

III. NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Technology Transfer at the Agency's Federal Laboratories – Approach and Plans, FY 2007 Activities/Achievements

1. Agency Approach and Plans for Technology Transfer

NOAA's mission is to understand and predict changes in the Earth's environment and conserve and manage coastal and marine resources to meet the Nation's economic, social, and environmental needs. This mission will become ever more critical in the 21st century as national needs intensify concerning climate change, freshwater supply, ecosystem management, and homeland security.

NOAA is one of the nation's premier scientific agencies. NOAA science and technology impact the daily lives of the nation's citizens and have a significant effect on the national economy. For example, about one-third of the U.S. economy (approximately \$3 trillion) is weather sensitive -- such as agriculture, energy, construction, travel, and transportation. Weather data and forecasts play a critical role -- and are transferred to industry and the public through the media, internet, and NOAA Weather Radio. Governments and the public use weather warnings to save lives and prevent destruction of property. Television weathercasters and many weather related firms use weather data and forecasts in their daily operations. Industry uses NOAA data in home construction and design, crop selection, disease control, and fuel delivery and supply. Additionally, industry has applied weather data for deciding such things as automobile fuel delivery system design, the best time to market umbrellas, and even for when the conditions would be best for the mating of honeybees. Increasingly accurate and longer range weather forecasts depend on an ongoing program of research and development.

Research by NOAA's federal laboratories is aimed at assisting NOAA's operational components. NOAA's research is directed at such topic areas as weather forecasting, solar emission forecasting, estimating fish stocks, predicting water resources, warning of tsunamis, and charting ocean bottom topography. The results of such research are transferred to NOAA's operational components to improve prediction, management, and other mission activities.

NOAA's web page at www.noaa.gov details the voluminous amount of research and technology data made available to the public in the form of information products and services, such as weather and climate forecast data, El Nino prediction and monitoring, tides and currents, satellite imagery and direct readout, fishery statistics and information on protected species, air quality, state of the coasts, beach temperatures, and nautical charts, as well as extensive databases on climate, oceans, ice, atmosphere, geophysics, and the sun.

NOAA's primary technology transfer mechanism has historically been the open dissemination of scientific and technical information to individuals, industry, government, and universities. This means of transfer is consistent with the agency's mission and scientific tradition and has been found to be more efficient and economical than transfer through patenting and licensing. Even

so, NOAA continues, where advantageous, to transfer intellectual property through licenses and CRADAs -- including to industry to benefit the competitiveness of U.S. companies.

In FY 2007, NOAA conducted an extensive technology transfer program through applications of meteorological and oceanographic technologies and information, and through open dissemination to individuals, industry, government, and universities. In addition, NOAA provided daily weather forecasts and warnings through the media and NOAA Weather Radio. NOAA technology is transferred through presentations at scientific meetings, publication in peer-reviewed scientific journals, and through NOAA scientific and technical publications. For example, the NOAA laboratories in the United States published 444 articles in scientific journals and 148 papers in NOAA Tech Reports.

NOAA collaborates with other federal research agencies on science and technology development matters of joint interest. For example, NOAA and the Environmental Protection Agency (EPA) team to provide new experimental air quality forecast guidance that enables state and local agencies to issue more accurate and geographically specific air quality warnings to the public. The annual cost of poor air quality to the U.S. from air pollution-related illnesses has been estimated at \$150 billion.

Furthermore, to ensure that the United States benefits from and fully exploits scientific research and technology developed abroad, NOAA collaborates and shares information with organizations in countries throughout the world. Through these international relationships, technology is transferred into NOAA for the eventual benefit of U.S. industry and public users. For instance, the understanding and forecasting of global phenomena that occur in the atmosphere, oceans, and on the sun require worldwide collaboration and information sharing. This is accomplished through formal agreements with individual countries and participation in international organizations, such as the World Meteorological Organization (WMO), the Intergovernmental Oceanographic Commission (IOC), and the International Astronomical Union (IAU). NOAA also participates in international scientific programs and shares technology and scientific data, such as in the Global Earth Observation System. This effort involves nearly 50 other countries, the European Commission, and 29 international organizations. NOAA also provides technical assistance and training to individuals from other countries, and participates in a visiting scientist program. In addition, environmental data is shared through NOAA participation in the World Data Center program.

In the future, NOAA will continue to direct its technology transfer and international collaboration activities toward four mission goals: 1. protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management; 2. understand climate variability and change to enhance society's ability to plan and respond; 3. serve society's needs for weather and water information; and 4. support the Nation's commerce with information for safe, efficient, and environmentally-sound transportation.

2. Performance in FY 2007: Activities and Achievements

■ Collaborative Relationships for Research & Development

	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
● CRADAs, total active in the FY ⁽¹⁾	11	9	8	6	5
- New, executed in the FY	0	0	0	0	0
▪ Traditional CRADAs, ⁽²⁾ total active in the FY	11	9	8	6	5
- New, executed in the FY	0	0	0	0	0
▪ Non-traditional CRADAs, ⁽³⁾ total active in the FY	0	0	0	0	0
- New, executed in the FY	0	0	0	0	0
● Other types of collaborative R&D relationships	0	0	0	0	0

CRADA = Cooperative Research and Development Agreement.

(1) "Active" = legally in force at any time during the FY. "Total active" is comprehensive of all agreements executed under CRADA authority (15 USC 3710a).

(2) CRADAs involving collaborative research and development by a federal laboratory and non-federal partners.

(3) CRADAs used for special purposes -- such as, material transfer or technical assistance that may result in protected information.

■ Invention Disclosure and Patenting

	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
● New inventions disclosed in the FY ⁽¹⁾	5	2	1	4	0
● Patent applications filed in the FY ⁽²⁾	0	0	1	0	0
● Patents issued in the FY	1	1	1	0	0

(1) Inventions arising at the federal lab.

(2) Tally includes U.S. patent applications, foreign patent applications filed on cases for which no U.S. application was filed, divisional applications, and continuation-in-part applications. Excludes provisional, continuation, duplicate foreign, and PCT applications.

■ Licensing

Profile of Active Licenses

	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
● All licenses , number total active in the FY ⁽¹⁾	5	5	4	5	
▫ New, executed in the FY	2	0	0	1	
▪ Invention licenses , total active in the FY	5	5	4	5	
▫ New, executed in the FY	2	0	0	1	
- Patent licenses, ⁽²⁾ total active in FY	5	5	4	5	
▫ New, executed in the FY	2	0	0	1	
- Material transfer licenses (inventions), total active	0	0	0	0	
▫ New, executed in the FY	0	0	0	0	
- Other invention licenses, total active in the FY	0	0	0	0	
▫ New, executed in the FY	0	0	0	0	
▪ Other IP licenses , total active in the FY	0	0	0	0	
▫ New, executed in the FY	0	0	0	0	
- Copyright licenses (fee bearing)					
▫ New, executed in the FY					
- Material transfer licenses (non-inventions), total active					
▫ New, executed in the FY					
- Other, total active in the FY					
▫ New, executed in the FY					

Multiple inventions in a single license are counted as one license. Licenses that include both patents and copyrights (hybrid licenses) are reported as patent licenses and are not included in the count of copyright licenses.

(1) “Active” = legally in force at any time during the FY.

(2) Patent license tally includes patent applications which are licensed.

Licensing Management

	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005
● Elapsed execution time , ⁽¹⁾ licenses granted in the FY					
▪ Invention licenses					
▫ Average, months	*8.0	5.0	**	**	*7.0
▫ Minimum		6.0			
▫ Maximum		7.0			
- Patent licenses ⁽²⁾					
▫ Average, months	*8.0	5.0	**	**	*7.0
▫ Minimum		6.0			
▫ Maximum		7.0			

	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005
● Licenses terminated for cause, number in the FY					
▪ Invention licenses	0	0	0	0	0
- Patent licenses ⁽²⁾	0	0	0	0	0

Data included in this table (intentionally) addresses only invention licenses, with patent licenses distinguished as a sub-class.

* Only a single new license was executed in FY 2001 and 2002. Thus, there is no range of execution times to report.

** No new licenses were executed in FY 2004 or FY 2005.

(1) Date of license application to the date of license execution. (Date of license application is the date the lab formally acknowledges the written request for a license from a prospective licensee and agrees to enter into negotiations.)

(2) Patent license tally includes patent applications which are licensed.

Characteristics of Licenses Bearing Income

	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
● All income bearing licenses, total number	5	5	4	5	
▫ Exclusive	1	1	1	1	
▫ Partially exclusive	0	0	0	0	
▫ Non-exclusive	4	4	3	4	
▪ Invention licenses, income bearing	5	5	4	5	
▫ Exclusive	1	1	1	1	
▫ Partially exclusive	0	0	0	0	
▫ Non-exclusive	4	4	3	4	
- Patent licenses, ⁽¹⁾ income bearing	5	5	4	5	
▫ Exclusive	1	1	1	1	
▫ Partially exclusive	0	0	0	0	
▫ Non-exclusive	4	4	3	4	
▪ Other IP licenses, income bearing	0	0	0	0	
▫ Exclusive					
▫ Partially exclusive					
▫ Non-exclusive					
- Copyright licenses (fee bearing)					
▫ Exclusive					
▫ Partially exclusive					
▫ Non-exclusive					
● All royalty bearing licenses, ⁽²⁾ total number	5	5	4	5	
▪ Invention licenses, royalty bearing	5	5	4	5	

	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
- Patent licenses, ⁽¹⁾ royalty bearing	5	5	4	5	
▪ Other IP licenses , royalty bearing	0	0	0	0	
- Copyright licenses (fee bearing)					

In general, license income can result from various sources: license issue fees, earned royalties, minimum annual royalties, paid-up license fees, and reimbursement for full-cost recovery of goods and services provided by the lab to the licensee including patent costs.

(1) Patent license tally includes patent applications which are licensed.

(2) Note that royalties are one component of total license income.

Income from Licenses

	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
• Total income , all licenses active in the FY ⁽¹⁾	\$4,716	\$24,961	\$16,100	\$13,100	
▪ Invention licenses	\$4,716	\$24,961	\$16,100	\$13,100	
- Patent licenses ⁽²⁾	\$4,716	\$24,961	\$16,100	\$13,100	
▪ Other IP licenses , total active in the FY	0	0	0	0	
- Copyright licenses					
• Total Earned Royalty Income (ERI) ⁽³⁾	\$4,716	\$24,961	\$16,100	\$13,100	
▫ Median ERI	\$696	\$1,923	\$1,000	\$1,000	
▫ Minimum ERI	\$100	\$116	\$100	\$100	
▫ Maximum ERI	\$1,920	\$21,000	\$9,000	\$5,000	
▫ ERI from top 1% of licenses	\$1,920	\$21,000	\$9,000	\$5,000	
▫ ERI from top 5% of licenses	\$1,920	\$21,000	\$9,000	\$5,000	
▫ ERI from top 20% of licenses	\$1,920	\$21,000	\$9,000	\$5,000	
▪ Invention licenses	\$4,716	\$24,961	\$16,100	\$13,100	
▫ Median ERI	\$696	\$1,923	\$1,000	\$1,000	
▫ Minimum ERI	\$100	\$116	\$100	\$100	
▫ Maximum ERI	\$1,920	\$21,000	\$9,000	\$5,000	
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▫ ERI from top 5% of licenses	\$1,920	\$21,000	\$9,000	\$5,000	
▫ ERI from top 20% of licenses	\$1,920	\$21,000	\$9,000	\$5,000	
- Patent licenses ⁽²⁾	\$4,716	\$24,961	\$16,100	\$13,100	
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▫ ERI from top 5% of licenses	\$1,920	\$21,000	\$9,000	\$5,000	
▫ ERI from top 20% of licenses	\$1,920	\$21,000	\$9,000	\$5,000	

	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
- Other IP licenses, total active in the FY	0	0	0	0	
▫ Median ERI					
▫ Minimum ERI					
▫ Maximum ERI					
▫ ERI from top 1% of licenses					
▫ ERI from top 5% of licenses					
▫ ERI from top 20% of licenses					
- Copyright licenses					
▫ Median ERI					
▫ Minimum ERI					
▫ Maximum ERI					
▫ ERI from top 1% of licenses					
▫ ERI from top 5% of licenses					
▫ ERI from top 20% of licenses					

(1) Total income includes license issue fees, earned royalties, minimum annual royalties, paid-up license fees, and reimbursement for full-cost recovery of goods and services provided by the lab to the licensee including patent costs.

(2) Patent license tally includes patent applications which are licensed.

(3) “Earned royalty” = royalty based upon use of a licensed invention (usually, a percentage of sales or of units sold). Not a license issue fee or a minimum royalty.

Disposition of License Income

	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
• Income distributed ⁽¹⁾					
- Invention licenses, total distributed	\$4,716	\$24,961	\$16,100	\$13,100	
- To inventor(s)	\$1,130 (24%)	\$11,070 (44%)	\$8,400 (52%)	\$7,500 (58%)	
- To other	\$3,586 (76%)	\$13,891 (56%)	\$7,700 (48%)	\$5,600 (42%)	
- Patent licenses, ⁽²⁾ total distributed	\$4,716	\$24,961	\$16,100	\$13,100	
- To inventor(s)	\$1,130 (24%)	\$11,070 (44%)	\$8,400 (52%)	\$7,500 (58%)	
- To other	\$3,586 (76%)	\$13,891 (56%)	\$7,700 (48%)	\$5,600 (42%)	

Invention licenses are the chief policy interest regarding disposition of income; content of table reflects this focus.

(1) Income includes royalties and other payments received during the FY.

(2) Patent license tally includes patent applications which are licensed.

■ Other Performance Measures Deemed Important by the Agency

	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
Journal articles published	626	419	397	444	
Technical reports published	245	300	226	148	

GREAT LAKES ENVIRONMENTAL RESEARCH LABORATORY	FY 2007
Web Site Hits (html pages)	2,244,420
Web Site downloads (PDF pages) (brochures, research papers, technical memos, etc.)	65,740

■ OUTCOMES FROM TECHNOLOGY TRANSFER

For this year's annual report, the cases described below are provided as examples of downstream outcomes being achieved by NOAA technology transfer efforts:

- New Tsunami Warning Stations Deployed.** The launch of the first Deep-ocean Assessment and Reporting of Tsunamis (DART) buoy station in the Indian Ocean in December 2006 marked an important milestone toward the goal of protecting the world from the threat of the deadly waves. Launched just a few weeks short of the second anniversary of the 2004 Boxing Day tsunami in Indonesia, the DART II buoy station brings important tsunami wave data to the region. One of the realities of the 2004 event was that the lack of real-time data made it very difficult to detect and warn of such an event. The DART system was developed by the NOAA Pacific Marine Environmental Laboratory, in Seattle, Washington. The stations consist of a bottom pressure sensor that is anchored to the seafloor and a companion moored surface buoy. An acoustic link transmits data from the bottom pressure sensor to the surface buoy. Then satellite links relay the data to ground stations. The result is tsunami detection that is communicated to forecasters in real-time. The new DART station will equip Indian Ocean countries with additional information to determine if and when to issue tsunami warnings. Thailand is responsible for the deployment and long-term maintenance as per a recently signed Memorandum of Agreement with NOAA. NOAA is also providing the region with technical leadership in building an end-to-end system by improving communications systems, establishing modeling and forecasting capabilities, building resilient communities, providing expertise in building regional and national operations centers, and training technical officials on various aspects of tsunami and multi-hazard warning operations. NOAA and the University of Washington trained tsunami warning and preparedness officials. The initial class included 31 participants from India, Indonesia, Thailand, Sri Lanka, and the Maldives.

The United States and Indonesia also launched a second Dart buoy in the Indian Ocean. The deployment was funded under a US Agency for International Development program (USAID) to make strategic investments in support of the Indian Ocean Tsunami Warning System (IOTWS).

Using technology developed by NOAA, the Australian Bureau of Meteorology deployed its first Deep-ocean Assessment and Reporting of Tsunami buoy station. The DART station is in the Tasman Sea some 1,200 kilometers from Tasmania.

Tsunamis: <http://www.noaa.gov/tsunamis.html>

Real-time DART Data: <http://www.ndbc.noaa.gov/dart.shtml>

● **In Record Wildfire Season, NOAA Satellites Aid U.S. Fire Managers.** The FY 2007 wildfire season in the United States set an all-time record with more than 9.8 million acres burned in more than 96,000 wildfires. NOAA satellites were key in detecting and monitoring the movement of the blazes, providing invaluable information to firefighters on the ground. Throughout the season, NOAA's two geostationary satellites and two polar-orbiting spacecraft provided more than 200 images each day. Along with satellite coverage, part of NOAA's operational fire and smoke program includes the Hazard Mapping System (HMS), which incorporates both NOAA and NASA satellites, tracks smoke from wildfires occurring throughout all of North America and pinpoints fires that are emitting the most smoke. HMS overlays fire locations with satellite imagery, providing analysts on the ground a high measure of quality control. The U.S. Forest Service, the Environmental Protection Agency, state and local land and air quality managers and NOAA's National Weather Service, use fire and smoke products produced by NOAA.

Relevant Web Sites:

NOAA National Fire Weather Program
NOAA Fire Weather Information Center
NOAA Fire Events Satellite Imagery

● **NOAA Providing More Specific Warning Information for Severe Weather.** NOAA's National Weather Service began issuing more geographically specific warnings for tornadoes, severe thunderstorms, floods, and marine hazards. The new storm-based warnings will allow forecasters to pinpoint the specific area where the threats are highest, reducing the area warned by as much as 70 percent when compared to today's county-by-county system. These are potentially deadly, short duration events that can develop very rapidly. NOAA's technology has evolved to support better warnings, and is adapting to meet public expectation to receive weather information on demand. By focusing the threat, NOAA can reduce the warned area by as much as 70 percent, which equates to more than \$100 million in savings to the public. The real bottom line is that this will potentially save more lives. Eliminating areas needlessly warned builds confidence that you need to take action when a warning is issued. Storm-based warnings are displayed graphically and are extremely adaptable to cell phones, PDAs, and the Web. The Emergency Alert System is geared toward counties, and NOAA Weather Radio All Hazards will still alarm if there is a warning anywhere in the county. However, text

and audio messages provide more specific information about where in the county the storm is, and the direction the storm is moving. Storm-based warnings reference landmarks such as highways, shopping centers, and parks, and use directional delimiters to indicate county location.

●**New Rapid Test for Domoic Acid.** NOAA scientists collaborated to develop and commercialize a rapid cost-effective new test to detect domoic acid. Domoic acid is a potent neurotoxin, produced by microalgae in the genus *Pseudo-nitzschia*. Domoic acid has been linked to mass mortalities of marine life including fish, seabirds, sea lions, and sea otters. This toxin concentrates in shellfish, including clams and crabs that people consume and poses a severe human health risk through poisoning and death. NOAA has been leading a research effort to develop and commercialize a more sensitive, low-cost, rapid test based on an enzyme-linked immunosorbent assay (ELISA). The development of programs to analyze the data, tests to determine the shelf life of the reagents and the development of the kit packaging for safe shipping and storage was done in association with an industry partner who will be responsible for commercialization of the DA test kits. NOAA's industry partner, Mercury Science Inc., are producing the test kits at a price of ~\$3.25 per sample, a 77 fold reduction of the cost of the old technique. In addition, NOAA provided training workshops to the Quileute tribe, the Quinault Nation and State regulators in Washington and Oregon. NOAA also held workshops to demonstrate the proper use of the kits to researchers at the University of California Santa Cruz (UCSC) working to enhance California's domoic acid monitoring and to shellfish regulators at the California State Health Department. NOAA worked closely with General Counsel to assign the rights of invention, so the technology developed by this NOAA team in conjunction with its industry partner could be transferred to the private sector. This was a necessary step so the kits could be sold commercially. Future sales of the new test will dramatically improve monitoring of this important environmental toxin. The ability to reliably detect and monitor for domoic acid has wider implications in seafood imports, because domoic acid events, leading to mass mortalities of marine life, and reports of human illness are increasing worldwide. Numerous bloom events have now been reported in coastal regions from California to Chile, both coasts of Canada, and France.

●**NOAA Adds Wind Component to Coral Bleaching Warning System.** NOAA's Coral Reef Watch, a part of the NOAA Coral Reef Conservation Program, now offers a satellite-based experimental low winds product that improves the ability to assess and forecast coral bleaching events. Low wind conditions of less than five knots, commonly known as doldrums, can increase the temperature and light stress that contribute to coral bleaching. Winds promote mixing of the surface waters helping to cool the waters and deliver oxygen to corals and remove nutrients and waste products. Wind-generated waves also scatter light reducing incoming solar radiation to below harmful levels. During periods of sustained low winds, there is less mixing of shallow waters, higher temperatures and increased light penetration promoting environmental conditions adverse to corals, increasing the likelihood of bleaching. High temperatures and light cause corals to expel symbiotic micro-algae living in their tissues—algae that provide corals with food. Losing their algae leaves coral tissues devoid of color, and thus the coral appears to be bleached. Prolonged coral bleaching of more than a week can kill coral and eliminate the habitats needed for a range of marine life. The NOAA Coral Reef Watch Program, gathers four-day mean surface wind data from the QuikSCAT satellite sensor. Persistent regions of low wind conditions are identified, and images and data are made available in a series of formats, including on Google Earth. The experimental doldrums product provides reef managers and

the coral research community with important information on the way that wind conditions influence bleaching and coral reef communities. NOAA's bleaching alerts have proved useful to coral reef managers and researchers in monitoring environmental stresses impacting their reefs. With advance notice, officials can take measures to prevent human activity, such as diving, boating and recreational fishing, from adding to the stress of higher ocean temperatures already affecting the coral reefs. See the Coral Reef Watch website at:

www.coralreefwatch.noaa.gov/satellite/index.html

Information on other Agency Technology Transfer Activities

Data and Resources Available on NOAA Web Pages

NOAA makes available on its web pages large amounts of information and data for transfer to a wide variety of users. Some of the new or updated web pages are as follows:

• **CAMEO Chemicals: NOAA's New Online Tool for Hazardous Materials Responders.** A new online tool for first responders to hazardous chemical accidents has been released by NOAA's Office of Response and Restoration. The new Web site, CAMEO (Computer-Aided Management of Emergency Operations) Chemicals, is the latest component of NOAA's popular CAMEO software suite, and the first to be available for use online. CAMEO is the most widely used chemical response software in the world. It has already been placed in service with a major chemical release on the Mississippi River and a dangerous train derailment in New York. CAMEO Chemicals is an online, easy-to-use version of the most popular components of CAMEO, the chemical database and the reactivity prediction tool. Key features include:

- **Extensive Chemical Database:** CAMEO Chemicals uses the same chemical database as CAMEO, which contains response recommendations for over 6,000 chemicals. The database also contains more than 100,000 chemical synonyms and identification numbers, which aid emergency responders in identifying unknown substances during an incident.
- **Critical Response Information:** The revised search engine and new ranking order for search results makes finding chemicals easier. Data sheets on each chemical provide physical properties, health hazards, information about air and water hazards, and recommendations for firefighting, first aid, and spill response.
- **Chemical Reactivity:** This tool predicts what hazards could arise if chemicals were to mix.

CAMEO Chemicals was developed by NOAA in partnership with the Environmental Protection Agency and the U.S. Coast Guard.

CAMEO Chemicals: <http://cameochemicals.noaa.gov/>

CAMEO Web site: <http://www.epa.gov/ceppo/cameo/>

NOAA's CAMEO information online: <http://response.restoration.noaa.gov/cameo/cameo.html>

•**Technology for Coastal Resource Managers.** The Cooperative Institute for Coastal and estuarine technology (CICEET), a partnership of NOAA and the University of New Hampshire, is responsible for the development and commercial application of technologies that are used by a wide range of coastal resource managers—from the municipal to federal levels of government, in academia, and in the nonprofit and private sectors. CICEET administers nationally competitive funding opportunity programs that focus the expertise of leading scientists on the priority technology needs of coastal resource managers. The Environmental Technology Development (ETD) program has resulted in several commercially available technologies and others that are applied by the private sector to perform services to coastal resource management. Here are a few examples:

•CICEET's investment in an automated radon mapping system for the assessment of submarine

groundwater discharge has led to commercial product development and sales at Durrige, Inc. These products are being used widely by state and federal agencies to help communities develop nutrient budgets for the coastal zone and are proving specially useful in previously hard to monitor estuarine settings. End users of this system are affiliated with East Carolina, Florida State, and Louisiana State universities, Woods Hole Oceanographic Institution, and the U.S. Geological Survey (on behalf of state agencies). Internationally, it is being used in the United Kingdom, France, Monaco, Germany, Philippines, Thailand, Japan, China, Azerbaijan, Israel, on Australia's Great Barrier Reef, and Brazil. Prior to completing the grant, the investigator began to collaborate with Durrige on a data transfer and interface system that would help the technology become a useful and commercially viable product.

•In response to CICEET's call for restoration technologies, researchers from Louisiana State University advanced a vertical-flow constructed wetland that breaks down harmful volatile organic compounds (VOCs) into harmless byproducts. Because of the wide variation in possible configurations for treating VOCs using wetlands, the technique was not patented. Instead, the project investigator worked to advance application with environmental services companies like ENSR AECOM and General Physics Corp, as well as hazardous waste site managers in Louisiana, Minnesota, Michigan, Massachusetts, Maryland, Connecticut, North Carolina, and Tennessee. Because traditional remediation can be costly and maintenance-intensive, site managers and companies have been very receptive to this approach, which relies on natural processes to treat contaminants in place. For example, ENSR-AECOM is using the vertical constructed wetland to address VOC-contaminated groundwater that threatens a drinking water reservoir in North Carolina, and predict they will use this approach widely in the future.

•Serial grant awards from CICEET's ETD allowed researchers from the University of Rhode Island to collaborate with SubChem Systems, Inc., to develop a commercially available nutrient monitoring system that includes the SubChemPak Analyzer, the XZ-Profiler towed chemical measurement system, and the SubChem Analyzer payload for REMUS, an autonomous, underwater vehicle. The system is able to assess seasonal and episodic events such as tidal and wind driven-currents, rainstorms, channel dredging, and ship activity that may lead to sediments resuspension and significant changes in the concentration of dissolved oxygen, chemical contaminants, and nutrients in coastal waters. SubChem Systems has sold these technologies to 13 environmental research

labs, including Florida's Mote Marine Laboratory.

●**NOAA Launches Local Three-Month Temperature Outlook.** In response to customer demand for climate information at the local level, the NOAA National Weather Service launched a new local three-month temperature outlook product for the continental United States. This product allows individuals and businesses to have reliable information to make important economic decisions, and are valuable tools to aid decision-makers in managing risks and opportunities at the regional and local level. Easily accessed on the Internet, the local three-month temperature outlook extends the NOAA Climate Prediction Center's national three-month temperature outlook to specific local sites, providing probabilistic forecasts of the average daily mean temperatures for 13 consecutive overlapping three-month periods (e.g.: January-February-March, February-March-April). It is available for approximately 1,150 sites nationwide. The information is released on the third Thursday of every month. The local three-month temperature outlook can be accessed from the NOAA National Weather Service Web page at:

www.nws.noaa.gov/predictions.php

●**Powerful New Tool to Track Atmospheric Carbon Dioxide by Source.** Scientists from NOAA have a new tool to monitor changes in atmospheric carbon dioxide and other greenhouse gases by region and source. The tool, called CarbonTracker, will enable its users to evaluate the effectiveness of their efforts to reduce or store carbon emissions. The online data framework distinguishes between changes in the natural carbon cycle and those occurring in human-produced fossil fuel emissions. It also provides verification for scientists using computer models to project future climate change. Users include corporations, cities, states and nations assessing their efforts to reduce or store fossil fuel emissions around the world. CarbonTracker distills an accurate assessment of greenhouse-gas increases or decreases. The resolution will increase to observe differences in concentration on finer geographical scales over time as data become available. Using the limited data that currently exist, the model can characterize emissions each month among U.S. regions, such as the West or the Southeast. As the observation network becomes denser, however, policymakers will be able to check the CarbonTracker Web site to compare emissions from urban centers. For instance, the resolution will be fine enough to determine the difference in net emissions from Sacramento as compared to San Francisco. One of the system's most powerful assets is its ability to detect natural variations in carbon uptake and release by oceans and vegetation, which could either aid or counteract societies' efforts to curb fossil fuel emissions on a seasonal basis. NOAA collaborates with partners in France, Australia, Brazil and other nations to measure greenhouse gases globally. Through a longstanding collaboration, Environment Canada has provided a quarter of the data for North America.

Relevant Web Sites:

NOAA CarbonTracker
NOAA Global Monitoring Division
NOAA Earth System Research Laboratory

●**New Federal Plan Keeps Air Travelers Safe from Volcanic Ash.** Federal agencies involved with aviation, volcanoes and weather have created a new way to work together to track volcanic ash plumes and report the risks to the aviation community and keep air travelers out of harm's way. Volcanic ash can cause aircraft engines to fail or damage navigational instruments. The plan, "National Volcanic Ash Operations Plan for Aviation," will improve the safety of flight operations in U.S.-controlled airspace. It defines agency responsibilities, provides a comprehensive description of an interagency standard for volcanic-ash-related observations, advisories, warnings, notices, and forecasts, as well as their formats. It also describes the agency backup procedures for operational products, and outlines the actions each agency will follow during a volcanic eruption that subsequently affects aviation services. The United States is one of the most volcanically rich countries in the world with 169 active and dormant volcanoes. Many of these volcanoes are capable of erupting explosively and ejecting volcanic ash high into busy air routes. When a volcanic ash hazard looms, advanced warning and coordinated efforts to share information among scientists, air traffic controllers, dispatchers and pilots can make a crucial difference in saving lives and protecting property. This plan helps achieve the goal of averting encounters of aircrafts with damaging ash clouds. The risks to aviation from airborne volcanic ash include degraded engine performance, flameouts, loss of visibility, failure of critical navigational and operational instruments and loss of life. Damages up to \$80 million have occurred to a single aircraft. Aircraft encountering less dense volcanic ash clouds can incur longer-term costs due to increased maintenance of engines and external surfaces. The plan was prepared and published by the Federal Coordinator for Meteorological Services and Supporting Research after a series of working group meetings among the Federal Aviation Administration, U.S. Air Force, NOAA, the U.S. Geological Survey, the National Aeronautics and Space Administration, and the Smithsonian Institution's National Museum of Natural History. The Air Line Pilots Association also participated in the development of the plan. The plan can be found Online at: <http://www.ofcm.gov/p35-nvaopa/fcm-p35.htm>

Appendix

A. Progress in the Agency's Performance Metrics for Technology Transfer

In future reports, the agency will list mission-related data that addresses NOAA's primary technology transfer mechanism, which is the open dissemination of its products and services. Presentations at scientific meetings, collaborative research (other than CRADAs), visiting scientists, data exchange agreements, numbers of data requests received by NOAA's environmental data centers, and external agency studies are being investigated as metrics for reporting this aspect of NOAA's technology transfer activities. Annual figures for the number of publications in scientific journals and NOAA technical reports are already included.