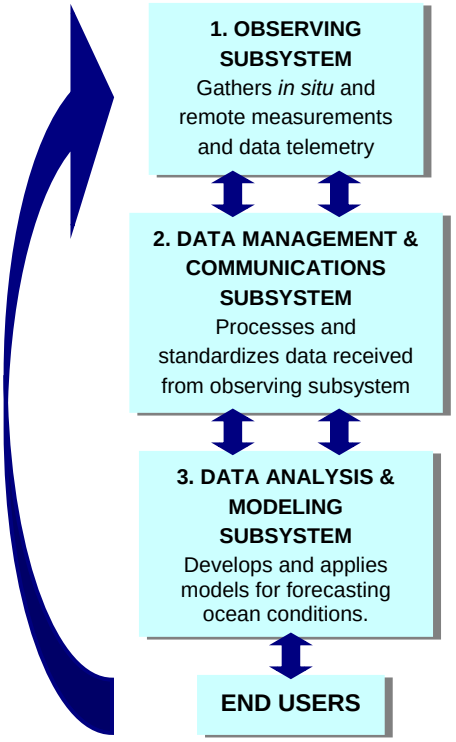
IOOS and United States Coast Guard Search and Rescue Responsibilities

What does IOOS do?

IOOS (Integrated Ocean Observing System) is a **multidisciplinary** system designed to provide ocean and coastal data in the formats, rates, and scales required for decision-making, based initially on the **integration** of existing private, federal, state, and local systems. Consisting of three major subsystems (see figure at right), IOOS will constantly evolve according to user needs.



Currently, numerous ocean and weather data collection systems are maintained by scores of federal, state, and non-governmental agencies and organizations. IOOS is gathering these useful but disparate and isolated data sources into integrated systems, giving users ready access to all ocean-related data gathered by all possible sources. In addition, IOOS will allow any compilation of data specified by the user to be manipulated using myriad existing forecasting models, thereby turning raw numbers into actionable information relevant to the user's specific concerns. Finally, IOOS is seeking new research and enhancements to add to its already-extensive catalog of products. In this way, IOOS becomes a flexible, adaptable system capable of keeping up with new developments while maintaining the reliable delivery of data, analyses, and forecasting results. IOOS will focus initially on a series of high priorities.

How can IOOS Help USCG Search and Rescue Operations?

One of the activities for which the USCG is most publicly known is its search and rescue (SAR) program. The primary objectives of the USCG SAR program are fourfold:

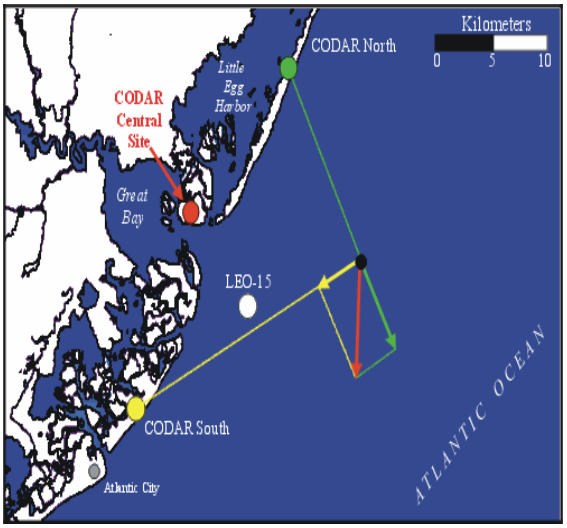
1. Minimize loss of life, injury, and property loss and damage in the maritime environment;
2. Minimize crew risk during SAR missions;
3. Optimize use of resources in conducting SAR; and
4. Maintain a world leadership position in maritime SAR

The USCG has also set **quantifiable SAR goals** for itself, including, after USCG notification and in waters over which the USCG has SAR responsibility, **saving at least 93% of all people** whose lives are in distress. Additionally, the USCG aims to prevent the loss of 80% of the property at risk of destruction.[1] In pursuit of these goals, the USCG has established several self-regulating standards that they strive to achieve and even surpass, including a maximum of a two-hour response time from notification to arrival on scene. The USCG has recently begun using a Search and Rescue Optimal Planning System (SAROPS). Using the Environmental Data Server (EDS) at the USCG's Operational System Center in West Virginia, oceanographic conditions (e.g., wind and currents) are collected, converted into a compatible format, and uploaded to SAROPS, either by request or four times daily.

Having access to real-time ocean current information is critical for numerous maritime-based activities, but the USCG's SAR operations can especially benefit. Rutgers University's **Coastal Ocean Observation Lab (COOL)** maintains the only operational high-frequency (HF) radar network in the eastern United States. Coastal Ocean Dynamics Application Radar (CODAR) consists of several pairs of antenna sites on the New Jersey coast. For each pair of sites, one remote site broadcasts radio waves across the ocean surface; the second remote site picks up the signal after it has been bounced back by the ocean waves. The measurements gathered from these two sites are **used to determine the net movement of the water's surface, and, therefore, the surface current speed in real-time**. Presently, this CODAR system covers virtually

[1] USCG. 2007. SAR Program Information. 2/2/07. http://www.uscg.mil/hq/g-o/g-opr/sar_program.htm.

the entire offshore New Jersey region, out to 100 nautical miles (nm); the most high-resolution results (detected by shorter range radar), however, are detected out to 20 nm (see example map below).



Rutgers Coastal Ocean Observation Lab's Short-Range HF radar network, showing the net movement of the water (red arrow).
Source: http://www.thecoolroom.org/instruments/instrument_codar.htm

In addition to this existing Rutgers system, the Mid-Atlantic Coastal Ocean Observing Regional Association (MACOORA) has formed a coalition of HF radar operators from southern New England to North Carolina as a pilot project for a future nationwide system. By combining and collating efforts, eleven long-range HF radar sites and three short-range (but higher resolution) sites in the Mid-Atlantic Bight (MAB) area will form a regional network that will measure real-time ocean currents for the majority of the MAB shelf.

HF radar networks like the existing CODAR system and the planned MACOORA consortium provide **high-resolution information about the state of the ocean**, down to detailed accuracy of characteristics like coastal eddies, wave height, and other mesoscale features. As demonstrated by Rutgers COOL, sea surface temperatures and other relevant remotely sensed ocean data can be combined with the real-time current information to **provide critical decision-making tools to the USCG such as survival likelihood, search area planning and transect plotting, and the identification of the most likely location of the target**, given the ocean and climate conditions. Users will be able to **customize their data requests** and use IOOS-based modeling tools to determine, for example, search radii based on currents, winds, wave information, and potential conditions that may compromise an effective search (e.g., fog). IOOS will allow formerly disparate sources of critical information to be collated and manipulated, augmenting the base of data currently utilized by the USCG and potentially improving SAR effectiveness.

Research conducted by Arthur Allen[2] at the USCG Office of Search and Rescue estimated the cost savings to the USCG of implementing HF radar capabilities into SAR operations. Allen assumes that approximately 1000 people annually either die or are unaccounted for after USCG case notification. He also places the value of a life at about $3 million, based on the Value of Statistical Life (VSL) estimates developed by the Department of Transportation. In conditions where the environmental conditions are highly uncertain (e.g., where currents and other oceanographic conditions are not known), the USCG experiences a 22% success rate. Using HF radar, the USCG has the potential to increase this success rate to 48-67%, thereby **saving 26-45 additional people every year**. In VSL terms, this translates to between a **$78 and $135 million savings** for the United States.

What Can USCG and Other Stakeholders Do?

The value added from the integrating and sustaining power of IOOS will only be realized with regional association **participation** and **data sharing**.

Participation: Stakeholders should get involved with an IOOS Regional Association (RA) (www.ocean.us/regional_associations). RAs are critical for engaging private and public user groups to identify regional data and information needs. Additionally, RAs can be high-value entry points for a user to get involved with specific IOOS pilot projects (many of which are happening right now) through which users help improve and refine IOOS. Pilot projects and RAs can facilitate data sharing, the cornerstone of IOOS, between previously unconnected parties. Even by sharing small amounts of data, users can reap significant benefits through invaluable forecasting results.

Data Sharing: Stakeholders should share data (e.g., weather information from vessel-based instruments or observations from offshore platforms) with federal, state, and local agencies. For instance, the data that enable search and rescue originate from a variety of state, local, and federal sources.

[2] Allen, A. SAROPS: Environmental Data Sources and their Uncertainties. Powerpoint presentation.