



# Oil Leak From a Sunken WWII Wreck Threatens the Fourth Largest Lagoon in the World

On 20 November 1944, a Japanese manned suicide torpedo struck and sank the US Naval tanker, USS Mississinewa, in 40 meters of water within Ulithi Lagoon in the north-western Pacific Ocean. The tanker was loaded with 19 million litres of aviation and heavy marine fuel oil, most of which was trapped within the wreck, where it lay undisturbed for the next 57 years.

However, on 6 August 2001, a tropical cyclone passing through the Pacific disturbed the wreck, causing an estimated 70,000 litres of oil to leak into the lagoon, creating hardship for the 700 islanders that live on the surrounding atoll and rely heavily upon the lagoon's fisheries resources. The leak was eventually plugged by contractors to the US Navy, however another 18 million litres remain on board, threatening to spill every time a cyclone sweeps by or another tank corrodes through.

The United States Government, who maintain sovereignty over the wreck and its cargo, have off-loaded the remaining fuel to prevent further pollution of the lagoon. The off-loading was completed on 18 March with a total of 1.8 million US Gallons pumped out.

Asia-Pacific ASA (APASA) carried out a detailed oil spill risk assessment to provide planners with an understanding of which environmental resources would be under threat if an uncontrolled oil release occurs. This work was carried out in collaboration with Trevor Gilbert from the Australian Maritime Safety Agency (AMSA) who has been assisting the Pacific Ocean Pollution Prevention Program (PACPOL).

The study made use of ASA's ocean/coastal hydrodynamic model, HYDROMAP, and three-dimensional oil spill model, SIMAP, to predict the potential and most likely trajectories and fates of oil originating from the wreck.

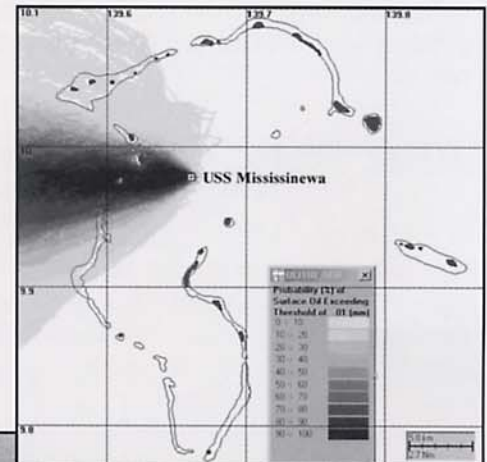
Contour maps showing the probabilities of exposure by surface slicks, and potential concentrations of physically en-

trained oil, and dissolved oil components (as aromatic hydrocarbons) were some of the outcomes of the study. This information will provide a guide for contingency planning and risk assessment and help the placement of protective equipment to guard sensitive resources and the selection of the optimal timing of operations.

While this study only focused on the risks of exposure from spills associated with the USS Mississinewa, there are another 1800 known WWII wrecks in the South Pacific that are loaded with oils, chemicals and ordnance, which also pose risks to the Pacific environment.

## THE INSIDE STORY

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*The USS Mississinewa during its glory days  
(Source: US Navy Archives)*

# BFSED: The Newest Addition to ASA's Boundary Fitted Modeling Software

BFSED is a sediment transport model that simulates the suspended load transport of cohesive (muddy) and noncohesive (sandy) sediment. It tracks these sediments as they erode from and deposit to the bottom and travel through the water column. The model predicts the distribution and amount of sediment that accumulates on or erodes from the sediment bed, as well as simulating sediment concentrations in the overlying water column. The model is based on the SEDZL algorithm that was originated by Kirk Ziegler, who started developing it at the University of California, Santa Barbara during the mid-1980s. He is now a principal at Quantitative Environmental Associates, LLC (QEA), a company with a strong reputation in sediment transport analyses, particularly in contaminated sediment fate modeling and analysis. ASA and QEA worked together to develop BFSED and the two firms have agreed to work jointly on major sediment transport-related projects that use BFSED.

BFSED joins ASA's other boundary-fitted models: BFHYDRO, a full hydrodynamic model, BFMASS, a constituent transport model and BFWASP, a water quality model based on the U.S. EPA's WASP model kinetics. All these models are integrated via the WQMAP framework, using the same state-of-the-art model gridding approach.

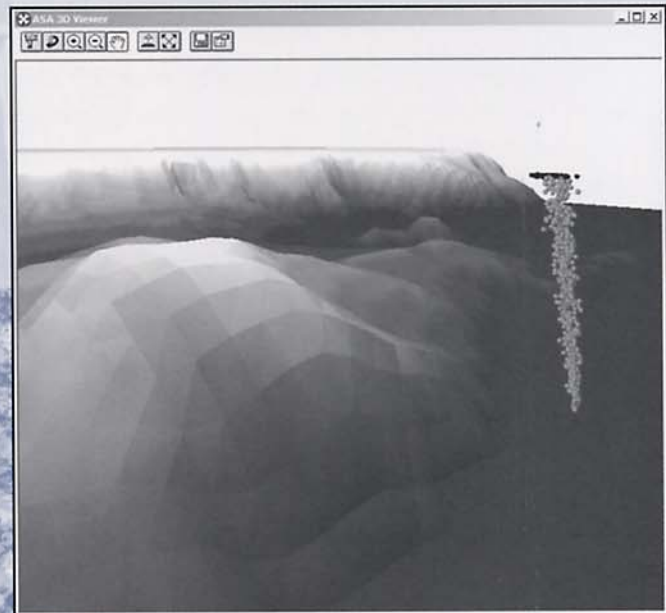
ASA recently used BFSED to predict the changes in sediment erosion and deposition that might occur in a narrow tidal estuary as a result of highway bridge reconstruction. Pre- and post-construction hydrodynamics developed in BFHYDRO for the estuary were used in BFSED to simulate sediment erosion and deposition processes presently occurring, and to predict how the deposition and erosion patterns in the estuary will change after work on the bridge is completed.



## ASA Participates in DeepWater Oil Spill Workshop

ASA is participating in a joint industry and government project (JIP) on the modeling of potential oil well blowouts in deep water. The program is administered by Dr. Cortis Cooper, ChevronTexaco, and receives funding from over twenty international and national oil companies, the U.S. Minerals Management Service, and the Norwegian government. As part of that effort, ASA has incorporated the Clarkson deep spill model (CDOG) and ASA's own deep spill plume model, OILMAPDEEP into the OILMAP system. The system allows the user to define and execute deep and shallow water blowout simulations and link oil-gas-hydrate plume formulations, subsurface advection of oil droplets, and surface advection and weathering of surface oil. Øistein Johansen (SINTEF, Trondheim, Norway) will be contributing his expertise in particle size distributions predicted for aerosol oil droplets from high pressure gas discharges for oil pipelines.

Additional model computations of predicted whole hydrocarbon and dissolved aromatic concentrations are also available using ASA's SIMAP system. OILMAPDEEP and OILMAP-CDOG are available for immediate distribution to interested parties.



# Personnel

**Craig Swanson** attended the 83<sup>rd</sup> American Meteorological Society Meeting in Long Beach, CA 10-11 February. He participated in the Coastal Environments Interactive Symposium on Developments in Operational and Research Coastal Oceanography and Meteorology with an invited presentation *Human Resource Needs for Coastal Oceanography: A Small Business Perspective*. Craig also presented *COASTMAP: A Globally Relocatable Integrated Coastal Ocean Monitoring and Modeling System* at the conference co-authored with **Malcolm Spaulding**.

On 12-14 February, **Eric Anderson**, and **Sasha Zigic** trained the Hong Kong Marine Department in the application of OILMAP and CMSMAP. The training included integration of hydrodynamic data from the Hydrographic Office and testing of the system by deploying oranges into the harbor and using the system to track their movement.



**Matt Ward** delivered and provided training for COASTMAP and WQMAP v4.2 to the Naval Oceanographic Office at the Stennis Space Center in Mississippi on 24-28 February. The data collected by COASTMAP is being used to develop initial conditions and environmental forcing for

operational coastal models, such as WQMAP, to support homeland security activities within US waters and coastal warfare and environmental response activities outside of the US.

**Roddy Thomas** recently visited the offices of ERM Iberia in Madrid to review some of the latest modeling work completed by ASA in support of a series of EIA studies being developed by ERM for oil operators offshore Spain.



At the invitation of the Centre for Environmental and Development for the Arab Region (CEDARE), **Roddy Thomas** participated in a regional Geographic Information Systems (GIS) and Advanced Remote Sensing Applications workshop held in Egypt. In support of a GIS program for the Regional Organization of the Environment of the Red Sea and Gulf of Aden (PERSGA), Roddy provided the course participants with an insight into the uses and application of pollutant transport model systems, and their potential integration with GIS. The course included participants from Egypt, Saudi Arabia, Sudan, Djibouti, Aden, Somalia and Jordan, together with expert staff from CEDARE and PERSGA.

**Matt Ward** presented COASTMAP to the Jamestown Yacht Club on 12 March. The focus of the presentation was to show how COASTMAP and ASA's forecast model of Narragansett Bay can be used for pre-race strategic planning. Visit [www.coastmap.com](http://www.coastmap.com) for more information on COASTMAP.



**Matt Ward** and **Roddy Thomas** conducted a workshop on marine modeling in support of oil exploration activities and platform design in Sutton, England on 18 March. The workshop topics included mud and drill cuttings releases, produced water, chemical and thermal releases. The participants included representatives from British Petroleum, URS Dames and Moore and Haliburton KBR.

On 3-4 April, **Deborah French-McCay** and **Eric Anderson** attended a two day meeting of the Deep Spill consortium hosted by NOAA's modeling group in Seattle. Eric displayed ASA's integration of the Clarkson University deep water plume model with ASA's OILMAP and OILMAPDEEP.

**Paul Hall** attended the Ocean Observing System Tech Workshop in Portland, ME on 3-4 April. The workshop was sponsored by a consortium including the Gulf of Maine Ocean Observing System (GoMOOS) and the Carolinas Coastal Ocean Observing and Prediction System (Caro-COOPS). The meeting focused on technical approaches to the in real-time acquisition and dissemination of oceanographic data.

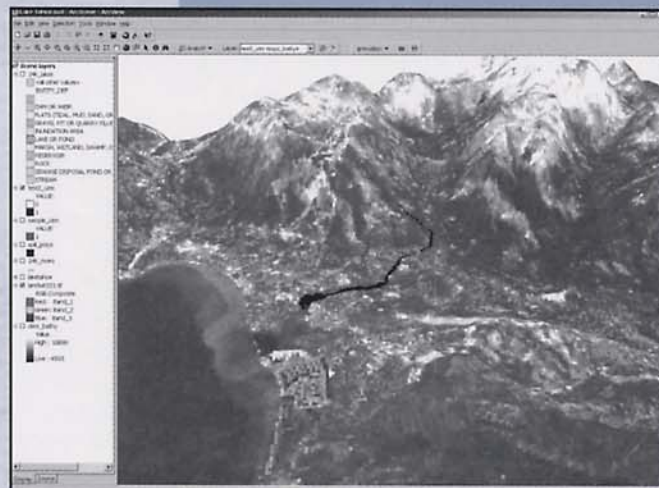
**Malcolm Spaulding** demonstrated COASTMAP at the Marine Technology Society New England Section April meeting. Malcolm showed how the globally relocatable, real time, marine environmental monitoring and modeling system can be applied in Narragansett Bay and southern New England coastal waters.

## Land Based Oil Spills

A pipeline ruptures carrying 20,000 barrels of oil per day or a tanker truck flips and spills 200 barrels of oil. What paths will the oil travel and how much area does the oil cover?

As of September 2004 owners and operators of pipeline systems are required to assess and evaluate potential affects to High Consequence Areas from segments that leak or fail for 50% of their pipeline (DOT OPS 49 CFR 195.452). The High Consequence Areas are: populated areas, environmentally sensitive areas, and commercially navigable waterways. New High Consequence Areas have been updated and are to be incorporated by January 2004 (<http://ops.dot.gov> for more information).

ASA's new addition to their extensive suite of models, OILMAPLAND, assists in answering these questions. The model incorporates baseline elevation data from the USGS digital elevation model (DEM) and hydrological data may be utilized to characterize the transport of the spill and to determine how the spill terminates. OILMAPLAND has been written as an ESRI ArcView extension so the model may easily be integrated with existing GIS-based pipeline and facility data.



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## PERSONNEL Continued

Eric Anderson and Deborah French-McCay attended the Vancouver IOSC (after a weekend of skiing at Whistler) the 7-10 April. Deborah made two presentations: "Modeling Assessment of Potential Fates and Exposure for Orimulsion and Heavy Fuel Oil Spills" by herself and Nicole Whittier and "Probabilistic Bio-Economic Modeling of Oil Impacts in San Francisco Bay" by Deborah, Jill Rowe, Nicole Whittier, and Sankar Sankaranarayanan of ASA, with Dagmar Schmidt Etkin of Environmental Research Consulting. Dagmar presented her cost analysis of spills based on the ASA model results. Shown at right are Gary Ott from NOAA visiting with Eric at ASA's booth.



Deborah French McCay presented "Development and Application of an Oil Toxicity and Exposure Model, OILTOXEX" and Nicole Whittier presented "Spill Hazard Evaluation for Chemicals Shipped in Bulk Using Modeling" at the Annual Meeting of the Society of Environmental Toxicology and Chemistry (SETAC) North Atlantic Chapter in Mystic CT on 24 April. These papers relate to our model development for ecological risk assessments of oil and chemical spills.

On 25 April, Malcolm Spaulding was awarded the 2002-2003 Royal Wales Award at the Fifth Annual College of Engineering Awards Banquet. Malcolm received the award for his distinguished service to the University of Rhode Island, College of Engineering and the Ocean Engineering department.

Sasha Zigic and Eric Anderson gave a two-day OILMAP training course to ConocoPhillips personnel in Beijing. ConocoPhillips will be applying OILMAP for the Bohai Sea. Also attending was Control IT's Nanjing office head, Mr. Canbin Chen, who assisted with translated presentations to government and industry invitees.



Despite being snowed in overnight in Hungary, Sasha Zigic finally made it to Atyrau, Kazakhstan for the 2nd OILMAP training session for the AGIP KCO staff. Sasha provided a one day training program covering the use of OILMAP to address potential oil spill impacts on the North Caspian region. The training session was attended by nine AGIP staff members from various departments (environmental engineering, ecology, hse and oil spill response).



Claudia Santos Suárez presented a paper at the Symposium "Scientific Research as a Strategy to Support Estuarine and Coastal Management" on 28 April at the University of Sonora in San Carlos-Sonora, México. The paper: "SIMAP, an Oil Spill Modeling Impact Assessment System application for Pemex" reviewed the SIMAP significance for Pemex, the National Oil Company in México.

## UPCOMING CONFERENCES & WORKSHOPS

On 5-6 May, Eduardo Yassuda will attend the PETROBRAS Potiguar Basin (Northern Coast of Brazil) Environmental Monitoring Workshop. In his presentation, Eduardo will show the results for the ocean outfall model, including hydrodynamics and oil-based pollutant dispersion, using CHEMMAP.

Deborah French McCay and Craig Swanson will present papers at the Mount Hope Bay Symposium on 10 May, which is part of the NEERS/SNECAFS Joint Meeting at the University of Massachusetts Dartmouth. Deborah will present: "Estimated Impacts of Cormorants on Fish Populations in the Narragansett Bay Estuary" and Craig will summarize a large modeling study "Simulated Thermal Variations in Mount Hope Bay and Application to Assessing Ecosystem Effects".

Craig Swanson will be presenting *COASTMAP*, a *Nowcast/Forecast System* at the upcoming Coastal Zone 02 conference in Baltimore 13-17 July. The presentation, coauthored with Matthew Ward, Eoin Howlett and Malcolm Spaulding, will describe how *COASTMAP* can be an effective tool to provide environmental monitoring and modeling information to a variety of user in coastal areas.

Rafael Bonanata and Marco Antonio Correa from ASA South America will present the paper "Development of bathymetric database for hydrodynamic, sediment transport, and pollutant dispersion models" in the upcoming III CBPAS (3rd Brazilian Congress on Environmental Research).

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