WRITTEN TESTIMONY OF

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HEARING ON:
HOW TO IMPROVE THE EFFICIENCY, SAFETY, AND SECURITY OF MARITIME TRANSPORTATION: BETTER USE AND INTEGRATION OF MARITIME DOMAIN AWARENESS DATA

BEFORE THE SUBCOMMITTEE ON COAST GUARD AND MARITIME TRANSPORTATION

Good Morning Chairman Hunter, Ranking Member Garamendi and Members of the subcommittee. Thank you for the opportunity to testify on the "Use and Integration of Maritime Awareness Data."

I am an observational physical oceanographer and have spent over thirty years collecting and analyzing oceanographic data on waves, currents and tides. I am a professor of oceanography at San Francisco State University and the Director of the University's environmental studies facility. The Romberg Tiburon Center is the only educational and research laboratory located directly on San Francisco Bay. I am a fellow of the California Academy of Sciences and hold long-term memberships in the American Geophysical Union and the Oceanography Society. I am a founding member of the Central and Northern California Ocean Observing System or CeNCOOS, one of the 11 regional observing systems within the U.S. Integrated Ocean Observing System (IOOS) that build on local expertise and knowledge to meet national ocean observing needs including safe marine operations.

My expertise is on how and why ocean water moves. I have done many experiments investigating specific phenomena like upwelling dynamics and coastal boundary currents. For the last 15 years I have put increased emphasis on collecting the environmental data critical to any activity on the water—in particular, coastal ocean currents and the water masses in coastal and estuarine environments. This has provided me opportunity to interact with both the Coast Guard Search and Rescue Operations (SAROPS) personnel and the National Oceanic and Atmospheric Administration (NOAA) Office of Response and Restoration (OR&R).

I start with the premise that since this is a Subcommittee on the Coast Guard and Maritime Transportation, it is given that the ocean is critical for both the prosperity and safety of our citizens. Knowledge of the ocean is essential for this country.

Maritime Domain Awareness is broad, encompassing the critical issues of safety, security and stewardship. My testimony today is that thanks to the innovative approach that IOOS is taking and the infrastructure it is building, real-time environmental data are now readily accessible to the Coast Guard to support Maritime Domain Awareness - and the Coast Guard is utilizing these data.

Overview of U.S. IOOS Program

The inclusion of real-time environmental data is possible because in 2009 the U.S. IOOS was created by Congress as a Federal – regional partnership charged with providing real-time and sustained observations on our coasts, oceans and Great Lakes. NOAA is the IOOS lead of 17 Federal agencies, including the U.S. Coast Guard, that are working together to provide seamless access to coastal ocean data. All 11 regional ocean observing associations collect environmental data and disseminate the data in open formats. Today, over 50 percent of the data provide to the Global Telecommunication System by NOAA's National Data Buoy Center (NDBC) comes from non-federal sources, most of which is directly attributable to the IOOS data management system and the work being done and supported by the Regional Associations. No proprietary data formats are used; this allows anyone to access the data.

In a maritime event, whether search and rescue or a pollution spill, two sets of data are critical to a successful initial response. The first is knowing when and where an event is initiated. The second is knowing how the currents will transport the objects or substance of interest. In the past, numerical models were the primary tool available for predicting ocean currents. The accuracy of such models depends on three factors: the physics that are used to drive the currents and the initial environmental conditions used to start any model run, and the environmental data used for forcing and assimilation during the model run. Over time, models have improved as computer capacity has increased, allowing finer resolution and enhanced "physics." Still, for any model to be effective in a real time response, knowledge of the initial, and ongoing, environmental conditions are critical and must be obtained from observational data.

Use of U.S. IOOS Data by the Coast Guard

Three examples illustrate how access to IOOS real time observational data has greatly improved the Coast Guard's Maritime Domain Environmental Awareness.

The first example starts in California, but involves much of the United States. In 2002, California voters approved two propositions that provided $21 million in funding to monitor ocean surface currents along the whole California coast. A collaboration of 10 public and private universities were awarded the contract to create an array of shore-based radio instruments that can measure the ocean surface currents in real time from the shore out to a distance of 130 km with a spatial resolution of 6 km on an hourly basis. These instruments, called high frequency radar (HF radar), are robust, accurate and economical to maintain. Between 2004 and 2006, an array of 43 instruments was deployed covering the entire California coast. The data are accessible through the two IOOS regional observing associations located in California CeNCOOS and the Southern California Coastal Ocean Observing System (SCCOOS) and the NOAA NDBC site. A common format was agreed upon and tailored products for both NOAA and the California Office of Spill Prevention and Response were produced. California Lieutenant Governor John Garamendi supported this State effort.

The 2005 interagency "Safe Seas" spill response training exercise off San Francisco included actual observed surface currents, measured by the HF radar array. The utility of having access to real time surface currents caused one Coast Guard officer to exclaim "I love HF radar." During the subsequent 2007 Cosco Busan fuel spill incident both NOAA and the Coast Guard accessed the same real time HF radar data during response operations in San Francisco Bay and the Gulf of the Farallones. This led to NOAA adopting protocols to include HF radar data in the NOAA model used to provide environmental conditions to the Coast Guard.

Other HF radar arrays have been established by different IOOS Regional Associations (Figure 1.). In each case, funding to implement the arrays came from non-traditional sources and now the system operations are primarily supported by IOOS. In 2005 IOOS developed a plan for making this technology into a national system. The National Surface Current Mapping Plan is now being implemented within all 11 IOOS regions. Data from these regions are processed and made publically available through NOAA's NDBC and feeds directly into the Coast Guard's operational models for use in search and rescue activities (second example below).

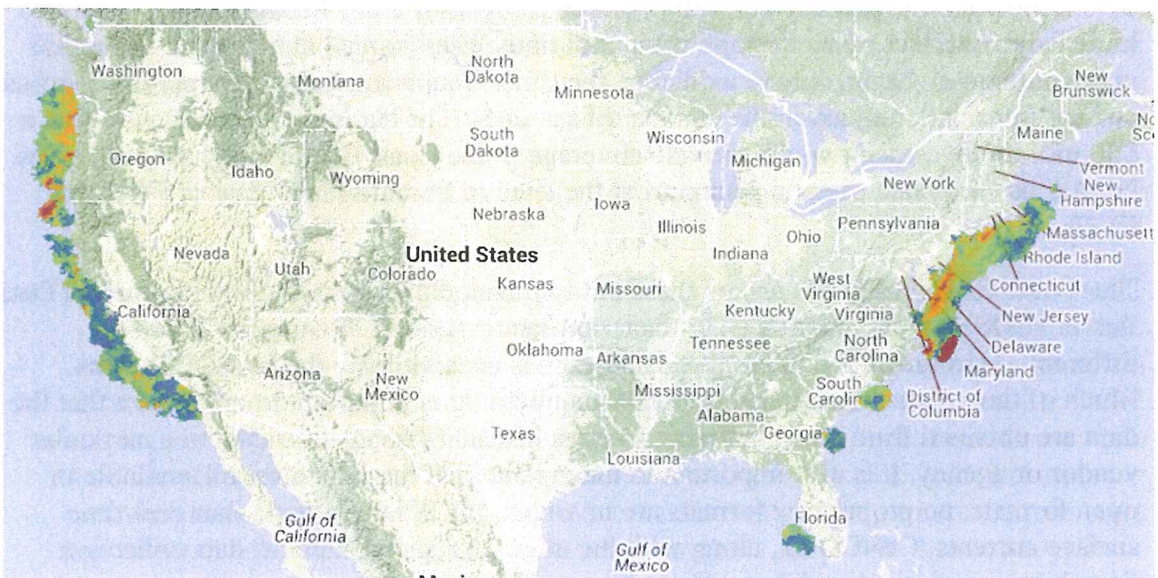

Figure 1. The distribution of HF radar determined surface currents along the coast of the continental United States. Image is for July 26, 2013 and warm colors represent higher speeds of the surface currents. Four IOOS regional observing associations—CeNCOOS, MARACOOS, NANOOS and SCCOOS—maintain the country's largest HF radar arrays.

During the response effort to the 2010 Deepwater Horizon oil spill the Unified Area Command was able to access data and model output from local universities, state agencies and private companies, increasing their understanding of the ocean conditions affecting the path of the oil. The IOOS network also deployed a fleet of underwater gliders, borrowed from regions across the country, to the Gulf area to assist with monitoring the subsurface flow of oil. Deepwater Horizon was the first time that Federal responders had routine access to non-federal information, which was enabled by the protocols developed by the IOOS data management system.

An IOOS goal is to create a single ocean data system that can serve multiple national and regional missions. Instead of each mission agency or regional program creating its own issue-specific ocean and coastal observing system, IOOS strives for one system that can be used by many agencies, programs and individuals. For example, real-time information on the speed and direction of surface currents is used by the U.S. Coast Guard in search and rescue operations, by fisheries managers to model the transport of fish larvae, by regional scientists to forecast harmful algal blooms, by commercial shippers to pick coastal routes, by aquaculture enterprises for water quality, by recreational boaters for safe outings and by public health officials to understand beach water quality. "Measure once, use multiple times" is the IOOS mantra.

A second example of the Coast Guard's use of IOOS data is using HF radar data to dramatically improve the ocean surface current estimates used in search and rescue. The traditional model used to direct searches was based on historical estimates of the tidally driven currents and the strength of the wind to estimate where a person in the water would drift. Using real time currents obtained from the HF radar instruments, it was determined that the search time could be reduced by two-thirds because of the improved knowledge of the currents through using real time observational data instead of the tide and wind model. Again, where available, the Coast Guard routinely uses real time surface current information to aid in the conduct of searches. The National Plan estimates that a $20 million investment would provide coverage to the Coast Guard's high priority areas. NOAA has provided operating support at the level of $5 million per year in FY12 and FY13.

The Coast Guard SAROPS access these environmental data from the Environmental Data Server (EDS) system maintained by their contractor ASA. EDS supports over 50 different environmental data products and each is accessible by the SAROPS teams. Much of those data are supplied by IOOS members. It is important to emphasize that the data are obtained from many different sources instead of being restricted to a particular vendor or agency. It is also important to understand that these data are all available in open formats; no proprietary formats are involved. IOOS serves more than real-time surface currents. CeNCOOS, along with the other 10 regions, support data collection from buoys, underwater gliders, pier stations and other means.

The third example is how other technology has assisted in improving maritime commerce and safety. An IOOS collaboration with the US Army Corps of Engineers' Coastal Data Information Program (CDIP) has been placing buoys that accurately measure both waves and swell at critical locations. In the San Francisco area, tugboat operators requested that one of these buoys be placed on the San Francisco entrance bar to monitor the wave conditions at this dangerous spot. With IOOS collaboration, the buoy is maintained at this location. The number of Coast Guard responses to the area dropped from nearly 80 in 2005 before the buoy was deployed to less than 20 in 2009. Clearly, there is a critical need for the type of real time data that IOOS and its partners are providing.

Recommendations and Conclusion

In conclusion, I would like to reiterate that the development of the IOOS system gives the Coast Guard unprecedented access to environmental data. IOOS is building critical infrastructure to provide real-time information about our oceans, coasts and Great Lakes. As the system expands, the Coast Guard will continue to derive benefits through access to ever more detailed environmental data. The interagency partnership and network of regional observing systems is based on sound science and is a model for building cost-effective programs to serve multiple needs. The Coast Guard, particularly the SAROPS group and the Unified Area Command group, have done a very good job ensuring that the agency has access to the environmental data essential for good Maritime Domain Awareness.

I recommend that the Coast Guard strive to utilize all non-classified environmental data available through the IOOS servers in their operational protocols and ensure that the different divisions within the Coast Guard utilize common protocols to access the data. The distributed observing infrastructure being developed by IOOS is as critical to the Coast Guard's functions as is its boats, piers and other infrastructure. Real-time observations and models directly enhance the Coast Guard's maritime domain awareness by providing rapid access to the best available science-based information. Also, I urge divisions of the Coast Guard to become members of their respective Regional Associations. Membership strengthens the collaboration between the organizations and provides a more efficient mechanism to create operational applications from IOOS data that the regional observing systems collect.

This approach of sharing the collection and dissemination of environmental data should be encouraged and supported by all 17 federal agencies who are party to the IOOS legislation. Since the Coast Guard is one of the parties and primary beneficiaries of IOOS, the Coast Guard should be commended for utilizing the available data and supporting efforts to maintain the data collection and dissemination.