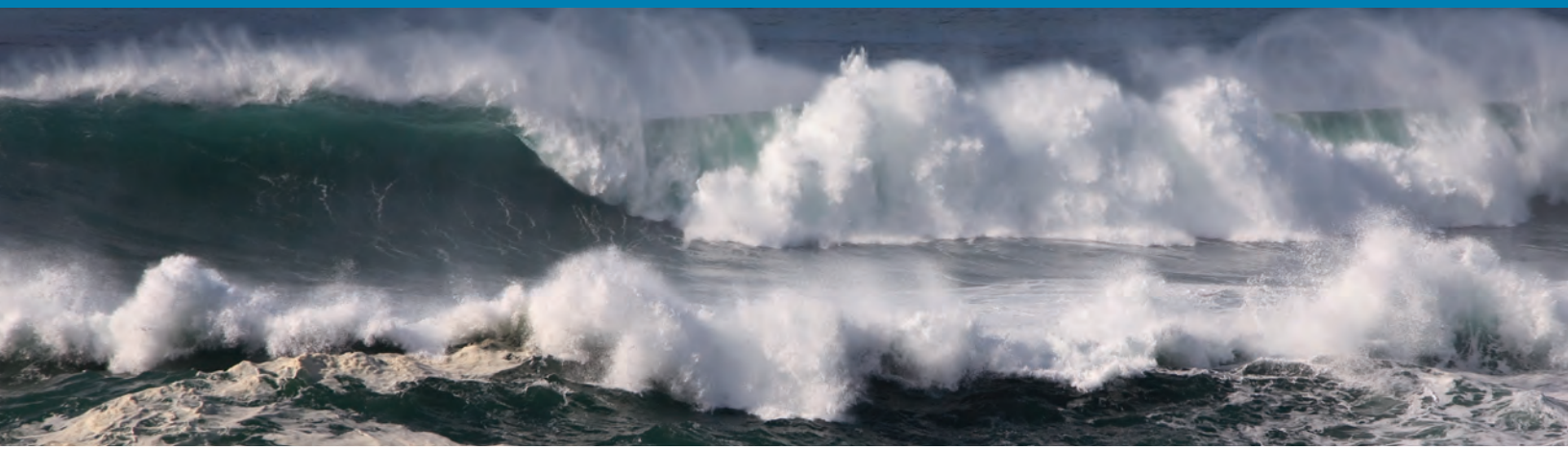


Supporting Effective Search and Rescue Missions

Every year, the U.S. Coast Guard performs thousands of search and rescue missions, saving more than 5,000 lives. The Coast Guard uses its Search and Rescue Operations (SAROPS) tool in its execution of searches to minimize response times.

An Applied Sciences project worked with the Coast Guard to apply data from *Aqua, OSTM/Jason-2*, and other satellites along with Earth science models into SAROPS. The project enhanced forecasts of currents and winds used in targeting search areas, reducing the areas and response times. Following tests of the application in the northeastern Pacific Ocean, the Coast Guard incorporated the NASA data and models into its operations off the coast of California in 2011.

Reducing Search Areas

Once alerted to a new case, the Coast Guard, aided by SAROPS, develops a search action plan based on the search area and available resources. SAROPS is a Monte Carlo simulation-based system that uses thousands of simulated particles to estimate ocean currents and likely locations of persons and property in distress. By enhancing predictions available in its SAROPS tool, the Coast Guard can narrow down the area of deployment and increase efficiency to locate possible survivors.

"I've been very impressed with the Coast Guard's commitment to bring NASA satellite data and model forecasts into their decision-making process in order to improve their search and rescue operations," said Yi Chao, who led the project.

The project team used Earth observations and Earth science models to enhance SAROPS forecasts of ocean surface current speed and direction as well as ocean surface wind speed and direction. It also used the models and observations to create the range of estimates of predicted current and winds. Characterizing the range can be crucial when deciding on how broad or narrow a search area to target.

The Coast Guard used NASA Earth observations and models to enhance its search area estimates, narrowing the area of deployment and increasing efficiency in locating possible survivors.

The project applied forecast capabilities from the Weather Research & Forecasting atmospheric model and the Regional Ocean Modeling Systems oceanographic model. For search and rescue activities, the project enhanced these models through the integration of data from NASA's Earth observing environmental satellites, which collect information on all parts of the Earth.

The team applied ocean height data from the *Jason* and *OSTM/Jason-2* satellites as well as sea surface temperatures from the Moderate Resolution Imaging Spectroradiometer (MODIS) sensor on *Terra* and *Aqua*. For example, measurements of sea surface temperatures, which are associated with thermal gradients, provided changes in surface patterns used to derive surface currents.

"[This application is an] extraordinarily powerful technique that we will continue to use and incorporate."

Arthur Allen
U.S. Coast Guard Office of Search and Rescue

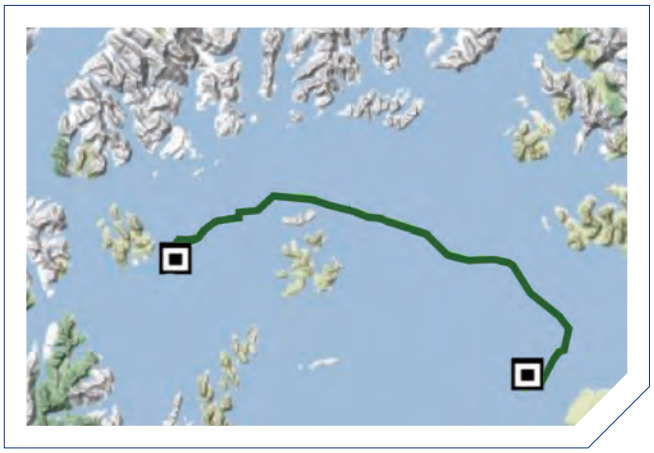
The project combined the satellite observations with surface current information from partners' high frequency radar, ship surveys, moorings, and drifters. The team completed field tests in Prince William Sound, Alaska, comparing the satellite data with known variables such as wind speed, wave height, and current direction gathered by equipment on-site. The team used these comparisons to refine the models.

Saving Lives, Time, and Money

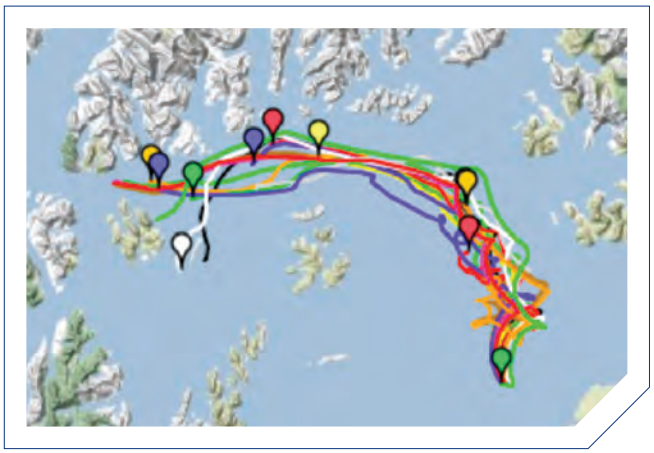
Time is critical when deploying search and rescue operations over oceans and other large bodies of water. By enhancing predictions available in SAROPS, the Coast Guard can narrow down the area of deployment and increase efficiency to locate possible survivors. A Coast Guard rotary-wing aircraft costs $8,500–14,500 per hour to operate, and a Coast Guard cutter costs $2,300–13,000 per hour to operate. Improved reliability of predictions can also significantly reduce costs and time and increase success of search and rescue deployments.

Effective search and rescue missions depend on having the right data at the right time and in the correct format. Of the application of NASA data and models, Arthur Allen, a physical geographer with the Coast Guard's Office of Search and Rescue, said that it was an "extraordinarily powerful technique that we will continue to use and incorporate. We, the Coast Guard, will continue to bring it to fruition."

In 2012, the NASA-sponsored project will make further refinements with the Coast Guard to improve the use of the satellite data and Earth science models in SAROPS, with possible uses in other regions. In addition, Applied Sciences will work with the Coast Guard to incorporate data from the *Suomi NPP* satellite launched in late 2011.



The project team conducted field tests in Prince William Sound, Alaska, to evaluate the application. The tests compared modeled drift trajectories with observed ones. This image shows the actual, observed drift trajectory in one test.



This image shows the forecasted drift trajectories based on the model including NASA data. Note points of correlation with observed trajectory.