Testimony of
Richard W. Spinrad, Ph.D.
Assistant Administrator
National Ocean Service
National Oceanic and Atmospheric Administration

Before the
Fisheries Conservation, Wildlife and Oceans Subcommittee
Resources Committee
U.S. House of Representatives

July 13, 2004

Introductory Comments

Good morning, Mr. Chairman and members of the Subcommittee. My name is Richard W. Spinrad, Ph.D., Assistant Administrator of NOAA for Ocean Services and Coastal Zone Management. In this capacity, I administer the programs within NOAA's National Ocean Service (NOS). This includes programs addressing coral reef conservation, marine protected areas, marine sanctuaries, oil and chemical spills, coastal resource management, coastal ecosystem science, coastal monitoring and observations, ecological forecasting, national estuarine research reserves, natural resource restoration, aerial photography and shoreline mapping, global positioning and marine navigation. A number of NOAA's ocean observation programs fall under my purview. I was recently named the U.S. Permanent Representative and Head of Delegation to the Intergovernmental Oceanographic Commission. I am also the chair of the executive committee overseeing Ocean.US, the interagency office developing plans for the Integrated Ocean Observing System (IOOS). Within NOAA, I co-chair the NOAA Ocean Council, which is one of two NOAA-wide bodies focused on the coordination of observing system activities. I appreciate this opportunity to discuss the wide-ranging benefits of ocean observations and NOAA's role in developing an integrated system for gathering much-needed information on the coastal and marine environment.

The oceans cover 70 percent of Earth's surface. The Integrated Ocean Observing System seeks to harness the wealth of technologies and capabilities that have developed over the last quarter century to more accurately and comprehensively understand how oceans impact our lives and how we impact the oceans. The goal is to use that understanding to inform and improve the capability of governments at all levels, as well as commercial, recreational and other interests, to meet a variety of needs, including the ability to make wise decisions. While IOOS will certainly result in new discoveries, its reach extends far beyond research. It provides a framework for merging environmental data with new technologies to create products that improve our management and use of the world's coastal and ocean areas. In fact, the early success of demonstrations and pilots has been a primary driver of the growing interest and support for the development of a more comprehensive system.

The users and beneficiaries of IOOS include everyone who traverses our marine waters from the tanker operator to the recreational boater, from the commercial fisher to the avid surfer. But, a farmer in the Midwest who may never visit the shore will also directly benefit. IOOS will speed trade and commerce, and also make it safer for vessels to navigate increasingly congested ports, harbors and waterways. It will directly benefit the nearly half of all Americans living near the coast by mitigating vulnerability to storms and enhancing security. It will support agriculture by providing better weather forecasts. It will improve the management of fish stocks and marine mammals through enhanced ecological information. In its preliminary report, the Preliminary Report of the U.S. Commission on Ocean Policy concluded implementation of IOOS must be a priority, stating that *“High quality, accessible information is critical to making wise decisions about ocean and coastal resources and their uses to guarantee sustainable social, economic, and environmental benefits from the sea.* [page xiii]

Comment [N1]: okay

The tools and capabilities provided by IOOS will help us to address many needs including the ability to:

1. Improve prediction of weather as well as climate change and variability and their impact on coastal communities and the nation;
2. Improve the safety and efficiency of marine operations;
3. More effectively mitigate the damaging effects of natural hazards;
4. Improve national and homeland security;
5. Reduce public health risks;
6. More effectively protect and restore healthy coastal marine ecosystems; and
7. Sustain use of marine resources.

Highlighting the importance of IOOS, the Preliminary Report of the Ocean Commission devotes an entire chapter to its development and implementation. But because the benefits of IOOS will be so far reaching, it is referenced in many other chapters. Throughout the Commission’s report, the term “Integrated Ocean Observing System” appears 85 times, and the acronym “IOOS” 150 times. The Commission concludes that, *“The United States simply cannot provide the economic, environmental, and security benefits noted above, achieve new levels of understanding and predictive capability, or generate the information needed by a wide range of users, without implementing the IOOS.* [page 320]

Comment [N2]: okay

Why Ocean Observations Matter: The Need for an Integrated Ocean Observing System

Coastal waters and adjacent lands are one of the most productive and active areas of the planet. Our coastal communities are major population and economic centers. Over half the U.S. population lives in coastal watershed counties, and about half of the nation’s Gross Domestic Product — some $4.5 trillion — and 60 million jobs are generated in coastal watershed counties and ocean waters. About 75 million Americans are directly involved in on-the-water activities and 90 percent of international trade by weight is carried by sea. On a global scale, over 25 percent of the world's energy is produced within nations' exclusive economic zones, which also yield approximately 90 percent of all fish landings[1].

But pressure on the marine environment is mounting:

- Regularly up to 12,000 square miles (according to some estimates) of the Gulf of Mexico becomes hypoxic, or abnormally low in oxygen, in the summer months[2].
- Thousands of beach closures and swimming advisories are issued annually[3].
- Of the 267 major fish stocks in the U.S., which represent 99 percent of total commercial landings, approximately 29 percent are already overfished or are experiencing overfishing[4].
- Over 500 invasive species are now established in North American coastal habitats[5].
- Harmful algal blooms cost the U.S. an average of $49 million each year due to fisheries closures, loss of tourism and recreation, and increased health care and monitoring expenses[6].
- Roughly 1,500 homes are lost to erosion each year[7].
- 70% of Federal Emergency Management Agency repeat flooding losses are in the coastal zone.

Managing multiple, complex and often competing demands is a major challenge. This task is made all the more formidable by a lack of basic understanding of marine processes and a reliable and sustained flow of data. How can we manage what we do not even fully understand? Safe and sustainable navigation, the continued use of marine resources, the safeguarding of both local and global marine environments, and the protection of human lives all require an enhanced capacity to gather data and provide information.

We know that the oceans drive long term and seasonal climate, as well as daily weather. But we are just beginning to understand the ocean/atmosphere interface and to develop systems that provide increasingly accurate predictive capabilities. On a global scale, improved earth and ocean observations will improve our ability to calculate and predict the timing and scope of significant interannual and seasonal climate events such as drought, floods and major storms. The potential humanitarian, ecological and resulting economic benefits of being able to meaningfully mitigate the impacts of these events is vast.

---

[1] Cicin-Sain, B., R.W. Knecht, and N. Foster, eds.Trends and Future Challenges for U.S. National Ocean and Coastal Policy Workshop Proceedings. 1999.

[2] Boesch, D.F., et al. Marine Pollution in the United States: Significant Accomplishments, Future Challenges. Arlington, VA: Pew Oceans Commission. 2001.

[3] Chasis, S., and M. Dorfman. Testing the Waters: A Guide to Water Quality at Vacation Beaches. Washington, DC: Natural Resources Defense Council. 2000.

[4] NOAA. Sustaining and Rebuilding: National Marine Fisheries Service 2003 Report to Congress - The Status of U.S. Fisheries. May, 2004

[5] Ruiz, G.M. Written testimony before the U.S. House of Representatives, Committee on Science, Subcommittee on Environment, Technology, and Standards. June 20, 2002.

[6] Anderson, D.M., P. Hoagland, Y. Kaoru, and A. White. Estimated Annual Economic Impacts from Harmful Algal Blooms (HABs) in the United States. 2000

[7] The H. John Heinz III Center for Science, Economics and the Environment. Evaluation of Erosion Hazards Summary. Washington, DC. 2000.

By way of example, on the morning of May 9, 1980, during a blinding spring squall, the freighter SUMMIT VENTURE rammed into the Sunshine Skyway bridge in Tampa, knocking out a 1,400-foot length of the bridge across the mouth of Tampa Bay. Seven vehicles and a Greyhound bus fell from the bridge killing thirty-five people. An experienced pilot was at the helm of the empty freighter, but suddenly caught in zero visibility without radar, the pilot did not realize the wind was pushing his high-riding vessel off course until it was too late. It was this incident that led to the concept of using real-time information on the ocean environment to improve navigation — and eventually to the first installment of the Physical Oceanographic Real-Time System (PORTS®). This program of NOAA's NOS supports safe and cost-efficient navigation by providing ship masters and pilots with accurate real-time information required to avoid groundings and collisions.

It is not the ocean observations per se that result in direct benefits for the nation; it is the products to which they contribute and how we use those products. For example information on water levels, tides and currents coupled with nautical charting and shoreline mapping support marine transportation; surveys of living marine resources support fisheries management; weather and current information supports offshore energy production management; and habitat and water quality information supports estuarine and marine protected areas management. We now know that the ocean and atmosphere are not only linked and collectively create weather and climate, but that fisheries, transportation, planning, coastal management and protection, and energy forecasts all benefit from improved ocean-atmosphere predictability. We also know that modern capabilities of high-resolution mapping, integrated with water level reference points can provide baseline maps for a wide range of non-navigation applications including coastal inundation and benthic habitat maps.

Ocean observing systems provide information that benefit the world in numerous ways. Excellent examples exist in the area of weather forecasting. In agriculture, many decisions could be improved with a reliable seasonal weather forecast. One recent study found that by incorporating El Niño Southern Oscillation (ENSO) forecasts into planting decisions, farmers in the U.S could increase agricultural output and produce benefits to the U.S. economy of $275-$300 million per year. Another study estimated that the value to society of ENSO forecasts on corn storage decisions in certain years may be as high as $200 million—or 1 to 2 percent of the value of U.S. agricultural production. A third study on the costs and benefits of ENSO forecasts concluded that for agricultural benefits alone, the real internal rate of return for federal investments in ocean observation for ENSO prediction is between 13 and 26 percent[8].

Improved weather forecasting can also benefit marine commerce. At least half of all commercial ocean transits today take advantage of weather-based vessel routing services, including National Weather Service (NWS) high seas forecasts, which rely on weather and oceanographic observations and forecasts, saving on the order of $300 million in transportation costs annually. Increases in future water-borne trade traffic, accompanied by improvements in routing based on

[8] Information on these studies can be found in: Economics of a US Integrated Ocean Observing System, prepared by Hauke Kite-Powell, Charles Colgan, Rodney Weiher.; and in: Sassone, P., and R. Weiher. 1999. Cost-Benefit Analysis of TOGA and the ENSO Observing System. In R. Weiher (ed.) Improving El Niño Forecasting: The Potential Economic Benefits, NOAA, Office of Policy and Strategic Planning. p. 47.

enhanced weather and oceanographic observations, should lead to even greater returns on investment.

But the benefits of accurate, reliable and up-to-date data from ocean observation go far beyond improved weather forecasts. Even small improvements (on the order of one percent) in search efficiency as a result of accurate, real-time information on the immediate marine environment could enhance search and rescue performance sufficiently to generate life and property savings in excess of $100 million per year[9]. Better information on the marine environment can also result in as much as $225,000 per event in saved effort for oil spill responses.

For the tourism industry, $100 to $200 million savings each year could be realized through more precise information on water quality and transport to better inform beach closure decisions and improve safety at beaches[10]. Some preliminary work also suggests that annual benefits for recreational boating (e.g., better trip planning with marine conditions forecasts) would be in the tens of millions of dollars annually[11].

Ocean observations made far out at sea can also help ensure beach safety. Waves generated by a storm well over the horizon can create unsafe beach conditions, leading to major injury or drowning. Wave action along the coast can also change the shoreline, resulting in beach erosion and loss of property such as houses and piers. Wave observations from buoys and satellites, as well as surface wind observations from buoys, ships and satellites, all provide information on wave height and enable more accurate forecasts that help protect people, and allow them to take appropriate measures to protect their property.

What is the Integrated Ocean Observing System: Defining Terms

I want to take just a moment to clarify each term in the phrase "Integrated Ocean Observing System" to shed light on the meaning of the phrase as a whole. "Integrated" means to join together and unify. This is a critical element of IOOS because an initial, and significant, task before us is to bring together existing international, national, regional, State, and local capabilities. The other bookend of IOOS is that it is a system, meaning it is a group of interrelated, interacting or interdependent elements forming a collective entity.

The "ocean" includes all international, national, and State ocean jurisdictions, including the Great Lakes. This includes the sea bottom, the water column and even water vapor at the interface of the oceans and atmosphere. It includes all coastal and near shore waters, bays, lagoons, sounds and estuaries. It even includes adjacent terrestrial regions and watersheds, which exert a significant influence on the condition of coastal waters. For example, fertilizers and pesticides that wash into estuaries from land enrich the waters and can lead to toxic red tides or other harmful algal bloom events. Any effort to understand, assess and predict change in the

---

[9] Kite-Powell, H., C. Colgan, and R. Weiher. The Economics of Sustained Ocean Observations. March, 2002.
[10] Weiher, R. Preliminary results of an ongoing research effort (subject to revision).
[11] Kite-Powell, H., C. Colgan, and R. Weiher. The Economics of Sustained Ocean Observations. March, 2002.

coastal ocean requires understanding and observation of the land adjacent to it and the waterways that feed into it.

The word "observing" sounds rather passive, but in practice includes not only the observation itself, but also the data and products that may be derived and used from various observations. The term may bring to mind images of satellites flying far overhead or of large buoys stationed in the middle of the ocean silently and distantly recording data. In the jargon of ocean observations we refer to these as types of "remote sensing" and "in situ" platforms, and indeed satellites and buoys are two important ocean observing components, but observations are also obtained by aircraft, submerged current meters, and Vessel Monitoring Systems placed on fishing vessels. Observations include hydrographic surveys to detect submerged hazards, samples taken from sediments and shellfish to test for chemical contamination, dedicated oceanographic studies from research vessels, and atmospheric measurements taken from ships of opportunity. They also include habitat characterization and monitoring to support stewardship of living marine resources, and they extend inland to encompass measurements taken from stream gauges. The information gathered through these observations, coupled with economic and social science data associated with ocean resources and their values, are critical to management and use of our coastal and ocean resources.

The Integrated Ocean Observing System is the joining together and unification of ocean observations to form a collective, interrelated entity. It consists of research efforts, pilot projects, pre-operational efforts, and fully operational components, and it is the *integration* of these into a *system* that will result in the whole being much more than the sum of its parts. This also represents a major part of the challenge and opportunity of IOOS.

Finally, the term "sustained" often precedes IOOS, and in many of the rewards of IOOS will be derived from a commitment to sustain observations over the long term.

NOAA's Role in the Integrated Ocean Observing System

Both programmatically and through our representation on key oversight, planning, and organizational bodies, NOAA is maintaining an active role in ocean observation efforts at the national and international levels.

Comment [N3]: do not add this sentence since the previous was deleted

NOAA's Ocean Observation Capabilities

NOAA's broad mission "to understand and predict changes in the Earth's environment and to conserve and manage coastal and marine resources" is matched by an equally wide-ranging array of observation programs. Today, NOAA maintains about 100 operational observing systems, comprised of nearly 30,000 deployed platforms or stations and measuring more than 500 different environmental, meteorological, oceanographic, and related parameters.

NOAA's strategic goals to 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 would be all but impossible without routine, reliable, sustained and credible observations. Many ocean observation capabilities reside within NOAA, including the direct observation of ocean and coastal conditions, living marine resources and their habitats, non-living marine resources, and necessary data management and distribution infrastructure.

Coordination and integration of NOAA, other federal and regional observing systems is needed to realize their full potential. This is not a trivial task. New technologies and new strategies now offer the potential for integrating and obtaining more value from these efforts both to support the NOAA mission and goals and to contribute to the emerging government-wide and international Earth observing system. While the challenges are significant, advances in data management and sharing protocols, improvements in observation technology and the recognition of the needs of the broader community within the IOOS planning framework provide new contexts for contributions from NOAA's long-standing and emerging observing programs.

I have provided for the record a separate document of representative NOAA ocean observation capabilities that describes a full range of data being collected and the uses for this information. As this list of examples demonstrates, NOAA's contribution to the federal observation assets (or national backbone) is significant. Within NOAA, a number of programs meet the IOOS specifications for operational or pre-operational status, making data available in a routine and sustained manner with broad spatial and temporal coverage. The National Data Buoy Center weather buoys and Coastal Marine Automated Stations are an excellent example of an operational system, as is the National Water Level Observation Program. Other NOAA offices also provide significant backbone contributions, including living marine resources surveys, PORTS®, hydrographic surveying, and various mapping conducted to examine shoreline and coastal change. NOAA has been working to organize itself so that its mission can be achieved in a way that looks at the "whole Earth system." By understanding our existing observing systems and how they are structured to meet mission goals, NOAA hopes to provide a basis upon which its systems can easily be integrated with other agency observing systems and international programs.

Many other Federal agencies have observing capacity that also will be a required part of the national backbone. While NOAA works to synthesize its observing capacity internally, it must also work externally with other agencies and various regional and local stakeholders to bring all the observational resources together in an organized manner and build a system that takes advantage of existing assets while assessing gaps and prioritizing for future investment.

NOAA's Coordination Activities

NOAA has joined national and international partners in placing top priority on Earth observations and considers an Integrated Global Environmental Observation and Data Management System its top crosscutting priority.

Domestically, NOAA Administrator VADM Conrad C. Lautenbacher, Jr. currently chairs the National Ocean Research Leadership Council (NORLC). The NORLC prescribes policies and procedures for the National Oceanographic Partnership Program (NOPP), oversees the allocation of funds for NOPP partnership programs, and assesses needs for managing the Nation's coastal and ocean data. The NORLC also directs Ocean.US, which is coordinating the planning and development of IOOS.

VADM Lautenbacher is also one of three Co-Chairs on the National Science and Technology Council's (NSTC) Committee on Environmental and Natural Resources (CENR), which is developing a multi-year plan for U.S. observational activities, through an Interagency Working Group on Earth Observations (IWGEO). IWGEO has 15 agencies working together to develop the U.S. national plan, as well as the U.S. inputs to the international effort.

In a related effort, I co-chair the NSTC Joint Subcommittee on Oceans that links the NSTC's CENR and the Committee on Science. The Joint Subcommittee on Oceans, which has representation from nearly two dozen federal entities, is currently establishing a Task Force on Ocean Observations to focus on national interests and needs in this area.

Internationally, VADM Lautenbacher serves as the co-chair to an intergovernmental working group on global Earth observation systems (Group on Earth Observations — GEO), along with representatives of the European Commission, Japan and South Africa. GEO was developed as a result of the first Earth Observation Summit that was held in the United States last July. At this Summit, it was agreed that a blueprint of a global system for monitoring the Earth's complex natural system was needed. GEO strives to monitor global climate and environmental systems at the international level and is currently working on a 10-Year Implementation Plan for building a comprehensive, coordinated and sustained Earth observation system (Global Earth Observation System of Systems — GEOSS), of which ocean and coastal systems are a component. Just this spring, at the second Earth Observation Summit in Tokyo, ministers of 47 nations and the European Union adopted the Framework Document for the 10-Year Implementation Plan. The plan itself will be presented at Earth Observation Summit III in February 2005. With the creation of a framework such as GEOSS and the current development of an Implementation Plan, we will begin to see the fruits of these efforts at not only the global level but at the local level to the "end users" where our technological abilities in observations will be used to support decision making.

As noted above, I serve as the U.S. representative to the Executive Committee of UNESCO's Intergovernmental Oceanographic Commission, or IOC. Through its Global Ocean Observation System (GOOS) efforts, the IOC is working to establish a permanent global system for observations, modeling and analysis of marine and ocean variables. An integrated ocean observing system for the U.S. would be a subset of GOOS, which in turn is a subset of the Global Earth Observation System of Systems.

In May, I attended the tenth meeting of the U.S. GOOS Steering Committee, and I have just returned from a meeting of the IOC Executive Council. I can tell you, with utmost assurance, that the strength of the U.S. investment in ocean observations is being watched globally. Our ability to share capabilities and capacities with other nations can serve as an important tool in international relations. Further, the Ocean Commission notes that, *"high-level U.S. participation in international global observing planning meetings is essential, particularly by top-level NASA and NOAA officials."*

Because observations are such a critical issue across NOAA, we have created two internal councils that assist with NOAA-wide coordination of observing systems activities. The NOAA Observing Systems Council (NOSC) is addressing integration of observations by providing recommendations on observing system requirements, architectures, and acquisitions to meet NOAA, national, and international observing needs. The goal is to develop a NOAA Observing System Architecture (NOSA). The second council, the NOAA Ocean Council (NOC), is focused on, among other issues, NOAA's capability to meet its contributions to the operational national backbone requirements of the IOOS, ensuring connectivity across the IOOS and the Global Ocean Observing System and NOAA support for NOPP.

Integrated Ocean Observing System Implementation Plan

The technology currently exists to gather data from a variety of sensors deployed on buoys, gliders, ships and satellites and integrate this information into useful, useable products for a range of stakeholders. What we are lacking, however, is the connection to create a national integrated ocean observing system, linked to a global system.

Through the working arrangements established by the National Ocean Research Leadership Council, the Ocean.US office is working with NOAA, other agencies, and regional and local stakeholders to develop the IOOS Implementation Plan. Much effort over the last few years, building on the work of the last decade, has gone into developing this plan. NOAA provides much of the funding to support Ocean.US, and, along with nine other federal agencies, works through the NORLC and the Ocean.US Executive Committee to guide the efforts of Ocean.US as it spearheads the development of IOOS. Many other agencies, regional, and local stakeholders are also involved with the development of IOOS.

In March 2002, Ocean.US convened the seminal Airlie House Workshop, which produced *Building Consensus: Toward an Integrated and Sustained Ocean Observing System (IOOS)* http://www.ocean.us. This effort brought together federal agencies and academic representatives to begin defining the scientific and environmental variables, and observing techniques, that should drive the IOOS. This report has been provided for the record.

Comment [N4]: not sure what the change is here

The Draft IOOS Implementation Plan is under development and currently consists of three parts covering 1) structure and governance; 2) the current state of the nation's operational observing assets; and 3) priority needs for future funding. A great deal of work has been done to begin integrating and augmenting the IOOS, while at the same time developing specific plans and structures to ensure it is an efficient and effective tool for meeting the needs of various stakeholders. Undertaking these efforts at the same time — both building and designing the IOOS — has proved challenging, but has also offered a real-time look at the issues, problems and opportunities that IOOS offers.

Comment [N5]: okay

Comment [N6]: okay

<u>A Regional Approach</u>

The Draft IOOS Implementation Plan envisions a national coastal and ocean observing system (the IOOS) formed through the integration of federal assets (the national backbone) and assets of regional coastal ocean observing systems (RCOOS). The Draft IOOS Implementation Plan documents the need for a coordinated network of regional associations (RAs), to guide the development and implementation of the RCOOS. This regional approach is fundamental to meeting user needs on global, national, regional, and local scales.

Comment [N7]: okay

Comment [N8]: okay on all three here

The purpose of IOOS is to integrate the disparate regional efforts and achieve greater efficiencies and utility of the collected information. At present, however, there are few examples that can be considered Regional Observing Systems. The Gulf of Maine Ocean Observing System (GoMOOS) is perhaps the best candidate. What presently exists in the United States is a loose collection of independent observing capabilities. The Draft Implementation Plan does not prescribe a specific number of regional systems needed. Instead, it is expected that the regional systems will be self-forming around natural biogeographic boundaries and established relationships. The Draft IOOS Implementation Plan expects on the order of ten to twelve regional systems, comprised of those assets within each region and coordinated by a Regional Association. Ocean.US is leading an ongoing effort, with representatives from various sectors and regions, to help define and establish criteria for RA certification and a national body to represent all the Regional Associations (the National Federation of Regional Observing Systems). Regardless of the final number of regional systems, it is imperative that assets within the regions, non-federal and federal, are integrated to form a comprehensive system that meets national and regional priorities.

Comment [N9]: okay

Comment [N10]: okay

NOAA is contributing to the regional approach by funding competitively selected projects in eight geographic regions to begin the process of forming Regional Associations. The Coastal Observation Technology System (COTS) is targeting two critical elements for establishing regional capacities for coastal and ocean observations: 1) creating the infrastructure and methodologies to collect, share and integrate environmental data and create useful information products and 2) developing the organizational and governance structures (Regional Associations) necessary for regional partnership formation, user-driven requirements assessments, and system management and sustainability. All regions except the Gulf of Maine, the Caribbean Islands and the Pacific Islands are presently funded to support RA development. NOAA is working with the other regions to also establish such projects.

Comment [N11]: deleted by OMB

<u>Data Management</u>

Improved data management infrastructure is also critical to the success of the IOOS. Merging disparate efforts into a truly integrated system is the primary challenge in establishing an Integrated Ocean Observing System. In 2002, Ocean.US established the Data Management and Communications (DMAC) Steering Committee to plan for the data management and communications subsystem of IOOS. The RAs have stated that the challenges of data management should be considered an overarching issue that must be funded and adhered to at all phases of the creation of IOOS. The DMAC Steering Committee has produced an implementation plan with 10-year budget estimates, which has not yet been vetted by the National Ocean Research Leadership Council (NORLC).

Comment [N12]: okay to add text. Note that "requirements" changed to "estimates" by OMB

There are a variety of “data management issues” that need to be considered as IOOS is implemented. These are being addressed, and will continue to be addressed as technology changes. At the national level, the DMAC helps guide direction, but solutions will likely emerge from those people addressing the issues head on as they form regional collaborations. DMAC can help “mainstream” such solutions nationally.

While funding individual projects helps establish capacity (infrastructure) for ocean and coastal observations at specific institutions, such capacity development is not itself sufficient to build an integrated ocean observing system or to realize the vision of a national backbone supplemented by regional observations. Achieving the benefits of IOOS requires cultural and technological frameworks that facilitate data standards, data sharing, data integration, and product development for users within and beyond the scientific community. NOAA, the Office of Naval Research, and Ocean.US have been working with the grant recipients to establish linkages among projects and with the federal agencies to ensure that data collection and management efforts are compatible with the goals of IOOS, recognizing that the cultural shift and commitment required to meet the IOOS vision is significant.

Through a special focus on data development, management and communications, integration, and applications, NOAA is working with COTS recipients to ensure that these projects contribute most effectively to IOOS, and thus to federal mission agency and public user needs. This is an on-going process that requires a high degree of commitment to relationship building, and to helping regional partners through technical assistance and other means to establish the capacities they need to help fulfill the IOOS vision of regional and national integration.

The monitoring and forecasting of El Niño events is a good example of integration of many data sources (terrestrial, coastal, ocean) to craft an understanding of El Niño o formation and intensity. The data management protocols are critical to establishing the capability for such integration.

Making it Happen

While the Draft Implementation Plan outlines a detailed strategy for effectively realizing the goal of an IOOS, much work has been done to attain this goal. International collaborations have led to the deployment of systems such as the Tropical Atmosphere Ocean, or TAO/TRITON, array and the Argo profiling array, described in the accompanying list of NOAA ocean observation capabilities. In the U.S., systems such as National Water Level Observation Program and those run by the National Data Buoy Center (NBDC) provide data on a national (coastal) scale. Regional systems currently run by a growing number of organizations also collect data at the higher resolution scale needed to forecast impacts to coastal communities.

Comment [N13]: okay

Based on the work of the international and national observing community highlighted above, the general reasons, needs, technologies, and drawbacks to building an IOOS have been detailed multiple times over the years. However, it is only recently that mechanisms have been established to pull the international, national and regional communities together to make it happen. In the U.S., direction and input from Congress, NOAA and other federal agencies, the U.S. GOOS Steering Committee, local and regional stakeholders, and the coordination efforts of the Ocean.US office are the impetus pushing to make IOOS a reality.

Twenty years of ocean observational experience in NOAA suggest that the human ability to utilize and apply large amounts of ocean data is a critical limiting factor for the effective use of data from large-scale ocean observational networks. Obtaining a better understanding of regional economic, social, and environmental requirements for IOOS is a key consideration as the system evolves. Validating these requirements through rigorous analysis is an equally important task that will serve to distill the highest priority activities for consideration as IOOS investments.

A three-year regional study on economic and policy drivers for the design of IOOS is currently underway. To-date, the study documents that five key economic sectors (intermodal transportation, construction and engineering, energy, financial services, and recreation and tourism), as well as the public health sector, are factoring ocean and coastal observational information into economic, business, operational, and policy decision making. The study is revealing that increasing the use of this information in and beyond these sectors will strengthen economic activities and fill these sectors' identified needs, such as watershed-based geographic information system (GIS) mapping, more reliable forecasting, improved and higher resolution data on wind fields, and enhanced hurricane models and storm predictions.

There is much work to be done to involve the private sector in IOOS, both as a provider and a beneficiary. The private sector brings years of experience and expertise to operational observing of the environment including for the fields of research, technology development and application, the fielding and maintenance of platforms and instruments, environmental monitoring and analysis, and the operation of complex systems involving the ingestion, processing and delivery of real-time data. Studies are being done to help to identify and validate business sector requirements for IOOS data and information. It will be important, especially in the near term, to maintain an open dialog between the private sector, Ocean.US, federal and state agencies, and the developing RAs.

Concluding Remarks

The Preliminary Report of the Ocean Commission notes that *"an integrated ocean and coastal observing system that is regionally, nationally, and internationally coordinated and is relevant at local to global scales can serve a wide array of users, be more cost-effective, and provide greater national benefits relative to the investments made. Although the current regional systems are valuable assets that will be essential to the implementation of the IOOS, they are insufficiently integrated to realize a national vision.* [page 321]

Comment [N14]: okay

The challenges that now exist to bring together individual observing efforts to create an integrated system are largely people issues:

- Governance
- Mapping the respective roles and responsibilities of the public and private sectors
- Interoperability and access to data, information and products
- Integration and coordination
- Different needs across a spectrum of users
- Sustainability

It is these challenges which now hold our attention and for which solutions are now being shaped into a strategy to pursue an IOOS both nationally and internationally. NOAA is working both internally (through NOSA, NOSC, and NOC) and externally (Ocean.US, IOC and others) to complete plans for integrated and sustained ocean observations.

Mr. Chairman, this concludes my testimony. I would be pleased to answer any questions that you or other Members may have.