

DRAFT
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National Oceanic and Atmospheric Administration
(NOAA)
Oceanic and Atmospheric Research (OAR)
Strategic Plan FY 12 -18

In Support of NOAA's Next Generation Strategic Plan

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Vision

To be the Nation's trusted source for oceanic, atmospheric, and Great Lakes research, technology, and related services that enable healthy, productive and resilient ecosystems, communities, and economies

Mission

Innovate, Incubate, and Integrate

*To apply innovative research and technology towards Earth-system discovery, understanding, and prediction
To incubate long-term research and extend knowledge that supports NOAA services and societal needs
To integrate research across NOAA, and with our external partners, to maximize NOAA's value to society*

Values

- Pre-eminence in Research
- Relevance to Society
- Culture of Transparency

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Letter from the NOAA Administrator

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Letter from the Acting Assistant Administrator of Oceanic and Atmospheric Administration

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The Office of Oceanic and Atmospheric Research (OAR) is one of five major organizations, known as “Line Offices,” within the National Oceanic and Atmospheric Administration (NOAA). OAR’s leadership role as NOAA’s centralized research Line Office is critical to NOAA’s ability to carry out its mission of science, stewardship, and service that touches the lives of all Americans. Through research and development activities, OAR, along with its many partners both inside and outside of NOAA, characterizes and predicts some of the Earth’s most complex environmental phenomena. Moreover, OAR continues to be successful in conducting high-risk, high-reward research and delivering products and services to society and other Line Offices in support of NOAA’s mission. Over the next five years, OAR will be strategically positioned in-line with NOAA’s goals to meet the grand challenges of the 21st century:

- An informed society anticipating and responding to climate and its impacts
- A society that is prepared for and responds to weather-related events
- Marine fisheries, habitats, and biodiversity sustained within healthy and productive ecosystems
- Coastal and Great Lakes communities that are environmentally and economically sustainable

Paramount to meeting these challenges is the availability of relevant scientific information that is unbiased and appropriate to key stakeholders. OAR will meet this need by enhancing specific areas of its scientific and service enterprise and by integrating various research domains across the agency towards the holistic understanding of the Earth-system. In the face of a challenging fiscal environment, this cannot be done without a clear prioritization and reallocation of investments toward critical mission needs. While specific prioritization will be the focus of a corresponding implementation plan, this strategic plan outlines OAR’s intent to strengthen its portfolio relating to observations and monitoring, understanding and describing, and predicting key environmental phenomenon. OAR will also engage, advise, and inform its stakeholders to help create a society that is capable of making informed environmental decisions.

Supporting the administration and the goals outlined in the NOAA’s Next Generation Strategic Plan, www.ppi.noaa.gov/ngsp, OAR has established the following mission and goals as a guiding framework for strategic planning.

Mission

Innovate, Incubate, and Integrate

*To apply innovative research and technology towards Earth-system discovery, understanding, and prediction
To incubate long-term research and deliver information that supports NOAA services and societal needs
To integrate research across NOAA, and with our external partners, to maximize NOAA’s value to society*

Science Goal

Holistic understanding and useful predictions of future states of the Earth-system

Service Goal

Engaged, educated public capable of making informed environmental decisions

Support Goal

An efficient, high-performing organization

OAR will pursue and evaluate each goal and corresponding objectives against outcome-oriented performance measures to determine progress and efficiency. Ultimately, this plan provides a framework for OAR to deliver significant benefits to society through NOAA’s mission of science, service, and stewardship.

Background—History of OAR

NOAA's Office of Oceanic and Atmospheric Research (OAR), is one of five organizational "Line Offices," serves as NOAA's primary research arm, and maintains a strong history of preeminent and innovative research. OAR's origins date back more than 200 years to the creation of the Survey of the Coast in 1807 by Thomas Jefferson. The Coast Survey, which became the U.S Lake Survey office in 1841, was developed to undertake "a hydrographic survey of northwestern Great Lakes." Research executed by the scientists of this group was innovative and holistic: they developed the first current meters to understand water flow rates, and enhanced forecasting techniques to predict water levels and their relationship to lakefront property. Long-term research that is innovative and relevant to understanding the world around us continues to define OAR today.

From the early beginnings of research in the Great Lakes region, scientists began to understand that environmental systems are interactive and the ability to understand and predict complex phenomena requires research efforts both within and integrated between fields of expertise. Even before the creation of NOAA, President Lyndon B. Johnson transferred the Central Radio Propagation Laboratory from the National Bureau of Standards, to join the United States Weather Bureau and the Coast and Geodetic Survey in a new scientific agency of the Department of Commerce -- the Environmental Science Services Administration (ESSA) in 1967. The coupling of these divisions recognized the importance of dedicated research to better understand the world's ocean, atmosphere, and their interactions. ESSA's mission was to respond to the national need for adequate warnings of severe and natural hazards, for technological advances in capabilities to observe the physical environment and for investigations into the physical environment as a "scientific whole" rather than a "collection of separate and distinct fields of scientific interest."

NOAA was created shortly after ESSA, in 1970, with a mission to predict environmental changes on a wide range of time and space scales in order to protect life and property, and provide industry and government decision-makers with a reliable base of scientific information. In 1977, NOAA was reorganized into five principal Line Offices reflecting its principal legislative mandates: the Office of Fisheries, the Office of Coastal Zone Management, the Office of Satellites, the Office of Oceanic and Atmospheric Services, and the Office of Research and Development. In 1983, the Office of Oceanic and Atmospheric Services and the Office of Research and Development merged into a single Line Office known to this day as the "Office of Oceanic and Atmospheric Research (OAR)." OAR is predicated upon innovative research as well as the development and the delivery of products, tools, and information services to meet the needs of the nation.

OAR was established to manage major research efforts that improve NOAA's service arms, to fulfill the agency's responsibilities for leadership in science, and to improve the understanding of the oceanic and atmospheric components of the global Earth-system. Although OAR has increased its scientific capabilities since its creation, its primary purpose as a necessary and dedicated research Line Office remains the same: "To strengthen NOAA's position in fundamental research in those areas that are pertinent to NOAA's mission and to remove any

programmatic myopia that might come from coupling development and application to the more fundamental areas of research (Ostenso, 1983¹).”

The same core elements define OAR’s values today; preeminent research, value to society, and a culture of transparency. OAR continues providing leadership for NOAA’s research portfolio and provides scientific services to constituents ranging from policy and other decision makers, to the scientific academic community, and to the American taxpayer. Moving forward, OAR will leverage its core capability as a research enterprise and work to strengthen its current research focal areas in addition to integrating various research domains across NOAA and other research enterprises. While OAR will not execute all NOAA research relating to Earth-system understanding, through integration it will help coordinate and strengthen NOAA research activities and bridge the gaps between areas of scientific expertise. The ability to understand and predict complex natural and human-induced environmental phenomena also is critical to long-term protection of life and property. As natural and human-induced events and pressures on the Earth’s environment and ecosystems increases, changing demographics cause a rising demand for scarce resources putting more people in the path of hazards.

OAR strives to understand changes in our oceanic and atmospheric systems at local, regional, and global levels in support of the agency’s efforts to provide effective services and stewardship to the Nation. This approach recognizes the importance of understanding the Earth-system on time scales ranging from minutes to decades and even longer when investigating processes associated with global environmental changes. OAR has established three long-term goals discussed in this strategic plan: Earth-system understanding and prediction capability; engaged society; and a high-performing organization. These goals embrace a view that the planet is an amalgam of complex systems – physical, chemical, biological, and social - which interact with and respond to one another through complex and dynamic processes. This view considers people as an integral component of positive and negative ecosystem changes. The ability to predict the Earth-system must include this interdependency—the balance between societal needs and the integrity of ecosystems. As a research line office, OAR is well positioned to develop a better understanding of the Earth-system and provide predictive assessments of how long-term environmental changes will impact people, places, and natural resources.

Along with its internal and external partners, OAR will help build a future where society is able to anticipate and take appropriate precautions against oncoming weather and water natural disasters such as hurricanes, tornadoes, tsunamis, as well as significant heat, snow, and rain events. In addition, OAR will provide data, information, tools, and resources that describe and predict the global impacts of climate change on oceans, sea level rise on coastal communities, agriculture food supplies, renewable energy supplies, ocean and coastal biodiversity, and declining fresh water supplies. These issues are connected on a global scale. The ability to deliver meaningful results will depend on OARs capacity to simultaneously strengthen its research and development programs as well as engagement services with the public to help create a society that is capable of making informed environmental decisions.

¹ Dr. Ned Ostenso, Assistant Administrator for OAR. In “Restructuring of NOAA Provides a Framework for the Future.” NOAA Annals V13,2. 1983

Science Goal

Holistic understanding and useful predictions of future states of the Earth-system

OAR maintains scientific expertise to understand and predict complex environmental phenomena in our world's oceans, atmosphere, coasts, and Great Lakes. Such capabilities have been developed and executed through decades of world class research that recognizes that the ability to monitor, understand, and predict key aspects of the environment is essential to preserving life and property. Recent events, both natural and human induced, remind us of the intimate relationship between humans and the environment. These events include the Indian Ocean Tsunami of 2004, Hurricane Katrina in 2005, the Chilean Earthquake of 2010, the Deepwater Horizon Oil Spill of 2010, the Japanese Tsunami and related nuclear contamination events of 2011, and countless others. These events were sudden, catastrophic, global and demonstrate the need for global monitoring and dissemination of relevant and rapid information to the public, policy makers and other science groups for sound decision making. OAR will continue to provide the relevant tools, products and services needed to help protect lives, property and economies.

Albeit less acute and visually dramatic, our environment is currently facing additional unprecedented challenges and changes. The concentration of important atmospheric compounds including carbon dioxide is increasing in the atmosphere and the ocean. Oceans are become more acidic, global sea surface and air temperatures are rising, and polar ice caps are melting. Significant air and water pollution continues, while fresh water for drinking and agriculture use declines and the numbers of people with air-quality illnesses increases. The full effects of this interrelated phenomena is not yet fully known. However, understanding the extent, causal mechanisms, and future impacts of these conditions will require OAR to develop the capacity to integrate various research domains of expertise, whether those domains exist within OAR, across NOAA, or within other agencies. OAR must leverage its capacity as a leader of innovative science to take a proactive approach towards understanding and predicting environmental phenomena occurring on local, national, and global scale. To begin to understand and make useful predictions of future states of the Earth-system, OAR will pursue five objectives:

1. Increase the development and utilization of accurate and reliable observing platforms and systems using integrative and cost-effective strategies
2. Improve the understanding of ecosystem trends, variability, and key processes
3. Improve the accuracy and reliability of Earth-system models
4. Increase the integration of ecosystem models and prediction capabilities ranging in time-scales from minutes to decades
5. Increase the development of next-generation tools, and technologies to predict the effects of the Earth-system with people, places, and natural resources

Through measurable success in these five objectives, OAR will be better equipped to monitor and understand key environmental processes, gather and model the data, integrate the various research domains, and transfer the models to research partners who make sophisticated forecasts and assessments. Ultimately, these capabilities will be designed and executed to protect lives and property and promote the sustainable use of natural resources.

Objective 1: Increase development and utilization of accurate and reliable observing platforms and systems using integrative and cost-effective strategies

Accomplishments across NOAA's mission goals are dependent upon the continued innovative development and utilization of observation platforms and systems. These, investments are needed to maintain and upgrade systems to ensure continuity of long-term data collection and rapid data collection from key regions across the world. Such data are critical to improve understanding and prediction of complex and often interdisciplinary phenomena.

Anticipating a fiscally challenging environment in the coming years, OAR must prioritize its investments and implement cost-effective strategies for gathering critical environmental data. OAR will outline specific priority observation systems in a corresponding implementation plan that will be developed in FY12. However, OAR will continue monitoring, and collecting hydrographic and atmospheric data for rapid and long-term water, air, and aerosol assessments. Specific strategies that OAR will use to collect cost-effective, relevant data include improving the development of innovative observing and data collection technology as well as the cross-sharing of assets, resources, and information between federal and external research partners.

While current monitoring and observation assets are critical to OAR's mission, innovative ideas which increase OAR's capacity to collect relevant data more rapidly and with less cost, must continue to be explored. OAR will manage a high-risk/ high-reward research portfolio that also includes the pursuit of novel concepts which could include the deployment of animal-borne observing systems at the scale of NOAA's regional ecosystems; development of DNA-based tools for identifying managed species, and development and integration of suite sensors for use on multiple research vessels. By evolving strategic investments into innovative observation platforms and systems, OAR and its partners will be better positioned to gather relevant data necessary to develop a holistic understanding of the Earth-system.

As a means of assessing the quality and relevancy of data collections, OAR will promote the use of Observing System Simulation Experiments (OSSEs) to quantitatively evaluate tradeoffs in the design and configuration of proposed observing systems (e.g., coverage, resolution, accuracy and data redundancy). This will lead to better planning and decision making for the observing system portfolio. OSSEs will also provide better assessments of where future investments are most needed with regard to observational assets, systems, and networks,

Lastly, OAR will routinely integrate its research across NOAA and its external research partners, to maximize assets, resources and information to obtain more cost-effective collection of and gathering of critical environmental data. Working with these groups, OAR also will categorize and seek to build cost-saving partnerships towards common priority objectives and reduced redundancy. With cost-effective strategies in place, OAR will increase the value of its investments in priority focus areas.

Objective 2: Improve the understanding of ecosystem trends, variability, and key processes

An OAR core capability is to understand data with regard to ecosystem trends, variability, and key environmental processes. Through dedicated research and the analysis of long-term data sets, researchers have already been able to determine; environmental trends such as increasing carbon dioxide in the atmosphere as well as rising global sea-surface temperatures; commonalities or patterns of variability such as those used to describe El Niño/La Niña events; and key processes such as those trends and variable patterns which closely associate with global climate changes. By analyzing and understanding data, OAR researchers also are able to answer where and which additional environmental observations are needed, and which data sets to prioritize for modeling complex environmental phenomenon. Improving understanding of ecosystem trends, variability, and key processes is a critical objective to OAR's science goal.

Improving OAR's ability to understand data and the interrelationships between research fields cannot be done across all areas of oceanic and atmospheric research given anticipated fiscal challenges. Rather a prioritized approach with dedicated resources and personnel is needed. Within identified priorities, OAR will identify and better understand the relationships between environmental changes, forcing, and feedback; environmental sensitivity of local and global changes; the mechanistic links between short- and long-term events; the frequency of event occurrence on regional, national, and global scales; and the opportunities and limits for predicting extreme events across spatial and temporal scales. Answering such questions requires a close relationship with the researchers and engineers dedicated to gathering pertinent environmental data, and with modelers who use the most relevant information and observations to develop simulations that describe complex phenomenon.

Objective 3: Improve accuracy and reliability of Earth-system models

Data gathered must be accurate, reliable, and easily manipulated into usable Earth-system models. To improve the accuracy and reliability of data and Earth-system models, OAR will:

- Improve the assimilation of a growing suite of observations and determine uncertainty
- Increase the computational power to run more accurate models
- Develop advanced models that can be tested and applied at higher resolutions to make accurate short and long-term predictions
- Enhance practices for linking models from global-to-local scales with a distributed network of academic and private modelers

OAR will also explore the next frontiers in High Performance Computing to increase the accuracy and scale of environmental models. High resolution computing is needed to meet the computational needs of the next generation of prediction models of complex phenomenon across local, regional, and global scales. In addition, research and development is required to determine how to best utilize Graphical Processing Units (GPUs) and how to port models to system architecture.

To increase the fidelity of models through better representation of the Earth-system, OAR will further improve numerical modeling capacity by generating models that can be tested and applied on multiple geographic as well as time scales. This includes the reanalysis and modeling of past conditions compared against observed results. Reliable predictions, projections and associated uncertainties from global models run at high spatial and temporal resolution to inform environmental-sensitive decisions. Understanding error estimates and calibrating the data used in models will also improve model accuracy. Estimates and explanations in the uncertainty of environmental data and projections across spatial and temporal scales is a first step towards predicting and projecting regional and global extremes with confidence. In combination with advanced computational power, the assessment and improvement of model accuracy will lead to progressively higher-resolution models and the development of multiple sophisticated models that improve our ability to understand the Earth-system.

Objective 4: Increase the integration of ecosystem models and prediction capabilities ranging in time-scales from minutes to decades

Ecosystems encompass physical, chemical, biological and social processes which together provide a suite of benefits to society, from food and energy production, to water regulation and treatment, to recreation. Understanding these systems requires the development of an integrated analysis system that captures or incorporates a broad range of environmental multi-model models. To provide relevant information that supports effective management of ecosystems through sound environmental decision making, OAR will increase its integration of data and models to better understand complex ecosystem processes and generate a new generation of decision support tools.

To accomplish this objective, a NOAA-wide Ecosystem Research Agenda, led by OAR, will provide a vision for how science, research, tools and technologies, and information sharing must integrate to address emerging issues within key geographically defined regions. OAR will provide leadership by observing and modeling key interrelated processes, integrating multidisciplinary research, and breaking down organizational barriers to data sharing to answer the key challenges of ecosystem management. In addition, OAR will work across NOAA, with the external science community, and other public constituents to both learn from and inform where research is needed and to communicate decisions regarding ecosystem uses and impacts. Similar to observation networks, investments in integrated ecosystem models also must be prioritized. OAR will continue to lead NOAA's efforts in defining priority research issues.

Objective 5: Increase the development of next-generation tools and technologies to predict the effects of the Earth-system with people, places, and natural resources

Understanding the interrelated processes of complex environmental systems is not sufficient to meet OAR's mission. Rather, an Earth-system analysis and prediction framework to support one-day to decadal predictions is needed. Information, tools and technologies generated from advances in Earth-system prediction capabilities will help to create a society that is more

adaptive to its environment; experiences fewer disruptions, dislocation, and injuries; and operates a more efficient economy. To accomplish this objective, OAR will continue to build upon its core capacity as a leader of environmental research by:

- Accelerating the development of innovative decision support systems technologies that merge information in a way that can be quickly understood by users such as forecasters and emergency managers
- Testing new technologies and social science linkages within testbed environments
- Utilizing integrated environmental models to generate long-term forecasts of global climate change and its associated impacts on people, places, and natural resources.

New observing and modeling systems will significantly increase information available to forecasters. OAR, working with its customers and partners, will develop approaches that allow forecasters to quickly and easily utilize the data and understand complex systems and models that identify and provide relevant prediction capabilities for specific situations and questions. In addition to severe weather and physical events, OAR will improve its capacity to generate meaningful long-term assessments and projections of global change events including the impacts of increasing carbon dioxide in the atmosphere and oceans on biota; the impacts of climate change on fresh water supplies and agriculture; the impacts of increasing water levels on coastal communities, and also provide the relevant environmental predictions needed to facilitate industry growth, job creation, and economic development. OAR is committed to continue executing and integrating the research domains necessary for predicting the effects of environmental changes in the Earth-system on people, places, and natural resources.

Service Goal

Engaged, educated public capable of making informed environmental decisions

OAR is recognized for its research and is dedicated to generating a holistic understanding and prediction capability of the Earth-system. However, little value is provided if society does not utilize the information. Therefore, OAR also will embrace the service goal of facilitating an engaged and educated public that is capable of making informed environmental decisions. In this sense, the public includes NOAA leadership and other federal agencies, policy makers, external NOAA research partners in academia and the private sector including commercial weather services, public and private emergency management officials, state and local officials, users of environmental data including water resource managers, civil engineers, farmers, energy planners, natural resource managers, and all individuals interested in environmental conditions.

The service goal supports OAR's mission to *incubate long-term research and deliver information that supports NOAA services and societal needs*. Incubation refers to the nurturing of early development programs until they are self-sustaining and can be transitioned to support the needs of society including protection of life and property and economies. By engaging the public, OAR will be better equipped to evaluate societal demands and respond through investments in research that is relevant and which encourages sound environmental decision making.

To achieve its service goal, OAR will increase its capacity to deliver relevant information and develop stronger a stronger linkage to the science goal. In addition to disseminating research findings through peer-reviewed journals and professional meetings, OAR will strengthen its communications and engagement activities to meet the diverse demands for OAR data, products, tools, and services. OAR has defined the following specific objectives to facilitate an engaged, educated public that is capable of making informed environmental decisions:

6. Enhance NOAA's social science capabilities
7. Improve engagement through the use of extension, education, and communications tools and resources
8. Increase the efficiency of OAR's transition of research to applications

Similar to the science objective, success in these three objectives will be monitored and measured. Through measurable success in these three objectives, OAR will be better equipped to quantify its benefits of research on society, understand and address societal needs, and prioritize and transition those products, tools, and information which best serve society. Ultimately, these capabilities will be designed and executed to protect lives, property and economies and promote the sustainable use of natural resources.

Objective 6: Enhance NOAA’s social science capabilities

OAR will enhance its ability to better understand societal needs and assess the economic impacts of its research on society through social science applications. Many applications can be gathered from “off the shelf” products and tools, however OAR’s social science needs are unique and require a specialized and dedicated approach. In fact, nearly every environmental science objective in OAR requires the services of applied social science to determine social behavior trends, costs and socioeconomic benefits, optimal delivery of information and services, and the determination of risk in environmentally sensitive societal sectors. OAR must develop economic impact and needs assessments capabilities to answer these questions and help prioritize future research endeavors.

The example of improving hurricane forecasting technologies demonstrates this need. While investing in hurricane forecasting technology will help protect lives and property, quantifying the extent of these benefits as a function of enhancing forecasting lead times through technology improvement, has yet to be performed. In addition, realizing the benefits of hurricane forecasting technology requires that society understands and appropriately responds. Enhancing social science capabilities would help answer the expected socioeconomic returns of OAR’s research and development , determine the best mechanisms to engage relevant publics, and tailor technology implementation to endure successful adoption.

As social science research is a relatively new activity in some parts of OAR, several actions must be taken to enhance its social science capabilities:

- Identify and prioritize social science needs;
- Streamline efforts across OAR and NOAA to identify and prioritize areas of social science needs;
- Utilize in-house as well as external social science capabilities;
- Create stronger linkages between social and natural research scientists. Natural research scientists must embrace and integrate social science into their research endeavors, and social scientists must work closely with scientists to fully understand the technical nature of the research enterprise

By overcoming these challenges, OAR will be able to better develop sound social science capabilities which complement the research enterprise and increase the societal value of OAR research.

Objective 7: Improve public engagement through the use of extension, education, and communications tools and resources

Equally important to understanding and quantifying the value of OAR to society, is the ability to deliver relevant data, information, and tools to the public in order to promote better understanding of the Earth-system. Understanding the Earth is necessary for policy makers and other stakeholders to make informed environmental decisions. Often times, however, such decision or lack of decision making, occur without understanding of long-term social,

environmental, and economic consequences. Filling this gap and promoting a better understanding of the world around us is a strategic priority for OAR.

To improve public outreach and promote better understanding of the Earth-system, OAR must employ multi-directional communication strategies. Data and information generated from OAR researchers often must be “translated” into audience-appropriate language =. At the same time, OAR must communicate with the stakeholder community to determine the information, tools, and resources they need from OAR’s research enterprise. OAR has identified the following actions that will be taken to improve public engagement through the use of extension, education, and communications tools and resources:

- Increasing extension and outreach to graduate, professional, and education programs;
- Increase the development and utilization of innovative educational tools and concepts;
- Increase partnerships that leverage the transfer of OAR research to the public;

Increasing extension and outreach to undergraduate, graduate, professional, and technical education programs in coastal, ocean, and Great Lakes-related areas is a targeted approach for high-impact delivery of OAR information and tools. Targeting educational settings ensures the education and training of younger generations and a future society that is environmentally aware and able to make informed decisions that reflect natural resource conservation and stewardship practices. Furthermore, OAR will promote understanding of the Earth-system through innovative delivery of information and services. Innovative solutions provide a modern outlook to education mechanisms and novel concepts can be promoted as educational tools that provide valuable information to people of all ages and scientific understanding. Further development of innovative tools and concepts would greatly enhance the public understanding of the Earth-system.

Lastly, OAR will enhance the number of strategic partnerships with academic and public groups. Within OAR, the National Sea Grant Program is a champion of engagement and service extension efforts and is critical for imparting “useful information to persons currently employed or interested in the various fields related to the development of marine resources, the scientific community and the general public (NSGCPA, 1966)².” OAR will not only leverage the Sea Grant community, but will also work with the NOAA Engagement Council to identify those groups and mechanisms to leverage extension and outreach services.

² The National Sea Grant College and Program Act of 1966

Objective 8: Increase the efficiency of OAR's transition of research to applications

OAR is charged with delivering information, products, and tools to meet the needs of the other NOAA Line Offices, the academic community, and a variety of other key stakeholders. A significant component of meeting this charge is to ensure the efficient transition of OAR's research to applications or Operations. To accomplish this objective, OAR will increase the efficiency of the transfer of products, services, and tools to the other Line Offices in NOAA, to other research institutions, and the private sector by reducing barriers to effective partnership and providing dedicated resources to prioritize transition projects. OAR also will continue transferring knowledge to the broader scientific community through peer review publications and contributions to scientific assessments (e.g., Intergovernmental Panel on Climate Change).

OAR will increase the transition of its information, productions, and tools to its partners internal and external to NOAA. This includes transitioning models, observations, and decision support technologies. OAR will actively work with the NOAA Line Office Transition Managers to develop guidance on optimizing processes and partnerships to improve the rate and efficiency of transitions. As research projects often require many years to develop the robust science needed for transition to operations, OAR will maintain a research portfolio that includes a mix of projects in various stages of development. OAR also will utilize and increase the transition of research to application and operations through the Office of Research and Technology Application, the Small Business Innovation Research Program, and National Sea Grant College Program.

Lastly, OAR will remain committed to the dissemination of its leading edge research through publishing in peer reviewed and non-peer reviewed scientific journals, as well as through scientific assessments such as the Intergovernmental Panel on Climate Change (IPCC). The availability and transfer of scientific information to multiple audiences is critical to the efficiency of transitioning research to applications.

Support Goal

An efficient and high performing organization

OAR is committed to the goal of a holistic understanding and prediction capability of the Earth-system. Through a stronger coordination with the Service Goal, OAR will be well positioned to maximize its value to society through the delivery of products, tools, and services that help protect lives and property. The ability to carry out these goals, however, is also dependent upon an efficient and high performing organization.

OAR will be challenged in the coming years with among other things, financial constraints and an aging workforce, which will impede OAR's success without adequate strategies and objectives in place. Recognizing these challenges and their potential impacts on the success of the science and service objectives, OAR has created the following additional objectives:

9. Increase the coordination of research and technology planning across NOAA
10. Advance the modernization of facilities, equipment, and IT infrastructure
11. Maintain an innovative, diverse and capable workforce
12. Increase strategic engagements and external partnership

OAR, working with NOAA's Research Council, will improve coordination of research and technology planning across NOAA. The NOAA Research Council, a body composed of senior scientific personnel from every Line Office in the agency, has charged OAR to help coordinate and streamline efforts throughout NOAA to deliver science products and services more efficiently to OAR stakeholders towards the holistic understanding of the Earth-system. Also important to a high-performing organization are advances in the modernization of facilities, equipment, and IT infrastructure that are necessary to ensure OAR's workforce is equipped with the necessary tools to accomplish its work.

To ensure long-term success, OAR must develop and implement a strategy to maintain an innovative, diverse, and capable workforce. This is especially critical OAR's workforce is aging. Not only does this present a risk through loss of expertise through attrition but also poses a difficulty in the retention and development of scientific leaders due to a lack of opportunities for advancement to senior level positions. Strategies are needed to ensure that OAR continues to acquire, retain, and develop a future workforce that can best serve the needs of NOAA and society.

Lastly, the need to increase strategic engagement and external partnerships is paramount. For the same underlying reasons that warrant the development of a NOAA NAO on R&D, increasing engagement and partnerships beyond NOAA is necessary to increase the efficiency of carrying out OAR's mission. Innovative engagement practices must also be utilized to meet this objective. Engagement with not-for profit including non-government agencies and foundations, and also with the private sector including small businesses must all be explored for potential as mechanism to generate a high performing organization

Objective 9: Strengthen research and technology through integration across NOAA

NOAA Administrator Dr. Jane Lubchenco, stated the following to the Committee on Science, Space, and Technology, U.S. House of Representatives on June 22, 2011:

“OAR will continue to serve as NOAA’s centralized research Line Office, serving all of NOAA by supporting and producing preeminent research and technology innovation that advances NOAA’s mission. OAR will innovate—make new discoveries and find new technology applications, incubate—conduct long term research and develop technology to make new discoveries that are useful to NOAA’s operations, and integrate—strengthen research and technology across NOAA and with partners.”

In support of this testimony, OAR will continue serving as NOAA research Line Office, and will be responsible for increasing coordination of research and technology planning across the agency by streamlining the efficient delivery of research to key stakeholders. In addition, OAR will strengthen research and technology throughout the agency by identifying, developing, and disseminating best management practices. Today, OAR utilizes a rigorous process for reviewing science and research across its laboratories. This process ensures that its research and development activities meet the highest level of scientific integrity. The same practices of science integrity and review will be promoted as best management practices and will be promoted within research activities across the agency.

OAR, working with the other NOAA Line Offices, will take a leadership role in integrating research across the agency. This authority and responsibility is characterized in the NOAA Administrative Order (NAO): Strengthening NOAA’s Research and Development (R&D) Enterprise. This NAO establishes the principles, policies, and responsibilities for planning, monitoring, evaluating, and reporting research and development (R&D) activities comprising the entire NOAA R&D enterprise. Coordinating research and development efforts, applies to internal and external R&D activities, and includes R&D conducted by NOAA and sponsored by others. OAR will develop further guidance, for NOAA, through a procedural Handbook that covers; R&D Planning, Enterprise R&D Monitoring Database, Program/Laboratory/Science Center Reviews, Portfolio Reviews, Benchmarking Reviews, Performance Measures and R&D Reporting. A critical component supporting coordination efforts across the agency is the development and population of a project level database.

Objective 10: Advance the modernization of facilities and equipment

OAR’s facilities and equipment must be maintained at optimal performance levels and sustained over the long-term to achieve OAR’s mission. OAR therefore recognizes the importance of the goal to advance the modernization of facilities and equipment. Three specific challenges must be overcome to meet this goal: The accurate estimation of full asset life cycle costs, cross NOAA prioritization of asset acquisition or development, and the innovative development of facilities and equipment with reduced infrastructure costs.

The first issue of estimating full asset life cycle costs requires an improved ability to assess acquisition, operational, and maintenance costs of significant assets (e.g., research vessels, planes, super-computing technology, etc...). While the acquisition or initial development costs may be more readily identified, long-term maintenance and operational costs must also be assessed in order to retain sufficient funding levels to maintain assets at their optimal performance. Accurate budget assessments prior to acquisitions or development, in addition to accurate yearly cost estimates would help resolve this issue and increase asset utilization.

In addition to the ability to generate full cost-estimates, OAR must lead a cross line office prioritization of asset acquisition or development. Working with the other line offices to combine resources towards high priority mission objectives and execute collaborative projects is necessary to ensure that all Line Office needs are met—especially in a fiscally challenging environment. Open ocean research cruises, for example, may be coordinated between OAR and the other line offices to reduce cost overlap in certain priority objectives. The OAR project database, that is being expanded to include all of NOAA, will be an important valuation tool to identify areas of potential collaboration.

Lastly, OAR will continue to explore innovative solutions to achieve its goals and objectives at less cost. Focal areas of innovation include but are not limited to manned (research and exploratory vessels) and unmanned system research vessels (Autonomous Underwater Vehicles, Unmanned Aircraft Systems, and Unmanned Surface Vehicles), research equipment including sensor technology, and super computing technology (e.g., Graphics Processing Units). The issue of innovation and modern facilities and equipment will be addressed annually by OAR's Senior Research Council.

Objective 11: Maintain an innovative, diverse, and capable workforce

OAR is committed to delivering preeminent research that meets the diverse needs of society. Meeting these needs requires that OAR maintain a highly-capable workforce that is enthusiastic, knowledgeable, and flexible. OAR must maintain a diverse workforce and provide training and development, both scientific and managerial, that is comparable to other government agencies and the private sector. Scientific and managerial training is needed to ensure that the workforce not only retains the knowledge and skill sets that would otherwise be lost through attrition and retirement, but also to advance OAR's capabilities and efficiency.

In addition to providing leadership training, OAR must continue to acquire and retain world-class talent. Science and administrative career paths need to be supported with stepwise career advancement. To better support the professional development of NOAA scientists, the NOAA Research Council, OAR, and Workforce Management are working to:

- Allow NOAA scientists full participation in professional and scholarly societies, committees, task forces, and other specialized bodies of professional societies, including removing barriers for serving as officers or on governing boards of such societies (related to section on Promoting Scientific Integrity)

- Coordinate with the office of the NOAA Chief Scientist on a formal recommendations to NOAA Senior Leadership on the broader user of Senior Technologist / Senior Leader (ST/SL) positions within NOAA
- Increase the recruitment and advancement of promising young professionals to senior level positions on a temporary basis to provide leadership opportunities and training. Encourage individual inventions that lead to patents and Cooperative Research and Development Agreements (CRADAs). Empower young professions to serve in senior level capacities with adequate an adequate support network is essential to transition the next generation of science leaders.

Objective 12: Increase strategic external engagement and partnerships

Engaging OAR's stakeholders and customers is paramount to success whether in research or services disciplines. Partnerships are especially important in the face of budget constraints anticipated in the coming years, allowing OAR can to leverage its investments and generate higher value to society. Opportunities with the academic science community primary through Cooperative Institutes (CIs), the international community, and with other federal agencies should be strategically promoted..

Cooperative Institutes are NOAA-supported academic institutions that have established an outstanding research program in areas directly related to NOAA's long-term mission needs. Established at research institutions, CIs have strong education programs with established graduate degree programs in NOAA-related sciences. As such, CIs must remain a strategic source for recruiting academic professionals to advance OAR's mission. CIs conduct research that requires substantial involvement of one or more research units within the research institution and one or more NOAA laboratories or programs. CIs provide significant coordination of resources among all non-government partners and promotes students and postdoctoral scientists involved in NOAA-funded research. OAR must continue to strengthen its collaboration with CIs through closer alignment between senior leadership from OAR and NOAA.

OAR also must strengthen cooperation with the international community. While increasing the number of international partnerships is not feasible in a fiscally challenging environment, specific geographic areas of particular interest to the OAR community and warrant an increase in directed engagement efforts. Lastly, increasing the support and cooperation among federal agencies, state and local governments, including the regional ocean governance groups identified in the National Ocean Policy, is critical to OAR's success. NOAA and OAR are committed to supporting the development and implementation of the NOP and especially those policies affecting Coastal Marine Spatial Planning (CMSP). By working with the other federal agencies in this process, OAR will increase coordination with regional groups and leverage its ability to deliver products and services to the general public. By increasing strategic partnerships through the cooperative institutes and academic partners, the international community, other federal agencies, and regional entities, OAR will greatly enhance its ability to cost-effectively deliver its products and services to meet the needs of society.

Strategy Evaluation and Execution

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List of Acronyms

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