CHAPTER 3

National Oceanic and Atmospheric Administration

Agency Approach and Plans for Technology Transfer

The mission of the National Oceanic and Atmospheric Administration (NOAA) 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 related to climate change, limited 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. About one-third of the U.S. economy (approximately $3 trillion) is weather sensitive. The agriculture, energy, construction, health, travel, and transportation industries are almost entirely weather dependent. Weather data and forecasts play a critical role in these major economic sectors of our economy-- and are transferred to the industry and the public through the media, internet, and NOAA Weather Radio. Federal, State, and local 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. Weather data have been used for deciding such things as automobile fuel delivery system design, the best time to market umbrellas, and even for when the conditions would be optimum 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 laboratories is primarily aimed at assisting NOAA's operational components. Recent examples demonstrating the direction of NOAA's research are weather forecasting, solar emission forecasting, estimating fish stocks, predicting water resources, warning of tsunamis, and charting ocean bottom topography. Research results 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, fishery statistics, 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 Cooperative Research and Development Agreements (CRADAs) -- with industry to benefit the competitiveness of U.S. companies.

In FY 2009, 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 also transferred through presentations at scientific meetings, publication in peer-reviewed scientific journals, and through NOAA scientific and technical publications.

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 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 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 an international visiting scientist program. In addition, environmental data are 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.

Performance in FY 2009: Activities and Achievements

■ Collaborative Relationships for Research & Development

	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
● **CRADAs,** total active in the fiscal year [1]	8	6	5	4	5
- New, executed in the fiscal year	0	0	0	1	1
▪ Traditional CRADAs,[2] total active in the fiscal year	8	6	5	4	5
- New, executed in the fiscal year	0	0	0	0	0
▪ Non-traditional CRADAs,[3] total active in the fiscal year	0	0	0	0	0
- New, executed in the fiscal year	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 fiscal year. "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 2005	FY 2006	FY 2007[3]	FY 2008	FY 2009
● New inventions disclosed in the fiscal year [1]	1	4	3	0	4
● Patent applications filed in the fiscal year [2]	1	0	2	3	1
● Patents issued in the fiscal year	1	0	0	1	0

(1) Inventions arising at the Federal laboratory.
(2) 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.
(3) Correction made to FY 2007 on number of patent applications and patents issued. The patent for the DART (Deep-ocean Assessment and Reporting of Tsunamis) system was expected to be issued in September 2007 but was not issued until October 30, 2007.

■ Licensing

Profile of Active Licenses

	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
● **All licenses**, number total active in the FY [(1)]	4	5	6	6	7
▫ New, executed in the FY	0	1	3	0	1*
▪ **Invention licenses**, total active in the FY	4	5	6	6	7
▫ New, executed in the FY	0	1	3	0	0
- Patent licenses,[(2)] total active in FY	4	5	6	6	7
▫ New, executed in the FY	0	1	3	0	0
- Material transfer licenses (inventions), total active	0	0	0	0	0
▫ New, executed in the FY	0	0	0	0	0
- Other invention licenses, total active in the FY	0	0	0	0	0
▫ New, executed in the FY	0	0	0	0	0
▪ **Other IP licenses**, total active in the FY	0	0	0	0	0
▫ New, executed in the FY	0	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.
* One-Time License only with one-time flat fee royalty

Licensing Management

	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
● **Elapsed execution time**,[(1)] licenses granted in the FY					
▪ **Invention licenses** ▫ Average, months ▫ Minimum ▫ Maximum	*	7.0	5.0 6.0 7.0	*	7.0
- Patent licenses [(2)] ▫ Average, months ▫ Minimum ▫ Maximum	*	7.0	5.0 6.0 7.0	*	7.0
● **Licenses terminated for cause**, number in the FY					
▪ Invention licenses	0	0	0	0	0

	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
- 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.

* No new licenses were executed in FY 2004, FY 2005, 2008.

(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 2005	FY 2006	FY 2007	FY 2008	FY 2009
● **All income bearing licenses**, total number	4	5	4	4	5
▫ Exclusive	1	1	0	0	0
▫ Partially exclusive	0	0	0	0	0
▫ Non-exclusive	3	4	4	4	5
▪ **Invention licenses**, income bearing	4	5	4	4	5
▫ Exclusive	1	1	0	0	0
▫ Partially exclusive	0	0	0	0	0
▫ Non-exclusive	3	4	4	4	5
- Patent licenses,[1] income bearing	4	5	4	4	5
▫ Exclusive	1	1	0	0	0
▫ Partially exclusive	0	0	0	0	0
▫ Non-exclusive	3	4	4	4	5
▪ **Other IP licenses**, income bearing	0	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	4	5	4	4	5
▪ **Invention licenses**, royalty bearing	4	5	4	4	5
- Patent licenses,[1] royalty bearing	4	5	4	4	5
▪ **Other IP licenses**, royalty bearing	0	0	0	0	0
- Copyright licenses (fee bearing)	4	5	4	4	5

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 2005	FY 2006	FY 2007	FY 2008	FY 2009
● **Total income**, all licenses active in the FY [(1)]	$16,100	$13,100	$22,000	$69,007	$138,444[(4)]
▪ **Invention licenses**	$16,100	$13,100	$22,000	$69,007	$138,444
- Patent licenses [(2)]	$16,100	$13,100	$22,000	$69,007	$138,444
▪ **Other IP licenses**, total active in the FY	0	0			
- Copyright licenses					
● **Total Earned Royalty Income** (ERI) [(3)]	$16,100	$13,100	$22,000	$69,007	$138,444
▫ Median ERI	$1,000	$1,000	$4,000	$9,007	$19,000
▫ Minimum ERI	$100	$100	$1,000	$1,000	$1,000
	$9,000	$5,000	$9,000	$25,000	$75,000
▫ ERI from top 1% of licenses	$9,000	$5,000	$9,000	$25,000	$75,000
▫ ERI from top 5% of licenses	$9,000	$5,000	$9,000	$25,000	$75,000
▫ ERI from top 20% of licenses	$9,000	$5,000	$9,000	$25,000	$75,000
▪ **Invention licenses**	$16,100	$13,100	$22,000	$69,007	$138,444
▫ Median ERI	$1,000	$1,000	$4,000	$9,007	$19,000
▫ Minimum ERI	$100	$100	$1,000	$1,000	$1,000
▫ Maximum ERI	$9,000	$5,000	$9,000	$25,000	$75,000
▫ ERI from top 1% of licenses	$9,000	$5,000	$9,000	$25,000	$75,000
▫ ERI from top 5% of licenses	$9,000	$5,000	$9,000	$25,000	$75,000
▫ ERI from top 20% of licenses	$9,000	$5,000	$9,000	$25,000	$75,000
- Patent licenses [(2)]	$16,100	$13,100	$22,000	$69,007	$138,444
▫ Median ERI	$1,000	$1,000	$4,000	$9,007	$19,000
▫ Minimum ERI	$100	$100	$1,000	$1,000	$1,000
▫ Maximum ERI	$9,000	$5,000	$9,000	$25,000	$75,000
▫ ERI from top 1% of licenses	$9,000	$5,000	$9,000	$25,000	$75,000
▫ ERI from top 5% of licenses	$9,000	$5,000	$9,000	$25,000	$75,000
▫ ERI from top 20% of licenses	$9,000	$5,000	$9,000	$25,000	$75,000
▪ **Other IP licenses**, total active in the FY	0	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					

	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
- 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 & 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.
(4) Increase is due to a license with Walt Disney for NOAA's Science on a Sphere for a one-time royalty of $75,000.

Disposition of License Income

	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
● **Income distributed** (1)					
▪ **Invention licenses**, total distributed	$16,100	$13,100	$22,000	$69,007	$138,444
- To inventor(s)	$8,400 (52%)	$7,500 (57%)	$12,200 (55%)	$21,802 (32%)	$45,153 (33%)
- To other	$7,700 (48%)	$5,600 (43%)	$9,800 (45%)	$46,205 (68%)	$93,291 (67%)
- Patent licenses, (2) total distributed	$16,100	$13,100	$22,000	$69,007	$138,444
- To inventor(s)	$8,400 (52%)	$7,500 (57%)	$12,200 (55%)	$21,802 (32%)	$45,153 (33%)
-To other	$7,700 (48%)	$5,600 (43%)	$9,800 (45%)	$46,205 (68%)	$93,291 (67%)

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 2005	FY 2006	FY 2007*	FY 2008*	FY 2009
Journal articles published	397	444	833	774	631
Technical reports published	226	148	265	201	134

*Publication counts have been recently updated by the NOAA Laboratories for FY 2007 and FY 2008.

GREAT LAKES ENVIRONMENTAL RESEARCH LABORATORY	FY 2007	FY 2008	FY 2009
Website hits (HTML pages)	2,244,420	3,086,605	2,790,351
Website downloads (PDF pages)—brochures, research papers, technical memos, etc.	65,740	110,880	93,400

*Update made for FY2007 and FY 2008 on number of articles published and reports published.

	FY 2009
NOAA Inventors on Patents filed "by Others"	**1***

*NOAA's PMEL Scientist on Cortland Patent

Other Performance Measures Deemed Important by the Agency

■ Prestigious Awards for NOAA's Scientific Technology received in FY 2009

● NOAA Technology Transfer Award:

Tracy Hansen, Thomas LeFebvre, Mark Mathewson, Mike Romberg – In recognition of the development of the Graphical Forecast Editor, which has proven its worth beyond government rank and is being used by private industry
to support forecast operations.

● NOAA Gold Medal Award:

Roland Draxler – In recognition "for being the driving force behind the initial development and continued improvement of the Hybrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) atmospheric and dispersion modeling system. He led the successful transfer of the HYSPLIT from research to operations within NOAA, where it supports protection of the public from hazards such as toxic chemicals, wildfire smoke, radioactive plumes, and volcanic ash. He has also led collaborations, technology transfer, and training that have enabled other agencies and countries to use HYSPLIT to protect life, property, and the environment."

Example Outcomes from NOAA Technology Transfer

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

● Tsunami "Train-the-Trainer" Training

The Washington State Train-the-Trainer program aims to develop an educational curriculum to train qualified Tsunami Public Education Instructors. The Train-the-Trainer program is a joint effort of the NOAA Center for Tsunami Research (NCTR) and the Washington state Emergency Management Division (WA EMD). On 9 June 2009, WA EMD hosted a Pilot Train-the-Trainer Workshop. The workshop objective was to conduct a Pilot Project to initiate, test, and refine a curriculum for a Trainer program that will be developed and taught by the NCTR in

collaboration with WA EMD to graduate qualified Tsunami Public Education Instructors as identified by WA EMD. This objective is a critical component essential to the National Tsunami Hazard Mitigation Program (NTHMP) Educational Plan. The Workshop was a joint effort of the WA EMD and the NCTR. A total of 31 participants from various coastal Washington jurisdictions took part in the Workshop. Attendees included personnel from county and community organizations such as Emergency Management and Community Emergency Response Team (CERT)

● HYSPLIT (HYbrid Single-Particle Lagrangian Integrated Trajectory) Model

The HYSPLIT model is the newest version of a complete system for computing simple air parcel trajectories to complex dispersion and deposition simulations. The model is widely used by government, commercial, and university personnel, both in the United States and from many foreign nations to provide plume simulations in support of emergency response operations, as part of research efforts addressing source-receptor questions, and by glider pilots and balloonists for recreational purposes. Registered users of HYSPLIT have increased dramatically over the past year. User statistics include: Commercial users: 244 Government (federal, state, and foreign) 442 University (US and foreign) 1383, Military 58, Non-Profits 57, private pilots (balloonists, glider pilots) 88 The model can be run interactively on the Web through the Air Resources Laboratory's READY system on the ARL web site site or the code executable and meteorological data can be downloaded to a Windows PC. The dispersion of a pollutant is calculated by assuming either puff or particle dispersion. In the puff model, puffs expand until they exceed the size of the meteorological grid cell (either horizontally or vertically) and then split into several new puffs, each with it's share of the pollutant mass. In the particle model, a fixed number of initial particles are advected about the model domain by the mean wind field and a turbulent component. The model's default configuration assumes a puff distribution in the horizontal and particle dispersion in the vertical direction. In this way, the greater accuracy of the vertical dispersion parameterization of the particle model is combined with the advantage of having an ever expanding number of particles represent the pollutant distribution.

● Graphical Forecast Editor

The Graphical Forecast Editor (GFE) is used operationally by NOAA's National Weather Service (NWS) forecasters to create and maintain sets of sensible weather elements (temperature, wind, precipitation, etc.) in gridded form over their respective forecast areas. These grids are the basis for generation of most routine text forecasts, long-fused warnings, and the increasingly popular point-and-click graphical forecasts available on the Web. They are also combined into a National Digital Forecast Database, available to the public and private industry to support weather-related decision making.

The sound fundamental design of GFE also makes it practical to adapt the system for international application. The NOAA team recently has worked with the meteorological agencies of Taiwan and Australia to tailor GFD systems for their forecast environments. Since October 2008 the Australia Bureau of Meteorology's Victorian Region Forecast Centre has used GFE to issue daily weather forecasts of Victoria State, including areas hit hard by wildfires

earlier this year. Commenting on their experience transferring this technology they state, "The success of the launch was critically dependent on two things. Firstly, you gave us a terrific system to start with. Its functionality, robustness and excellent design has been so important. Secondly, your help in further developing the GFE to our requirements has been superb. We couldn't have asked for more enthusiastic, responsive and professional support." The meteorological agency in Spain has also recently expressed interest in transferring GFE technology into their forecast operations.

- **Collaboration and Training: Harmful Algal Blooms and Harmful Algal Toxins**

The NOAA's National Centers for Coastal Ocean Science (NCCOS) researchers hosted a visiting researcher from the Republic of Korea's National Fisheries Research and Development Institute during January and February of 2009 to initiate development of a method for detecting the Harmful Algal Bloom organism Psuedo-nitzschia . Species of Psuedo-nitzschia and their associated toxin, domoic acid, have recently been identified near aquaculture sites along the Korean coast and are growing concern to industry and public health officials. Molecular probes targeting Korean species of this organism are being designed and incorporated into a test kit that will enhance monitoring and mitigation efforts.

In April 2009, NCCOS researchers conducted a month-long training course to transfer detection technologies for harmful algal toxins to regulatory officials and scientists from Thailand The training course, sponsored by the United Nations International Atomic Energy Agency and facilitated by NOAA's National Ocean Service's International Program Office, is designed to improve toxin detection methods currently used to regulate and monitor seafood for domestic consumption and export, as well as for research purposes.