OCEANIC AND ATMOSPHERIC RESEARCH
OPERATIONS RESEARCH AND FACILITIES
FY 2008 OVERVIEW

SUMMARIZED FINANCIAL DATA
($ in thousands)

Operations Research and Facilities	FY 2006 ACTUALS	FY 2007 CURRENTLY AVAILABLE	FY 2008 BASE PROGRAM	FY 2008 ESTIMATE	INCREASE / DECREASE
Climate Research	168,688	184,000	182,538	192,791	10,253
Weather and Air Quality Research	67,146	39,000	42,170	47,170	5,000
Ocean, Coastal, and Great Lakes Research	125,524	92,586	98,947	105,447	6,500
Information Technology and R&D	6,410	12,900	12,969	12,969	0
TOTAL	367,768	328,486	336,624	358,377	21,753
FTE	710	714	714	717	3

For FY 2008, NOAA requests a total of $358,377,000 and 3 FTE for the Office of Oceanic and Atmospheric Research Operations, Research and Facilities (ORF), a net increase of $21,753,000.

The primary center for research and development within NOAA is the Office of Oceanic and Atmospheric Research (OAR), also referred to as NOAA Research. The major research themes are Climate Research; Weather and Air Quality Research; Ocean, Coastal and Great Lakes Research; and Information Technology and Research and Development (R&D). The goal of Climate Research is the greater understanding of the climate system to improve predictions on subseasonal through decadal time scales. The goal of Weather and Air Quality Research is to better understand and forecast atmospheric events that endanger lives and property. The goal of Ocean, Coastal and Great Lakes Research is to develop innovative management tools through a better understanding of our ocean and Great Lakes habitats and resources. The goals of Information Technology and Research and Development are to accelerate the adoption of advanced computing, communications, and information technology throughout NOAA.

NOAA Research's FY 2007 Budget introduced a transition to a revised structure of its climate activities. This simplified structure is continued in FY 2008 and is composed of five line items under the Climate Research subactivity: Laboratories & Cooperative Institutes, Competitive Research Program, Climate Operations, Climate Data & Information, and Other Partnership Programs. The new line items (Competitive Research Program, Climate Operations, and Climate Data & Information) have absorbed program activities that formerly were carried under the Climate and Global Change, Climate Observations & Services (including Climate Change Research Initiative), and Arctic Research Programs. The new structure clarifies and better aligns research activities with their appropriate executing offices.

NOAA Research operates through a national network of OAR laboratories and other OAR and university-based research programs. The OAR budget activity is managed through six organizational components: OAR Research Laboratories and Cooperative Institutes, NOAA Climate Program Office, National Sea Grant College Program, Office of Ocean Exploration and Research, Office of Weather & Air Quality, and the NOAA High-Performance Computing and Communications Program. The NOAA Undersea Research Program has been combined with Ocean Exploration, and the Arctic Research Office is now part of the Climate Program Office. With this diverse research "tool kit," OAR provides national and international leadership on critical environmental issues and addresses environmental R&D needs of internal NOAA customers, states, industry, the Department of Commerce, and other Federal agencies.

NOAA Research Laboratories and Cooperative Institutes

OAR's seven laboratories and thirteen cooperative institutes are charged to advance scientific understanding of the Earth. The research conducted at the laboratories is divided into three sub-activities: (1) Climate Research, which has the mission of monitoring and understanding the Earth's climate system to predict both the potential long-term changes in global climate as well as shorter-term climate variations that are of societal and economic importance; (2) Weather and Air Quality Research, where researchers strive to provide the Nation with more accurate and timely warnings and forecasts of various high-impact weather and air quality events, such as storms and elevated levels of ozone and aerosols (particulate matter), all of which may disrupt economic productivity, impact human health, or cause loss of life and property; and (3) Ocean, Coastal, and Great Lakes Research, where the research serves to increase our understanding of coastal and marine processes for the purpose of predicting, monitoring, and mitigating the effects on ecosystems of not only climate change but also other environmental and ecosystem changes (e.g., invasive species).

The NOAA Research Laboratories administer and manage OAR programs, emphasizing theoretical and analytical studies, laboratory experiments, and field observations. The primary purposes of OAR's research are to improve NOAA services and to provide the basis for improved decision making by policymakers and the public. The OAR laboratories collaborate closely with thirteen university-based cooperative institutes and sponsor research through contracts and grants with other universities, state and Federal agencies, and private enterprises. The seven laboratories are:

Air Resources Laboratory (ARL) is headquartered in Silver Spring, MD, with divisions in Oak Ridge, TN; Research Triangle Park, NC; Idaho Falls, ID; Las Vegas, NV. ARL carries out research on processes that affect the quality of the atmosphere. These processes include the transport, transformation, and removal of trace substances through wet and dry deposition and the exchange between the atmosphere and biological and non-biological surfaces as field crops and structures. ARL's field and laboratory studies lead to the development of air quality simulation models. The Laboratory provides scientific advice to NOAA and other government agencies to assist with emergency preparedness for environmental problems such as nuclear mishaps, volcanic eruptions, and homeland security issues.

ARL climate research studies the biogeochemical cycles of trace substances and their effects and interactions with the radiative balance at the earth's surface. ARL operates research-grade measurement stations where the exchange of carbon dioxide and water vapor between the air and the biosphere is directly measured. ARL focuses not only on the development of deterministic models to describe the relevant processes, and on the often-dominant role of random variability that cannot be explained by current understanding. Research in all of these areas involves physical and numerical studies, leading to the

development of specialized models. The laboratory provides scientific advice to elements of NOAA and other government agencies on climate issues, and on the role of natural variability.

ARL weather and air quality research conducts physical and numerical studies of the processes affecting the quality of the atmosphere, primarily related to transport, transformation, and removal of trace substances, and uses these results to develop improved air quality forecast and assessment models. Research and development efforts include physical and numerical studies, leading to the development of air quality simulation models for regulatory and policy purposes, and increasingly for forecasting; improvement of understanding of processes that influence air quality, such as complex terrain, local meteorological conditions, and long-range transport; the Real-time Environmental Applications and Demonstration system (READY) as a mechanism for external users to gain access to ARL's suite of air quality forecast products; and providing relevant scientific advice to elements of NOAA and other government agencies, including those associated with homeland security.

Atlantic Oceanographic and Meteorological Laboratory (AOML) in Miami, FL, conducts research in oceanography, tropical meteorology, atmospheric and oceanic chemistry, and acoustics. AOML seeks to understand the physical and biological characteristics and processes of the ocean and the atmosphere, both separately and as a coupled system. AOML scientists study hurricanes, ocean current and temperature structures, ocean/atmosphere chemical exchanges, coral reefs, and the coastal ocean. This is accomplished by using research ships and aircraft, satellite remote sensing techniques, numerical and statistical models, radar, acoustics, and drifting buoys.

The principal focus of AOML is to contribute scientific research that may ultimately lead to improved prediction and forecasting of tropical cyclones and severe weather, better use and management of marine resources, better understanding of the factors affecting both climate and environmental quality, and improved ocean and weather services for the nation.

AOML climate research provides and interprets oceanographic data and conducts research relevant to decadal climate change and coastal ecosystems. This research includes the dynamics of the ocean, its interaction with the atmosphere, and its role in climate and climate change. On a global scale, AOML scientists, in conjunction with the PMEL and CMDL are studying the exchange of CO2 between the ocean and the atmosphere and its effects on global warming and climate change. This research is conducted through numerous cruises aboard the NOAA Ship *Ronald H. Brown.* AOML hosts NOAA's Global Ocean Observing System Center (GOOS Center), which uses expendable probes and other equipment to provide ocean surface and sub-surface data to NOAA's National Centers for Environmental Prediction (NCEP) in support of seasonal to interannual climate forecasts, as well as data for decadal-scale climate research.

AOML weather and air quality research is NOAA's primary component for research on hurricanes. The aim of this research is to improve the understanding and prediction of hurricane track and intensity change through directed research and the transfer of research results to the operational hurricane forecast components of NOAA.

Research and transition efforts include:

- The annual hurricane field program, supported by the NOAA Aircraft Operation's Center research/reconnaissance aircraft;
- Analysis of data from field programs;
- Theoretical and numerical modeling studies of hurricanes;
- Preparation of storm surge atlases and wind field diagrams;
- Assessment of interannual and decadal hurricane trends;
- Providing critical assistance to the NWS Tropical Prediction Center's forecast improvement; and
- Active participation in and support of the Joint Hurricane Testbed.

AOML ocean, coastal, and Great Lakes research scientists gather, analyze, and report coastal ocean data on land-based sources of pollution and their potential environmental impacts to the coastal environment. Scientists work in cooperation with other NOAA Line Offices, other federal, state, and local authorities, including the EPA and the U.S. Army Corps of Engineers, to maximize research knowledge for use in economically and environmentally important projects in the coastal ocean such as the South Florida Ecosystem Restoration Program. AOML conducts research by monitoring coral reef ecosystems and using the data to make predictions. The Coral Reef Watch Program seeks to accomplish NOAA's goal of ecosystem forecasting and management by improving understanding of the reef ecosystem. Initiation of comprehensive long-term *in situ* coral-reef monitoring stations is intended to provide information essential for sound management decisions, and long-term planning. AOML also generates oceanographic data and conducts research relevant to decadal climate change and coastal ecosystems, such as ocean-atmosphere interactions and its role in climate and climate change. With a diverse scientific staff of physical, chemical, biological, and geological oceanographers, AOML is able to use multi-disciplinary approaches to improve NOAA's management activities.

Earth System Research Laboratory (ESRL) in Boulder, CO, represents a combination of climate and weather research capabilities aimed at undertaking the complex, interdisciplinary research increasingly needed to achieve scientific and technological breakthroughs in today's modern world, including understanding the roles of gases and particles that contribute to climate change, providing climate information related to water management decisions, improving weather prediction, understanding the recovery of the stratospheric ozone layer, and developing air quality forecast models.

ESRL has the collective goal of observing and understanding the Earth system and developing products through a commitment to research that will advance the National Oceanic and Atmospheric Administration's (NOAA's) environmental information and services on global-to-local scales. ESRL achieves this goal through its four major divisions:

Chemical Sciences Division provides the chemical-process measurements, analyses, and understanding that are needed for the Earth System Research Laboratory to address NOAA's Climate Goal (Climate Forcing) and Weather and Water Goal (Air Quality), with the aim of improving NOAA's abilities in two areas: (1) to predict changes in climate, the stratospheric ozone layer, and air quality, and (2) to deliver related science information products that address societal and policy needs.

Global Monitoring Division continuously monitors atmospheric gases, particles, and radiation across the globe to determine trends influencing climate change, ozone depletion, and baseline air quality, and to communicate the findings in usable and understandable forms.

Global Systems Division incorporates new findings in atmospheric, oceanic, and hydrologic sciences. These systems are designed to improve understanding of climate and weather at all time scales through new observation techniques, innovative diagnostic and predictive models, advanced computational analysis, and leading-edge workstation display technology.

Physical Science Division addresses physical science questions with short- and long-term societal and policy relevance within NOAA's Climate and Weather and Water Goals. The division also conducts the physical process research necessary for ESRL to provide the nation with a seamless suite of information and forecast products, ranging from short-term weather forecasts to longer-term climate forecasts and assessments.

Geophysical Fluid Dynamics Laboratory (GFDL) in Princeton, NJ, conducts cutting-edge research on many topics of great practical value, including weather and hurricane forecasts, El Niño prediction, stratospheric ozone depletion, and global warming. GFDL's goal is to understand and predict Earth's climate and weather, including the impact of human activities on climate.

GFDL's *Climate Research* mission is to conduct research to better understand natural climate variability and anthropogenic climate changes via the development and improvement of global climate models. GFDL also works cooperatively in NOAA to provide expert assessments of changes on regional, national, and global climate. To achieve its mission, GFDL conducts comprehensive long lead-time climate research fundamental to expanding the scientific understanding of the physical and chemical processes governing the behavior of the atmosphere and oceans. This research leads to state-of-art global climate models which provide a suite of climate products for decision support by policy makers. To ensure the maintenance of its climate modeling capability, GFDL supports a very large, scalable computer system that provides critical computing, storage, and analysis capabilities, as well as model development and infrastructure support. This computing program allows NOAA to leverage the world-class research staff at GFDL to advance the Nation's climate program.

Weather and Air Quality Research at GFDL is engaged in comprehensive long lead-time research fundamental to NOAA's mission. The goal of the Laboratory's atmospheric research is to expand the scientific understanding of the physical processes governing the behavior of the atmosphere as a complex fluid system. This system can then be modeled mathematically and their phenomenology studied by computer simulation methods. The need for short-term warning and forecast product covers a broad spectrum of environmental events, which have lifetimes ranging from several minutes to several weeks.
Efforts at GFDL are centered on the development of comprehensive numerical global climate models and the frameworks in which the models are embedded. These numerical models are used in the prediction of "short-term" atmospheric phenomena such as hurricanes and coastal storms, and may also be used to study longer-term events such as the climatology of storm tracks over the oceans. The research conducted at GFDL can be developed and transitioned to NOAA operations of numerical models used in the prediction of short-term atmospheric phenomena, including tornadoes, hurricanes, and coastal storms.

Great Lakes Environmental Research Laboratory (GLERL) in Ann Arbor, MI, has a field facility in Muskegon, MI. Under the Ocean, Coastal, and Great Lakes Research line item, GLERL conducts integrated, interdisciplinary environmental research in support of resource management and environmental services in coastal and estuarine waters, with a primary emphasis on the Great Lakes. The laboratory performs field, analytical, and

laboratory investigations to improve understanding and prediction of biological and physical processes in estuaries and coastal areas and their interdependencies with the atmosphere and sediments. GLERL emphasizes a systems approach to problem-oriented research to develop environmental service tools.

National Severe Storms Laboratory (NSSL) in Norman, OK, conducts *Weather and Air Quality* research to improve the accuracy and timeliness of forecasts and warnings of hazardous weather events such as blizzards, ice storms, flash floods, tornadoes, and lightning. NSSL accomplishes this goal through a balanced program of research to:

- Advance the understanding of weather processes;
- Improve forecasting and warning techniques;
- Development of operational applications;
- Transfer of knowledge, techniques, and applications to the NWS and other agencies;
- Development of the NEXRAD Doppler weather radar, the cornerstone Doppler radar network now operated by NWS offices across the United States, and the development of new radar technologies (e.g., dual-polarization and phased array radar); and
- Conduct field programs that use mobile, *in situ*, and remote observational capabilities to collect data that support theoretical research.

Pacific Marine Environmental Laboratory (PMEL) in Seattle, WA, carries out interdisciplinary scientific investigations in oceanography, marine meteorology, and related subjects. PMEL focuses on coastal and open-ocean observations and modeling to improve: (1) our understanding of the physical, biological, and geochemical processes operating in the world oceans, and (2) environmental forecasting capabilities and other supporting services for marine commerce and fisheries. PMEL also supports an undersea observation and research program (VENTS) in Newport, OR.

Climate research at PMEL focuses on coastal and open ocean observations in support of prediction of the ocean environment on daily through decadal time scales. Studies are conducted to improve our understanding of the complex physical and geochemical processes operating in the world oceans, define the forcing functions and the processes driving ocean circulation and the global climate system, and improve environmental forecasting capabilities and other supporting services for marine commerce and fisheries. The internationally known laboratory conducts El Niño research, which has improved climate forecasts and contributed to leading to reduced loss of life and property.

The focus of PMEL's *weather and air quality* activities is to support the NWS tsunami warning centers by conducting research and development on the improvement of tsunami forecasting. NOAA develops and transfers PMEL's research results to NWS to improve forecast abilities and modeling which provides valued information to decision makers. The Tsunami Project seeks to mitigate tsunami hazards in Hawaii, California, Oregon, Washington, and Alaska through improved tsunami warnings using state-of-the-art instrument systems developed by the Laboratory's Engineering Development Division. The goal of this project is to reduce fatalities, damage, and losses caused by these natural hazards.

Ocean, Coastal, and Great Lakes Research at PMEL consists of the following ocean research programs:

- Fisheries Oceanography Coordinated Investigations (FOCI) is a collaborative research effort by scientists at PMEL and the Alaska Fisheries Science Center to improve the prediction of valuable fish (e.g. Pollock) and shellfish stocks in the Gulf of Alaska and the Bering Sea for the Alaska Regional Fisheries Management Council. Forecasts of these changes provide North Pacific fisheries managers with the best available information necessary for allocating fish landings by commercial fishermen.
- The VENTS Program, established in 1984, conducts research on the oceanic impacts and consequences of submarine volcanoes and hydrothermal venting. The program focuses on understanding the chemical and thermal effects of venting along the northeast Pacific Ocean seafloor spreading centers, which provides the foundation for prediction of the global-scale impact of seafloor hydrothermal systems on the ocean.

Cooperative Institutes - OAR has developed cooperative institute partnerships with academic and scientific institutions dedicated to oceanic and atmospheric research. Cooperative Institutes, as described in NOAA's Cooperative Institute policy, foster long-term collaborations that address research topics of importance to NOAA. OAR laboratories rely on the capabilities and expertise at the Cooperative Institutes to conduct long-term research that leads to improvements in NOAA operations. These partnerships are established with a cooperative agreement. By design, most of the Institutes are co-located with one or more NOAA facilities to promote scientific exchange and technology transfer. The primary purpose of each Institute is to bring together the diverse resources of a research university or institution, one or more OAR laboratories, and other branches of NOAA to develop and maintain a center of excellence in research.

The OAR Cooperative Institutes include:

The **Cooperative Institute for Climate Applications and Research** (CICAR) is located at the Lamont-Doherty Earth Observatory Campus of Columbia University in Palisades, NY. CICAR scientists conduct research on earth system modeling, modern and paleoclimate observations, and climate variability and change applications. The strategic vision that under girds all CICAR science emphasizes that ocean observations and coupled ocean-atmosphere modeling are key to understanding long-term climate variability and change, and that paleoclimate research produces climate scenarios quite distinct from those revealed in the short instrumental record, thereby providing a more complete view of the Earth's climate system. A major portion of CICAR's research agenda is accomplished in collaboration with the Climate Program Office and the Geophysical Fluid Dynamics Laboratory.

The **Cooperative Institute for Climate and Ocean Research** (CICOR) is located at the Woods Hole Oceanographic Institution (WHOI) in Woods Hole, MA. CICOR scientists conduct research on coastal ocean and near-shore processes, oceanic participation in climate and climate variability, and marine ecosystem processes analysis. The CICOR-WHOI partnership provides NOAA research excellence in oceanographic research and marine policy and access to research ships and submersibles, remotely operated and autonomous vehicles, and state-of-the-art ocean observing systems. CICOR conducts its research in close collaboration with the Climate Program Office.

The **Cooperative Institute for Climate Science** (CICS) is located at Princeton University's Forrestal Campus in Princeton, NJ. CICS scientists conduct research on earth system studies, biogeochemistry, coastal processes, and paleoclimate. CICS plays a central role in fulfilling the demand for basic and applied research on climate variability and change, environmental impacts, mitigation options and response strategies, as well as training future scientists in

these areas and disseminating research results to policy makers, public school teachers, business leaders, and the general public. CICS is aided in its mission by strong collaborative partnerships with the Climate Program Office and the Geophysical Fluid Dynamics Laboratory.

The **Cooperative Institute for Arctic Research** (CIFAR) is located at the University of Alaska in Fairbanks, AK. CIFAR scientists conduct research on arctic atmosphere and climate, fisheries oceanography, tsunami research, marine ecosystem studies, contaminant effects, ultraviolet and arctic haze studies, hydrographic and sea ice studies, climate modeling, and data archiving and support. CIFAR is designed to be a focal point for interactions between NOAA and the arctic research community for research that serves the NOAA mission, especially in the Western Arctic/Bering Sea region. CIFAR's key collaborators are the Climate Program Office and the Pacific Marine Environmental Laboratory.

The **Cooperative Institute for Limnology and Ecosystems Research** (CILER) is located at the University of Michigan in Ann Arbor, MI. CILER scientists conduct research on climate and large lake dynamics, coastal and near shore processes, large lake ecosystem structure and function, remote sensing of large lakes and coastal ocean dynamics, and marine environmental engineering. One of the main objectives of CILER is to improve the effectiveness of NOAA sponsored research on freshwater, coastal and estuarine areas, with particular emphasis on Great Lakes issues. This is accomplished, in large part, by fostering collaboration between the Great Lakes Environmental Research Laboratory and other federal, international, state and local agencies, and the Great Lakes academic research community.

The **Cooperative Institute for Marine and Atmospheric Studies** (CIMAS) is located at the University of Miami in Miami, FL. CIMAS scientists conduct research on climate variability, fisheries dynamics, regional coastal ecosystem processes, human interactions with the environment, air-sea interactions and exchanges, and integrated ocean observation. Recent growth in CIMAS has been due to a significant great increase in research activities associated with the South Florida Ecosystem Restoration, whose purpose is to rectify the ecological damage done to South Florida and the Everglades due to water diversion projects carried out to mitigate flood damage from hurricane rains. NOAA's Atlantic Oceanographic and Meteorological Laboratory and the Southeast Fisheries Science Center are key CIMAS collaborators.
The **Cooperative Institute for Mesoscale Meteorological Studies** (CIMMS) is located at the University of Oklahoma (OU) in Norman, OK. CIMMS scientists conduct research on basic convective and mesoscale research, forecast improvements, climatic effects of/controls on mesoscale processes, socioeconomic impacts of mesoscale weather systems and regional-scale climate variations, Doppler weather radar research and development, and climate change monitoring and detection. CIMMS promotes cooperation and collaboration on problems of mutual interest among OU research scientists and students and the National Severe Storms Laboratory, the National Weather Service (NWS) Radar Operations Center for the WSR-88D (NEXRAD) Program, the NWS National Centers for Environmental Prediction Storm Prediction Center, and the NWS Warning Decision Training Branch.

The **Cooperative Institute for Research in the Atmosphere** (CIRA) is located at the Colorado State University (CSU) in Fort, Collins, CO. CIRA scientists conduct research on global and regional climate, local and mesoscale weather forecasting and evaluation, applied cloud physics, applications of satellite observations, air quality and visibility, societal and economic impacts, and numerical modeling. Current research being performed at CIRA includes that in support of new NESDIS satellite programs – GOES-R (Geostationary Operational Environmental Satellite/R Series) and NPOESS

(National Polar-orbiting Operational Environmental Satellite System). These two weather satellite programs are designed to support weather forecasting for the next two to three decades. NOAA's Earth System Research Laboratory is a key CIRA collaborator.

The **Cooperative Institute for Research in Environmental Sciences** (CIRES) is located at the University of Colorado, in Boulder, CO. CIRES scientists conduct research on advanced modeling and observing systems, climate system variability, geodynamics, integrative activities, planetary metabolism, and regional processes. CIRES research is designed to help decision-makers resolve complex problems by providing sound scientific information to shape informed policy. Examples of such research include assessing the health of Earth's ozone layer, documenting the thinning of polar ice, developing microbial agents for degrading environmental pollutants, and improving earthquake predictions. Collaborative research contributions by CIRES scientists are crucial to research conducted at NOAA's Earth System Research Laboratory.

The **Joint Institute for Marine and Atmospheric Research** (JIMAR) is located at the University of Hawaii in Honolulu, HI. JIMAR scientists conduct research on tsunamis and other long-period ocean waves, equatorial oceanography, climate, fisheries oceanography, and tropical meteorology, and coastal research. Recent growth in the JIMAR research portfolio has been in tsunami research and fisheries and coastal research associated with the creation of the Northwestern Hawaiian Islands Marine National Monument, the single largest conservation area under United States administration and the largest marine conservation area in the world. JIMAR maintains strong collaborative research linkages to NOAA's National Marine Fisheries Service and Pacific Marine Environmental Laboratory.

The **Joint Institute for Marine Observations** (JIMO) is located at Scripps Institution of Oceanography (SIO) at the University of California – San Diego. JIMO scientists conduct research on climate and coastal observations, analysis, and prediction, biological systems, research in extreme environments, and research and development on observations systems. JIMO also oversees NOAA funding for the entire University of California system in a multi-campus effort to promote collaboration and resource pooling. As such, SIO's facilities, including its fleet of four research vessels and one-of-a-kind research platform, are made available to NOAA and other organizations through JIMO collaborations. JIMO conducts its research in close collaboration with the Climate Program Office.

The **Joint Institute for the Study of the Atmosphere and Ocean** (JISAO) is located at the University of Washington in Seattle, WA. JISAO scientists conduct research on climate, environmental chemistry, marine ecosystems, and coastal oceanography. Climate research remains JISAO's dominant research endeavor, a major component of which is devoted to supporting NOAA's ocean monitoring programs. Collaborative research between JISAO and the Pacific Marine Environmental Laboratory, for example, includes the Tropical Atmosphere Ocean project, which supplies real-time data from moored ocean buoys for improved detection, understanding and prediction of El Niño and La Niña. JISAO's collaborative research network also includes the Alaska Fisheries Science Center and the Northwest Fisheries Science Center.

The **Northern Gulf Institute** (NGI) is located at Stennis Space Center, MS and is a consortium of universities, led by Mississippi State University, which includes the University of Southern Mississippi, Louisiana State University, Florida State University, and the Dauphin Island Sea Lab. NGI scientists conduct research on ecosystem management, geospatial data integration and visualization in environmental science, climate change and climate variability effects on regional ecosystems, and coastal hazards. The fundamental philosophy of the NGI is integration – integration of the land-coast-ocean-

atmosphere continuum; integration of research to operations; and integration of individual academic institutional strengths into a holistic research and educational program specifically geared to the needs of Northern Gulf of Mexico users. Research activities at NGI make an important contribution to NOAA's ecosystem, oceanic, and coastal research.

NOAA's Climate Program Office (CPO) - NOAA's Climate Program encompasses activities formerly described within the Office of Global Programs and Climate Observations and Services Program, and Arctic Research Office. OAR's activities within the CPO are executed by multiple line offices (OAR, NESDIS, NWS), and through sponsored research conducted by external partners. The goal of NOAA's CPO is to understand climate variability and change to enhance society's ability to plan and respond. This goal is achieved in OAR through the development of integrated ocean and atmospheric observing systems, research into the forcings and feedbacks contributing to changes in the Earth's climate, improved climate predictive capability from weeks to decades, and the development of climate products and services to enhance decision making capabilities across all sectors of society. To further achieve this goal, in 2006, NOAA established the National Integrated Drought Information System (NIDIS) Office in Boulder, CO, to implement NIDIS and coordinate activities within NOAA, across Federal agencies, and with stakeholders. In addition, CPO serves as the focal point for NOAA's research activities in the Arctic, Bering Sea, North Pacific, and North Atlantic regions: represents NOAA on the Interagency Arctic Research Policy Committee: leads U.S. involvement in the international Arctic Monitoring and Assessment Program: participates in multilateral and bilateral policy discussions through interaction with the Global Earth Observing System of Sysytems (GEOSS), the UN Framework Convention on Climate Change (UNFCCC), the Intergovernmental Panel on Climate Change (IPCC), the WMO, key bilateral partners, and other climate leadership organizations; and promotes climate literacy and outreach activities.

National Sea Grant College Program - Congress established the National Sea Grant College Program in 1966 to enhance the development, use, and conservation of the Nation's marine and Great Lakes resources. The legislation establishes a network of Sea Grant Colleges to conduct education, training, and research in all fields of marine study. It also directs that grants and contracts may be awarded to: "any individual; any public or private corporation, partnership, or other association or entity (including any Sea Grant College, Sea Grant Institute or other institution) or any State, political subdivision of a State, or agency or officer thereof" [PL 105-160]. The National Sea Grant College Program Office is located in Silver Spring, MD. Currently, there are 30 State Sea Grant programs located in most coastal and Great Lakes states. Most Sea Grant programs include multiple campuses of different universities across the state.

The **Office of Ocean Exploration and Research (OER)** is comprised of the former NOAA Undersea Research Program (NURP) and the Ocean Exploration (OE) Program. Its two most prominent functions are:

Research - Scientists funded by OER conduct wide-ranging research investigations in such areas as the causes behind depletion of fisheries, the impacts of commercial fishing activity on critical habitats, and the role of undersea volcanism in coastal hazards. This program also conducts mandated studies of underwater diving techniques and equipment to advance safety and improve diver performance. In FY 2007, the program provides national support through regional National Undersea Research Centers on both the east and west coasts, including the Aquarius Undersea Laboratory in Florida, and a headquarters office in Silver Spring, MD.

Exploration – NOAA is the only Federal agency with a dedicated program of ocean exploration. This program supports exploration in unknown and poorly known ocean areas, and applies 10% of the yearly budget to marine exploration and science-based education. The program works with other NOAA programs and Federal agencies, as well as the academic community, to identify and prioritize areas of the world's oceans that should be explored, and then funds interdisciplinary science-based exploratory missions and education activities through a peer-review process. The program works with the results obtained from these missions to further NOAA's research and marine management objectives as outlined in the NOAA Strategic Plan. The program provides direct support to several multidisciplinary expeditions per year, facilitates across NOAA program offices to develop and apply data management tools and techniques to appropriately organize, archive, and disseminate data and information collected during expeditions. The four key objectives to the program are:

- Explore unknown and poorly known areas of the ocean;
- Map the physical, geological, biological, chemical, and archaeological aspects of the oceans;
- Develop new sensors and systems for ocean exploration to regain U.S. leadership in marine technology; and
- Connect in innovative ways to stakeholders to improve the literacy of learners of all ages with respect to ocean issues.

The new Office of Ocean Exploration and Research (OER) connects and expands on the activities conducted by NURP and OE, building on the strengths of the two programs. The primary objective of the new program will be to increase the pace and efficiency of discovery in unknown and poorly known ocean areas, and to translate and disseminate the results to further NOAA and the Nation's ecosystem management efforts. The program will support interdisciplinary exploration expeditions, conduct research necessary to transition the results of expeditions to applications, and engage in advanced technology development. The program will include activities to facilitate and manage at-sea operations, manage and disseminate data and information obtained during expeditions, and will continue and expand on education and outreach efforts, which represent an investment of 10% of the overall budget on a yearly basis.

In FY 2005 Congress directed the Department of Defense to provide NOAA with a T-AGOS class vessel and funding to convert the ship into a platform dedicated to support NOAA ocean exploration missions. The ship is currently undergoing conversion, and is scheduled to begin operations in the summer of FY 2008. Once tested and ready for operation, the new vessel will support missions that meet the above objectives and will complement ocean exploration missions currently conducted with other vessels.

Office of Weather & Air Quality - The goal of Weather and Air Quality Research programs is to: (1) provide the Nation with more accurate and timely warnings and forecasts of: (a) weather events, particularly high-impact weather events, that disrupt economic productivity and cause loss of life and property, (b) air quality, particularly ozone and aerosol (particulate matter) that impact human health, cause crop damage, and affect private sector operational planning for power generation; and (c) solar disturbances and their terrestrial effects, including hazards to satellites and disruptions of communications, navigation, and utility systems and (2) provide the scientific basis for developing public policy tools for air quality by: (a) improving the understanding and characterization of air quality (i.e., aerosol, ozone, VOC, NOx, and SOx); (b) improving air quality sensor technology to structure the monitoring network; and (c) developing and prototyping air quality models to forecast air quality and to perform diagnostic analysis of air quality episodes.

High Performance Computing and Communications - The Office of High Performance Computing and Communications (HPCC) supports a number of objectives in NOAA's Strategic Plan, primarily through support of IT research targeted at improving NOAA's mission and services and science education. The purposes of the HPCC program are to make major improvements in the Nation's ability to forecast the weather and climate, and to disseminate environmental information. The program also seeks to stimulate modernization of NOAA's computationally intensive services through the use of evolving high performance computing and high-speed networking technologies. Through this program, NOAA participates as a "mission" agency in the Interagency Working Group on Information Technology Research and Development. Improvements in the accuracy and timeliness of NOAA's short-term weather warnings, seasonal forecasts, and regional and global climate predictions are heavily dependent on major advances in high-end computing power, advanced information technology, and the widespread availability of environmental data and information. Timely and responsive dissemination of NOAA's services and information requires full use of modern network and communication technologies.

Support for the NOAA Strategic Plan

OAR's activities support three Mission Goals in the NOAA Strategic Plan:

- Protect, Restore, and Manage the Use of Ocean and Coastal Resources Through an Ecosystem Approach to Management;
- Understand Climate Variability and Change to Enhance Society's Ability to Plan and Respond; and
- Serve Society's Needs for Weather and Water Information.

Activities also support NOAA's Mission Support Goal to Provide Critical Support for NOAA's Mission.

The NOAA Climate Program was rated "Moderately Effective" under the **Program Assessment Rating Tool (PART)** conducted in FY 2004. The assessment found that the program is relatively strong and has undertaken steps to improve program management and focus on results. Additional findings included: (1) NOAA Climate coordinates with other Federal agencies through the Climate Change Science Program; (2) Deficiencies in the management of NOAA's laboratory activities as identified by the NOAA Research Review Team; (3) Need to better integrate performance into budget decisions; and (4) Program has appropriate long-term goals and annual measures that demonstrate progress. In response to these findings, NOAA has sent forward a proposal to consolidate its Boulder laboratories and to implement other management changes recommended by the Review Team. NOAA is also developing an internal data base to track performance and to link performance to the budget. The NOAA Ecosystem Research Program underwent a PART review and was rated "Adequate". Two follow-up actions to be taken: (1) Assess the portfolio of research within NOAA's Ecosystem Research Program to clarify the role of each of the Program's components and eliminate redundancies; (2) Modify planning and management processes so that research activities meet the highest priority science needs and provide a balanced response to local, regional, and national issues.

Research and Development Investments

The NOAA FY 2008 Budget estimates for its activities, including research and development programs, are the result of an integrated, requirements-based Planning, Programming, Budgeting, and Execution System (PPBES) that provides the structure to link NOAA's strategic vision with programmatic detail,

budget development, and the framework to maximize resources while optimizing capabilities. The PPBES process incorporates the President's Management Agenda and the Office of Science and Technology Policy's Research and Development Investment Criteria (relevance, quality, and performance) for NOAA's R&D programs, and leads to NOAA budget proposals that reflect the R&D investment criteria.

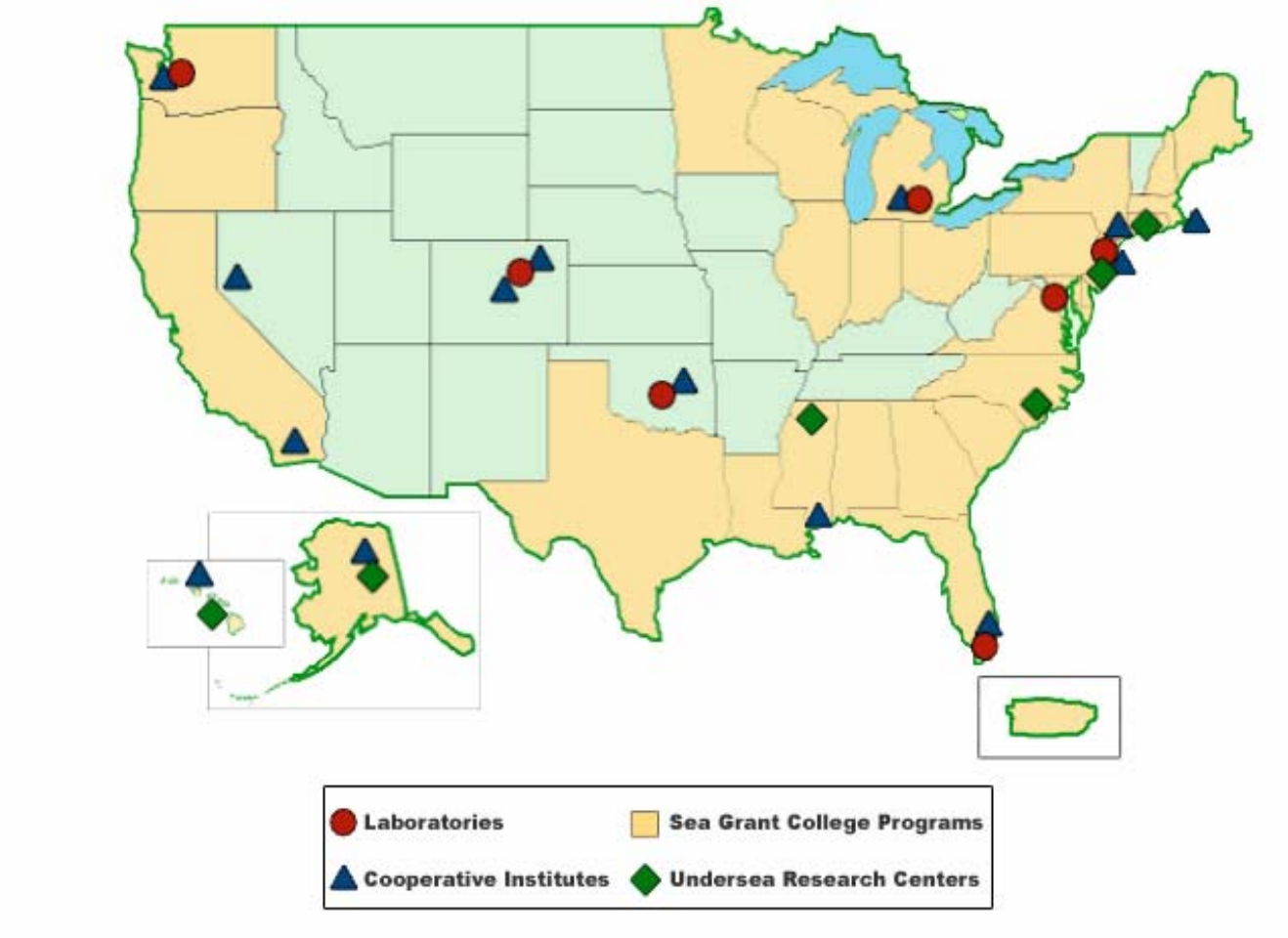
Significant Adjustments-to-Base (ATBs): NOAA requests an increase of 0 FTE and $2,951,000 to fund adjustments for NOAA Research activities. Within this increase, program totals will fund inflationary adjustments for labor and non-labor.

NOAA Research also requests the following transfer for a net change to NOAA of $0.

From Office	Line	To Office	Line	Amount
Oceanic and Atmospheric Research	Ocean Exploration and Research	OMAO	OKEANOS EXPLORER	$4,600

OAR requests a technical adjustment to transfer $4,600,000 from Ocean Exploration and Research to Marine Services to fund operations and maintenance of the OKEANOS EXPLORER, NOAA's new, dedicated ocean exploration vessel.

The map below shows the locations of OAR Laboratories, National Undersea Research Centers, Cooperative Institutes, and Sea Grant College States.



Subactivity: Climate Research
Line Item: Laboratories & Cooperative Institutes

GOAL STATEMENT:

The goal of the Climate Laboratories and Cooperative Institutes is to develop a more comprehensive understanding of atmospheric and oceanic processes that drive and respond to changes in climate over a variety of spatial and temporal scales through sustained monitoring and research. This research will lead to better understanding and prediction of climate variability and change and help the Nation respond to the risks and opportunities associated with global climate change.

BASE DESCRIPTION:

The OAR Laboratories and Cooperative Institutes are an integral part of the interagency Climate Change Science Program, which links the U.S. Global Change Research Program (USGCRP) and the Administration's Climate Change Research Initiative (CCRI). OAR Laboratories and Cooperative Institutes conduct a wide range of research into complex climate systems. The research aims to improve NOAA's ability to assess climate variability on seasonal to interannual timescales, as well as interdecadal to centennial timescales and beyond. NOAA researchers strive for consistent and uninterrupted monitoring of the Earth's atmosphere and ocean that provide us clues about long-term changes in the global climate. The data collected worldwide by NOAA researchers aids our understanding of, and ability to forecast changes in, complex climatic systems. Using sophisticated computer systems, NOAA researchers work on the numerical modeling of climate systems, which improves the accuracy of climate forecasts. NOAA's strategy is to: (1) acquire the essential data; (2) develop diagnostic and predictive models related to changes in the equatorial oceans; and (3) establish the relationship of those changes to widespread climate variations through data analysis and modeling.

These base activities support the objective, "Advance understanding and predict changes in the Earth's environment to meet America's economic, social, and environmental needs" under the Department of Commerce Strategic Goal of "Observe, protect, and manage the Earth's resources to promote environmental needs."

PROPOSED LEGISLATION:

None.

SUMMARIZED FINANCIAL DATA
(Dollars in thousands)

Subactivity: Climate Research	FY 2006 ACTUALS	FY 2007 CURRENTLY AVAILABLE	FY 2008 BASE PROGRAM	FY 2008 ESTIMATE	INCREASE / DECREASE
Line Item: Laboratories & Cooperative Institutes					
Laboratories & Cooperative Institutes	48,646	47,000	49,337	50,337	1,000
TOTAL	48,646	47,000	49,337	50,337	1,000
FTE	248	249	249	249	-

Note: The dollars in this table represent budget authority.

PROGRAM CHANGES FOR FY 2008:

Research Supercomputing: Computational Support for Assessing Abrupt Climate Change (+0 FTE and +$1,000,000): NOAA is requesting 0 FTE and $1,000,000 to provide computational support for assessing abrupt climate change in a warming world. Changes to regional extremes (like Western drought) or extreme events (like Atlantic hurricanes) result from the impact of simultaneous climate phenomena that include global warming and the modes of natural climate variability. NOAA has pioneered progress in the predictive understanding of parts of this paradigm.

Statement of Need:
The Nation requires a significantly better predictive understanding of abrupt climate change and its impact on extreme events and regions throughout the U.S. Recent climate events such as the unprecedented frequency of hurricanes in 2005, the warmest year on record for the U.S. in 2006, and last summer's heat waves in California and Western Europe, have clearly demonstrated the potential for a rapidly changing climate to present significant socioeconomic and policy issues for the U.S. on local, regional, national, and international scales. Five such key problem areas which require improved understanding and future enhanced prediction capabilities are: 1) increased hurricane activity in the Atlantic; 2) prolonged drought in the West; 3) the acceleration in the rate of sea level rise; 4) the role of the Atlantic Meridional Overturning Circulation (AMOC) to force rapid climate change; 5) the potential for an ice free Arctic in summer by mid century.

The building blocks for a systematic program for assessing abrupt change include global ocean observations and data assimilation systems; model development; climate diagnostics and modeling. Progress is being made to implement the global ocean observing system. A key component for the forecast capability needed to make progress in assessing the potential for abrupt change is the ability to do ocean analyses (based on data assimilation techniques) and to use these to initialize the earth system models for decadal (and seasonal) forecasts. An enhanced effort will be required to improve the climate diagnostics and modeling of how a) the various models of climate variability on different timescales interact, and b) how these might be impacted by the trend toward global warming. A central issue is a better understanding of climate variability on decadal timescales. Specific focus areas include:

decadal phenomena in the Indo-Pacific and North Pacific and their impact on the U.S.; understanding of the impacts of high latitude cryospheric processes on sea-level rise and greenhouse gas emissions, and the impact of variability in the AMOC (a program supported through a requested increase in the Competitive Research Program).

Solutions to these critical problems require new computational resources because the use of large scale, state-of-the-art climate modeling is the principal means of addressing these problems within the context of NOAA's research program. This increase will support research supercomputing needed to improve predictive understanding of the climate system and assess abrupt climate change.

Proposed Actions and Deliverables:
Enhance R&D High Performance Computing Systems ($1,000,000)
This funding for climate computing will be used to enhance NOAA's new R&D High Performance Computing Systems (HPCS) being implemented in FY2007. The R&D HPCS represents a new, holistic, "One NOAA" approach to planning, acquiring, and managing its HPC resources. The enhancements to the HPCS will specifically address computational resources needed for the following five key climate areas:

- $300K applied to increased hurricane activity in the Atlantic;
- $200K applied to prolonged drought in the West;
- $200K applied to the acceleration in the rate of sea level rise;
- $200K applied to the role of the Atlantic Meridional Overturning Circulation (AMOC) to force rapid climate change;
- $100K applied to the potential for an ice free Arctic in summer by mid century.

Milestones:

FY 2008: Augment NOAA Research and Development (R&D) High Performance Computing System (HPCS)

FY 2009: Upgrade NOAA R&D High Performance Computing System
Unified Ocean Modeling Code
Develop experimental framework for hydroclimate regime studies for last 1000 year climate studies
Prototype high resolution global model for hurricanes (NextH)

FY 2010: Ocean modeling and assimilation infrastructure
High resolution climate/carbon/ice model for polar regions
Experimental seasonal forecasts with NextH

FY 2011: Implement routine seasonal NextH forecasts

FY 2012: Assess decadal prediction understanding for polar regions

FY 2013: Regional Operational ecosystems forecasts
Assessment of accuracy of sea level rise rates

Benefits:
The ability for the Nation to predict seasonal hurricane activity a year or more in advance, reduce the uncertainty of the location, frequency, and duration of droughts, determine when the Arctic will open for commercial shipping, and assess the impacts of abrupt climate change on our coastline and the ecosystems that reside there, have clear advantages for important sectors in the U.S. economy and for our society. The additional research supercomputing resources will help scientists develop and operationalize forecasting capabilities on decadal timescales and provide the computational support needed to address the five key climate issues identified above. New information products will be developed related to regional impacts and climate extremes resulting from an improved predictive understanding of the climate system, taking into account both natural and anthropogenic factors.

Outcomes:
The development of new research results and reliable products will create an informed public, promote sound decisions on adapting to climate change over the next several decades, and guide policy-makers toward understanding the long-term impacts of mitigation strategies. New routine decadal prediction products will begin to be developed that provide the Nation with

- The likelihood of increased hurricane-related impacts over the US
- Regional US drought outlooks
- Decadal ice forecasts for the Arctic
- Regional decadal sea-level rise outlooks

In particular, experimental products supporting one of the four near-term priorities outlined in the draft implementation plan of the Ocean Research Priorities Plan, namely, Assessing Atlantic Meridional Overturning Circulation Variability and its Implications for Rapid Climate Change will be developed with this additional computational resource.

Subactivity: Climate Research
Line Item: Competitive Research Program

GOAL STATEMENT:

NOAA's Competitive Climate Research Program sponsors scientific research, within eleven elements, aimed at understanding how society can best adapt and respond to climate variability and change. Researchers coordinate activities that jointly contribute to improved predictions and assessments of climate variability over a continuum of timescales ranging from seasonal to decadal and beyond.

BASE DESCRIPTION:

NOAA's Competitive Climate Research Program is an integral part of the interagency U.S. Climate Change Science Program (CCSP), which incorporates the U.S. Global Change Research Program (USGCRP) and the Administration's Climate Change Research Initiative (CCRI). The program addresses an important aspect of global change - understanding the global climate system - and advances research and assessment activities designed to address the interface between scientific information and society's various decision-making needs. Current research activities are organized across the following elements within two main components, Research and Major Observing Systems:

A. Research Programs

The **Atmospheric Composition and Climate Program (ACCP)** pursues two overall research objectives: (1) to improve the predictive understanding of the radiative forcing of the climate system by aerosols (airborne fine particles) and by chemically-active greenhouse gases, such as tropospheric ozone, and (2) to better characterize the recovery of the stratospheric ozone layer and its role in climate change. The integrated research activities that address these objectives involve instrument development, global observations, laboratory studies, and theoretical modeling by NOAA and extramural partners. Activities in FY06 focused on conducting an intensive field study in the Gulf of Mexico region to identify and quantify the sources of climate forcing due to aerosols and to assess the influence of aerosols–cloud interactions. Another significant component of the ACCP is the extramural component of the CCRI ***Aerosol-Climate Interactions.*** Details of this research are described below.

The **Climate Change Data and Detection (CCDD)** program element ensures that the data needed to understand the climate system are available for analysis. The data and resultant products extend the existing long-term climate record and serve as essential input for predictive models. In addition, CCDD provides support for documenting variations in climate on time scales ranging from seasonal to decadal and beyond. Support is also provided for the analysis of observed climate variations and identifying causes that are consistent with Earth's long-term climate history. This program was heavily involved in the production of the first Climate Change Science Program Synthesis and Assessment Report (S&A 1.1). The report, titled "Temperature Trends in the Lower Atmosphere: Steps for Understanding and Reconciling Differences" tackles some of the long-standing difficulties that have impeded understanding of changes in atmospheric temperatures and the basic causes of these changes. The report concludes there is no longer a discrepancy in the rate of global average temperature increase for the surface compared with higher levels in the atmosphere.

The **Climate Dynamics and Experimental Prediction (CDEP)** program element supports NOAA's efforts toward improved global climate predictions on seasonal to interannual timescales through the Applied Research Centers (ARCs), which help develop and support climate services through applied research, development, and experimental applications. The end-result is a coordinated suite of contributions to the predictions and assessments of climate variability and regional assessments and applications produced by NOAA's Climate Prediction Center (CPC) and the International Research Institute for Climate Prediction (IRI). CDEP also supports the development of new climate reanalysis data sets and the capability to deliver explanations of the causes for observed climate variability and change in coordination with Weather-Climate Research described under the Labs & Cooperative Institute line item, above. This effort represents a key NOAA contribution to the CCSP goal to improve knowledge of the Earth's past and present climate and environment, including its natural variability, and improves understanding of the causes of observed variability and change.

The ultimate goal of the **NOAA Climate Variability and Predictability (CVP)** program element is to develop skillful predictions of climate variability and change on seasonal to multi-decadal time scales and regional spatial scales for optimal use in resource planning and policy decision making. The scientific objective of the NOAA CVP program is to understand the mechanisms of major climate variability and change on seasonal to decadal and longer time scales, including the thresholds and non-linearities of abrupt climate change, and to develop the predictive capability for these climate processes. An initial focus of the leading large-scale phenomena includes the El Nino-Southern Oscillation (ENSO), the Pacific Decadal Oscillation (PDO), Tropical Atlantic Variability (TAV), Arctic Oscillation/North Atlantic Oscillation (AO/NAO), the Meridional Overturning Circulation (MOC) and the American Monsoon systems. CVP research approaches include development of observational, theoretical, and computational means to understand and predict climate variability and change and to make enhanced predictions, where feasible.

The **Climate Prediction Program for the Americas (CPPA)** element seeks to improve operational intra-seasonal to interannual climate and hydrologic forecasting. CPPA seeks to: (1) improve the understanding and model simulation of ocean, atmosphere and land-surface processes through observations, data analysis, and modeling studies; (2) determine the predictability of climate variations on intra-seasonal to interannual time scale, including predictability of the continental-scale monsoon systems across the Americas; (3) advance NOAA's operational climate forecasts, monitoring, and analysis systems; and (4) develop climate-based hydrologic forecasting capabilities and decision support tools for water resource applications.

The **Global Carbon Cycle (GCC)** program element seeks to improve NOAA's ability to predict the sources and sinks of anthropogenic CO2 and future atmospheric CO2 concentrations using a combination of atmospheric and oceanic global observations, process-oriented field studies, analysis, and modeling. The GCC program is a part of the interagency Carbon Cycle Science initiative of the Climate Change Science Program. GCC research addresses priorities identified in the U.S. Carbon Cycle Science Plan (1999), the North American Carbon Plan (2002), and the Ocean Carbon and Climate Change Plan (2004). The goal of GCC research is to aid in the achievement of NOAA's climate forecasting goals, including the advancement of understanding of the global carbon cycle and its role in regulating climate. The GCC Program currently supports research to identify the impacts of anthropogenic CO2 on ocean chemistry and biology. NOAA funded investigators found new evidence of ocean acidification in the north Pacific. This acidification could be the result of the ocean's uptake of anthropogenic CO2 over the past 16 years. (Feely, R.A. et al. *Anthropogenic ocean acidification over the twenty-first century and its impact on calcifying organisms.* Nature, 437(7059), 681–686 (2005)).

The Transition of Research Applications to Climate Services (TRACS) program is a proposal-driven program that supports the transition of well-developed research and prototype decision products, processes and policy tools that will expand regional decision makers' (e.g., private sector, agriculture, state, and local government) use of climate information. These transition products and tools are the result of the research community's investigations, through programs such as Sector Applications Research Program and Regional Integrated Sciences and Assessments, of the climate information needs of decision makers and the development of user-relevant, place based applications. The program requires structured partnerships between operational staff, decision makers, and prototype developers and requires an extension component to ensure effective use of the application by decision makers. The TRACS Program transitions experimentally mature climate tools, methods, and processes from research mode into settings where they may be applied in an operational and sustained manner. TRACS seeks not only to support implementation of these transitions, but also to learn from users how better to accomplish technology transition processes for public goods applications and improved risk management. TRACS works with universities, NOAA labs and operational units, and stakeholder partners.

The **Regional Integrated Sciences and Assessments (RISA)** program supports integrated, place-based research across a range of social, natural, and physical science disciplines to expand decision-makers' (e.g., private sector, agriculture, state, and local government) options in the face of climate change and variability at the regional level. It does this in a manner that is cognizant of the demands and constraints faced by decision-makers regarding their climate sensitive resources. RISA possesses three distinct qualities: (1) foster interdisciplinary research and assessment synthesis; (2) improve understanding of and bridging the gap among climatic, environmental and societal interactions on various temporal and spatial scales; and (3) contribute to regional decision support and climate information service. A successful RISA program requires innovative and embedded long-term partnerships among a spectrum of interested parties including Federal, State, Native, regional, local and private entities. The program relies heavily on consolidating the results and data from ongoing NOAA-OGP disciplinary program elements, already funded in a region, into an integrated framework. In 2006, as part of the RISA program, NOAA established the Alaska Center for Climate Assessment and Policy, which focuses on transportation and water resource management research.

The **Sector Applications Research Program (SARP)** replaces and refocuses activities formerly supported by Health and Human Dimensions and Environment, Science, and Development. The SARP's main goals are to provide new knowledge to the identification and reduction of vulnerability to climate variability and change through: improved knowledge of the impacts of climate on society specifically in economic, ecologic, and social sectors (e.g., coastal, water resources agriculture, health, etc.); enhanced use of forecast information; increased understanding by scientists and policy makers of the needs of stakeholders impacts of a changing climate; and a better understanding of society's ability to plan for and adapt to future uncertainties. SARP is built upon the evolution and successes of NOAA's Human Dimensions of Global Change; Environment, Science and Development; and Climate Variability and Human Health Programs. SARP is an interdisciplinary program, which promote social science methodologies and scientific findings required to build a knowledge base that addresses climate impact and adaptation uncertainties for stakeholders within sectors most at-risk. Specifically, SARP: (1) funds research projects that provide a better understanding of the impact of climate variability on specific sectors recognizing the role of complex societal and environmental interactions; (2) creates stronger sector communities by operating as a focal point for researchers, policy makers and decision makers to aggregate, evaluate and set evolving requirements for new knowledge critical to decision making; and (3) translates the results of the

research and interactions regarding decision making needs and capacities to relevant programs within the NOAA Climate Office including RISA, TRACS and CPPA and to other programs within the Agency that would benefit from this research such as Sea Grant and the National Weather Service.

The role of the **Arctic Research Program (ARP)** is to improve forecasts of temperature, precipitation, and storms across Alaska and the mainland U.S., and support improvements in forecasting and planning for energy needs, growing seasons, hazardous storms, water resources, and provide for better management of Alaskan and Arctic resources. This will be accomplished by: (1) creating an effective climate observing system focused on the U.S. region of the Arctic to allow for regional-scale climate change detection and development models capable of predicting Arctic climate change; (2) creating and analyzing Arctic physical and biological data sets designed to detect climate change, validate satellite observations, improveand initiate models, and support decision-making; and (3) through partnerships, develop observing and modeling capability to detect and assess Arctic-wide change and impact, and determine how Arctic processes affect North American and global climate systems. In 2006, one of these partnerships between NOAA and two Canadian organizations resulted in the opening of a new Arctic observatory in Eureka, Canada designed to make long-term climate measurements of Arctic clouds and aerosols. The achievement of these tasks will help to assess climate change in the Arctic. The most well known impact of general warming is illustrated by the loss of sea ice and glacier mass, the thawing of permafrost, and other temperature-related phenomena. These changes affect every part of the Arctic environment and have significant impacts on society.

Weather-Climate Research seeks to understand the relationship between sub-seasonal tropical variability and changes in the frequency, location and intensity of extreme weather events over the U.S. An example is El Niño, during which shifts in the Pacific storm track affect the paths of storms approaching the U.S. west coast, and influence weather across the entire country.Observational and modeling efforts document the pattern of variations in tropical rainfall on weekly to monthly time scales as well as air-sea interactions in both tropical systems and in mid-latitude oceanic and land-falling storms. An improved historical reanalysis dataset will substantially reduce uncertainty in historical climate variations and improve the analysis and detection of interannual-to-decadal variability and trends in weather and climate in the 20th century. OAR climate attribution research will enable NOAA to better interpret causes of observed climate variability, which is crucial for meeting the climate information needs of policy-makers on regional climate issues, including major droughts, floods, prolonged warm or cold conditions, climate trends and extremes, and multi-decadal variability. Weather-Climate Research activities culminate in transferring research and observational advances into operational practices at NWS/NCEP Climate Prediction Center.

The Climate Modeling Center will enable the Geophysical Fluid Dynamics Laboratory to take the national lead in the systematic production of model-based products developed in consultation with stakeholders to document, understand, and assess the impacts of climate variability and change on the U.S. Continued development and refinement of computational models capable of simulating past and future conditions of the Earth system are crucial to develop capabilities to provide more accurate projections of future change.

Aerosol-Climate Interactions, Clouds & Climate Change research focuses on attaining a better understanding of the absorption and scattering of radiation by aerosols (fine airborne particles) and the associated heating and cooling roles in the climate system. Aerosols and tropospheric ozone play unique, but poorly quantified roles in the atmospheric radiation budget. The goals of research are to: (1) establish new and augment existing in-situ monitoring sites, in and down wind of major population areas (e.g., Asia, Eastern North America, and South America) to determine temporal and spatial

distributions, trends, and aerosol chemical and radiative properties and (2) develop integrated models used to study regional patterns, evaluate our understanding of source and sink processes, and project future distributions. In collaboration with NPOESS, the program will evaluate and advance the development of algorithms and establish the appropriate in-situ measurements for the calibration and validation of the NPOESS data. In addition, this research will address the development of better decision-support tools that will improve the linkage between sources of emissions of compounds that directly or indirectly contribute to climate-relevant aerosols, which impact climate radiative forcing.

B. Observing Systems

The **Office of Climate Observation (OCO)** is responsible for establishing and maintaining the sustained global ocean observing system necessary for climate research and prediction as well as the long-term monitoring system necessary for climate change detection and attribution. NOAA's ocean climate contributions provide the major U.S. contribution to the Global Component of the U.S. Integrated Ocean Observing System. All of NOAA's contributions to the global ocean observing system are managed internationally in cooperation with the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (WMO: World Meteorological Organization. IOC: Intergovernmental Oceanographic Commission of the United Nations Educational, Science, and Cultural Organization). This international observation network is based on a set of core observations (e.g., temperature, surface wind stress, salinity, sea level, CO2), consisting of both in situ and remotely sensed measurements that have been identified in national and international reports as needed to satisfy research and operational climate requirements. In 2006, the global ocean observing system reached 53 percent completion. Initial investments in the ocean observing system include:

- ***Argo Floats:*** These floats, together with satellites, will initiate the oceanic equivalent of today's operational observing system for the global atmosphere. Fourteen nations plus the European Union currently provide floats.

- ***Surface Drifting Buoys*****:** Sea surface temperature is the single most important ocean parameter for the global heat, water, and carbon cycles. A global array of 1,250 surface drifting buoys is maintained by NOAA and 14 international partners to calibrate satellite observations and reduce errors in global measurement. The Buoys also measure surface currents globally and provide critical sea surface data during hurricanes to help improve hurricane landfall projections.

- ***Tide Gauge Stations****:* Sea level rise is one of the most immediate impacts of climate change. NOAA, in cooperation with 64 nations, is implementing the Global Climate Observing System (GCOS) sea level reference network of 170 tide gauge stations. The stations report in near-real-time and are also used for the tsunami warning system and other marine services.

- ***Tropical Moored Buoys****:* The Earth's tropics are the ocean's major capacity for heat exchange with the atmosphere. The Pacific El Niño influences global climate and weather. Together with international partners, NOAA is working to instrument all three tropical oceans – the Pacific, Atlantic, and Indian Ocean.

- ***Ocean Reference Stations:*** NOAA, in cooperation with the National Science Foundation and international partners, has implemented a sparse global network of ocean reference station moorings, expanding three pilot stations to a permanent network of 16 by 2010. These stations have provided decadal-to-centennial documentation of changes in ocean properties and are designed to improve seasonal-to-interannual forecasting by providing calibration/validation data for remote sensing of surface flux fields. This network also monitors ocean transports to identify changes in circulation that could provide possible indications of abrupt climate change.

- ***Ships of Opportunity (SOOP):*** The global atmospheric and oceanic data from ships of opportunity have contributed to the understanding of long-term changes in marine climate and are essential input to climate and weather forecast models.

- ***Ocean Carbon:*** Projecting decadal to centennial global climate change is closely linked to assumptions about feedback effects between the ocean and atmosphere related to sequestering of carbon in the ocean and additional input of carbon dioxide into the atmosphere. NOAA, in cooperation with the National Science Foundation and international partners is implementing an ongoing ocean carbon inventory surveying the globe once every ten years and will be supplemented by autonomous carbon dioxide sampling instruments added to the moored arrays .

- ***Arctic Ocean Fluxes:*** Over at least the past 20 years, significant changes have been noted in the Arctic, such as thawing of permafrost, earlier break-up of ice on rivers, and thinning of the ice cover on the Arctic Ocean. NOAA is joining with other Federal agencies and international collaborators to begin a long-term effort to quantify the flux of fresh water from the Arctic to the North Atlantic. The initial steps will be made through deployment of moorings at critical locations in the Arctic.

- ***Dedicated Ships:*** Ocean research vessels from NOAA and university partners are essential elements of the support infrastructure necessary to sustain the ocean observing system. The dedicated ships provide: (1) the highest quality reference data sets, (2) the platforms for the ocean carbon surveys, and (3) platforms for deployment of the moored and drifting buoys and Argo floats.

- ***Data Management, Data Assimilation and Analysis:*** A robust and scalable Data Management and Communications (DMAC) infrastructure is essential to the vision of a sustained ocean observing system. Standards and protocols are essential to enable interoperability across all global and coastal ocean observing systems. Data must be retained and made available for analyses and for assimilation into models to understand and forecast climate change, and for efficiently managing observing system operations and improvements. The advancement of assimilation techniques and the scientific analysis of ocean data are also important components of the observing system.

Base activities support the objective, “Advance understanding and predict changes in the Earth’s environment to meet America’s economic, social, and environmental needs” under the Department of Commerce Strategic Goal of “Observe, protect, and manage the Earth's resources to promote environmental needs."

Baseline Observatories (previously funded under CO&S). These funds are used to maintain and expand operations at NOAA's manned Global Atmospheric Baseline Observatories, which measure up to 250 different atmospheric parameters relevant to the study of climate change and ozone depletion at: Barrow, Alaska; Mauna Loa, Hawaii (since 1957); Cape Matatula, American Samoa; and South Pole, Antarctica (also since 1957), and for operations at NOAA's Baseline Air Quality station at Trinidad Head, California. These observations are critical to the collection and continuity of the world's longest atmospheric data time series, supplying information on: (1) the state and recovery of the ozone layer, (2) global carbon dioxide and other trace gases impacting the global climate, and (3) the quality of the air entering the west coast of the U.S. These data are used for assessments of atmospheric change that are valuable for environmental policy.

Carbon Cycle Atmospheric Observing System and other carbon cycle/carbon monitoring activities (previously funded under both CO&S and CCRI). The U.S. scientific community coordinates its carbon cycle activities through an integrated interagency effort that aims to quantify, understand, and project the evolution of global carbon sources and sinks in order to better predict future climate. As part of this multi-agency effort, NOAA has launched a network of airborne and tall-tower based sampling sites over North America. This sampling program will complement local-scale process research managed by other agencies and provide an estimate of the magnitude of regional terrestrial sinks on a continental scale. This monitoring program will provide decision-makers, resource managers, and the American public with solid, quantitative information on the role of the U.S. as a source and a sink for carbon. The information gathered will be useful for international negotiations and identifying regions where mitigation activities are most needed or would have the most impact. Similarly, projections of climate change and the scenarios used to inform assessments will be improved; and additional insight into the societal risks of climate change and human efforts to mitigate climate change will be derived. Recent advancements in the program include expansion of a pilot program using small aircraft and tall towers to profile carbon gases. With input from other agencies, this program forms the foundation for routine spatial carbon “maps” and periodic “State of the Carbon Cycle” reports that will keep scientists and policy-makers abreast of progress in understanding the North American carbon cycle.

PROPOSED LEGISLATION:

None.

SUMMARIZED FINANCIAL DATA
(Dollars in thousands)

Subactivity: Climate Research	FY 2006 ACTUALS	FY 2007 CURRENTLY AVAILABLE	FY 2008 BASE PROGRAM	FY 2008 ESTIMATE	INCREASE / DECREASE
Line Item: Competitive Research Program					
Competitive Research Program	110,090	130,000	126,049	133,302	7,253
TOTAL	110,090	130,000	126,049	133,302	7,253
FTE	99	102	102	102	-

Note: The dollars in this table represent budget authority.

PROGRAM CHANGES FOR FY 2008:

Water Vapor Process Research (+0 FTE and +$880,000): NOAA is requesting 0 FTE and $880,000 to initiate and enhance measurements of water vapor in the lower-atmosphere (mid and upper troposphere) to elucidate its role in altering forcing by greenhouse gases, aerosols, and clouds. It will also undertake efforts to understand the processes that lead to the current distributions and lay the foundation for future prediction of water vapor distributions.

Statement of Need:
Water vapor has the potential to contribute to global climate change because it: (1) accounts for most of the greenhouse effect, (2) amplifies the greenhouse warming capability ascribed to CO2 and other greenhouse gases, (3) enhances the ability of aerosols to induce climate change, (4) plays a crucial role in aerosol-cloud interactions, (5) alters the concentrations of other greenhouse gases, and (6) is a key component for calculating climate feedbacks. Yet, the distribution of water vapor in the mid-to-upper troposphere and the lower stratosphere are poorly mapped out for climate purposes. Our ability to model the processes that control water vapor is also poor and, hence, not well-represented in models. The sources of water vapor changes in the lower stratosphere are increases in methane and possible changes in transport. Changes in the upper troposphere are not clear. This is a big issue because small perturbations locally by emissions, for example from aircraft, can make large changes in cirrus clouds. The changes come about because of land use change and many other factors. The amount of anthropogenic water vapor forcing will be published as part of the Intergovernmental Panel on Climate Change (IPCC) report and is roughly one-tenth that of CO2. The exact numbers and uncertainties in the IPCC report will be released at the end of February 2007. The "direct forcing" is small, but non-negligible relative to the indirect forcing. The amount of water from hydrogen fuel is unknown until the amount of hydrogen usage is known. This needs to be evaluated before climate gains can be determined.

It is essential to first measure accurately the water vapor abundances and its distribution, understand the processes that control this distribution, and develop the capability to predict the future levels of water vapor. This program change request takes the first step towards rectifying this deficiency.

Water vapor issues cut across goals and organizations within NOAA, and span many other national and international (e.g., World Climate Research Program's (WCRP) Stratospheric Processes and their Role in Climate (SPARC) and Global Energy and Water Experiment (GEWEX) projects) research efforts. NOAA is uniquely placed to address an important sub-set of the many needed efforts because of the technical expertise in measuring water vapor, the ability to deploy instruments on NOAA aircraft, and the scientific expertise to elucidate the processes. Further, we can reduce costs because these measurements can be carried out during currently on-going NOAA missions (e.g., G-IV flights as a part of the Winter Storm Program, the field studies using WP-3 and Twin Otter aircraft). This effort would be complemented by the work of others in NOAA to acquire long-time series of in-situ data using the Global Hawk, high spatial and temporal data from satellites, and long-time series measurements from reference net works.

Proposed Actions and Deliverables:

Instrument development and deployment ($500,000)

- Develop some key instrumentation to measure water vapor in-situ and with varying altitude. Specifically, it involves developing a water vapor LIDAR, which is a type of radar known as a laser radar and improving hygrometers, which are instruments used for measuring relative humidity.
- Measure water vapor abundance using sondes (including drop sondes), LIDARs, hygrometers (frost-point and Lyman-alpha), satellite sensors, and other methods. The aim is to (a) measure water at reference radiosonde stations and elsewhere, (b) provide climate quality data (e.g., for long time trends) at select sites, and (c) develop instruments with quantified accuracy to identify what is the best standard for widespread measurements.
- Maintain and operate reference water stations that obtain water vapor vertical profiles using sondes for long-term trends.
- Gather extensive in-situ data in the upper troposphere and lower stratosphere using platforms such as the Global Hawk and WB-57, measure vertical distributions using LIDAR onboard aircraft such as NOAA's G-IV, WP-3 and Twin Otter, and measure from satellite, and compare these observations with radiosondes. Radiosondes have a long history and are archived but only at a few locations. The other platforms provide larger coverage, some with better vertical resolution than others. Together, these observations will provide inter-calibrated data that could be extended in time, if data assimilation is carried out.

Impact analysis and assessments ($380,000)

- Develop and improve models designed to provide a predictive understanding of the physical processes affecting water vapor concentration in the mid-to-upper troposphere and lower stratosphere; the end result will be the ability to assess how future changes in water vapor impacts mid-upper tropospheric/lower stratospheric temperature which has major implications for future global climate change.
- Assess the role of water vapor in affecting the potential impacts of greenhouse gases, aerosols, and clouds on global climate.

Schedule of Key Milestones:

FY2008:

- Initiate acquisition of components.
- Complete installation of LIDAR and make hygrometers ready.

FY2009:

- Initiate intercomparison studies.

FY2010:

- Complete analysis of intercomparison studies.

FY2011:

- Analyze and develop process understanding of water vapor distributions and incorporation of this data in radiative forcing calculations.

FY2012:

- Complete implementation of water vapor distribution in models and calculation of influence of water vapor in future predictions.

Benefits:

The NOAA water vapor process research will allow more accurate estimation of the ability for water vapor to affect global climate through changes in water vapor concentrations and its interaction with other greenhouse gases. Specifically, it clarifies how much the surface temperature will change for a given change in a greenhouse gas. This research will allow NOAA to more accurately quantify the influence and better understand the role of water vapor on climate change.

Outcomes:

- A data set in the mid- and upper-troposphere for use by Climate and Earth System modelers;
- A better understanding of the processes that control water vapor and hence better representation of these processes in models;
- A better quantification of the forcing by other agents such as aerosols and ozone;
- Improved evaluation of the role of various climate forcing agents and their connection to surface temperature changes;
- Provide some data needed Weather and Water goal.

Performance Goals & Measurement Data:

This increase will support the objective, "Advance understanding and predict changes in the Earth's environment to meet America's economic, social, and environmental needs" under the Department of Commerce strategic goal of "Observe, protect, and manage the Earth's resources to promote environmental needs." Specifically, water vapor process research will allow more accurate estimation of water vapor distributions in the atmosphere for improved models and climate predictions.

Performance Goal*: Climate*	FY05 Baseline	FY06	FY07	FY08	FY09	FY10	FY11	FY12
Performance Measure ***with*** Adjustment: Better prediction of influence of water vapor on forcing by aerosols and other forcing agents, including water vapor	0%	0%	0%	0%	0%	25%	30%	40%
Performance Measure ***without*** Adjustment	0%	0%	0%	0%	0%	0%	0%	0%

* Lead time for implementation of developments and improvements expected to be realized beginning in FY10.

NIDIS: Improving NOAA Climate Forecasts (+0 FTE and +$1,065,000): NOAA is requesting 0 FTE and $1,065,000 to develop and transition research advances in drought monitoring and prediction into enhanced NOAA climate forecasts and application products.

Statement of Need:
NOAA has identified a significant demand for a concentrated research effort that assesses the nation's vulnerability to drought based on experiences with stakeholders in drought-affected regions and recent reports on drought and stakeholder needs. Specifically, NOAA needs to work with stakeholders to develop products to support drought planning and communicating climate impact information that are tailored to specific regional needs. In response to this demand and a request from the Western Governors' Association (WGA), NOAA has taken the lead on the development and implementation of a National Intergrated Drought Information System (NIDIS) in partnership with other federal, regional and state organizations. This initiative will implement a critical component of the NIDIS Drought Early Warning System (DEWS) through the delivery of enhanced drought information products for risk management. The DEWS includes 1) a real-time drought monitoring system based on NCEP operational global and regional analyses of atmosphere, ocean, and land surface conditions, 2) a state-of-the-art seasonal drought forecasting system based in part on the next generation NCEP fully coupled Climate Forecast System, and 3) an interactive drought information delivery system for drought monitoring and prediction products – including an internet portal for forecasts, data, GIS products, etc. (see complimentary NIDIS narrative under Climate Data & Information). The latter will be a collaborative effort with the Climate Prediction Center (CPC) and the National Drought Mitigation Center to provide real-time drought monitoring and forecast products and develop interactive drought maps. These efforts will directly support the development of next generation U.S. Drought Monitor and U.S. Seasonal Drought Outlook products, while contributing to improvements in the skill of the official U.S. 6-10 day, 8-14 day, monthly and seasonal precipitation and temperature forecast products. This work will also draw on and contribute to other components of NIDIS including coordinated monitoring, forecast, and impacts research, and improved dissemination and feedback. Additional activities to develop and transition research advances in drought monitoring and

prediction that support NIDIS will include drought monitoring and drought prediction on time scales from a week to a year with multiple land-surface hydrologic models, execution of high resolution land models for snowpack and runoff simulations, implementation of localized seasonal drought prediction products, and generation of a long-term 25-30 year North American land surface dataset.

This initiative will address two critical elements of NOAA climate forecast operations and services: (a) **improving** NOAA's operational intraseasonal to seasonal drought and climate forecast capability by utilizing ensembles of multiple state-of-the-art coupled climate models to better quantify forecast uncertainties and reduce forecast errors, and (b) **increasing** the scope and applicability of NOAA's operational climate forecasts by developing new and improved drought forecast products to meet the needs of decision makers. These model and forecast improvements will enable businesses, academia, and government agencies to minimize the impacts of drought**.**

FY 2008 Proposed Actions and Deliverables:

A. Competitive Transition Projects ($615,000)
Initiate a number of transition projects through competitive grants aimed at: (1) assessing, testing and transitioning state-of-the-art coupled climate forecast models developed at various U.S. institutions towards an operational multi-model ensemble forecast system; (2) developing and evaluating new drought monitoring and forecast products for a wide range of national, regional and sectoral applications in support of drought prediction and NIDIS, water resource management, agriculture applications, wild fire risk outlooks; and (3) providing the broader climate research community with enhanced access to models and data sets to enable collaborative research for improved understanding and attribution of drought and accelerating future improvements of NOAA operational climate forecast and application products..

B. Visiting Scientist Program ($250,000)
Supporting a visiting scientist program at NOAA's National Centers for Environmental Prediction for testing and transitioning models, data sets, analysis methods, etc. to NOAA climate forecast operations.

C. Infrastructure ($200,000)
Provide management and contractors for scientific, technical and logistic support for transition activities.

Schedule of Key Milestones:

FY2008:
- Establish System Support Team
- Establish Visiting Scientist Program
- Initiate Competitive Transition Projects Announcement of Opportunity

FY2009:
- Implement state-of-the-art land surface model in NCEP's operational Coupled Forecast System
- Implement operational drought monitoring and seasonal drought prediction capability for NIDIS

FY2010:
- Implement DEWS for NIDIS
- Tailor, QC, provide and archive special products for the climate community, including GEWEX and CLIVAR projects.
- Upgrade operational drought monitoring and seasonal drought prediction capability for NIDIS using multiple models via uncoupled North American Land Data Assimilation System (NLDAS).

FY2011:
- Implement retrospective and realtime Global Land Data Assimilation (GLDAS) with new land surface model for land-state initial conditions and next-generation NCEP global reanalysis
- Implement downscaled seasonal drought prediction for NIDIS via Regional Climate Models (RCMs)

FY2012:
- Upgrade land surface model physics and physical parameters
- Demonstrate improved seasonal prediction skill of NCEP Climate Forecast System (CFS) via land component

Benefits:
This initiative will strengthen cooperative partnerships between NOAA operational centers and the broader research community by providing an operational testing environment to accelerate the transition of research advances into improved NOAA operational climate forecasts and increase the scope and applicability of operational forecasts for the external user community.

Outcomes:
- A DEWS as an integral component of NIDIS for real-time drought monitoring, seasonal drought forecasting, and interactive drought information delivery of drought monitoring and prediction products;
- New and improved data sets and components for operational models;
- New and improved methods to provide more accurate intraseasonal and interannual climate forecasts;
- New and improved climate forecast products for use in decision making (e.g., energy, agriculture, water resources, health, human dimensions);

- Greater understanding of operational model strengths/weaknesses via assessment and detailed analyses of model diagnostics;
- Improved use of climate observations for enhanced operational climate forecast and application products; and
- Evaluation and refined requirements for observing systems.

Performance Goals & Measurement Data:
This increase will support the objective, "Advance understanding and predict changes in the Earth's environment to meet America's economic, social, and environmental needs" under the Department of Commerce strategic goal, "Observe, protect, and manage the Earth's resources to promote environmental needs." This investment will address two critical elements of NOAA's climate forecast operations and services by improving NOAA's operational intraseasonal to seasonal drought and climate forecast capability and by increasing the scope and applicability of NOAA's operational climate forecasts.

Performance Goal*: Climate*	FY05 Baseline	FY06	FY07	FY08*	FY09	FY10	FY11	FY12
Performance Measure ***with*** Adjustment Improvement in climate predictive skill over a range of time scales	0	18	19	19	21	22	23	24
Performance Measure ***without*** Adjustment	0	18	19	19	20	21	21	22

* Lead time for implementation of developments and improvements expected to be realized beginning in FY2010.

<u>Ocean Research Priorities Plan: Assessing Atlantic Meridional Overturning Circulation Variability - Implications for Rapid Climate Change (+0 FTE and +$5,000,000)</u>: NOAA is requesting 0 FTE and $5,000,000 as part of an interagency effort with NASA and NSF to improve understanding of the mechanisms behind fluctuations of the Atlantic Meridional Overturning Circulation (MOC) and the impact of those fluctuations. This research activity will lead to new capabilities for monitoring and making predictions of MOC changes (an abrupt change early warning system), assessing the risks of rapid climate changes, and identifying impacts of these changes on the ocean, climate, extreme weather events, regional sea level changes, ecosystems, and carbon budgets.

Statement of Need:
In 2000, Congress tasked the U.S. Commission on Ocean Policy to investigate and provide recommendations for a "coordinated and comprehensive national ocean policy," which led to the development of the U.S. Ocean Action Plan. This funding supports one of the four NOAA lead near-term priorities identified by the Joint Subcommittee on Ocean Science and Technology (JSOST) Ocean Research Priorities Plan.

Decadal variability in the Atlantic has been linked to the recent upswing in Atlantic hurricane seasons, persistent droughts in surrounding continental areas, and enhanced warming in the Arctic. None of these changes was anticipated and, if they persist, would require significant adaptation. A pragmatic definition of abrupt or rapid climate change is changes on decadal or multidecadal timescales to which human or natural systems have difficulty in adapting. Hence rapid climate change could be going on right now, and we might no be aware of it. This decadal variability is partly linked to changes in the Atlantic Meridional Overturning Circulation, an element of the global scale ocean circulation responsible for long-term climate variations. Atlantic Meridional Overturning Circulation refers to the process through which the warm, saline surface water from the North Atlantic Subtropical Gyre flows northward and eventually begins to sink into the deep ocean as its density increases due to cooling. MOC changes are thought to play a key role in the abrupt changes evident in the paleoclimate record.

Given current limited understanding of the MOC, fundamental research to describe the MOC, its variability, and critical process, and the ability to model these will be an early and ongoing emphasis of the proposed program. In an effort to address the impact of MOC fluctuations on regional and global climate and ecosystems, NOAA, NASA, and NSF will develop observing, nowcasting (short–term weather forecasting) and forecasting capabilities for the MOC and improve understanding of the physical mechanisms behind fluctuations in the MOC and the potential for prediction of those fluctuations.

This research effort is founded on federal and international initiatives to understand and forecast this large-scale ocean phenomenon and its potential for global impacts. The coordinated activities will be able to expand upon existing collaboration with international partners, such as the UK RAPID program and the European Union DAMOCLES program. The U.S. has a rare opportunity to leverage UK and EU observing and modeling capabilities in pursuit of answers to critical questions by implementing a complementary, not duplicate, program, as well as to take advantage of an unprecedented suite of ocean remote sensing satellites that can contribute to the focused MOC research program. In addition, activities will be established to engage the end-user communities to assess the impacts of decadal climate variability on their decision-making processes and to identify future product suites that would provide needed information.

NOAA's involvement in research, modeling and forecasting make it an appropriate partner for this interagency research effort. As an operational agency, whose strengths are in observing and prediction capabilities after a research phase, NOAA would assume the responsibilities for routine monitoring for decadal and abrupt changes and production of the operational decadal predictions. NSF's primary focus is on research and NASA on the demonstration of satellite technologies as applied to this problem.

Proposed Actions and Deliverables:

Conduct Fundamental Research: Current understanding of the MOC is limited; research to describe the MOC, its variability, and critical processes is fundamental. ($2,500,000)

- Conduct research on the origins, dynamics, and structure of MOC variability and trends.
- Conduct research on the potential for climate and process thresholds and feedbacks, which might accelerate changes.
- Conduct potential predictability studies utilizing statistical and dynamical approaches.

Develop Nowcasting Capabilities and Experimental Products: New nowcasting and forecasting capabilities are dependent on appropriate ocean observing systems, data assimilation systems that combine the observations with models results, ocean models that incorporate both observations and process mechanics. These capabilities are critical to predicting the current MOC state, changes on a decadal scale, and assessing the potential for abrupt changes ($1,750,000)

- Develop ocean data assimilation, targeted model parameterization, and capability for observing system design experiments. Develop and implement required high-resolution ocean and ice models. Implement routine ocean data assimilation (analysis - now casting) capability. Establish program of systematic observing system simulation studies to establish future observations required for MOC monitoring and prediction.
- Conduct experimental decadal predictability studies (joint with CCSP). Establish a routine program of decadal predictions of the MOC and related phenomena.

Assess Potential Impacts of Rapid MOC Changes: The combined capabilities of observations, modeling, analyses, and nowcasting will enable the assessment and forecasting of potential impacts of decadal and rapid changes on ecosystems, carbon budgets, regional sea level changes, regional climate and socioeconomic systems.($750,000)

- Conduct simulation studies of impacts of MOC changes on extreme events and global climate (joint with CCSP). Extend research and modeling studies to impacts of MOC variability on ecosystems, fisheries, carbon budgets and suggestions of the required observing systems.
- Establish research program to establish the socioeconomic impacts of rapid and decadal climate change

Schedule of Key Milestones:

	Conduct Fundamental Research	Develop Nowcasting Capabilities and Experimental Products	Assess Potential Impacts of Rapid MOC Changes
FY2008	Establish Interagency Project Office Establish program of research grants	Implement program of ocean data assimilation development for MOC	Establish socio-economic impacts project
FY2009		Deliver last 15 years of ocean analyses related to the MOC	
FY2010	Report of interpretation of last 15 years of MOC related analyses	Deliver report on observing system simulation experiments for MOC arrays designs	Report on assessment of MOC changes on regional climate and extremes
FY2011	Report of methodology for assessing risks of rapid climate change Report of interpretation of last 55 years of MOC related analyses	International workshop to establish design of MOC observing system Deliver last 55 years of ocean analyses related to the MOC	Report of socio-economic impacts of MOC variations and rapid climate changes
FY2012		Implement routine nowcasting capability for MOC Implement prototype system for decadal outlooks for MOC variations	Report on assessment of MOC impacts on ecosystems and carbon cycle

Benefits:
NOAA's research component is an important aspect of the interagency research effort to increase understanding and prediction of the MOC. Through these efforts a comprehensive observation and monitoring program for the MOC will be designed and implemented as part of the attempt to nowcast and forecast fluctuations in the MOC and their associated impacts.

Outcomes:

- Documentation and understanding of MOC changes during the last 15 years (a period intensely observed) and the past 55 years based on ocean reanalyses and attribution studies
- A modeling, observing, and data assimilation framework for routine monitoring of the Atlantic, and to a lesser extent, the global ocean for decadal and rapid changes
- An objective design for the ocean observing system required to monitor for MOC changes
- Robust and credible assessments of risks of MOC changes to regional climate and extremes and rapid climate changes
- Assessment of the socio-economic benefits of MOC monitoring and prediction
- Reduced uncertainty in MOC projects based on prototype decadal forecast systems

Performance Goals & Measurement Data:

This increase will support the one of the four near-term priorities outlined in the draft implementation plan developed by the NSTC, one of the immediate and long-term actions specified in the US Ocean Action Plan. It will also support the CCSP objective to assess abrupt changes in a warming world.

Performance Goal*: Climate*	FY07 Baseline	FY08	FY09	FY10	FY11	FY12
Performance Measure ***with*** Adjustment: Major milestones completed toward the goal of prediction of MOC changes and impacts (milestones per year). Accomplishment of these requires a supporting program of 10-15 grants per year.	0	4	1	3	5	3
Performance Measure ***without*** Adjustment	0	0	0	0	0	0

<u>Analysis of Unmanned Aircraft Systems (UAS) Data from the Arctic Test Base - (Climate Program Office) (+0 FTE, +$308,000):</u> NOAA requests 0 FTE and $308,000 to provide focused application of data from Unmanned Aircraft Systems (UAS) to be deployed from the Arctic Test Base. The UAS platforms will be deployed as part of NOAA's Weather Research, Science and Technology Infusion Acceleration program to address critical weather and

climate observation gaps in regions important to the U.S., *e.g.* the Central Pacific Ocean and the Arctic. The funds requested here will provide the ability to analyze UAS data from the Arctic Test Base in an international context, thereby multiplying the value of the UAS data. Also funds will be used to purchase additional sondes for use in the Arctic to improve density of data collected. This initiative will be closely coordinated with the UAS activities under the Weather Research Program.

Statement of Need

The well-documented recent changes in the Arctic climate and the influence of Arctic climate processes on the northern hemisphere make this a pressing issue. This initiative will provide a focused means for analyzing novel UAS-derived Arctic data and blending it with relevant data from international sources as part of the International Polar Year (IPY). The analytical approaches developed during the IPY will be continued over the longer term to provide climate-relevant analysis and application.

Proposed Actions

NOAA will plan deployment strategies from the Arctic Test Base, conduct analysis of UAS data, and build integrated data sets for broader, Arctic-wide analysis. Reports from these analyses will be published in scientific literature and made available for future assessments and modeling activities on climate change in the Arctic. After the initial data analysis, consideration will be given to acquiring additional sondes or sensors to complement those provided under Weather Research to improve the ability of the UAS to provide climate-relevant data from the Arctic Test Base.

Benefits

NOAA believes that deployment of UAS from the Arctic Test Base will provide a significant new type of data to complement that available from satellites and infrequent ship-based observations of the Arctic atmosphere. The analyses to be conducted under this initiative will also demonstrate the utility of UAS in climate observations in the Arctic, and the value of these observations in improving the output from global and regional climate models and forecasts.

Performance Goals and Measurement Data

Performance Goal: Climate		**FY06**	**FY07**	**FY08**	**FY09**	**FY10**
Performance Measure: Updates to State of the Arctic Report Based on UAS Data	Annual	0	0	0	1	1
Performance Measure: Updates to NOAA Global Climate Model Based in UAS Data	Annual	0	0	0	1	1

In addition, these activities will support improvements to other NOAA services, such as weather forecasting performance measures by providing improved observing capabilities, improved scientific understanding, and input for numerical weather models.

Subactivity: Climate Research
Line Item: Climate Operations

GOAL STATEMENT:

The goal of NOAA's Climate Operations is to provide accurate and timely climate information/forecasts to best serve the public and private sector. The goal will be achieved via improved climate forecasts on timescales from subseasonal through interannual and beyond.

BASE DESCRIPTION:

Seasonal and interannual climate variability impact life and property on local, regional, and global scales. Since societal impacts from climate variability and change extend down to sub-seasonal time scales, connections between climate and extreme weather events must be identified. The establishment of climate/weather links will improve the forecast timing and location of extreme weather events thereby minimizing their impacts on the lives and property of U.S. inhabitants. Activities funded under Climate Operations include Operational Forecasts. This is a primary mission of NOAA to provide improved forecasts on subseasonal through interannual timescales and beyond. This will be achieved by improving model performance, developing new forecast designs, and upgrading existing datasets. The end-result will be the ability to produce and disseminate operational forecast products to private industry and the public resulting in the preservation of life and property.

Base activities support the objective, "Advance understanding and predict changes in the Earth's environment to meet America's economic, social, and environmental needs" under the Department of Commerce Strategic Goal of "observe, protect and manage the Earth's resources to promote environmental needs."

Under the new FY 2007 OAR budget structure, the Climate Operations line item remains as defined in the FY 2006 budget, including operational climate activities funded under former CO&S lines: Regional Assessments Education and Outreach, Climate Data and Information, and Weather-Climate Connection.

PROPOSED LEGISLATION:

None.

SUMMARIZED FINANCIAL DATA
(Dollars in thousands)

Subactivity: Climate Research	FY 2006 ACTUALS	FY 2007 CURRENTLY AVAILABLE	FY 2008 BASE PROGRAM	FY 2008 ESTIMATE	INCREASE / DECREASE
Line Item: Climate Operations					
Climate Operations	363	867	886	886	-
TOTAL	363	867	886	886	-
FTE	-	-	-	-	-

Note: The dollars in this table represent budget authority.

PROGRAM CHANGES FOR FY 2008:

None.

Subactivity: Climate Research
Line Item: Climate Data & Information

GOAL STATEMENT:

NOAA's Climate Data and Information Program manages the Nation's resource of global climatological in-situ and remotely sensed data and information to promote global environmental stewardship; to describe, monitor and assess the climate; and to support efforts to predict changes in the Earth's environment. This effort requires the cooperation of national and international meteorological services for the acquisition, quality control, processing, summarization, dissemination, and preservation of a vast array of climatological data.

BASE DESCRIPTION:

The primary goal of climate observing networks is to assemble, develop, and communicate data and information about the trends and predictions of climate and weather events to public and private sector decision makers (e.g., energy, agriculture, state and local officials). To accomplish this goal, NOAA must develop the required infrastructure which addresses: (1) improving access and data management activities with, large-volume climate databases supplied by satellite and ground-based instruments; (2) implementation of operational updates to NOAA's long-term ocean and atmospheric reference data sets; and (3) improving the performance of the observational network consisting of the U.S. Surface Hourly, Upper-Air, and Buoy Networks. The following activities are funded under the Climate Data and Information line item:

- The **U.S. Climate Reference Network** (USCRN) (previously funded under CO&S) provides baseline, high-quality surface observations of air temperature and precipitation to detect long-term changes in climate through a robust climate record. The Climate Reference Network is an integral component of NOAA's plans for IOOS and contributes to the integrated GEOSS. USCRN observations will provide benchmark measurements for an improved national climate and weather monitoring network. CRN data already serve over 100,000 users each year from government, academia, and the private sector. Full implementation of the network of reference stations will fulfill the ultimate goal of routinely explaining at least 95% of national annual average precipitation variance and 98% of national annual average temperature variance for the contiguous U.S. The network is currently 52% complete (58 commissioned out of 110 planned stations); full implementation of the network is slated for 2009.

- **Data and Information Products**: The improvement in the quality and integrity of observed datasets is fundamental to our Nation's and the global climate and weather monitoring programs. Early detection and remediation of network problems that can adversely affect the quality of data records and diminish our ability to evaluate climate variability and change will be provided through NOAA's Observing System Monitoring Program. This will alert Observing System Managers in near real time to problems that in the past have been discovered long after the data became part of the historical archive, and thus too late to take immediate corrective action.

- **Global Climate Atmospheric Observing System:** The Climate Data and Information line item remains as defined in the FY 2006 budget with one additional change. In addition to climate activities funded under former CO&S lines: Regional Assessments Education and Outreach, Climate Data and Information, and Climate Reference Network, the Climate Data and Information line item now includes the Global Climate Atmospheric Observing System.

PROPOSED LEGISLATION:

None.

SUMMARIZED FINANCIAL DATA
(Dollars in thousands)

Subactivity: Climate Research	FY 2006 ACTUALS	FY 2007 CURRENTLY AVAILABLE	FY 2008 BASE PROGRAM	FY 2008 ESTIMATE	INCREASE / DECREASE
Line Item: Climate Data & Information					
Climate Data & Information	2,401	6,133	6,266	8,266	2,000
TOTAL	2,401	6,133	6,266	8,266	2,000
FTE	4	3	3	3	-

Note: Note: The dollars in this table represent budget authority.

PROGRAM CHANGES FOR FY 2008:

NIDIS Implementation: U.S. Drought Portal and Soil Moisture Sensors (+0 FTEs and +$3,300,000): NOAA requests $3,300,000 and 0 FTEs to: (1) establish the U.S. Drought Portal (USDP) on an expedited basis to provide user-friendly access to historical and real-time data and products from National Integrated Drought Information System (NIDIS) partners, and (2) install soil moisture and temperature sensors at an accelerated rate at U.S. Climate Reference Network stations (USCRN), consistent with the U.S. Global Earth Observations Near-Term Opportunity (NTO) NIDIS Implementation Plan.

Statement of Need:
The National Drought Policy Commission reported in 2000 that the US needed to improve collaboration among scientists and managers to enhance the effectiveness of observation networks, monitoring, prediction, information delivery, and applied research and to foster public understanding of and preparedness to drought.

Persistent periods of drought have a cumulative effect on humans and society with significant impacts on the economies of the affected regions and the U.S. The Federal Emergency Management Agency estimates the annual direct losses to the U.S. due to drought is $6-8 billion, the highest average annual cost of any natural disaster. This is on par with losses due to shorter-term weather fluctuations, such as tornadoes and hurricanes which are more apparent. Recent evidence points to the possibility that U.S. droughts may intensify and over the next 10 years. During the next 10-25 years scientists believe the U.S. may experience more frequent droughts which last longer than current droughts, and may cover a larger portion of the U.S. (Bulletin of the American Meteorological Society (AMS), 1998, Vol 29, No. 12).

Drought is a multifaceted, natural disaster that occurs on time-scales of months through years to decades, and beyond. There is a need to provide the capability to assemble and provide efficient access to observations and assessments related to monitoring and evaluating drought conditions and trends at the regional and national levels. NOAA will establish and maintain a “Drought Portal” that will improve the access and sharing of drought related data and

information among all users regionally, locally, and nationally. This system was authorized on December 22, 2006 in P.L. 109-430, the National Integrated Drought Information System Act of 2006.

The number and location of ground based observing stations equipped with soil moisture and temperature sensors is inadequate for drought monitoring purposes. This deficiency particularly impacts agribusiness. The installation of soil moisture sensors to existing observational monitoring climate networks is required to turn long-term climatology into information useful to agricultural and other drought risk sensitive business sectors. Current inadequacies, such as the lack of soil sensors, prevent drought experts from quickly and accurately analyzing drought conditions in the U.S. Drought Monitor, as well as forecasts related to agricultural and water management operational plans and longer term future annual, inter-annual, and even decadal policies.

The following list includes drivers for the creation of the NIDIS Drought Portal and installation of soil moisture sensors:

- Creating a Drought Early Warning System, for the 21st Century: The NIDIS 2004, Western Governors' Association.
- White House Science and Technology Council, Committee on Environment and Natural Resources, Subcommittee on Disaster Reduction. 2005.
- Grand Challenges for Disaster Reduction.
- National Drought Preparedness Act of 2005.
- U.S. GEO. 2005. Near-Term Opportunity Implementation Plan for NIDIS.
- Global Earth Observing System of Systems.
- National Drought Policy Commission Report, 2000, Preparing for Drought in the 21st Century.
- National Integrated Drought Information Systems Act of 2006.

Proposed Actions:

A. U.S. Drought Portal ($2,150,000).

- NOAA will establish the USDP in FY 2008 the *programmatic* and *information technology* infrastructure that will support the NIDIS vision to be a dynamic and accessible drought information system that provides users with the ability to determine the risk of drought and its associated impacts, while also providing them with needed decision support tools. The USDP goals are to support the ability to graph relevant data and products spatially and temporally, and interactively compose maps, allow users to arrange and save selected products for a specific geographic area for easy return visits, and support links to specific decision support systems describing drought conditions at county, state, regional, and national scales.

The USDP will:

- Provide user-friendly, internet navigation from national to county levels;

- Be populated with historical and real-time drought data and products from a variety of partners; and
- Support easy to understand interpretations of relevant drought products designed for the lay person.

Examples of products to be included in the USDP are:

- Observed elements at multiple time and spatial scales, as both station and gridded datasets: precipitation, snow pack, stream flows, reservoir levels, ground water, crop moisture, soil moisture, temperature, anomalies, and drought impacts.
- Derived products and indexes: U.S. Drought Monitor, Palmer Drought Severity Index (PDSI), Standardized Precipitation Index (SPI), Objective Blends, Surface Water Supply Index (SWSI), Vegetation Drought Response Index (VegDRI), and the Keetch-Bryam Fire Index.
- Forecast products: water supply, stream flow, climate, snow pack, and U.S. Drought Outlook.
- Educational products: Information that educates the user on what data are used to construct specific products, uncertainty in the observations, indexes, and forecasts.

Schedule

FY2008 activities include establishing, operating, maintaining, and maturing the portal capability and capacity. Development activities include:

- Portal Software and Hardware Deployment: Establish portal environment using "drought.gov" domain in compliance with IT security and management standards. ($950,000)

- Portal Incorporation of Drought Resources: Inclusion of core data sets and linking to drought-related data resources using portlets and other web-based applications. ($350,000)

- Portal Design and Mapping Capabilities: Assure robust Geographic Information System (GIS) capabilities and incorporate professionally designed graphical elements in collaboration with partner resources. ($350,000)

- USDP Project Management and Education and Outreach development. ($200,000)

- Help Desk within the NIDIS Operations Center. ($300,000)

B. Soil Moisture Sensors ($1,150,000)

Measurements of soil moisture are one of the most critical parameters for evaluating and understanding the state of drought throughout the country. Today, only one small national network of stations measuring soil moisture exists, the Soil Climate Analysis Network (SCAN) consisting of 111 stations in 38

states. Although all sites provide automatic reports of observations on a daily basis, the total number of SCAN sites is not sufficient to monitor and evaluate soil conditions across most regions or nationally.

The plan will double the number of soil moisture/soil temperature monitoring points across the U.S. by installing reference-quality soil moisture and temperature sensors at each USCRN station across the contiguous 48 states during the period FY 2008-2012, inclusive. The number of USCRN stations currently commissioned is 79 and there are plans to commission an additional 12 stations in FY 2008. The increase in FY 2008 funding will be directed toward installing as many soil sensor suites as possible in FY 2008, thus accelerating the completion of soil sensor suites at all 114 USCRN stations. The remainder of the USCRN stations not yet installed and commissioned should be completed no later than FY 2009, for a network total of 114 USCRN stations.

In conjunction with the use of the U.S. Drought Portal, significant improvements in data availability and access to climate- related parameters, such as soil moisture and temperature can be realized by the deployment of these sensors. Several factors support the selection of the USCRN as the network of choice for enhancing soil moisture capacity throughout the U.S.:

- The USCRN network is well established and designed to provide the highest quality long-term record of climate conditions coupled with real-time access to current conditions, while being specifically engineered for easy augmentation with new sensors.
- The existing observing and data management infrastructure is well suited to supporting the addition of extremely precise, highly calibrated soil moisture and soil temperature sensors at the lowest possible cost of initial investment and life cycle operations and management costs.
- Monitoring of the performance of the USCRN individual sensors, each integrated station and the network as a whole is conducted on a daily basis to identify any anomalies and deterioration of sensor and/or station performance. The health of the network (HON) monitoring system automatically initiates maintenance actions to correct failing components.
- Each USCRN station footprint (60 x 60 feet) has sufficient area set aside for expansion instrumentation to be installed.
- Each USCRN station has an operational Site License Agreement that enables additional instrumentation to be placed at each station.
- The USCRN maintenance program, which was designed to ensure the continued accuracy and reliability of every CRN station, will guarantee the continued integrity of the soil moisture and temperature measurements throughout the network's 50+ year lifetime.

Benefits:
The enhanced network of point-based soil measurements will reveal large-scale soil moisture patterns. In addition to supporting drought monitoring, preparedness, and response, the increased number of observations of soil moisture will benefit climate forecasting and modeling, reservoir management, irrigation scheduling, crop yield forecasting, contribute to independent verification and validation (IV&V) and calibration of satellite based sensors and measurements as well as maximizes the value and utility of satellite measurements, and minimizes the number of point ground based sensors over large areas because high confidence in the satellite measurements.

Proposed Actions:

US Drought Portal

FY 2008

- Establish, operate, and maintain (update/improve) U.S. Drought Portal (USDP).
- Mapping capabilities incorporated.
- Advanced communities of users capability established.

FY 2009

- Steady increase in volume of data and comprehensive information products delivered through the USDP.

Soil Moisture Sensors

FY 2008

- Install 60 soil suites.

FY 2010

- Complete installation of soil moisture and soil temperature sensors at all USCRN sites (114 stations planned).
- Number of soil and temperature sensor stations will increase from the 111 SCAN stations to include 114 USCRN stations for a total of 225 sampling points.

Performance Goals and Measurement Data:

Performance Goal*: Climate*	FY05 Baseline	FY06	FY07	FY08*	FY09	FY10	FY11	FY12
Performance Measure ***with*** Adjustment Number of drought monitoring products/tools provided to regional, state and local users (Cumulative total number)				5	10	11	13	15
Performance Measure ***without*** Adjustment	0	0	0	3	9	9	12	14
Performance Measure ***with*** Adjustment Number of soil moisture and temperature sensors suites installed and operational at	0	0	0	60	87	114	-	-

USCRN stations with real-time reporting. (**Cumulative Total Number**)								
Performance Measure ***without*** Adjustment				12	30	51	72	93 (114 by 2013)

U.S. Global Climate Observing System (+0 FTE, -$1,300,000): NOAA requests a decrease of 0 FTE and -$1,300,000 from the FY 2007 base funding level for Climate Data & Information, specifically in the U.S. Global Climate Observing System (GCOS) project.

The GCOS project contributes to NOAA's development of Effective Strategic Partnerships and Integrated Information Services. U.S. GCOS works with other national and international entities to provide the comprehensive, high-quality observing system needed to support climate assessments and forecasts. Specifically, U.S. GCOS is a key driver supporting a sustained global infrastructure of complementary *in-situ* data management and access subsystems to accurately document the global state of Earth's climate system, necessary for more reliable climate predictions and projections.

The request will reduce FY 2008 funding for GCOS from $2,743,000 in the FY 2007 President's Budget to $1,443,000. This will be due to the following adjustments in the observing system:

- Suspend support for: Global Atmosphere Watch's Quality Assurance/Science Applications Center for the Americas for Precipitation Chemistry Data (-$300,000), the GCOS portion of NOAA's Central UV Calibration Facility (CUCF) (-$50,000), and radiosondes for 4 GCOS Upper Air Network (GUAN) sites in developing nations (-$350,000).
- Eliminate planned installation of one new GUAN reference site (-$150,000) and 2 new GCOS Surface Network reference sites (-$150,000).
- Reduce support for GCOS Secretariat's Operations (-$300,000).

Subactivity: Climate Research
Line Item: Other Partnership Programs

GOAL STATEMENT:

The strength of NOAA Research is that it does not operate in isolation but rather in partnership with a multitude of external experts in its fields of research. These partnerships extend to other parts of NOAA; other Federal, state, and local government entities; universities; and industry. The contribution of the unique strengths of each partner greatly enhances the accomplishments of NOAA Research.

BASE DESCRIPTION:

Other Partnership Programs contains various programs appropriated by Congress. NOAA Research manages these programs in a manner that leverages their objectives in concert with NOAA's mission responsibilities and requirements.

PROPOSED LEGISLATION:

None.

SUMMARIZED FINANCIAL DATA
(Dollars in thousands)

Subactivity: Climate Research	FY 2006 ACTUALS	FY 2007 CURRENTLY AVAILABLE	FY 2008 BASE PROGRAM	FY 2008 ESTIMATE	INCREASE / DECREASE
Line Item: Other Partnership Programs					
East Tennessee Ozone Study	291	-	-	-	-
Climate System Research Center	740	-	-	-	-
Univ of AL Huntsville Climate Research	979	-	-	-	-
Abrupt Climate Change Research	247	-	-	-	-
Drought Research Study	986	-	-	-	-
Coastal Vulnerability to Climate Change	1,480	-	-	-	-
Center for Urban Environmental Research	986	-	-	-	-
Advanced Study Institute for Environmental Prediction	1,479	-	-	-	-
TOTAL	7,188	-	-	-	-
FTE	-	-	-	-	-

PROGRAM CHANGES FOR FY 2008:

None.

Subactivity: Weather and Air Quality Research
Line Item: Laboratories & Cooperative Institutes

GOAL STATEMENT:

NOAA's Weather and Air Quality Research Programs work towards fulfilling of two goals: (1) to provide the Nation with more accurate and timely warnings and forecasts of: (a) weather events, particularly high-impact weather events that disrupt economic productivity and cause loss of life and property, and (b) air quality, particularly ozone and aerosols (particulate matter) that impact human health, and (2) to provide the scientific basis to develop public policy for air quality.

BASE DESCRIPTION:

The Weather and Air Quality Research objectives for the laboratories and cooperative institutes are to provide theoretical frameworks, remote sensing technologies, and scientific understanding to: (1) develop and assess new, cost-effective atmospheric observing systems; (2) develop data acquisition, management, analysis, and display systems; (3) develop and verify numerical models and other techniques to provide prediction guidance for all types of weather, particularly high-impact events; and (4) transfer research results to both aid the research and policy communities and improve operational warnings and forecasts. Included in the four activities are: daily and extreme weather forecasts; air quality forecasts; and crosscuts of weather, air quality, and climate change.

Improved forecasts and warnings require more frequent and higher-density observations, faster communications, and better local data-handling systems. NOAA has implemented a major capital investment that substantially upgrades its ability to collect weather data. In support of this modernization effort, research is needed to improve the spatial and temporal resolution of remote observations of the atmosphere and to integrate the resulting data into descriptions of the atmosphere for use in weather forecasting research and operations. The primary research activities currently include:

- Development of dual-polarization, phased-array, and multi-frequency Doppler radars and passive radiometers to study convective storms, in order to improve rainfall estimates, to detect damaging winds and tornadoes;
- Improvement of short-range (1-12 hour) forecasting by the development and evaluation of new local data system technologies and techniques;
- Incorporation of satellite-observed wind profile data into forecast models to determine whether the accuracy of weather forecasts is improved;
- Application of current wind-profiler radar technology to coastal environments, using both land-based and buoy-mounted systems will allow better characterization of coastal weather and improve short-term forecasts of hazardous events;
- Development of airborne radiometric and optical instruments designed to map ocean color and salinity along coastal waterways and in the open ocean. Airborne instruments address this fundamental gap in current observational technology (between in-situ buoy-mounted instruments and the low spatial and temporal resolution of satellite-borne instruments) by virtue of their ability to map relatively broad ocean regions with high

spatial resolution and a temporal resolution governed by the frequency of the flights. Ocean color provides information about the onset and dissipation of harmful algal blooms. Salinity maps can be used to identify and estimate the strength of ocean circulation drivers.

- Transition hurricane model and forecast decision aide improvements to operations;
- Development and transition to operational use air quality forecasting capabilities to include additional key pollutants (e.g., particulate matter) and extend forecast lead times;
- Identification and policy-relevant explanation of key atmospheric causes of serious air pollution problems;
- Accelerate improvements in medium range (3-14 day) numerical weather prediction and;
- Development of improved atmospheric profiling systems to continuously measure vertical profiles of wind speed and direction, temperature, and humidity using ground and satellite-based remote sensing;
- Development of advanced light detecting and ranging systems and infrared Doppler multi-frequency radars as research tools to improve our knowledge of atmospheric winds, turbulence, aerosols, and moisture processes.

Base activities support the objective, "Advance understanding and predict changes in the Earth's environment to meet America's economic, social, and environmental needs" under the Department of Commerce Strategic Goal of "Observe, protect, and manage the Earth's resources to promote environmental needs."

PROPOSED LEGISLATION:

None.

SUMMARIZED FINANCIAL DATA
(Dollars in thousands)

Subactivity: Weather and Air Quality Research	FY 2006 ACTUALS	FY 2007 CURRENTLY AVAILABLE	FY 2008 BASE PROGRAM	FY 2008 ESTIMATE	INCREASE / DECREASE
Line Item: Laboratories & Cooperative Institutes					
Laboratories & Cooperative Institutes	35,258	36,000	39,198	44,198	5,000
NOAA Joint Institute for Northern Gulf of Mexico	2,959	-	-	-	-
TOTAL	38,217	36,000	39,198	44,198	5,000
FTE	178	182	182	185	3

Note: The dollars in this table represent budget authority.

PROGRAM CHANGES FOR FY 2008:

Unmanned Aircraft Systems (UAS) - (Earth Systems Research Laboratory, Boulder, CO) (+3 FTE, +$3,000,000): NOAA requests an increase of 3 FTE (4 positions) and $3,000,000 to implement an end-to-end initiative to accelerate the research and development, and transition of innovative new observational platforms and forecast tools to advance NOAA's Earth-system product, service, and information enterprise. Specifically, NOAA will develop, test, and evaluate UAS platforms, payloads, and applications to determine their role in filling critical observational gaps in order to improve NOAA's environmental monitoring and prediction capabilities. UAS platforms are part of a larger Weather Research Science, Technology and Infusion Acceleration program effort. These platforms help NOAA by addressing our Nation's water resources information needs. This UAS initiative advances the development of observing systems and 21st century forecast tools and accelerates their infusion into the operational environment. UAS platforms represent a collaborative effort of several organizations within NOAA, including NOAA laboratories, NOAA National Weather Service, NOAA National Ocean Service, NOAA Marine and Aircraft Operations, and NOAA Cooperative Institutes. This initiative is linked closely to the needs of multiple Federal, state, and local agencies.

Statement of Need

NOAA's Strategic Plan and Mission include observing, describing, and predicting changes in the Earth system as a means of informing and protecting the public and managing our Nation's resources. A specific example of this mission is the need to meet long standing challenges in weather forecasting and climate monitoring, including the need for accurate predictions of precipitation and associated storms. As a first step in this goal and to support improvements in other research and operations areas, this effort will focus on the development and testing of UAS platforms, payloads, and applications to determine their future role in helping achieve NOAA mission objectives by filling current critical observational gaps. A key initial strategy is the establishment of regional UAS test bases and associated research campaigns.

Proposed Actions
NOAA will carry out demonstration missions using currently available UAS platforms, including those in the class known as High-Altitude Long-Endurance (HALE), which have the most potential to improve NOAA's ability to carry out its diverse missions. These platforms must be large enough to carry remote sensors and durable enough to reach remote areas. NOAA will lease existing aircraft suitable for top priority applications and develop associated diagnostic and forecasting tools to use the new UAS-acquired data. The missions will develop and integrate the necessary sensors, plan and conduct field tests, analyze results, and explore the elements required to operate and maintain UASs in the future. A range of operating conditions and applications will be chosen for testing and evaluating diverse applications.

NOAA will conduct field tests for at least four applications in FY 2008, including at least one using a HALE-class UAS. They will focus on data collection over large remote areas, e.g., the Central Pacific Ocean and/or the Arctic, and will document phenomena that connect weather and climate, including hurricanes and the atmospheric water budget. The hurricane tests will address both operational surveillance needs and scientific research requirements. In the Central Pacific, we face important data gaps that hinder both weather and climate monitoring, including the key role of atmospheric rivers in global and regional water vapor transport. Understanding water vapor transport will lead to better predictions of such climate hazards as winter flooding and such key seasonal conditions as snow pack in the western U.S. The Arctic is important because key changes there influence climate and weather, and is the focus of the International Polar Year. The UAS tests will aid NOAA in scientific discovery and assessment of data gaps impeding monitoring and prediction, and will provide the foundational experience to perform a Cost and Operational Effectiveness (CORE) analysis that will inform NOAA of the potential value of implementing an operational UAS capability. (The risk of platform loss in adverse weather will be addressed in any potential lease agreements so as to avoid a potentially open-ended liability.)

The following table summarizes the spending plan and specific activities associated with this increase, including 50% for contracts, 25% for Federal staff-related costs, and 25% for other objects, such as equipment:

UAS Spending plan				
Task / Positions	**Level**	**Type**	**Cost $K**	**Notes**
Planning and management	Senior	Fed	300,000	1 position; Coordinates plans across NOAA; interacts and coordinates with external partners.
Major Field Tests	Mid	Contract	1,000,000	2 positions; Develops and coordinates platform and field deployment costs through contractors.
Sensors	Mid	Fed	550,000	1 position; Develops, integrates, and operates sensors; includes funds for sensor development materials.
Applications tool development	Mid	Fed	250,000	1 position; Develops and tests new diagnostic and forecasts tools/processes.
Analysis of tests	Mid	Fed and Contract	900,000	2 positions; Fed leads evaluation of test results; coordinates test analyses among technologists, scientists, and forecasters; contractor does analysis

Total			**3,000,000**	4 Federal positions, 3 contractors; balance of 50% internal NOAA capability/capacity building and 50% contracts

Benefits

Much like the advent of radar in the 1940s and satellites in the 1960s/'70s, the development of UAS in the 1990s (initially to meet military requirements) has the potential to revolutionize our ability to monitor the global environment by filling critical information gaps over expansive, remote reaches of the oceans and poles. This project explores key potential civilian applications, providing the critical experience needed to guide NOAA's decisions regarding major future investments in this technology. This project will also help strengthen U.S. scientific and technical leadership, thereby enhancing our global competitiveness. UAS is a technology whose time has come for civilian application. NOAA, in partnership with NASA, DOE and other agencies, is poised to develop major applications of this technology that will help our economy through improved environmental monitoring and prediction as well as strengthened scientific and technical capability. Specific applications that will be explored through this FY 2008 investment include:

Climate: The proposed UAS project will test two important climate issues: (1) Climate models show that the upper atmosphere over the Arctic Ocean should have warmed by 3° F by late in the current decade. Existing measurements taken at different spatial locations do not allow comparison of temperatures at the same location over time. By dropping sondes at locations chosen during the International Polar Year, we can address this important question of whether or not the models are right. (2) Similarly, the change of water vapor in the upper and lower atmosphere over the tropics is crucial to evaluating climate models. The proposed Pacific test will measure water vapor with higher accuracy and denser spatial specificity than has been possible in the past and will test the ability of UASs to monitor atmospheric rivers, which currently are poorly observed but yet are believed to be crucial to both the global water budget and weather prediction.

Weather Research: The potential for UAS to aid in hurricane reconnaissance and research will be evaluated. The central Pacific UAS project will test the ability of UAS to fill gaps in satellite data that currently limit our ability to monitor water vapor transport over the ocean.

Fisheries Enforcement: Over parts of both Alaska and Hawaii, NOAA will test new concepts of fisheries enforcement using advanced sensors on UAS platforms.

Coastal Zone Studies: NOAA will test and evaluate UAS applications in Marine Sanctuaries for monitoring whale migrations and other phenomena occurring over extensive areas that currently cannot be monitored using manned ships or aircraft.

Performance Goals and Measurement Data

Performance Goal: Weather & Water		FY05	FY06	FY07	FY10
Performance Measure: Flash Flood Warning	Lead-Time in minutes	48	48	49	50
	Accuracy in percent	89	90	90	91
Performance Measure: Winter Storm Warning Lead-Time and Accuracy	Lead-Time in hours	15	15	15	17
	Accuracy in percent	90	90	90	92

These activities support improvements to these and other NOAA National Weather Service weather forecasting performance measures and climate research by providing improved observing capabilities, improved scientific understanding, and input for numerical weather and climate prediction models.

Hurricane Intensity Research (+0 FTE and +$2,000,000): NOAA is requesting 0 FTE and $2,000,000 to improve NOAA's ability to forecast hurricane intensity.

Statement of Need:
The impact and risks from hurricanes have been clearly illustrated during the past several years. In addition to the significant loss of life, hurricanes have very large economic impacts. Although coastal watershed counties account for only a quarter of the Nation's total land area, they contain half of the Nation's population and economic output, and are among the most prone to flooding. Further, the H. John Heinz III Center for Science, Economics and the Environment has reported that coastal storms account for 71% of recent U.S. disaster losses, including Katrina ($40.0 billion insured losses), Rita ($4.7 billion), and Wilma ($6.1 billion).

Although NOAA's forecasts of hurricane path have improved significantly over the past decade and increased lead-time from three to five days, hurricane intensity forecasts have improved only slightly. For instance, the rapid changes in intensity by hurricanes Katrina, Rita, and Wilma in 2005 were not well forecast. Obviously, better predictions of hurricane intensity would be crucial information for emergency managers, allowing them to initiate appropriate risk mitigation actions.

Limited scientific understanding of the factors underlying the physical processes within hurricanes constrains our ability to forecast accurate changes in intensity. For instance, although we know that ocean-atmosphere exchanges of heat, moisture, and momentum critically influence hurricane intensity, our

existing simulations do not model these processes with a high degree of reliability due to extreme conditions that are poorly represented in studies in more calm conditions. Key to success are better measurements of the interface between the atmosphere and ocean, which in hurricanes is characterized by very high waves,and strong winds lifting up a tremendous volume of water droplets from the surface. Depsite such difficulties, NOAA must collect measurements in actual hurricane conditions to improve our understanding of these physical processes during extreme conditions and use that information to improve the numerical simulation models of hurricanes and improve hurricane intensity forecasts.

In addition to physical and modeling research, we also need to research better ways to communicate hurricane risks to emergency managers and the public. As more accurate predictions become available, we need to determine what types of information about hurricane strength (*e.g.*, maxiumum wind speed, breadth of strong winds, etc.) will enable people to make appropriate decisions. Sound social science research can help maximize the value of this information for decision-makers and the public.

FY 2008 Proposed Actions:

NOAA will expand its efforts to understand the physical processes that contribute to hurricane intensity and changes in storm structure. The Hurricane Research Division of NOAA's Atlantic Oceanographic and Meteorological Laboratory in Miami, FL, will partner with other NOAA labs and organizations to develop and demonstrate methods to significantly improve hurricane intensity forecasts by:

- Filling key gaps in existing observations of hurricane processes that affect intensity changes. NOAA will take advanced observations of air-sea interactions from buoys along likely hurricane tracks and will also use land-based instruments to measure wind structures and turbulence as hurricanes reach shore. Obviously, these instruments will be designed and constructed to collect information in extreme conditions.

- Analyzing and integrating existing observations (including measurements from airborne Doppler radar and from satellites) with the new observations to understand the factors that drive hurricane intensity. NOAA will synthesize and incorporate these new insights into numerical models and will confirm that they lead to more accurate simulations of hurricanes.

- Improve the societal value of hurricane intensity research by focusing on those measures (e.g., peak wind speed, the breadth of the region of high winds, etc.) that best convey critical information to users in ways that can be accurately interpreted. This research should lead to new methods for communicating information about hazards. Ensuring that predictions align with how people use information will help emergency managers and the public better understand the hazards that threaten them so they can respond effectively.

Schedule of Key Milestones:

- Use advanced models and new high-quality specialized observations to assess operational numerical model guidance.
- Each year, evaluate current operational as well as advanced research model performance to ascertain the impacts of quality, quantity, sampling strategy, and type of observations.
- Each year, use evaluations to advise operational centers, focusing primarily on augmented field collection efforts (2009 through 2011).

Proposed Program	FY08	FY09	FY10	FY11	FY12
Diagnostic Study Results (Storms)	3	4	4	3	4
New&Updated Algorithms for HWRF	0	1	2	1	2
Quality controlled datasets (Storms)	3	4	4	4	3
WP-3 Sea spray 0.3-mm Doppler Radar	Integrate Install	Flight tests	Deploy 2 storms	Deploy 4 storms	Deploy 4 storms
Land-based hardened wind sensors	Design & Test prototype	Field trials	Acquire Deploy 2	Acquire Deploy 2	Acquire Deploy 2
WP-3 GPS-based storm surge sensor	Deploy research unit	Deploy research unit	Design Acquire prototype	Deploy prototype	Deploy prototype
Buoy-based hardened turbulence sensors	Design & Test prototype	Field trials	Acquire Deploy 2	Acquire Deploy 2	Acquire Deploy 1

Benefits:

These activities will significantly improve NOAA's ability to forecast hurricane intensity and provide better and more usable information for emergency managers and the public to decide how to respond to approaching storms. These activities address key objectives of NOAA's operational hurricane forecasters in addition to opening new lines of attack on the hurricane intensity problem, laying the basis for ongoing improvements in forecast accuracy in future years.

Outcomes:

The proposed work will contribute to a number of societal outcomes, including the following:

- Communities will experience fewer deaths and injuries and reduced property damage by using improved forecasts to guide mitigation efforts.
- Communities will ensure well orchestrated and proactive planning, preparedness, and response/recovery through improved access to timely and reliable weather and water information.
- The global competitiveness of the Nation's commerce and industry will be enhanced by reducing costs associated with weather and water conditions and related uncertainties.

Performance Goals & Measurement Data:
This increase will support the objective, "Advance understanding and predict changes in the Earth's environment to meet America's economic, social, and environmental needs" under the Department of Commerce strategic goal, "Observe, protect, and manage the Earth's resources to promote environmental needs." The key performance measure will be based on improvement in the official TPC/NHHC 48-hr hurricane intensity forecast (the FY 2005 RMS error was 15.8 kts).

Performance Goal*: Weather and Water*	FY05 Baseline	FY06	FY07	FY08*	FY09	FY10	FY11	FY12
Performance Measure ***with*** Adjustment (Cumulative 48-hr improvement, kts)	0	0.15	0.30	0.45	.60	1.0	1.4	1.8
Performance Measure ***without*** Adjustment (Historical cumulative 48-hr improvement, kts)	0	0.15	0.30	0.45	0.60	0.75	0.90	1.05

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Subactivity: Weather and Air Quality Research
Line Item: Weather & Air Quality Research Programs

GOAL STATEMENT:

The strength of NOAA Research is that it operates in partnership with a multitude of external experts in its fields of research. These partnerships extend to other parts of NOAA; other Federal, state, and local government entities; universities; and industry. The contribution of the unique strengths of each partner greatly enhances the accomplishments of NOAA Research.

BASE DESCRIPTION:

Tornado/Severe Storm Research (Phased-Array Radar): NOAA is developing new technologies for forecasting and detecting tornadoes and other forms of severe weather and to disseminate this information to emergency managers, the media, and the general public. Phased-array radar has the potential to significantly extend lead times for tornadoes and other forms of severe and hazardous weather. Faster scan rates can reduce the time it takes to make a complete Doppler radar observation from six minutes to less than one minute. Coupled with artificial-intelligence-based decision-support systems, tornado lead times could be almost doubled from 12 to 22 minutes.

Major components of this program are continued research support and the construction of and experimentation with a phased-array research testbed at the National Severe Storms Laboratory (NSSL) in Norman, OK. Congress established a joint R&D program for NOAA, DOD, and FAA to investigate the feasibility and benefits of using military phased- array radars for improving severe weather forecast and warning systems. U.S. Navy SPY-1 Phased-Array Radar technology holds considerable promise for making significant improvements to the existing WSR-88D system. Using multiple beams and frequencies, The SPY-1 Phased-Array Radar reduces the scan time for severe weather from six minutes to less than one minute, which can lead to increased lead times for warnings of tornadoes and other forms of hazardous weather. NOAA/NSSL is designated to operate and maintain the equipment, provide facilities, approve associated research, and otherwise assist in all related efforts.

Base activities support the objective, “Advance understanding and predict changes in the Earth’s environment to meet America’s economic, social, and environmental needs” under the Department of Commerce Strategic Goal of “Observe, protect, and manage the Earth's resources to promote environmental needs.”

PROPOSED LEGISLATION:

None.

SUMMARIZED FINANCIAL DATA
(Dollars in thousands)

Subactivity: Weather and Air Quality Research	FY 2006 ACTUALS	FY 2007 CURRENTLY AVAILABLE	FY 2008 BASE PROGRAM	FY 2008 ESTIMATE	INCREASE / DECREASE
Line Item: Weather & Air Quality Research Programs					
Tornado Severe Storm Research / Phased Array Radar	3,945	3,000	2,972	2,972	-
Coordinate NASA-NOAA Severe Storm R&D	1,972	-	-	-	-
TOTAL	5,917	3,000	2,972	2,972	-
FTE	2	2	2	2	-

Note: The dollars in this table represent budget authority.

PROGRAM CHANGES FOR FY 2008:

None.

Subactivity: Weather and Air Quality Research
Line Item: Other Partnership Programs

GOAL STATEMENT:

The strength of NOAA Research is that it operates in partnership with a multitude of external experts in its fields of research. These partnerships extend to other parts of NOAA; other Federal, state, and local government entities; universities; and industry. The contribution of the unique strengths of each partner greatly enhances the accomplishments of NOAA Research.

BASE DESCRIPTION:

The Other Partnership Programs line item contains various programs initiated by Congress. NOAA Research manages these programs in a manner that leverages their objectives consistent with key NOAA mission responsibilities and requirements.

PROPOSED LEGISLATION:

None.

SUMMARIZED FINANCIAL DATA
(Dollars in thousands)

Subactivity: Weather and Air Quality Research	FY 2006 ACTUALS	FY 2007 CURRENTLY AVAILABLE	FY 2008 BASE PROGRAM	FY 2008 ESTIMATE	INCREASE / DECREASE
Line Item: Other Partnership Programs					
New England Air Quality Study	2,924	-	-	-	-
NE Center for Atmospheric Science and Policy	1,480	-	-	-	-
Inst. For Study of Earth, Oceans & Space (AirMap - CCRC)	4,931	-	-	-	-
Risk Reduction in Water Forecasts (MSU)	1,972	-	-	-	-
Remote Sensing Research (ISU/BCAL)	493	-	-	-	-
STORM (U. of N. Iowa)	641	-	-	-	-
Central CA Air Quality Study	370	-	-	-	-
Great Plains Center for Atmosphere and Human Health	986	-	-	-	-
Urbanet	5,917	-	-	-	-
High Altitude Air Study	346	-	-	-	-
Reducing Wind-Induced Damages from Storms	986	-	-	-	-
Targeted Wind Sensing	1,966	-	-	-	-
TOTAL	23,012	-	-	-	-
FTE	-	-	-	-	-

Note: The dollars in this table represent budget authority.

PROGRAM CHANGES FOR FY 2008:

None.

Subactivity: Ocean, Coastal, and Great Lakes Research
Line Item: Laboratories & Cooperative Institutes

GOAL STATEMENT:

NOAA's Ocean, Coastal, and Great Lakes Research programs seek to improve the protection, restoration, and management of coastal and ocean resources through research and monitoring activities that support ecosystem-based management. These programs accomplish this goal by providing:

- Ecosystem research to analyze ecosystem management decisions and their outcomes;
- Integrated observing and data management systems;
- Outreach and education to improve public understanding and use of coastal and marine ecosystems;
- Partnerships for placed-based ecosystem approaches to management; and
- International diplomacy, negotiation, and partnerships.

BASE DESCRIPTION:

To be an effective steward of the ocean, coastal, and Great Lakes environments, NOAA relies on state-of-the-art research conducted at in-house laboratories and by external partners. The three OAR laboratories supporting the agency under this subactivity provide long-term research and scientific expertise to meet NOAA's stewardship mission. Three partnership programs also support this activity primarily through peer-reviewed proposals to the external research community. These labs and programs are the Atlantic Oceanographic and Meteorological Laboratory (Florida), Great Lakes Environmental Research Laboratory (Michigan), Pacific Marine Environmental Laboratory (Washington), the National Sea Grant College Program, the Ocean Exploration Program, and the National Undersea Research Program. Ocean, Coastal, and Great Lakes Research laboratories and programs are regularly evaluated by outside experts for quality and relevance to NOAA's management mission. High quality, peer-reviewed research is the basis of sound decision-making.

The primary objective for Ocean, Coastal, and Great Lakes Research is to protect and restore ocean, coastal, and Great Lakes resources. In support of this objective, NOAA Research has identified the following priority research areas:

- Ecosystem Observations - monitor coastal and ocean ecosystems.
- Ecosystem Research - activities in support of ecosystem modeling and forecasting, technology transfer, undersea research and exploration.
- Aquaculture - research and outreach efforts focusing on near shore and offshore systems development, genetics, physiology, endocrinology.
- Corals - health and monitoring activities.
- Coastal and Marine Resources - activities that support improved resource management decision-making.
- Habitat - invasive species research and outreach.

Benefits of our approach:

- NOAA is a science-based agency whose scientists have the expertise to conduct the highest quality research, subject to peer-review by outside experts.
- In-house experts provide objective answers and direction to managers and the public.
- Long-term (5-10 year), sustained research investment by NOAA labs and their academic partners leads to agency-specific technology and forecasting models that can not be achieved by either entity separately.

Base activities support NOAA's mission goal to "Protect, Restore, and Manage the Use of Coastal and Ocean Resources through an Ecosystem Approach to Management." In addition, they support the objective, "Enhance the conservation and management of coastal and marine resources to meet America's economic, social, and environmental needs" under the Department of Commerce Strategic Goal of "Observe, protect, and manage the Earth's resources to promote environmental stewardship."

PROPOSED LEGISLATION:

None.

SUMMARIZED FINANCIAL DATA
(Dollars in thousands)

Subactivity: Ocean, Coastal, and Great Lakes Research	FY 2006 ACTUALS	FY 2007 CURRENTLY AVAILABLE	FY 2008 BASE PROGRAM	FY 2008 ESTIMATE	INCREASE / DECREASE
Line Item: Laboratories & Cooperative Institutes					
Laboratories & Cooperative Institutes	22,637	19,000	20,185	20,185	-
TOTAL	22,637	19,000	20,185	20,185	-
FTE	123	119	119	119	-

Note: The dollars in this table represent budget authority.

PROGRAM CHANGES FOR FY 2008:

None.

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Subactivity: Ocean, Coastal, and Great Lakes Research
Line Item: National Sea Grant College Program

GOAL STATEMENT:

NOAA's National Sea Grant College Program seeks to:

- Conduct research to enable NOAA to tackle priority problems and opportunities identified by coastal residents and businesses and local, regional, state and Federal agencies;
- Transfer scientific research results to user groups such as natural resource managers and coastal business people;
- Provide training opportunities for K-12 teachers to bring the sciences into the classroom and for undergraduate and graduate students to be mentored by senior researchers; and
- Inform the public about marine and coastal issues through extension and communications projects.

BASE DESCRIPTION:

Sea Grant Network – NOAA's National Sea Grant College Program enhances the development, use, and conservation of the Nation's marine and Great Lakes resources through a network of Sea Grant Colleges that conduct education, training, and research in all fields of marine and Great Lakes study. The 30 state Sea Grant programs, located in every coastal and Great Lakes state and Puerto Rico, serve as the core of a dynamic national network of more than 300 participating institutions involving more than 3,000 scientists, engineers, outreach experts, educators and students. The Sea Grant network addresses key issues and opportunities in areas such as aquaculture, aquatic invasive species, coastal community development, estuarine research, fisheries management, coastal hazards, marine biotechnology, marine engineering, seafood safety and water quality. As a non-regulatory program, Sea Grant focuses on generating and disseminating science-based information to a wide range of groups. Some of these include: commercial and recreational fishermen, educators, fish farmers, state and local planning officials, port and harbor commissioners, seafood processors and retailers, and natural resource, water and environmental quality managers.

Sea Grant is developing a system of regional networks that allows for organizing multi-state responses to regional/ecosystem-level problems. This effort supports the U.S. Ocean Action Plan and a major Ocean Commission recommendation that NOAA move to a regional ecosystem management approach and develop research and information plans that identify priority actions to coordinate ocean and coastal activities in each region. Sea Grant will play a key role in NOAA's efforts by applying its resources to engage regional and local stakeholders through the 30 state Sea Grant programs. Sea Grant expects these regional plans to be completed by FY 2009. Once the plans are completed, Sea Grant will target research, education, extension, and outreach resources to support the priority actions identified in the plans. This new regional focus will enhance Sea Grant's ability to make a critical contribution to this NOAA effort.

Research – Sea Grant funds high-quality research that is responsive to user needs, leveraging university expertise to solve today's marine environmental problems. Each of the Sea Grant colleges conducts research to solve problems and explore new uses for the world's marine, Great Lakes and coastal resources. This work addresses priority problems and opportunities identified by coastal resource managers and users. As a national network of research institutions, Sea Grant leads the Nation's efforts in the emerging field of marine biotechnology, and is addressing critical medical, food and environmental concerns.

Education – For three decades, Sea Grant has provided national leadership to enhance marine literacy for grades K-12 and in the development of professionals who understand marine and aquatic science and research. Sea Grant programs offer programs such as summer in-service programs, newsletters, speakers and curriculum materials. By developing innovative science curricula and teacher training programs, and embracing new technologies to enhance learning and pique students' curiosity, Sea Grant helps students understand how relevant science is to their lives. At the university level, Sea Grant recruits and trains undergraduate and graduate students, and employs senior researchers who form a national brain trust for dealing with coastal economic and environmental challenges.

Outreach and Extension – One of Sea Grant's greatest strengths is its ability to help clients use knowledge and research results through a broad multidisciplinary approach to outreach. The results of Sea Grant research are communicated to users at all levels in various ways. Outreach education activities for the public and private sectors are conducted through NOAA and: (1) a *communications program* comprised of writers, editors and media specialists who create a variety of printed and electronic information products for many audiences, including the general public; and (2) an *extension program* consisting of an interactive network of about 300 specialists and field agents (mostly university-based), who transfer information and research results to the marine and aquatic community. The overall goal of extension education is to encourage individuals, groups and institutions to use science-based information.

Technology Transfer – Sea Grant advisory specialists and coastal field agents convey the needs of the marine communities to university scientists, and transfer research results to resource users and managers at the local level. Sea Grant communications specialists package and deliver research, outreach and educational information on a wide range of topics, from fishing vessel safety to coastal erosion, using the full spectrum of modern print, electronic and mass media. Sea Grant organizes and hosts hundreds of scientific and public conferences and workshops each year on topics including: zebra mussels and other invasive species, commercial fishing, seafood processing, aquaculture, autonomous underwater vehicles, and offshore structures.

Program Evaluation – Sea Grant has implemented a rigorous four-year external performance review process for its federally sponsored university-based state programs. Performance review teams are comprised of highly experienced, distinguished, and knowledgeable individuals. Performance is judged quantitatively using performance benchmarks, and metrics developed with the help of outside experts. Foremost among these benchmarks is a program's impact on mission and programmatic objectives including its connection with users of science-based information. Individual program performance is used to determine merit-based funding for each state program.

Benefits:

- Stable partnerships between NOAA and the Sea Grant institutions allow the Agency to address long-term programmatic goals and develop constituent relationships and local leadership nationwide.
- Local management ensures NOAA's investments flow to the highest local priorities, bringing the most appropriate university resources to bear on these problems.
- Sea Grant's extension and outreach infrastructure enables rapid transfer of objective information to users, timely identification of emerging issues and a forum to engage local constituencies in policy and priority setting.
- Sea Grant reaches millions of people through its communication, education and extension networks. In a world where public awareness and knowledge of the environment will be increasingly critical to public policy, Sea Grant capabilities play an important role to transfer objective information to a diverse, nationwide audience.
- Sea Grant plays a unique and important role advancing our national interest in marine resources. Together with the Office of Naval Research and the National Science Foundation, Sea Grant and other NOAA programs provide the only sustained federal contact and funding source for universities with marine research capabilities. Sea Grant provides a regional and national research focus while supporting marine and coastal resource research of immediate public importance and application. It is virtually the only source of funding in the United States for marine policy studies.
- By employing the expertise and skills of the network's universities, research institutions and programs, Sea Grant activities have spurred economic growth and cost savings, created new products and services, enhanced coastal and marine resource management, reduced the loss of life and property, and educated tens of thousands of K-12 and university students.

Base activities support NOAA's mission goal to "Protect, Restore, and Manage the Use of Coastal and Ocean Resources Through an Ecosystem Approach to Management." In addition, they support the objective, "Enhance the conservation and management of coastal and marine resources to meet America's economic, social, and environmental needs" under the Department of Commerce Strategic Goal of "Observe, protect, and manage the Earth's resources to promote environmental stewardship."

PROPOSED LEGISLATION:

None.

SUMMARIZED FINANCIAL DATA
(Dollars in thousands)

Subactivity: Ocean, Coastal, and Great Lakes Research	FY 2006 ACTUALS	FY 2007 CURRENTLY AVAILABLE	FY 2008 BASE PROGRAM	FY 2008 ESTIMATE	INCREASE / DECREASE
Line Item: National Sea Grant College Program					
National Sea Grant College Program Base (Base)	48,277	52,000	54,900	54,900	-
Aquatic Nuisance Species/Zebra Mussel Research	986	-	-	-	-
Gulf of Mexico Oyster Initiative	986	-	-	-	-
Oyster Disease Research	986	-	-	-	-
National Sea Grant Law Center	1,480	-	-	-	-
Fisheries Extension/Outreach Program (Sea Grant)	986	-	-	-	-
TOTAL	53,701	52,000	54,900	54,900	-
FTE	23	23	23	23	-

Note: The dollars in this table represent budget authority.

PROGRAM CHANGES FOR FY 2008:

None.

Subactivity: Ocean, Coastal, and Great Lakes Research
Line Item: Ocean Exploration and Research

GOAL STATEMENT:

NOAA seeks an investment in undersea exploration, science, and technology in the deep ocean and areas of special concern, such as the U.S. Exclusive Economic Zone (EEZ) and marine protected areas such as National Marine Sanctuaries (NMS). The NOAA Office of Ocean Exploration and Research (OER) will conduct multidisciplinary expeditions, document and disseminate the results, and engage partners in other federal agencies, academia, and industry to develop and apply the "tools of tomorrow" in order to increase the pace and efficiency of exploration. It is envisioned that OER will provide a strong foundation for building strategic connections between "discoveries" and future investments in research and management to increase our knowledge of the ocean realm to support NOAA's goal of Ecosystem Management. The activities undertaken seek to:

- Increase the pace of discovery in unknown and poorly known areas of the world's ocean;
- Provide data and information to promote effective ecosystem management;
- Foster stewardship of the ocean's resources;
- Develop appropriate technologies for undersea exploration and research;
- Develop innovative education & outreach efforts through partners.

BASE DESCRIPTION:

Under the direction of the Assistant Administrator for Oceanic and Atmospheric Research, an Office of Ocean Exploration and Research (OER) has been created from the former NOAA Undersea Research Program (NURP) and the Ocean Exploration (OE) Program. The new OER program will support a matrix of exploration, research, and advanced technology development efforts. The synergy of these efforts will expand the efficiency, pace, and scope of discovery and increased understanding through a robust program of advanced ocean technology development and applications. The new program will consist of the following functions:

Exploration – The scope of exploration includes visiting unknown areas of the ocean; returning to poorly known areas to refine our understanding of what resources and processes they contain; mapping the bathymetry and the physical, biological, geological, and chemical nature of the ocean habitat; discovery of living and non-living resources, and discovery and preservation of the world's cultural heritage. The outcomes from exploration will provide NOAA programs with information critical for their work and for making decisions, and will provide a framework for NOAA to consider future missions and investments. Exploration will provide the Nation with knowledge of the ocean, its resources, and its inhabitants, and will enhance our ability to describe and predict how the ocean and its interrelated ecosystems function.

Advanced Technology Development – The advanced undersea technology development program will identify and anticipate NOAA's priority undersea exploration and research technology needs and support development, testing, and transition of the solutions to these needs. It will address cutting-edge challenges to include those in the fields of AUV applications, ecosystem modeling, and undersea sampling and monitoring. Solutions may include new or innovative uses of existing hardware, procedures, or techniques. The program will approach this challenge comprehensively, ensuring that new technologies are tested, evaluated, and applied to furthering the Nation's undersea exploration objectives. Furthermore, the program will include activities to transition these technologies to meet other, at now unforeseen, needs.

Research – The scope of research supports both of the above functions and includes: (1) research necessary to translate discoveries to applications; and (2) research that is integral to the identification, development, testing, and transition of undersea technologies.

Undersea Operations – The merged organization will facilitate the deployment of undersea equipment to further its exploration, undersea technology development, and research missions, as well as supporting NOAA's scientific activities. This facilitation may include owning, leasing, or contracting assets. FY 2008 marks the first field season of the only federal vessel designed specifically for the purposes of ocean exploration. NOAA ship OKEANOS EXPLORER will support three primary missions: (1) deep water mapping to 6,000 meters; (2) exploring, filming, and sampling using a sophisticated dual system remotely operated vehicle (ROV); and (3) providing data and information, including video, real-time to shore-based stations using satellite technology. The ship will also be equipped to collect standard oceanographic observations. As designed, the ship will provide NOAA with the ability to explore little known areas of the oceans in a consistent, systematic manner, complementing – not replacing – the current projects and expeditions that OE supports through the annual proposal process.

Education and Outreach – OER's education component will enhance ocean science literacy through NOAA OER for K-16/formal and informal and the general public as it relates to discovery and understanding of new resources and ecosystem processes; mapping and characterizing key features and habitats; and identifying, developing and applying science tools to increase the pace, efficiency and scope of discovery and understanding of the ocean, coastal waters, and Great Lakes. The OER outreach component will communicate the excitement and importance of ocean exploration, research, and associated advanced technology development in ways that inform, educate and motivate individuals and organizations in general and targeted audiences. Ten percent of OER's budget will be dedicated to education and outreach initiatives.

Data Management – The OER data function will focus on meeting the data and information management needs of the other NOAA programs, partner agencies and institutions, the education community, and the general public. The scope of the OER data function will include the actions necessary to facilitate/support the following office activities: (1) management of proposal process documentation; (2) science and field operations planning; (3) project management and reporting; (4) product development; and (5) data dissemination.

The merged program will consist of a core headquarters capability, strengthened by extramural partnerships. These partnerships will augment the program through participation in specific functions defined above. These partners will be geographically distributed with a focus on serving NOAA regional needs.

Benefits:
NOAA's OER Program is a national and international program, providing the opportunity of discovery to scientists in academia, federal agencies, and commercial sector. No other dedicated source of funding or logistics exists for discovery-based ocean science. While the economic and social benefits of anticipated discovery are potentially significant, the promise of discovery is clear; wherever the program has looked, new discoveries and information are found. The OER program will combine the best of the two programs to provide capabilities in the mission areas of: ocean exploration and transitional research, undersea technology development, and undersea services. The program will support a variety of NOAA's needs such as:

- Access to tools and technologies currently unavailable through other NOAA programs;
- Greater knowledge of living marine resources, their habitats, and ecosystems enhances fisheries and ocean stewardship;
- Comprehensive site surveys and inventories inform NOAA's National Marine Sanctuaries management;
- Characterization of the EEZ improves habitat and marine resource management;
- Inventories our Nation's and other submerged cultural and historic resources are significantly increased; and
- Governance and scientific investigation in support of the international Census of Marine Life.

Base activities support NOAA's mission goal to "Protect, Restore, and Manage the Use of Coastal and Ocean Resources through an Ecosystem Approach to Management." In addition, they support the objective, "Enhance the conservation and management of coastal and marine resources to meet America's economic, social, and environmental needs" under the Department of Commerce Strategic Goal of "Observe, protect, and manage the Earth's resources to promote environmental stewardship."

PROPOSED LEGISLATION:

In FY 2005, the 109th Congress introduced two Bills: H.R. 3835 and S. 39 to support the National Ocean Exploration and Undersea Research programs within NOAA. In January 2007, the 110th Congress reintroduced S. 39.

SUMMARIZED FINANCIAL DATA
(Dollars in thousands)

Subactivity: Ocean, Coastal, and Great Lakes Research	FY 2006 ACTUALS	FY 2007 CURRENTLY AVAILABLE	FY 2008 BASE PROGRAM	FY 2008 ESTIMATE	INCREASE / DECREASE
Line Item: Ocean Exploration and Research					
Ocean Exploration and Research	23,276	16,000	19,763	27,763	8,000
TOTAL	23,276	16,000	19,763	27,763	8,000
FTE	17	17	17	17	-

Note: The dollars in this table represent budget authority.

PROGRAM CHANGES FOR FY 2008:

Ocean Exploration and Research (0 FTE, +$8,000,000): The NOAA budget includes an increase of 0 FTE and +$8,000,000 for its Ocean Exploration and Research program for the purpose exploring and defining the limits of the U.S. Extended Continental Shelf (ECS). One of the primary goals of the NOAA Ocean Exploration and Research Program is to map the physical, geological, biological, chemical, and archaeological aspects of the ocean to provide information to policy makers, regulators, commercial ventures, researchers, and educators. As such, the program supports interdisciplinary expeditions to map and assess unknown and poorly known ocean areas. The increase in funds includes an investment of up to $4.6M of base funds and a $3.4M of research efforts to support expeditions to collect and analyze data that describe the depth, shape, geophysical, and biological characteristics of the seabed and sub-sea floor for the purpose of redefining the ECS. This will be accomplished using a variety of assets, including but not limited to, the new NOAA ocean exploration vessel OKEANOS EXPLORER, UNOLS vessels, and other vessels equipped for mapping. NOAA will use a wide array of tools and technologies in this effort, including multi-beam and side-scan sonars, autonomous underwater vehicles (AUVs), and remotely operated vehicles (ROVs) equipped with high-resolution cameras to collect video and still photography that can be geo-referenced and accessed in geographic information systems (GIS). The increase will enable the program to strengthen connections with other NOAA programs, including the NOS Office of Coast Survey and NESDIS, as well as other Federal agencies and such NOAA partners as the Joint Hydrographic Center at the University of New Hampshire and the Institute for Exploration at the University of Rhode Island to ensure that the data collected are appropriately processed, archived, and made accessible to users.

Statement of Need

This effort supports the NOAA Strategic Goal to "Protect, Restore, and Manage the Use of Coastal and Ocean Resources Through an Ecosystem Approach to Management", as well as Article 76 of the United Nations Conference on Law of the Sea (LOS). Under LOS, the ECS is defined as the area of the continental shelf that lies beyond the 200 nautical mile limit of the U.S. Exclusive Economic Zone (EEZ), which may contain important mineral and

natural resources. Identifying the true extent and nature of the ECS is a priority, enabling the U.S. to establish sovereign rights for the exploration, exploitation, and conservation of natural resources.

Proposed Actions

NOAA will partner with other agencies and the private sector to engage in interdisciplinary expeditions using a variety of vessels, tools, and technologies to collect comprehensive data and information on areas of the U.S. continental shelf that are not included in the U.S. EEZ, for the purpose of describing and defining the presence and extent of natural resources in support of defining the limits of the ECS. The expeditions will include technicians and researchers to collect, organize, assess, and develop products from the information collected. In the case of the NOAA Ship OKEANOS EXPLORER, when it is working on ECS-related missions, the information collected will be transmitted to shore-based stations via broadband satellite connections for more rapid assessment.

As a prerequisite, the NOAA Ocean Exploration and Research program will work with the Interagency Committee on Ocean Science and Resource Management Integration (ICOSRMI), the subcommitte on oceans policy, a subgroup of the Global Environment Policy Coordinating Committee, the Joint Subcommittee on Ocean Science and Technology (JSOST), the Subcommittee on Integrated Management of Ocean Resources (SIMOR), and the Integrated Working Group on Ocean and Coastal Mapping (IWG-OCM) to identify priority areas for the expeditions, identify opportunities to leverage funding from other agencies and institutions with shared ECS objectives (potentially increasing the annual number of coastal, marine, and Great Lakes ecological characterizations that meet management needs). An anticipated result of this activity will be a mapping plan that will include the joint collection of data and information, the processing and archiving of such data, and the development and dissemination of critical products.

Benefits

Conducting comprehensive surveys of areas of the continental shelf outside of the EEZ will allow the U.S. to define and declare sovereign rights to resources that are currently outside of US jurisdiction. The potential value of these resources is estimated to be at least $1 trillion. A comprehensive approach that transcends standard bathymetric surveys and includes the collection of video and still photography, and samples will provide for the description and delineation of mineral and living marine resources. The data and information and products derived from this effort will allow decision-makers to establish the ECS, plan for the use and conservation of resources, manage the construction and positioning of pipelines and other infrastructure, and manage human activities so as to reduce the potential for the destruction of critical resources.

Performance Goals and Measurement Data

Performance Goal: Ecosystems	**FY07**	**FY08**	**FY09**	**FY10**	**FY11**	**FY12**
Performance Measure: Annual number of coastal, marine, and Great Lakes ecological characterizations that meet management needs	0	6	6	5	5	4

For this performance measure, an ecological characterization is defined as a 20-day mapping survey that includes the collection of sonar data (multibeam, side scan, etc.), video and still photography, and samples required to verify the presence and extent of natural resources. Each characterization includes the collection and processing of data, as well as the development of georeferenced products for use by natural resource managers, other decision-makers, scientists, and educators. At a steady rate of investment, the number of characterizations is estimated to decrease over time due to inflation.

Subactivity: Ocean, Coastal, and Great Lakes Research
Line Item: Other Ecosystems Programs

GOAL STATEMENT:

In addition to supporting its individual Ocean, Coastal, and Great Lakes Research laboratories, NOAA Research also seeks to initiate and maintain research and development programs that cut across its own intramural foundation and other NOAA and university research programs in an effort to advance the cutting edge of NOAA research capabilities.

BASE DESCRIPTION:

NOAA Aquatic Invasive Species (AIS) Program: Aquatic invasive species disrupt the stability of coastal ecosystems, affecting recreational, economic, and other beneficial uses of coastal resources. They constitute one of the largest present and future threats to coastal ecosystems, coastal economies, protected habitats and species, and human health in coastal regions. Invasive species are one of the two greatest threats to endangered species (second only to habitat loss), and they have been responsible for some of the most dramatic fishery losses in recent times (e.g., Lake trout, turbot, whitefish, and salmon in the Great Lakes). Hundreds of millions of dollars are spent each year to mitigate the effects of non-indigenous aquatic species in our coastal and Great Lakes ecosystems and to prevent new invasions. The AIS program implements a national program to detect, monitor, and control aquatic invasive species. Currently, this program focuses on the prevention and control of invasive species. In the outyears, this item will include research for the development of new control technologies. Activities under the AIS program include, but are not limited to, ballast water research, education and outreach, and control activities, which include eradication, population reduction, preventing further spread, and/or mitigating the impact of invasive species on user groups.

Efforts undertaken by the NOAA AIS Program involve cooperation and coordination between NOAA Research (including the National Sea Grant College Program), National Ocean Service, and National Marine Fisheries Service, eight other federal agencies, and the academic community. This program is a critical component of the Department of Commerce's support of the interagency Aquatic Nuisance Species Task Force and National Invasive Species Council. NOAA co-chairs each of these two policy bodies. The AIS program responds to the mandates identified in the National Aquatic Nuisance Prevention and Control Act, the National Sea Grant College Program Act, and Executive Order 13112. All of these mandates identify the need for early detection, monitoring, and reducing the impact of aquatic invasive species.

Benefits

- An AIS program that is responsive to legal mandates and the most urgent national needs related to the growing AIS problem;
- Partially meet legislative prevention mandates;
- Increased number of pathways and high-risk species identified, and effective approaches developed to reduce invasion risk to resources for which NOAA is the Nation's steward;

- One or more ballast water treatment technologies and management approaches verified and available for use;
- Other pathways reduced or interdicted through targeted risk-reduction actions, education, and increased public awareness and participation;
- Increased ability to detect new AIS invasions early enough to allow targeted rapid response;
- Availability of management information to help control invasive species, (e.g., life- history parameters, potential range, and potential pathways identification); and
- Development of new control technologies, which will reduce the economic and environmental costs of highly invasive species.

NOAA Marine Aquaculture Program: OAR is responsible for the NOAA Marine Aquaculture Program, which provides the science and technology capability for the larger NOAA Aquaculture Program, a matrix-managed effort led by the National Marine Fisheries Service (NMFS) in collaboration with the National Ocean Service, OAR, and the National Environmental Satellite, Data, and Information Service (NESDIS). OAR is responsible for the program's science and technology capability, including overseeing the National Marine Aquaculture Initiative, a competitive research grants program. This initiative funds external partners to: (1) expand regional efforts in developing new species suitable for aquaculture; and (2) promote sustainable aquaculture through support for projects that: (a) field-test new environmentally compatible production systems; (b) develop new technologies, including offshore, near-shore, and re-circulating aquaculture systems; and (c) improve and clarify the regulatory framework and coastal zoning for aquaculture. These projects lead to technical developments in genetics, nutrition, disease, hormone manipulation, biotechnology, and mitigation of environmental impacts. In addition, the Program develops collaborative studies with international partners on ecosystem effects and carrying capacities for coastal ecosystems. NOAA's aquaculture education and extension network facilitates the transfer of research into business operations as well as informs the public and practitioners about key issues and information related to aquaculture. The program promotes an environmentally friendly and profitable aquaculture industry that will alleviate stress on natural fish stocks, create jobs, provide healthy protein to Americans at a reasonable cost, improve food safety, and help alleviate our Nation's trade deficit.

Background:
The United States faces a "seafood deficit" amounting to $8 billion annually. We import more than 70 percent of the fish and shellfish we consume. Marine aquaculture in U.S. waters has the potential to provide up to 25 percent of our seafood within the next 20 years and providing the seed to rebuild some fishery stocks. The NOAA Marine Aquaculture Program will be at the forefront of efforts to grow the U.S. marine aquaculture industry through an integrated program of research, education, and technology transfer that is focused on key scientific, engineering, environmental, and socioeconomic issues that currently inhibit this emerging industry.

Benefits:
The NOAA Marine Aquaculture Program will work to:
- Offset the current $8 billion annual U.S. trade deficit in seafood through increased domestic production from marine aquaculture;
- Ensure the sustainability of marine aquaculture; and
- Spur job creation in both the production and processing of fishery products, thereby revitalizing fishing communities devastated by collapsing fisheries industries.

Base activities support NOAA's mission goal to "Protect, Restore, and Manage the Use of Coastal and Ocean Resources through an Ecosystem Approach to Management." In addition, they support the objective, "Enhance the conservation and management of coastal and marine resources to meet America's economic, social, and environmental needs" under the Department of Commerce Strategic Goal of "Observe, protect, and manage the Earth's resources to promote environmental stewardship."

PROPOSED LEGISLATION:

None.

SUMMARIZED FINANCIAL DATA
(Dollars in thousands)

Subactivity: Ocean, Coastal, and Great Lakes Research	FY 2006 ACTUALS	FY 2007 CURRENTLY AVAILABLE	FY 2008 BASE PROGRAM	FY 2008 ESTIMATE	INCREASE / DECREASE
Line Item: Other Ecosystems Programs					
Aquatic Invasive Species Program	986	-	2,485	985	(1,500)
Marine Aquaculture Program	4,558	-	1,614	1,614	-
TOTAL	5,544	-	4,099	2,599	(1,500)
FTE	3	4	4	4	-

Note: The dollars in this table represent budget authority.

PROGRAM CHANGES FOR FY 2008:

Aquatic Invasive Species (+0 FTE, -$1,500,000). NOAA requests a decrease of 0 FTE and -$1,500,000 from its FY 2007 base funding level for its Aquatic Invasive Species program. As a result of this decrease, NOAA will reduce work with the Regional Fisheries Management Councils intended to reduce the risk both to human health and to the commercial fishery industry from the venomous predator Lionfish and other aquarium fish that escape into the wild and edge out commercially valuable native fish populations. This decrease will also reduce NOAA's effort to develop ballast water technologies necessary for implementation of ballast water management program. NOAA will, however, continue about half of its current work with the Pacific States Marine Fisheries Commission and EPA to study and halt the spread of invasive green crabs (which threaten a $40M shellfish industry in the Pacific Northwest) as well as work with Canada's Department of Fisheries and Oceans (DFO) to attack the spread of invasive tunicates threatening near- and off-shore shellfish beds on U.S. & Canadian coasts. This decrease will fund higher priority items within OAR.

Subactivity: Ocean, Coastal, and Great Lakes Research
Line Item: Other Partnership Programs

GOAL STATEMENT:

NOAA's Ocean, Coastal, and Great Lakes Research Other Partnership Programs seek to improve protection, restoration, and management of coastal and ocean resources through research and monitoring activities that support ecosystem-based management. These programs accomplish this goal by providing:

- Outreach and education to improve public understanding and use of coastal and marine ecosystems;
- Ecosystem approaches to management decision making;
- Partnerships for placed-based ecosystem approaches to management;
- Ecosystem research to analyze ecosystem management decisions and their outcomes;
- Integrated observing and data management systems; and
- International diplomacy, negotiation and partnerships.

BASE DESCRIPTION:

The Other Partnership Programs line item contains various programs initiated by Congress.

PROPOSED LEGISLATION:

None.

SUMMARIZED FINANCIAL DATA
(Dollars in thousands)

Subactivity: Ocean, Coastal, and Great Lakes Research	FY 2006 ACTUALS	FY 2007 CURRENTLY AVAILABLE	FY 2008 BASE PROGRAM	FY 2008 ESTIMATE	INCREASE / DECREASE
Line Item: Other Partnership Programs					
Invasive Species and Ocean Partnership Programs	-	5,586	-	-	-
Aquatic Ecosystems - Canaan Valley Institute	5,917	-	-	-	-
Atmospheric Dispersion Forecasting / Jackson State Univ	1,480	-	-	-	-
Gulf of Maine Council	740	-	-	-	-
Lake Champlain Research Consortium	346	-	-	-	-
NISA/Ballast Water Demonstrations	2,959	-	-	-	-
NISA/Alaska	1,480	-	-	-	-
Invasive Milfoil	246	-	-	-	-
HI Micronesia Invasive Species Program	493	-	-	-	-
Cooperative Institute for New England Mariculture and Fisheries	1,972	-	-	-	-
Pacific Tropical Ornamental Fish	493	-	-	-	-
Center for Aquaculture Development	986	-	-	-	-
West Alabama Shrimp Acquaculture Program	493	-	-	-	-
Urban Coastal Institute	493	-	-	-	-
Lake Champlain Emerging Threats	493	-	-	-	-
Center for the Environment	789	-	-	-	-
Bio-screening Technology for Imported Seafood	986	-	-	-	-
TOTAL	20,366	5,586	-	-	-
FTE	-	-	-	-	-

Note: The dollars in this table represent budget authority.

PROGRAM CHANGES FOR FY 2008:

None.

Subactivity: Information Technology and R&D
Line Item: High Performance

GOAL STATEMENT:

NOAA's Information Technology and R&D programs seek to make major improvements in NOAA's ability to forecast weather and climate and disseminate environmental information. They also seek to stimulate the modernization of NOAA's computationally intensive services through the use of evolving high-performance computing and communication (HPCC) technologies.

BASE DESCRIPTION:

High-Performance Computing and Communication: The purpose of the HPCC program is to make major improvements in NOAA's ability to forecast the Nation's weather and climate, to model ecosystems and the ocean, and to disseminate environmental information. Improvements in the accuracy and timeliness of NOAA's short-term weather warnings, seasonal forecasts, and regional and global climate predictions are heavily dependent on major advances in high-end computing power, advanced information technology, and the availability of environmental data and information.

Current funding supports software development for improved weather modeling, including hurricanes, tornadoes, aviation, and other severe weather forecasts. However, thirteen GPRA performance measures across all four NOAA Mission Goals, including hurricane forecast tracking, winter storm warning accuracy, regional climate forecasts, and the accuracy of wave heights and wind speed forecasts, will not be met as scheduled. NOAA is requesting a budget increase in FY 2007 to restore the HPCC funding to prevent further performance delays. Improvements to NOAA's services require continually evolving computer technology, high-speed networking, and communications technologies that cannot be met at the base budget level.

The HPCC supports objectives in NOAA's Strategic Plan through IT research. These critical investments allow NOAA to meet its Mission in delivering vital services and science education to the public. The program allows NOAA to participate as a "mission" agency in the Interagency Working Group on Information Technology Research and Development, assuring coordination with Federal initiatives. The HPCC primarily serves the Environmental Modeling objective of the NOAA Strategic Goal to: "Serve Society's Needs for Weather and Water Information."

Base activities support the objectives: "Advance understanding and predict changes in the Earth's environment to meet America's economic, social, and environmental needs" and "Enhance the conservation and management of coastal and marine resources to meet America's economic, social, and environmental needs" under the Department of Commerce Strategic Goal of "Observe, protect, and manage the Earth's resources to promote environmental needs."

PROPOSED LEGISLATION:

None.

SUMMARIZED FINANCIAL DATA
(Dollars in thousands)

Subactivity: Information Technology and R&D	FY 2006 ACTUALS	FY 2007 CURRENTLY AVAILABLE	FY 2008 BASE PROGRAM	FY 2008 ESTIMATE	INCREASE / DECREASE
Line Item: High Performance					
High Performance	6,410	12,900	12,969	12,969	-
TOTAL	6,410	12,900	12,969	12,969	-
FTE	13	13	13	13	-

Note: The dollars in this table represent budget authority.

PROGRAM CHANGES FOR FY 2008:

None.

Exhibit 13

Department of Commerce
National Oceanic and Atmospheric Administration
Oceanic and Atmospheric Research
Contribution to the NOAA Strategic Planning Goals and Objectives
(Dollar amounts in thousands)

Oceanic and Atmospheric Research	FY 2006 Actuals Amount	FY 2007 Currently Available Amount	FY 2008 Base Program Amount	FY 2008 Estimate Amount	Inc/Dec from Base Amount
Climate					
Climate	160,077	175,631	173,836	184,089	10,253
Total C	160,077	175,631	173,836	184,089	10,253
Ecosystems					
Ecosystems	123,236	91,053	97,250	103,750	6,500
Total ECO	123,236	91,053	97,250	103,750	6,500
Mission Support					
MS	18,352	12,007	12,519	12,519	-
Total MS	18,352	12,007	12,519	12,519	-
Weather and Water					
Weather and Water	66,103	49,795	53,019	58,019	5,000
Total WW	66,103	49,795	53,019	58,019	5,000
Total Oceanic and Atmospheric Research	367,768	328,486	336,624	358,377	21,753

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Exhibit 10

Department of Commerce
National Oceanic and Atmospheric Administration
Operations Research and Facilities
PROGRAM AND PERFORMANCE: DIRECT OBLIGATIONS
(Dollar amounts in thousands)

Activity: Oceanic and Atmospheric Research		FY 2006 Actuals Personnel	FY 2006 Actuals Amount	FY 2007 Currently Available Personnel	FY 2007 Currently Available Amount	FY 2008 Base Program Personnel	FY 2008 Base Program Amount	FY 2008 Estimate Personnel	FY 2008 Estimate Amount	Inc/Dec from Base Personnel	Inc/Dec from Base Amount
Climate Research											
Laboratories & Cooperative	Pos/BA	259	48,646	259	47,000	259	49,337	259	50,337	-	1,000
Institutes	FTE/OBL	170	41,253	249	47,378	249	49,337	249	50,337	-	1,000
Climate Data & Information	Pos/BA	4	2,401	4	6,133	4	6,266	4	8,266	-	2,000
	FTE/OBL	-	-	3	6,133	3	6,266	3	8,266	-	2,000
Competitive Research Program	Pos/BA	105	110,090	105	130,000	105	126,049	105	133,302	-	7,253
	FTE/OBL	150	121,365	102	130,293	102	126,049	102	133,302	-	7,253
Climate Operations	Pos/BA	-	363	-	867	-	886	-	886	-	-
	FTE/OBL	-	-	-	867	-	886	-	886	-	-
Other Partnership Programs	Pos/BA	-	7,188	-	-	-	-	-	-	-	-
	FTE/OBL	1	7,197	-	3	-	-	-	-	-	-
Total: Climate Research	Pos/BA	368	168,688	368	184,000	368	182,538	368	192,791	-	10,253
	FTE/OBL	321	169,815	354	184,674	354	182,538	354	192,791	-	10,253
Weather and Air Quality Research											
Laboratories & Cooperative	Pos/BA	182	38,217	187	36,000	187	39,198	191	44,198	4	5,000
Institutes	FTE/OBL	184	38,556	182	36,441	182	39,198	185	44,198	3	5,000
Weather & Air Quality	Pos/BA	3	5,917	3	3,000	3	2,972	3	2,972	-	-

Exhibit 10

Department of Commerce
National Oceanic and Atmospheric Administration
Operations Research and Facilities
PROGRAM AND PERFORMANCE: DIRECT OBLIGATIONS
(Dollar amounts in thousands)

Research Programs	FTE/OBL	1	5,917	2	3,000	2	2,972	2	2,972	-	-
Other Partnership Programs	Pos/BA	-	23,012	-	-	-	-	-	-	-	-
	FTE/OBL	7	22,807	-	270	-	-	-	-	-	-
Total: Weather and Air Quality Research	Pos/BA	185	67,146	190	39,000	190	42,170	194	47,170	4	5,000
	FTE/OBL	192	67,280	184	39,711	184	42,170	187	47,170	3	5,000
Ocean, Coastal, and Great Lakes Research											
Laboratories & Cooperative Institutes	Pos/BA	127	22,637	122	19,000	122	20,185	122	20,185	-	-
	FTE/OBL	103	22,742	119	19,283	119	20,185	119	20,185	-	-
National Sea Grant College Program	Pos/BA	25	53,701	25	52,000	25	54,900	25	54,900	-	-
	FTE/OBL	13	56,186	23	52,070	23	54,900	23	54,900	-	-
Ocean Exploration and Research	Pos/BA	20	23,276	20	16,000	20	19,763	20	27,763	-	8,000
	FTE/OBL	21	23,479	17	16,117	17	19,763	17	27,763	-	8,000
Other Ecosystems Programs	Pos/BA	4	5,544	4	-	4	4,099	4	2,599	-	(1,500)
	FTE/OBL	3	5,363	4	181	4	4,099	4	2,599	-	(1,500)
Other Partnership Programs	Pos/BA	-	20,366	-	5,586	-	-	-	-	-	-
	FTE/OBL	5	20,745	-	5,613	-	-	-	-	-	-
Total: Ocean, Coastal, and Great Lakes Research	Pos/BA	176	125,524	171	92,586	171	98,947	171	105,447	-	6,500
	FTE/OBL	145	128,515	163	93,264	163	98,947	163	105,447	-	6,500
Information Technology and R&D											

Exhibit 10

Department of Commerce
National Oceanic and Atmospheric Administration
Operations Research and Facilities
PROGRAM AND PERFORMANCE: DIRECT OBLIGATIONS
(Dollar amounts in thousands)

High Performance	Pos/BA	15	6,410	15	12,900	15	12,969	15	12,969	-	-
	FTE/OBL	11	6,741	13	12,948	13	12,969	13	12,969	-	-
Total: Information Technology and R&D	Pos/BA	15	6,410	15	12,900	15	12,969	15	12,969	-	-
	FTE/OBL	11	6,741	13	12,948	13	12,969	13	12,969	-	-

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Exhibit 14

Department of Commerce
National Oceanic and Atmospheric Administration
Operations Research and Facilities
PROGRAM CHANGE PERSONNEL DETAIL

Activity: Oceanic and Atmospheric Research
Subactivity: Weather and Air Quality Research

Title		Grade	Number	Annual Salary	Total Salaries
Engineer	Boulder, CO	ZP3	1	70,000	70,000
Meteorologist	Boulder, CO	ZP4	1	95,000	95,000
Physical Scientist	Boulder, CO	ZP4	1	95,000	95,000
Physical Scientist	Boulder, CO	ZP5	1	120,000	120,000
Total			4		380,000
Less Lapse	25%		-1		(95,000)
Total full-time permanent (FTE)			3		285,000
2007 Pay Adjustment (2.2%)					6,270
2008 Pay Adjustment (3%)					8,738
Total					300,008

Personnel Data	Number
Full-time permanent	3
Other than full-time permanent	0
Total	3
Authorized Positions	
Full-time permanent	4
Other than full-time permanent	0
Total	4

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Exhibit 15

Department of Commerce
National Oceanic and Atmospheric Administration
Operations Research and Facilities
PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollar amounts in thousands)

Activity: Oceanic and Atmospheric Research
Subactivity: Climate Research

	Object Class	2008 Increase
21	Travel and transportation of persons	153
23.3	Communications, utilities and miscellaneous charges	850
25.2	Other services	1,606
25.5	Research and development contracts	200
26	Supplies and materials	358
31	Equipment	608
41	Grants, subsides and contributions	7,778
99	Total Obligations	11,553

Exhibit 15

Department of Commerce
National Oceanic and Atmospheric Administration
Operations Research and Facilities
PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollar amounts in thousands)

Activity: Oceanic and Atmospheric Research
Subactivity: Climate Research

	Object Class	2008 Decrease
25.2	Other services	(350)
31	Equipment	(300)
41	Grants, subsides and contributions	(650)
99	Total Obligations	(1,300)

Exhibit 15

Department of Commerce
National Oceanic and Atmospheric Administration
Operations Research and Facilities
PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollar amounts in thousands)

Activity: Oceanic and Atmospheric Research
Subactivity: Weather and Air Quality Research

	Object Class	2008 Increase
11	Personnel compensation	
11.1	Full-time permanent	380
11.9	Total personnel compensation	380
21	Travel and transportation of persons	125
22	Transportation of things	175
24	Printing and reproduction	20
25.2	Other services	1,400
25.4	Operation and maintenance of facilities	300
25.5	Research and development contracts	350
26	Supplies and materials	150
31	Equipment	1,400
41	Grants, subsides and contributions	700
99	Total Obligations	5,000

Exhibit 15

Department of Commerce
National Oceanic and Atmospheric Administration
Operations Research and Facilities
PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollar amounts in thousands)

Activity: Oceanic and Atmospheric Research
Subactivity: Ocean, Coastal, and Great Lakes Research

	Object Class	2008 Increase
23.3	Vessel charter	6,000
41	Grants, subsides and contributions	2,000
99	Total Obligations	8,000

Exhibit 15

Department of Commerce
National Oceanic and Atmospheric Administration
Operations Research and Facilities
PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollar amounts in thousands)

Activity: Oceanic and Atmospheric Research
Subactivity: Ocean, Coastal, and Great Lakes Research

	Object Class	2008 Decrease
22	Transportation of things	(60)
24	Printing and reproduction	(25)
25.2	Other services	(310)
25.5	Research and development contracts	(480)
26	Supplies and materials	(25)
41	Grants, subsides and contributions	(600)
99	Total Obligations	(1,500)

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