International Civil Aviation Organization

Search and Rescue (SAR) Meeting for the North American, Caribbean and South American Regions (SAR/NAM/CAR/SAM)

(Puntarenas, Costa Rica, 18 to 22 May 2009)

Agenda Item 2: SAR Organization in the NAM/CAR/SAM Regions
2.1 SAR drills

SARMAP Software System for SAR Planning, Coordination and Operations Control

(Presented by SARSAT)

SUMMARY

This Information Paper shows one of the most useful and functional software tool of the SAR Mission Coordinators. [SMC] when an emergency occurs.

REFERENCES

- Annex 12- Search and Rescue
- IAMSAR Manual (Doc. 9731)

1. Background

1.1 **SARMAP** provides rapid and accurate predictions of the movement of drifting objects and missing persons at sea. SARMAP includes the ability to deploy search & rescue units (SRUs) with search patterns and calculate probability of containment (POC), probability of detection (POD), and probability of success (POS).

2.- General Description

2.1 Applications for SARMAP

- Determine search area for missing vessels, persons or containers
- Identify probable location of an accident site or lost object
- Store home base locations of all available Search & Rescue Units (SRUs)
- SRU Deployment and Search Pattern management
- Floating contraband tracking
- Reverse trajectory calculations

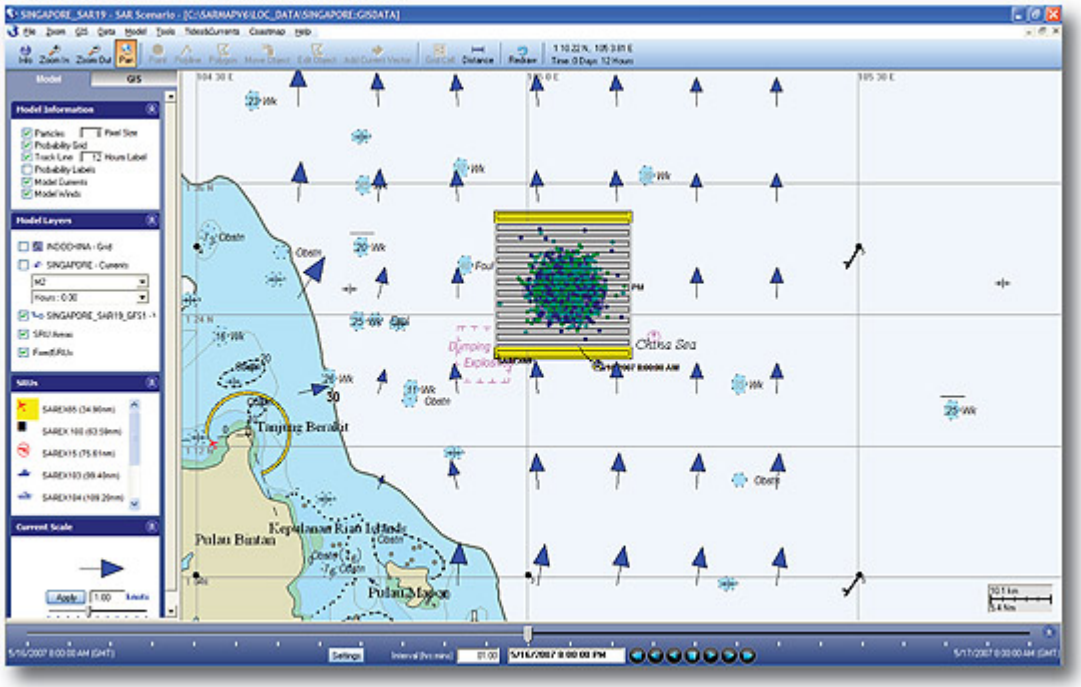
2.2 Features

- Can be used in other GIS software such as ArcView® or ASA's GIS
- Contains a database of drift behavior for a variety of objects based on the latest U.S. Coast Guard data

- Easily interpreted visual display of search area over time
- Performs a series of postulated accident sites to develop envelopes of likely search areas
- Real-time data links, integrated with the Environmental Data Server™ (EDS)
- Online web map and metocean data services
- Links floating debris to find a lost object or an accident site
- Rapid Response Module (RRM) or SARMAP
- Wizard to very quickly lead through the steps required to calculate a search area.
- Easily linked to COSPAS-SARSAT alerts via the Techno-Sciences, Inc.- RCC software suite
- Supports commercial nautical charts:
  - BSB NOAA Charts
  - MapTech Charts
  - NDI Charts
  - NOS Charts
  - British Admiralty (ARCS) Charts

2.3 SARMAP Modules

- Search Planning Tool
- IAMSAR and MonteCarlo methods for computing drift
- Forward and Back Tracking SAR
- Optimal Search Planner (2008 release) – an additional module that allows controllers to:
  - Combine multiple resources for a single or multiple search target(s)
  - Cumulative POS and optimization tools to maximize probability of success
  - Integrate prior/subsequent searches to improve in future/successive search planning
- SRU text reporting (ASCII, Notepad, Word, etc.)
- SARMAP for ArcView®

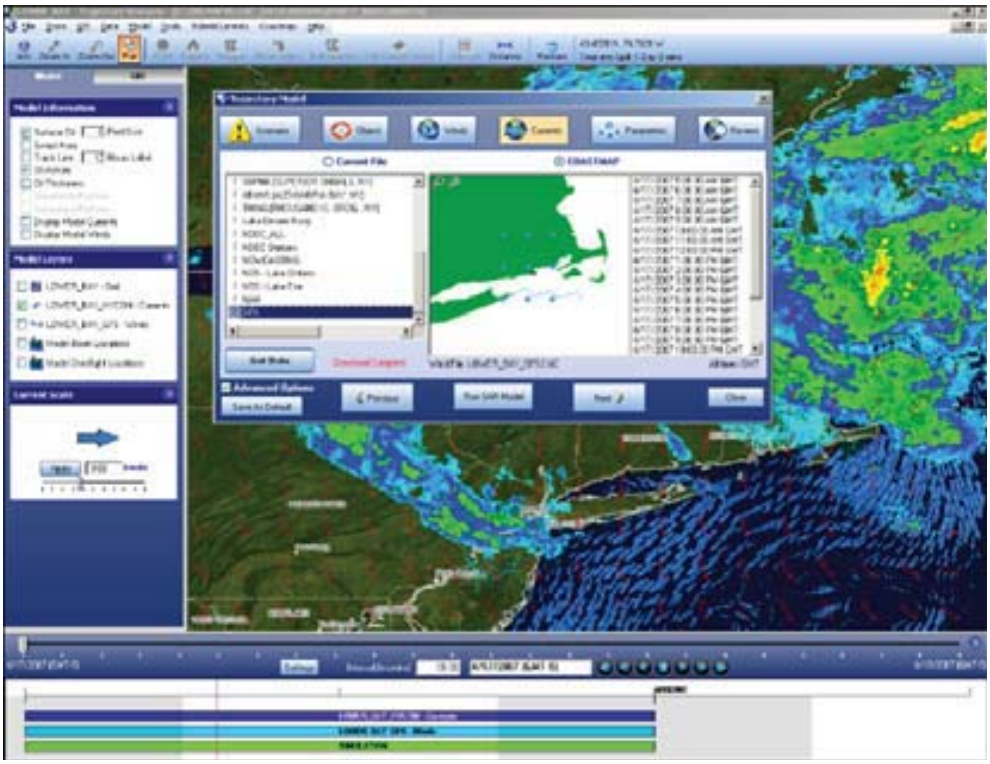


2.4 Environmental Input Data

Since the quality of model predictions depends on the quality of the environmental data, a suite of tools allow the user to manage environmental data efficiently. Specifically, SARMAP integrates metocean data (winds and surface currents) for accurate SAR predictions.

SARMAP can be connected to EDS to obtain the latest current and wind data forecasts for the region of interest. This is very fast and allows the user to make a prediction in a matter of minutes without needing to manually enter data.

States and/or SAR organizations may request a subscription service to EDS for different data products from different sources or providers, public or private.



EDS provides the best environmental data solution because it aggregates different data sources

3.- Conclusions and Recommendations

3.1.- Conclusions

Computer programs can be used to great advantage in relieving the search planner of much of the computational burden, allowing more computations of greater complexity to be done in less time with greater accuracy. These programs can be made relatively small, simple, and narrow in scope by limiting them to specific search planning functions. On the other hand, they can be

quite large and sophisticated, addressing the entire search planning problem, including the optimization of search effort allocation over several search cycles. Such sophisticated software requires specialized expertise to develop and maintain. However, with a well designed user interface, it can be used by search planners with relatively little training.

Computers and appropriate software can provide a great deal of assistance to the search planner.

3.2 - Recommendations

a.- Delegates and representatives are invited to consider the introduction of new technologies regarding software as SARMAP; and

b.- Delegates and representatives are invited to research more about SARMAP and to study seriously the possibility of implementation in their own States.

Note: During the meeting, a copy of the SARMAP Power Point Presentation will be available [electronic file] for delegates and representatives that request it.

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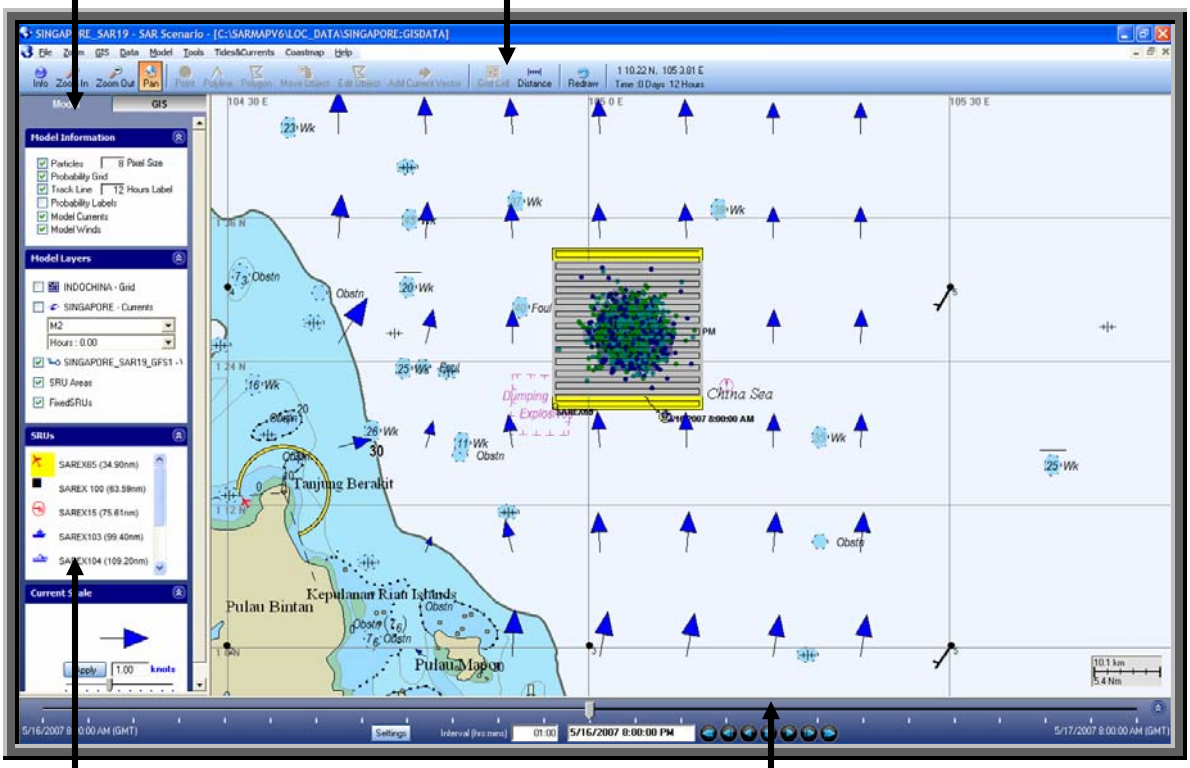
APPENDIX A

Release Notes of SARMAP

Shortcut Toolbar

Model Options



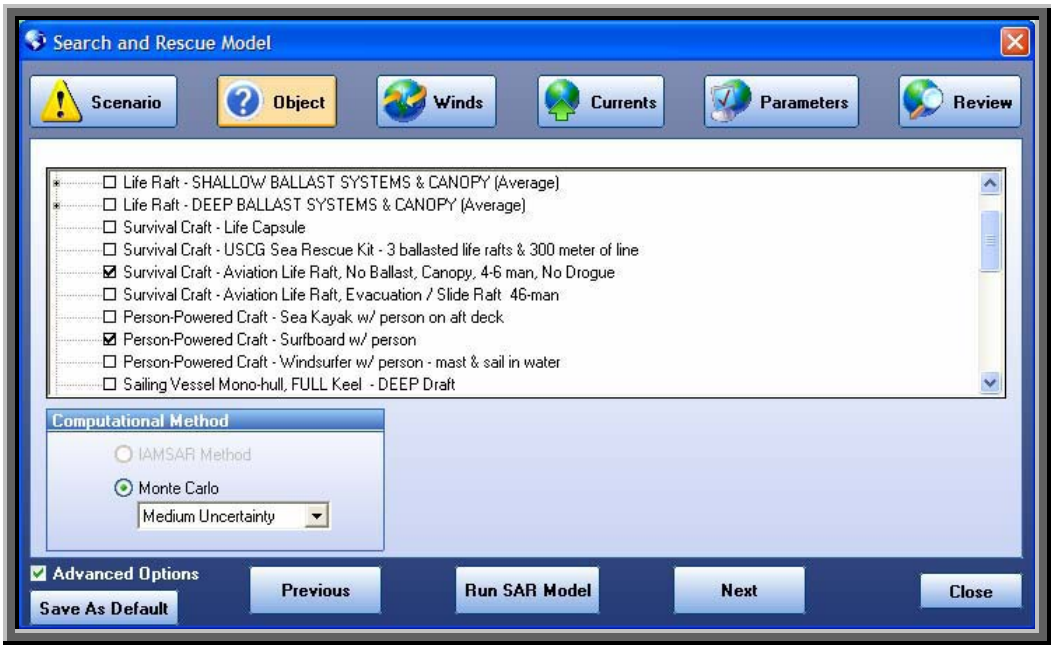
SRU's

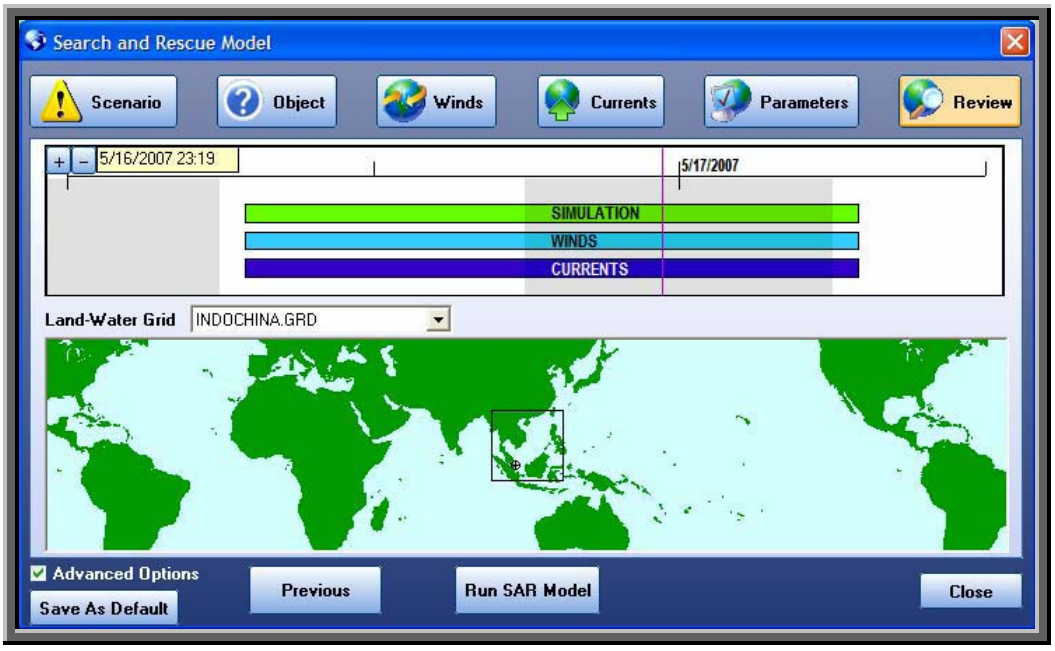
Time Slider

New SAR Case Dialog

The case/scenario dialog in SARMAP has been completely updated for Version 6 and replaces the wizard from version 4.x. The information within the SAR form has been re-organized into 6 input cards.

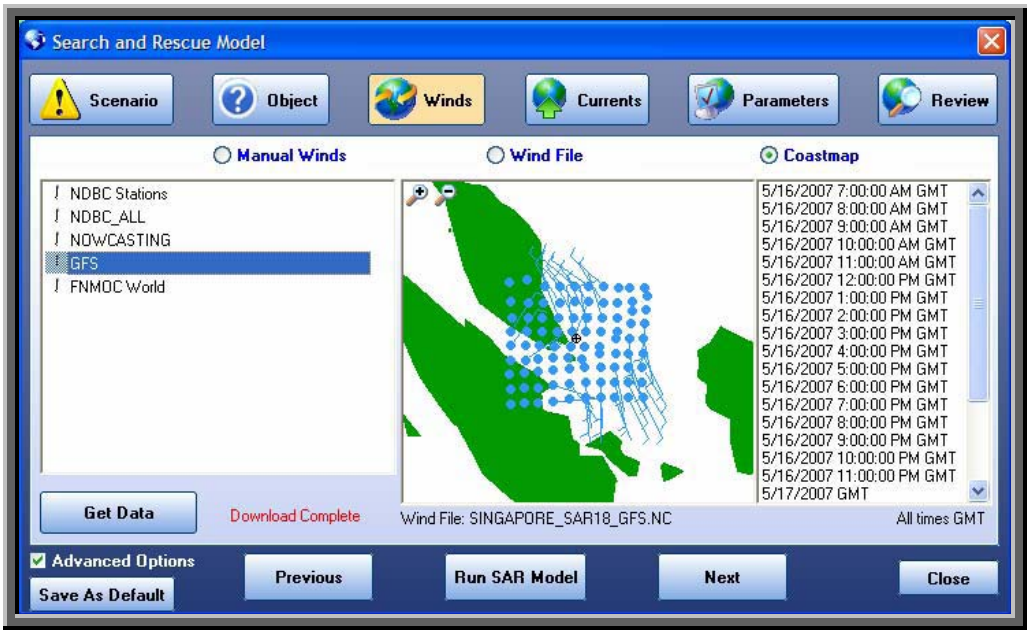
Scenario– Case Information (e.g. LKP Time, Simulation Length)
Object – Drift Object Types (targets)
Winds – Wind Information (e.g. Wind File, Time Zone)
Currents – Current Information (e.g. Current File, Time Zone)
Review – Model Review (e.g. Gantt Chart, Grid File)



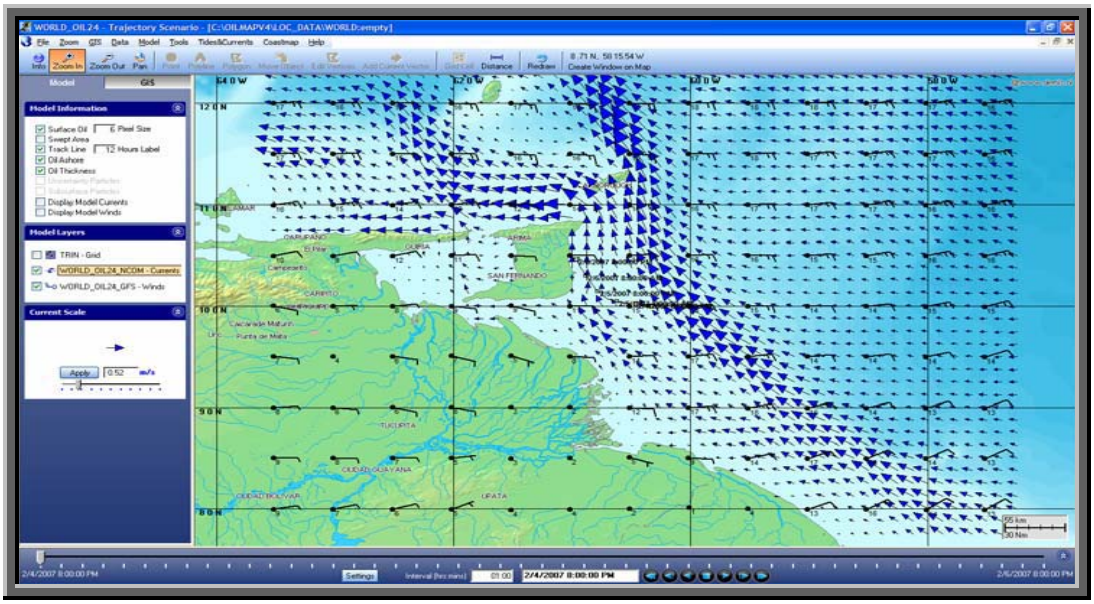


Accessing COASTMAP EDS

The COASTSMAP Environmental Data Server (EDS) is a server that collects and disseminates public and private weather, wind, and current forecasts and observation data. This data is global and regional and custom forecast products can be developed for specific regions



SARMAP Version 6.0 now includes automated linkages to the COASTMAP Environmental Data Server (EDS). This allows SARMAP users to access both the meteorological and hydrodynamic data available on the COASTMAP EDS by making a request via the new web service tools available in SARMAP.

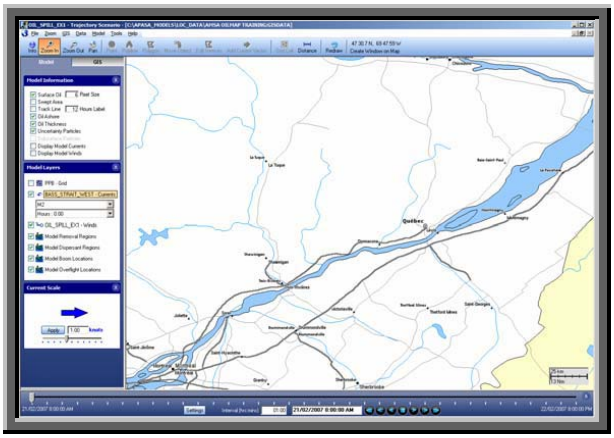


COASTMAP EDS Currents and Winds for Trinidad

New Mapping Options

New mapping options available in SARMAP Version 6.0 allow for connection to web based mapping services and electronic charts.

WMS Service

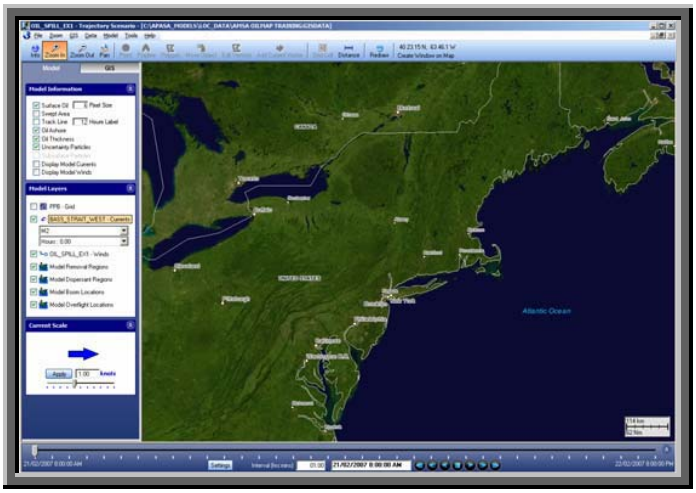


A Web Map Service (WMS) produces maps of georeferenced data for distribution over the web. The map produced is not the data itself but a visual representation of the geodata. The map is a portrayal of geographic information presented as a non-projected digital image file which is displayed in SARMAP

ArcIMS Service

ArcIMS services are part of ESRI's framework for distributing georeferenced data over the web.

As with the WMS Service the data returned to SARMAP is a digital image for display.



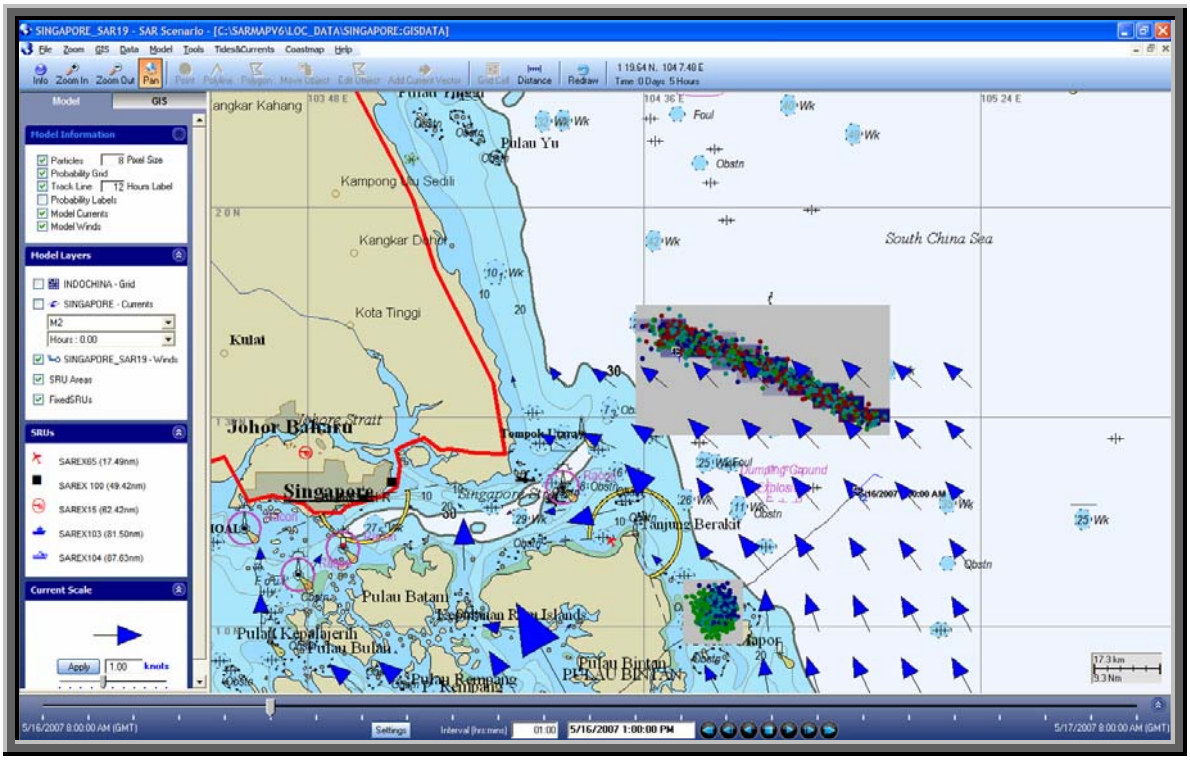
CMAP Charts

Version 6 now supports global electronic charts from CMAP.

The CM-93/3 format has been certified by DnV to meet all the requirements of the international electronic chart format S-57/3 and is used by thousands of vessels, shipping companies, and governmental organizations around the world.

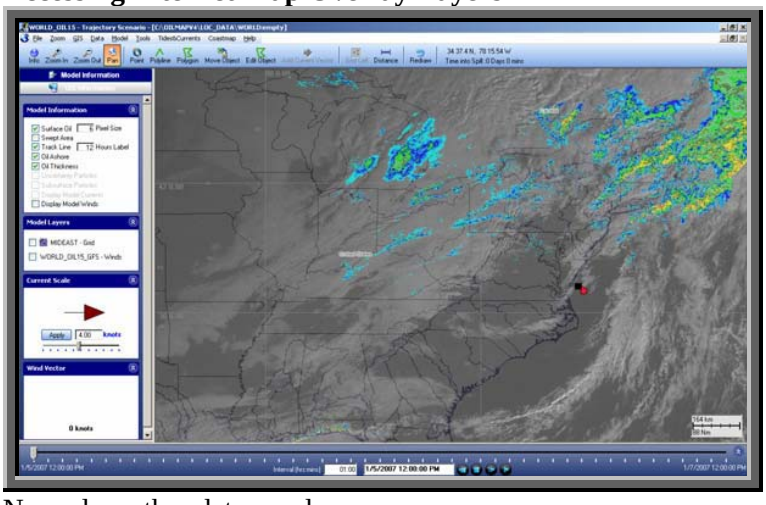
Viewing Multiple Scenarios

A new feature is available to load and display multiple Search and Rescue scenarios. Accessing the new feature is done via the *"Add New Scenario"* menu option located under the *"File"* menu.



Example of two scenarios being displayed together

Accessing Internet Map Overlay Layers



Nexrad weather data overlay

A new capability has been added to SARMAP allowing web mapping service layers to be added as map overlay layers. Map overlay layers can contain both spatial and temporal information, allowing them to be animated using the time slider tool. As shown, weather overlay data may be shown with this option.

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APPENDIX B

Functional Characteristics to Consider with Computer-based Search Planning Aids

Overview

The computer software, hereinafter referred to as the search planning model, should be designed to accept all inputs that the SAR Co-ordinator can reasonably be expected to use in search planning and present the calculated results to the Co-ordinator as useable information in the form of an optimal search plan, useful statistics and values important to the search planning process. It should not simply produce a mass of data outputs. The desirable functional characteristics of the search planning model should include, but should not be limited to, those in the following list. The model should perform the following functions:

- Accept and integrate various environmental data from multiple sources, together with their estimated error and variability patterns;
- Simulate the effects of the environment on search object status and motion, sensor performance and the survivors;
- Use appropriate sampling techniques for simulating possible search object movements (e.g. drift), and determining the area of containment;
- Have the flexibility to develop updated search plans based on new information or assumptions made by the search planner;
- Have the ability to allow for time uncertainty and/or position uncertainty of the initial distress location;
- Simulate hazards, possible encounters between the missing craft and the hazards, and the probabilities that such encounters would result in a distress incident;
- Have the ability to generate initial probability density distributions using the previous two features together;
- Be capable of simulating post-distress changes (state changes) in the status of distressed persons such as abandoning a vessel into a liferaft;
- Be capable of predicting the survivability of distressed persons based on selectable scenarios and when computing optimal effort allocations;
- Generate valid probability density distributions of possible search object locations based on post-distress search object trajectories using low- to high-resolution environmental data, as available (high-resolution data are always preferred);
- Be capable of handling multiple scenarios simultaneously which includes the ability to compare the scenarios and assign weighting factors to them;
- Produce an operationally feasible search plan that maximizes the probability of finding the distressed persons alive with the available search facilities – i.e., produce an optimal search plan for the situation at hand. Factors to consider are the possible (weighted) scenarios, the dynamic probability density distribution of search object locations, survivor state changes, survival times, environmental parameters, search facility characteristics (number, type, location, endurance, sensors, etc.), previous search results, etc. Both tactical (myopic, day-to-day or sortie-to-sortie) and strategic optimization (when resource availability can be predicted with reasonable certainty) should be available;
- Be able to properly evaluate search results (in the computational sense), including both positive (e.g., debris sightings) and negative (no sightings of search object) aspects. It should perform detailed updates of the dynamic probability density distributions of the possible search object locations based on actual sortie tracks and reports of sensor performance;

- Make proper use of previous search results when computing optimal plans for subsequent searches;
- Correctly simulate the effects of the relative motion between moving search objects and moving search facilities;
- Compute and display estimates of search effectiveness in the form of POS values for sorties and the cumulative POS value for all searching done to date;
- Be capable of processing and re-evaluating new (including late-arriving) information such as update of last known position and/or distress time to produce an updated optimal search plan;
- Consideration should be given to the man–machine interface so that the information generated by the computer-based tool and database would be useful to the search planner. The model should also be capable of displaying large volumes of information in ways that promote rapid assimilation. The model should contain or be integrated with appropriate geographical displays and useful tools for describing search sub-areas, generating search patterns, communicating search plans to search facilities, etc.; and,
- Finally, the software of such a model must be developed using sound software engineering principles to keep life-cycle costs down, maximize reliability, provide for ease of making future improvements, and have it operate with as many hardware platforms and operating systems as possible.

SARMAP MEETS THE STANDARDS

- END –