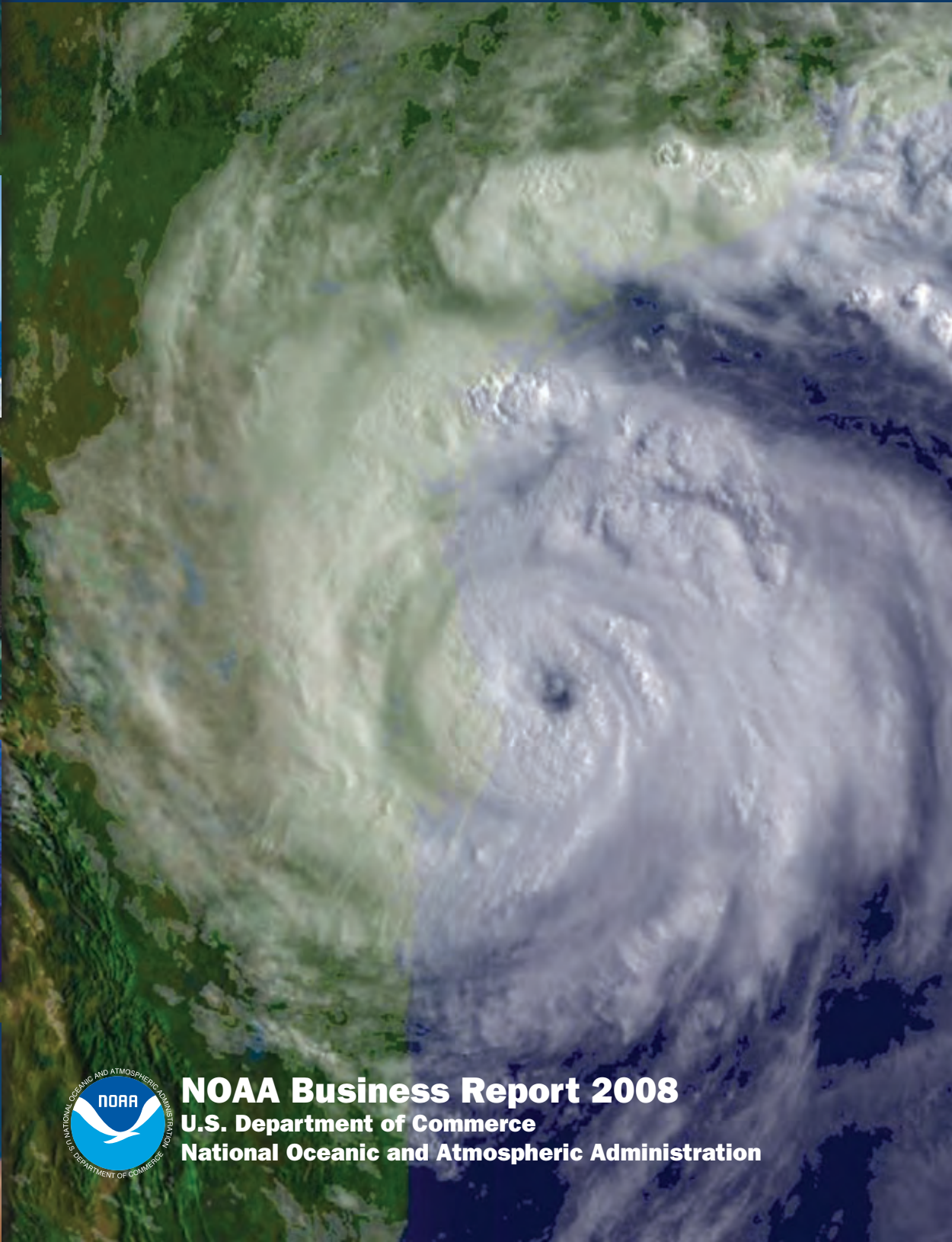




NOAA

Protecting Lives and Livelihoods



NOAA Business Report 2008
U.S. Department of Commerce
National Oceanic and Atmospheric Administration



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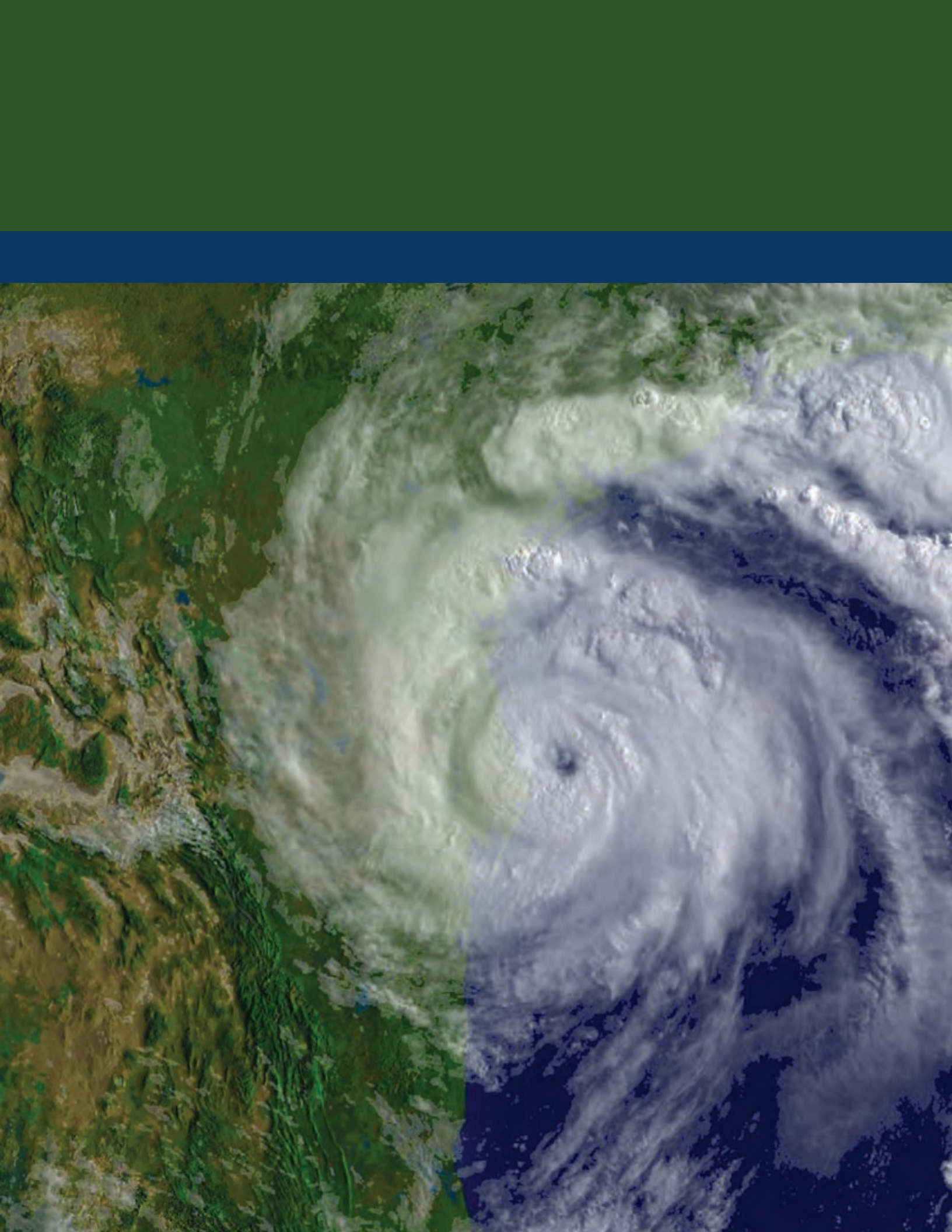
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On July 23, 2008, Hurricane Dolly made landfall as a Category 2 hurricane at South Padre Island, Texas.





Mary M. Glackin,
Deputy Under Secretary
for Oceans and Atmosphere

NOAA: Protecting Lives and Livelihoods

The National Oceanic and Atmospheric Administration (NOAA) is a key component of the U.S. Department of Commerce. Every day, NOAA's work touches the lives of each person in the United States, and the lives of many around the world. From weather forecasts to fisheries management, safe navigation to coastal services, and climate research to ocean exploration, NOAA's products and services contribute to the foundation of a healthy economy—indeed, they impact approximately one-third of the nation's gross domestic product.

In addition to producing world-class science, NOAA is dedicated to enhancing economic security and national safety through the prediction and research of weather and climate, the delivery of information services for transportation, and the provision of environmental stewardship of our nation's coastal and marine resources. NOAA is also working with its federal partners and more than 70 countries and the European Commission to develop the Global Earth Observation System of Systems, an integrated global monitoring network that will enhance environmental knowledge and public safety across our planet. In addition, NOAA's Web site at www.noaa.gov provides a wealth of knowledge to policymakers, planners, schools, and the general public, including those involved in industry and scientific enterprises.

MAJOR FY 2008 ACCOMPLISHMENTS

During fiscal year (FY) 2008, NOAA continued its record of service to the American people through several improvements and accomplishments in the application of its scientific and technological expertise.

Hurricane Preparation and Response Support Provided

In 2008, NOAA supported the U.S. Coast Guard and U.S. Army Corps of Engineers in preparing for and responding to Hurricanes Dolly, Gustav, and Ike. After the storms, NOAA surveyed the areas affected and ensured ports and channels were free of obstructions to allow ship traffic to resume service to these areas. NOAA also collected aerial imagery in response to

these storms and provided the information to disaster managers and the public alike. The images were available through such programs as Google Earth, as well as on the NOAA Web page.

Oil Spill Trajectory and Behavior Modeled

In July 2008, NOAA responded to a major oil spill when an estimated 419,000 gallons of No. 6 fuel oil spilled in the Mississippi River, just north of New Orleans, Louisiana. NOAA provided trajectory and oil behavior modeling, information on natural resources at risk, and toxicity assessment data. NOAA provided its first spill trajectory predictions within two-and-a-half hours of the spill and continues to provide overall on-scene support.



During FY 2008, NOAA collected aerial imagery in response to Hurricanes Dolly, Gustav, and Ike, and provided the information to disaster managers and the public.



In addition to its work in New Orleans, NOAA remains active aiding in responding to the spill of an estimated 58,000 gallons of intermediate fuel oil, which occurred in November 2008, when the container ship M/V Cosco Busan struck the Oakland Bay Bridge in San Francisco Bay.

Large Hypoxic Zone Predicted

NOAA predicted the 2008 hypoxic or “dead” zone, which forms annually in the northern Gulf of Mexico, would be the largest on record. The dead zone was expected to exceed the previous record set in 2002 by 17–21 percent, resulting in a low-oxygen zone of 8,800 square miles in the summer. A research cruise later estimated the size of the zone was the second-largest on record and confirmed NOAA’s prediction of a significant increase in the dead

zone for 2008. This research provided the foundational science for the *2008 Gulf Hypoxia Action Plan* to reduce the size of the Gulf of Mexico dead zone.

Overfishing of Four Commercially Valuable Stocks Ended

During FY 2008, NOAA continued its efforts to eliminate overfishing. Under the revised Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006, NOAA Fisheries is re-

quired to end overfishing for stocks experiencing overfishing by 2010. Overfishing of four commercially valuable stocks ended in FY 2008: petrale sole, summer flounder, bigeye tuna–Atlantic, and finetooth shark–Atlantic. NOAA also published regulations that would limit ship speed during times and in areas along the East Coast where relatively high right whale and ship densities overlap near a number of ports, at calving/nursery areas



In FY 2008, NOAA opened 623 stream miles for migrating fish.

in waters off Georgia and Florida, and in New England waters. This was a critically important step in the conservation of this species, since there are only 300-400 North Atlantic right whales remaining.

Habitat Acres Restored and Protected

In 2008, NOAA also restored, improved, and protected 11,254 habitat acres and opened 623 stream miles for migrating fish. NOAA's habitat restoration, protection, and improvement efforts improve water quality and increase "green armor" in U.S. coastal areas, creating strong, natural coastlines that serve as effective buffers against storm damage.

Marine National Monument Announced

In commemoration of Earth Day, on April 22, 2008, NOAA participated in a ceremony in Honolulu, Hawaii, to announce the release of the Draft Management Plan for the Papahānaumokuākea Marine National Monument. The monument was also announced as one of two sites that the United States has nominated for consideration as a United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage site.

Argo Float Network and U.S. Climate Reference Network Completed

In 2008, NOAA researchers, including those at NOAA's Joint Institute for Marine Observations, completed the Argo float network by deploying and maintaining 3,000 Argo floats in active service. The Argo array of profiling floats provides essential broad-scale, basin-wide monitoring of upper-ocean heat content. The Argo network allows scientists to gather real-time, evolving data around the clock and around the world. With a complete Argo network, scientists can test hypotheses and study the ocean's role in climate variability.

In addition, NOAA's Air Resources Laboratory finished installing the 114 stations

comprising the U.S. Climate Reference Network (CRN). The CRN tracks national average changes in temperature and precipitation trends with exceptional precision and will help pinpoint shifts in America's changing climate. All stations are constructed in rural environments, away from urban areas that could confound interpretation of observed trends.

Fewer, More Intense Atlantic Hurricanes Predicted

NOAA researchers released two studies that concluded there will be fewer, but more intense Atlantic hurricanes in the future. In the first study, scientists from NOAA's Atlantic Oceanographic and Meteorological Laboratory and Cooperative Institute for Marine and Atmospheric Studies reported that global warming of the sea surface is associated with an increase of vertical wind shear in the main development region for Atlantic hurricanes. The increased vertical wind shear coincides with a lower number of U.S. landfalling hurricanes. The second study involved scientists at NOAA's Geophysical Fluid Dynamics Laboratory, who published a new model simulation study of Atlantic hurricane activity for the late 21st century. Their model projected fewer but more intense hurricanes, along with more intense rainfall. The study employed a new regional model that offered both higher resolution and an improved ability to simulate past observed changes in Atlantic hurricane activity.

Collaboration to Enhance Research on Hurricanes and Climate Change

To support similar types of research on hurricanes and climate change, in September 2008 NOAA signed a memorandum of understanding with the U.S. Department of Energy (DOE). In the agreement, DOE will make available more than 10 million hours of high-performance computing time for NOAA to explore advanced climate change models at three of DOE's national laboratories. The agreement will give NOAA the ability to use DOE super computers to prototype and improve our understanding of the impact of climate change on tropical cyclone activity by inte-

In FY 2008, NOAA restored, improved, and protected 11,254 habitat acres.

grating NOAA's tropical cyclone research into its global climate modeling efforts. The collaboration should also reduce uncertainty in climate predictions and offer incorporation of information at a regional scale that goes beyond today's climate simulations.

Report Released on Lower Levels in Lake Erie

In FY 2008, NOAA released a report warning that Lake Erie water levels could drop between 3.28 and 6.56 feet by 2066 as the climate in the region warms. The study of the Detroit River–western Lake Erie corridor used data and analyses from NOAA's Great Lakes Environmental Research Laboratory. Winter freezing normally seals off lake evaporation, but in winters when Lake Erie does not freeze, more evaporation can occur, resulting in a water level drop. As the lake shrinks, western Lake Erie's shoreline could expand by nearly 4 miles, potentially harming the shipping industry and water treatment facilities.

NPOESS Key Tasks Completed

In 2008, several key tasks were completed for the National Polar-orbiting Operational Environmental Satellite System (NPOESS). The Ozone Mapping and Profiler Suite successfully completed environmental testing in August and is preparing for shipment to be integrated with the satellite. This sensor suite will protect the





In August 2008, NOAA added Okeanos Explorer to its fleet, which is the only U.S. ship dedicated to systematic exploration of Earth's largely unknown oceans.

public by monitoring the depletion of ozone in the stratosphere, which can result in a number of negative health effects, including an increase in skin cancer. Two additional sensors were also added to the program: Total Solar Irradiance Sensor (TSIS) and Clouds and the Earth's Radiant Energy System (CERES). TSIS measurements address long-term climate change, natural variability and enhanced climate prediction, and atmospheric ozone and UV-B radiation. Scientists use CERES data to study how clouds affect the Earth's climate.

Ship and Aircraft Fleets Recapitalized and Expanded

NOAA has been busy recapitalizing its fleet of ships and aircraft to better meet its needs for observations at sea and in the air. In 2008, NOAA received approval for a 15-year ship recapitalization plan, which has been delivered to Congress for action. The Agency launched a new Fisheries Survey Vessel, which will enter service in 2009, and decommissioned three of its oldest ships.

NOAA also added *Okeanos Explorer* to the fleet, which will change how we explore the oceans. Commissioned in August 2008, *Okeanos Explorer* is the only U.S. ship dedicated to systematic exploration of Earth's largely unknown oceans. This pioneering

mission will also utilize a new ocean research paradigm in which most of the scientists will remain ashore. Via telepresence, live images from the seafloor and other data will flow over satellite and high-speed Internet paths to five land-based Exploration Command Centers. The ship will also be able to stream images and interviews live into classrooms, newsrooms, and living rooms.

Jason-2 Spacecraft Launched

On June 20, 2008, the Ocean Surface Topography Mission/Jason-2 spacecraft launched from the Vandenberg Air Force Base. The Jason-2 is an international effort between NOAA, the National Aeronautics and Space Administration, France's Centre National d'Etudes Spatiales, and the European Organisation for the Exploitation of Meteorological Satellites. The Jason-2 satellite monitors the rate of sea level rise and helps measure ocean conditions that contribute to the strength of hurricanes. NOAA uses data from the Jason-2 to extend a 15-year record from its predecessor missions, which shows sea level is rising at a rate of 3.4 millimeters per year—nearly twice as fast as the previous 100 years. If this rate of sea level rise continues, it will have a large impact on coastal regions, causing more erosion and flooding. Jason-2 will also be used to help scientists predict short-term, severe weather events, such as hurricanes and tropical storms that are fueled by heat energy stored in the upper layer of the ocean.

First Operational Greenhouse Gas Products Developed

NOAA's Center for Satellite Applications and Research developed the first operational greenhouse gas products. These products, which became operational in August 2008, are derived from data taken by the European Metop-A satellite. With this information NOAA will be able to provide accurate mid-troposphere greenhouse gas concentrations well into the next decade and beyond. Increasing atmospheric concentrations of heat-trapping green-

house gases can lead to increasing severe weather conditions, such as droughts and intense hurricanes. Information on the seasonal and geographic distribution of greenhouse gases will provide critical data on the sources of these gasses and how best to mitigate the risks. Measurements include carbon dioxide, carbon monoxide, and methane.

Radar Capabilities Improved

NOAA also improved its radar capabilities in 2008. NOAA's National Weather Service Systems Engineering Center is now providing displays of super-resolution Next-Generation Radar (NEXRAD) images that provide twice the resolution and allow forecasters to view higher-resolution data at greater distances from the radar. NEXRAD super-resolution capability was implemented primarily to better detect tornadic circulation patterns, but the improved resolution will also benefit hydrologic applications offering improved resolution rainfall estimates, particularly for urban flooding and small valley watersheds. Tornado warning lead time increased from 11 to 14 minutes in 2008, and during the tornado outbreak of February 5-6, the average tornado watch lead time for the first tornado in the watch was 2 hours. NOAA also added nearly 300 hydrologic forecast points to the Advanced Hydrologic Prediction Service, which displays the magnitude and uncertainty of occurrence of floods or droughts, from hours to days and months in advance. NOAA also improved its weather information delivery by distributing over 97,000 NOAA Weather Radios to schools in 2008.

Mary M. Glackin
Deputy Under Secretary
for Oceans and Atmosphere



NOAA Highlights

Bill Goodwin, a resource specialist from the Florida Keys National Marine Sanctuary, uses a glue gun to reattach a piece of living coral broken lose when a boat went aground on the shallow coral reef.





Mary M. Glackin,
Deputy Under Secretary
for Oceans and Atmosphere



James M. Turner, Ph.D.,
Deputy Assistant Secretary
for International Affairs

Management Priorities Focusing on Strategic Priorities

To respond to an ever-changing world, NOAA must continuously calibrate its programmatic and managerial priorities to determine where to direct finite resources. While some issues and priorities evolve gradually and are best managed over the long term, others are properly addressed with shorter-term adjustments. In all cases, strategic planning and management of NOAA’s activities work best when those who benefit from these activities and those who provide NOAA’s services are able to contribute to the process. Only by involving stakeholders, employees, and partners can NOAA fulfill its vision and mission.

The *NOAA Strategic Plan* articulates NOAA’s long-term corporate vision and mission, four long-term goals for realizing that mission, tangible outcomes marking progress toward each goal, and strategies for employing the agency’s capabilities to achieve each outcome. To foster short-term responsiveness, NOAA’s annual planning cycle provides an opportunity to re-evaluate progress, accommodate new developments within and outside NOAA, and adjust programmatic focus areas to ensure progress toward our strategic goals. For this year’s planning cycle, NOAA again employed systematic methods for gathering and synthesizing stakeholder views on NOAA’s priorities to generate high levels of collaboration with stakeholders and further corporate alignment of NOAA-wide programs on high-impact mission areas.

The current *Annual Guidance Memorandum*, developed during Fiscal Year (FY) 2008, identifies the most urgent and compelling programmatic and managerial priorities for FY 2011–2015, reflecting the views of NOAA’s stakeholders, internal analyses of mission requirements, external trends and drivers, program capabilities, and alternative solutions to achieving NOAA’s strategic goals. In light of these external pressures and the current set of capabilities on which NOAA relies to achieve its long-term strategic goals, NOAA’s vision for the future is embodied within the following annual priorities.

FY 2011–2015 STRATEGIC PRIORITIES

Climate

Understanding, mitigating, and adapting to climate variability and change require relevant, reliable, and authoritative climate information, and the federal government needs a commensurate effort to meet evolving national needs. NOAA’s climate priorities include:

- Integrate and build capacity in NOAA’s unique climate observational assets, as-

essment and prediction expertise, research and modeling excellence, and service delivery capabilities by:

- improving climate observations and monitoring;
- delivering national-, regional-, and local-scale climate predictions and projections;
- developing scientific assessments of climate impacts and vulnerabilities; and



- providing an early warning system for drought and other user-driven issues.
- Promote the establishment of a National Climate Service that draws upon the full capacity of the government and other sectors to provide climate information and services.

Coasts

Rising impacts from coastal hazards, loss of habitat from increased and competing uses, and coastal pollution effects on human health are increasing requests from coastal managers for information and decision-support tools to help them assess

and respond to the changing demands in their regions. NOAA's priorities for U.S. coasts include:

- Reauthorize the Coastal Zone Management Act to set common national priorities for integrated management and improve incentives for state and local partners.
- Build on NOAA's infrastructure, partnerships, and scientific expertise to monitor climate change impacts, provide sea level rise projections, develop ecosystem vulnerability assessments, and build local capacity for adaptation planning.

The Smithsonian Institution's National Museum of Natural History's Sant Ocean Hall opened in September 2008. The hall's exhibits include the "Ocean Today," which NOAA's National Ocean Service developed in partnership with the Smithsonian. Through similar partnerships, NOAA will continue to work toward achieving its vision of an informed society that uses a comprehensive understanding of the role of the oceans, coasts, and atmosphere in the global ecosystem to make the best social and economic decisions.



Working to meet NOAA's marine stewardship responsibility to ensure the sustainable use of fisheries, NOAA researchers remove very young salmon bound for the Atlantic from water-powered traps in Maine's Sheepscot River.



NOAA's priorities for U.S. coasts include coordinating and expanding conservation and restoration of coastal habitats.

- Expand NOAA's science, monitoring and modeling to forecast harmful algal bloom, hypoxic, and pathogen events.
- Coordinate and expand conservation and restoration of coastal habitats.

Oceans and Marine Life

NOAA's marine stewardship responsibilities must balance sustainable use of fisheries and other marine natural resources with the protection of marine mammals, endangered species, and vulnerable habitats. NOAA's priorities for ocean and marine life include:

- Fully implement the Magnuson-Stevens Reauthorization Act of 2007, end over-fishing, and ensure safe and sustainable seafood supplies.

- Invest in infrastructure required to observe, assess, and manage ocean resources, including:
 - recapitalize and modernize the aging NOAA fleet; and
 - deploy autonomous underwater vehicles, multi-beam sonar, and remote-sensing systems.
- Undertake impact analyses and develop adaptation strategies for climate change effects, including:
 - ocean acidification, loss of sea ice, and sea level rise;
 - global warming impacts on animal migrations and ocean productivity; and
 - changes in fresh-water flows.
- Establish authorities for aquaculture and Integrated Ocean Observing Systems.

High-Impact Weather and Water

People are moving to hurricane-prone coastal areas, to wildland-urban boundaries, and to regions without a reliable renewable water supply. Additionally, power transmission, air transportation, and telecommunications systems are increasingly vulnerable to solar storms. NOAA must continue to improve its forecasts of high-impact events and deliver information that public managers and the public need, when they need it, and in a way they can understand it. NOAA's priorities for high-impact weather include:

- Improve hurricane track and intensity forecasts by 50 percent.
- Extend the current 1-hour forecasts of geomagnetic storms to 1- to 4-day forecasts.
- Provide “fire-scale” weather forecasts that enable first responders to fight wildfires.
- Deliver the integrated, high-resolution products and services demanded by NOAA's water customers.

Transportation

Demands on the U.S. air transportation system will double by 2025, overtaking the system and generating huge costs in delays and service gaps. Additionally, the lack of fundamental navigation and forecasting information limits the U.S. response to the rapidly changing Arctic environment. NOAA's priorities for transportation include:

- Deliver advanced weather information services to support the Next-Generation Air Transportation System.
- Develop navigation and weather information infrastructure for the Arctic that:
 - improves geo-positioning accuracies from 2 meters to 2 centimeters for Alaska and the Arctic;
 - builds a geospatial framework with current water level and shoreline/hydrographic data;
 - expands NOAA's marine weather service to cover Arctic Ocean waters; and
 - augments capacity to respond to maritime oil and chemical spills in the Arctic Ocean.

NOAA's priorities for transportation include building a geospatial framework with current water level and shoreline/hydrographic data.

Continuity of Service

Maintaining the capacity and value of NOAA's existing oceanic and atmospheric research and services depends upon highly specialized infrastructure and personnel. These satellite systems, ships, aircraft, buoys, and other observing systems; high-performance computing and associated facilities; and the people who produce, provide, and manage NOAA's functions form the basis for NOAA's current and future performance. NOAA's priorities for community service include:

- Recapitalize and modernize mission-critical observing platforms (ships, aircraft, buoys, submersibles, satellites) and sensors.
- Acquire high-performance computing assets for complex weather, climate, and ecosystem modeling and prediction.
- Improve capacity through standards and other methods for integrating observing and data management systems.
- Expand capabilities through international partnerships (e.g., the Global Earth Observing System of Systems, bilateral data-sharing and access agreements).
- Repair and modernize existing facilities.
- Strategically manage human capital to fill skills gaps, and address recruitment, retention and retirement challenges.



NOAA's satellite systems, ships, aircraft, buoys, and other observing systems; high-performance computing and associated facilities; and the people who produce, provide, and manage NOAA's functions form the basis for NOAA's current and future performance.





James M. Turner, Ph.D.
Deputy Assistant Secretary
for International Affairs

International Affairs

Building Global Alliances

International engagement is one of NOAA's core capabilities; international cooperation is essential to the achievement of the agency's overarching mission goals. NOAA's leaders serve as the U.S. representatives to the Group on Earth Observations, Intergovernmental Oceanographic Commission, World Meteorological Organization, International Hydrographic Organization, and International Whaling Commission, among others. For this reason, exercising international leadership is designated in NOAA's Strategic Plan as one of its six crosscutting priorities for the 21st century. To advance NOAA's mission, the Deputy Assistant Secretary (DAS) for International Affairs provides policy advice and direction as well as support with respect to negotiations, partnerships, and other NOAA international interests and activities. The DAS chairs the International Affairs Council, using matrix management principles to ensure coordination of, and communication on, NOAA's international activities to achieve the objectives of NOAA's Goal Teams.

ACCOMPLISHMENTS

60th Annual Meeting of the International Whaling Commission

The 60th Annual Meeting of the International Whaling Commission (IWC) took place June 23–27, 2008, in Santiago, Chile. Dr. Bill Hogarth, U.S. IWC Commissioner, presided as Chair of the meeting, and Dr. Doug DeMaster, U.S. Deputy Commissioner, led the U.S. delegation. The IWC agreed to establish a small working group to discuss the future of the organization, given the impasse reached on the Revised Management Scheme and the number of issues for which polarization, rather than consensus, appears to be the norm. The United States is a member of this working group, along with 24 other member nations. The IWC also tasked the working group to look at ways to improve the practice and procedures of the IWC.

The small working group has met twice since the 60th Annual Meeting, first on September 15–19 in St. Petersburg, Florida,

and again on December 8–12 in Cambridge, United Kingdom. The small working group has divided the list of 33 critical issues into those issues that require immediate attention and those that can be addressed over a longer time frame, and has started to consider each issue in greater detail. The results of the working group will be discussed by the full Commission at a March 2009 intersessional meeting and again at the 61st Annual Meeting in Madeira, Portugal, in order to try to identify a consensus way forward and resolve the existing impasse.

Convention on the Conservation of Migratory Species of Wild Animals

On May 22, 2008, NOAA and the Secretariat of the Convention on the Conservation of Migratory Species of Wild Animals (CMS) signed a Letter of Cooperation (LOC). The LOC aims to foster cooperation between NOAA and the CMS Secretariat to conserve and manage migratory



The United States is a signatory to the Memorandum of Understanding (MOU) for the Conservation and Management of Marine Turtles and Their Habitats. The species of marine turtles covered by the MOU include the Green turtle (*Chelonia mydas*) shown here. Photo: Dr. Dwayne Meadows, NOAA Fisheries

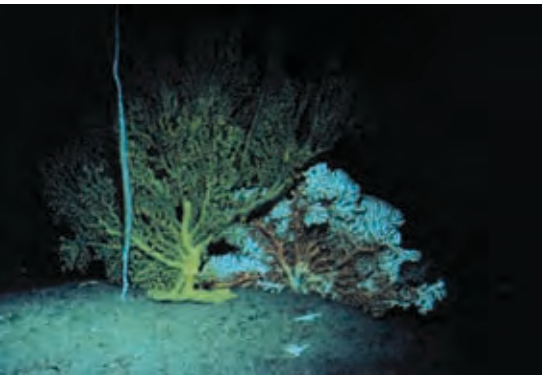


marine animals and their habitats throughout their range. It contemplates a range of potential areas of cooperation with the CMS Secretariat, including through the exchange of information and technical assistance, public education and outreach, participation in and implementation of CMS agreements, and engagement through other marine migratory species-related fora.

Generally, cooperation with the CMS Secretariat is helpful to accomplishing mutual objectives regarding the conservation of migratory marine animals and their habi-

tats. The United States is already party to the CMS Memorandum of Understanding (MOU) for the Conservation and Management of Marine Turtles and Their Habitats of the Indian Ocean and South-East Asia. The United States is also actively considering how to contribute more to the work of Agreement on the Conservation of Albatrosses and Petrels, including through possible accession. NOAA is also interested in new regional agreements and MOUs related to marine species that the CMS has proposed to develop in the next few years, including sharks and turtles in the Pacific Ocean.

The International Whaling Commission provides for the conservation of whale stocks, designates specified areas as whale sanctuaries, set limits on the numbers and size of whales that may be taken, prescribes open and closed seasons and areas for whaling, and prohibits the capture of suckling calves and female whales accompanied by calves.



In 2008, the Food and Agriculture Organization of the United Nations (FAO) adopted *International Guidelines for Deep Sea Fisheries on the High Seas*. The guidelines are designed to ensure the long-term conservation and sustainable use of marine living resources in the deep seas and to prevent significant adverse impacts on vulnerable marine ecosystems, including cold-water corals.

21st Annual Meeting of the APEC Marine Resource Conservation Working Group

The 21st Annual Meeting of the Asia-Pacific Economic Cooperation (APEC) Marine Resource Conservation Working Group (MRCWG) met on April 15–17, 2008, in Piura, Peru. Attended by 31 participants from 16 economies, including the United States, the meeting focused on a range of issues, including the Terms of Reference for the MRCWG, project reporting/status, new project proposals, update on the MRCWG portion of the Bali Plan of Action, priority issues for 2008, the Coral Triangle Initiative, and the ongoing MRCWG Independent Assessment. NOAA delegates provided information on a recently produced *Tsunami Warning Center Reference Guide*, updated the meeting on

the ongoing project on Marine Ecosystem Identification and Mapping, and presented a proposal for a new project on Marine Ecosystem Assessment and Management in the Asia-Pacific Region. Meeting participants provided positive feedback on the ongoing project, as well as expressed support for the new project proposal on marine ecosystems.

In addition, the seventh joint session of the APEC MRCWG and the Fisheries Working Group was held on April 18, 2008 in Piura, Peru. The 18 member economies in attendance discussed a range of issues that are of mutual interest to both groups, including ecosystem-based management, climate change, and marine debris. The next meeting will take place June 1–4, 2009, in Vancouver, Canada.

International Guidelines for the Management of Deep Sea Fisheries in the High Seas

In 2008, the Food and Agriculture Organization of the United Nations (FAO) adopted *International Guidelines for the Management of Deep Sea Fisheries in the High Seas*. The guidelines are designed to ensure the long-term conservation and sustainable use of marine living resources in the deep seas and to prevent significant adverse impacts on vulnerable marine ecosystems (VMEs), including cold-water corals. The guidelines will assist states and regional fisheries management organizations (RFMOs) in their implementation of the 2006 United Nations General Assembly (UNGA) sustainable fisheries resolution 61/105, chapter 10, concerning responsible fisheries in the marine ecosystem, by developing standards and criteria for identifying VMEs, and significant adverse impacts due to fishing on VMEs in the high seas.

The United States has been a key player in these developments. In 2006, the President issued a directive that the Departments of State and Commerce work with other countries directly and through new and existing RFMOs to protect VMEs from destructive fishing practices on the high seas. Based on this directive, U.S. negotiators participated actively in the development of UNGA Resolution 61/105, as well as in the ensuing FAO International Guidelines.

The United States has taken a leadership role in RFMOs, including the Convention on the Conservation of Antarctic Marine Living Resources, the Northwest Atlantic Fisheries Organization, and developing RFMOs in the Pacific, to ensure the UNGA resolution and the guidelines developed at FAO are fully implemented by RFMOs and their member states. Specifically, NOAA invested significant time and effort developing a negotiating text on VME identification and the assessment of fishing impacts thereon, which resulted in NOAA's position being largely incorporated directly into the FAO International Guidelines on the issue.

NOS Leads U.S. Delegation to the Intergovernmental Oceanographic Commission

John H. Dunnigan, Assistant Administrator of NOS, led the U.S. Delegation to the United Nations' Intergovernmental Oceanographic Commission (IOC). Comprised of government agencies from around the world, this scientific organization is the United Nations' focal point for ocean sciences and services in collaboration with 136 member countries. Vice Admiral Conrad C. Lautenbacher, Jr. (U.S. Navy, ret.), then-NOAA Under Secretary for Oceans and Atmosphere, addressed the IOC Exec-

MISSION

- Serve as principal advisor to the Under Secretary of Commerce for Oceans and Atmosphere and NOAA Administrator on international policy issues,
- Represent NOAA and the United States with foreign governments and in international fora.

- Establish policies, guidelines, and procedures for NOAA's international programs.
- Provide coordination and support to NOAA's lines offices.

VISION

Utilize international collaboration and partnerships to better understand, predict, and take steps to respond to changes in the Earth's environment, conserve and manage coastal and marine resources, protect life and property, and provide decision makers with reliable and timely scientific information in support of NOAA's mission.

utive Committee, met with Latin American representatives participating in the inter-governmental Group on Earth Observations (GEO), and signed a bilateral scientific and technology Memorandum of Understanding with the French ocean science agency IFREMER. In 2008, the IOC's priority issues were to reinforce IOC administrative arrangements with the United Nations Educational, Scientific and Cultural Organization; begin planning for the IOC 50th anniversary in 2010; enhance coordination of the global ocean observing system and global tsunami warning system within the context of GEO; and examine emerging ocean science issues critical to climate issues, maritime transportation, and the environment.

NOAA Fisheries Leadership Achieves Yellowtail Flounder Fishing Privilege

After a six-year campaign to achieve usable fishing privileges for Grand Bank yellowtail flounder, the United States signed an agreement with Canada that will make up to 1,500 metric tons (mt) of quota per year available to U.S. fishermen. The arrangement was recognized by the Northwest Atlantic Fisheries Organization at its annual meeting in Vigo, Spain, on September 22–26, 2008. Initially, the fish will come in a 1,000-mt transfer from the Canadian quota, which can be increased to 1,500 mt per year for a one-time transfer of the U.S. Division 3L quota for shrimp. The United States and Canada are preparing a separate exchange of letters recording their intent that the 1,500-mt yellowtail will become a



In Alaska, experiments designed to compare the new Oscar Dyson's winter acoustic surveys with the older Miller Freeman in the Bogoslof Island area of the Bering Sea, the Shelikof Strait, and the Shumagin Islands area of the Gulf of Alaska were completed in 2008.

permanent U.S. quota, and that the two countries will jointly pursue that outcome beginning in 2011.

Acoustic Survey Results Presented at International Symposium

In Alaska, experiments designed to compare the new *Oscar Dyson's* winter acoustic surveys with the older *Miller Freeman* in the Bogoslof Island area of the Bering Sea,

the Shelikof Strait, and the Shumagin Islands area of the Gulf of Alaska were completed in 2008. Results of this portion of the ongoing inter-vessel experiments were presented in Bergen, Norway, in June 2008 at the International Council for the Exploration of the Seas Symposium on the Ecosystem Approach with Fisheries Acoustics and Complementary Technologies.



Louisa Koch
Director of Education

Office of Education Promoting Environmental Literacy

NOAA's Office of Education provides advice and counsel to the Under Secretary of Commerce for Oceans and Atmosphere in matters pertaining to education. The office, in conjunction with the Education Council, coordinates educational activities across NOAA and oversees the implementation of NOAA's Education Plan and Policy. These efforts help to ensure that NOAA's education programs and activities are based on NOAA science and support the agency's cross-cutting priority of promoting environmental literacy. The Office of Education also works with external partners to promote environmental literacy efforts that directly benefit the NOAA mission, striving to improve the efficiency and effectiveness of NOAA's collective education efforts. The office provides crucial coordination for these efforts by chairing NOAA's Education Council. Such coordination functions are typical of a staff office portfolio and analogous to responsibilities of many of the other headquarters offices. The Office of Education is unique among the staff offices in that it also directly implements and manages projects aimed at advancing key educational goals.



These NOAA scholars received awards for oral and poster presentations describing their NOAA research. Left to right: LaToya Chandler, EPP Undergraduate Scholar (Environmental Science major, Florida A&M University); Elizabeth Drenkard, Hollings Undergraduate Scholar (Cell and Molecular Biology major, Cornell University); and Jillian Cutler-Vitacco, Hollings Undergraduate Scholar (Biology major, Cornell University). Photo: Department of Commerce Office of Photographic Services

ACCOMPLISHMENTS

Educational Partnership Program

The Educational Partnership Program (EPP) supports education of students in NOAA mission sciences, particularly students from underrepresented communities. During FY 2008 the Office of Education published its Report on the Educational Partnership Program, which highlighted many EPP significant program accomplishments during 2001–2007.

EPP Cooperative Science Centers

The EPP provides funding to eligible minority-serving institutions on a competitive basis, to educate and graduate students in NOAA sciences, including atmospheric, oceanic, environmental, and living marine resource sciences, and remote-sensing and scientific environmental technology. The program's goal is to increase the number of students from underrepresented commu-

nities who are educated and graduate with degrees in sciences directly related to NOAA's mission. To date, 475 students have graduated from these EPP Cooperative Science Centers, and 444 students are currently enrolled.

As a result of EPP funding, NOAA's Cooperative Science Centers accomplished the following in 2008:

- *University of Maryland Eastern Shore*—Created a summer Fish Stock Assessment training program that includes internships at NOAA labs; and
- *Hampton University*—Created a minor in Space, Earth and Atmospheric Sciences, which resulted in the formation of a new department of Atmospheric and Planetary Sciences.

EPP Graduate Sciences Program

The EPP Graduate Sciences Program provides opportunities for students in NOAA-

related fields to pursue research and educational training in atmospheric, environmental, and oceanic sciences and remote-sensing technology at minority-serving institutions, when possible. Overall, the objective of the Graduate Sciences Program is to increase the number of students who undertake coursework and graduate with postgraduate degrees in the targeted areas integral to NOAA's mission. In 2008, three new Graduate Sciences Program students were selected, and seven Graduate Sciences Program participants completed their academic degrees and were reassigned into full-time, permanent NOAA positions.

EPP Environmental Entrepreneurship Program

The EPP Environmental Entrepreneurship Program provides funding to eligible minority-serving institutions on a competitive basis to encourage students to pursue advanced academic study and entrepreneurship opportunities in NOAA-related sciences. This program supports student training and experiential learning opportunities for the purpose of stimulating job creation and business development. Its objective is to increase the number of students at minority-serving institutions proficient in environmental business enterprises.

EPP Undergraduate Scholarship Program

This program provides support for students who study and graduate with degrees in areas integral to NOAA's mission. It targets students who have completed their sophomore year and who attend minority-serving institutions. Scholars are placed at NOAA offices and sites for two 10-week paid summer internships. In 2008, sixteen Undergraduate Scholarship Program students were selected.



NOAA Education 2008 scholarship recipients attend orientation at NOAA headquarters in Silver Spring, Maryland. NOAA Education administers the EPP Undergraduate Scholars Program, the Dr. Nancy Foster Scholarship Program, and the Ernest F. Hollings Undergraduate Scholarship Program.

Dr. Nancy Foster Scholarship Program

This program provides support for outstanding academic scholarship, and encourages independent graduate-level research in oceanography, marine biology, or maritime archaeology, particularly for women and members of minority groups. In 2008, nine Nancy Foster Scholarship Program recipients were selected.

Ernest F. Hollings Undergraduate Scholarship Program

This program provides support for undergraduate student training in NOAA mission sciences and teacher education. Awards include academic assistance for full-time study during an academic year; a 10-week internship during the summer at a NOAA facility; and, if reappointed, academic assistance for full-time study during a second academic year. In 2008, 113 Ernest F. Hollings Undergraduate Scholars

were selected for the Class of 2008, the largest class to date. In addition, one Hollings Undergraduate Scholarship recipient entered the NOAA Corps, and another entered the NOAA EPP Graduate Sciences Program.

Environmental Literacy Grants

The Environmental Literacy Grant Program is a highly competitive program with the goal of creating an environmentally literate public that uses a comprehensive understanding of the role of the ocean, coasts, and atmosphere in the global ecosystem to make the best social and economic decisions. These grants support a vast array of educational organizations that reach diverse audiences. They fund informal and formal education projects that are implemented on statewide to nationwide scales and emphasize partnerships, particularly with NOAA offices and programs.

Through this grant program, the following types of informal education projects have been funded through 2008:

- installations of Science On a Sphere® and other spherical display systems;
- citizen science;
- adaptation of NOAA data and data visualizations for use in networks of informal science education institutions;
- development of a traveling exhibit on



Science On a Sphere® installations are located throughout the United States.

Science On a Sphere® users attend a Collaborative Network meeting.

the importance of watersheds, connecting local watershed information to the ocean;

- short radio programs translating current NOAA science for public audiences;
- experiential learning opportunities for youth and their families; and
- opinion research on public ocean literacy.

Environmental Literacy Grants have also supported in-service K-12 teacher professional development, pre-service teacher education at the undergraduate level, and development and revision of instructional materials and curricula for grades K-12 on topics relevant to NOAA's mission goals.

Science On a Sphere® Users Collaborative Network

Science On a Sphere® (SOS) is an animated 68 inch-diameter globe used in museums and science centers across the country, designed to show dynamic images and data of the atmosphere, ocean, or surface of a planet or moon. To keep the groups involved in the SOS education program working together and focused on program-wide education goals, the Office of Education has formed the SOS Users Collaborative Network. This network consists of institutions that have SOS installed (or

in the process of being installed) as part of a public exhibit, or are currently working with NOAA to support the development and application of the technology.

Bay Watershed Education and Training Program

The NOAA Bay Watershed Education and Training (B-WET) program offers competitive grants to promote locally relevant, systemic experiential learning in the K-12 environment. The criteria for these awards emphasize meaningful watershed educational experiences (MWEEs): sustained, hands-on, environmental activities that are aligned with academic learning standards. B-WET funding supports organizations that provide MWEEs directly to students or offer professional development in support of MWEEs to teachers. These experiential opportunities are intended to supplement and enrich the traditional formal learning environment.

NOAA B-WET responds to regional educational and environmental priorities through local implementation. The program has been highly successful in Chesapeake Bay, California, and Hawaii. In 2008, the NOAA Office of Education received funding to expand the program to include the Pacific Northwest, Gulf of Mexico, and New England, funding fifteen projects in these new regions.





Middle school students with the Gulf of Maine Research Institute’s Vital Signs program document the occurrence of purple loosestrife to share with an online community of students and scientists. The Gulf of Maine Research Institute is a 2008 B-WET grant recipient.

Climate and Ocean Literacy Frameworks

Working with the education and scientific communities, the NOAA Office of Education has provided leadership for the development and promotion of guides that present a vision of a climate- and ocean-literate society and serve as a practical resource for educators. They were designed to provide criteria to judge progress toward a national vision of ocean and climate literacy both inside and outside the formal K-12 system. In 2008, NOAA and the American Association for the Advancement of Science published *Climate Literacy: The Essential Principles of Climate Sciences*. This brochure is a companion to *Ocean Literacy: The Essential Principles and Fundamental Concepts*, which the Office of Education published in 2006 with the National Geographic Society.

NOAA Education Council and Education Strategic Plan

The NOAA Education Council was formed in 2003 as an outgrowth of a recommendation made by the NOAA Science Advisory Board’s Subcommittee on Education, by recommendations derived from the NOAA

Program Review Team process, and out of a growing recognition of the need for a formal, yet internal Education Council. The council consists of 15 senior staff members of NOAA’s line, program and staff offices. Their primary responsibilities are to serve as a forum within NOAA for the discussion of ideas and proposals for NOAA-wide education and outreach activities and priorities and to make recommendations to NOAA management on all aspects of NOAA’s educational activities. Council members represent their offices’ interests and activities dealing with education and outreach programs. The Education Council is staffed by NOAA’s Office of Education and meets monthly or at the request of the council’s chair.

Because every line office in NOAA deals with education and outreach in one form or another, NOAA, through its strategic planning program, has developed a cross-cutting priority dealing with goals to attain toward environmental literacy, outreach, and education. The Education Council helps to provide input into the goals as well as help to monitor achievements associated with the implementation of the NOAA



These two companion brochures present a vision of a climate- and ocean-literate society and serve as a practical resource for educators.

Strategic Plan and NOAA's *Education Strategic Plan* goals. As education, outreach, and support for environmental literacy continue to increase in importance to our society, members of the NOAA Education Council will serve an important role in helping direct NOAA's efforts along the right path.

Development of Education Strategic Plan

NOAA recently received broad legislative authority from Congress through the *America COMPETES Act* to develop, support, promote, and coordinate educational

activities to enhance public awareness and understanding of ocean, coastal, Great Lakes, and atmospheric science. This legislation complements the standing legislation of the National Sea Grant Program, the Office of National Marine Sanctuaries, the National Estuarine Research Reserve System, and the Coral Reef Conservation Program, providing a unifying mandate for education across the agency. In conjunction with the Office of Education and with public input, in 2008 the Education Council developed NOAA's Education Strategic Plan, establishing the goals for NOAA's education programs for the next twenty

years. The upcoming implementation plan will provide near-term targets for reaching those goals.

Education Outreach Center

Located in Silver Spring, Maryland, the Education Outreach Center provides major support to all of NOAA and its external constituents with education and outreach materials to support various NOAA science-related events. As an example, the center supports the annual NOAA Bring a Child to Work Day through workshop development, coordination, and age-appropriate materials for students.



Students explore oil spill remediation at the 2008 Bring a Child to Work Day at NOAA headquarters in Silver Spring, Maryland.

In addition to supporting NOAA exhibits at conferences around the country, the center provides services to broader public audiences that request materials for local training and community events. Therefore, the resources of the Education Outreach Center aid both education and community engagement in support of safety and stewardship.

Smithsonian Ocean Hall and “Ocean Today” Kiosk

NOAA’s Education Council and Office of Education provided content, spherical displays, and technical support to both the Sant Ocean Hall exhibit and the “Ocean Today” kiosk in conjunction with the Smithsonian Institution. The exhibit is designed to enhance ocean literacy among visitors through a multimedia experience. Office of Education has leveraged NOAA’s investment in the “Ocean Today” kiosk by including other aquariums in the United States, putting content developed for the Sant Ocean Hall in a regional context for visitors to those venues. Through these exhibits, NOAA has the potential to reach people around the country with relevant messages about the ocean and our coasts.

National Academy of Sciences Review of NOAA Education

NOAA’s Office of Education has commissioned the National Academies Board on Science Education to review and assess the role of NOAA in education, as well as its program goals and objectives, program impact, portfolio balance and priorities, and evaluation strategy.

Taking the Pulse of the Planet Award

Part of the Intel International Science and Engineering Fair, this award recognizes students whose outstanding projects further our understanding of Earth’s systems. The award is intended to recognize the importance of the U.S.-led initiative to develop a global Earth Observation System.

FUTURE OUTLOOK

The broad authority granted in the *America COMPETES Act* enables NOAA to be a leader in both science research and education, beginning with a 20-year education plan that will have significant impacts on the future direction of education within NOAA. To provide critical support for its mission, NOAA must exploit its expertise in oceanic and atmospheric science to train and attract its future workforce and promote environmental literacy among the public. This will happen through a strategically directed education program capable of harnessing the power of NOAA science.



The Taking the Pulse of the Planet Award is an annual event at the Intel International Science and Engineering Fair. Here Dr. George Sharman (right) presents the award to 2008 winner Zaki Daniel Moustafa. Photo: Society for Science & the Public



*Brook Davis, Acting Director
of Legislative Affairs*

Office of Legislative Affairs

NOAA's Office of Legislative Affairs (OLA) coordinates all NOAA contacts with Congress and is responsible for planning, directing, and coordinating legislative programs that are of concern to the Office of the Under Secretary of Commerce for Oceans and Atmosphere and the Administration. As the official liaison between the NOAA and the United States Congress, the OLA communicates the Administration's views to Congress and is proactive in notifying Congress of important NOAA developments. Conversely, the OLA keeps senior NOAA and Department of Commerce officials informed of critical congressional information and activities.

SAMPLE OF FY 2008 CONGRESSIONAL EVENTS

Officials Celebrate Narragansett Bay Marine Debris Removal Grant

On October 1, Senator Jack Reed (D-RI), Representative Patrick Kennedy (D RI-1), and Governor Don Carcieri (R) joined Deputy Assistant Secretary for Oceans and Atmosphere Tim Keeney in Bristol, Rhode Island, to celebrate a \$170,000 NOAA award for marine debris removal in Narragansett Bay.

Senator Nelson Praises NOAA Green Ship Initiative

On November 8, Senator Ben Nelson (D-NE) told a Military Energy Security Forum meeting in Washington, DC, he was "very impressed by what NOAA is doing on the biofuels side" by reducing dependency on overseas sources of energy. The NOAA Green Ships all use 100 percent soy biodiesel for engine fuel, and canola-based motor oil and vegetable-based hydraulic oil for its deck crane, winches, transmission, and steering gear.

Representative Shuler Tours National Climatic Data Center

On November 2, National Climatic Data Center (NCDC) Director Tom Karl briefed Representative Heath Shuler (D NC-11) on NCDC activities during a tour of the Asheville, North Carolina, facility.

Representative Frelinghuysen Joins VADM Lautenbacher on Antarctica Scientific Trip

Representative Rodney Frelinghuysen (R NJ-11) joined then-Under Secretary for Oceans and Atmosphere VADM Conrad C. Lautenbacher, Jr., USN (Ret.), on a January 7-13 National Science Foundation-sponsored tour of Antarctica.

NOAA Scientists Advise House Delegations Visiting the Great Barrier Reef

On January 5-7, NOAA scientists William Skirving and Scott Heron served as technical advisors to two House delegations visiting Australia's Great Barrier Reef. Both delegations were en route home from trips to Antarctica.

Majority Leader Steny Hoyer (D MD-5) and Minority Whip Roy Blunt (R MO-7) led the first delegation. The scientists highlighted NOAA's partnerships with Australia and NOAA's Coral Reef Conservation Program activities. The first delegation also included Representative Debbie Wasserman Schultz (D FL-20), Representative Baron Hill (D IN-9), Representative Bobby Etheridge (D NC-2), Representative John Lewis (D GA-5), Representative Emmanuel Cleaver (D MO-5), Representative Ben Chandler (D KY-6), Representative Madeleine Bordallo (D-Guam), Representative Lynn Westmorland (R GA-3), Representative Jo Ann Emerson (R MO-8), Representative Kay Granger (R TX-12), Representative Ander Crenshaw (R FL-4), and Representative Ray LaHood (R IL-18).

The following day, the NOAA scientists met with a second delegation from the House Committee on Science and Technology (Chairman Bart Gordon, D TN-6). The second delegation included Representative Brian Baird (D WA-3), Representative Charlie Melancon (D LA-3), Representative Mike Ross (D AR-4), Representative Russ Carnahan (D MO-3), Representative Frank Lucas (R OK-3), Representative Adrian Smith (R NE-3), Representative Randy Neugebauer (R TX-19), Representative Bob Inglis (R SC-4), Representative John Tanner (D TN-8), and Representative Loretta Sanchez (D CA-47).

En route to the Mainland, the House Committee on Science and Technology delegation also stopped in Hawaii, where NOAA's Integrated Data and Environmental Applications Center Director Eileen Shea joined the delegation on a boat tour of Pearl Harbor. She briefly discussed NOAA's new site on Ford Island and the Pacific Regional Center.

Representative Pickering Attends Weather Service Briefing

On January 17, Representative Charles "Chip" Pickering (R MS-3) was briefed by radar expert and National Weather Service (NWS) contractor Bob Saffle and John Sokich, Program and Policy Advisor to the NWS Director. The briefing included an overview of the NWS and specifically focused on radar coverage and related issues in Mississippi.

Members of Congress Visit NWS Weather Forecast Offices

Throughout FY 2008, several members visited NWS Weather Forecast Offices (WFOs) across the country. On March 8, Representative Leonard Boswell (D IA-3) visited the NWS WFO in Des Moines, Iowa, where he discussed hydro/flooding concerns, given the substantial snowpack across portions of the state. On May 29 and June 13, respectively, Representative Emanuel Cleaver (D MO-5) and Representative Ike Skelton (D MO-4) toured the NWS WFO in Kansas City, Missouri. And on September 4, Senator Mike Enzi (R-WY) visited the NWS WFO in Riverton, Wyoming.

Senator Murkowski Visits NOAA Alaska Fisheries Science Institute

On March 18, Senator Lisa Murkowski (R-AK) visited the NOAA National Marine Fisheries Service's Ted Stevens Marine Research Institute (TSMRI) in Juneau. Dedicated in August 2007, the TSMRI was the headquarters of the Alaska Fisheries Science Center's Auke Bay Laboratories.

Members of Congress Visit NOAA's NHC

Throughout FY 2008, several Members of Congress visited NOAA's NWS National Hurricane Center (NHC) in Miami, Flori-



National Hurricane Center Director Bill Read (left) briefs Senator Mel Martinez (R-FL) on the track of Tropical Storm Gustav.

da. Representative Mario Diaz-Balart (R FL-25) visited on March 19; Senator Mel Martinez (R-FL), on August 25; and Representative Ron Klein (D FL-22), on September 6. They met with Director Bill Read, toured the NHC, and thanked the NHC employees for their valuable work.

Representative Ros-Lehtinen Visits NOAA's AOML

On March 24, Representative Ileana Ros-Lehtinen (R FL-18) visited NOAA's Atlantic Oceanographic and Meteorological Laboratory (AOML) in Miami, Florida. She spoke to NOAA scientists in the Oceanography Engineering and Environmental Microbiology labs, and received an overview of the Florida Coastal Programs.

Annual NOAA Day on Capitol Hill

On April 10, NOAA held its 2nd Annual NOAA Day on Capitol Hill in the Rayburn House Office Building foyer, which featured displays of NOAA's scientific achievements staffed by NOAA professionals. Over 250 people attended the event throughout the day, including over 200 congressional staffers from the Senate and House. In addition, five Members of Congress who joined us and viewed the displays:

- Delegate Madeleine Bordallo (D-Guam), Chair of the House Committee on Natural Resources, Subcommittee on Fisheries, Wildlife, and Oceans;
- Representative Rodney Frelinghuysen (R NJ-11), Ranking Member of the House Committee on Appropriations, Subcommittee on Commerce, Justice, Science, and Related Agencies;
- Representative Vern Ehlers (R MI-3), Ranking Member of the House Committee on Science and Technology, Subcommittee on Research and Science Education;
- Representative Mike Honda (D CA-15), Member of the House Committee on Appropriations; and
- Representative Ileana Ros-Lehtinen (R FL-18), Ranking Member of the House Committee on Foreign Affairs.



Left to right: Paul Bitzel, Supervisor of Curatorial Services, National Park Service; Representative John Sarbanes (D MD-3); and Vice Admiral Conrad C. Lautenbacher, Jr., USN (Ret.), then-Under Secretary for Oceans and Atmosphere and NOAA Administrator, attended NOAA Restoration Day on April 19 at Fort McHenry, Maryland.

Also in attendance were then-Under Secretary for Oceans and Atmosphere VADM Conrad C. Lautenbacher, Jr., USN (Ret.); Deputy Under Secretary for Oceans and Atmosphere Mary Glackin; and other members of NOAA's leadership.

Groundbreaking with Representative Mollohan

On April 19, Representative Alan Mollohan (D WV-1) joined NOAA Deputy Under Secretary for Oceans and Atmosphere Mary Glackin at the groundbreaking for the Canaan Valley Institute's Research and Education Center and a tour of NOAA's air quality and research station at the Institute. Representative Mollohan was the keynote speaker.

Red Snapper Event with Representative Lampson

On April 25, NOAA participated in a town hall meeting in Representative Nick Lampson's (D TX-22) district in the Galveston Bay area to discuss red snapper management. Members of the public, including recreational fishermen and environmental representatives, attended the event. Representative Lampson moderated the event, and an official from NOAA's National Marine Fisheries Service Southeast Region answered questions from the audience.

Maine Delegation Praise NWS Efforts

On May 2, Senator Olympia Snowe (R-ME), Senator Susan Collins (R-ME), Representative Tom Allen (D ME-1), and Representative Michael Michaud (D ME-2) attended a briefing on the historical flood event on the St. John River in Fort Kent, Maine. The briefing was hosted by emergency managers and law enforcement representatives, who were joined by staff from the NWS WFO in Caribou, Maine. The WFO staff members were praised for the timely and accurate information and 24/7 support they provided during the flood.

Representative Udall Sponsors NOAA Hosted Reception

On May 20, Deputy Under Secretary for Oceans and Atmosphere Mary Glackin spoke at a NOAA/National Aeronautics and Space Administration (NASA) reception held in conjunction with the Space Weather Enterprise Forum. Representative Mark Udall (D CO-2) was the congressional sponsor. Representative Ron

Klein (D FL-22) and Representative Tom Feeney (R FL-24) attended the reception, along with a number of congressional staff.

Representative Wasserman Schultz Joins NOAA at Hurricane Press Event

On May 29, Representative Debbie Wasserman Schultz (D FL-20) joined Dr. Robert Atlas, Director of NOAA's Atlantic Oceanographic and Meteorological Laboratory (AOML), in Miami at the Broward County Emergency Operations Center for a press briefing on the upcoming hurricane season.

Representative Brown-Waite Lends Support to NOAA Weather Radios

On May 31, Representative Ginny Brown-Waite (R FL-5) joined the NWS WFO in Tampa at the Hernando County Hurricane Preparedness Expo for a presentation focused on the need for NOAA Weather Radios, their operation, set up, and special needs features.

Representative Ros-Lehtinen Promotes Hurricane Preparedness

On June 2, Representative Ileana Ros-Lehtinen (R FL-18) hosted her Hurricane Preparedness Summit for the Florida Keys for the second year. The goal of this event was to seek advice from national hurricane experts, including NOAA and Federal Emergency Management Administration experts, to help the Florida Keys community prepare for the season's possible storms. NHC Director Bill Read, AOML Director Dr. Robert M. Atlas; and NWS Key West WFO Meteorologist-In-Charge Matt Strahan attended and provided remarks.

Chairwoman Bordallo Is Keynote Speaker at Coral Reception

On June 4, Delegate Madeleine Bordallo (D-Guam), Chair of the House Committee on Natural Resources, Subcommittee on Fisheries, Wildlife, and Oceans, provided the keynote address at the NOAA-organized Capitol Hill Oceans Week Coral Reception.

Representative Baird Addresses Coral Reef Panel

On June 4, Representative Brian Baird (D WA-3) provided the opening remarks at the NOAA-organized U.S. Coral Reef Task Force Congressional Coral Reef Ecosystem Panel, held during Capitol Hill



Senator Carl Levin (D-MI) attended a ceremony at NOAA's Great Lakes Maritime Heritage Center, within the Thunder Bay National Marine Sanctuary, in honor of the opening of the center's new exhibit.

Oceans Week. Selected to highlight the International Year of the Reef 2008, the forum focused on the state of coral reef science, as well as innovative policy approaches needed to conserve coral reef ecosystems in the United States and internationally.

Senator Reed Speaks at Shellfish Symposium

On June 9, Senator Jack Reed (D-RI) joined Deputy Assistant Secretary for Oceans and Atmosphere Tim Keeney at

the National Symposium on Shellfish and the Environment in Warwick, Rhode Island. NOAA hosted the symposium to increase broad understanding of the key environmental issues surrounding shellfish aquaculture.

Senator Levin Helps Launch New Sanctuary Exhibit

On June 14, Senator Carl Levin (D-MI) attended the grand opening of a permanent exhibit at the Thunder Bay National Marine Sanctuary in Alpena County, Michigan, and noted the outstanding learning experience offered by the new exhibit, entitled Exploring the Shipwreck Century. Later that evening at the ceremonial dinner, Senator Levin provided laudatory remarks about the sanctuary, the new exhibit housed in NOAA's Great Lakes Maritime Heritage Center, and the strong partnership between NOAA and the Alpena community.

Representatives Mollohan and Edwards Visit NOAA Satellite Operations Facility

On June 16 and September 3, respectively, Representative Alan Mollohan (D WV-1, Chairman of the House Committee on Appropriations, Subcommittee on Commerce, Justice, Science, and Related Agencies) and Representative Donna Edwards

(D MD-4) joined Deputy Under Secretary Mary Glackin for a tour of the NOAA Satellite Operations Facility in Suitland, Maryland.

Members of Congress Attend Sea Grant Day

On July 18, Representative Charlie Wilson (D OH-6) and Representative Marcy Kaptur (D OH-9) attended the 17th Ohio Sea Grant State Legislature/Congressional Day on Lake Erie. They were joined by NOAA's Deputy Under Secretary for Oceans and Atmosphere, Mary Glackin; National Marine Fisheries Service Assistant Administrator, James Balsiger; and Office of Oceanic and Atmospheric Research Assistant Administrator, Rick Spinrad.

Members of Congress Attend Chesapeake Bay Buoy Events

On July 19, Representative Rob Wittman (R VA-1) joined Deputy Under Secretary for Oceans and Atmosphere Mary Glackin at a NOAA Chesapeake Bay Interpretive Buoy System (CBIBS) deployment ceremony near Stingray Point, Virginia. And on September 13, Senator Ben Cardin (D-MD) and Representative C.A. "Dutch" Ruppersberger (D MD-2) joined then-Under Secretary of Commerce for Oceans

PRODUCTS AND SERVICES

Services for NOAA, the Department of Commerce, and the Administration

- Develops, coordinates, and implements the overall legislative strategy for NOAA; identifies and tracks all legislation of interest to NOAA; and keeps the Office of the Under Secretary and Assistant Administrators informed.
- Ensures good communication and coordination among legislative activities within NOAA Line, Program, and Staff offices.
- Manages every aspect of NOAA's participation in congressional hearings, including advising NOAA senior management of official requests for witnesses, ensuring that the witnesses are properly briefed, and overseeing the preparation and clearance of NOAA testimony, including providing drafting assistance for the written and/or oral testimony as requested.
- Coordinates with the Department of Commerce Office of Legislative and Intergovernmental Affairs.

Services for Congress

- Rolls out the President's annual budget request to Congress.
- Coordinates and communicates the Administration's position on issues and programs of interest to NOAA on proposed pending legislation through views letters and congressional testimony at hearings.
- Provides congressional staff with technical drafting assistance, views letters for legislation, and opportunities to meet with NOAA experts, and ensures congressionally mandated reports ordered by NOAA authorizing committees are completed on time.
- Responds to all congressional inquiries in a timely manner through personal visits, e-mail, phone, fax, and mail.
- Briefs Members of Congress and their staff regularly on important NOAA programs, issues, and activities.

Legislative Program Outputs

- Every year the OLA's legislative program activities encompass more than:
- 21,000 e-mails and phone calls with Members and congressional staff;
 - 1,000 briefings and meetings with Members and congressional staff;
 - 30 oversight and legislative hearings;
 - 400 Questions for the Record in follow-up to hearings;
 - 125 letters of incoming correspondence from Members requiring prepared response; and
 - 1,000 NOAA grants, totaling over \$856,932,439 (FY 2008), that the OLA reviews and then notifies Congress of the award. Notifications are sent to the Representative in whose district the work is based, both Senators and other Members, as relevant.

and Atmosphere VADM Conrad C. Lautenbacher, Jr., USN (Ret.), at an event in Havre de Grace, Maryland, during which NOAA's Chesapeake Bay Office deployed another CBIBS "smart buoy" at the mouth of the Susquehanna River. CBIBS marks significant points along the new Captain John Smith Chesapeake National Historic Trail, and provides real-time monitoring data on local weather, water, and oceanographic conditions to mariners and educators.

Senator Mikulski Attends Conference Launch

On July 22, Senator Barbara Mikulski (D-MD) joined Deputy Under Secretary for Oceans and Atmosphere Mary Glackin at the "We Have Come A Long Way" reception for Dr. Sally K. Ride, the first American woman in space, held at the Goddard Space Flight Center. This was the opening event for the "Earth Then, Earth Now: Our Changing Climate" educator conference, co-sponsored by NOAA and NASA and held at the NOAA Silver Spring campus, at which Dr. Ride was a featured presenter.

Senator Thad Cochran (R-MS) touring the Port of Gulfport via tugboat with NOAA staff.

Open House at *Aquarius*

On August 4, Representative Ileana Ros-Lehtinen (R FL-18) and congressional staff from the House Committee on Science and Technology attended an Open House at NOAA's *Aquarius* to celebrate 20 years of successful marine science. NOAA's *Aquarius* is the only undersea laboratory dedicated to marine science operating in the world.

Senator Cochran Attends PORTS Ceremony

On June 21, Senator Thad Cochran (R-MS) joined Deputy Under Secretary Mary Glackin at the opening ceremony to mark NOAA's Physical Oceanographic Real-Time System (PORTS) becoming fully operational in Gulfport, Mississippi. Gulfport is the third busiest container port in the U.S. Gulf of Mexico, and has become the 16th PORTS location in the United States.

Congressional Staff Visit NOAA's James Howard Laboratory

On August 7, staff from the office of Representative Frank Pallone (D NJ-6) toured NOAA's James Howard Laboratory in Sandy Hook, New Jersey, to see how the lab works, how it conducts science related to

summer flounder, and how NOAA partners with other institutions.

Congressional Staff Visit NOAA Facilities in Seattle

On August 11–13, staff from the office of Senator Maria Cantwell (D-WA), Representative Norm Dicks (D WA-6), Representative Jim McDermott (D WA-7), Representative Jay Inslee (D WA-1), and the House Committee on Science and Technology visited Seattle to learn about the breadth of NOAA activities and projects in the Seattle area. This included the Northwest Fisheries Science Center's Manchester Research Station in Western Puget Sound, the Pacific Marine Environmental Laboratory, the Office of Response and Restoration, and the NOAA Diving Center.

Congressional Staff Attend NOAA Ship Commissioning Ceremony

On August 13, staff from the offices of Senator Maria Cantwell (D-WA), Senator Patty Murray (D-WA), Representative Norm Dicks (D WA-6), Representative Jim McDermott (D WA-7), Representative Jay Inslee (D WA-1), Representative Rick Larsen (D WA-2), and the House Committee on Science and Technology joined Deputy Secretary of Commerce John



Sullivan; then-Under Secretary for Oceans and Atmosphere VADM Conrad C. Lautenbacher, Jr., USN (Ret.); and other members of NOAA leadership for the commissioning of the NOAA ship *Okeanos Explorer* in Seattle. The ship is the nation's first federal ship dedicated solely to ocean exploration.

Congressional Staff Visit Port of Seattle

On August 13–14, congressional staff from the offices of Senator Maria Cantwell (D-WA), Representative Jim McDermott (D WA-7), and Representative Rick Larsen (D WA-2) visited the port of Seattle. The trip demonstrated to congressional staff how a port operates, and how NOAA and U.S. Coast Guard products and services are essential to operation of a port and the vitality of the nation's economy.

Congressional Staff Visit South Florida and the Keys

On August 18–22, staff from the Senate Committee on Commerce, Science, and Transportation; Senate Committee on Appropriations; House Committee on Science and Technology; and the offices of Senator Richard Shelby (R-AL) and Senator Thad Cochran (R-MS) received first-hand experience of NOAA's coral reef ecosystem science and management activities in South Florida and the Florida Keys, which highlighted NOAA's Coral Reef Conservation Program and the Florida Keys National Marine Sanctuary.

Congressional Delegation Attends Penobscot River Restoration Event

On August 21, Representative Michael Michaud (D ME-2) and staff from the offices of Senator Olympia Snowe (R-ME), Senator Susan Collins (R-ME), and Representative Tom Allen (D ME-1) joined NOAA's Assistant Secretary of Commerce for Oceans and Atmosphere and Deputy Administrator, Bill Brennan, in Old Town, Maine, for an event in honor of the Penobscot River Restoration Project. They were joined by other dignitaries, including Governor John Baldacci and the Chief of the Penobscot Indian Nation, Kirk Francis. The Penobscot River Restoration Trust organized this event to celebrate the first stage (dam purchase) of a \$50 million project, which will ultimately remove two dams and build a bypass channel around a third dam, opening nearly 1,000



Representative Sam Farr (D CA-17) (4th from right) helping to ceremonially present 2008 B-WET awards on September 2 in Monterey, California.

miles of habitat for Atlantic salmon and 11 other species of migratory fish. NOAA has provided significant funding toward this project, including \$10 million in FY 2008.

Senator Sununu and Congressional Staff Attend Dam Removal Event

On August 21, Senator John Sununu (R-NH) and congressional staff from the offices of Senator Judd Gregg (R-NH) and Representative Paul Hodes (D NH-2) joined NOAA representatives in Merrimack, New Hampshire. NOAA and partners organized this event to celebrate the removal of the Merrimack Village Dam. The project will restore fish passage to over 14 miles of main-stem and tributary habitat for migratory fish. Undertaken through NOAA's Open Rivers Initiative, this was one of the largest and most complex dam removal projects to take place in the Northeast in 2008.

Senator Cochran Attends NOAA Sentinel Dedication

On August 22, Senator Thad Cochran (R-MS) attended a dedication ceremony sponsored by NOAA's Center for Oceanographic Products and Services in honor of the installation of a NOAA Sentinel at Bay Waveland, Mississippi. NOAA Sentinels are water-observing stations that have been built, or fortified, to withstand Category 4 hurricanes and deliver real-time storm-tide data, including water levels and weather conditions, during severe coastal weather events.

Representatives Farr and Capps Attend B-WET Event

On September 2 and September 3, respectively, Representative Sam Farr (D CA-17) and Representative Lois Capps (D CA-23) joined NOAA representatives at the Bay Area Watershed Education and Training Grant Awards ceremonies in Monterey (Farr) and Santa Barbara (Capps), California. These events ceremonially presented recipients with their FY 2008 grant from NOAA's Bay Watershed Education and Training Program.

Representative Herseth Sandlin Meets With ESRL and NWS Staff

On September 7, Representative Stephanie Herseth Sandlin (D SD-At Large) met with representatives of NOAA's Earth System Research Laboratory and NWS prior to her address at the BioEconomy Conference held at Iowa State University in Ames, Iowa. The discussion covered NOAA's drought-related services, including the National Integrated Drought Information System, development of a proposed National Climate Service within NOAA, and NOAA's involvement in Missouri River issues.

Congressional Staff Fly on WP-3D Orion Aircraft

On September 17, congressional staff from the House Committee on Science and Technology, Subcommittee on Energy and Environment and the Senate Committee on Appropriations joined the Director of NOAA's National Hurricane Center on one of NOAA's WP-3D Orion aircraft for a flight over parts of the coast of Louisiana and Texas. The flight was a post-Ike damage assessment flyover.



KEY CONGRESSIONAL HEARINGS—FY 2008

Date	Congressional Committee	Subject	NOAA Witness
2007			
October 23	House Committee on Science and Technology, Subcommittee on Energy and Environment	GOES-R: Progress Has Been Made, But Improvements Are Needed to Effectively Manage Risks	Mary Kicza, Assistant Administrator, National Environmental Satellite, Data, and Information Service
October 24	House Committee on Natural Resources, Subcommittee on Fisheries, Wildlife, and Oceans	HR 1907, the Coastal and Estuarine Land Protection Act, HR 3352, the Hydrographic Services Improvement Act, and HR 1187, the Gulf of the Farallones and Cordell Bank National Marine Sanctuaries Boundary Modification and Protection Act	John H. Dunnigan, Assistant Administrator, National Ocean Service
November 3	House Committee on Natural Resources, Subcommittee on Fisheries, Wildlife, and Oceans	Reauthorization of the National Marine Sanctuaries Act	Bill Douros, Superintendent, Monterey Bay National Marine Sanctuary
November 19	House Committee on Transportation and Infrastructure, Subcommittee on Coast Guard and Maritime Transportation	November 2007 Oil Spill Causes and Response	William Conner, Division Chief, NOAA Office of Response and Restoration, HAZMAT and Emergency Response Division

Date	Congressional Committee	Subject	NOAA Witness
December 5	House Committee on Natural Resources, Subcommittee on Fisheries, Wildlife, and Oceans	Rebuilding Overfished Fisheries Under the Magnuson-Stevens Fishery Conservation and Management Act	Steve Murawski, Chief Science Advisor, National Marine Fisheries Service
December 18	Senate Committee on Commerce, Science, and Transportation, Subcommittee on Oceans, Atmosphere, Fisheries, and Coast Guard	Oil Spills from Non-tank Vessels: Threats, Risks, and Vulnerabilities	Mary Glackin, Deputy Under Secretary for Oceans and Atmosphere, NOAA
2008			
January 23	House Committee on Transportation and Infrastructure, Subcommittee on Water Resources and Environment	Progress Toward Improving Water Quality in the Great Lakes	Dr. Stephen B. Brandt, Director, Great Lakes Environmental Research Laboratory, Office of Oceanic and Atmospheric Research
February 19	Senate Committee on Commerce, Science, and Transportation, Subcommittee on Oceans, Atmosphere, Fisheries, and Coast Guard	Atlantic Large Whale Take Reduction Plan	James H. Lecky, Director, Office of Protected Resources, National Marine Fisheries Service
February 26	House Committee on Natural Resources, Subcommittee on Fisheries, Wildlife, and Oceans	National Oceanic and Atmospheric Administration's FY 2009 Budget Request	Mary Glackin, Deputy Under Secretary for Oceans and Atmosphere, NOAA
February 26	House Committee on Science and Technology, Subcommittee on Energy and Environment	National Oceanic and Atmospheric Administration's FY 2009 Budget Request	Vice Admiral Conrad C. Lautenbacher, Jr. (U.S Navy, Ret.), Under Secretary of Commerce for Oceans and Atmosphere and NOAA Administrator
February 26	House Committee on Science and Technology	National Weather Service Aviation Support Through Center Weather Service Units	Dr. John L. "Jack" Hayes, Assistant Administrator, National Weather Service
February 28	House Committee on Natural Resources, Subcommittee on Fisheries, Wildlife, and Oceans	Reauthorization of the <i>Coastal Zone Management Act</i> , and HR 3223, HR 5452, and HR 5453	John H. Dunnigan, Assistant Administrator, National Ocean Service
March 6	Senate Committee on Appropriations, Subcommittee on Commerce, Justice, Science, and Related Agencies	Department of Commerce FY 2009 Budget Request	Carlos Gutierrez, U.S. Secretary of Commerce
March 11	House Committee on Transportation and Infrastructure, Subcommittee on Water Resources and Environment	Comprehensive Watershed Management and Planning: Drought-Related Issues in the Southeastern United States	John Feldt, Hydrologist-In-Charge, Southeast River Forecast Center, National Weather Service
March 19	Senate Committee on Commerce, Science, and Transportation, Subcommittee on Science, Technology, and Innovation	Impacts of Climate Change on Hawaii and the Pacific Islands	Bill Thomas, Director, Pacific Services Center, National Ocean Service
April 3	House Committee on Natural Resources, Subcommittee on Fisheries, Wildlife, and Oceans	National Sea Grant College Program	Dr. Richard W. Spinrad, Assistant Administrator, Office of Oceanic and Atmospheric Research
April 3	Senate Committee on Commerce, Science, and Transportation	International Fisheries: Management and Enforcement	James W. Balsinger, Acting Assistant Administrator, National Marine Fisheries Service
April 10	House Committee on Appropriations, Subcommittee on Commerce, Justice, Science, and Related Agencies	National Oceanic and Atmospheric Administration's FY 2009 Budget Request	Vice Admiral Conrad C. Lautenbacher, Jr. (U.S Navy, Ret.), Under Secretary of Commerce for Oceans and Atmosphere and NOAA Administrator

Date	Congressional Committee	Subject	NOAA Witness
April 16	House Committee on Natural Resources, Subcommittee on Fisheries, Wildlife, and Oceans	Illegal, Unreported, and Unregulated Fishing and the Conservation of Sharks	Dr. Rebecca Lent, Director, Office of International Affairs, National Marine Fisheries Service
April 24	House Committee on Natural Resources, Subcommittee on Fisheries, Wildlife, and Oceans	HR 5320: To Authorize the Secretary of Commerce to Sell or Exchange Certain National Oceanic and Atmospheric Administration Property Located in Norfolk, Virginia, and for Other Purposes	William F. Broglie, Chief Administrative Officer, NOAA
May 6	House Committee on Transportation and Infrastructure, Subcommittee on Aviation	Aviation and the Environment: Emissions	Dr. David W. Fahey, Earth System Research Laboratory, Office of Oceanic and Atmospheric Research
May 6	Senate Committee on Commerce, Science, and Transportation, Subcommittee on Oceans, Atmosphere, Fisheries, and Coast Guard	National Oceanic and Atmospheric Administration's FY 2009 Budget Request	Vice Admiral Conrad C. Lautenbacher, Jr. (U.S Navy, Ret.), Under Secretary of Commerce for Oceans and Atmosphere and NOAA Administrator
May 6	Senate Committee on Commerce, Science, and Transportation, Subcommittee on Oceans, Atmosphere, Fisheries, and Coast Guard	S 2281, <i>Thunder Bay National Marine Sanctuary and Underwater Reserve Modification Act</i>	Jefferson Gray, Superintendent, Thunder Bay National Marine Sanctuary and Underwater Reserve, National Ocean Service
May 8	House Committee on Natural Resources, Subcommittee on Fisheries Wildlife and Oceans	The Management, Conservation, and Science Related to Atlantic Menhaden	Peyton Robertson, Director, Chesapeake Bay Office, National Marine Fisheries Service
May 8	Senate Committee on Commerce, Science, and Transportation	Climate Modeling	Dr. Alexander MacDonald, Deputy Assistant Administrator for Laboratories and Cooperative Institutes, Office of Oceanic and Atmospheric Research
May 12	House Committee on Transportation and Infrastructure, Subcommittee on Water Resources and Environment	Nutrient Pollution in the Great Lakes	Dr. Craig Snow, Physical Research Scientist, Great Lakes Environmental Research Laboratory, Office of Oceanic and Atmospheric Research
May 14	House Committee on Science and Technology	Water Supply Challenges for the 21st Century	Dr. Roger S. Pulwarty, Director, National Integrated Drought Information System, Office of Oceanic and Atmospheric Research
May 15	House Committee on Natural Resources, Subcommittee on Fisheries, Wildlife, and Oceans	West Coast Salmon Fishery	Rodney R. McInnis, Southwest Regional Administrator, National Marine Fisheries Service
May 21	House Committee on Science and Technology, Subcommittee on Energy and Environment	National Sea Grant College Program	Craig McLean, Deputy Assistant Administrator for Programs and Administration, Office of Oceanic and Atmospheric Research
May 21	House Committee on Natural Resources	The Proposed Rule to Implement Speed Restrictions to Reduce the Threat of Ship Collisions with North Atlantic Right Whales	Jane Luxton, General Counsel, NOAA

Date	Congressional Committee	Subject	NOAA Witness
May 27	Senate Committee on Commerce, Science, and Transportation, Subcommittee on Oceans, Atmosphere, Fisheries, and Coast Guard	Effects of Climate Change in Marine and Coastal Ecosystems in Washington State	Dr. Christopher L. Sabine, Pacific Marine Environmental Laboratory, Office of Oceanic and Atmospheric Research
June 5	House Committee on Science and Technology, Subcommittee on Energy and Environment	Ocean Acidification	Dr. Richard A. Feely, Program Leader, Pacific Marine Environmental Laboratory, Office of Oceanic and Atmospheric Research
June 10	House Committee on Natural Resources, Subcommittee on Fisheries, Wildlife, and Oceans	60th Annual Meeting of the International Whaling Commission	William T. Hogarth, U.S. Commissioner to the International Whaling Commission
June 18	House Committee on Natural Resources, Subcommittee on Fisheries, Wildlife, and Oceans	Reauthorization of the <i>National Marine Sanctuaries Act</i>	John H. Dunnigan, Assistant Administrator, National Ocean Service
June 19	House Committee on Science and Technology, Subcommittee on Energy and Environment	Environmental Satellites Polar-Orbiting Satellite Acquisition Faces Delays; Decisions Needed on Whether and How to Ensure Climate Data Continuity	Vice Admiral Conrad C. Lautenbacher, Jr. (U.S Navy, Ret.), Under Secretary of Commerce for Oceans and Atmosphere and NOAA Administrator
June 24	Senate Committee on Commerce, Science, and Transportation	Climate Change and Transportation Infrastructure	Dr. Thomas C. Peterson, National Climatic Data Center, National Environmental Satellite, Data, and Information Service
June 24	House Committee on Natural Resources, Subcommittee on Fisheries, Wildlife, and Oceans	Planning for a Changing Climate and Its Impacts on Wildlife, Coasts, and Oceans: State and Federal Efforts and Needs	Margaret A. Davidson, Director, Coastal Services Center, National Ocean Service
June 26	House Committee on Transportation and Infrastructure, Subcommittee on Water Resources and the Environment	Protecting and Restoring America's Great Waters: Estuaries and Coasts	David Kennedy, Director, Office of Ocean and Coastal Resource Management, National Ocean Service
June 26	House Committee on Science and Technology, Joint Hearing Between the Subcommittee on Energy and Environment and the Subcommittee on Research and Science Education	Hurricane Research Initiative Legislation, HR 2407	Dr. John L. "Jack" Hayes, Assistant Administrator, National Weather Service
July 10	House Committee on Science and Technology, Subcommittee on Energy and Environment	Harmful Algal Blooms in Coastal Waters and Great Lakes	Dr. Robert E. Magnien, Director, Center for Sponsored Coastal Ocean Science, National Ocean Service
July 24	House Committee on Natural Resources, Subcommittee on Fisheries, Wildlife, and Oceans	Reauthorization of the <i>National Marine Sanctuaries Act</i>	John H. Dunnigan, Assistant Administrator, National Ocean Service
September 10	House Committee on Natural Resources, Subcommittee on Fisheries, Wildlife, and Oceans	Status of Eastern Oyster Restoration Efforts in Chesapeake Bay	Peyton Robertson, Director, Chesapeake Bay Office, National Marine Fisheries Service
September 16	House Committee on Transportation and Infrastructure, Subcommittee on Coast Guard and Maritime Transportation	Oil Spill in New Orleans in July 2008 and Safety on the Inland River System	David Westerholm, Director, Office of Response and Restoration, National Ocean Service



Operations, Products, and Services

*NOAA supports an industry that contributes
\$34.2 billion annually to the U.S economy.*



John H. Dunnigan
Assistant Administrator

National Ocean Service

America's Oceans and Coasts: Safe, Healthy, and Productive

Our nation's coastal areas are home to over half of all Americans. They provide more than 13 million jobs, and contribute an estimated \$2 trillion annually in economic activity. Yet these areas upon which we so greatly depend are in jeopardy. Issues like port congestion, water pollution, marine debris, storms, sea level rise, climate change, erosion, and population growth are all jeopardizing the health, economy, and beauty of our coastal waters and shorelines.

With ten program and staff offices covering a broad range of issues, the diversity of expertise within the National Ocean Service (NOS) is the organization's greatest strength. Bringing together scientists, natural resource managers, and specialists, NOS is well equipped to protect coastal communities, observe our oceans and coasts, ensure safe and efficient marine transportation, reduce ocean and coastal health risks, and conserve coastal and marine environments.

ACCOMPLISHMENTS

NOS Prepares for and Responds to 2008 Major Hurricanes

When hurricanes and severe weather threaten our coastal areas, NOS is ready to help. In 2008, NOS provided support to the U.S. Coast Guard and U.S. Army Corps of Engineers for both the preparation and the response and recovery efforts following Hurricanes Dolly, Gustav, and Ike. NOS collected aerial imagery in response to storm events and provided this information to disaster managers and the public alike. The images were available through programs like Google Earth, as well as on the NOAA Web site. During Hurricane Gustav, NOS and partners supported development of a comprehensive Web site for local residents (<http://masgc.org/gulfstorms/>).

After a storm comes through, NOAA's Navigation Response Teams jump into action to ensure navigational safety. Using a variety of tools, like portable fly-away

survey systems, NOS identifies dangers to navigation and collects data needed to reopen ports and harbors. Following Hurricane Gustav, NOS provided necessary trajectory information and pollution expertise, as needed, for spill incidents. NOS also delivered accurate nowcasts and forecasts throughout the duration of Hurricane Ike with the Galveston Bay Operational Forecast System.

NRTs Provide Rapid Response to Survey Requests

During FY 2008, NOAA's Navigation Response Teams (NRTs) responded to survey requests near some of the nation's busiest ports. These requests included the following events:

- In December 2007, British Petroleum, Inc., discovered a World War II-era German torpedo while laying fiber-optic cable in the Gulf of Mexico. NOS charted the torpedo, which had over 600 pounds of high explosives, and issued a



Following Hurricane Ike, NOS used the NOAA Mobile Integrated Survey System to search for hazards to navigation.

local notice to mariners to warn of the hazard.

- In January, after several incidents of tugs and barges striking submerged objects in the Gulf Intracoastal Waterway, an NRT responded to a U.S. Coast Guard request to conduct a side-scan and bathymetric survey for potential demolition obstructions.
- In April, a U.S. Army Corps of Engineers contract crew removed approximately 600 tons of rock hazards from the Belle Pass (entrance to Port Fourchon, Louisiana) that had been identified by NRT surveys.
- In May, an NRT stationed in the Gulf of Mexico notified the Pensacola Bay Pilots of a large sunken wreck, observed in local surveys, which could impact deep-draft ship traffic to the Port.
- And, in partnership with the Coast Guard, Minerals Management Service, and the State of Louisiana, an NRT aided in the removal of a floating pipeline adjacent to a survey area in South Plaquemines Parish.

NOS Responds to San Francisco Bay and Mississippi River Oil Spills

On November 7, 2007, the container ship M/V *Cosco Busan* struck the Bay Bridge in San Francisco Bay, California. A 100-foot gash in the hull of the vessel caused the release of an estimated 58,000 gallons of



Vessels wait for the opening of the Mississippi River following the New Orleans barge collision oil spill.

fuel oil into the bay. Within hours of the spill, NOS deployed scientists to the area to carry out overflights, coordinate beach surveys, evaluate oil recovery options, develop cleanup standards and protocols, and support the U.S. Coast Guard. In addition, NOS provided trajectory and oil behavior modeling, information on natural resources at risk, and toxicity assessment data from Seattle..

Also, early in the morning of July 23, 2008, a 600-foot chemical tanker and 200-foot fuel barge collided on the Mississippi River just north of New Orleans, Louisiana. The impact tore the fuel barge in half and

caused a major spill of an estimated 419,000 gallons of #6 fuel oil. NOS provided trajectory and oil behavior modeling, information on natural resources at risk, and toxicity assessment data. NOS provided its first spill trajectory predictions to the Unified Command within two-and-a-half hours of the spill and provided overall scientific on-scene support. The NOAA Scientific Support Coordinator for the Gulf of Mexico region remained on site to support the response from the Incident Command Center and was assisted by the NOAA Scientific Support Team.

NOS scientists are now working in both of the damaged areas with NOAA's Damage Assessment, Remediation, and Restoration Program and with state and federal partners to assess the natural resources affected by the spill and plan for their restoration, which will be paid for by the parties responsible for the spills.

Navigation Response Teams perform hydrographic surveys for updating nautical charts and conduct hazardous obstruction surveys throughout the Atlantic Seaboard, Pacific Coast, Great Lakes, and the Gulf of Mexico. The teams operate every day of the year to promote safe marine navigation.

NOS Continues Support for the Gulf of Mexico Alliance

Throughout 2008, NOS provided federal leadership in support of the Gulf of Mexico Alliance and its regional priorities. In 2006, the Gulf Alliance released the *Governors' Action Plan for Healthy and Resilient Coasts*, a three-year statement of action that identified five priority issues for the region: water quality for healthy beaches and shellfish beds, wetland and coastal conservation and restoration, environmental education, identification and characterization of Gulf habitats, and reduction of nutrient inputs to coastal ecosystems. NOAA played a key role in implementing many actions identified in the *Governors' Action Plan* and also supported the Gulf States' efforts to create a sixth Priority Issue Team centered around coastal community resilience. NOS continues its leadership role in the Gulf Alliance by participating in all six of the Priority Issue Teams and coordinating across NOAA to identify specific activities that will support this next phase of the Alliance.

Conservation Program Protects Over 8,000 Acres of Estuaries and Coast

The Coastal and Estuarine Land Conservation Program (CELCP) was created in 2002 to protect coastal and estuarine lands considered important for their conservation, recreation, ecologic, historic, or aesthetic values. In FY 2008, more than 8,000 acres of critical coastal habitat were acquired or put under conservation easement for long-term protection through CELCP. In total, more than 30 properties were protected with CELCP funding in approximately 15 states through grants to state or local governments. Many of these projects were completed in partnership with nongovernmental conservation organizations. (Note that as of the printing of this report, these figures are not final for FY 2008.) Five new CELCP projects, which will help protect coastal watersheds in Maine, Alaska, California, New Hampshire, and New York, were also selected to receive a total of more than \$10 million in funding.

In December 2007, the Coastal and Estuarine Land Conservation Program helped Mississippi acquire the "Gex" tract in Waveland, resulting in the protection of more than 75 acres of valuable habitat, including coastal forest and salt marsh.

Coastal Zone Management Program Protects the Nation's Coasts

NOS awarded \$67.5 million to state and territory coastal zone management programs to implement their state coastal zone management and coastal nonpoint source pollution programs. The National Coastal Zone Management Program is a partnership between NOS and coastal states to effectively protect and manage the nation's coasts. Through the program, NOS helps state programs engage in comprehensive planning, community development, and other activities to protect and restore habitats, mitigate hazards, protect water quality, and enhance public access to coastal areas.

Comprehensive Shoreline Data Now Available from NOAA Web Site

Accurate, accessible shoreline information and data have never been more important, as sea level rise is expected to bring unprecedented challenges to coastal communities worldwide in the coming decades. For the first time, shoreline data and related information from NOAA and other federal agencies are now available from the NOAA Shoreline Web site (<http://shoreline.noaa.gov>). Local and state officials use this information to predict sea level rise, establish setback lines, and perform a multitude of ocean and coastal community planning tasks.

Data Integration Framework Initiates Cross-NOAA Partnerships

The Data Integration Framework (DIF) project, led by the NOAA Integrated Ocean Observing System (IOOS®) program, is a limited-scope, risk-reduction effort to make selected NOAA and non-NOAA ocean observation data sets easily accessible and interoperable, thereby increasing their value and utility. In FY 2008, NOAA IOOS® achieved several important milestones on the DIF project by focusing on an initial set of five oceanographic observations—temperature, salinity, water level,

currents, and ocean color; selecting three NOAA data providers for DIF implementation—the National Data Buoy Center, NOAA CoastWatch, and the Center for Operational Oceanographic Products and Services; and targeting four NOAA applications for data delivery—harmful algal bloom forecasts, coastal inundation predictions, integrated ecosystem assessments, and hurricane intensity forecasts. In April, the DIF launched a series of partnership agreements across NOAA to implement new data services and protocols in order to achieve interoperability among ocean observations from various platforms.

Installation Begins for Sentinel Climate Change Monitoring Network

NOS is working to establish and monitor coastal land elevations in relation to local sea level throughout the National Estuarine Research Reserve System (NERRS). The effort will improve understanding of climate variability and change, and will enhance society's ability to plan and respond. The kick-off to this initiative included training on geodetic and tidal datum concepts and high-accuracy surveying



This marker provides the spatial framework to establish estuarine reserves as sentinel sites for measuring and monitoring the impacts of climate change on estuarine systems. The inscription on the marker reads: "National Oceanic and Atmospheric Administration – National Estuarine Research Reserve System – National Geodetic Survey."



techniques for five NERRS sites. The intent is to expand this program to the other 27 reserves in support of the NERRS Habitat Mapping and Change Plan. Data on coastal land elevations are critical to monitoring climate change and are an important component of the IOOS®.

National Water Level Observation Network Enhanced

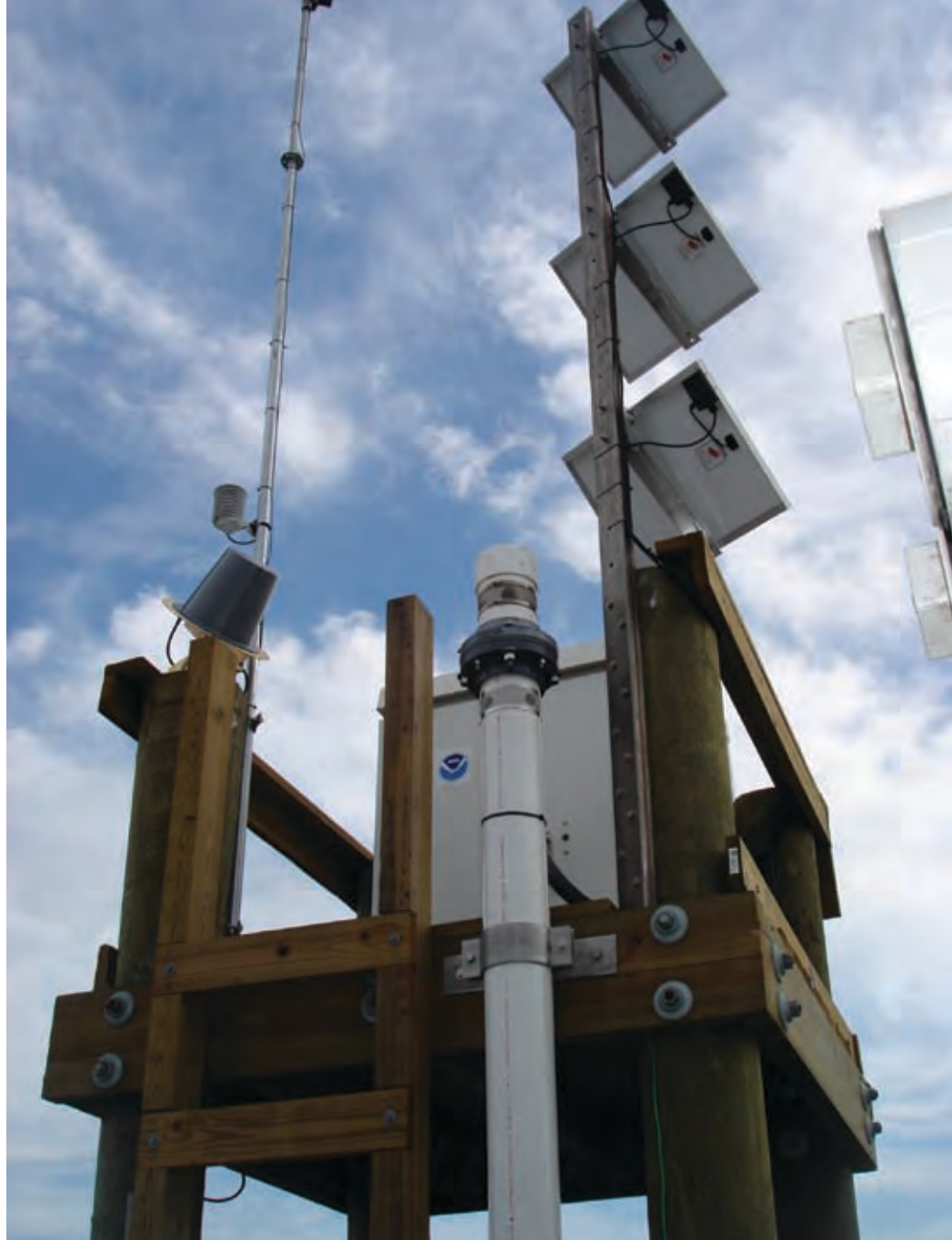
During the summer of 2008, NOS constructed four NOAA “Sentinels of the Coast” at Bay Waveland, Mississippi, and at Shell Beach, Amerada Pass, and Calcasieu Pass, Louisiana. NOAA sentinels are water-level observing stations that have been built to withstand Category 4 hurricanes and deliver real-time storm data, including water levels and weather conditions during severe coastal weather events. In addition, NOS and the National Weather Service began a two-year effort to add meteorological sensors to National Water Level Observation Network stations. A total of 25 stations were upgraded in FY 2008. The upgrades included the installation of wind, barometric pressure, and air temperature sensors, followed by monitoring and validation of the data.

NOAA Transitions Regions to a National Network of Observing Systems

In FY 2008, NOAA IOOS® awarded \$20.4 million to various partners across the nation, as part of an effort to develop a national network of 11 Regional Coastal Ocean Observing Systems and management structures, or Regional Associations (RAs). In February, representatives from all 11 regions expressed enthusiastic support for the DIF, and indicated their willingness to implement DIF standards and protocols. This regional participation supports the rapid expansion of interoperable ocean data. NOAA IOOS® also conducted a status assessment of each region to better understand how the RAs manage IOOS® activities and engage regional stakeholders to help determine future regional priorities.

New PORTS® Installed in Three States

The Physical Oceanographic Real-Time System® (PORTS®) provides economic and safety benefits by supplying mariners with real-time data that can reduce the risk of vessel groundings and increase the amount of cargo moved through a port. In 2008, NOS installed four new PORTS® in Pascagoula and Gulfport, Mississippi; Sabine-Neches, Texas; and Cherry Point, Oregon.



This tide station supports the Sabine-Neches PORTS® in Texas.

The Cherry Point PORTS® supports the British Petroleum Cherry Point Refinery’s safety and oil spill prevention programs by providing real-time data to assist in vessel traffic management and to support decision making regarding the safety and efficacy of oil transfer activities. The Pascagoula and Gulfport observation systems assist the State of Mississippi with safe and efficient transport of commodities through its waterways, contributing \$1.4 billion to the state economy (almost 3 percent of the gross state product), including some 34,000 direct and indirect jobs paying \$765 million in wages. The Sabine-Neches PORTS® supports the safe transport of liq-

uefied natural gas (LNG) to the LNG terminals recently established in the area. The data are online at <http://tidesandcurrents.noaa.gov/ports.html>.

Upgraded Online Positioning User Service Processes Data Rapidly

Since 2002, the Online Positioning User Service (OPUS) has transformed how Global Positioning System (GPS) users across the country and the world can obtain highly accurate, positioned coordinates. OPUS allows users, such as professional surveyors, to submit their GPS observations to NOAA, where the data are



Crew members from the U.S. Coast Guard icebreaker Healy lower echo-sounding equipment into the water. The equipment is helping scientists to map the U.S. extended continental shelf in the Arctic's Chukchi Sea.

processed to determine corresponding three-dimensional positional coordinates. In February 2008, NOS released a new version of OPUS, called OPUS-Rapid Static (OPUS-RS). Designed in partnership with Ohio State University, OPUS-RS needs only 15 minutes of GPS data processing to deliver a position, whereas standard OPUS requires at least two hours of data processing. OPUS-RS results are less accurate than standard OPUS, but the difference in accuracy is small enough to be inconsequential for many applications. NOS expects that OPUS-RS use will exceed OPUS use. Each OPUS solution is estimated to save the user \$600 over traditional positioning methods.

New GIS Web Mapping Portal Provides Near Real-Time Information

NOS has released a new version of NowCOAST (<http://nowcoast.noaa.gov/>). This geographic information system (GIS)-based Web mapping portal provides users with near real-time coastal environmental information, including gridded weather forecasts and high-resolution global sea-surface temperature analyses. Designed to

be a planning aid to assist recreational and commercial mariners, emergency managers, coastal managers, HAZMAT responders, coastal ocean modelers, and marine educators, the new version displays the National Weather Service's National Digital Forecast Database forecasts of surface wind velocity, significant wave height, relative humidity, quantitative precipitation, and maximum/minimum air temperatures.

NOAA and Partners Continue to Map Arctic Sea Floor

From August 14 to September 5, NOS and the University of New Hampshire (UNH) led an expedition to the Arctic's Chukchi Sea aboard a U.S. Coast Guard icebreaker to map the sea floor north of Alaska. This was the fourth in a series of efforts by NOAA and UNH to explore this poorly understood region and determine the potential for including the region in the United States' extended continental shelf under the United Nations Convention on the Law of the Sea. NOAA will also use the sea-floor data collected from this cruise to update nautical charts and improve understanding of sea-floor processes.

New Report on Coastal Waters Shows Decline in Contaminants

NOS released a 20-year study showing that environmental laws have had a positive effect on reducing overall contaminant levels in coastal waters of the United States. However, the report points to continuing concerns regarding elevated levels of metals and organic contaminants found near urban and industrial coastal areas. The report, *NOAA National Status and Trends Mussel Watch Program: An Assessment of Two Decades of Contaminant Monitoring in the Nation's Coastal Zone from 1986–2005*, is the first of its kind to present national, regional, and local findings in a quick-reference format. The findings are the result of monitoring efforts that analyze 140 different chemicals in U.S. coastal and estuarine areas, including the Great Lakes.

Forecast Predicted Record "Dead Zone" in the Gulf of Mexico

A forecast released by NOS-funded scientists predicted that the 2008 hypoxic zone or "dead zone," which forms annually in the northern Gulf of Mexico, would be the largest on record. An NOS-funded research

cruise to map the dead zone found that the actual size of the zone was slightly smaller than predicted, but with an area of 8,000 square miles, it was still the second-largest dead zone on record. High spring nutrient concentrations and discharges from the Mississippi River are the major causes of the large dead zone, according to the prediction. The official prediction is the result of a long-term NOS research effort to characterize and model the dead zone and assess its ecological and socioeconomic impacts. This research provided the foundational science for the Gulf of Mexico Hypoxia Task Force's 2008 *Gulf Hypoxia Action Plan* to reduce the size of the dead zone.

NOAA Hosts Educators' Climate Change Conference

In July, Sally Ride, the first American woman in space, joined NOAA scientists in Silver Spring, Maryland, to teach K-12 educators how to integrate the science of Earth's changing climate into their classroom lesson plans. During "Earth Then, Earth Now: Our Changing Climate," 250 participants investigated the basic science of climate change, as well as global impacts on the atmosphere, ocean, and every continent and ecosystem around the world. NOAA and the National Aeronautics and Space Administration co-sponsored the two-day event in partnership with Ride's science education company, Sally Ride Science™. The event was broadcast live on the Internet.

NOS Part of the Launch of Smithsonian's New Sant Ocean Hall

The Smithsonian Institution's National Museum of Natural History's new Sant Ocean Hall opened in September 2008. The "Ocean Today" is a highly visual and dynamic exhibit in the Ocean Hall that presents video and audio content designed to enhance ocean literacy among museum visitors. NOS led the development of the exhibit "Ocean Today" in partnership with the Smithsonian, developed content in partnership with NOAA and outside ocean institutions, and provided key technical services for and oversight of content development and video production.

Speaking at the opening of the Ocean Hall on September 26, President George W. Bush announced the expansion of the Monterey Bay National Marine Sanctuary to include the Davidson Seamount. The

sanctuary expansion, which is the result of a seven-year management plan revision process involving public input and agency collaboration, is expected to be initiated by early November.

Sanctuaries Draft Management Plans Released

In commemoration of Earth Day, Vice Admiral Conrad C. Lautenbacher, Jr., participated in an April 22 ceremony in Honolulu, Hawaii, to announce the release of the Draft Management Plan for the Papahānaumokuākea Marine National Monument. The monument was also announced as one of two sites that the United States has nominated for consideration as a United Nations Educational, Scientific and Cultural Organization World Heritage site.

The Stellwagen Bank National Marine Sanctuary Draft Management Plan was released in May. Based on several years of scientific study and extensive public input, the plan recommends specific actions to address issues affecting the sanctuary at the mouth of Massachusetts Bay, and serves as a nonregulatory policy framework for addressing the issues facing the sanctuary

over the next five years. The plan lays the foundation for restoring and protecting the sanctuary's ecosystem, details the human pressures that threaten the qualities and resources of the sanctuary, and recommends actions that should be taken now and in the future to better manage the area and its resources.

Sanctuaries Expand Capabilities with Launch of New Vessels

In 2008, NOS debuted several new vessels within the national marine sanctuary (NMS) system. The 83-foot R/V *Manta* was commissioned for service in the Flower Garden Banks NMS. In addition, two 41-foot vessels will provide greater flexibility, safety, and efficiency in the daily operations of sanctuary staff—one at the Channel Islands NMS, and the other at the Hawaiian Islands Humpback Whale NMS. These new ships will enhance the capabilities of staff to conduct research, monitoring, education, enforcement, and emergency response missions as they work to preserve, protect, and manage our sanctuaries now and in the future.



The "Ocean Today" exhibit, part of the Smithsonian Institution's National Museum of Natural History's new Sant Ocean Hall, includes two kiosks, each with a 32-inch touch-screen display and a 42-inch echo monitor to broadcast short video and audio features about the ocean.

PRODUCTS AND SERVICES

Protecting Coastal Communities

To make coastal communities safer, more sustainable, and more resilient, NOS provides the tools, training, and technical assistance needed to minimize impacts from coastal hazards; protects and restores coastal habitats; analyzes information on ecosystems to help coastal managers better manage coastal resources; reduces impacts associated with coastal development and other uses; works with state partners to improve coastal zone management; and responds to more than 100 marine oil and chemical spills each year.

Observing Our Oceans and Coasts

From measuring and predicting tides and currents, monitoring sea level rise, and providing data for tsunami and storm warnings, NOS is filling gaps needed to better understand and forecast ocean and coastal changes. NOS is also leading efforts to establish an Integrated Ocean Observing

System to coordinate and disseminate ocean and coastal data and information to decision makers.

Supporting Safe and Efficient Marine Transportation

NOS maps and charts the nation's 3.4 million square nautical miles of ocean; manages the nation's geospatial reference system; surveys 95,000 miles of coastline; provides accurate positioning information; and delivers real-time tide, water-level, current, and other oceanographic data to keep marine transportation safe, efficient, and environmentally sound.

Reducing Ocean and Coastal Health Risks

NOS is working to predict, manage, and prevent ocean and coastal health risks by providing early-warning systems and forecasts to reduce risks of exposure to contaminants, building networks to moni-

tor and evaluate illness in humans and marine animals, and increasing our ability to respond to health risks. Biological and chemical sensors and observations are helping to measure and predict public health threats, such as harmful algal blooms, and NOS research is establishing links between land use and chemicals in the marine environment.

Protecting Coastal and Marine Places

To balance environmental conservation, economic development, and recreational enjoyment of ocean and coastal resources, NOS is protecting 13 national marine sanctuaries, Papāhānaumokuākea Marine National Monument, 27 national estuarine research reserves, and a network of marine protected areas. NOS is also working to reduce and prevent marine debris and to conserve coral reefs.



Young children are inspired by the wonder of marine life, such as this little girl holding a sea urchin.

NOAA Activities Protect Coral Reef Ecosystems

The NOAA Coral Reef Conservation Program (CRCP) received over \$29 million to support activities to conserve, manage, and understand coral reef ecosystems in the United States and around the world. The funding allowed NOAA to implement over 150 projects within the agency, fund four coral reef research institutes, and provide over \$11 million in grants for additional external projects. In 2008, CRCP released a roadmap to set forth the program's direction for FY 2010–2015, focusing on ways to address the impacts of fishing, land-based sources of pollution, and climate change. CRCP also led activities for the International Year of the Reef, to raise awareness of the importance of coral reef ecosystems; released a report to Congress on the implementation of deep-sea coral research by NOAA and partners; and offered training to help reef managers from around the world address coral bleaching and conduct socioeconomic monitoring of coral reef ecosystems.

NOAA Releases Coral Reef Status Report

In July 2008, at the International Coral Reef Symposium in Fort Lauderdale, Florida, NOAA released the third in a series of status reports assessing the condition of coral reef ecosystems in 15 locations ranging from the U.S. Caribbean and Gulf of Mexico to the western Pacific. The report uses the results of coral reef monitoring programs and the contributions of over 270 coral reef scientists and managers to assess the condition of the nation's coral reefs and associated ecosystems. Research indicates that nearly half of these reefs are now considered to be in "poor" or "fair" condition. The report also describes the impacts of 13 major threats in each location, while offering recommendations for on-the-ground conservation actions.

NOS Works with Partners to Combat Marine Debris

NOS held its first Information Forum in April 2008 to increase information exchange and marine debris removal efforts. Data indicate that from 1996 to 2008, more than 660 tons of derelict fishing nets were removed from reefs and shorelines in the

Papahānaumokuākea Marine National Monument. Also, from 2006 to 2008, some 32 tons of derelict fishing nets and used monofilament line were turned into electricity through the Honolulu Derelict Net Recycling Program and port reception bin. In Chesapeake Bay, results from a three-year survey showed that densities of ghost crab traps in the bay range from 10 to 690 traps per square kilometer, and approximately 400,000 lost crab traps are located in the Maryland portion of Chesapeake Bay alone. Also, in 2008, NOS furthered its partnerships with the National Fish and Wildlife Foundation and Covanta Energy Corporation to reduce unused fishing gear in communities and the marine environment, and developed a second educational public service announcement with The Walt Disney Company, the Ad Council, the National Marine Sanctuaries Foundation, the U.S. Department of the Interior, and Environmental Defense.

FUTURE OUTLOOK

NOS envisions America as a place that fosters safe, healthy, and productive oceans and coasts for ecology, heritage, and economy. To achieve this outcome, NOS will continue to:

- Prepare the coasts for a changing climate through tools and information to help communities better use coastal resources and plan for vital infrastructure investments in a rapidly changing environment.
- Create tomorrow's solutions through innovative integration of ocean and coastal science and technologies, and make these solutions accessible to coastal communities.
- Protect human health and safety by providing early-warning systems for threats through systematic ocean assessments, and by ensuring timely data reaches NOAA partners to help them take actions to protect human health and safety.
- Sustain coasts and economies by promoting economic security, while sustaining community and environmental health and productivity.
- Monitor changing oceans and coasts by ensuring accurate, timely, and relevant observations of dynamic environments,



A crane loads derelict fishing gear in the form of rope and line collected by local fishermen into a designated bin to be taken to a processing plant and turned into energy for homes in New England as part of the Fishing for Energy Project. The Fishing for Energy project is a partnership between NOAA, the National Fish and Wildlife Foundation, Covanta Energy, and Schnitzer Steel Northeast.

so communities have the right data from the right place at the right time.

- Protect resources at risk through conservation and by responding to environmental threats at home and abroad to prevent damage to critical watersheds and other resources.
- Raise the nation's coastal conscience by connecting people with oceans and coasts, linking protection with future prosperity, and prompting individual, community, and global action.

- Foster action by all nations to better manage our global ocean and coasts.

NOS will achieve these outcomes by leveraging resources in partnership with other federal agencies; state, regional, and tribal institutions; public, private, and international organizations; and others.



James W. Balsiger, Ph.D.
Acting Assistant Administrator

National Marine Fisheries Service Sustaining, Protecting, and Rebuilding Our Nation's Living Oceans

NOAA's National Marine Fisheries Service is dedicated to the stewardship of our nation's living marine resources and their habitats through scientific research, fisheries management, law enforcement, and habitat conservation. NOAA Fisheries is a world leader in fisheries research, providing a sound scientific foundation for the stewardship of living marine resources. NOAA Fisheries is also a leading voice for commercial and recreational fisheries from the Atlantic Ocean to the Gulf of Mexico to the Pacific Ocean. We couple our interdisciplinary expertise in biological, physical, and social sciences with our talents in information technology to monitor, assess, and predict the status and trends of marine stocks, their natural environment, and the socioeconomic benefits they provide. We will continue to focus on conservation, management, and sustainable development as we face new challenges in the 21st century.

ACCOMPLISHMENTS

NOAA Fisheries Makes Significant Progress Toward Eliminating Overfishing

During FY 2008, NOAA Fisheries continued its efforts to eliminate overfishing. Under the revised Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006, NOAA Fisheries is required to end overfishing for stocks experiencing overfishing by 2010 and for all other stocks by 2011. A proposed rule regarding guidance for the establishment of annual catch limits, a key new element of the Magnuson-Stevens Act, has been completed. The final rule is expected in early 2009.

Overfishing of four commercially valuable stocks ended in FY 2008: Petrale Sole, Summer Flounder, Bigeye Tuna—Atlantic, and Finetooth Shark—Atlantic. In addition, NOAA Fisheries took important steps to end overfishing of the bottomfish stock complex in the Main Hawaiian Islands. Implementing regulations included the

establishment of permits and reporting for noncommercial fishermen, total annual catch management, and annual closure and bag limits. NOAA Fisheries implemented a variety of management measures, such as quota reductions, time/area closures, reporting requirements, rebuilding plans, and measures, to address recreational fishing concerns.

NOAA Expands Market-Based Approaches to Fisheries Management

NOAA Fisheries added one dedicated access (privileges) program (DAP) in 2008: Bering Sea Groundfish (non-Pollock) Cooperatives. With this addition, 12 DAPs are now in operation. NOAA anticipates having 16 dedicated access programs in operation by FY 2011. Amendment 80, establishing the Bering Sea Groundfish Cooperatives DAP, was adopted by the North Pacific Fishery Management Council in June 2006 and implemented in the



Crew members attach pocket nets to test whether the Aleutian wing trawl is an accurate sampling tool for determining how many fish can escape the net during a trawl. Photo: Mark Rauzon, U.S. Fish and Wildlife Service



During FY 2008, NOAA Fisheries implemented a variety of management measures, such as quota reductions, time/area closures, reporting requirements, rebuilding plans, and measures, to address recreational fishing concerns.

2008 fishing year under regulations promulgated by the Secretary of Commerce. This action allocates several Bering Sea and Aleutian Islands non-Pollock trawl groundfish species among trawl fishery sectors, and facilitates the formation of harvesting cooperatives in the non-American Fisheries Act trawl catcher/processor sector.

NOAA Fisheries Completes Comprehensive Pesticides Consultation

In July 2008, NOAA Fisheries completed a draft biological opinion on authorization of pesticide products. In conducting this consultation, NOAA Fisheries assessed the effects of these pesticides on 28 listed Pacific salmonids in the Pacific Northwest and California. This is the first comprehen-

sive evaluation the agency has completed on the effects of pesticides on listed salmonids. The consultation concluded that the use of these pesticides is likely to jeopardize listed Pacific salmonids and adversely modify their critical habitat. As a result, the consultation will lead to changes in the registration and use of pesticides in the Pacific Northwest to better protect salmonids. NOAA Fisheries will consult on an additional 34 pesticides in the coming years.

Navy and Energy Activities Increase Demand for Incidental Take Authorizations

During FY 2008, NOAA Fisheries increased its capacity to address a growing

demand for authorizations to incidentally take marine mammals. This allowed two key administration mandates to move forward, while remaining in compliance with environmental statutes.

NOAA Fisheries and the Navy progressed toward compliance with the Marine Mammal Protection Act (MMPA), Endangered Species Act (ESA), and NEPA for the Navy's Range Complexes and major mid-frequency active sonar (MFAS) training exercises. NOAA Fisheries and the Navy have completed several important milestones: biological opinions were issued for the Navy's ongoing 2008 MFAS activities in the Hawaii Range Complex, off the Atlantic Coast, and in California; and the proposed



NOAA Fisheries has submitted proposals to the International Maritime Organization to reduce the risk of ship strikes to North Atlantic right whales. NOAA Fisheries is also implementing broad-based gear modifications to protect migrating large whales along the U.S. Eastern Seaboard.

rules for the Navy's MFAS activities have also been published. NOAA Fisheries continues to process MMPA authorizations and ESA biological opinions for Navy activities other than MFAS that are critical for national security as well, such as Surveillance Towed Array Sensor System low-frequency active sonar, ship shock trials, and other smaller-scale activities involving sonar sources or explosive detonations.

NOAA Fisheries has also responded to an increase in the number of applications received to conduct research and oil and gas exploration activities in the Chukchi and U.S. Beaufort Seas in Alaska due to increased U.S. demand for energy. For FY 2008, the number of applications to conduct seismic surveys increased from two to six, and there was an increase in exploratory drilling activities as well. These increases will most likely continue as the demand for domestic energy supplies increases.

During FY 2008, NOAA Fisheries increased the number of staff working to address the expected increase in incidental harassment authorization (IHA) applications, and worked more closely with the oil and gas industry to address their concerns, facilitate the public review process required by the MMPA, and ensure that the IHAs are issued in a timely manner so that energy exploration can go forward during the

brief Arctic summer. NOAA Fisheries has also worked closely with native communities and organizations, such as the Alaska Eskimo Whaling Commission, to ensure that increased exploration and seismic activities will result in a negligible impact on the ability of native Alaskans to conduct traditional whale harvests in coastal communities.

NOAA Fisheries Takes Key Actions to Protect Large Whales

NOAA Fisheries has published regulations that would limit ship speed during times and in areas along the East Coast where relatively high right whale and ship densities overlap near a number of ports, at calving/nursery areas in waters off Georgia and Florida, and in New England waters. Evidence indicates that the likelihood of death and serious injury to large whales struck by ships is related to ship speed.

NOAA Fisheries submitted two proposals to the International Maritime Organization (IMO) to reduce the risk of ship strikes to North Atlantic right whales. One would amend the north-south leg of the IMO-adopted traffic-separation scheme in the approach to Boston, while the other would establish a seasonal Area To Be Avoided in the Great South Channel. The two draft proposals were approved by the

IMO Subcommittee on Safety of Navigation in July. NOAA Fisheries is also implementing broad-based gear modifications to protect migrating large whales along the U.S. Eastern Seaboard.

After a season in which three blue whales washed ashore near Santa Barbara, California, due to injuries related to vessel strikes—only five confirmed deaths from ship strikes occurred off the entire California coast from 1980 to 2007—NOAA Fisheries worked with the U.S. Coast Guard and the California Department of Fish and Game to mitigate ship impacts on the whales. Flights over Santa Barbara Channel located where blue whales were feeding. The whales' positions were plotted and sent to the Port of Los Angeles and relayed to all commercial vessel traffic, with a request to reduce speed to 10 knots when in the area. Since this action taken by NOAA Fisheries, there have been no other known whale deaths from ship strikes on the West Coast.

New Vessels Preserve Important Fish Survey Data Series

To be able to relate survey data collected with NOAA's new more capable noise-quieted survey vessels with data collected using older ships, large-scale calibration experiments are being conducted on both the East and the West Coasts. In New England, researchers at NOAA Fisheries' Northeast Fisheries Science Center have conducted long-term, broad-scale multi-species bottom trawl surveys on the NOAA Fisheries ship *Albatross IV* since 1963, the world's longest continuously running survey. In 2009, this survey is scheduled to move to the new larger and more powerful *Henry B. Bigelow*, which is equipped with new bottom trawl sampling gear that will provide more accurate and precise survey data. The calibration experiment for these two vessels began in the fall of 2007.

NOAA Fisheries Improves Recreational Fishery Survey Methods

On June 12, 2008, NOAA Fisheries published in the *Federal Register* a proposed rule to implement the National Saltwater Angler Registry Program. The directory will increase the confidence of anglers and fishery managers in the results of telephone surveys by improving the quality of data over that obtained from current random digit-dialing survey methods. This

will address the National Research Council's concerns about possible sources of bias, and will also increase the efficiency of surveys.

The proposed rule identifies the requirements and process for registration of anglers and for-hire vessels and the process by which states may agree to submit angler and vessel identification and contact information, exempting their license-holders from the requirement to register federally. An Angler Registry Data Base Work Group that includes technical experts from NOAA Fisheries and state governments has been established, and is developing data requirements and a database design for state license-holder data that will be included in the national registry. When implemented, the registry data will be compiled in a series of regional directories to be used to support surveys of anglers and vessel operators to determine their angling effort and related data.

The National Saltwater Angler Registry Program is a component of the Marine Recreational Information Program (MRIP), a collaborative effort coordinated by NOAA Fisheries that includes state natural resource agencies, interstate fishery commissions, regional fishery management councils, and the recreational fishing industry and will improve recreational fishery statistics. The MRIP initiative responds to requirements of the Magnuson-Stevens Act, and is working to redesign regional data collection programs so that they better address the specific information needs for fish stock assessments and fisheries management. In September 2008, the MRIP leadership team completed the MRIP Implementation Plan, which provides an update on progress to date, as well as a blueprint for putting new survey methods into action.

NOAA has provided significant funding for dam removal projects, such as this dam across the Contoocook River in Henniker, New Hampshire. The project has reconnected 15 miles of rivers, improved fish habitats, enhanced the ability of fish to move through the system, and provided more paddling and recreational opportunities.

NOAA Restores and Opens Access to Vital Fish Habitat

In 2008, NOAA restored, improved, and protected 11,254 habitat acres and opened 623 stream miles for migrating fish. The restoration work was carried out through programs such as large-scale, regional restoration projects in Louisiana conducted under the *Coastal Wetlands Planning, Protection, and Restoration Act*; the Community-based Restoration Program, a novel, grass-roots approach to restoration designed to actively engage communities in on-the-ground restoration of local habitats; and the Damage Assessment, Remediation, and Restoration Program, which helps assess damage to habitat after disasters and provides recommendations and necessary restoration and compensation.

NOAA's habitat restoration, protection, and improvement efforts improve water quality and increase "green armor" in U.S. coastal areas, creating strong, natural coastlines that serve as effective buffers against storm damage. NOAA programs, including the Open Rivers Initiative and Hydropower Program, open freshwater rivers and streams to migrating fish, allowing them to spawn in healthier habitats, which enhances the overall health of the river systems. NOAA's Open Rivers Initia-



NOAA Fisheries works to protect marine mammals and sea turtles under its jurisdiction, and to restore threatened and endangered marine animals to healthy populations.

tive celebrated an important milestone in July when NOAA completed the first phase of a two-phase dam removal project to open access to salmon habitat on the main stem of the Rogue River in Jackson County, Oregon. NOAA and its partners removed Gold Hill Dam, which was no longer in use and had become a safety and maintenance concern. In the second phase, nearby Savage Rapids Dam will be removed in 2009, opening access to 15 miles of high-quality spawning and rearing habitat for salmon.



Protecting Bottom Habitat Is A NOAA Priority

Some areas of the ocean bottom are habitats with high biological diversity, but are vulnerable to damage from certain fishing practices, especially bottom trawling. To protect vulnerable bottom habitat in the Bering Sea, in August, 2008, NOAA implemented management measures that close approximately 133,000 square nautical miles of the Bering Sea to non-pelagic trawling as a precautionary measure to minimize potential adverse effects on bottom habitat. The closed areas include locations that have not been previously fished with non-pelagic trawl gear, nearshore bottom habitat areas that may support subsistence marine resources, and a research area that could be used for studying the potential impacts of non-pelagic trawl gear on bottom habitat.

In December 2007, NOAA released the first comprehensive, peer-reviewed report on deep coral ecosystems in the United States, *The State of Deep Coral Ecosystems of the United States*. The report provides an

up-to-date assessment of deep coral ecosystems in U.S. waters, highlighting 2009 research priorities and recommendations for addressing knowledge gaps. It emphasizes that society is only beginning to appreciate the importance of these habitats to sustainable fisheries and the need to protect them through appropriate management actions.

NOAA Fisheries has also addressed this priority internationally by providing leadership in implementing the requirements of United Nations General Assembly Resolution 61/105, which call for a January 1, 2009, moratorium on any bottom fisheries that significantly harm vulnerable marine ecosystems. These initiatives extend from the Northwest Atlantic to the Antarctic to the Northwest and South Pacific Oceans.

NOAA Report Highlights the Benefits of Offshore Aquaculture to the U.S. Economy

Aquaculture shows significant economic potential and good prospects for success in the United States, according to a 2008

NOAA-commissioned report. Written by leading fisheries and resource economists and business experts, *Offshore Aquaculture in the United States: Economic Considerations, Implications & Opportunities* considered the long-term implications of an established domestic offshore aquaculture industry in the United States and the role such an industry might play in helping to meet global demand for seafood and other sustainable uses of the ocean.

The study found that a significant domestic offshore aquaculture industry could develop and be successful over the next 20 years with a clear regulatory framework. A primary barrier to developing an offshore aquaculture industry is the lack of a clear

NOAA Fisheries is the only federal agency with the authority to bestow the U.S. Grade A mark for seafood. Approximately 2,500 seafood vendors participate in the NOAA Seafood Inspection Program annually.

PRODUCTS AND SERVICES

Managing the Nation's Fisheries

NOAA Fisheries management supports an industry that contributes \$34.2 billion annually to the U.S. economy. It is guided by more than 100 federal laws, including the Magnuson-Stevens Fishery Conservation and Management Act, the Marine Mammal Protection Act (MMPA), and the Endangered Species Act (ESA). NOAA Fisheries develops fishery management plans and reports annually to Congress on the status of U.S. fisheries.

Supporting American Anglers

Recognizing the value and contributions of recreational fisheries to the U.S. economy, NOAA Fisheries has begun to modernize its recreational data collection program by establishing a national registry of saltwater anglers. Agency scientists and managers are collaborating with partners in the recreational fishing industry to design a new data collection program for the nation's marine recreational fisheries.

Protecting Marine Mammals and ESA-Listed Marine Species

NOAA Fisheries works to protect marine mammals and sea turtles under its jurisdiction. Many of these species are affected by fishing and other human impacts, as well as environmental changes. Several innovative programs—recovery plans, ship strike strategies, stranding networks, and rehabilitation efforts—are working to restore threatened and endangered marine animals to healthy populations. NOAA Fisheries develops recovery plans and publishes biological opinions, an MMPA annual report, and an ESA biennial report.

Maintaining Healthy Ecosystems and Habitat Conservation

NOAA Fisheries leads regional and community-based efforts to protect and restore habitat vital for healthy ecosystems and sustainable populations of protected and harvested species. Riverine, coastal, and ocean habitats support the nation's

fisheries and are home to dozens of imperiled species. Scientists and managers address threats to habitat posed by natural events and human activities, recommending improvements to proposed development plans to protect vital habitat and extend fish passage. NOAA Fisheries also provides stewardship training, restores degraded habitat, and works to address threats from aquatic invasive species.

Working Globally for Healthy and Productive Oceans

NOAA Fisheries' strong domestic programs give it credibility and a platform to engage and persuade other countries to enter into international management agreements and tariff and trade agreements that take a strong conservation approach to fisheries management and work to end overfishing throughout the world's oceans. In addition, the Agency leads efforts to curtail illegal, unregulated, and unreported fishing throughout the world.



Achieving World-Class Science

NOAA Fisheries is the leader in providing world-class science programs that continue to improve with the adoption of robust scientific peer reviews and the continued development of an ecosystem approach to managing the nation's marine resources. In addition, NOAA Fisheries conducts cooperative marine research with a number of federal and state agencies, universities, fishermen, and others to help develop sound fishery management measures.

Enabling Sustainable Marine Aquaculture

NOAA Fisheries' Aquaculture Program fosters additional domestic marine aquaculture production to meet the growing demand for safe, healthy seafood, create jobs in U.S. coastal communities, increase regional food supply and security, help restore depleted commercial and recreational marine species, and help the na-

tion reduce its \$8.7 billion annual seafood trade deficit. The program's priorities are published in the *10-Year Plan for Marine Aquaculture*.

Providing Seafood Inspection Services

The NOAA Seafood Inspection Program offers a variety of professional inspection services that ensure compliance with all applicable federal food regulations. NOAA Fisheries is the only federal agency with the authority to bestow the U.S. Grade A mark for seafood. The program also offers product quality evaluation, grading, and certification services on a product-lot basis. The approximately 2,500 annual program participants include seafood processors, distributors, retailers, importers, and exporters. Many participants require their suppliers to provide inspected seafood products. For example, Kroger, the nation's largest supermarket chain, has been associated with the Inspection Program for

over 10 years. Albertson's is another well-known retail participant. Within the last year, Giant Eagle, Winn-Dixie, and most recently Wal-Mart have begun requesting inspected products from their suppliers.

Enforcing Federal Laws and Regulations

NOAA special agents and enforcement officers are charged with protecting the nation's marine resources under a variety of federal laws and regulations. Enforcement activities include investigating criminal and civil violations, seizing contraband and illegal goods, implementing advanced technologies through a Vessel Monitoring System program to monitor and verify positions of fishing vessels using satellite-based tools, and applying community-oriented policing and problem solving to promote voluntary compliance with the Magnuson-Stevens Fishery Conservation and Management Act.

regulatory or permitting process to allow seafood farming in federal waters, 3 to 200 miles offshore. To address that gap, the Bush Administration proposed legislation to give the Department of Commerce the authority to set regulations for this type of marine aquaculture. The legislation, which is currently pending before Congress, would provide a clear regulatory process for businesses and individuals to develop safe, sustainable aquaculture in U.S. federal waters.

NOAA Fisheries Protects Consumers From Seafood Fraud

During 2008, NOAA Fisheries made significant progress in combating the fraudulent mislabeling of seafood products. Through cooperation with the Federal Bureau of Investigation, U.S. Customs Ser-

vice, and the Food and Drug Administration, NOAA Fisheries seized thousands of pounds of falsely labeled seafood and successfully indicted or convicted many individuals involved in these illegal activities.

Treasury Department Streamlines Billing for Seafood Inspection Services

During 2007, the U.S. Treasury Department selected the NOAA Seafood Inspection Program as one of only three agencies to develop and test a pilot program for Treasury's PAY.GOV Web site. Designed to provide collection services for all federal agencies, this Web site, will allow interested Inspection Program customers to pay their inspection services bill via the Internet. The site will be completely secure and will be monitored by the Treasury Department. Customers registered in the program will receive an e-mail notice that they have a bill available for payment. They will be able to view, print, and pay the bill online using credit card or bank transfer. Customers

who wish to pay their bills via check will be able to print the bill and mail their payment to the Inspection Program's account as usual.

FUTURE OUTLOOK

NOAA Fisheries has the stewardship responsibility for the world's largest Exclusive Economic Zone. Healthy and productive coastal, marine, and Great Lakes ecosystems create billions of dollars of value in recreational and commercial activity each year. New legislation, evolving management philosophies, and scientific advances have created new opportunities for managing the nation's living marine resources. The Bush Administration's *U.S. Ocean Action Plan* identifies and supports an ecosystem approach to management and clearly states that an effective U.S. ocean policy must be grounded in an understanding and management of ecosystems. This ecosystem approach is the cornerstone of the management tools that will

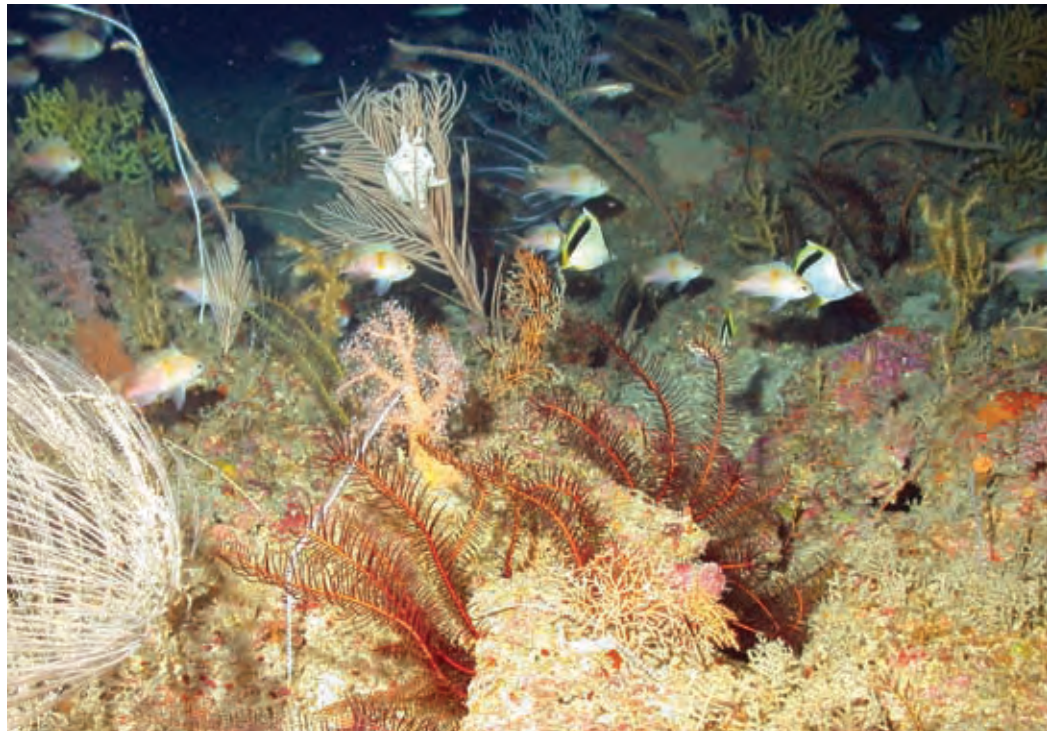
NOAA Fisheries special agents and observers are charged with protecting the nation's marine resources under a variety of federal laws and regulations.



lead NOAA Fisheries to meet its immediate and long-term goals, including:

- implementing the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006,
- ending overfishing,
- reducing bycatch and discards,
- doubling the number of dedicated access programs to 16 by 2011,
- securing passage of offshore aquaculture legislation,
- providing effective conservation under the Endangered Species Act and the Marine Mammal Protection Act,
- ensuring effective science and management,
- strengthening environmental compliance for national defense and energy-related activities in our oceans and coastal areas,
- being an environmental leader domestically and internationally, and
- promoting healthy coastal habitats in support of fisheries and environmentally and economically resilient coastal communities.

NOAA Fisheries will also work collaboratively with other agencies and organiza-



Some highly biologically diverse areas of the ocean bottom are vulnerable to damage from fishing practices, especially bottom trawling.

tions on an ecosystem-based approach to develop indicators of ecosystem status and trends, and joint strategies to address regional ecosystem priorities. NOAA Fisheries will continue to adopt the necessary

tools to meet all of its goals well into the future and will apply fiscal and programmatic resources wisely to ensure the integrity of the nation's marine ecosystems for the sustained socioeconomic, environmental, and cultural benefit of all Americans.



John L. "Jack" Hayes, Ph.D.
Assistant Administrator

National Weather Service *Science and Service for Protecting Lives, Livelihoods, and Your Way of Life*

Each year, the United States averages some 10,000 thunderstorms, 5,000 floods, 1,000 tornadoes, and six deadly hurricanes, as well as widespread droughts and wildfires. Approximately 90 percent of all presidentially declared disasters are weather-related, causing approximately 500 deaths per year and \$14 billion in damage. About one-third of the U.S. economy—about \$4 trillion—is sensitive to weather.

NOAA's National Weather Service (NWS) provides weather, water, and climate forecasts and warnings for the United States, its territories, adjacent waters and ocean areas, for the protection of life and property and the enhancement of the national economy. NWS services cost each American about \$3 a year—roughly half the price of a fast-food meal. This investment allows NWS to issue climate, public, aviation, marine, fire weather, air quality, space weather, river, and flood forecasts and warnings every day. NWS has approximately 4,800 employees in 122 weather forecast offices, 13 river forecast centers, 9 national centers, and other support offices around the country.

The NWS 2008 annual budget of approximately \$911 million supports a national infrastructure to gather and process data worldwide from the land, sea, and air. NWS data and products form a national information database and infrastructure that can be used by other governmental agencies, the private sector, the public, and the global community. This infrastructure includes collecting data using technology, such as Doppler weather radars; satellites operated by NOAA's National Environmental Satellite, Data, and Information Service; data buoys for marine observations; surface observing systems; and instruments for monitoring space weather and air quality. These data feed sophisticated computer models running on high-speed supercomputers. NWS's highly trained and skilled workforce uses powerful work stations to analyze all of these data and issue forecasts and warnings. High-speed communications tie this information infrastructure together and disseminate forecasts and warnings to the public.

NWS staff also use trained community volunteers to enhance weather service operations. Volunteers collect weather data that become part of the nation's climate records, and citizen storm spotters provide NWS with visual confirmation of severe weather events as well as precursors to severe weather. As environmental information becomes more sophisticated, complete, and available to all, the public's environmental literacy becomes more important. NWS outreach, education, and social science activities focus on ensuring that the public understands the information NWS provides and can use it effectively in making decisions.



In January 2008, a storm in Caledonia, Lowndes County, in Jackson, Mississippi, produced three strong EF3 tornadoes on the enhanced fujita tornado damage scale.

ACCOMPLISHMENTS

Weather Infrastructure

NWS Completes the U.S. Tsunami Detection Network

In late March 2008, NWS deployed the final two tsunami detection buoys in the South Pacific, completing the U.S. tsunami 39-buoy detection network. In response to the December 2004 Indian Ocean tsunami, NWS has placed Deep-ocean Assessment and Reporting of Tsunami (DART II) stations at sites in regions with a history of generating destructive tsunamis to ensure early detection and warning of tsunamis and to acquire data critical to real-time forecasts.

DART station 52406 represented the 39th and final successful establishment of the planned U.S. DART stations to strengthen the U.S. tsunami warning system, meeting full operational capability. Station 32412 (in the southeastern Pacific Ocean) completed the process of filling the gap in coverage for seismic events occurring along the west coast of South America. Prior to

this deployment, the only station covering this area was owned and operated by Chile (located 630 nautical miles southwest of Lima, Peru). NOAA's DART network constitutes a critical element of the NOAA Tsunami Program, which is part of a cooperative effort to save lives and protect property through hazard assessment, warning guidance, mitigation, research capabilities, and international coordination.

FAA Terminal Doppler Weather Radars Data Integrated into Forecast Operations

Terminal Doppler Weather Radar (TDWR) is a high-quality, dedicated meteorological surveillance technology. The Federal Aviation Administration (FAA) installed upgraded TDWRs near large U.S. airports that were vulnerable to wind shear conditions (thunderstorms, frontal passages, etc.). Data from the TDWRs were recently made available to NWS Weather Forecast Offices (WFOs) through an agreement between the NWS and the FAA. The range resolution of the upgraded TDWR radar is finer than what was available in the Weather



In response to the December 2004 Indian Ocean tsunami, NWS has placed Deep-ocean Assessment and Reporting of Tsunami (DART II) stations at sites in regions with a history of generating destructive tsunamis to ensure early detection and warning of tsunamis and to acquire data critical to real-time forecasts.

er Surveillance Radar, 1988 Doppler (WSR-88D), or any other FAA radar that has weather channel capabilities.

Over the last several years, NWS has been developing and deploying a system to ingest TDWR data. By the end of September 2008, communication connections and installations of 45 Supplemental Product Generators (SPGs) were completed. These initial prototype systems have worked with two builds of the processing system and have shown that TDWR data can provide valuable information for forecasts and



Jeff Smith of NOAA's Aircraft Operations Center explains Dropsonde technology to NOAA Chief Information Officer CIO Joe Klimavicz. Dropsondes are deployed from WP-3D and G-IV aircraft over data-sparse oceanic regions. They activate upon hitting the ocean surface and radio sea temperature, salinity, and current information back to computers aboard the aircraft.

warnings, as well as allow for integration and display within the Advanced Weather Interactive Processing System. Finally, with the success of the TDWR SPG program, NWS continues to seek additional avenues to ingest other types of radars from the government, private sector, and partner nations.

NWS Adds New Elements to the National Digital Forecast Database

On July 8, 2008, NWS transitioned Quantitative Precipitation Forecast (QPF), Sky Cover, and Snow Amount elements of the National Digital Forecast Database (NDFD) to operational status, and implemented the experimental Hazard element. This completes the transition to operational status for all of the original 12 baseline forecast elements in NDFD. The QPF element has improved gridded verification of NWS forecast and analysis capabilities at WFOs. One customer noted, “From the graphical forecast, we get much more accurate prediction of rainfall, wind gusts, etc., than from any other source.”

The Sky Cover element has many applications, but is especially important to aviation because it is the expected amount of opaque clouds (in percentage) covering the sky for the indicated hour. A user of this grid explained, “I am a pilot and I use this tool more than anything else when I am

concerned about conditions on the ground for takeoff or landing. Wind and sky conditions given graphically every three hours and updated hourly are excellent.”

Feedback from businesses that rely on the Snow Amount element have been advocates on its importance to their livelihood: “We are in the snow management industry, and we use the information to prepare our troops and equipment. We then decide to run with a pre-treatment or wait it out for active or post treatments.”

The Hazard element contains all the active long-duration watches, warnings, and advisories and is the first element in the NDFD to have one-hour temporal resolution (through 72 hours); for Day 4 and Day 5, the temporal resolution will be every 6 hours. The addition of the Hazard element to NDFD will benefit the diverse NWS user community and help NWS advance its mission.

On August 21, NWS added the following climate outlook elements to the NDFD for the contiguous United States: 8- to 14-day, 1-month, and 3-month average temperatures above and below normal, and total precipitation above and below median. These elements are the first climate forecasts to be incorporated into the NDFD. Their availability in the NDFD responds to a large and growing demand from the pub-

lic and private sectors for climate forecasts. Providing digital forecast services is a major element of NOAA’s strategic goal to serve society’s changing needs for better and more valuable weather and water information in standardized formats, which can be used with other data sets to save lives and property.

NWS Implements Experimental Gridded Mean Sea Level Pressure Forecasts

The Ocean Prediction Center (OPC), one of NWS’s National Centers for Environmental Prediction, began producing experimental sea-level pressure grids for the 48- and 96-hour forecast time steps in early January 2008. The maritime community is increasing its use of gridded analysis and forecast fields for determining shipping routes. These gridded fields extend over the North Atlantic and North Pacific oceanic domains and cover the main intercontinental shipping trade routes. They are derived from operational OPC graphical 48- and 96-hour surface forecasts, and are created using the graph-to-grid capabilities of the Advanced Weather Interactive Processing System. The 48-hour forecasts are completed two times a day based on 00 and 12 Universal Coordinated Time (UTC) forecast guidance, and the 96-hour grid is created once a day based on the 12 UTC guidance package.

Aviation Weather Services

NWS Issues Experimental Aviation Weather Product

For decades, NWS has issued text-based Airmen’s Meteorological Information (AIRMET), providing broad-scale descriptions of hazardous weather. Often referred to as a time “smear,” the text-based AIRMET requires meteorologists to describe hazardous weather over large geographical areas for six-hour periods.

During the winter of 2007–2008, the NWS Aviation Weather Center (AWC) forecasters routinely produced experimental graphical AIRMETs. These graphics were made available on the AWC testbed site, and positive feedback was collected via a



Each year, NWS prepares and provides approximately 4 million forecasts for the aviation community, primarily through the Center Weather Service Unit (CWSU) program.

survey approved by the Office of Management and Budget. G-AIRMETS provide more frequent, precise, and informative weather hazard depictions than the text-only AIRMETS, enabling pilots to maintain high safety margins while flying more efficient routes. They create a better path from the aviation meteorologist to the weather user, by providing precise, interactive, and easy-to-understand graphical displays. Meteorologists can now put their energy into creating and updating G-AIRMET weather graphics, while the traditional text AIRMETS are generated from, and fully consistent with, G-AIRMET information.

Initiative Improves Aviation Weather Forecasting Capabilities at CWSUs

Each year, NWS prepares and issues approximately 4 million aviation weather forecasts for the National Airspace System. The Center Weather Service Unit (CWSU) is a key component of this production. CWSUs are staffed by 84 NWS meteorologists located at the 21 FAA Air Route Traffic Control Centers throughout the country. They provide aviation weather services to the FAA through an interagency agreement. NWS developed the CWSU Short-Term Improvement Plan in response to both the FAA's request for improved services and the Government Accountability Office's February 2008 report recommending that NWS improve the consistency of CWSU products and services and develop and implement a Quality Assurance Program with metrics and site evaluations. The Improvement Plan includes ten different projects under four key focus areas: improve consistency of products and services, improve customer service, enhance situational awareness, and implement quality assurance measures. All ten projects under the plan have been completed, and the site evaluations have begun.

Hurricane Forecasts

Real-Time Ocean Forecast System—Atlantic Enhances Hurricane Weather Research and Forecast System

NWS Hurricane Weather Research and Forecast (HWRF) model upgrades have been focused on improving hurricane intensity forecasts. Better use of the NWS National Hurricane Center's information on storm strength and vertical characteristics in initializing the hurricane core circulation in the HWRF has led to a 75 percent



NWS field work during July 2008.

reduction of a weak storm bias at the initial time and a reduction of as much as 60 percent for the 4-day forecasts. An enhanced treatment of the model diffusion and numerics over topography has also contributed to improved HWRF forecasts, although to a lesser extent. In preparation for the 2008 hurricane season and this implementation, careful testing of these upgrades has shown over a 26 percent improvement in the 3-, 4- and 5-day forecasts of the HWRF intensity forecasts.

One mission of NOAA's Atlantic Oceanographic and Meteorological Laboratory (AOML) is to advance the understanding and prediction of hurricanes and other tropical weather. Hurricane research at AOML includes direct remotely sensed observations of both hurricanes and the ocean underneath their predicted path. However, observations made inside the inner core of tropical cyclones and their surrounding atmosphere is of critical importance to NOAA's research. A key aspect of this research is an annual field program of flights aboard research aircraft (two WP-3D turboprops and a Gulfstream IV-SP jet) flown by NOAA's Aircraft Operations Center. These aircraft feature on-board instrumentation such as radars, fixed probes to measure cloud and aerosol particles, expendable probes to measure wind speed, temperature, and pressure, as



well as instruments that can remotely determine wave height and sea surface temperature.

NOAA's research scientists are engaged in several approaches to better understand and predict tropical cyclones. These investigations involve theoretical studies, computer modeling, and the collection and

examination of measurements taken in actual hurricanes. The ultimate goal is to improve scientific understanding of how and why hurricanes form, strengthen, and dissipate, which will lead to improved forecasting of tropical weather and mitigation of damage from the hurricane's destructive power.

Fire Weather Services

NWS Issues GIS-Compatible Products for Convective and Fire Weather Outlooks

The Areal Outline product for the NWS Storm Prediction Center Day 3–8 Fire Weather Outlook in a GIS-compatible format became official on May 20, 2008. The product gives latitude-longitude couplets that define each of the areas in the associated outlook. These outlines in the new products depict the following areas: DSTM—Dry Thunderstorm Area, CRIT—Critical Fire Weather Area, and EXTM—Extremely Critical Fire Weather Area. This product, which is a repackaging of existing fire weather areal outlook information in a more readable format, was specifically requested by several fire weather users.

Probabilistic Lightning Guidance Is Expanded to Alaska

NOAA's Storm Prediction Center (SPC) has implemented an experimental probabilistic lightning guidance product for Alaska. Since most fires in the huge expanses of Alaska are ignited by lightning strikes, the probabilistic forecast approach provided a focus for forecasters to issue fire

weather watches and red flag warnings during Alaska's 2008 fire season. Because of this guidance, in conjunction with NWS fire watch and warning products, land managers were able to plan for and move resources prior to significant events, ultimately leading to greater effectiveness and reduced costs of containing wildfires. Based on this success, SPC probabilistic lightning guidance will be added to the operational product suite for the 2009 warm season.

Severe Weather Services

NWS Provides Improved Lead Time for Tornado Outbreaks

NWS forecasters anticipated several days in advance the February 5–6, 2008, tornado outbreak that swept across the southeastern United States. NOAA's Storm Prediction Center (SPC) began focusing on the possible affected areas six days before the event. The SPC continued emphasizing, refining, and enhancing the threat throughout the event, ultimately issuing a high-risk warning for a large portion of a threatened area. The initial lead time allowed the WFOs to gradually ramp up for severe weather operations and tailor their Hazardous Weather Outlooks to include the risk of severe weather and tornadoes as far as four days in advance. All of the offices were also in contact with emergency managers and media the morning of the event. All of the tornado fatalities occurred within the boundaries of Tornado Watches and were preceded by Tornado Warnings.



NWS forecasters anticipated several days in advance the February 5–6, 2008, tornado outbreak that swept across the southeastern United States. NOAA's Storm Prediction Center began focusing on the possible affected areas six days before the event. This photo shows wreckage from the tornado in Macon County, Tennessee.

The average SPC Tornado Watch lead time for the first tornado within the watch was 2 hours. The preliminary average lead time for all verified Tornado Warnings from the WFOs evaluated during this event was 18 minutes, with a 17-minute preliminary average lead time for warnings that covered deadly tornadoes. The national average lead time for Tornado Warnings for 2007 was 13 minutes.

PRODUCTS AND SERVICES

Local Warnings and Forecasts

NWS provides an integrated suite of warning and forecast products and services from its 122 Weather Forecast Offices (WFO) located across the nation. Forecasters at the WFOs integrate multiple sources of observational data from radars, surface-observing systems, weather data buoys, and satellites, along with centrally provided weather prediction model guidance using advanced processing systems to generate these key products.

Public Weather: NWS provides advanced local forecasts and warnings of severe weather, such as tornadoes, thunder-

storms, flash floods, winter storms, and extreme heat and cold conditions.

Aviation Weather: NWS provides advanced aviation warnings and forecasts for airport terminals of hazardous flight conditions at all levels within domestic and international air space.

Marine: NWS provides advanced warnings and forecasts services for coastal waters, bays, national marine sanctuaries, offshore, and the Great Lakes.

Fire Weather: NWS provides routine fire weather forecasts, "red-flag" warnings, and wildfire spot forecasts, along with on-site meteorological support for wildfires.

Tsunami Watches and Warnings: NWS provides advanced tsunami warnings based on strengthened tsunami warning systems consisting of Deep-ocean Assessments and Reporting of Tsunami (DART) buoys, seismic sensors, tide gages, inundation mapping/modeling, and local community awareness. Forecasters are able to produce estimates of wave amplitudes, flow velocities, and arrival times for offshore and coastal inundation areas.

Environmental Modeling & Prediction

The NWS National Centers for Environmental Prediction (NCEP) support the local warning and forecast process through centralized processing of weather observations, followed by the application of

NWS Increases the Number of Recognized TsunamiReady Communities

During FY 2008, NWS increased the number of recognized TsunamiReady communities from 41 to 51. To be recognized as TsunamiReady, communities need to establish a 24-hour Warning Point and Emergency Operations Center, have the ability to disseminate tsunami warnings, develop a formal Tsunami Hazard Plan, and run a proactive community tsunami awareness program. In addition, communities must ensure multiple ways to receive tsunami warnings, designate tsunami evacuation areas and evacuation routes with appropriate signage, establish a system that monitors environmental conditions locally, and partner with NOAA in promoting public readiness and response through workshops and educational materials, and conducting routine emergency exercises.

AWIPS Display Incorporates NEXRAD Super-Resolution Data

The NWS Systems Engineering Center manages the development and integration of the displays of super-resolution next-generation radar (NEXRAD) data. Super-resolution data provide twice the azimuthal resolution and allow NWS forecasters to view higher-resolution data at greater distances from the radar. The Advanced

Weather Interactive Processing System (AWIPS) radar displays were updated to accommodate the higher-resolution data. The AWIPS displays have been tested and deployed to the field sites, and as the NEXRAD Build 10 is deployed, the data will begin flowing from the NEXRAD Build 10 Beta sites.

AWIPS is the centerpiece of NWS operations. It is a high-speed, interactive, technologically advanced, versatile computer processing, display, and telecommunication network system that integrates all meteorological, hydrological, satellite, and radar data into one computer work

station. AWIPS allows forecasters the interactive capability to view, analyze, combine, and manipulate large amounts of graphical and alphanumeric weather data. AWIPS is designed so that software and data can be migrated to new platforms as technology evolves. In fact, AWIPS is a dynamic system that frequently is updated with new software and hardware capabilities to keep it a state-of-the-art system for NWS forecasters.

NEXRAD super-resolution capability was implemented primarily to better detect tornadic circulation patterns. The improved spatial detail for subjective tornadic



Senior forecaster Mark Wool, working at the Aviation and Fire weather desk, points out an interesting image on radar to hydrometeorological technician Jim Bolden.

high-resolution computer models of the atmosphere and oceans on NOAA supercomputers, and critical input by NCEP forecasters. NCEP's weather and climate prediction model output and forecast products are also used directly by the public, industry, and the commercial weather enterprise to improve decision making across a wide range of applications, all impacting the nation's economy. NCEP's forecasts and predictions give overarching management to nine centers: Aviation Weather Center, Climate Prediction Center, Environmental Modeling Center, Hydrometeorological Prediction Center, NCEP Central Operations, Ocean Prediction Center, Space Weather Prediction Center, Storm Prediction Center, and Tropical Prediction Center.

Hydrologic Services

NWS provides river-flow and flood forecast services using prediction models and databases at 13 River Forecast Centers. This information is the basis for flash-flood and flood-warning programs implemented at WFOs. These services support emergency management and water resources activities. NWS is striving to provide water resource managers with localized water and soil condition forecasts via a national digital database incorporating all available hydrometeorological data and observations.

Air Quality Forecasting Services

NWS currently provides forecast guidance for ozone and smoke-based air quality on numerical atmospheric predictions updated twice daily. These predictions are produced by linked models for weather prediction, developed by NOAA's Office of Oceanic and Atmospheric Research, which are run operationally on supercomputers at NWS's National Centers for Environmental Prediction. These predictions provide information for people in cities, suburbs and rural areas alike, at hourly intervals through midnight the next day.



The March 20th spring outlook by NOAA's Advanced Hydrologic Prediction Service stated: "Major floods striking America's heartland this week offer a preview of the spring seasonal outlook.... Americans should be on high alert to flood conditions. Above-normal flood potential is evident in much of the Mississippi River basin, the Ohio River basin and the lower Missouri River basin...." The Midwestern Regional Climate Center found that 286 NWS Cooperative Observer Network stations reported precipitation totals for the first half of 2008 that ranked within their top five records for the January–June period. These photos show a June 2008 flood rescue in Waterloo, Iowa.

analyses is immediately available to WFO forecasters through the AWIPS display of super-resolution reflectivity and velocity products. In addition, the NWS Office of Hydrologic Development (OHD) will benefit from the better spatial resolution of rainfall estimates, particularly for urban flooding and small valley watersheds. OHD is working on modifying these algorithms.

OMB Rewards Tsunami Program with Outstanding PART Score

The White House Office of Management and Budget (OMB) rates the efficiency and effectiveness of federal agencies using the Program Assessment Rating Tool (PART). The Tsunami Program was selected for review this year, and received a score of 94 out of 100, or "Effective." The Tsunami Program is one of only 43 programs rated by PART to achieve this rating, and is now the highest-rated NOAA program.

Climate and Integrated Water Resource Data

NWS Upgrades Global Ocean Data Assimilation System

Over the last few years, a new Global Ocean Data Assimilation System (GODAS) was developed to be the replacement for the Pacific ODAS, and to provide the oceanic initial conditions for the new National Centers for Environmental Prediction Climate Forecast System (CFS). During 2008, the GODAS was extended from a depth of 750 meters to 2,175 meters. This action corrected a troublesome temperature bias in the deeper ocean waters, which impacts seasonal prediction of tropical sea surface temperature and, therefore, seasonal forecasts globally. In addition, the lag between observation time and analysis time was reduced from 7 days to 1 day, thereby making the GODAS more representative of ocean conditions. Finally, two new forecast members were added to the daily Climate Forecast System runs to make a four-



member-per-day ensemble. These additional runs provide more statistically reliable results for forecasts in the 3–6 month lead time frame. The expected benefits from this upgrade include improvement in the Climate Prediction Center Week 2 and U.S. hazards assessments forecast, improved spread in the monthly CFS forecasts, reduced temperature bias in global intermediate waters for real-time ocean condition monitoring, and improved Climate Prediction Center forecasts in the week 3–6-month range.

NWS Adds Its Advanced Hydrologic Prediction Service at 270 Forecast Locations

The Advanced Hydrologic Prediction Service (AHPS) is a new and essential component of NWS Climate, Water, and Weather Services. The system displays the magnitude and uncertainty of occurrence of floods or droughts, from hours to days and months in advance. During 2008, NWS implemented AHPS at 270 forecast locations for a total of 2,219 U.S. points, expanding AHPS to all regions of the country, including tributaries within the Ohio River Basin in parts of Kentucky, Ohio, and western Pennsylvania. The expansion, which brings AHPS to almost 55 percent completion, will enable government agencies, private institutions, and individuals to make more informed decisions about risk-based policies and actions to mitigate the dangers posed by floods and droughts.

NWS Enhances Community Hydrologic Prediction System

In January 2008, NWS provided basic training for the pilot Community Hydrologic Prediction System (CHPS) at three

NWS River Forecast Centers (RFCs): the Northwest RFC in Portland, Oregon, the North Central RFC in Chanhassen, Minnesota, and the Arkansas-Red Basin RFC in Tulsa, Oklahoma. These three CHPS pilots are ready for limited experimental use and will provide the basis for the development of the final forecasting system delivered to all 13 RFCs over the next three years. NWS's Office of Hydrologic Development intends to evolve these robust pilot systems with regular software updates.

NWS and USGS Develop Flood Inundation Map Guidelines

During 2008, in coordination with U.S. Geological Survey (USGS), NWS developed guidelines and recommended methods for the construction of flood inundation maps. The document contains specific information related to data, modeling, mapping, access, and display on NOAA's AHPS Web site. Inundation maps graphically depict flood hazard boundaries and water depth for use by decision makers in order to mitigate the impacts of floods. The document is intended to ensure the process of creating inundation maps is consistent with practices used to produce Federal Emergency Management Agency National Flood Insurance Program flood maps. NWS intends to use this document to support partnerships working to improve flood risk communication.

FUTURE OUTLOOK

NWS is looking to the future to become, by 2016, an integrated environmental information service provider with expanded capabilities to contend with a more diverse set of high-impact environmental events.

The NWS of 2016 will provide even greater value by providing more nimble and customer-focused decision support services. Local offices will better support high-impact weather events, collaborate more readily with other NOAA partners and external partners, and maximize the value of new science and technology. NWS services will evolve to meet society's changing weather, water, and climate needs. NWS is committed to maintaining its role as a preeminent environmental information services provider and to energizing partnerships with the media and others in the broad Weather Enterprise to meet society's growing information needs. NWS will infuse new science and apply new technologies to meet these commitments.

NOAA's NWS 2016 vision means:

- Providing superior, customer-focused response for high-impact events.
- Meeting the increasing demands for services in the digital age and beyond.
- Strengthening partnerships with all sectors.
- Enhancing economic opportunities for the private sector.
- Accelerating science and technology infusion from NOAA research, academia, and the commercial sector.

By evolving its services, NWS aims to develop and support new high-impact decision-support services that are customer-focused to protect lives, livelihoods, and the standard of living Americans have come to expect.



Richard W. Spinrad, Ph.D.
Assistant Administrator

Office of Oceanic and Atmospheric Research NOAA Research Matters

The Office of Oceanic and Atmospheric Research (OAR) conducts preeminent research to provide value to society through improved weather and climate forecasts, enhanced navigation and aviation safety, and improved ocean and coastal services. From remote sensing to climate research and ocean exploration, OAR's world-class scientists conduct research that contributes to public health and safety, healthy ecosystems, and a robust economy.

Today, NOAA's research team is working with partners to build the foundation for Earth system modeling, which will provide a more complete picture of our planet and increase our capacity to predict changes in our oceans and atmosphere. Through research, NOAA studies the Earth system from the depths of the ocean to the upper reaches of the atmosphere. Research helps us understand and predict environmental changes on local to global scales and at time scales from minutes to millennia.

OAR is integrated across three central research themes: climate; weather and air quality; and ocean, coastal, and Great Lakes resources. The NOAA Research network consists of seven federal research laboratories; an Office of Ocean Exploration and Research sponsoring both internal and extramural research; the National Sea Grant College program, a nationwide network (administered through NOAA) of 30 university-based programs that work with coastal communities; an Office of Weather and Air Quality to facilitate the transition of weather and air quality research to operations; a climate research grants program through the Climate Program Office; and 13 cooperative institutes with academia. Ultimately, the information NOAA Research provides is used by decision makers at all levels to prevent the loss of human life and manage natural resources, while maintaining a strong economy.

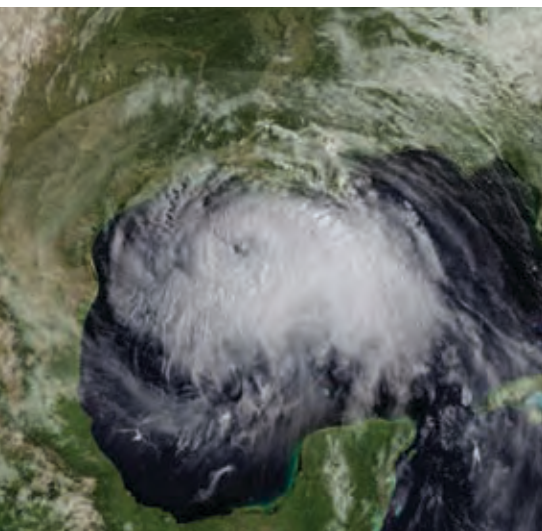
ACCOMPLISHMENTS

NOAA Installs Its 3,000th Argo Float and Reduces Temperature Measurement Error

NOAA researchers, including those at NOAA's Joint Institute for Marine Observations (JIMO), met the goal of deploying and maintaining 3,000 Argo floats in active service. The Argo array of profiling floats provides essential broad-scale, basin-wide monitoring of the upper ocean heat content. The heat content of the upper 2,000 meters of the world's oceans, and the

transfer of that heat to and from the atmosphere, are variables central to understanding the climate system. Global sea level change is directly related to the ocean's heat content: as the ocean's temperature rises the water expands and thus sea level rises.

The Argo array provides measurements needed to document heat uptake, transport, and release by the ocean; global sea level change; and the air-sea exchange of heat and water and the ocean's overturning



The first dual-polarized Doppler radar data of a landfalling hurricane eyewall were collected as Hurricane Ike came ashore in Texas in September 2008.

circulation. While prior oceanic data collection relied heavily upon research vessels with limited timetables and ranges, the Argo network has made it possible for scientists to gather real-time, evolving data around the clock and around the world. The Argo float network provides an average coverage of one sensor for every three degrees of latitude and longitude. Such coverage is necessary to understand the complex interplay between the components of the world's air-sea-land climate system.

Some climate scientists have posited that the oceans have absorbed more than 80 percent of the excess heat generated by global warming over the past 50 years, though they have lacked observational data needed to verify such claims. With the completion of the Argo network, scientists will now have the ability to test such hypotheses and advance the study of oceans and their role in climate variability.

Bycatch Days May Be Bygone With Creation of "Eliminator" Trawl

A team of Rhode Island Sea Grant researchers was awarded the \$30,000 grand prize in the World Wildlife Federation's International Smart Gear Competition for a net called "The Eliminator." Cod and flounder are heavily restricted by federal fisheries regulations but often swim with haddock, and are caught together in commercial fishing trawlers. Fishermen then have to throw thousands of pounds of cod and flounder back into the ocean—where they will likely die—because they were caught alongside haddock. The Eliminator effectively solves this problem by taking advantage of haddock's tendency to swim up when faced with a net, when other fish swim down. The collaborative design and development of the Eliminator trawl is a



Live images from the seafloor and from a research vessel flow from Dr. Robert Ballard's ocean expedition to NOAA's Exploration Command Center in Silver Spring, Maryland. Several of Ballard's missions with NOAA helped to shape the telepresence technology built into NOAA ship Okeanos Explorer and at Exploration Command Centers ashore.

great example of industry and scientists working together with fisheries managers to develop innovative solutions to reduce or eliminate bycatch. It is expected to give fishermen continued access to haddock, while allowing the cod stocks to rebuild.

New NOAA Tools Improved Monitoring and Predictions of the 2007 U.S. Drought

NOAA Earth System Research Laboratory (ESRL) researchers tested the newly developed Drought Monitoring and Prediction System on the early 2007 drought in the western and southern regions of the United States. This system provides near real-time monitoring and prediction of drought, which is an invaluable tool for drought preparation and impact assessment at national to regional scales. NOAA research and operations are providing crit-

ical scientific information and resources on drought and climate change to inform decision makers and reduce environmental and economic impacts. A major part of that effort involves the implementation in FY 2008 of the National Integrated Drought Information System hosted at ESRL.

Report Warns of Lake Erie Water Levels Plunging as the Climate Warms

A three-year study of the Detroit River-western Lake Erie corridor has found that Lake Erie water levels could drop between 3.28 and 6.56 feet by 2066 as the climate in the region warms. Released in late 2007, *State of the Strait: Status and Trends of Key Indicators 2007* involved 75 scientists from nearly 50 government, business, academic, and public interest groups, and utilized



NOAA engineer Paul Fukumura-Sawada captures air near NOAA's Mauna Loa Observatory in Hawaii, using one of many methods to measure carbon dioxide and other greenhouse gases in Earth's atmosphere.

data and analyses from NOAA's Great Lakes Environmental Research Laboratory. Funded in part by NOAA's Michigan Sea Grant program, the study cites the 2007 report of the U.N. Intergovernmental Panel on Climate Change (IPCC), in which a consensus of scientists worldwide agreed that human activity is contributing to warming observed in the Earth's climate.

Taking the midpoint of the report's prediction, a 4.92-foot drop would result in a 4 percent reduction in the surface area of the western basin and a 20 percent reduction in its volume. Winter freezing normally seals off lake evaporation, but in winters when Lake Erie doesn't freeze, more evaporation can occur, resulting in lower water levels. As the lake shrinks, western Lake Erie's shoreline could expand by nearly four miles potentially harming the shipping industry and water treatment facilities.

Studies Predict Fewer, More Intense Hurricanes

Separate studies by NOAA researchers point to fewer, more intense Atlantic hurricanes. An article on global warming and Atlantic hurricane activity, written by scientists at NOAA's Atlantic Oceanographic and Meteorological Laboratory and the Cooperative Institute for Marine and At-

mospheric Studies and published in *Geophysical Research Letters*, reported that global warming of the sea surface is associated with an increase of vertical wind shear in the main development region for Atlantic hurricanes. The increased vertical wind shear coincides with a downward trend in U.S. landfalling hurricanes.

A new model simulation study of Atlantic hurricane activity for the late 21st century by scientists at NOAA's Geophysical Fluid Dynamics Laboratory, published in *Nature Geoscience*, projects fewer hurricanes overall, but a slight increase in intensity for hurricanes that do occur. Hurricanes are also projected to have more intense rainfall, on average, in the future. Simulations reveal higher levels of wind shear and other changes projected to accompany 21st-century global warming, acting to reduce the overall number of hurricanes in the model. This study employed a new regional model that offers both higher resolution and an improved ability, compared to current climate models, to simulate past observed changes in Atlantic hurricane activity.

Autonomous Underwater Vehicles Investigate Bonaire Coral Reef Health

A NOAA-sponsored expedition investigated shallow and deep-sea coral ecosystems

off the Caribbean island of Bonaire to help identify why deep-water coral reefs appeared to remain relatively healthy, while many in the Caribbean and around the world are threatened by circumstances, such as overfishing, coastal development, ocean warming and ocean acidification. During their investigation, scientists were surprised to find that corals in mid-depth waters were not as healthy as they had expected. The mission was one of the first in the International Year of the Reef 2008. In shallower waters, the team measured changes from limited surveys in the 1980s and 1990s. In deeper waters, three robots called autonomous underwater vehicles (AUVs) surveyed the "twilight zone," 65 to 150 meters deep, where sunlight is scarce and little is known about reef systems. AUVs obtain wide-area data, allowing scientists to pinpoint further investigation.

NOAA Studies Atmospheric Mercury for Gulf of Mexico

Researchers from NOAA's Air Resources Laboratory (ARL) completed installation of ambient air mercury monitoring equipment at a permanent site within the Grand Bay National Estuarine Research Reserve, in Moss Point, Mississippi. This constitutes one of the first such stations in an emerging multi-agency national mercury net-

work. Mercury is a powerful neurological toxin that accumulates in fish and is consumed by people. Long-term measurements provide essential information needed to better quantify atmospheric deposition of mercury to local watersheds, discern natural versus anthropogenic sources of mercury, and elucidate source-receptor relationships from known or suspected emission sources. The collected data will facilitate a more thorough evaluation of NOAA's mercury models. These models are key to establishing clear linkages between atmospheric processes (emission, atmospheric chemistry, deposition) and aquatic and biochemical processes that govern the incorporation and migration of mercury through the food web.

Scientists Deploy New Tool to Monitor Solomon Sea

NOAA researchers deployed a new instrument, called the "Spray Glider," to measure the currents and temperatures in the Solomon Sea, near Papua New Guinea. The Spray Glider is a two-meter-long tube with wings that is remotely controlled by satellite communication. It moves through the ocean, making a series of dives to 600 meters, reporting the northward flow through the Solomon Sea, one of the major currents of the world ocean. Variations of this current may be a key to the prediction of the El Niño climate oscillation. After three months, the glider returned to be picked up, refurbished, and redeployed.

NOAA Researchers Receive Patent for DART® Buoy

NOAA Pacific Marine Environmental Laboratory researchers were awarded a U.S. patent for the invention of the NOAA Deep-ocean Assessment and Reporting of Tsunami (DART®) system. This system employs a seafloor tsunameter linked to an ocean surface buoy via a bi-directional communication system for near real-time measurement and reporting of tsunamis. As the tsunami wave propagates across the ocean and reaches the DART® systems, these systems report sea level information

measurements back to the Tsunami Warning Centers, where the information is processed to produce a new and more refined estimate of the tsunami source. The result is an increasingly accurate forecast of the tsunami that can be used to issue watches, warnings, or evacuations (and avoid unnecessary evacuations).

Ozone Hole Recovery Could Reshape Southern Hemisphere Climate Change

Scientists from NOAA's ESRL and Cooperative Institute for Research in Environmental Sciences report a full recovery of the stratospheric ozone hole could strongly modify climate change in the Southern Hemisphere and possibly amplify warming of the Antarctic continent.

As ozone levels recover, the lower stratosphere over the polar region will absorb more ultraviolet radiation from the sun. As a result, intense westerly winds that block air masses from crossing into the continent's interior would weaken, and Antarctica would no longer be isolated from the warming patterns affecting the rest of the world. The influence of a full stratospheric ozone recovery on seasonal Southern Hemisphere climate will largely depend on how fast carbon dioxide and other greenhouse gases increase. While average surface temperatures have been rising globally, the interior surface of Antarctica has exhibited a unique cooling trend during the Southern Hemisphere summer and fall, resulting from stratospheric ozone depletion during spring.

The Montreal Protocol on Substances That Deplete the Ozone Layer restricted pro-

duction of ozone-depleting substances, starting in 1987. Scientists predict the ozone hole will recover completely by 2070. Such changes in large-scale circulation patterns may ultimately have consequences for Australian and South American climate during late spring and summer. Australia could experience warmer and drier conditions, while areas in Argentina, Brazil, Uruguay, and Paraguay could become wetter.

NSSL Researchers Develop "On-Demand" Severe Storms Verification System

Researchers at the National Severe Storm Laboratory (NSSL) have developed a severe storm verification system to help National Weather Service meteorologists quickly verify their severe thunderstorm and tornado warnings. Part of NSSL's Warning Decision Support System, the new system is a suite of multiple radar/sensor severe weather decision assistance algorithms that run in real time across the entire continental United States. Current methods of warning verification can be a time-intensive responsibility involving numerous phone call inquiries to the public, manual replay of single-radar data, and manual plotting and tracking of rotation in the thunderstorm often associated with tornadoes and severe weather, taking up to several hours. This new system has the capability to reduce the preparation time for damage surveys by combining the geospatial data with a geographic information system or other mapping software, such as Google Earth, to quickly determine where the potential tornadic damage may have occurred. A high-resolution street map of

Dr. Christopher Sabine of OAR's Pacific Marine Environmental Laboratory on a 2008 ocean acidification field study in the Southern Ocean aboard NOAA Ship Ronald H. Brown.
Photo: NOAA Pacific Marine Environmental Laboratory





Dr. Susan Solomon, senior scientist at the ESRL Chemical Sciences Division, was named by TIME Magazine as one of the world's 100 most influential people for 2008.

potential damage areas can also be produced for damage surveyors and emergency responders. Improved verification efficiency will get surveyors into the affected areas sooner, before recovery and cleanup begins.

Study Finds Increasing Ocean Oxygen Depletion

Gregory Johnson, a scientist from NOAA's Pacific Marine Environmental Laboratory, co-authored an article published May 2 in *Science*. Titled "Expanding Oxygen-Minimum Zones in the Tropical Oceans," the article reports on an analysis of ocean-dissolved oxygen concentrations from the 1960s through the current decade in six study areas near or in the oxygen-minimum zones (OMZs) of the tropical Atlantic, Pacific, and Indian Oceans. In the Atlantic, and to a lesser extent, the Pacific Oceans, these zones of low oxygen concentrations have become thicker as oxygen concentrations have decreased, while results for the Indian Ocean suggest there has been no substantial change. The observations made in this study support climate model predictions of both declining dissolved oxygen in tropical oceans and expansion of the tropical OMZs as a result of increased temperatures.

The term OMZ describes areas with the lowest concentrations of dissolved oxygen. While there are seasonal OMZs, such as

the dead zone off of the Louisiana coast, this study refers to year-round layers of low oxygen found at intermediate depths in tropical oceans. When oxygen concentrations become too low, commercially important organisms become stressed or die.

NOAA Researcher Named to TIME Magazine's 100 Most Influential People

Dr. Susan Solomon, senior scientist at the ESRL Chemical Sciences Division, was named by *TIME Magazine* as one of the world's 100 most influential people for 2008. She was one of 19 people named in the "Scientists and Thinkers" category of the listing. This is the fifth year that *TIME* has published its list. The list spans politics, entertainment, the arts, science, business, and other categories. Each of the 100 people is featured with a one-page profile. Solomon's profile, written by IPCC Chair Rajendra Pachauri, mentions Solomon's scientific achievements related to the Antarctic ozone hole and her work as Co-Chair of the IPCC's science working group. The latter effort was recognized with the 2007 Nobel Peace Prize that was shared by the IPCC and former U.S. Vice President Albert Gore, Jr.

Researchers Improve Air Pollution Dispersion Model for NOAA Forecasters

Researchers at NOAA's ARL completed enhancements to the operational transport

and dispersion model (hybrid single-particle Lagrangian integrated trajectory [HySPLIT]) to allow for long-range dispersion beyond four days and for generating additional output graphical formats, such as that used by Google Earth. These new capabilities greatly enhance and support NOAA's atmospheric dispersion forecasting capability. HySPLIT detects hazardous atmospheric releases (such as from explosive volcanic eruptions and radiological releases) and also provides fire smoke forecasts. HySPLIT is run operationally by NOAA's National Centers for Environmental Prediction as needed. Volcanic ash and radiological forecasts are provided under the auspices of the International Civil Aviation Organization, the World Meteorological Organization, and NOAA's Regional Specialized Meteorological Center for Environmental Emergency Response. For the radiological application, long-range forecasts now will be used to help answer when and where radioactivity from an overseas incident will reach the United States and allows backtracking capabilities for estimations of source areas when the source is unknown.

ESRL Implements Soil Moisture Observational Network

ESRL implemented a Soil Moisture Observational Network across southern Arizona's San Pedro River Basin, measuring soil moisture and temperature, and basic meteorological parameters at the surface (pressure, temperature, humidity, and rainfall). ESRL, working with the National Weather Service, aims to improve flash flood forecasting and better understand how soil information (i.e., moisture, texture, and temperature) can be included in hydrologic models. Southern Arizona's San Pedro River recharges groundwater storage and provides water for human and agricultural needs. However, during the North American monsoon season (July–September), heavy precipitation events can cause severe flooding in the San Pedro basin. Arizona's dry climate and a rapidly growing population increase the risk of impacts from both flash floods and drought. Accurate soil information is needed to support flash flood forecasts and warnings and can be useful in water resource management studies.



Commissioned on August 13, 2008, NOAA Ship Okeanos Explorer will use telepresence technology to transmit live images and data from the seafloor to scientists ashore.

Aviation Weather Tools Enhance Flight Safety and Efficiency

Aviation technology developed by the ESRL was successfully transferred to Raytheon for integration into NOAA's Advanced Weather Information Processing System (AWIPS). The new forecasting tool provides aviation-specific enhancements regarding icing, turbulence, convection, ceiling, and visibility. For the first time, NOAA forecasters can use the AWIPS Remote Display to view aviation weather products and map backgrounds for use in their aviation forecasting and briefings to the Federal Aviation Administration's Traffic Management Units. This sophisticated technology, which gives visual references to affected airspace, allows air traffic controllers and managers and aviation dispatchers to make informed decisions about how to route planes from the path of severe weather events and volcanic ash plumes. The focus of this technology is to increase flight efficiency and safety and minimize delays. These tools are now being demonstrated in Alaska, Texas, and Northern Virginia. An economic study found that integrated terminal weather system services provide economic benefits of \$176 million per year as a result of improved air traffic decision making.

Hawaii Sea Grant Beach Restoration Project Wins National Award

The American Shore and Beach Preservation Association awarded Kuhio Beach in Waikiki a 2008 Best Restored Beaches Award. Spearheaded by Hawaii Sea Grant,

The Manta unmanned aircraft flew a series of flights to observe glacier ice melt, a key but poorly understood parameter that could contribute to a collapse of the Greenland ice sheet and, hence, significantly raise sea level.

Photo: John Adler, NOAA Corps

the pilot project restored the beach by dredging 10,000 cubic yards of sand that had eroded 2,000 feet offshore instead of the old method of trucking sand in from elsewhere. The sand enlarged three sites on Kuhio Beach by as much as 40 feet and raised the areas up to four feet vertically, keeping the beach dry in areas previously inundated with water. In addition, the \$475,000 project cut in half the cost of the old method. An added benefit in the long run is that the project should facilitate coral reef ecosystem restoration in nearshore areas previously smothered by eroded sand.

Restoring Kuhio Beach in Waikiki, world-renowned for its expanse of white sand and turquoise water, served as a unique opportunity to demonstrate the value and effectiveness of "recycling" eroded sand as well as restoring a high-value recreational beach for both local residents and tourists. The restoration project is a successful demonstration of the local technical capability, cost-effectiveness, and environmental soundness of using offshore sediment for local beach restoration.

ESRL Sponsors Unmanned Aircraft System Flights Over Greenland

ESRL and the Cooperative Institute for Research in Environmental Sciences sponsored a three-week unmanned aircraft systems mission over Greenland titled "Arctic MUSCOX." The Manta unmanned aircraft flew a series of flights to observe glacier ice melt, a key but poorly understood parameter that could contribute to a collapse of the Greenland ice sheet and, hence, signifi-

cantly raise sea level. Using the Manta, scientists increased the area and frequency of observation and collected data from remote areas difficult to monitor. The Manta, whose gross maximum weight is 60 pounds, can carry a 15-pound payload and fly up to 16,000 feet in altitude for as long as six hours. For this particular mission, the aircraft flew as low as 500 feet over unfamiliar terrain to monitor the melt-off. This mission helped develop a new methodology for frequently monitoring a broader area of ice-melt ponds than is feasible with manned aircraft in an inherently dangerous and remote area.

New NOAA Ship Will Change How We Explore the Ocean

NOAA ship *Okeanos Explorer*, "America's Ship for Ocean Exploration," was commissioned on August 13, 2008, setting it on a course as the only U.S. ship assigned to systematically explore our largely unknown ocean for the purpose of discovery and the advancement of knowledge. Unlike many other NOAA ocean expeditions, most of the scientists will remain ashore. Via telepresence, live images from the seafloor and other science data will flow over satellite and high-speed Internet pathways to scientists standing watches in any of five land-based Exploration Command Centers. Those scientists, and others on call if a discovery is made at sea, will add their expertise to missions no matter where in the world the ship is located. The ship will also stream seafloor images and interviews from sea over standard Internet connections to bring the excitement of ocean exploration and discoveries live into



classrooms, newsrooms, and living rooms, helping to raise ocean literacy among stakeholders and increasing their ability to make informed decisions about important ocean issues.

NOAA Completes Climate Reference Network in Continental United States

Researchers at NOAA's ARL finished installing the 114 stations comprising the U.S. Climate Reference Network (CRN) that will track national average changes in temperature and precipitation trends with exceptional precision and accuracy. The CRN will help pinpoint the shifts in America's changing, often unpredictable, climate. The placement of each CRN station is crucial to obtain accurate information on current and likely future climatic conditions. All stations are constructed in rural environments, away from urban areas that could confound the interpretation of any precipitation and/or temperature trends observed. Each CRN station logs real-time measurements of surface temperature, precipitation, wind speed, and solar radiation. NOAA's geostationary satellites relay the data from these ground-based stations to the National Climatic Data Center, which posts the observations online. As a result of installing the additional stations, NOAA exceeded its goal of improving the percentage of explained variance for temperature

and precipitation, improving scientists' ability to understand and predict trends and variation in climate.

Agreement with Department of Energy Enhances NOAA Climate Modeling

As part of a memorandum of understanding between NOAA and the U.S. Department of Energy's (DOE's) Office of Science, DOE is making available more than 10 million hours of computing time for NOAA to explore advanced climate change models at three of DOE's national laboratories. Advanced, high-resolution climate models from NOAA's Geophysical Fluid Dynamics Laboratory (GFDL) will be prototyped and compared to other models, like the Community Climate System Model sponsored by the National Science Foundation and DOE.

NOAA will work with DOE's technical staff and apply advanced, computationally expensive climate models prototyped on DOE systems to address crucial climate change problems, such as drought, water resources, and a rapidly changing Arctic. The high-resolution simulations will provide a better understanding of the impact of cloud feedbacks on the sensitivity of climate to increased greenhouse gases and improve understanding of future trends in high-impact weather events.

Prototypes of advanced, high-resolution climate GFDL models run on DOE supercomputers will improve understanding of the impact of climate change on tropical cyclone activity by integrating NOAA's tropical cyclone research into NOAA's global climate modeling efforts. The collaboration should also reduce uncertainty in climate predictions and offer unprecedented regional fidelity beyond today's highly parameterized climate simulations by explicitly resolving deep convective clouds, tropical cyclones, and extreme weather events.

NSSL Mobile Dual-Polarized Doppler Radar Captures Hurricane Ike

The first dual-polarized Doppler radar data of a landfalling hurricane eyewall were collected as Hurricane Ike came ashore in Texas in September 2008. The data were collected by a new mobile dual-polarized X-band radar (called NO-XP) built and operated by NOAA's National Severe Storms Laboratory and the University of Oklahoma. NO-XP was on the edge of the western portion of the eyewall, and the maximum wind gust at this location was 85 miles per hour.

Radars with dual-polarization capabilities—radio waves that are sent out both horizontally and vertically—can more

PRODUCTS AND SERVICES

Environmental Observation and Monitoring Networks

To learn more about Earth's atmosphere and oceans, OAR scientists monitor ozone, record solar radiation, collect air samples from all over the world to measure greenhouse gases and observe the oceans. Much of these data are collected through international partnerships. The measurements have allowed NOAA scientists to answer important questions regarding the variability of oceanic and atmospheric chemistry. In addition, long-term observations of physical, chemical, and biological parameters are used to monitor the status and trends of environmental conditions and provide a baseline for assessing future changes.

Interagency Field Experiments

OAR scientists lead field experiments (often with government, academic, and private-sector partners) focused on the

study of environmental phenomena. Fieldwork improves our ability to understand and predict the Earth's climate and atmosphere by investigating important phenomena where they occur. Major efforts focus on exploring the links between oceans and atmosphere in the eastern tropical Pacific; analyzing natural and anthropogenic climate change by aerosols; and tracking intercontinental movements of pollutants that result from human activity, such as the increased concentrations of ozone particles, fine particles, and other chemically active "greenhouse" compounds.

Global Models

OAR models of the atmosphere, ocean, and climate are becoming increasingly accurate and comprehensive in terms of predictive capabilities. Future models enabled by necessary advances in computing will enhance NOAA's ability to simulate regional climate change, as well as changes in climate extremes. Efforts will continue toward developing Earth system models. More sophisticated prediction capabili-

ties provide leaders in government and industry with better scientific information for decision making.

Scientific Assessments

OAR plays a leading role in periodically assessing the state of scientific understanding on many environmental issues facing government and industry decision makers, including climate change, air and water quality, and stratospheric ozone depletion.

Outreach and Extension

Important discoveries are made every day by scientists sponsored by NOAA or working at one of NOAA's laboratories. These discoveries solve problems, answer questions, and can save lives. It is science that offers real-world solutions. Through outreach efforts, such as those of the National Sea Grant College Program, this research is translated into usable information and products for a variety of audiences. These efforts ensure science is delivered to those who need it in ways they can use the information.

accurately determine precipitation types and amounts. NO-XP, which was built to study precipitation processes as well as severe weather, became operational in April 2008. Research data provided by NO-XP will help improve the quality and accuracy of forecasts and warnings of hazardous weather.

Pacific Marine Environmental Laboratory Director Awarded Prestigious Service to America Medal

On September 16, Dr. Eddie Bernard, Director of the Pacific Marine Environmental Laboratory in Seattle, Washington, became the first NOAA scientist to be awarded a Service to America Medal. Dr. Bernard received the Homeland Security medal for creating a tsunami detection system that has dramatically increased warning times and decreased the risk of a catastrophic loss of life. For the millions of Americans who live, work, and tour our treasured coastlines (approximately 53 percent of the U.S. population), his efforts have made their lives and communities safer from tsunami hazards.

Service to America Medals have been presented annually since 2002 by the nonprofit, nonpartisan Partnership for Public Service, to celebrate excellence in our federal civil service. More than 3,000 public servants have been nominated for the award since its inception. Dr. Bernard and Dr. Alexander E. “Sandy” MacDonald, Deputy Assistant Administrator of Oceanic and Atmospheric Research, were both finalists in this year’s competition. NOAA’s only other previous finalist was former National Hurricane Center Director Max Mayfield.

FUTURE OUTLOOK

Changing demographics will increase demand for scarce resources and place more people in the path of natural hazards. The changing climate will affect economic prosperity, human and environmental health, and national security. NOAA Research is unlocking the mysteries of variability in our oceans and atmosphere in support of NOAA’s efforts to provide effective environmental service and stewardship to the nation. NOAA Research will play an important role in answering the critical questions of our time.

Our ocean is changing. We are studying ocean warming, sea level rise, ocean chemistry, and fluctuations in ocean currents.



As Hurricane Ike came ashore in September 2008 in Texas, the first dual-polarized Doppler radar data of a landfalling hurricane eyewall were collected by the NO-XP, a new mobile dual-polarized X-band radar. Photo: NOAA National Severe Storms Laboratory

We are helping to make energy production more efficient, reliable, and environmentally friendly, including alternative energies. And we are developing tools to track and depict the creation, movement, and removal of carbon in the atmosphere.

We are consulting with decision makers and providing guidance on mitigating and adapting to climate change. Our next focus on climate change includes shrinking the probabilities of error in climate models and developing regional climate models to aid decision makers at state and county levels.

We continue to place a strong research focus on hazardous weather forecasting to reduce human lives lost and minimize financial burdens. New radar technologies and techniques will give us earlier indications of severe weather. As computing capacities grow and numerical modeling techniques mature, we will develop improved local models to enable forecasters to issue warnings even earlier, giving people in harm’s way extra minutes to find shelter from severe storms.

As we perfect our use of unmanned aircraft systems for Arctic ice surveys and marine mammal surveys, we are also beginning to gather better observations around hurricanes where conditions are too dangerous for piloted aircraft. We are partnering with many federal, intergovernmental, academic, and private-sector collaborators

to make more gains in hurricane landfall and intensity prediction accuracy.

We are also focused on an element that looms large in the coming century and is vital to our expanding population: water quality and water availability. Our research will focus on coastal water quality, ecosystems management, and further developing the components of the National Integrated Drought Information System.

We are using new ocean-observing tools and live undersea telecommunications to bring scientists and students virtually aboard the world’s only dedicated ocean exploration vessel as discoveries are happening.

NOAA Research balances near-term responsibilities to enhance the operational and regulatory roles of NOAA and our stakeholders with a long-term commitment to conduct transformational, discovery-based research. This dual responsibility requires transfer of research to operations, as well as continued exploration and discovery in new areas to expand the boundaries of our understanding of the Earth system, and lays the foundation for the NOAA services of the future.

A well-planned and focused research effort that enlists workforce creativity will enable NOAA’s near-term goals to be achieved, and will position the nation and society to make informed decisions in the decades to follow.



Mary E. Kicza
Assistant Administrator

National Environmental Satellite, Data, and Information Service

The Nation's Eye on the Environment

The National Environmental Satellite, Data, and Information Service (NESDIS) operates the nation's civil operational environmental satellite system, making constant observations of Earth and its oceans and atmosphere. Satellite observations are collected, processed, and used to develop weather, climate, and other environmental products, services, and long-term recorded observations that benefit all people and sectors of society.

NOAA's satellites include Geostationary Operational Environmental Satellites (GOES) and Polar-orbiting Operational Environmental Satellites (POES). Together these two systems provide the U.S. space-based component of an operational global environmental monitoring system. On behalf of the U.S. Department of Defense, NESDIS also operates the Defense Meteorological Satellite Program spacecraft, part of the military's sixth generation of weather satellites. Additionally, on behalf of the U.S. Department of Commerce, NESDIS licenses the operation of commercial remote-sensing space systems.

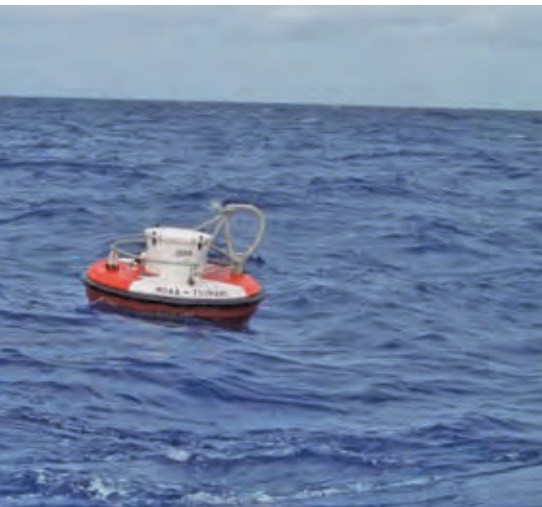
NESDIS also provides long-term stewardship of environmental data, managing the world's largest collection of atmospheric, geophysical, and oceanographic data derived from both *in situ* and space-based systems. Environmental data directly impact the national economy; for example, weather forecasts affect the tourism industry; solar weather information influences decisions on energy distribution; and climate research informs natural resource managers and the public. These data are also used to monitor global food supplies, and they play a key role in mitigating the impacts of natural disasters on people, property, and the economy. NESDIS serves a broad spectrum of users, from meteorologists to climate scientists to coastal resource managers.

ACCOMPLISHMENTS

Jason-2 Launched from Vandenberg Air Force Base

On June 20, 2008, the Ocean Surface Topography Mission (OSTM)/Jason-2 spacecraft was launched from the Vandenberg Air Force Base (VAFB). OSTM/Jason-2 is an international effort between NOAA, the National Aeronautics and Space Administration, France's Centre National d'Etudes Spatiales (CNES), and the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT).

The OSTM/Jason-2 satellite will monitor the rate of change in sea level and help measure ocean conditions that contribute to the strength of hurricanes. NOAA will use data from the OSTM/Jason-2 to extend a 15-year record from its predecessor missions TOPEX/Poseidon and Jason-1. The data show that sea level is rising at a rate of 3.4 millimeters per year—nearly twice as fast as during the previous 100 years. If this rate of rise continues, it will impact coastal regions, causing more erosion and flooding.



NOAA Deep-ocean Assessment and Reporting of Tsunamis (DART®) buoy at sea.

OSTM/Jason-2 will also be used to help scientists predict short-term, severe weather events, such as hurricanes and tropical storms, which are fueled by heat energy stored in the upper layer of the ocean. For example, Katrina grew explosively to a Category 5 hurricane as it crossed over an area of anomalously high heat energy in the Gulf of Mexico, visible to the Jason-1 altimeter as an area of high sea surface elevation. NOAA scientists have shown that hurricane intensity predictions can be improved by as much as 96 hours into the future using altimeter observations to identify these regions.

NOAA is working with CNES to provide ground system support for OSTM/Jason-2. This function includes commanding all the satellite's maneuvers, downloading all the satellite's data, and distributing it to weather and climate forecasters, who are monitoring ocean-born storms and phenomena, such as El Niño/La Niña and global sea level rise. NOAA's National Oceanographic Data Center, using the Comprehensive Large Array-data Stewardship System, provides long-term archive and data stewardship for the mission. OSTM/Jason-2 is the first international satellite to receive ground support at the new NOAA Satellite Operations Facility in Suitland, Maryland.

Climate Sensors Restored on Next-Generation Environmental Satellites

In FY 2008, the National Polar-orbiting Operational Environmental Satellite System (NPOESS) Tri-Agency Executive Committee completed several key tasks to remanifest three key climate sensors, one on the NPOESS Preparatory Project (NPP) satellite and two on the first NPOESS satellite. NOAA requested funds in the FY 2009 President's Budget to complete this effort. The measurements provided by these sensors will help scientists to better under-



On June 20, 2008, the Ocean Surface Topography Mission (OSTM)/Jason-2 spacecraft was launched from the Vandenberg Air Force Base. The OSTM/Jason-2 satellite will monitor the rate of change in sea level and help measure ocean conditions that contribute to the strength of hurricanes.



A joint NOAA and the National Aeronautics and Space Administration project will design and develop the Geostationary Lightning Mapper, which will detect lightning flashes occurring in the Western Hemisphere (including multiple cloud-to-ground and cloud-to-cloud lightning strokes shown here), and lightning patterns that are early indicators of severe thunderstorms and tornadoes.

stand the natural and human causes of climate change.

The Clouds and Earth Radiant Energy System (CERES) and Ozone Mapping and Profiler Suite (OMPS) instruments will be flown on NPP, the precursor mission for NPOESS. CERES measurements will shed light on how clouds influence the Earth's energy balance and the role they play in regulating climate. The OMPS sensor suite will protect the public by monitoring the depletion of ozone in the stratosphere, which can result in a number of negative health effects, including an increase in skin cancer. The OMPS successfully completed environmental testing in August and is preparing for shipment to be integrated with the NPP satellite. A second CERES instrument and the Total Solar Irradiance Sensor (TSIS), a sensor critical to monitoring global climate, will fly on the first NPOESS spacecraft. TSIS will measure the total amount of solar energy coming into the Earth's atmosphere, a fundamental element in understanding climate change.

GEONETCast Americas is part of a global effort of the intergovernmental Group on Earth Observations to collect and distribute Earth observational data to a variety of users, including government agencies, decision makers, academia, and the public.

Lightning Instrument Contract Awarded for Next Generation Geostationary Satellites

In December 2007, NOAA and the National Aeronautics and Space Administration selected Lockheed Martin Space Systems Company for a \$96.7 million (including options) contract to design and develop a new instrument, the Geostationary Lightning Mapper (GLM), for the next generation of geostationary satellites, called GOES-R series.

The GLM instrument will detect all lightning flashes, including cloud-to-ground, cloud-to-ocean, and in-cloud lightning, occurring anytime and anywhere in the Western Hemisphere, and will detect patterns in lightning flashes that are early indicators of severe thunderstorms and tornadoes. Lightning is the second-highest storm-related killer in the United States and causes \$4–\$5 billion in economic losses each year. For example, route changes

due to lightening cost about \$2 billion annually in airline operating expenses and passenger delays. Lightening also is a frequent cause of wildfires. Today's ground-based national lightning detection networks are designed to locate mostly cloud-to-ground lightning—a small fraction of the total lightning.

NOAA GEONETCast Americas Effort Moves Forward

GEONETCast Americas is part of a global effort of the intergovernmental Group on Earth Observations to collect and distribute Earth observational data to a variety of users, including government agencies, decision makers, academia, and the public. Once this system is fully operational, it will provide continuous environmental data distribution for much of North, Central, and South America and the Caribbean. This low-cost information delivery system will improve public access to satellite and *in situ* data, products, and services through the use of communications satellites. With a 24/7 data stream, GEONETCast Americas will provide information critical to efforts, such as disaster mitigation, high-impact weather forecasting, agriculture management, and professional training.

NOAA has been instrumental in facilitating agreement among and contributions from GEONETCast's many international partners. In FY 2008, NOAA awarded the GEONETCast Americas commercial services contract to Intelsat General Corporation (IGEN). The contract with IGEN will provide continuous environmental data distribution for much of North, Central, and South America and the Caribbean for one year, using digital video broadcast-satellite technology. NESDIS staff will configure and manage this system remotely from the NOAA Satellite Operations Facility in Suitland, Maryland.

Annual State of the Climate Report Published

The *State of the Climate in 2007* report, published as a supplement to the *Bulletin*



of the American Meteorological Society, provides a summary of global climate conditions for the year. This 170-page report was spearheaded by NOAA's National Climatic Data Center scientists, who teamed with over 200 scientists from more than 50 countries. The report, which contains extensive climate information about 2007, highlights last year's tropical cyclones of record intensity and extreme weather and climate conditions that impacted each continent.

For the first time since these annual reports have been published, scientists explored the specific causes for observed climate conditions. For example, they determined greenhouse gases were a likely factor in the record-warm global land surface temperature in 2007. They also found El Niño's warm sea-surface temperatures in the Pacific most likely were not responsible for the drought conditions that plagued the southern United States.

Some major highlights from the 2007 report include:

- The global land and ocean combined surface temperature for 2007 fell within the ten highest on record, while the average land surface temperature was the warmest since global records began in 1880.
- The globally averaged concentration of carbon dioxide continued to increase in 2007, rising to 382.7 parts per million, based on preliminary measurements at NOAA's Mauna Loa Observatory in Hawaii.
- The global mean sea level in 2007 was 1.1 millimeters higher than in 2006, which is less than the 15-year increasing trend of 3.4 millimeters per year.
- 2007 was the warmest year on record for the Arctic, continuing a general, Arctic-wide warming trend that began in the mid-1960s.
- End-of-summer Arctic sea ice extent reached a new record low, 23 percent below the previous record low set in 2005.
- 2007 was the warmest year on record in Russia, with a mean annual air temperature of 2.0°C (3.6°F) above normal (meteorological observations in Russia date back to 1891). China also experienced record warmth in 2007, and Japan had near-record warmth.

NOAA's Comprehensive Environmental Data Storage System Advances

NOAA's Comprehensive Large Array-data Stewardship System (CLASS) is an online data management system that provides long-term, secure storage of and archives environmental data. In addition, the information technology (IT) features of CLASS provide weather forecasters with quick access to NOAA's archived data, allowing them to compare current and previous storms. CLASS features also enable access to data that will help researchers track climate trends.

CLASS has served more than 35,000 users and has delivered more than 25 million files since 2001. Users can search through and order 43 types of atmospheric, coastal, and ocean data products. In FY 2008, CLASS increased its volume of data by approximately 33 percent, from 615 terabytes (TB) to 817 TB.

To continue this data stewardship effort, NOAA awarded a new CLASS contract in FY 2008 to the Diversified Global Partners Joint Venture, LLC. This organization will provide IT services for the planning, development, and maintenance of CLASS for several years.

In addition, NOAA's National Climatic Data Center and National Geophysical Data Center are expanding CLASS to receive data regularly from NOAA's polar-orbiting and geostationary satellites and the Defense Meteorological Satellite Program. In the future, CLASS will archive data from NOAA's ground-based observing systems, including data buoys and the Next-Generation Weather Radar (NEXRAD).

Climate Change Science Program Synthesis and Assessment Product 3.3 Released

In June 2008, the U.S. Climate Change Science Program and the Subcommittee on Global Change Research released *Weather and Climate Extremes in a Changing Climate*. NOAA staff played a key role in producing this scientific assessment, which provided the first comprehensive analysis of observed and projected changes in weather and climate extremes in North America and U.S. territories.

The report is based on scientific evidence that a warming world will be accompanied by changes in the intensity, duration, fre-



The June 2008 Weather and Climate Extremes in a Changing Climate report projects that sea ice extent is expected to continue to decrease, and may even disappear in the Arctic Ocean during the summer in coming decades.

quency, and geographic extent of weather and climate extremes. According to the report, global warming over the past 50 years is due primarily to human-induced increases in atmospheric concentrations of heat-trapping gases. Many types of extreme weather and climate event changes have been observed during this period, and continued changes are projected for this century. As human activities continue to increase heat-trapping gases, droughts, heavy downpours, excessive heat, and intense hurricanes are likely to become more commonplace. Specific future projections include:

- Abnormally hot days and nights, along with heat waves, are very likely to become more common. Cold nights are very likely to become less common.
- Sea ice extent is expected to continue to decrease. Sea ice may even disappear in the Arctic Ocean during the summer in coming decades.
- Precipitation, on average, is likely to be less frequent but more intense.
- Droughts are likely to become more frequent and severe in some regions.
- Hurricanes will likely have increased precipitation and wind.
- The strongest cold-season storms in the Atlantic and Pacific are likely to produce stronger winds and higher extreme wave heights.

NOAA Completes Installation of New Tools to Accurately Measure Climate Change

NOAA developed the U.S. Climate Reference Network (CRN) to provide future long-term homogeneous observations of temperature and precipitation that can be coupled to long-term historical observations for the detection and attribution of present and future climate change. In 2008, NOAA installed the last nine of the 114 CRN stations as part of this new, high-technology climate monitoring network.

The CRN is helping to pinpoint the shifts in America's changing, often unpredictable, climate. Each CRN station is crucial to obtaining accurate information on current—and likely future—conditions. Each station logs real-time measurements of surface temperature, precipitation, wind speed, and solar radiation across the nation. NOAA's geostationary satellites relay the data from these ground-based stations to NOAA's National Climatic Data Center, which posts the observations online.

NGDC Named Primary Steward for Extended Continental Shelf Data Management

As a result of recommendations from the Extended Continental Shelf (ECS) Task Force, NOAA's National Geophysical Data Center (NGDC) was named the primary steward for data, information, and analysis in support of a U.S. ECS claim. Under the United Nations Convention on the Law of the Sea (UNCLOS), countries are entitled to an Exclusive Economic Zone (EEZ) extending 200 nautical miles from the coastline, and they may also exercise sovereign rights over the physical continental shelf in areas beyond the EEZ. As many as 80 countries may expand their EEZs under Article 76 of UNCLOS, based on a complex set of criteria that define the water depth, including the 2,500-meter isobath, seafloor geology, sediment thickness, and distance from the coastline.

To take advantage of this opportunity, the United States initiated a program to confirm its exclusive sovereign rights over its

continental shelf and to manage the natural resources on and under that area of at least one million square kilometers. The value of the natural resources within the U.S. ECS is estimated to be at least \$1 trillion.

In this stewardship capacity, NGDC will establish and maintain a central database and metadata repository for ECS data, lead construction and maintenance of the ECS data management system, and help to develop systems to preserve critical ECS analyses and decisions. The use of legacy data is critical, as the estimated cost of collecting all new multichannel seismic data at a density required for defining the ECS exceeds \$34–37 million. Some new seismic data will need to be collected, but NGDC will review and use existing geophysical data when possible.

COSPAS-SARSAT System Saves 308 Lives

NOAA's polar-orbiting and geostationary satellites, along with Russia's COSPAS

PLATFORMS, PRODUCTS, AND SERVICES

Geostationary Operational Environmental Satellites (GOES)

NESDIS operates a system of GOES that continuously collect meteorological and space environment data that help to protect life and property across the United States. Two GOES spacecraft are operational at all times: one satellite (located at 75° West longitude) covers the eastern United States and most of the Atlantic Ocean, and the other satellite (located at 137° West) covers the western United States and Pacific Ocean basin. An on-orbit spare satellite (located at 105° West) is maintained to permit rapid recovery from a failure of either of the operational satellites. GOES products and services include:

- continuous monitoring necessary for intensive data analysis of Earth's weather and space weather events;
- critical atmospheric, oceanic, climatic, and space weather products supporting weather nowcasting (e.g., watches and warnings) and long-range forecasting, climatologic analysis and prediction, ecosystems management, and safe and efficient public and private transportation; and
- images of the entire United States every 15 minutes, with the capability of

imaging as frequently as every minute to monitor the development of severe weather.

The National Weather Service uses GOES temperature and water vapor data in powerful numerical prediction models to produce local weather forecasts and warnings for severe weather events. Daily weather reports regularly bring GOES images into homes across America and around the world.

GOES-N Series

The new spacecraft of GOES-N through P will be used to continue and to enhance the environmental monitoring and communications functions of the previous GOES-I through M (GOES-8 through 12) series of NOAA operational spacecraft. The multi-mission GOES-N series will be a vital contributor to weather, solar, and space operations and science; will aid activities ranging from severe storm warnings to resource management and advances in science; and will provide data that add to the global community of knowledge, embracing many civil and government environmental forecasting organizations that work to benefit people everywhere and help save lives. A highly advanced altitude control system fosters enhanced instrument performance for improved weather service quality. GOES-N was launched on May 24, 2006. GOES-O is scheduled to launch in

February 2009, with GOES-P following in the April 2010 time frame.

GOES-R Series

The next generation of geostationary satellites after the GOES-N series is the GOES-R series. Scheduled to launch in FY 2015, GOES-R will offer improved spacecraft and instrument technologies over the GOES-N series, will maintain geostationary satellite data continuity into the future, and will provide new and improved atmospheric, oceanic, climatic, solar, and space data. GOES-R will scan Earth nearly five times faster than the current GOES, providing television meteorologists, private weather companies, the aviation and agriculture communities, and national and international government agencies with about one hundred times the amount of data currently provided. GOES-R sensor and system advancements will result in more timely and accurate weather forecasts, and will improve support for the detection and observation of meteorological phenomena that directly affect public safety, property, and, ultimately, economic health and development.

Polar-orbiting Operational Environmental Satellites (POES)

The NESDIS POES provide an uninterrupted flow of critical global information used in global numerical weather models. Continuous global temperature and humidity values from the POES system

spacecraft, are part of the international Search and Rescue Satellite-Aided Tracking System, called COSPAS-SARSAT. This high-tech system uses a network of satellites to quickly detect and locate distress signals from emergency beacons on board aircraft and boats and from hand-held personal locator beacons. In 2007, a record 353 people were rescued in 130 incidents from potentially life-threatening emergencies, thanks to COSPAS-SARSAT in the United States. In FY 2008, this system aided in the rescue of 308 people in the United States. Now in its 26th year of operation, COSPAS-SARSAT has been credited with more than 22,000 rescues worldwide, including more than 5,800 in the United States and its surrounding waters.

NODC Creates Online Tools for Displaying and Analyzing Environmental Data

NOAA's National Oceanographic Data Center (NODC) has created innovative tools for analyzing and visualizing complex ocean and ecosystem data and informa-

Workers secure the fairing around the Ocean Surface Topography Mission (OSTM)/Jason-2 spacecraft to complete encapsulation.

tion, dramatically increasing the usefulness of several online applications. These new tools enable nonscientific audiences to use ocean data, improving the public's understanding of oceans, weather, and climate. For example:

- NODC's Coastal Water Temperature Guide Web site now has an interactive Google Maps™ application, allowing beachgoers and other users to browse water observations on a map interface, and a subscription service that notifies users automatically of changing temperatures.
- The new Regional Ecosystem Data Management portals integrate disparate (physical, biological, economic, etc.) data sets and increase access to observatory system data from NOAA and



are used to create quality three- to five-day and long-range temperature, precipitation, and snow forecasts. These satellites also monitor global sea-surface temperature, indicating as early as possible the location, onset, and severity of events, such as El Niño. Earlier warnings of these impending events allow emergency and agricultural managers to activate plans to reduce the impacts of floods, landslides, and droughts.

POES also support a data collection system (DCS) called Argos, which is a joint U.S., France, and EUMETSAT mission. The Argos DCS is used for transmitting weather and oceanographic information from buoys and ships, as well as for wildlife tracking and other experimental activities.

National Polar-orbiting Operational Environmental Satellite System (NPOESS)

The U.S. government has traditionally maintained two polar weather satellite systems, one for civil purposes and one for military purposes. In 1994, a Presidential Decision Directive created NPOESS to merge these programs. NPOESS provides a single, improved national system capable of satisfying both civil and national security requirements for real-time, space-based, remotely sensed environmental data. NOAA also receives data from and share data with its European partner, the

European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT), which launched the Metop-A satellite in October 2006.

Advanced NPOESS sensors deliver higher-resolution atmospheric, oceanic, and terrestrial data, enabling more accurate short-term weather forecasts and severe storm warnings. NPOESS also provides improved information about the space environment for reliable operations of space- and ground-based systems, and will continue to provide surface data collection and search-and-rescue capabilities.

Office of Satellite Operations (OSO)

OSO manages and directs the operation of NOAA's satellites and the acquisition of remotely sensed data. OSO has operational responsibility for the Satellite Operations Control Center in Suitland, Maryland, and the Command and Data Acquisition facilities in Wallops, Virginia, and Fairbanks, Alaska, to command and control the satellites, to track the satellites, and to acquire their data.

OSO supports the launch, activation, and evaluation of new satellites and the in-depth assessment of satellite and ground system anomalies. It prepares plans and procedures for responding to such anomalies, and establishes and coordinates the schedules for satellite operation and data

acquisition to meet users' needs. OSO also evaluates the technical performance of the satellites, and maintains current information and future predictions on satellite orbits and attitudes. It evaluates the effectiveness of the operational facilities and procedures in terms of the quality, quantity, coverage, and timeliness of the data acquired.

Office of Satellite Data Processing and Distribution (OSDPD)

OSDPD manages and directs the operation of the central ground facilities, which ingest, process, and distribute environmental satellite data and derived products to domestic and foreign users, and serves as the primary operating-level interface with the civil sector users of data from operating Earth satellites. OSDPD also manages the Search and Rescue Satellite Aided Tracking (SARSAT) system, and is responsible for coordinating and implementing U.S. activities in the international satellite-aided search-and-rescue program, COSPAS-SARSAT. The office evaluates the effectiveness of the operational ground facilities and procedures in terms of the quality and quantity, assesses the timeliness of the products and services provided, maintains an inventory of operational products and services, and prepares assessments, recommendations, and plans for the initiation of new products and services.

Center for Satellite Applications and Research (STAR)

Located in Camp Springs, Maryland, STAR is the science arm of NESDIS. Its mission is to create satellite-based observations of the land, atmosphere, and ocean, and transfer them from scientific research and development into routine operations. In addition, STAR offers state-of-the-art data, products, and services to decision makers. STAR is a leader in planning future satellite-observing systems to enhance the nation's ability to remotely monitor the environment. STAR also calibrates the Earth-observing instruments of all NOAA satellites to provide reliable measurements for assessing the current conditions on Earth in a timely manner, predicting changes in conditions, and studying long-term trends in the environment.

Environmental Data and Information Services

NESDIS operates three NOAA data centers: the National Climatic Data Center, the National Geophysical Data Center, and the National Oceanographic Data Center. The NOAA data centers provide global environmental data and information products and services in the atmospheric, marine, solid earth, and solar-terrestrial sciences to meet the needs of users in commerce, industry, agriculture, science, and engineering; the general public; and federal, state, and local agencies. Environmental data and information maintained by NOAA are vital to practically every economic sector and are used in making decisions critical to national defense; industrial productivity; energy development and distribution; world food supplies; public health, safety, and welfare; and the development of natural resources. Environmental scientists and observers also have a critical need for historical and recent global data to assess long-term environmental trends, evaluate the current state of the environment, and predict future environmental conditions and events. The usefulness of NOAA data archives makes the NOAA data centers resources a national treasure.

National Climatic Data Center (NCDC)

Located in Asheville, North Carolina, NOAA's NCDC archives billions of meteorological observations, making it the largest climate data center in the world. NCDC receives, processes, archives, and disseminates surface, marine, upper-air, radar, satellite, and model output data. NCDC serves a large and diverse community, responding to more than one million requests per year. It makes environmental data and information available through both the Internet and physical delivery of products and services.

NCDC's climate data products support decision making in many sectors of the economy, including energy, transportation, agriculture, insurance, engineering, health care, and manufacturing.

NCDC also develops climatic applications for other government agencies, including the National Aeronautics and Space Administration, the U.S. Environmental Protection Agency, and the U.S. Departments of Defense and Energy. In addition, NCDC scientists are key participants in numerous national and international climate assessments, including the Intergovernmental Panel on Climate Change reports, the U.S. Climate Change Science Program's Synthesis and Assessment Products, and the U.S. State of the Climate reports. Through its participation in these assessments and dialog with users in workshops and Webinars, NCDC actively identifies the needs of NOAA data users in addressing climate change.

National Geophysical Data Center (NGDC)

Located in Boulder, Colorado, NOAA's NGDC provides scientific stewardship, products, and services for geophysical data describing the solid earth, marine, and solar-terrestrial environments, as well as Earth observations from space. NGDC's data holdings contain more than 400 digital and analog databases. Digital databases at NGDC include more than 20 million data records. As technology advances, so does the search for more efficient ways of preserving these data. NGDC works closely with contributors of scientific data to prepare documented, reliable data sets, and continually develops data management programs that reflect the changing world of geophysics. Recent examples of NGDC's work include the creation of digital elevation models of U.S. coastal communities for prediction of potential tsunami impacts, estimation of global emissions of natural gas associated with petroleum production, and support of a future submission for extended continental shelf boundaries under the United Nations Convention on the Law of the Sea.

National Oceanographic Data Center (NODC)

Located in Silver Spring, Maryland, NOAA's NODC maintains the largest collection of publicly available oceanographic data and information in the world, including hundreds of millions of records gathered from ocean observation programs conducted over the past 150 years. These data document the physical, chemical, and biological properties of the oceans, currents,

weather, and biota, as observed from ships, buoys, and satellites. NODC provides access to these data to more than 270,000 users each year, including ocean researchers within NOAA, other agencies, academia, environmental program managers, educators, maritime industries, and foreign communities. Examples of these products and special-topic data sets include the World Ocean Database, the Global Argo Data Repository, the Coral Reef Information System, and the Global Ocean Data Assimilation Experiment High-Resolution Sea-Surface Temperature Project.

NODC also operates the NOAA Library and Information System, which consists of the NOAA Central Library in Silver Spring, Maryland, and regional libraries in Seattle, Washington, and Miami, Florida. The NOAA library data collection consists of more than 1.7 million volumes and thousands of images on topics related to NOAA's diverse missions. Access to the library collection and information services is available through the library's Web site, which routinely handles more than 250,000 queries a month (<http://www.lib.noaa.gov>).

National Coastal Data Development Center (NCDDC)

NOAA established NCDDC as a major component of NODC, at the Stennis Space Center in Mississippi, to provide access to the long-term coastal data records and the archives of coastal records at the appropriate NOAA data centers and NOAA Centers of Data. Coastal zone resource managers, the research community, coastal weather forecasters, fisheries managers, and others require accessible marine data to help the nation acquire a better understanding of the health of our coastal environment. NCDDC's goal is to improve the quality of and accessibility to marine data characteristics (such as chemistry, biology, and geology) and to physical parameters (such as water levels, bathymetry, winds, and waves). Working with federal, state, and local agencies, academic institutions, non-profit organizations, and the private sector, NCDDC will create a unified, long-term database of coastal data sets. It will also develop and maintain a catalog of coastal data, ensure the quality of these data, and provide online access to the coastal user community. Additionally, NCDDC will produce retrospective analyses and trend information to help form the basis for Integrated Ecosystem Assessments and public policy.

regional associations. These new portals also enhance access to the Coral Reef Information System regional portal.

- A new online sea-surface temperature (SST) intercomparison framework provides easy access to a large collection of satellite-based, in situ, and blended SST data sets in a standard format. This new tool also has interactive graphics and statistics, facilitating understanding and analysis of a highly diverse collection of SST information.

NOAA's National Oceanographic Data Center Improves Timeliness of Critical Ocean Data

The World Ocean Database (WOD) is a global, comprehensive, quality-controlled compilation of oceanographic vertical profile data. Ocean researchers around the world submitted data sets for this collection to NODC. In the past, WOD was scheduled for periodic releases (sometimes four years apart); however, since data are continuously being added to this database, NODC is now updating its WOD every three months. These quarterly releases are critical to scientists studying the rapidly changing ocean environment.

WOD data are used in developing ocean climatologies and in studies of interdecadal variability and global climate change. WOD is the largest digital collection of quality-controlled historical and modern ocean profile data available internationally. NODC has made most of these data available online, or will shortly make them available online.

NOAA Expands Tsunami Data and Information Activities

The National Geophysical Data Center (NGDC) compiles, archives, and makes accessible data and information about tsunamis worldwide. NGDC stewards tsunami information, such as coastal and deep-ocean water level data; tsunami event and impact data; imagery; and bathymetric, topographic, and shoreline data. NGDC's tsunami information archive supports hazard evaluation and mitigation efforts. This year, the archive grew by over 700 percent, from 12 to 100 gigabytes. The data are used by a broad range of scientists, emergency managers, disaster relief agencies, land-use planners, utility and transportation companies, engineers and surveyors, insurance companies, educators, the public, and federal, state, and local governments.

NGDC is also developing Digital Elevation Models (DEMs) for at-risk coastal communities, with 34 DEMs already produced. These gridded representations of Earth's surface improve forecasting for early tsunami warning systems and for predicting inundation due to tsunami, storm surge, and rainfall flooding in coastal areas. In FY 2008, 6 DEMs were produced; an additional 9–12 DEMs are expected to be produced in FY 2009.

NGDC has also provided 42 custom-made, reconnaissance, siting maps for the deployment of Deep-ocean Assessment and Reporting of Tsunamis (DART®) buoys, based on the most current bathymetric data for a deployment site. NOAA satellites collect and transmit DART® buoy data to the NOAA Tsunami Warning Centers and the NOAA National Data Buoy Center in real time to enable early detection, measurement, and real-time reporting of tsunamis in the open ocean. NGDC provides high-resolution, historic DART® buoy data online for downloading and viewing. In FY 2008, NGDC provided the final 11 DART® siting maps, which brought the total to 42 as outlined in the project plan (<http://nctr.pmel.noaa.gov/Dart/index.html>).

NGDC's support of NOAA's Tsunami Program is significant in preparing coastal communities to be resilient in the face of low-probability but high-impact tsunamis. In addition to tsunamis, this information supports coastal community planning and preparation for flooding caused by extreme weather.

FUTURE OUTLOOK

International events and technological progress have reshaped the global context in which NESDIS operates. Looking forward to anticipate future environmental observing needs is vital to creating NESDIS's vision for the future. Future environmental observing capabilities, new information technologies, and the growing needs and expectations of our numerous customers will present opportunities and challenges for delivering improved products and services.

The nation's security, economy, and environment have become inextricably linked. No single environmental observing platform can fulfill all environmental remote-sensing requirements. Therefore, NESDIS's



NOAA satellites collect and transmit DART® buoy data to the NOAA Tsunami Warning Centers and the NOAA National Data Buoy Center in real time to enable early detection, measurement, and real-time reporting of tsunamis in the open ocean.

customers need the best mix of observations from available and planned platforms and sensors. The upcoming expansion of advanced satellite instruments and data from such systems as NPOESS, the next generational geostationary satellites (GOES-R), and the European polar meteorological satellite program (MetOp) promise an auspicious future as NESDIS strives to improve forecasts from numerical weather prediction models. NESDIS must use operational satellite-observing systems comprehensively to extract the best-quality products as it plans for observing systems that serve both weather and climate system needs. NESDIS must also realize the full potential of current and future satellite and ground-based data and provide timely, comprehensive, and easily accessible environmental data relevant to current and future economic and environmental issues on the local, regional, national, and global scales.

NESDIS will continue to operate and develop the world's premier environmental satellite systems and will lead efforts with other agencies and countries to establish a global observing system to meet the world's weather, climate, ocean, and hazard-support information needs. NESDIS will also implement new technologies and continue to expand existing systems to archive and provide access to the massive amount of new data that describe our climate to fulfill growing customer requirements for quality and timely state-of-the-art products and services.



*Rear Admiral Jonathan W. Bailey
Director, NOAA Corps and
Office of Marine and Aviation
Operations*



*NOAA Teacher at Sea Mark Friedman
displays a giant strand of sea kelp.*

Office of Marine and Aviation Operations *On the Sea and In the Air*

NOAA's Office of Marine and Aviation Operations (OMAO) manages, operates, and maintains the nation's largest domestic fleet of research and survey ships and aircraft, which acquire data in support of NOAA's mission. OMAO also manages NOAA's Diving, Small Boat, and Aviation Safety Programs and partners with other NOAA offices on the Teacher At Sea Program. In addition, OMAO administers the NOAA Commissioned Officer Corps (NOAA Corps), one of the nation's seven uniformed services. Besides the NOAA Corps, OMAO employees include civil service, wage grade, and wage marine civilians.

NOAA ships operate worldwide, supporting data acquisition for a broad range of oceanic and atmospheric activities, including fisheries and coastal research, nautical charting, and long-term ocean and climate studies. The ships are equipped with state-of-the-art technology and have data collection capabilities generally not found in the commercial fleet. For example, NOAA fisheries vessels conduct joint operations of fishery stock assessments and oceanography, giving scientists a complete picture of a fish species, its habitat, and the physical oceanographic properties of its surrounding environment.

NOAA aircraft operate throughout the world, collecting data for national programs ranging from hurricane surveillance, research, and reconnaissance, to snow-pack surveys for flood prediction and water resource management, to coastline mapping and marine mammal surveys. NOAA's aircraft are uniquely configured to carry scientific instruments to support a wide variety of missions.

The NOAA Corps operates NOAA ships and aircraft, and brings its operational expertise and knowledge of platform capabilities to land-based assignments throughout NOAA. NOAA Corps officers serve in management, policy, and technical positions throughout all line offices of NOAA. They can be readily reassigned to other offices within NOAA or folded into the Department of Defense during times of war. Aside from supporting science operations in the seas and skies, NOAA Corps officers are in the vanguard of those advancing NOAA's Homeland Security efforts—including maintaining continuity of operations at NOAA in the event of an emergency. A NOAA Corps officer serves as Director of NOAA's homeland security office. Along with other line office representatives, rotating NOAA Corps watch officers also staff the Department of Homeland Security Operations Center. These officers help maintain round-the-clock operations at the Operations Center during significant events, such as hurricanes, earthquakes, and tsunamis.

ACCOMPLISHMENTS

New Leaders Take the Helm at OMAO

After their nomination by President Bush, confirmation by the U.S. Senate, and appointment by Commerce Secretary Carlos Gutierrez, NOAA's two new flag officers officially assumed new leadership positions at NOAA during a formal ceremony in the military tradition at the Thomas Jefferson Memorial in October 2007. Rear Admiral Jonathan W. Bailey assumed the position of Director of the NOAA Corps and NOAA's Office of Marine and Aviation Operations. In the same ceremony, Rear Admiral Philip M. Kenul assumed command of the Marine and Aviation Operations Centers. These are the two top positions held by NOAA Corps officers.

NOAA Teacher at Sea Program Helps Promote Ocean Literacy and NOAA Careers

NOAA's Teacher at Sea program sent 24 teachers from 18 states on NOAA research ships and two teachers from two states aboard NOAA aircraft in FY 2008. Teachers who participated in the program attended nine professional conferences to talk about their experiences. This year alone, an estimated 2,000 students will benefit from their teachers' experience at sea. An outside evaluator found that teachers who take part in the NOAA Teacher at Sea Program (1) use the experience back in the classroom; (2) are affected both by how they teach and on a very personal level; (3) share their experiences with others, including students, teachers, and members of the community; and (4) talk with others, including students, about possible NOAA-related career opportunities. Some of the teachers participating in the program this year were recognized by Congressman Frelinghuysen (New Jersey), Senator In-



NOAA's two new rear admirals officially assumed their new positions at a formal ceremony in the military tradition at the Thomas Jefferson Memorial in October 2007. Standing from left to right: Vice Adm. Conrad C. Lautenbacher, Jr., U.S. Navy (Ret.), then-Under Secretary of Commerce for Oceans and Atmosphere and NOAA Administrator; outgoing NOAA Corps and OMAO Director Rear Adm. Samuel P. DeBow, Jr.; incoming NOAA Corps and OMAO Director Rear Adm. Jonathan W. Bailey; and Rear Adm. Philip M. Kenul, Director, NOAA Marine and Aviation Operations Centers. Photo: U.S. Department of Commerce

ouye (Hawaii), Congressman Bilirakis (Florida), Congressman Serrano (New York), and Mayor Iorio (Tampa, Florida).

2010–2024 Ship Recapitalization Plan Sent to Congress

The Department of Commerce transmitted to Congress a major recapitalization study for NOAA's ships. The *FY 2010–FY 2024 NOAA Ship Recapitalization Plan*

assesses the service life and requirements of NOAA's ten oldest ships. It addresses challenges similar to other observational infrastructure: expanding mission requirements, age and obsolescence, and finite resources for recapitalization. The plan links programmatic and legislative requirements to ship operating day requirements, and articulates the national benefit gained from the NOAA products and services that



In December, NOAA launched *Pisces*, the third of four new fisheries survey vessels of the same design.

depend on at-sea data. A similar Aircraft Recapitalization Plan is expected to be transmitted to Congress in 2009.

Small Boat Safety Program Manual and NAO Approved

NOAA's Small Boat Safety Program achieved a significant accomplishment with the official release of the new *Small Boat Standards and Procedures Manual* and NOAA Administrative Order 209-125, which replaces NAO 217-103. These new policies, standards, and procedures will

enhance the safe operation of all NOAA small boats (i.e., boats less than 300 gross tons) and encourage a corporate culture that values the skilled small boat operator, encourages the distribution of information, seeks a quality approach, shares commitment, and manages operational risk.

NOAA Platforms and Charters Advance Data Acquisition and Global Observations

OMAO employs a mix of NOAA platforms and charters to fulfill NOAA's data acquisition needs. The data support such varied missions as climate change research, nauti-

cal charting, flood forecasting, fisheries management, and ocean exploration. Data acquired aboard NOAA ships and aircraft across the globe will become an important component of the emerging Global Earth Observation System of Systems, through which NOAA is working with its federal partners and more than 60 countries to develop a global Earth observation network.

In FY 2008, NOAA aircraft logged 4,369 mission flight hours and NOAA ships accomplished 3,625 operating days in support of NOAA's programs. NOAA also outsourced 2,350 flight hours and approximately 1,564 accomplished ship charter days.

Fleet Recapitalization Moves Ahead

Several major ship recapitalization milestones were achieved in FY 2008. In December 2007, NOAA launched *Pisces*, the third of four new fisheries survey vessels under construction at VT Halter Marine in Moss Point, Mississippi. The ship will be homeported in Pascagoula, Mississippi, when it becomes operational in 2009. In September 2008, NOAA ship *Bell M. Shimada*, the fourth new fisheries survey vessel of the same class, was launched at the VT Halter Marine shipyard. The *Shimada* will be homeported on the West Coast.

PRODUCTS AND SERVICES

NOAA Commissioned Officer Corps

The NOAA Commissioned Officer Corps operates and manages NOAA ships and aircraft, while bringing operational expertise and knowledge to land-based NOAA programs through rotational assignments. Officers work under a personnel system similar to that of the U.S. Armed Forces, giving them the flexibility to move rapidly into disaster-response situations. NOAA Corps officers work closely with other uniformed services. For example, they coordinated many of NOAA's hurricane response activities with the U.S. Coast Guard, Army Corps of Engineers, and Navy following Hurricanes Katrina and Rita, and flew remote-sensing missions over the collapsed World Trade Center and Pentagon after September 11, 2001, at the request of the U.S. Army. NOAA Corps officers, with

their flexibility and broad-based experience, leadership, and operational and management skills, are a valued resource used by all NOAA line offices to achieve mission goals.

Data Collection and Global Observations

NOAA ships and aircraft have sophisticated data collection capabilities, such as Doppler radar on *Ronald H. Brown*, state-of-the-art acoustic quieting technology aboard the new fisheries survey vessels, and Stepped Frequency Microwave Radiometers on the WP-3D Orion hurricane research aircraft. Most ships are equipped with an OMAO-developed Scientific Computer System, which integrates data from shipboard and deployed sensors into one central system, enabling scientists to make research decisions based on real-time data access and visualization.

Additionally, working in partnership with NOAA's Office of Ocean Exploration and Research and Dr. Bob Ballard, OMAO successfully completed a trial of its new telepresence system on *Okeanos Explorer*. Telepresence allows land-based scientists and observers to participate in operations at sea in real time. This technology will significantly increase the efficiency of field operations and benefit outreach and education. Autonomous underwater vehicles and unmanned aircraft systems are also undergoing research-to-operations in the NOAA fleet, facilitating data acquisition in areas that are less safe for manned operations, and also serving as force multipliers for data collection.

Outsourcing Support

OMAO provides guidance and staff support to NOAA programs interested in obtaining chartered ships and aircraft. OMAO recommends chartering options to NOAA



NOAA ship *Bell M. Shimada* looms over the launchway before its christening and launch ceremony begins. Susan Lautenbacher, the Shimada's sponsor, christens the ship in a spray of champagne.

In August 2008, NOAA commissioned *Okeanos Explorer* in Seattle, Washington. The ship, a former U.S. Navy submarine surveillance ship converted to conduct research, is the only federal ship dedicated to ocean exploration. It will be homeported in Rhode Island once its Pacific tour is completed.

NOAA's two oldest ships, *Rude* and *John N. Cobb*, were decommissioned in March and August 2008, respectively. A coastal mapping vessel currently under construction at VT Halter Marine will replace *Rude* in



programs and ensures that platforms are safe and outfitted to meet program requirements.

Aviation Safety Program and Small Boat Safety Program

To promote safe use of small boats and aircraft, OMAO manages two safety programs. The NOAA Small Boat Safety Program ensures that small boat operators at NOAA have properly trained personnel, appropriate equipment, and safety standards. The safety program provides standardized operator training and safety equipment, assistance with boat acquisition and alterations, and routine safety inspections. Similarly, the NOAA Aviation Safety Program ensures that NOAA personnel who use commercial aviation services or NOAA aircraft are properly trained in basic safety procedures and provided with aviation life support equipment. The program ensures that contracted aircraft meet NOAA airworthiness and operational

safety standards and that these standards are incorporated in aviation services procurement documents.

NOAA Diving Program

The NOAA Diving Program (NDP) oversees and manages NOAA diving personnel, equipment, and activities to ensure that all diving operations are performed safely and efficiently. The program provides beginner and specialty dive training to NOAA employees and outside agencies, including the Federal Bureau of Investigation, the U.S. Environmental Protection Agency, the U.S. Secret Service, the U.S. Fish and Wildlife Service, and local law enforcement. NDP averages more than 15,000 dives per year.

NOAA Teacher at Sea and Teacher in the Air Programs

Since 1990, the NOAA Teacher at Sea Program has enabled more than 500 educators to gain hands-on NOAA research

experience at sea. Each year, approximately 30 kindergarten through college-level educators spend time aboard NOAA hydrographic, oceanographic, and fisheries survey and research vessels. Teachers become a part of the NOAA research team by living and working side-by-side with scientists and with NOAA Corps officers and crew. This unique opportunity provides the teachers with a new understanding of NOAA science and shipboard life—enriching their lives as well as their curricula. While onboard, teachers write logs, take photos, and interview scientists and crew. Some teachers use the Internet to communicate their experiences to students back home. NOAA's successful Teacher at Sea program has led to the creation of an offshoot—the NOAA Teacher in the Air program—where teachers fly with NOAA on airborne missions. This concept will be expanded in the future to include other NOAA field experiences.

2009; *Cobb's* mission will be addressed by a combination of other ships in the NOAA fleet and charter vessels.

In addition, OMAO acquired two new 28-ft. survey launches for NOAA ship *Rainier* that will improve overall survey efficiency and safety of operations. The new vessels replaced launches that were more than 30 years old.

On the aircraft side, structural modifications to house the tail Doppler radar (TDR) on the NOAA Gulfstream-IV hurricane surveillance jet were completed and certified by the Federal Aviation Administration as airworthy. Work continues on the TDR antenna design. Once it becomes operational in 2010, the G-IV's TDR will acquire meteorological data that will help forecasters more accurately predict the intensity of hurricanes.

NOAA Corps Training Protocols Revamped

In FY 2008 the Commissioned Personnel Center initiated a new program with Basic Officer Training Class (BOTC) 112 that will enable the officers to sit for a United

States Coast Guard 1600-ton mate's license after one year of sea time (365 days). Officers must also complete four sea projects during their first sea assignment. This new BOTC program provides officers with the Standards of Training, Certification, and Watchkeeping approved courses and certificates, and Officer in Charge of a Navigational Watch and Rating Forming Part of a Navigational Watch assessment. Under this approved program, the sea time requirement is only one year, as opposed to the three years required for non-NOAA individuals obtaining the certificates on their own.

NOAA Scientific Diving Standards and Safety Manual Approved

The NOAA Diving Program developed a new *NOAA Scientific Diving Standards and Safety Manual* to ensure that all scientific diving is conducted in a manner that will maximize protection of scientific divers from accidental injury and/or illness. It also sets standards for training and certification that will allow a working reciprocity with other science-oriented diving programs. This manual sets minimum stan-

dards for NOAA scientific diving operations, describes the organization for the conduct of scientific diving, and the basic standards and procedures for safety in scientific diving operations. It also establishes a framework for reciprocity between NOAA and other organizations that adhere to these minimum standards.

NOAA Aircraft Fly Record-Breaking Hurricane Season

The Atlantic hurricane season kept NOAA hurricane aircraft extremely busy in support of the National Hurricane Center and Hurricane Research Division. In FY 2008 (which covers parts of two hurricane seasons), OMAO flight crews from the Aircraft Operations Center flew in six named storms: three tropical storms and three hurricanes. The Gulfstream-IV high-altitude surveillance jet flew 23 missions and 177 flight hours. The two WP-3D Orion research and reconnaissance turboprops flew a total of 54 missions, with 383 flight hours logged.

Once Hurricanes Gustav and Ike had passed after making landfall, the NOAA



During FY 2008, members of Basic Officer Training Class 112 received small-boat training at the U.S. Merchant Marine Academy in Kings Point, New York.



In FY 2008, OMAO flight crews from the Aircraft Operations Center had a busy hurricane season. The Gulfstream-IV high-altitude surveillance jet flew 23 missions totaling 177 flight hours, and the two WP-3D Orion research and reconnaissance turbo-props flew 54 missions totaling 383 flight hours.

Citation jet and Jet-prop Commander flew 16 damage assessment flights and 47 flight hours in support of NOAA's Remote Sensing Division. More than 5,500 photographs of the hardest-hit areas were collected for federal and local managers. A NOAA WP-3D also conducted a damage assessment flight after Hurricane Ike to compare hurricane forecasts with actual damage.

NOAA P-3 and G-IV Participate in Hurricane Awareness Outreach

A NOAA P-3 "hurricane hunter" and its flight crew from the Aircraft Operations Center participated in the five-city Gulf Coast Hurricane Awareness Tour in May. The purpose of the tour was to raise public awareness of hurricanes that can threaten the Gulf Coast, and to educate the public that preparation is vital.

FUTURE OUTLOOK

Emerging mission requirements in the areas of ecosystem research, ocean mapping, climate research and homeland security will place additional demands for NOAA ship and aircraft data acquisition. OMAO will work to improve the efficiency of existing platforms, while implementing a major recapitalization of the NOAA fleet. When possible, recapitalization efforts will incorporate emerging technologies, such as unmanned aircraft systems and telepresence systems. Most important, OMAO will also invest in the following elements, which are the foundation of a well-managed fleet: recruitment, retention, and training of a motivated and technically competent workforce; enhancement of safety of operations; increased platform maintenance; and standardized operating procedures.



During FY 2008, two new 28-foot survey launches were acquired for NOAA ship Rainier, to improve overall survey efficiency, productivity, and safety levels.



Laura K. Furgione
Assistant Administrator

Office of Program Planning and Integration

Guiding NOAA Strategically

The Office of Program Planning and Integration (PPI) helps NOAA fulfill its vision and mission through strategic, corporate leadership and the application of matrix management principles to major NOAA programs. PPI is driven toward the ideal of one NOAA working together, guided by a clear strategic vision for planning, programming, and execution to achieve its mission goals and mandates. Strategic planning and management of NOAA's activities work best when those who benefit from these activities and those who provide NOAA's services contribute to the process. As such, PPI works with stakeholders, employees, and domestic and international partners to ensure that every initiative—existing or new—arises from a collaborative effort among line offices, goal teams, and councils. PPI believes that more fully developed and better executed NOAA programs foster richer, more productive partnerships with the public, private, and academic sectors and improved outcomes for the nation.

PPI defines NOAA's high-impact missions and focuses corporate-wide attention on them through formal Strategic Planning and Performance Evaluation. PPI develops the *NOAA Strategic Plan*, which articulates NOAA's long-range vision and path for the future. PPI also develops the *Annual Guidance Memorandum*, which provides annual adjustments to the direction of NOAA program priorities. Both products demand yearly assessment of emerging challenges and opportunities and yearly evaluation of NOAA's priorities and progress. PPI strives to improve the efficiency and effectiveness of NOAA's strategic planning processes, using research and economic evaluations as the basis for identifying the changing national needs in NOAA's mission areas.

PPI not only creates NOAA's strategy and updates it annually, but also continually maintains NOAA's internal strategic alignment through *Program and Policy Integration*. PPI also provides corporate management to coordinate NOAA's many lines of service with the nation's many needs for environmental information and stewardship. PPI also ensures that the agency's investments and actions are guided by the *NOAA Strategic Plan* and *Annual Guidance Memorandum*; are based on sound social science analysis; adhere to executive branch and legislative branch science, technology, and environmental policy; and integrate the full breadth of NOAA's resources, knowledge, and talent to meet its stated mission goals.



PPI provides corporate management to coordinate NOAA's many lines of service with the nation's many needs for environmental information and stewardship.

ACCOMPLISHMENTS

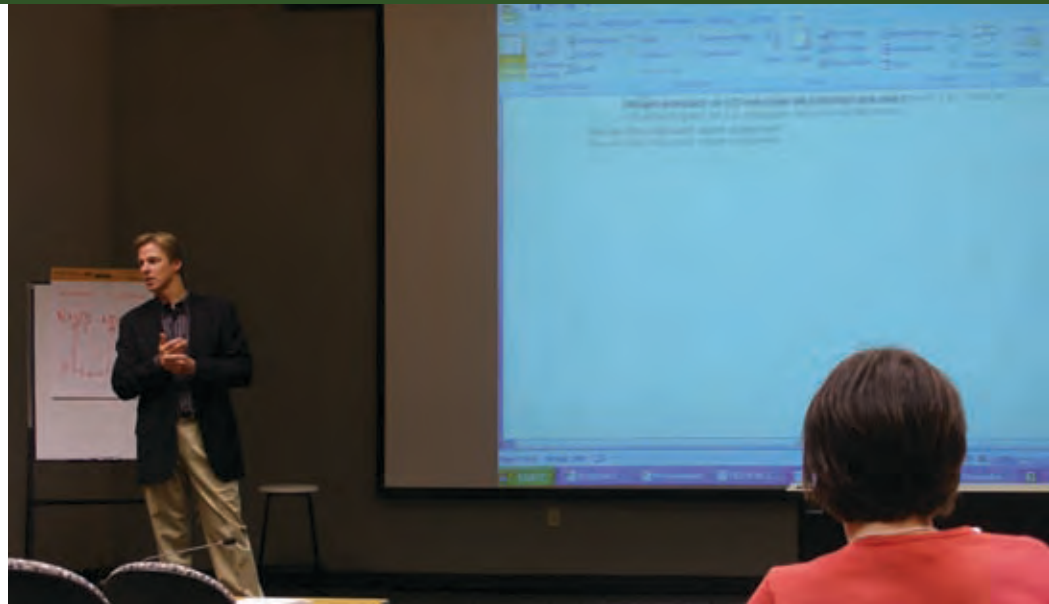
PPI Completes Technical Adjustment of NOAA's Strategic Plan

The last extensive internal and public review of NOAA's strategic plan occurred in April 2005 and resulted in an updated NOAA Strategic Plan for FY 2005–2010. A technical adjustment conducted this year, and in accordance with the Government Performance and Results Act and the Program Assessment Rating Tool, keeps the strategic plan current and relevant. This update for FY 2009–2014 is timely in light of the current transition to a new Administration. Retaining the basic structure of the 2005 strategic plan, this update:

- retains NOAA's Vision, Mission, and Goals;
- better describes NOAA's functions and structure;
- updates NOAA's Mission Goal & Sub-goal Objectives and Sub-goal Outcomes;
- describes programs that constitute Mission Goals and Sub-goals;
- better characterizes the environment in which NOAA works; and
- describes key successes on the road to strategic outcomes.

PPI Guides Corporate Decision-making Policy and Standardized Business Operations

PPI continues to lead efforts to update NOAA's Transition of Research to Application policy (NAO 216-105), as well as the policy's implementation procedures. The policy establishes the process for identifying and transitioning research results to applications and outlines the roles and responsibilities of various officials. The updated policy aims to institutionalize im-



Paul Doremus, Acting Deputy Assistant Administrator and Director of Strategic Planning, gives a presentation during the plenary session at the NOAA 2008 Regional Collaboration Workshop.

proved accountability, oversight, and planning for research results transitioning into an application or operational environment. Additionally, the updated policy and its implementation procedures aim to better align accountability and responsibility with the line office's execution function.

PPI has also published another significant revision of the *NOAA Business Operations Manual* (BOM), a living document that provides a comprehensive overview of NOAA's functions, organizational structure, and business operations, including information on all phases of NOAA's Planning, Programming, Budgeting, and Execution System (PPBES). The BOM is designed to ensure quality and uniformity of operations within NOAA and is useful as a primary reference guide for NOAA employees, especially those involved in the PPBES process. The BOM provides standardized, up-to-date information and

guidance for greater clarity and transparency of business processes, enhanced internal and external communications to support client and stakeholder needs, and fact-based decision making. It also provides employees with a comprehensive overview of the NOAA Functional Model, organizational structure, management techniques, PPBES, operational support services, and program support services. PPI reached an agreement with NOAA's Workforce Management Office to provide copies of the BOM to new employees during their orientation briefings.

PPI Leads NOAA Efforts to Respond Effectively to Regional Priorities

NOAA continues to build its capabilities at the regional level to provide products and services tailored to constituents' highest-priority needs. PPI is leading NOAA's effort to understand the complex demand



NOAA's Western Region is providing assistance to promote a Priority Area in the West Coast Governors' Agreement on Ocean Health.

for the agency's services across the country through eight NOAA regions. These regions serve as a flexible framework to bring together NOAA assets to address environmental issues that occur at a variety of scales. Bringing together the components of the NOAA family and fostering critical partnerships allow PPI to develop collaborative solutions for product delivery that meet unique regional needs and increase the value of NOAA's products and services. Regional stakeholder voices gathered by Regional Teams inform NOAA's priorities in the *Annual Guidance Memorandum*, and NOAA will continue to use this mechanism to anticipate future priorities and prepare for trends in mission requirements.

The impact of NOAA's commitment to regional collaboration is already being seen, perhaps most clearly with the decision by five NOAA line offices (National Environmental Satellite, Data, and Information System, National Marine Fisheries Service, National Ocean Service, National Weather Service, and Office of Oceanic and Atmospheric Research) to hire a full-time federal employee for each of the eight regions to serve as the in-region coordinator for this effort. Additionally, there is evidence of stronger relationships between NOAA and stakeholders. For example, the Alaska Regional Team Lead was invited to serve on the Governor of Alaska's Sub-cabinet on Climate Change Adaptation Technical Work Group; the Western Region is providing assistance to promote a Priority Area in the West Coast Governors' Agreement on Ocean Health; and the Central Region led a workshop at an annual

Biobased Industry Outlook Conference, "Growing the Bioeconomy."

PPI Develops Strategies for NEPA Compliance

PPI continues to develop several important National Environmental Policy Act (NEPA) products, including *Procedures for Adopting NEPA Documents Prepared by Other Federal Agencies*, *Cumulative Effects Analysis Recommendations and Tips*, and *Strategies for Public Participation During the NEPA Process*. PPI has also assisted NOAA's National Marine Fisheries Service (NMFS) in developing a proposed rule to revise and update NMFS procedures for complying with NEPA.

PPI Leads Integration Efforts for Transition of Research to Applications

In an effort to accelerate and streamline the transition of research to applications, PPI continues to lead the NOAA Transition Board. Specifically, in 2008, PPI facilitated:

- identification and appointment of line office Transition Managers;
- bottom-up identification of current and future transition projects by incorporating transition planning into the FY 2011 Program Operating Plans;
- integration of transition projects in each line office FY 2008 Annual Operating Plan; and
- semi-annual execution reporting of transition projects' status and path forward.

These activities are designed to provide better integration and standardization for

Program Managers, Goal Leads, and line office management as they plan for and execute the transition of research results to applications.

PPI Instrumental in Developing a Strategy for a National Climate Service

In an effort to address emerging national needs for credible, comprehensive, and authoritative climate information, NOAA is developing a strategy for the creation of a National Climate Service (NCS). The NCS would provide climate information in an integrated and focused manner leveraging NOAA's core strengths and expanding NOAA's existing capabilities to service new and intersecting sectors related to NOAA's mission priorities, such as water, coastal, and living marine resources. While many parts of NOAA deliver innovative and highly valued products and services today, PPI is leading NOAA's effort to ensure its climate capabilities are better coordinated and responsive to user needs. Additionally, NOAA is engaging federal and nonfederal partners through its Science Advisory Board to develop options for an NCS that would support the nation with climate information and services beyond those of any single entity.

PPI Provides NOAA Leadership for the Subcommittee on Integrated Management of Ocean Resources (SIMOR)

In an effort to improve federal coordination and collaboration on ocean-related matters consistent with Executive Order 13366, PPI continued to co-chair the SIMOR interagency body in 2008. Continued progress was made in this

federal interagency framework in the following areas: developing a common resource management viewpoint across federal agencies (e.g., recognition of best practices in research transition); facilitating communication and coordination across resource management activities (e.g., clearance of a federal report from the Interagency Marine Debris Coordinating Committee Report to Congress); providing a common federal framework for engaging regional governance initiative (e.g., collaborating with the West Coast Governors in the development of their final Action Plan); completing new pilot activities initiated in the 2006 SIMOR Action Plan; and coordinating a common federal message on purpose, principles, and priorities for the transition to the new Administration.

In its continuing role as co-chair of the Subcommittee on Integrated Management of Ocean Resources interagency body, PPI has guided progress in several areas, such as providing clearance of a federal report from the Interagency Marine Debris Coordinating Committee Report to Congress. Photo: Southwest Fisheries Science Center



The proposed National Climate Service would provide climate information to service new and intersecting sectors related to NOAA's mission priorities, such as water, coastal, and living marine resources.





Financial Overview

NOAA works to protect marine mammals and sea turtles under its jurisdiction. Many of these species are affected by fishing and other human impacts, as well as environmental changes.





Maureen E. Wylie
Chief Financial Officer

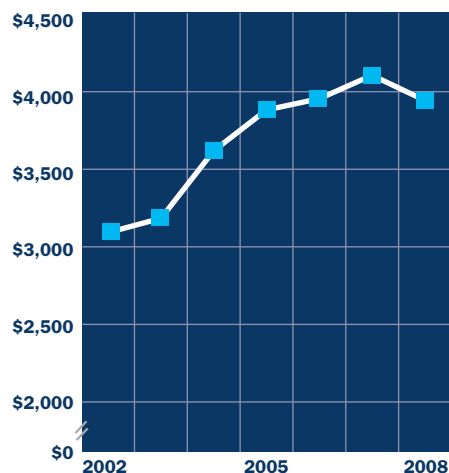
Office of the Chief Financial Officer Managing NOAA's Resources

The Chief Financial Officer (CFO) serves as the principal financial manager for NOAA's appropriated resources. The CFO Act of 1990 requires the CFO's Office to provide the leadership necessary for NOAA to obtain a yearly unqualified opinion in the audit of its consolidated financial statements. Under the direction of the CFO, the Budget and Finance Offices perform studies using methods and procedures analysis, and systems and organizational analysis, to support senior management's executive decisions for ensuring operational efficiencies within NOAA.

The Budget Office coordinates the preparation of NOAA budget submissions to the Department of Commerce, the Office of Management and Budget (OMB), and Congress, including data on budget authority, obligations, outlays, permanent positions, and full-time equivalent employment. It also provides for the proper allocation and control of the execution of all budgetary resources, as required under the Congressional Budget and Impoundment Act of 1974 and related statutes, and as specified by OMB. The Budget Office also maintains a staff that focuses on outreach and communication, particularly with the staff of congressional appropriations committees, as well as other Executive Branch agencies.

The Finance Office works to ensure that NOAA's consolidated financial statements and reports accurately reflect NOAA's fiduciary status at the end of the fiscal year, as required of all government agencies under the CFO Act. It provides NOAA's managers access to timely financial data necessary to make informed programmatic decisions, and is responsible for paying NOAA's bills in a timely manner.

FIGURE 1
NOAA Budget Growth (in billions)



Note: The amounts reflect enacted appropriations.

BUDGET OVERVIEW

NOAA's total budget appropriation was \$4.1 billion for FY 2008 (Figure 1). These funds were directed toward fulfilling NOAA's statutory and legal obligations, as well as congressional responsibilities. NOAA conducts research and gathers data about the global oceans, atmosphere, space, and solar activities, and applies this knowledge to science and services that touch the lives of all Americans. NOAA warns of dangerous weather, charts our seas and skies, guides us in the prudent use of ocean and coastal resources, and conducts research to improve our understanding and stewardship of the environment that sustains us all. Over the last 10 years, NOAA's appropriated funding level has grown by 51 percent.

NOAA's budget is composed of several appropriations and special fund accounts. NOAA's two main appropriations are Operations, Research, and Facilities (ORF) and Procurement Acquisition and Construction (PAC). The ORF account supports core NOAA operations, such as advanced, short-term forecast and warning services, fisheries and protected species management, and coastal ecosystem health responsibilities. NOAA's PAC account was created in FY 1999 in response to requirements of the Federal Acquisition Streamlining Act of

1996. This account captures funding for multi-year capital projects. NOAA's other accounts, aggregated in the Non-ORF total Budget Authority, include the Damage Assessment and Restoration Revolving Fund, the Coastal Zone Management Fund, and various fisheries funds.

CONSOLIDATED BALANCE SHEET

Assets

The FY 2008 Consolidated Balance Sheet reflects total assets of \$9.6 billion (Table 1) and primarily consists of Fund Balance with Treasury; Accounts Receivable, Net; Loans Receivable and Related Foreclosed Property, Net; Inventory and Related Property; and General Property, Plant, and Equipment, Net.

TABLE 1
Assets (in thousands)

	FY 2008	FY 2007
Intragovernmental Assets	\$3,721,475	\$3,711,866
Fund Balance with Treasury	3,589,596	3,580,037
Accounts Receivable, Net	42,964	47,003
Loans Receivable and Related Foreclosed Property, Net		3
Advances and Prepayments	88,915	84,823
Non-intragovernmental Assets	\$5,868,491	\$5,463,974
Cash and Other Monetary Assets	513	490
Accounts Receivable, Net	24,047	20,656
Loans Receivable and Related Foreclosed Property, Net	487,870	493,623
Inventory, Materials and Supplies	74,548	81,475
General Property, Plant and Equipment, Net	5,238,349	4,804,596
Other	43,164	63,134
Total Assets	\$9,589,966	\$9,175,840

Fund Balance with Treasury

The Fund Balance with Treasury of \$3.6 billion consists primarily of appropriated funds to pay current liabilities and finance authorized purchase commitments (Figure 2).

FIGURE 2
Fund Balance with Treasury
(in millions)

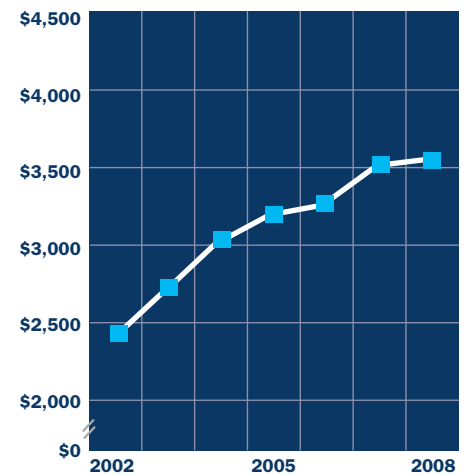


FIGURE 4
Loans Receivable and Related Foreclosed Property, Net (in millions)

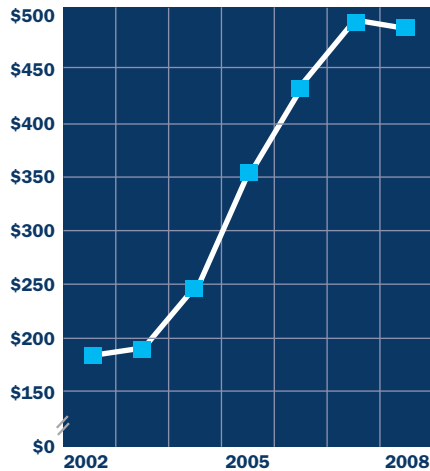
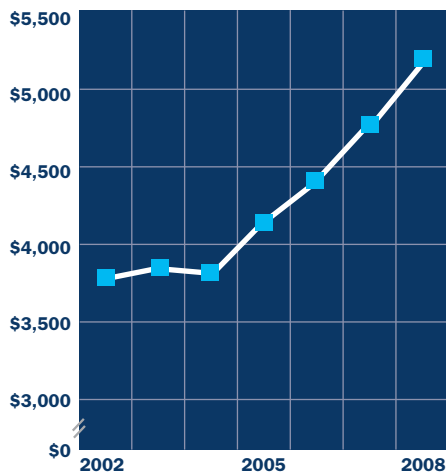


FIGURE 5
Inventory and Related Property (in millions)



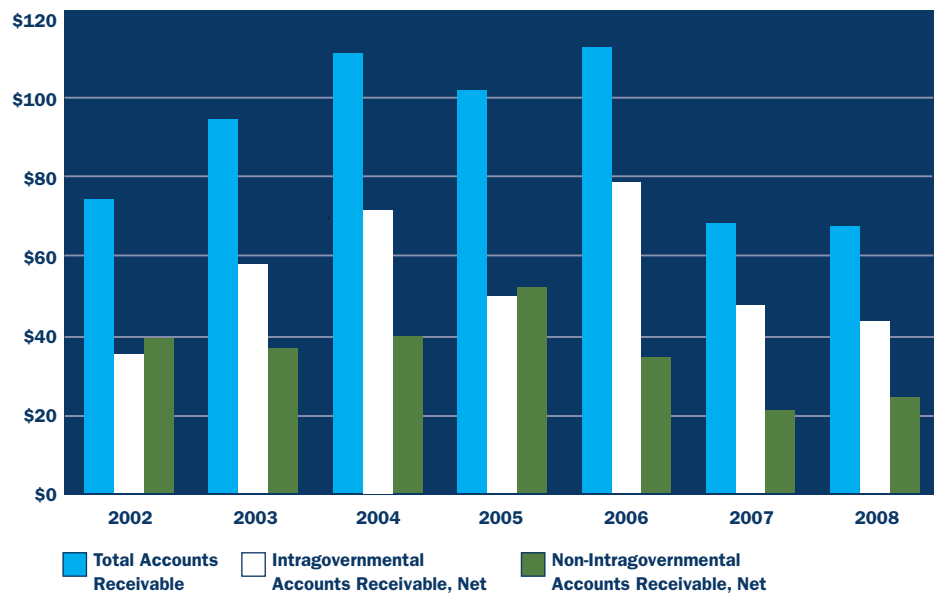
FIGURE 6
General Property, Plant, and Equipment (in millions)



Accounts Receivable, Net

Accounts Receivable, Net of \$67.0 million consists of intragovernmental (federal agencies) accounts receivable of \$42.9 million and non-intragovernmental accounts receivable of \$24.1 million (Figure 3). Outstanding billed and unbilled reimbursable services provided to other federal agencies compose the majority of NOAA's accounts receivable. Accounts receivable are established to receive payments for direct and indirect costs of services provided to another federal agency or non-intragovernmental entity.

FIGURE 3
Accounts Receivable, Net (in millions)



Loans Receivable and Related Foreclosed Property, Net

Loans Receivable and Related Foreclosed Property, Net of \$487.9 million consist of monies disbursed by the Fisheries Finance Program to private lenders for guaranteed loans in default, and monies disbursed as direct loans to finance various National Marine Fisheries Service loans totaling \$8.4 million and \$479.5 million, respectively (Figure 4).

Inventory and Related Property

Inventory and Related Property of \$74.5 million consist solely of operating materials and supplies that are tangible personal property to be consumed in normal operations (Figure 5). The majority of operating materials and supplies are located at the National Logistics Support Center and are used mainly by the National Weather Service. NOAA's inventory, consisting primarily of maps and charts, was transferred to the Federal Aviation Administration during FY 2001.

General Property, Plant, and Equipment

General Property, Plant, and Equipment is stated at net book value of \$5.2 billion (Figure 6). It consists mainly of construction work in progress, satellites and weather systems, structures and facilities, and other personal property with net book values of \$3.8 billion, \$0.7 billion, \$0.3 billion, and \$0.4 billion, respectively. Satellite and launch services are generally procured under long-term, multi-satellite contracts, which provide for payments by NOAA over the contract periods.

Liabilities

The FY 2008 Consolidated Balance Sheet reflects NOAA liabilities totaling \$1.7 billion. The significant liabilities presented in Table 2 represent monies owed for goods and services that have been received but for which payment has not yet been made.

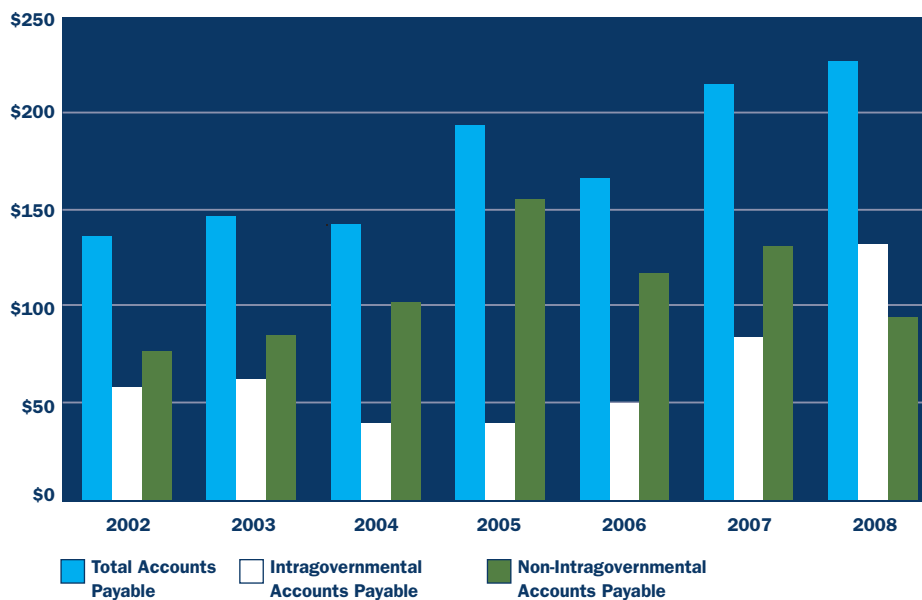
TABLE 2
Liabilities and Net Position (in thousands)

	FY 2008	FY 2007
Intragovernmental Liabilities	\$661,961	\$679,537
Accounts Payable	94,965	84,608
Debt to Treasury	471,926	478,958
Resources Payable to Treasury	1,885	1,862
Unearned Revenue	55,244	53,959
Other	37,941	60,150
Non-intragovernmental Liabilities	\$1,030,446	\$967,555
Accounts Payable	133,639	132,072
Loan Guarantee Liabilities	621	998
Federal Employee Benefits	564,041	524,508
Environmental and Disposal Liabilities	13,643	20,474
Other Liabilities	318,502	289,503
<i>Accrued Payroll and Annual Leave</i>	<i>153,189</i>	<i>139,526</i>
<i>Accrued Grants</i>	<i>83,591</i>	<i>85,247</i>
<i>Capital Leases</i>	<i>14,174</i>	<i>15,395</i>
<i>Unearned Revenue</i>	<i>41,488</i>	<i>41,019</i>
<i>Other</i>	<i>26,060</i>	<i>8,316</i>
Total Liabilities	\$1,692,407	\$1,647,092
Net Position	\$7,897,559	\$7,528,748
Unexpended Appropriations	3,113,158	3,210,005
Cumulative Results of Operations	4,784,401	4,318,743
Total Liabilities and Net Position	\$9,589,966	\$9,175,840

Accounts Payable

Accounts Payable of \$228.6 million consists of \$95.0 million of intragovernmental accounts payable and \$133.6 million of non-intragovernmental accounts payable (Figure 7).

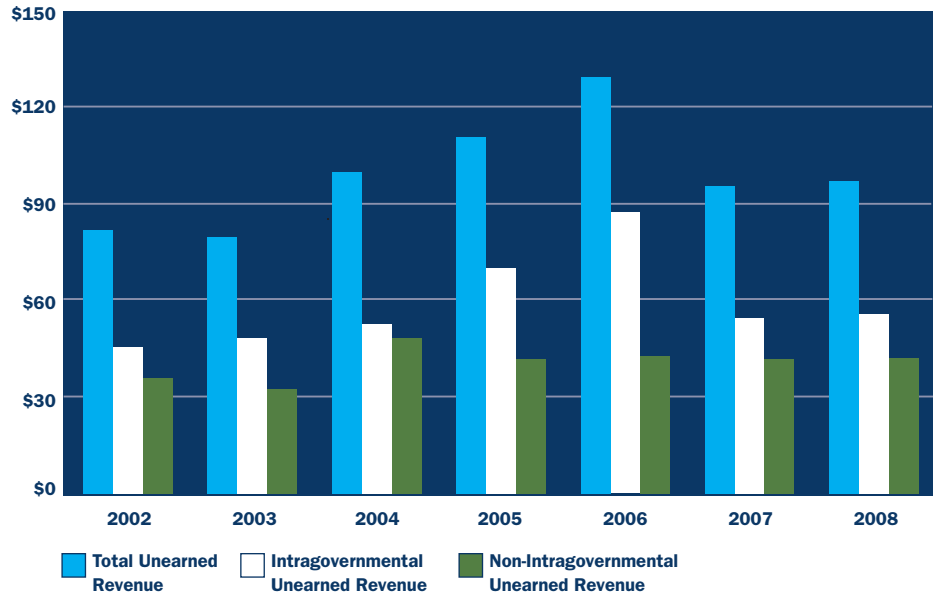
FIGURE 7
Accounts Payable (in millions)



Unearned Revenue

Unearned Revenue of \$96.7 million consists of intragovernmental and non-intragovernmental unearned revenue of \$55.2 million and \$41.5 million, respectively (Figure 8). The majority of NOAA's unearned revenue consists of amounts advanced to NOAA by other federal entities (such as the U.S. Departments of Transportation and Defense) and non-intragovernmental entities, for goods and services to be furnished.

FIGURE 8
Unearned Revenue (in millions)



Future Funding Requirements

Future Funding Requirements of \$696.2 million represent liabilities not funded by budgetary resources (Figure 9). These liabilities include NOAA Corps pension liability of \$448.1 million, NOAA Corps retirement health benefits of \$49.0 million, accrued leave balances of \$103.2 million, Federal Employee Compensation Act actuarial and accrued liabilities of \$81.2 million, environmental cleanup costs of \$13.6 million, and contingent liabilities of \$1.1 million.

FIGURE 9
Future Funding Requirements (in millions)

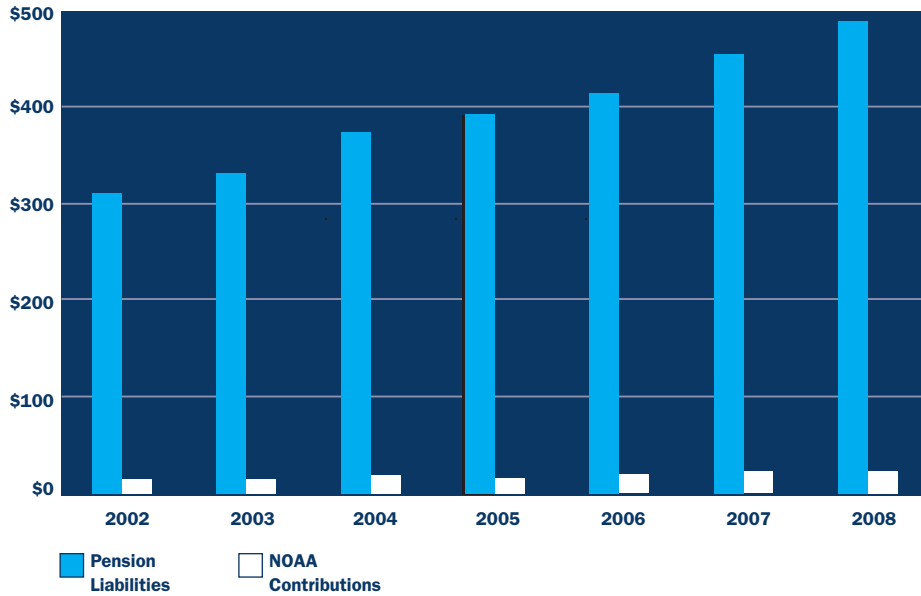


Liabilities not covered by budgetary resources result from the receipt of goods or services in the current or prior periods, or the occurrence of eligible events in the current or prior periods, for which appropriations, revenues, or other financing sources of funds necessary to pay the liabilities have not been made available through Congressional appropriations or current NOAA earnings. As of September 30, 2008, the total amount of liabilities classified as unfunded exceeded the \$186.8 million in available unobligated appropriations by \$509.4 million. These liabilities are presented as unfunded, rather than allocating portions of each of them to appropriated funds.

NOAA Corps Pension Liabilities

NOAA Corps Pension Liabilities of \$497.1 million, as mentioned above, represent non-intragovernmental liabilities not covered by budgetary resources relating to the NOAA Corps Retirement System (Figure 10). The NOAA Corps Retirement System is a non-contributory, defined benefit plan covering all active duty officers, retiree annuitants, and surviving families totaling 696 as of September 30, 2008. During FY 2008, NOAA contributed \$22.8 million to the NOAA Corps Retirement System.

FIGURE 10
NOAA Corps Pension Liabilities (in millions)



Fluctuation Analysis

The following balance sheet fluctuations were noted between FY 2007 and FY 2008 financial statements:

Total Assets

NOAA's total assets increased by approximately \$397.9 million from September 30, 2007, to September 30, 2008. The majority of the increase in total assets is attributable to increases in Property, Plant, and Equipment of \$417.6 million, and Fund Balance with Treasury of \$9.6 million. Decreases in Loans Receivable and Related Foreclosed Property totaled \$7.0 million, and decreased in Other Assets totaled \$14.6 million.

Total Liabilities

NOAA's total liabilities increased by approximately \$29.1 million from September 30, 2007, to September 30, 2008. This was mainly due to an increase in Federal Employee Benefits of \$39.5 million. There were decreases in Environmental and Disposal Liabilities of approximately \$7 million, and Other Liabilities of \$4.5 million.

Equity

NOAA's Net Position increased by approximately \$368.8 million from FY 2007 to FY 2008. The \$7.9 billion of net position consists of \$3.1 billion of Unexpended Appropriations and \$4.8 billion from Cumulative Results of Operations.

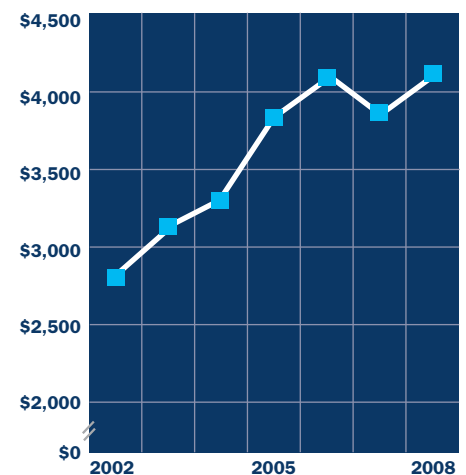
Consolidated Statement of Changes in Net Position

The FY 2008 Consolidated Statement of Changes in Net Position reports the beginning net position, the items that caused net position to change during the year ended, and the ending net position. The majority of the activity in this statement involves two components of net position: net cost of operations and appropriations used (revenues), totaling \$4.0 billion and \$4.1 billion, respectively.

Appropriated Capital Used

Appropriated capital used represents revenue or a financing source to NOAA made available through Congressional appropriations. Appropriations are recognized as financing sources at the time the related expenses are incurred and the assets are consumed in operations (Figure 11).

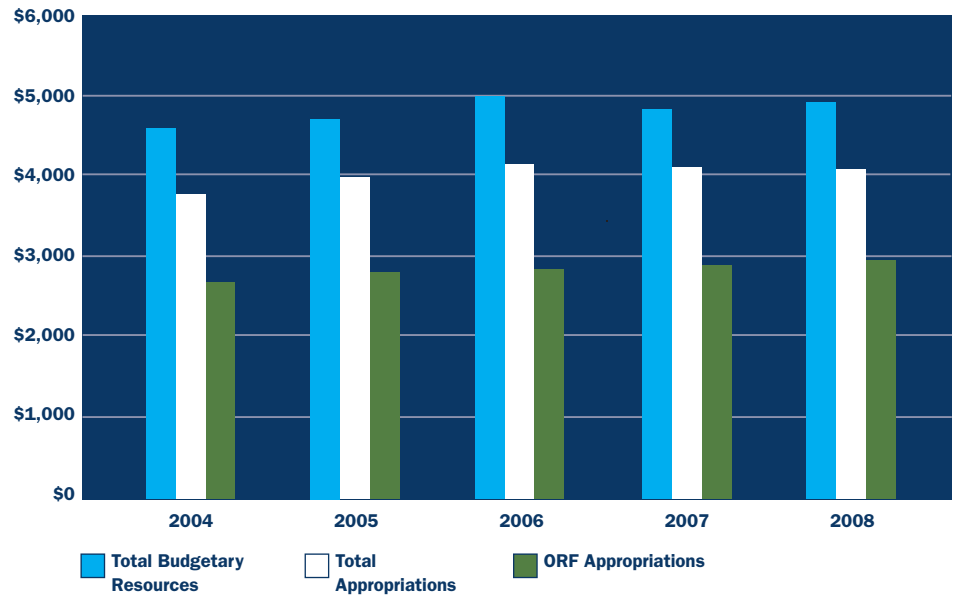
FIGURE 11
Appropriated Capital Used
 (in millions)



Combined Statement of Budgetary Resources

The FY 2008 Statement of Budgetary Resources details how budgetary resources were made available as well as their status at the end of the period. NOAA received approximately 82 percent, or \$4.1 billion, of its budgetary resources of \$5.0 billion through appropriations (Figure 12). Of the \$4.1 billion, NOAA's ORF appropriation received \$3.0 billion. Other major sources of budgetary resources include unobligated balances carried over from FY 2007 and spending authority from offsetting collections, totaling \$291.0 million and \$317.2 million, respectively. Of the total budgetary resources of \$5.0 billion, \$4.5 billion were obligated during FY 2008.

FIGURE 12
Budgetary Resources (in millions)



U.S. Department of Commerce
National Oceanic and Atmospheric Administration
14th and Constitution Avenue, N.W.
Washington, D.C. 20230
www.noaa.gov

National Ocean Service
www.oceanservice.noaa.gov

National Marine Fisheries Service
www.nmfs.noaa.gov

National Weather Service
www.nws.noaa.gov

Office of Oceanic and Atmospheric Research
www.research.noaa.gov

National Environmental Satellite, Data and Information Service
www.nesdis.noaa.gov

Office of Marine and Aviation Operations
www.oma.noaa.gov

Office of Program Planning and Integration
www.ppi.noaa.gov

Office of International Affairs
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