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## AMSA's Advanced Oil Spill System Used to Combat Pollution of the Sea

The Australian Maritime Safety Authority (AMSA) have been using ASA's oil spill model (OILMAP) since 1999, as part of marine protection and oil spill response for 18,000,000 square miles of ocean (1/10<sup>th</sup> of the globe). OILMAP is used as a decision support tool to predict the movement and weathering of oil spills as part of spill response training and to aid in the effective deployment of oil spill response personnel and equipment to protect environmentally sensitive areas in the event of an actual spill. OILMAP is also being used on a frequent basis in the investigation and prosecution of the illegal discharge of oil at sea by ships.

In June 2004 AMSA upgraded their hydrodynamic model to now include HYDROMAP, ASA's ocean/coastal model, to predict ocean currents for OILMAP's trajectory models. Embedded in a user-friendly interface, HYDROMAP's unique gridding features expand OILMAP's modelling capability, allowing AMSA staff to resolve the effects of high-resolution coastal features such as through-flows between small islands and circulation within ports and harbours. This advancement enables accurate predictions of the water movement in the event of spills near the coast.

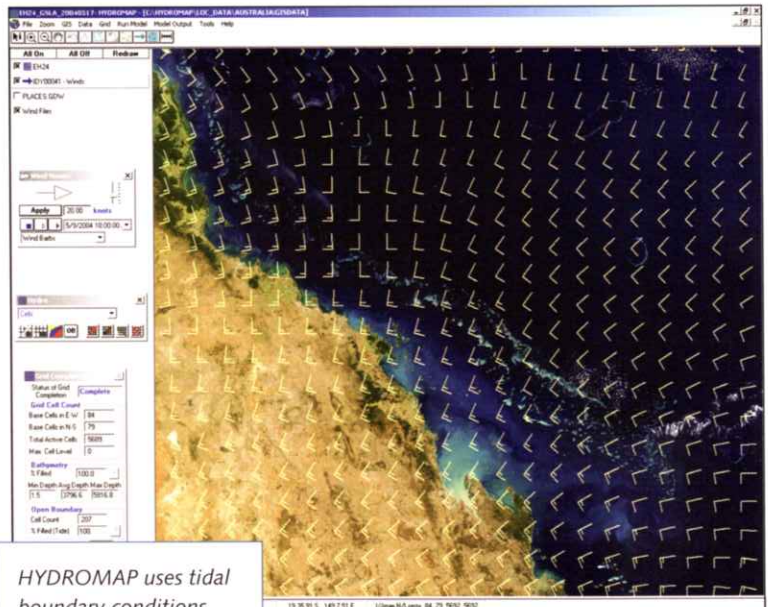
Using hydrodynamic models such as HYDROMAP to drive oil spill models is not unusual. However, what makes the OILMAP-HYDROMAP system significantly more advanced than other standard systems is the ability to include large scale currents measured by orbiting satellites supplied by CSIRO, as well as the use of detailed spatial wind data provided by the Bureau of Meteorology for the entire AMSA response region. ASA has developed tools to integrate the large-scale currents (in NetCDF format) that develop in deeper water off the continental shelf with the in-shore HYDROMAP-predicted tidal currents. This allows the AMSA staff to forecast the movement of spilled oil should it originate in deep waters and move towards the coastline, or vice-versa. The spatial wind data (LAPS & GASP), provides a 3-day forecast, allowing the user to run models forward in time and predict the future movement and weathering of the oil. The goal is to allow more time for planning and preparedness.

As part of this implementation of HYDROMAP, the system has been tested and validated for a number of Australia's known high risk sites including South Great Barrier Reef, Sydney Harbour, Port Phillip Bay and Darwin Harbour. In August 2003, HYDROMAP was used as part of a ground-truthing exercise in Moreton Bay National Marine Park. During this exercise, the integrated HYDROMAP-OILMAP system was found to produce accurate forecasts for the region.

For more information please contact Sasha Zigic, [szigic@apasa.com.au](mailto:szigic@apasa.com.au)

### THE INSIDE STORY

- COASTMAP in an ArcGIS Environment
- New Projects
- Personnel News
- Upcoming Conferences



*HYDROMAP uses tidal boundary conditions, meteorological wind forecasts and satellite derived altimeter data to provide integrated off-shore and nearshore forecasts.*

*Snapshot of the HYDROMAP model with the Bureau of Meteorology, LAPS 3-day spatial wind data forecast for the Southern Great Barrier Reef.*



*Photo of the Great Barrier Reef courtesy of the Australian Government Department of the Environment and Heritage.*



# COASTMAP in an ArcGIS Environment

# NEW PROJECTS

## USGS-COASTMAP

The United States Geological Survey (USGS) has purchased COASTMAP as part of the Tampa Bay Integrated Science project. The USGS Tampa Bay Study uses an integrated science approach to study the interrelations between geological, biological, chemical, and hydrological components of estuarine systems, and the impact of natural and anthropogenic change to all components of estuarine systems. The USGS Geological (GD), Biological Resources (BRD), Water Resources (WRD), and National Mapping (NMD) disciplines are working together with other federal, state and local partners to develop and implement an integrated, multidisciplinary science strategy for estuarine research. COASTMAP will be used to integrate a suite of hydrodynamic and pollutant transport models with observational data and provide an integrated platform for data distribution and analysis.

## Alyeska-AIRMAP

Alyeska Pipeline Service Company, operator of the Trans Alaska Pipeline System, has purchased AIRMAP to use with the Alyeska Tactical Oil Spill Model (ATOM) for Prince William Sound and surrounding areas. ATOM was developed by ASA in the early 90's and is used by Alyeska for oil spill response preparedness and training. The linkage of ATOM and AIRMAP will take the total evaporative losses predicted by ATOM and automatically input this to AIRMAP, which will then predict the movement and concentrations of the atmospheric plume.

COASTMAP is a globally re-locatable, integrated system for real time observation, modeling, and data distribution for estuarine, coastal, shelf, and ocean waters. The system collects data (observations and model predictions) either from its on-line data storage system, via the internet from sources not served by its online storage system, or through its own network of observation stations.

The COASTMAP Professional Client has been designed for high end users that need to add metocean data management and analysis to their desktop GIS. COASTMAP is currently in transition to an extension for ESRI ArcGIS so that users can add metocean data management tools to their existing GIS framework.

To add metocean data, the COASTMAP user can request data from a COASTMAP data server. Communications between the client and server is handled using .NET-based web services. Support for Integrated Ocean Observing System (IOOS) OpenDAP servers is also being added.

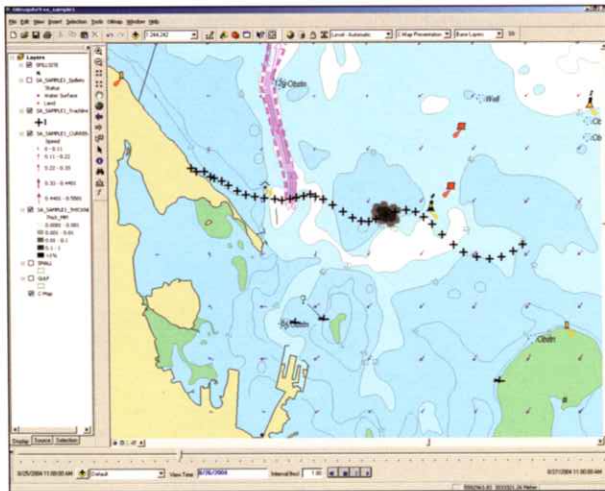
COASTMAP allows the user to ingest data formats such as NetCDF, GRIB, and HDF. Because of

the size and the nature of the data, these data files are not converted to standard GIS formats but accessed in their native formats through the use of custom layers within the ArcMAP framework. These temporal data layers are available for visualization, animation, and data analysis within ArcGIS.

ASA's Time Toobar extension allows the user to animate time series data (point source and gridded) in the ArcGIS framework and synchronize all temporal layers stored in the project.

The COASTMAP Web Browser Client has been designed to reach a larger audience. It features a GIS based interface similar to the Professional Client, but simpler. The web-based system has limited data analysis and modeling capability, but allows the user to visualize model predictions and observations.

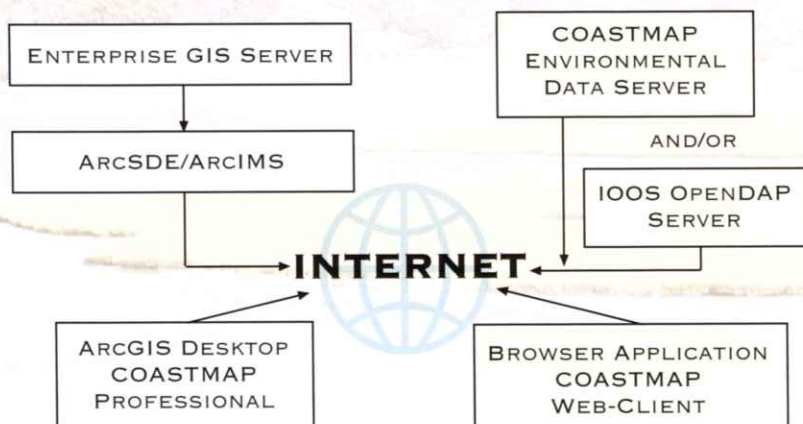
"Our challenge is to integrate very large time-varying datasets in a GIS environment" says Eoin Howlett, "and the new development tools available within ArcGIS9 combined with the use of .NET for web services has allowed us to implement solutions that were not possible a few years ago."



Sample Oil Spill Animation using the COASTMAP-OILMAP extension. Purple vectors represent tidal data for the Arabian Gulf. Black and gray slick corresponds to the thickness of the oil.

## GIS

## METOCEAN DATA

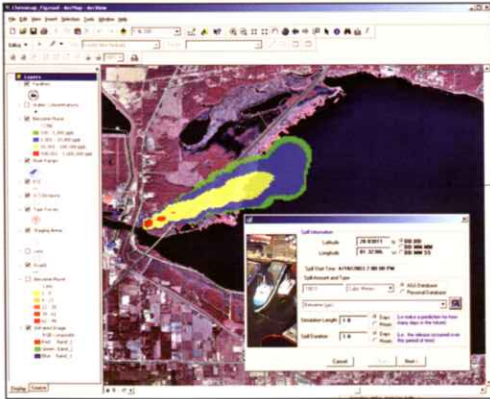


## Upcoming Conferences ASA will be attending

- Rio Oil & Gas Expo; 4-7 October; Rio de Janeiro, Brazil
- Brazilian Oceanography Congress; 10-15 October; Itajai (SC), Brazil
- Technologies for Search, Assistance and Rescue Seminar; 18-20 October; Brest, France
- IMEMS conference; 19-21 October; Washington, DC
- Global Ocean Data Assimilation Experiment (GODAE) Symposium; 1-3 November; St. Petersburg, FL

## City of Houston-AIRMAP

The City of Houston's (Texas) Department of Health and Human Services, Bureau of Air Quality Control has purchased the AIRMAP extension for ESRI's ArcGIS. The bureau is responsible for air quality issues within Houston's city limits and enforces federal and state air pollution regulations. AIRMAP will assist the City of Houston in defining the pollution plume footprint from industrial facilities. Since AIRMAP is fully integrated within ArcGIS the City of Houston can use all their existing enterprise GIS data.



Atmospheric concentration predictions of an ammonia release using AIRMAP for ArcGIS.



Photo courtesy of Alyeska Pipeline Service Company and Crowley Tug.

- American Water Resources Association annual conference; 1-4 November; Orlando, FL
- Gulf and Caribbean Fisheries Institute GIS and Remote Sensing in Fisheries Research and Management session; 8 November; St.Petersburg, FL
- Clean Gulf conference and exhibition; 17-18 November; Tampa, FL
- Regional Conference & Exhibition on Offshore/Coastal Protection - Offshore Arabia 2004; 29 November - 1 December; Dubai

## PERSONNEL

On 6 September, Eduardo Yassuda went to Argentina to deliver the COASTMAP wave analysis module which interfaces with the SWAN model. This development is part of the GEF Patagonia Project that also includes oil spill modeling capabilities. The photo below is from the training that was conducted with the "Servicio de Hidrografia Naval - SHN" (Argentinean Navy) in Buenos Aires, Argentina, in April 2004.



Eoin Howlett, Tatsu Isaji and Paul Hall attended meetings at the United States Coast Guard Research and Development Center to coordinate an analysis of the use of current data from high frequency sea surface radar systems (e.g., CODAR, OSCAR) for search and rescue modeling. ASA is working with Anteon, UConn and URI on a project for the US Coast Guard to integrate current data from sea surface radar systems into the new SAROPS search and rescue system. The trajectories of nine Self Locating Data Marker Buoys (SLDMBs) deployed in July in regions with active sea surface radar coverage will be modeled using current data from the radar systems. The results will be used to optimize future search and rescue planning efforts.

ASA's SARMAP system was recently featured in the July 2004 Discovery Channel documentary and investigation into the downing of Korean Airlines 007 (KAL007) which was shot down in 1983 with 269 aboard. Eoin Howlett and Malcolm Spaulding demonstrated the use of SARMAP to determine where the plane went down using known locations of where debris washed ashore.



In July Chris Galagan conducted a three-day OILMAP training course for AGIP KCO personnel in Atyrau, Kazakhstan. Training sessions focused on the difficult issues that would be faced by AGIP in the event of an oil spill in the North Caspian Sea. Training participants came from the Oil Spill, Ecology and Environment, and GIS/Geomatics Groups within AGIP.

On 14-15 September Chris Galagan attended the U.S. Maritime Security Expo at the Jacob Javits Convention Center in New York City. The expo brought key decision makers from government and industry together to identify issues and explore possible solutions in a public-private partnership environment.

Craig Swanson and Tatsu Isaji, along with Douglas Clarke and Charles Dickerson of the USACE Engineer Research and Development Center (ERDC), were co-authors of a paper *Simulations of Dredging and Dredged Material Disposal Operations in Chesapeake Bay, Maryland and Saint Andrew Bay, Florida*. Craig and Doug presented the paper at the WEDA XXIV / 36th TAMU Dredging Seminar on 7-9 July in Orlando, FL. The paper focused on calibration of the SSFATE model with field measurements by ERDC from sites in MD and FL.

On 13 July, Marco Correa went to Santa Catarina State in southern Brazil to make a presentation to PETROBRAS, the University, and local authorities about modeling ocean outfall effluent. ASA South America is using CHEMMAP for environmental permitting simulations for the S.Francisco Terminal outfall.

Sasha Zigic presented a paper "Modelling the 3-dimensional flow between the Nerang River Estuary and Burleigh Lakes system, Gold Coast" at the 8th National Conference on Hydraulics in Water Engineering, Gold Coast on the 16th July 2004.

As part of the technology transfer, The Australian Maritime Safety Authority (AMSA) staff underwent a three day intensive HYDROMAP and OILMAP training course from the 28-30 June, carried out by Sasha Zigic and Marc Zapata. See story on front page for more details on the technology transfer.



Eoin Howlett and Chris Galagan attended the ESRI International User Conference in San Diego, CA 9-13 August. Eoin presented a paper on SAROPS, a search and rescue application that is currently being developed for the US Coast Guard within the C/JMTK framework.

On 16 August, Eduardo Yassuda went to Chile to deliver additional licenses of OILMAP that will be used in the five new emergency centers along the Chilean coast.

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## Personnel continued

**Kelly Knee** and **Claudia Suárez** conducted a stream gauging survey to measure freshwater flow in the Palmer River for a project to characterize the environmental effects of a proposed desalinization plant in the town of Swansea, MA.



Asia Pacific's premier marine environmental pollution prevention and response conference, Spillcon, was held in Brisbane, Australia, 23-27 August. **Brian King**, **Marc Zapata** and **Sasha Zigic** shared a booth with John Leeder, Bill Stavropoulos and Rean Monfils from Leeder Consulting, and provided information about our various services. The conference was considered a great success with approximately 250 delegates from around the globe.

**Kathy Sheridan** presented the results of the Port Walcott Oil Spill Risk Assessment study to the Western Australian Department for Planning and Infrastructure (DPI). HYDROMAP and SIMAP were used to estimate the rate of spread of a possible oil spill, and results were added to the WA Oil Spill Response Atlas to help guide spill response.

**Jiganesh Patel** has returned to ASA after completing his Master of Science in Environment and Resource Management at the Free University in Amsterdam, the Netherlands. He completed his thesis at Delft Hydraulics on the subject of oil spill modeling on the Dutch coastal zone as it relates to the issue of place of refuge. Jiganesh will be working with the USGS to use COASTMAP and other ASA software as part of the Tampa Bay Integrated Science Project.

**Craig Swanson** and Dan Mendelsohn of Applied Technical and Management presented the results of a thermal mapping field program and hydrothermal modeling study of the Saugus River in Massachusetts to state and federal agency representatives in support of the re-permitting of the Wheelabrator Saugus facility thermal discharge. One unexpected finding was the large natural daily variation of water temperatures (4-6 degrees Celsius) that appeared to be generated from the extensive mud flats along the river that are exposed at low tide.

**Craig Swanson** was lead author on a poster session presentation at the 2<sup>nd</sup> National Conference on Coastal and Estuarine Habitat Restoration (Restore America's Estuaries 2004) in Seattle, WA on 12-15 September. The poster was entitled *Advanced Source Identification Tool for Estuary Restoration: Integrated Hydrodynamic and Pollutant Transport Model System for Bacteria in Southport Harbor, Connecticut*. Other authors included Kelly L. Streich (CT Department of Environmental Protection), Mary E. Garren (US Environmental Protection Agency), and Harry X. Zhang (Parsons Corporation).

In the first week of July **Sasha Zigic** provided ESSO Australia with an intensive 1-day OILMAP training course. The training course exercises provided hands on experience for emergency response and contingency planning for their various operations around Victoria.



September 21-24, **Deborah French McCay** participated in NOAA Damage Assessment Center's Rapid Assessment Program (RAP) Annual Training hosted by Northwestern Michigan College in Traverse City, MI. Debbie presented an overview of the chemistry of acid and base spills into fresh and salt water and the use of the "Acid-Base Calculator" developed by Debbie, **Nicole Whittier**, and Jim Payne (Payne Environmental Consultants, Inc.). The calculator estimates the volume of water where pH change would exceed limits tolerated by aquatic life. The calculator will be useful for planning spill response and damage assessments.

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