sigma S6 radar systems

How to teach an old radar new tricks

For the past 50-plus years, marine radars have been the workhorse sensor for vessel navigation and maritime safety requirements. During this time, the basic technology has not changed very much outside of improvements in the physical displays and associated charting applications.

Recently, this has all changed. As a result of the rapid improvements in data processing, newly available systems push the boundaries of commercially available marine radars. One of the technology leaders in this area of radar signal processing and systems is a Canadian company, Rutter Inc.

Based in St. John's Newfoundland & Labrador, Rutter has developed the *sigma* S6 Radar Data Processor and associated radar applications that are driven from that core technology. Using common X-Band marine radars, the *sigma* S6 is designed to maintain the full signal return from the radar and then it interrogates the signal using its proprietary software to extract the target information embedded in the radar return that is ignored by the standard radar processors.

Radar Basics

The history of radar goes back to the early 20th century, however it was not until the development of the basic technology still used today that the US Signal Corps in 1939 adopted the term RADAR being an acronym for *Radio Detection And Ranging.*

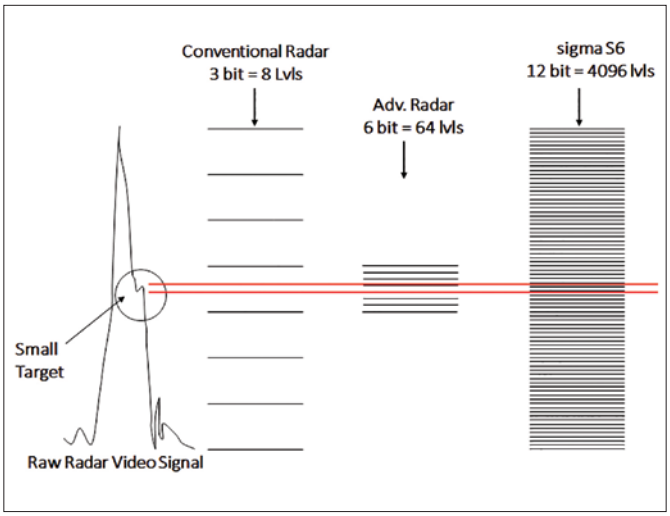


Figure 1. *sigma* S6 12-bit processing compared to other radar processing levels, noting the improvement in detection of small targets in sea clutter.

The two most common marine radars used today are the X-band and S-band; referring to the frequency of the microwave radio spectrum that is emitted. X-band radars have a higher resolution than S-band, however they generally have less range and are more attenuated by unfavorable weather conditions (i.e. heavy rain) or sea-clutter. S-band radars usually have a lower resolution with greater range and less attenuation.

Two common uses of marine radars are for avoiding collisions and vessel traffic management. Since the primary objective is the detection of targets, the presence of sea clutter is viewed as a source of interference and is suppressed by the radar processor. When clutter reduction takes place there is generally a reduction in target strength.

Conversely, there are times when the sea clutter is the source of information and therefore suppression is not desired. Wave radars use sea-clutter information to measure wave spectra (wave height, speed, direction, and wavelength) as well as surface current speed and direction.

Radar manufacturers use varying signal processing and imaging technologies to produce the clearest possible image while minimizing signal loss. Standard radars have 3-bit processing which give eight levels of resolution, resulting in images that look like turn of the 20th century photographs. Some advanced radars offer 6-bit processing which improve the resolution to 64 levels, however the Rutter *sigma* S6 technology uses 12-bit processing which offers 4,096 levels of resolution, an improvement of over 500 times that of standard radars and 64 times other advanced radars. (Fig. 1)

The *sigma* S6 radar system processes and distributes the radar video and track data using multi-layered processing that strips out weather and other forms of clutter that constrain conventional radars, giving superior target detection and tracking capabilities. All of the *sigma* S6 applications can be combined and used concurrently on a single Radar Data Processor.

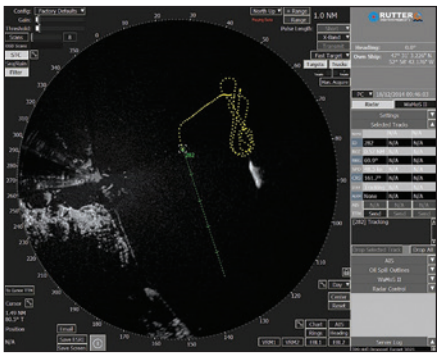
Applications

Small target surveillance

The Rutter *sigma* S6 Small Target Surveillance (STS) system detects and tracks multiple target types from persons in the water and small maneuvering craft to large vessels and other sea surface features or anomalies.

Rutter's STS solutions are used in many applications including interdiction, search and rescue, bird and wildlife detection, ice detection, and searching for lost containers.

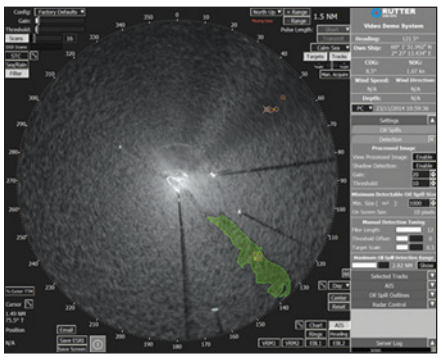
The system also supports interfacing with an AIS receiver to maintain an overview of the surrounding traffic, and to track AIS buoys and markers.



sigma *S6 Small Target Surveillance radar system detected and tracked small vessels performing high speed maneuvers*

Oil spill detection

This system combines early detection with tools that produce information about oil spill volume, thickness, deformation, and drift. Rutter's *sigma* S6 Oil Spill Detection (OSD) systems provide accurate and reportable current state data and intelligence. *sigma* S6 systems are installed on fixed platforms, FPSO's, offshore workboats, patrol vessels and specialty clean-up vessels in Brazil, the North Sea, Gulf of Mexico, Eastern Canada, China, and Russia. For northern drilling operations, Rutter OSD systems have been integrated with *sigma* S6 Ice Navigator to provide simultaneous oil and ice detection and tracking capabilities in one display.



sigma *S6 Oil Spill Detection radar system with oil slick detected, outlined and tracked.*

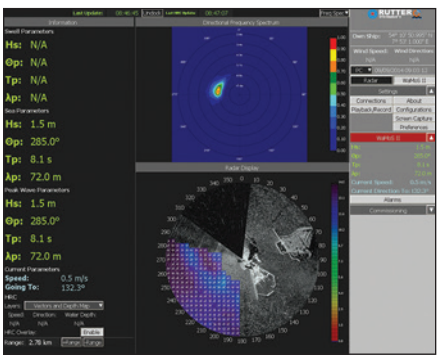
WaMoS II™ Wave Monitoring System

The WaMoS® II is a radar-based wave and surface current monitoring system developed by OceanWaveS GmbH (wholly owned by Rutter Inc.). In comparison to conventional wave rider buoys and current profiling devices that generate single point measurements, WaMoS® II offers the advantages of presenting this information for a broad area, and in a richer context.

WaMoS® II measures and displays essential wave field parameters including: significant wave height (Hs), peak wave period (Tp), peak wave direction (θp), surface current speed (U) and direction (θu). It operates automatically and unattended from moored platforms, moving vessels and coastal sites.

WaMoS® II provides higher fidelity information with comparable accuracy, at lower lifecycle costs.

The WaMoS® II High Resolution Current (HRC) feature displays detailed current and bathymetry information for the area around a radar site for drift prediction of oil slicks, the planning and monitoring of offshore activities, harbour entry planning, route planning, and coastal protection. The bathymetry information provided by HRC assists in the monitoring of sedimentation and erosion processes.



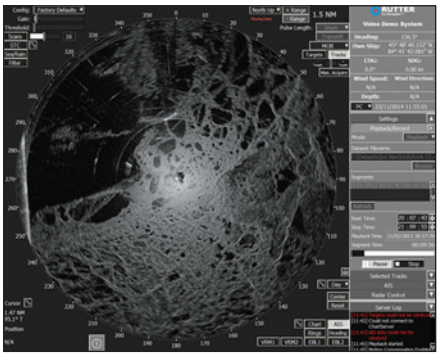
WaMoS II™ Wave Monitoring System

sigma S6 Ice Navigator™

The sigma S6 Ice Navigator™ Ice Detection and Navigation system enables ships operating in areas prone to ice to differentiate between open water, ice pans, leads in ice fields and the thicker ice ridges. In open water the Ice Navigator detects small bergy bits and growlers that can significantly damage a vessel or platform.

These qualities make it an essential component for real time route planning and decision making in ice operations.

Used by many of the world's ice breaker fleets as well as tankers, bulk carriers, research vessels, and coast guard vessels from countries operating in arctic and subarctic regions, Ice Navigator™ systems have also been selected by oil and gas companies as part of their ice defence and ice management solutions where they are resident on platforms, drill ships and specialty support vessels.



sigma *S6 Ice Navigator™ with high definition radar imagery.*

The Ocean Networks Canada Innovation Centre at the University of Victoria has recently purchased three WaMoS II® systems and one Oil Spill Detection and Management System for deployment along the coast of BC.

For more information about the Rutter sigma S6 product line contact either Rutter Inc through www.rutter.com or their West Coast agent, Sea-Image Corporation through www.sea-image.com .