

Written Testimony Provided By

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To

**The House Commerce, Justice, Science and Related Agencies Appropriations
Subcommittee**

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As the Director of the SURA Coastal Ocean Observing and Prediction (SCOOP) program, I appreciate the opportunity to testify before the House Commerce, Justice, Science and Related Agencies Appropriations Subcommittee regarding the National Oceanic and Atmospheric Administration's (NOAA) coastal research programs.

The Southeastern Universities Research Association (SURA) is a consortium of over 60 Universities from across the U.S. Among other activities, SURA jointly operates the Thomas Jefferson Nuclear Accelerator Facility for the U.S. Department of Energy. For the past five years, I have been directing the SCOOP program, which is SURA's Coastal Research initiative. During that same period, I have also served as CEO of the Gulf of Maine Ocean Observing System (GoMOOS). GoMOOS is a nonprofit organization that delivers information to solve problems, predict events, and better understand the Gulf of Maine. GoMOOS was the first stakeholder organization of its kind, created ten years ago as a pilot "Regional Association" for the Integrated Coastal and Ocean Observing System (ICOOS). The partnership between SURA and GoMOOS has been strategic, for reasons that I will explain. The beginning of the story predates my involvement. In fact, the vision for the ICOOS can be traced back twenty years to a resolution of the Intergovernmental Oceanographic Commission (IOC), which marked the formal beginning of the Global Ocean Observing System.

The purpose of my testimony today is first to applaud your efforts and to celebrate successful passage of H.R. 146, which authorizes a national Integrated Coastal and Ocean Observing System (ICOOS). After almost a decade of failed attempts, ICOOS has finally become law. The second purpose of my testimony is really intended for my son, for your children, and for future generations. Authorization of the ICOOS is a tremendous first step, but only the first step. I am here to encourage investment in what should become a truly multi-agency, multi-sector, international and sustained endeavor. Future generations deserve a safe and healthy planet -- the ICOOS is a critical part of their future.

SURA has been advancing a multi-institutional, trans-regional collaborative effort through the SCOOP program (<http://scoop.sura.org>). The goal has been a shared information technology (IT) infrastructure for distributed data-management and community modeling. SCOOP has engaged some member universities and partnering organizations with expertise in IT and coastal

wave and storm surge modeling. The SCOOP infrastructure is a prototype "distributed coastal laboratory" designed to support community-oriented research and development.

As the Congress/Committee knows, NOAA currently has an "Integrated Observing System (IOOS)" activity underway (see <http://ioos.noaa.gov/>). The NOAA/IOOS Data Integration Framework (DIF) shares many features in common with the SCOOP program. We have worked with part of the DIF team on a highly successful ocean-data network (<http://www.OpenIOOS.org>). In October 2008, the network instantly grew to include new data services from NOAA's National Data Buoy Center and National Water Level Observing Network. This huge accomplishment demonstrates the power of open standards for bridging the operational and research communities. Our open-access network now includes over one thousand platforms reporting real-time data from over fifteen different organizations. And the network continues to grow.

Given the maturity of our capabilities and approach, we know we can work well with NOAA to achieve other cost-effective solutions. We encourage stronger coordination (and funding). The differences in our respective approaches could work to mutual benefit. Whereas the NOAA/IOOS DIF team has been working largely within NOAA and on NOAA systems, the goal of SCOOP is an open access, community network. The benefit to society from a coordinated approach could accelerate progress toward the promise of safe and healthy coasts – "safe" meaning a reduced risk of loss of life due to lack of information about severe weather events and "healthy" meaning preserving ecosystems for fish and shellfish stocks in coastal areas and keeping water safe for recreation (control of water-borne pathogens).

Information Technology must play a central role in implementing the ICOOS. In the 90's, before the emergence of the World Wide Web, we may have been tempted to centralize the ICOOS, or to house it inside a single agency. The last twenty years have shown how to build the cost-effective solutions. The last decade demonstrates the power, economies and innovative capacity of the network. We chose the network solution with SCOOP.

A global ocean observing system was a good idea twenty years ago, and a U.S. ICOOS was a good idea ten years ago. Today, neither is functioning at adequate levels:

- The intended economies-of-scale have not been realized;
- The sustained funding for user-tailored products and services has not been achieved; and
- The integration of observational systems and product-delivery systems has only been demonstrated in a few geographic areas on a few topics with pilot-program money and no stable continuation of those efforts.

For example, despite over 1.5 million visitors per year on our website, I recently watched myself on the evening television news talking about how budget cutbacks have eliminated half of the GoMOOS buoy array. And despite the fact that we help the National Weather Service forecast coastal storm damage for emergency managers, the SCOOP program has run out of funding as well. These are two of many examples. In twenty years, some remarkable achievements have been made with meager funding by an international community of scientists and engineers. The system can be cost effective, but it is not free. Many individuals have already moved on to other

jobs. I hope the ICOOS does not have to start from scratch.

The origin of the doldrums is easy to explain. It's related to the complexity of the system: (1) a large number of possible observations feeds (2) a large number of possible products-and-services to provide (3) useful information to a large number of possible end-users. In addition, a large number of public, academic, industrial and government organizations would like to be involved in some or all three layers of this system. It has not yet been possible to simplify this complexity to a tractable set of efforts and players, although progress is being made within selected geographic regions. We have learned a lot in the last twenty years. In fact, I would argue that we now know what the system should look like.

Our experiences have taught us that the heart of a true ocean observing system is the capacity to link together many generators of ocean data and thousands of data collection systems. The system must turn raw observations into predictions – whether the navigability of waters a few hours from now, a harmful algal bloom or a flooding event a few days from now, recruitment of a fishery a few years from now, or the rate of climate change a few decades from now.

While various regions were deploying ocean-observing capabilities similar to GoMOOS, the SCOOP program at SURA focused on the Information Technology needed to connect and integrate the disparate and varied regional data providers, to help turn those data into environmental predictions, and to enable the broad array of research and end-user applications. The focus at SURA has been to demonstrate that Information Technology can provide a foundation for simplifying the complexity, and assuring maximum benefit from a system that is comprised of a wide variety of contributors.

We are rethinking our federal funding strategy and trying to diversify our business model in response to recent budget decisions. Our cutbacks reflect trickle down from bigger problems facing the nation and many other national science programs. These problems cannot be solved by any one entity. National leadership understands the real problem:

“...observing and information systems reside in dozens of federal and state agencies, universities and private industries and are tailored to the individual missions of those who fund them. By continuing on this course of developing isolated, individual systems instead of an integrated system, the nation over the next 20 years could spend billions of additional dollars on ocean observations because of the multiplied costs of development, operations and maintenance.”
[Interagency Working Group on Ocean Observations, 2007]

The solution seems simple: integrate first, augment second. We see this wisdom in the five-year strategic plan of that working group, which goes on to advocate for the type of solution we have prototyped:

“Existing data provided by observing systems operated by federal and state agencies, academic institutions, and other local or regional entities will expand the geographic distribution and scope of data types offered through ICOOS. The observations will be most useful and timely, and serve the broadest number of users

when they are combined and conveyed in an integrated and standardized manner to ensure maximum interoperability.”

Clearly, the most cost-effective solution is not a centralized database. In fact, it is easy to argue that no centralized system of any kind will work. Rather, the solution must be a distributed “system of systems” -- a network. In this modern version of an observing system, the entire community participates. This type of ICOOS will be achieved using the same Web technologies that have globalized the economy and changed social interactions.

The nation must advance an open-access network that enables data archive, discovery and reuse, as well as computational ability to turn data into predictions. The network must span multiple science domains, serve a variety of end-users and influence policy. The infrastructure is neither program specific, nor agency specific. Dr. Arden L. Bement, Jr. , former Director of the National Science Foundation, described it well in his letter to the community supporting the NSF vision for Cyberinfrastructure in the 21st century. Cyberinfrastructure "enables distributed knowledge communities that collaborate and communicate across disciplines, distances and cultures." These communities "extend beyond traditional brick-and-mortar facilities, becoming virtual organizations that transcend geographic and institutional boundaries." SURA agrees that the vision is new, exciting and bold -- and necessary for the ICOOS.

How will Congress fund the network solution when so many agencies must take part? Herein lies a special challenge, if not a paradox. The most cost-effective solution -- the multi-disciplinary, multi-agency, multi-sector network solution -- may be the most difficult to fund from a budgetary perspective. Can a single line item in a single agency budget serve the purpose? A National Academies report earlier this year calls for a nationally “integrated education-research-extension model” to develop “a powerful alternative to the current pattern of investment in expensive short-term and disconnected ‘projects’.”

The novelty lies in the architecture of the system. The ICOOS network must extend the standards of the World Wide Web consortium, and it must involve a process for adoption by the disparate communities. At SURA, we have found huge benefit from working with open standards and within the framework of consensus standards organizations such as the Open Geospatial Consortium (OGC). This organizational construct may offer a solution to the budgetary problem. All the agencies that must contribute to the ICOOS are already members of the OGC, as are many of the research institutions, nonprofits and private companies that stand to contribute to and benefit from an ICOOS. We offer that non-governmental organizations like the OGC could be part of the solution.

Twenty years later the concept of ICOOS is no longer new, but it is still timely. And we are well positioned now because that last ten years has taught us not to underestimate the power of the network. The Web has clearly demonstrated that standards enable innovation. But the biggest challenges are not technical, or we’d be there by now. The metaphor of an eight-person racing shell seems apt. The fastest boat rows in sync, and there’s unspoken magic when everyone works together. But when one person tries to go it on their own, even if they’re twice as strong as everyone else in the boat, their effect on the boat is like someone throwing out the anchor. The ICOOS will arrive when we all agree to work together to make it happen.