

## CHAPTER 3

### National Oceanic and Atmospheric Administration

#### **Overview of NOAA Technology Transfer**

NOAA's mission is to understand and predict changes in climate, weather, oceans, and coasts; to share that knowledge and information with others; and to conserve and manage coastal and marine ecosystems and resources. This mission will become ever more critical in the 21<sup>st</sup> century as national issues related to climate change, severe weather, limited freshwater supply, ecosystem management, and homeland security intensify.

NOAA's definition of technology transfer: *“Technology transfer is the process by which existing knowledge, facilities, or capabilities developed under federal research and development funding are utilized to fulfill public and private needs.”*

#### **NOAA Goals and Technology Transfer**

NOAA is one of the nation's premier scientific agencies providing science-based forecasts and related services to the public on the current and future state of oceans, coasts, the climate, and the weather. Accurate and longer range forecasts depend on a robust and ongoing program of research and development, much of which is done in collaboration with non-federal scientists or is transferred to the public, positively impacting the daily lives of the nation's citizens and providing substantial economic benefits.

NOAA's technology transfer program disseminates applications resulting from its meteorological and oceanographic technologies to individuals, industry, government, and universities. In addition, NOAA provides real-time weather information, including forecasts and warnings, seasonal projections, drought outlooks, and other products through a variety of media, including NOAA Weather Radio. NOAA also transfers its technology through presentations at scientific meetings, publication in peer-reviewed scientific journals, and publication of NOAA scientific and technical documents.

NOAA collaborates with other federal research agencies on many topics of joint interest in science and technology development. For example, a current collaboration with National Institute of Standards and Technology, the US Forest Service, and other agencies provides research in support of operational fire weather forecasts. According to a 2008 report from NOAA's Science Advisory Board, “Wildfire-suppression costs are estimated at \$3B a year, with additional costs for damage to property, infrastructure, health (particularly from air quality issues), and natural resources. Insurance claims from wildland fires are averaging \$1 billion a year this decade, with claims from 2007 alone totaling \$4 billion. Local and regional weather play significant roles in the initiation of wildland fire and on the behavior of the fire once it has

started. Much of the historical research on fires has focused on surface conditions but there is increasing recognition that the three-dimensional atmosphere also plays a key role. While the specific effects of climate change on wildfire occurrence, extent, and severity are likely to vary in different regions of the country, there is growing scientific evidence that climate change will increase the number and size of wildfires”<sup>1</sup>.

To ensure that 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, NOAA receives technology that may eventually benefit U.S. industries and public users. For example, 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 participates in international scientific programs, such as in the Global Earth Observation System, and shares technology and scientific data. This effort involves nearly 50 countries, the European Commission, and 29 international organizations. NOAA also provides technical assistance and training to individuals from other countries, and participates in an international visiting scientist program. Further, NOAA shares environmental data through its participation in the World Data Center program.

Over the next five years, NOAA will continue to direct its technology transfer and international collaboration activities toward accomplishing its four mission goals:

1. **Climate Adaptation and Mitigation:** An informed society anticipating and responding to climate and its impacts;
2. **Weather-Ready Nation:** Society is prepared for and responds to weather-related events;
3. **Healthy Oceans:** Marine fisheries, habitats, and biodiversity are sustained within healthy and productive ecosystems; and
4. **Resilient Coastal Communities and Economies:** Coastal and Great Lakes communities are environmentally and economically sustainable.

## **Current Technology Transfer Mechanisms**

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. Although NOAA finds this method of technology transfer to be the most efficient and economical, NOAA continues to transfer certain intellectual property through MOUs, licenses, and Cooperative

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<sup>1</sup> Fire Weather Research: A Burning Agenda for NOAA. A Report from the NOAA Science Advisory Board, October 22, 2008. [http://www.sab.noaa.gov/Reports/2008/FWRWGreportFINALfromSABtoNOAA\\_11\\_03\\_08.pdf](http://www.sab.noaa.gov/Reports/2008/FWRWGreportFINALfromSABtoNOAA_11_03_08.pdf)

Research and Development Agreements (CRADAs) when it provides a competitive edge to U.S. companies. The following are additional technology transfer mechanisms used by NOAA:

### **Cooperative and Joint Institutes**

NOAA Cooperative Institutes are academic and non-profit research institutions that demonstrate the highest level of performance and conduct research that supports NOAA's Mission Goals and Strategic Plan. Many of the Cooperative Institutes are collocated with NOAA research laboratories, creating a strong, long-term collaboration between scientists in the laboratories and in the university. Cooperative Institutes not collocated with a NOAA laboratory often serve diverse research communities and research programs throughout NOAA. In addition, many of the cooperative agreements between NOAA and our academic partners provide for formal NOAA sponsorship of students through fellowships. Cooperative Institutes are located at parent institutions whose geographic expanse extends from Hawaii to Maine and from Alaska to Florida. Currently, NOAA supports 18 Cooperative Institutes consisting of 48 universities and research institutions across 21 states, Puerto Rico and the US Virgin Islands.

### **International Working Groups and Assessments**

Because many environmental policy-setting institutions rely on clear scientific information for decisions, NOAA researchers make it a priority to summarize and translate scientific understanding for constituents. Our researchers play leading roles in scientific assessments that relate the "state of the science" on topics including ozone layer depletion (Montreal Protocol, UNEP / WMO), climate change (IPCC, USGCRP), safety and security of shipping and the prevention of marine pollution by ships (IMO), and air quality (NARSTO).

As an indication of the value placed on such assessments, the IPCC (Intergovernmental Panel for Climate Change) was awarded the 2007 Nobel Peace Prize for its role in communicating understanding of man-made climate change through its scientific reports over the past 20 years. Several NOAA researchers received this award for their contributions to the IPCC reports.

### **National Data Centers and Public Data Portals**

NOAA provides a wide variety of environmental data, models, and resources to the public through its public data centers and data portals. Scientists, academics, industry specialists, and the interested public may all access full data sets relating to the full range of NOAA's mission activities. Following are the primary NOAA data centers and portals.

*National Oceanographic Data Center (NODC)* archives and distributes oceanographic data and information. These data include physical, biological, and chemical measurements from in situ oceanographic observations, satellite remote sensing, and industrial oceanographic activities in coastal and deep ocean areas.

Through NODC archive and access services, these ocean data are used to answer questions about climate change, ocean phenomena, and management of coastal and marine resources, marine transportation, recreation, national security, and natural disasters. Another significant user community is Education, where these data and information products help teach each new generation of students about the oceans. Requests for oceanographic data and information have increased each year since the Center was established in 1961.

*The National Climatic Data Center* is the world's largest active archive of weather and climate data. These are the cornerstone for the prediction of future events, which affect the world's environment and economy. NCDC responds to data requests from all over the world.

NCDC is the authoritative source for climate monitoring. State of the Climate reports are published monthly and annually for the United States and the globe.

NCDC operates the World Data Center for Meteorology that is co-located at NCDC in Asheville, North Carolina, and the World Data Center for Paleoclimatology that is located in Boulder, Colorado.

NCDC supports a three tier national climate services support program - the partners include: NCDC, Regional Climate Centers, and State Climatologists.

*The National Geophysical Data Center* provides stewardship, products, and services for geophysical data from our Sun to Earth and Earth's sea floor and solid earth environment, including Earth observations from space.

*The Geophysical Fluid Dynamics Laboratory (GFDL) Data Portal:* Public data sets from GFDL are made available through the GFDL Data Portal. The Data Portal is designed to allow one to download files, display data file attributes, and graphically display the data. One can download complete files via "http" and "ftp" access. One can also display data file attributes that provide information about file contents without having to download the file itself. Continued development of the Live Access Server is ongoing to enhance the ability of a remote user to graphically display the data.

*NOAA Environmental Visualization Laboratory:* EVL is the only full-time science and data visualization program within NOAA. Our staff is supported through NESDIS/STAR and through collaboration with other NOAA organizations and scientists. All animations and images accessed through this website are in the public domain and are freely available for reuse.

*Significant Events Imagery:* The Operational Significant Event Imagery team produces high-resolution, detailed imagery of significant environmental events that are visible in remotely-sensed data available at the NOAA Science Center in Suitland, Maryland. The media resources page provides members of the media with broadcast, print and web-quality imagery created by

the OSEI team of particularly significant or newsworthy environmental events that are visible in satellite data available to us.

*CLASS Data Archive*: The Comprehensive Large Array-data Stewardship System (CLASS) is an electronic library of NOAA environmental data. This web site provides capabilities for finding and obtaining those data.

*National Data Buoy Center*: The National Data Buoy Center (NDBC) manages the development, operations, and maintenance of the national data buoy network. It serves as the NOAA focal point for data buoy and associated meteorological and environmental monitoring technology. It provides high quality meteorological/environmental data in real time from automated observing systems that include buoys and a Coastal-Marine Automated Network (C-MAN) in the open ocean and coastal zone surrounding the United States. It provides engineering support, including applications development, and manages data buoy deployment and operations, and installation and operation of automated observing systems installed on fixed platforms. It manages the Volunteer Observing Ship (VOS) program to acquire additional meteorological and oceanographic observations supporting NWS mission requirements. It operates the NWS test center for all surface sensor systems. It maintains the capability to support operational and research programs of NOAA and other national and international organizations.

*National Centers for Environmental Prediction (NCEP) Central Operations (NCO)*: NCO sustains and executes the operational suite of numerical analyses and forecast models and prepares NCEP products for dissemination.

*NCEP Environmental Modeling Center*: EMC develops and improves numerical weather, climate, hydrological and ocean prediction through a broad program in partnership with the research community.

*U.S. Integrated Ocean Observing System (IOOS<sup>®</sup>): Data Management Subsystem*: The Data Management and Communications (DMAC) subsystem is the central mechanism for integrating all existing and projected data sources. The U.S. IOOS Program has developed common services for bringing data together and making it accessible in a common format. IOOS partners collect coastal and marine data — water temperature, water level, currents, winds, waves, and more — using satellites, buoys, tide gauges, radar stations and underwater vehicles. This ocean data is then turned into information that people can use, often in the form of forecasts and products designed to track, predict, manage, adapt, and respond to changes in our marine environment. At the Global level, NOAA's OAR/CPO/Climate Observation Division provides access to data from global programs such as ARGO, Tide gauges, drifting buoys, and open-ocean moored buoys. At the National level, the National Data Buoy Center (NDBC), the Center for Operational Oceanographic Product and Services (CO-OPS) and NOAA/NESDIS Coastwatch are U.S. IOOS data assembly centers that contribute to U.S. IOOS. At the Regional level, U.S. IOOS has eleven Regional Coastal Ocean Observing Systems (RCCOS) spanning the entire United States coastal

area and the Great Lakes. The RCOOS have stood up Regional data assembly centers that provide access to State, Local, Tribal government, academia and research institutes, industry and non-governmental organizations. Two examples are the IOOS Regional Partner, Central and Northern California (CeNCOOS), which provides real-time ocean and coastal information from 183 assets and 23 partners and our Pacific Northwest partner, the Northwest Association of Networked Ocean Observing Systems (NANOOS), which provides information from 167 assets and 25 partners. The U.S. IOOS data catalog/portal provides users a single location where they can search for and retrieve data. The goal is to maximize the availability of data by allowing users to find the data they want, for the location and time period of interest, from all available U.S. IOOS partners without having to know in advance what partners actually operate the observing systems and data servers.

### **NOAA Test Beds and Proving Grounds**

Testbeds and proving grounds have become a key strategy in NOAA to link research and operations (<http://www.testbeds.noaa.gov>). NOAA testbeds and proving grounds include:

*Aviation Weather Testbed (AWC)*: AWC tests new science and technology to produce better aviation weather products and services.

*Climate Testbed (CTB)*: CTB accelerates transition of scientific advances from the climate research community to improved NOAA climate forecast products and services.

*Developmental Testbed Center (DTC)*: DTC improves weather forecasts by facilitating transition of the most promising new NWP techniques from research into operations.

*GOES-R Proving Ground (GRPG)*: GRPG tests and evaluates simulated GOES-R products before the GOES-R satellite is launched into space.

*Hazardous Weather Testbed (HWT)*: HWT accelerates transition of new meteorological insights and technologies into advances in forecasting and warning for hazardous weather events.

*Hydrometeorology Testbed (HMT)*: HMT conducts research on precipitation and weather conditions that can lead to flooding, and fosters transition of scientific advances and new tools into forecasting operations.

*Joint Center for Satellite Data Assimilation (JCSDA)*: JCSDA accelerates and improves use of research and operational satellite data in weather, ocean, climate and environmental analysis and prediction systems.

Joint Hurricane Testbed (JHT): JHT is a competitive, peer-reviewed, granting process to choose the best mature research products for testing and transitioning to operations. Includes modeling, data gathering, and decision support components.

Operations Proving Ground (OPG): NOAA's National Weather Service OPG serves as a framework to advance NWS decision-support services and science & technology for a weather-ready nation.

Space Weather Prediction Testbed (SWPT): SWPT supports development and transition of new space weather models, products, and services.

Related programmatic testing activities in NOAA include the Coastal and Ocean Modeling Testbed (COMT), established by the U.S. IOOS Program with the Southeastern Universities Research Association (SURA) to accelerate the transition of scientific and technical advances from the coastal and ocean modeling research community to improve identified operational ocean products and services. Initially developed to address chronic issues of high relevance in the Atlantic and Gulf regions, such as flooding from storm surge and seasonal depletion of oxygen in shallow waters, this project has established a robust infrastructure to facilitate model assessment and detailed scientific investigation of both model output and data. Through the COMT, methods will also be explored for effectively delivering model results to regional centers, scientists, and managers relying on U.S. IOOS.

### **Peer Reviewed Publications and Technical Reports**

Peer-reviewed publications and technical reports are a direct method of disseminating our research results to industry, academia, and other agencies. In 2011, NOAA staff authored more than 1,000 publications in peer-reviewed journals and produced 150 technical reports.

### **Websites and Web Portals**

NOAA and its programs, laboratories, and data centers each have a dedicated public website. These sites provide useful environmental data and information to the public. In addition, NOAA portals, such as the Climate Portal at Climate.gov, seek to provide the public and decision-makers with educational materials, news, data, and access to specific services.

### **Outreach and Education**

The NOAA Office of Education oversees a range of programs, scholarships, and grant programs that transfer knowledge from NOAA.

The Educational Partnership Program: The goal of the Educational Partnership Program is to increase the number of students from underrepresented communities who are educated, trained and graduated in fields that directly support NOAA's mission.

Cooperative Science Centers: EPP established five Cooperative Science Centers at Minority Serving Institutions (MSIs) to advance collaborative research in the NOAA-related sciences.

Graduate Sciences Program: The Graduate Sciences Program (GSP) is aimed primarily at increasing opportunities for students in NOAA-related fields to pursue research and educational training in atmospheric, environmental, remote sensing and oceanic sciences.

Undergraduate Scholarship Program: The Undergraduate Scholarship Program provides an opportunity for rising junior and senior students to study disciplines relating to the NOAA's mission.

*Environmental Literacy Grants Program:* NOAA's Office of Education advances public environmental literacy and learning in science, technology, engineering, and mathematics (STEM) through the Environmental Literacy Grants (ELG) Program. The ELG Program is a competitive grants program that supports formal and informal/non-formal education projects implemented on regional to national scales. The ELG Program's primary mission is to increase the understanding and use of environmental information to promote stewardship and increase informed decision making by U.S. educators, students, and the public, which directly contributes to NOAA's mission.

*Bay Watershed Education and Training (B-WET):* B-WET is an environmental education program that promotes locally relevant, experiential learning in the K-12 environment. The primary delivery of B-WET is through competitive funding that promotes Meaningful Watershed Educational Experiences (MWEEs). B-WET currently serves seven areas of the country: California, Chesapeake Bay, Great Lakes, Gulf of Mexico, Hawai'i, New England, and the Pacific Northwest.

*Ernest F. Hollings Scholarship Program:* The Hollings Scholarship Program provides successful undergraduate applicants with awards that include academic assistance (up to a maximum of \$8,000 per year) for full-time study during the 9-month academic year; a 10-week, full-time internship position (\$650/week) during the summer at a NOAA facility; and, if reappointed, academic assistance (up to a maximum of \$8,000) for full-time study during a second 9-month academic year. The internship between the first and second years of the award provides the Scholars with "hands-on"/ practical educational training experience in NOAA-related science, research, technology, policy, management, and education activities. Awards also include travel funds to attend a mandatory NOAA Scholarship Program orientation, conferences where students present a paper or poster, and a housing subsidy for scholars who do not reside at home during the summer internship.

## **Commercialization and Technology Development Plan and Transfer Initiatives**

### Overview:

The NOAA Office of Research and Technology Applications (ORTA), housed under the NOAA Office of Oceanic and Atmospheric Research (OAR), serves as the central point for providing service to NOAA Labs and external organizations for technology transfer.

In 2010, ORTA staff conducted an initial survey of NOAA staff from each Line Office to determine the overall awareness of the program and effectiveness of the tools provided. The results showed a general lack of knowledge related to mechanisms for technology transfer across the organization, as well as a consistent need for knowledgeable, dedicated staff in ORTA to act as a single resource for NOAA scientists with commercialization activities. To quote one response: “To develop any of these types of commercialization agreements requires development of this skill set by leadership and other staff who work to develop these types of agreements...scientists have the technical skill sets but not the legal knowledge of how to move these agreements forward and this often leads to very inefficient use of time by both parties.”

Based on the findings from these initial surveys, ORTA has proposed a series of eight programmatic actions to increase internal and external awareness, improve support and programmatic functions, and better track our progress toward increasing technology transfer.

### Action 1: Optimize ORTA Management and Staffing Structure:

The ORTA (Technology Transfer Office) is the link between internal laboratories and external technology transfer customers. In order to provide the required level of service, ORTA will seek staffing consistent with its mandated functions of managing technology transfer and the Small Business Innovation Research Program. In addition, ORTA will work through the Research Council to request each NOAA lab designate one scientific staff member as a point of coordination for Laboratory technologies and technology transfer activities.

The NOAA ORTA will also seek two staff-level details to work for a six to twelve month period on technology transfer activities. These details will enable candidates to combine their science, legal or business background with training and experience in the technology transfer field. The selected staff will work with ORTA staff, as well as researchers and technology and business development individuals within and outside NOAA on the following activities:

- Evaluation of technology for patentability and commercialization;
- Identifying laboratory technologies to be used in partnering efforts;
- Development of marketing materials, such as brochures, posters, or technology summaries;
- Drafting and negotiating Cooperative Research and Development Agreements; (CRADAs) for NOAA scientists and their industrial/academic research partners;

- Organization of specialized meetings or conference sessions;
- Development of technology transfer educational programs for scientists;
- Program coordination and monitoring;
- Developing technology transfer success stories;
- Overseeing patent related issues for NOAA scientists;
- Other duties as pertaining to intellectual property and technology transfer.

ORTA staff will work closely with other agencies to implement, as much as possible, a set of commercialization best practices for NOAA. The goal for these activities will be to maintain develop a consistent process and framework with other agencies, streamline administrative processes where possible, and take advantage of the lessons-learned from more mature programs.

Lastly, ORTA will seek to have a trained specialist in technology transfer processes to answer staff questions regarding licensing, CRADAs and MOUs. This person will work closely with designated staff in the NOAA Office of General Counsel to provide consistent and seamless support and minimize the administrative burden on NOAA scientists and staff.

Action 2: Set Up Centralized Patent Fund for NOAA:

To encourage the broader use of patents in NOAA, ORTA will seek annual funding for a USPTO account to pay patent application and maintenance fees for NOAA scientists. This resource would remove the current burden from the individual Laboratory and have great potential of increasing invention disclosures and patent applications NOAA-wide.

Action 3: Programmatic Advice and Guidance:

ORTA has already been working through the NOAA Research Council (RC) to review and approve SBIR annual solicitations. Expanding on this paradigm, the RC agreed to provide advice and general guidance to ORTA. ORTA has also stood up a NOAA-wide coordination group to increase the awareness and facilitate a range of technology transfer activities.

ORTA is located administratively under the Office of Atmospheric and Oceanic Research and receives funding from across NOAA. ORTA will maintain programmatic independence; the RC will provide guidance and advice to ORTA on issues of strategic importance for NOAA R&D. The RC will also help focus ORTA technology transfer activities to align closely with strategic R&D priorities. Finally, the RC will provide ORTA a direct line of communication with NOAA leadership through the NOAA Chief Scientist.

In addition, ORTA will closely coordinate with NOAA Line Office Transition Managers to ensure ORTA policies and procedures are consistent with their activities as guided by NOAA Administrative Order NAO 216-105.

#### Action 4: Establish Technology Transfer Review Board:

Determining technologies for which NOAA should seek patent protection is a key component of the technology transfer process. Currently, there is no process in place for this activity. A NOAA review board would provide inventors the opportunity to present detailed information concerning their technology. The review board would determine which technologies to move forward with based on NOAA mission and which has the highest commercial potential. ORTA will work with the RC to determine the best path forward for establishing this proposed board.

#### Action 5: Enhance Internal Education:

ORTA will provide NOAA laboratory and program personnel with training in the following areas:

- A general understanding of intellectual property and intellectual property rights
- The necessity of protecting innovations
- Avoiding premature disclosure
- Working with the NOAA ORTA and patent counsel
- Filing disclosure statements
- Filing patent applications

Activities may include:

- An initial briefing to NOAA Senior Leadership explaining the benefits and necessity of technology transfer followed by a briefing.
- Release of a memo/email from the NOAA Administrator to staff on the benefits of technology transfer.
- Follow-up with a memo/email from the NOAA Chief Scientist explaining the technology transfer process to NOAA Managers.
- Continuing message to the research staff and management that invention recognition, disclosure, patenting (when appropriate) and licensing are important to NOAA's mission.
- Brown bag seminars, webinars, one-on-one and small group interactions, including:
  - ORTA staff and DOC/NIST Counsel (**Initial NOAA Library brown bag was held December 6, 2011**)
  - Staff responsibility to disclose inventions
  - How to recognize technological innovation and inventions
  - How to report emergent inventions using the invention disclosure form
  - ORTA support for invention disclosure
  - Staff incentives for disclosure
- Update to ORTA website to provide points of contact, links to needed forms and templates, as well as extensive background information on program benefits.

Action 6: Increase Outreach to Industry:

ORTA will begin activities designed to better inform the public of the processes and benefits of partnering with NOAA for research and development activities. The activities may include:

- **Website Redesign:** We will redesign of the ORTA website to feature pending opportunities, benefits, success stories, and answers to FAQs for companies or other entities looking to partner with NOAA.
- **Trade Show Marketing:** ORTA staff will attend selected events and trade shows to meet with target audiences and distribute ORTA marketing materials.
- **Targeted Meetings:** ORTA staff will meet with select trade associations and NGOs to increase awareness of technology transfer opportunities and brainstorm methods of increasing technology transfer activities with NOAA.
- **Joint Meetings with DoC Partners:** ORTA staff will collaborate with its sister bureaus in the Department of Commerce and in other agencies to initiate joint outreach and promotional activities.

Action 7: Develop Database of NOAA Technologies and Opportunities:

ORTA envisions part of the Laboratory technology transfer representative’s time would be spent compiling a list of technologies available in their respective Laboratory, which could then be included in a centralized database for all of NOAA.

ORTA is currently exploring a number of internal NOAA and existing technology transfer database capabilities for hosting NOAA technology transfer data. The focus of the ORTA effort will be to use existing capabilities to meet these needs and not recreate or duplicate efforts.

Action 8: Improve Performance Measurement and Tracking:

NOAA has identified 8 performance measures as an initial basis to track the effectiveness of its technology transfer. ORTA will review this set annually and update measures to ensure NOAA’s ability to effectively monitor its performance. NOAA ORTA will request reporting of these performance measures quarterly to determine progress toward quarterly and annual goals. We believe individual performance results will vary even under ideal programmatic circumstances. However, taken as a whole, we believe this set of performance metrics will offer an accurate snapshot of NOAA’s ongoing technology transfer activities and will provide valuable insight for ORTA to structure its education and training activities in the future.

NOAA will use the following chart and measures to track its performance metrics each annually.

	Q1 Goal	Q1 TTL	Q2 Goal	Q2 TTL	Q3 Goal	Q3 TTL	Q4 Goal	Q4 TTL	Annual Goal	Annual Total
Number of CRADAs										

Completed										
Number of Licenses Completed										
Number of MOUs with External Entities Completed										
Number of Patents Completed										
Number of NOAA CI/JI authored peer-reviewed papers										
Number of Data/Data Product Downloads from NOAA Data Centers										
Number of Peer Reviewed Publications										
Number of In-Reach Training Seminars by ORTA										