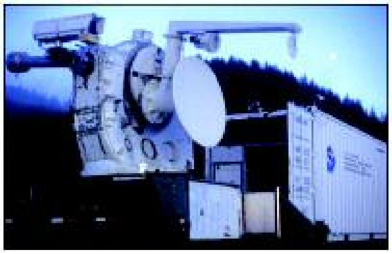
OAR - ETL - Marine Atmospheric Boundary Layer Observation System
Marine Atmospheric Boundary Layer Observation System
This system is deployed on seagoing ships in order to measure air-sea radiative and turbulent fluxes, boundary layer clouds, temperature, humidity and wind profiles.

(no picture)

OAR - ETL - Platteville - 915 - Profiler
Platteville Tropospheric Profiler
The Platteville Tropospheric Profiler is a narrow-beam, high-power, radar wind profiler operating at 915 MHz. Recently, it has been upgraded to multi-frequency capability.

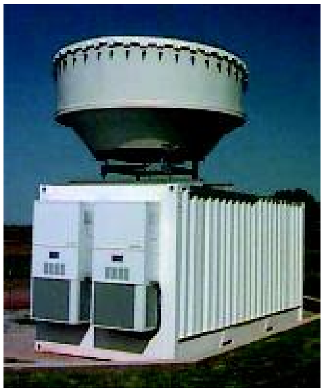
(no picture)

OAR - ETL - Narrow Band IR Radiometer
Narrow Band IR Radiometer
Infrared radiation sensor for measuring temperature.



OAR - ETL - NOAA/K
Mobile Scanning Cloud Radar
NOAA/K is a dual-polarized, scanning, Doppler radar (short wavelength -- 8.66 mm/35GHz), for cloud physics research and climate studies.

OAR - ETL - OPAL
Ozone Profiling Atmospheric Lidar
The Ozone Profiling Atmo-spheric Lidar (OPAL) observing system provides ozone profiles for health of the atmosphere and climate change programs. It is used for field campaigns to profile ozone and aerosol backscatter.



OAR - ETL - Portable Cloud Observatory
Portable Cloud Observatory
This system is comprised of a 35 GHz radar, a 3-channel microwave radiometer and an infrared radiometer packaged in a seatainer. An integral part of the system is a data processing package and a suite of theoretical retrieval techniques that allows real time production of cloud micropysical and optical properties.

OAR - ETL - PROFILING RADAR
Wind and Temperature Profiling Radar
915 MHz Doppler radar used to measure profiles of wind speed and direction in the lower atmosphere.

OAR - ETL - PSR
Polarimetric Scanning Radiometer
Polarimetric Scanning Radiometer (PSR) for airborne or ground-based microwave radiometric imaging.

NOAA Research Observing Systems

OAR - ETL - RadiometricsRadiometer
Radiometric Radiometer
This is a Liquid/Vapor radiometer system.

OAR - ETL - WVDIAL
Compact WaterVapor DIAL Lidar
This is a compact eye-safe autonomous lidar for profiling water vapor in the lower troposphere.

OAR - ETL - Rawinsonde - MW11
Rawinsonde - MW11
OAR - ETL - Rawinsonde - MW15
Rawinsonde - MW15
OAR - ETL - Rawinsonde - MW21
Rawinsonde - MW21
The Rawinsonde MW11, MW15, and MW21 observing systems consist of a sounding system manufactured by Vaisala. These systems measure temperature, relative humidity, pressure, wind speed and direction of the atmosphere. They use Global Positioning Systems (GPS) to determine wind speed and direction.

(no picture)

OAR - ETL - SODAR
Wind Profiling Sodar
[No description in NOSA database]

OAR - GSLN
Global Sea Level Network
GSLN stations are fixed platforms on islands and in the coastal zone that measure and report sea level information in real-time using geostationary satellites and the GTS.

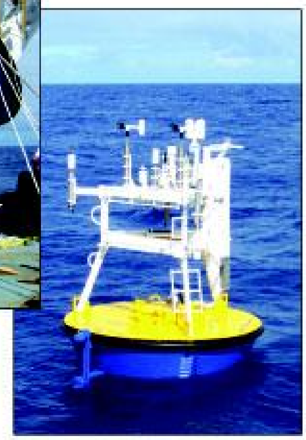
GSLN station, Hulului Island, Maldives

OAR - ETL - Windprofiler - RB
Electronically-Stabilized Wind Profiler
915-MHz clear-air radar for measuring wind speed and direction from 150 - 3000 m altitude. System automatically compensates for platform motion.

NOAA Research Observing Systems

OAR -PMEL - FOCI
Fisheries Oceanography Coordinated Investigations
This sytem takes physical and biological marine measurements in the Bering Sea, Gulf of Alaska, and North Pacific Ocean. The system includes moorings, drifters, tows, and surveys.

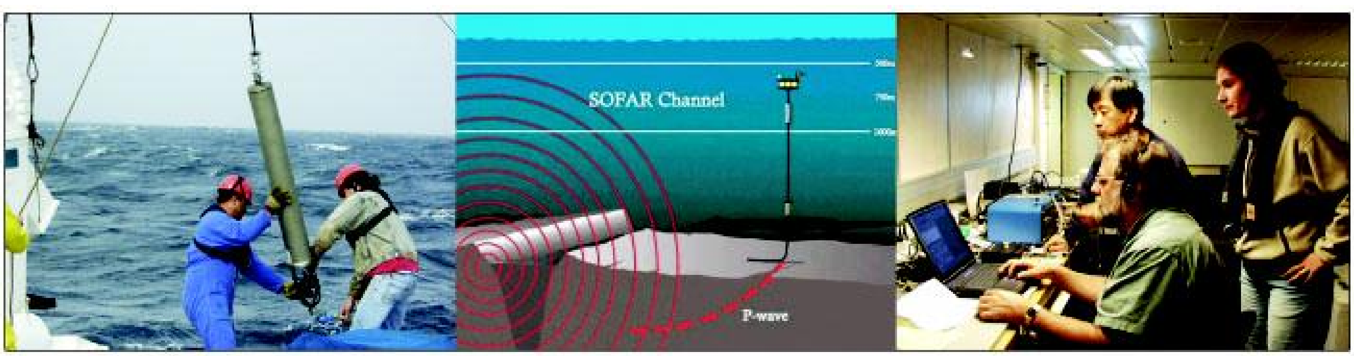
Deployment of Stratus 3 mooring off the northern coast of Chile.



OAR - Stratus
Long-term Evolution of the Coupled Boundary Layers
The Stratus project is obtaining a reliable multi-year dataset of meteorological and subsurface measurements beneath the coast of Chile and Peru. Moorings are put in place for one year, and then retrieved and replaced with another, similar mooring. The buoys have meteorological systems that measure wind speed, wind direction, air temperature, sea surface temperature, barometric pressure, relative humidity, incoming shortwave radiation, incoming longwave radiation, precipitation. Subsurface instruments attached to the mooring line measure water temperature, conductivity, current speed, current direction, salinity, and precipitation.

OAR - PMEL -Ocean Acoustic Monitoring System
Ocean Acoustic Monitoring System
Arrays of underwater hydrophones, both autonomous and cabled, deployed at numerous sites around the global ocean that collect continuous digital acoustic data for ocean observation.

Left to right: Hydrophone is deployed from the French vessel Le Suroit. *The mooring is designed to place the hydrophone within the oceanic sound channel. NOAA and French researchers acoustically interrogate the newly deployed mooring to refine its position.*



Appendix 6: NOAA Acronyms

Line Offices of National Oceanic and Atmospheric Administration:

NMFS	National Marine Fisheries Service
NESDIS	National Environmental Satellite, Data, and Information Service
NMFS	National Marine Fisheries Service
NOS	National Ocean Service
NWS	National Weather Service
OAR	Office of Atmospheric Research

Office of Atmospheric Research (OAR) Environmental Research Laboratories:

AL	Aeronomy Laboratory
ARL	Air Resources Laboratory
AOML	Atlantic Oceanographic and Meteorological Laboratory
CDC	Climate Diagnostics Center
CMDL	Climate Monitoring and Diagnostics Laboratory
ETL	Environmental Technology Laboratory
FSL	Forecast Systems Laboratory
GFDL	Geophysical Fluid Dynamics Laboratory
GLERL	Great Lakes Environmental Research Laboratory
NSSL	National Severe Storms Laboratory
PMEL	Pacific Marine Environmental Laboratory
SEC	Space Environment Center

Other acronyms:

ATDD	AL's Atmospheric Turbulence and Diffusion Division
CLASS	Comprehensive Large Array-data Stewardship System
DMAC	Data Management and Communications Subsystem
ENSO	El Niño Southern Observing System
FGDC	Federal Geographic Data Committee
GCOS	Global Climate Observing System
GEO	Group on Earth Observations
GOOS	Global Ocean Observing System
GPS	Global Positioning System
IOOS	Integrated Ocean Observing System
IWGEO	Interagency working Group on GEO
LIDAR	Light Detection and Ranging
NFA	NOAA Finance and Administration
OSP	Office of Strategic Planning
PA&E	Program Assessment and Evaluation
PPI	Program Planning and Integration
SDS	Scientific Data Stewardship
SEAS	Shipboard Environmental Data Acquisition System

to be updated

Index

Contacts

For more information about NOAA's observing systems, please visit:

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NOAA Oceans
National Ocean Service
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NOAA Fisheries
National Marine Fisheries Service
http://www.nmfs.noaa.gov

NOAA Weather Services
National Weather Service
http://www.nws.noaa.gov

NOAA Research
Office of Oceanic and Atmospheric Research
http://www.oar.noaa.gov

NOAA Satellites and Information
National Environmental Satellite, Data, and Information Service
http://www.nesdis.noaa.gov

NOAA Office of Program Planning and Integration
http://www.ppi.noaa.gov