Specialized Radar for

Ice and Oil-Spill Detection

By Andrew Safer

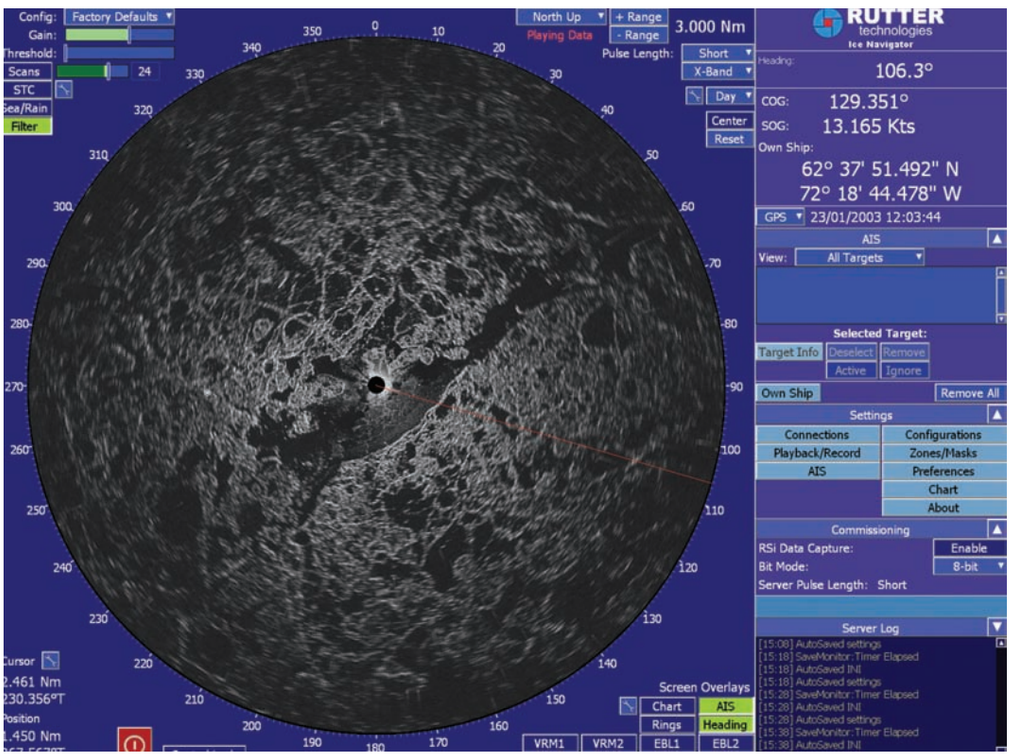
"Canada is one of the world's leading maritime nations, with the world's longest coastline and bordering three of the world's oceans," Jane Rutherford, Global Practice Lead, Ocean Technologies, Department of Foreign Affairs and International Trade (Canada), was quoted as saying in the last issue of Marine Technology Reporter. "We know the sea. Our innovative marine technology products and services are based on our experiences in one of the most challenging marine environments in the world."

A case in point is a core radar processing technology originally developed to detect sea ice and icebergs, which is also being used for oil spill detection.

Manufactured and marketed by Rutter Inc. of St. John's, the Sigma S6 Ice Navigator (Sigma S6 system) has been utilized for more than 10 years to detect small chunks of ice offshore on the Grand Banks, Newfoundland for the oil industry. Standard ship's radar is designed for collision avoidance and is used to detect other ships and land and is not designed to detect sea ice and icebergs. The Sigma S6 system connects to the ship's radar, processes the full dynamic range of the raw radar signal, and the advanced signal processing generates a high-resolution image with 256 video intensity levels, producing finer ice definition.

Captain John Broderick is the Commanding Officer of the Canadian Coast Guard's CCGS Henry Larsen, a 320-ft-long, 6500-gt Arctic-class icebreaker that operates in the Canadian Arctic and sub-Arctic regions. Navigating in these waters can be demanding and dangerous for all ships, he explains, even those with Icebreaker classification. Arctic ice regimes including thick first-year ice, old or multi-year ice, ice islands and glacial features such as icebergs and bergy bits (glacier ice less than five meters above the surface) can be hazardous to vessels. Safe navigation requires the ability to detect and differentiate between these features, as well as to determine floe size—often challenges for normal navigational radar systems.

Since 2006, the Sigma S6 system has been used onboard the CCGS Henry Larsen. For the past four years Captain



Rutter's Sigma S6 Ice Navigator: Image shows pack ice in the vicinity of the vessel (center).

Pictured is the CCGS Henry Larsen.

Broderick has been conducting an R&D project focused on improving the safety and efficiency of ice navigation by enhanced detection. In the first phase, the Sigma S6 system was fitted to a standard X Band navigational radar. In the second phase, it was combined with a dedicated high-speed radar. In the third phase, planned for the 2011 Arctic season, it will be used with enhanced scanning with dual polarization.

"Although considered a trial radar, very early on we found ourselves relying on the capabilities of the Sigma S6 system regularly to navigate around and through multi-year ice regimes." Typically, the Henry Larsen is escorting vessels such as tankers that have standard radar. "We've got somebody behind us with lesser capability, and we're looking for the easiest route," Captain Broderick explains. "We're looking for the weak points (in the ice) and the leads (fields of floating ice). With the Sigma S6 system, there is a clearer definition of floe edges. The enhanced visual of the ice regime gives clear floe definition and outlines the water leads and weak points within the ice pack. While operating in old ice regimes, this definition was particularly useful in avoiding large floes in restricted visibility. With practice and continuous use, our navigators could differentiate between floe size and often the ice type. It is important to know before entering an ice field, if the ice floe is a consolidated mass more than a mile wide, or

just a collection of small floes that are easier to navigate through." The second phase of the R&D project focused on detecting bergy bits and growlers (less than 1 meter above the surface). During his annual trip from Newfoundland to the west coast of Greenland in 2008, Captain Broderick was able to detect the smaller icebergs in low visibility. At distances up to two miles, he estimates a 20 to 25 percent improvement with the Sigma S6 system compared to standard radar—both in terms of detection and its ability to hold the target over time. The Sigma S6 system has been installed on more than a 100 ships and offshore platforms operating in the Russian, Canadian, and Norwegian Arctic and sub-Arctic regions, Baltic Sea, Alaska, Antarctica, and offshore Newfoundland and Labrador.

The Norwegian Coastal Administration has been using the Sigma S6 system for ice operations since 2007, and in 2008 they discovered that it can also be used to detect a small oil slick. The Norwegian Clean Seas Association (NOFO) proceeded to test Rutter's Oil Spill Detection system over a three-year period. In August 2010 NOFO certified that the system meets these standards for NOFO oil recovery vessels: "(1) The vessel must have an oil detection system permanently installed that gives automatic detection, and (2) Must be able to present area and position determination of oil slick, operating history, speed and direction of the slick." NOFO is currently operating two of these systems on oil recovery vessels. The system is also deployed on other oil spill recovery vessels in Norwegian waters as well as a Statoil platform. "To date," said

Byron Dawe, President, Business Development and Innovation, Rutter Technologies, a division of Rutter, Inc. "the Sigma S6 is one of only two systems in the world to be given the green flag indicating it meets the stringent requirements of vessels operating under jurisdiction of the Norwegian Clean Seas Association."

Rutter Inc. partnered with Aptomar AS of Trondheim, Norway to increase the system's functionality, and in June 2010 the two companies launched the Integrated Oil Spill Response and Management System. This system integrates Rutter's S6 radar processor and display with Aptomar's infrared camera, real-time video, searchlight capabilities, and chart-based display. The integrated system provides automatic oil spill detection and tracking, area, thickness and volume estimations as well as oil spill drift prediction, detection of boom leakage and disposition of the oil spill skimmer. The system can provide this functionality during both day and night operations.

The Sigma S6 system detects a potential oil spill target by detecting a reduced signal return where the wind-generated capillary waves on the ocean's surface are suppressed due to the presence of oil. Once the oil spill is detected, the Sigma S6 system continues to track and exchange data with the Aptomar system to validate the presence of oil. The resulting radar image is displayed and outlined in a chart system.

The infrared camera is used to determine the area where the spill is thickest. All of the information can then be distributed either onboard, ship-to-ship, or ship-to-shore. Edison Chouest Offshore LLC has purchased three Integrated Oil Spill Response and Management Systems to be deployed on vessels operating in Brazil in support of Petrobas. Rederi AB TransAtlantic has purchased a system to be deployed off Norway on a vessel in support of Statoil operations, and the Danish shipping company Esvagt is leasing two systems in support of Statoil operations off the coast of Egypt.

"With the heightened awareness of environmental issues and the opening up of the North," said Dawe, "these types of advances in radar processing and integration dramatically improve the efficiency and safety of operations, whether it be for oil spill or ice management."

Rutter's Sigma S6 Oil Spill Detection system: Outlined shapes show oil spills actively being tracked. Arrow pointing east from green outlined section shows drift direction. Triangles show the location of other vessels.

Photo credit: Rutter Inc.