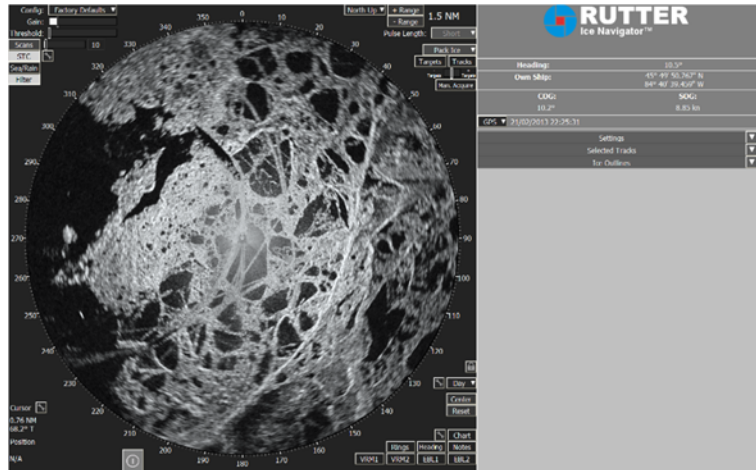


Rutter's *sigma* S6 Ice Navigator™ system enables vessels operating in ice to differentiate between open water, ice pans, open water leads in ice fields and the ice ridges that impact operations in ice zones. Its high resolution image processing provides enhanced ice imaging, leading to superior detection and tracking. In open water the *sigma* S6 Ice Navigator™ system's ability to reliably detect small bergy bits and growlers that can significantly damage a vessel or platform is industry-proven.

Across a wide range of sea states, weather, and daylight or nighttime conditions the *sigma* S6 Ice Navigator™ improves situational awareness and provides tactical information essential for real time route planning and decision making in ice operations. Its installation base includes many of the world's ice breaker fleets, tankers, research vessels, bulk carriers and coast guard vessels from countries operating in Arctic and subarctic regions. *sigma* S6 Ice Navigator™ systems have also been selected by oil and gas companies as part of their ice defence and ice management solutions to increase the safety and operational time of offshore platforms, drill ships and support vessels.

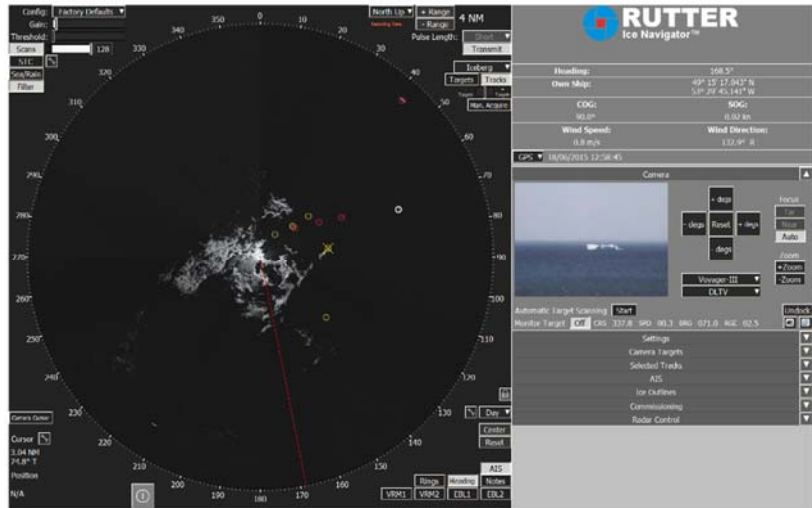


*sigma* S6 Ice Navigator™ – Ice Pack Imaging

The *sigma* S6 Ice Navigator™ can be installed with a dedicated ice radar, but it also passively interfaces with, and significantly enhances, commercially available marine radars. The *sigma* S6 Ice Navigator™ system is fully motion compensated and operates equally well from both fixed platforms and vessels under way. It includes an integrated target tracker, SeaTrack, specifically tuned for maximum ice detection and tracking while supporting up to 300 simultaneous ice targets. Ideal for tracking bergy bits, growlers and ice bergs detected by the *sigma* S6 Ice Navigator™, SeaTrack with its ability to integrate up to 128 radar scans allows for optimal ice detection and tracking compared to common Automatic Radar Plotting Aid (ARPA) radar trackers, taking advantage of the *sigma* S6's superior imaging. This typically improves the range of detection of ice formations and small targets by a factor of 2 to 4, subject to the individual radar's properties. The table below highlights the improvement of the *sigma* S6 Ice Navigator™ system over conventional X-band radar ice detection (*source: Canadian Coast Guard, Barbara O'Connell*).

Ice Type	Size (Height Above Sea Level)	Distance Visible on X-Band Radar	Distance Visible on <i>sigma</i> S6 Ice Navigator
Bergy Bit	1 to 5 m	< 1 NM	> 4 NM
Growler	< 1 m	< 0.5 NM	> 2 NM

The *sigma* S6 Ice Navigator™ features full integration with select FLIR IR cameras. Features include the ability to support multiple cameras, intelligent selection of a best camera for specific targets, and automatically directing the camera to ice targets entering a guard zone. These features support quick decision making in addressing potential threats and possible interruptions to operations. For other camera systems, the *sigma* S6 Ice Navigator™ supports the NMEA Tracked Target Message (TTM) output to provide standardized targeting information.



*sigma* S6 Ice Navigator™ – FLIR camera integration

The *sigma* S6 Ice Navigator™ features AIS integration. Through a connection to an AIS receiver, this overlay displays all AIS Class-A and Class-B targets providing an overview of the surrounding marine traffic enhancing situational awareness.

The *sigma* S6 Ice Navigator™ offers a variety of outputs to both record and stream ice imaging and targets to external systems. A built-in Screen Recorder allows recording of the radar display which is useful for documenting an incident, scientific research or ice breaking operations. Recordings are supported as a series of JPEG or PNG images, or as an AVI video. In addition, the *sigma* S6 Ice Navigator™ system comes standard with a web enabled interface, allowing external systems to interface with the *sigma* S6 Ice Navigator™ system to view radar imaging (GeoTIFF, PNG, JPEG) and targets (GML, KML, DXF, ESRI).

Rutter engages in continual R&D improving its products. New features currently being developed for the *sigma* S6 Ice Navigator™ and expected to be released in 2017 include:

- **Ice Ridge Detection** – Detect and highlight ice ridges in ice fields
- **Iceberg Detection in Pack Ice** – Detect and track icebergs embedded in pack ice
- **Identification of Open Water Leads** - Detect and outline of open water leads within an ice floe

In addition, research is being undertaken for new ice products expected to be released in 2017 including:

- **Automatic Ice Pan Outlining and Drift Tracking** – Detect and outline ice pans in an ice floe, tracking the drift of the pans over time
- **Automatic Ice Floe Outlining and Drift Tracking** – Detect and outline ice floes, tracking the drift of the floe over time
- **Near Range Ice Drift Prediction** – Predict ice drift of ice in open water using radar based wave and current analysis and wind sensors



# *sigma S6 Ice Navigator™*

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## *sigma S6 Ice Navigator™*

- Marine certified (IEC 60945)
  - Rack Mountable/Desktop Radar Data Processor
  - 19" marine certified Rack Mountable/Desktop monitor (alternate sizes available)
  - Keyboard/Trackball Unit (Desktop style or Console Mount)
- Windows 7 operating system
- SeaTrack tracker, optimized for ice tracking without constraints of navigational ARPA radar trackers
- Fully motion compensated scan-to-scan integration of up to 128 radar sweeps, allowing the *sigma S6 Ice Navigator™* to identify and detect the smaller bergy bits and growlers that pose a navigational threat to the vessels
- Advanced sea, rain, interference & clutter suppression
- AIS Class-A and Class-B target overlay
- Built-in interfaces for FLIR camera systems and TTM output to other camera systems for enhanced target verification and identification
- Automatic Screen Recording in selectable time intervals for evidence documentation
- Remote client capability
- Computer-Based Training package