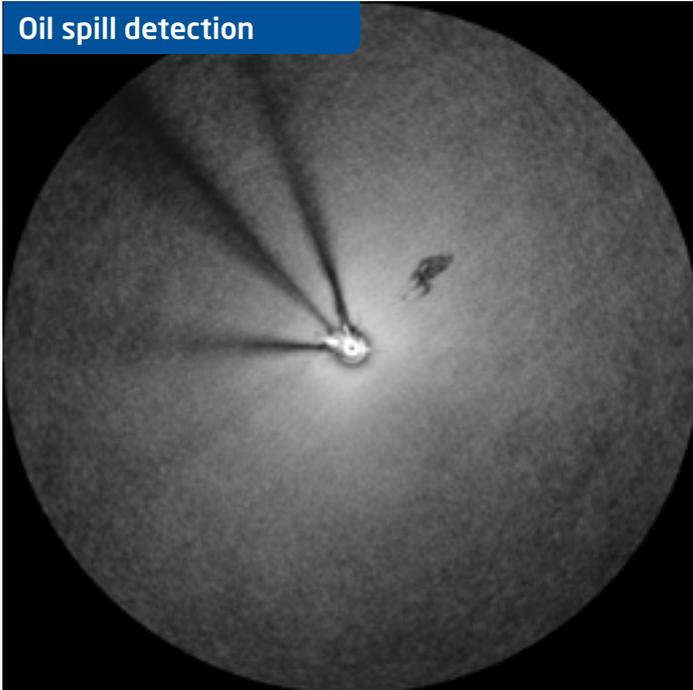


Using a high resolution marine X-band radar, the SeaDarQ software can detect and monitor oil spills on the ocean surface. Using a combination of fast update rates, great horizontal resolution and low detection limits, the Nortek detection system is both technologically at the forefront and an established tool in oil spill recovery operations.

SeaDarQ

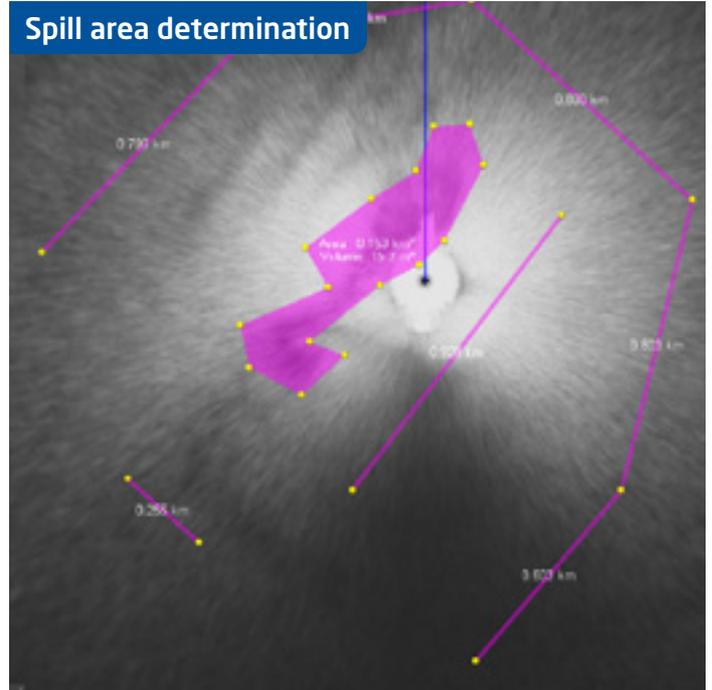
Oil Spill Detection with Radar

Oil spill detection



Detection and monitoring of oil spills 24/7, even in difficult weather conditions.

Spill area determination



Multiple geostationary polygons identifies the slick, highlighting the contaminated surface area.

Shipboard



Courtesy of Rijkswaterstaat

Nortek oil spill detection system installed onboard "Arca" as part of an Oil Spill Response Network.

Land based



Fixed radars mounted on land can both monitor oil on surface and gather hydrographic information. A tall mounting tower is required to obtain maximum operational range.



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 True innovation makes a difference

SeaDarQ

OIL SPILL DETECTION AND MONITORING

SeaDarQ Features

- Fulfilling and exceeding the basic standards of Oil Spill Detection equipment – area determination, trajectory prediction and detection to at least 2 Nm
- Delivering real time information of the slick movement to other sensors and systems
- Defining the spread of the oil spill with multiple measuring points
- Unique filtering techniques sensitive to small signal differences allows detection of small size spills at long ranges
- One of the main suppliers to European Marine Safety Agency fleet of OSRVs



Real time oil spill monitoring

The ability of the SeaDarQ system to measure oil spills when there is only a small surface roughness represents one of the significant and unique advantages SeaDarQ holds over competitive products. The SeaDarQ software operates on the principle that oil on water reduces the sea surface roughness, and attenuates wind-generated waves. This reduces the backscatter intensity from the radar signals which, in turn, appears as dark structures in the radar images. The software records a number of consecutive images and integrates these over time to produce continuous real time images of oil spills. Typically, 64 revolutions of the radar are needed to produce a stable image, which means that it takes about 90 seconds to produce the first image. After that the image is updated continuously. When waves are present, the SeaDarQ oil spill detection system works optimally and can clearly identify areas of reduced backscatter.

Prediction

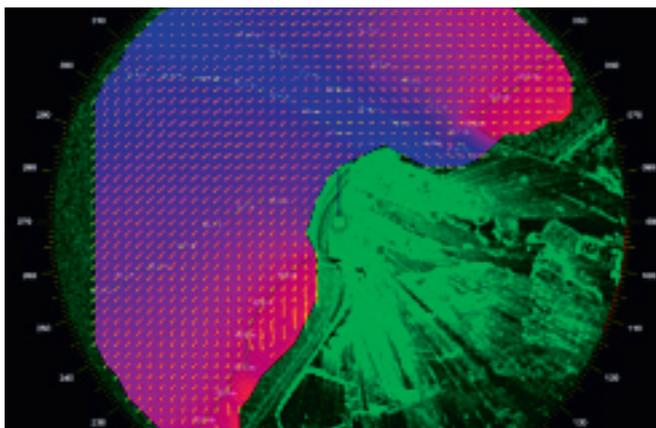
An oil slick will drift with the wind and the currents. Because the software also inputs the GPS information, the time history of the slick position(s) can be calculated and predictions of future movement can be provided to the operator. The SeaDarQ software measures surface currents with unlimited number of points, 360 degrees around the antenna and adjusts the grid of measuring points from 100 by 100 meters to 1000 by 1000 meters. This simplifies the planning and organization of the clean-up operation and can save time and resources at critical stages of the oil recovery campaign.

Sensitivity

To maximize the sensitivity of the system and increase the spatial resolution, a short pulse radar with fast turning, vertically polarized antenna should be used. Early detection and fast recovery are key elements and tests have shown the system to be capable of detection quantities as small as 5 litres. Unlike satellite and airborne radars, SeaDarQ can continuously measure oil spill, without the need of the external source such as sunlight.

Polygon

To determine the area of the spill, SeaDarQ has developed a polygon, which can be drawn around the slick and detail the affected surface in square kilometers or nautical miles. When using the tool during an incident, the appropriate clean up equipment can be directed to the most efficient location, reducing environmental disturbances. Geostationary vertices of the polygon and the possibility to project maps and charts underneath the radar screen allow operators to precisely direct the recovery vessels. The data delivered by the system can be integrated in a VTMS, transmitted to an aircraft or projected on a webserver. The mouse position on the screen provides real time data such as latitude, longitude, distance to the antenna and bearing. This information is available as output and can be used to control other sensors or equipment.



Measurement of currents, waves, depth, bottom topography and small objects monitoring

The backscattered radar signal is modulated by ocean waves and the SeaDarQ software can provide direct measurements of the wave length and wave direction in a high resolution grid within a 2-6 km diameter circle. If the wave period is longer than 3-4 seconds – normally the case in the open ocean – the wave period can be estimated from a sequence of radar images that are processed real time. The relationship between wave direction, wave period and wave length depends on the depth and the ocean current in the surface layer. Through sophisticated inversion methods, expanded version of the SeaDarQ software operating in “hydrography mode” can estimate the bottom bathymetry and currents with astonishing resolution and accuracy in a finely tuned grid. The SeaDarQ software also has the capability to detect small objects that generate persistent surface signals through the use of special filtering methods developed to detect small boats or weakly scattering surface objects.

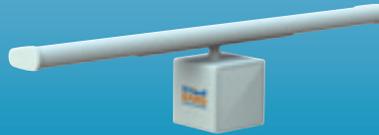
SeaDarQ System 

Radar System 

Optional products 

The best solution for oil recovery specialists, combining oil spill detection with hydrographic data extraction to optimize prevention and cleaning operation. The outstanding sensitivity of the SeaDarQ software allows detecting oil spill from the sea surface clutter even with a very weak breeze.

Radar Antenna



For the best results, use large (minimum 8 feet) and vertically polarized antennas with low-noise receivers.

Web Server



Web Server allows to view the data and control the system from remote locations through internet connection and password control access.

Radar Hardware



To transmit and receive radar signal.

The rotating X-band radar can either be supplied from Nortek or it is possible to integrate third party radars.

GYRO - GPS - AIS - Anemometer

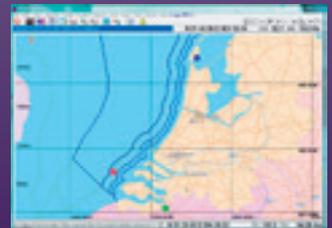
Gyro and GPS inputs are necessary to provide the location, orientation and allow alignment of radar images.



NMEA protocol

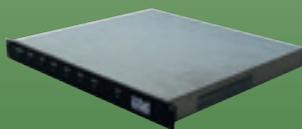
Data protocol for communication between Gyro, GPS, AIS and Anemometer

Electronic Chart Overlay



Add chart as a layer under the radar image

Radar NMEA Interface



The routing hardware is designed to accommodate the use of radars from different manufacturers. It also provides an interface for GPS, AIS, and gyro data that are important for the smooth operation of ship-installation.

SeaDarQ has been successfully operating with the Sperry Litton Marine, GEM, Raytheon, Furuno, JRC, Kelvin Hughes and Terma.

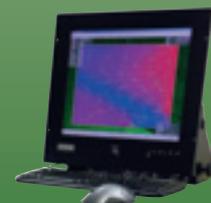
SeaDarQ Hardware



The multi-processor computer with high speed digitization boards is a cornerstone in the system performance.

Raw radar lines are stored on the discs and available for later use to reproduce circumstances during an oil spill incident and cleanup operation.

SeaDarQ Software



The software controls the data acquisition and it also serves as the user interface for oil slick detection and monitoring.

Screen images can be saved as a snapshots or recorded within chosen time intervals in geotiff format.

Technical Specifications

Function / Parameter

Image Presentation:	Logarithmic display of amplitude, Zooming, panning, scrolling overlay of geocode information Software STC – Sensitive Time Control – adjustable gain control
Image sampling grid:	Cartesian
Detection range:	0.1-3.5 km distance (depending on antenna height)
Resolution:	Better than 3.75 m (short pulse mode)
Operational wind speed:	> 2 m/s
Vessel Movement Compensation:	Real time
Static Object Enhancement:	Up to detection resolution in real-time

Operator Controls

Keyboard and Mouse:	Function buttons/ docking windows/ pop-up menus
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Current Mode

Current Speed:	Range: ± 2 m/s; Accuracy: ± 0.1 m/s; Resolution: 0.1 m/s
Current Direction:	Accuracy: 5°-10° Measurements apply to upper 3 m water layer
Water depth:	Depth range: up to 30 m; Accuracy: ± 0.5 m

Interface

Video Input:	0-1 Volt Analog, 75 Ohm*
Trigger Input:	TTL*
Azimuth Input:	TTL/RS422 pulses, up to 4096 pulses/revolution*
North Reset Input:	TTL/RS422 pulses, up to 4096 pulses/revolution*
Data communications:	RS232/RS422*

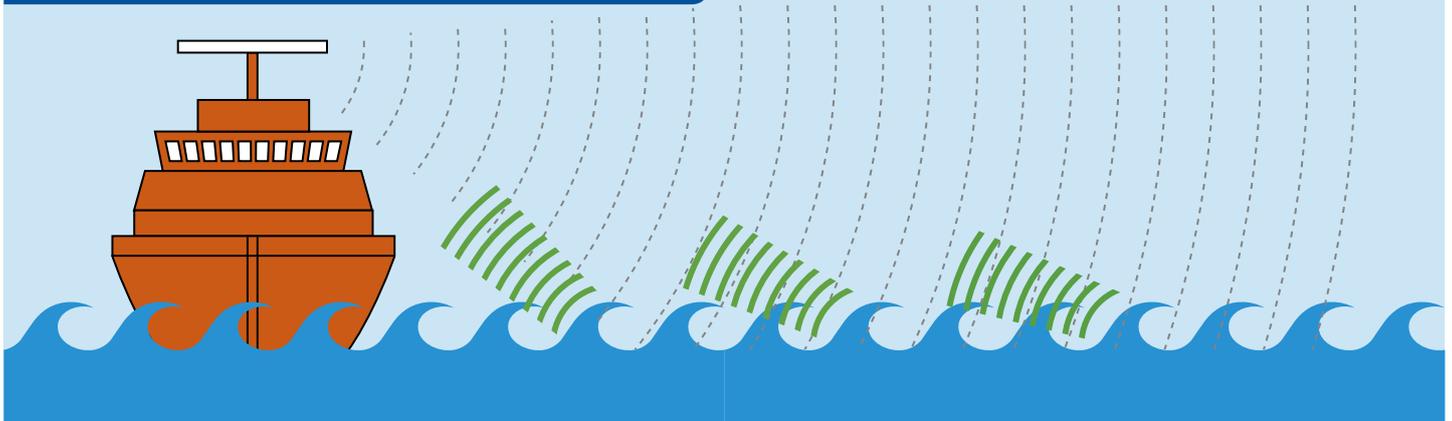
*Signal levels can be customized.

Recommended navigation radar system specifications

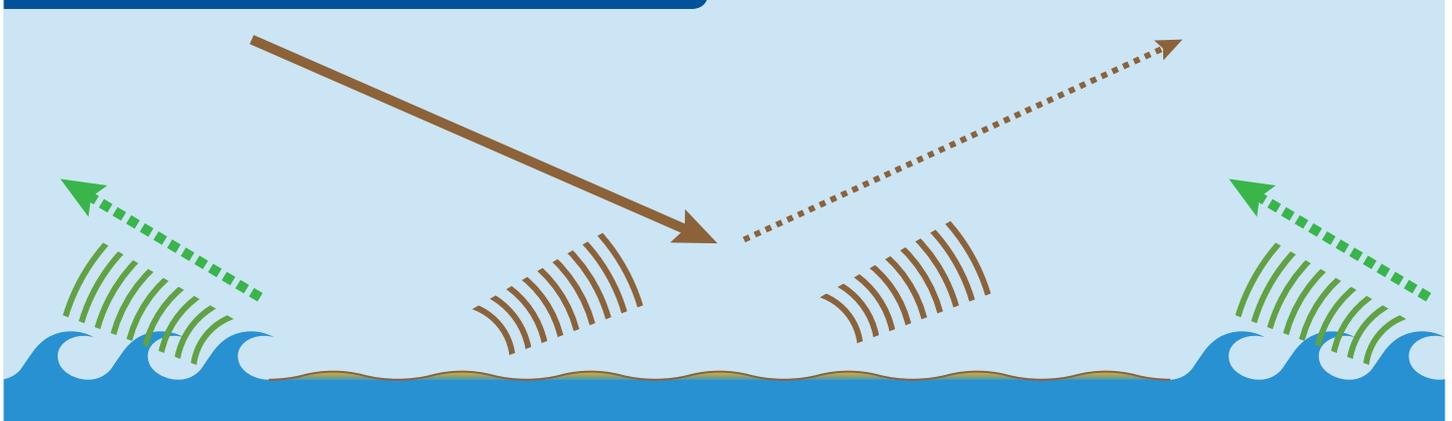
Frequency:	X-Band
Antenna length:	8 feet or longer
Minimum antenna height:	15 meters
Polarisation:	Vertical
Field of view: Range:	>2500 m
Azimuth:	360°
Pulse width:	50 ns/250 ns/1 μ s
Peak Power:	25 kW and more
PRF:	1800 Hz/1300 Hz/ 650 Hz
Rotation speed:	48 RPM
Receiver:	No clutter suppression
GPS/DGPS:	NMEA RS232/RS422 OUTPUT
Heading:	NMEA RS232/RS422 OUTPUT

How does SeaDarQ work?

Waves - good backscatter



Clutter disturbances - oil on water - no waves



TRUE INNOVATION MAKES A DIFFERENCE

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