Kelvin Hughes Mk11 SharpEye™
Naval Radar Systems
HENSOLDT UK, formerly known as Kelvin Hughes, is a world leader in the development, manufacture and supply of maritime navigation and surveillance radar systems.

For over 70 years, Kelvin Hughes has supplied navigation radars to naval and commercial shipping users for navigation and surveillance purposes. The SharpEye radar technology has been adopted by over 30 navies, utilising the advanced capability of SharpEye in surface search, navigation and helicopter approach applications.

Technical innovation and engineering excellence are the core values which have built and secured Kelvin Hughes’ market position.

Kelvin Hughes pioneered the use of coherent pulse Doppler technologies, making SharpEye radars unbeatable for tracking and identification of small targets in rough weather and clutter situations. The SharpEye technology outperforms in demanding conditions including rough seas, rain, fog and land clutter.

HENSOLDT UK will continue the technical innovation and engineering excellence which were the core values that built and secured Kelvin Hughes’ market position.
Kelvin Hughes Mk11 SharpEye is a state-of-the-art coherent, pulse Doppler radar for navigation and situational awareness. The ability to see smaller targets in clutter and at greater ranges increases the warship’s capability.

Features

- Enhanced detection performance – see smaller targets such as RHIBs and submarine periscopes at greater ranges in clutter.
- Small target detection – can detect targets with a 0.5m² RCS at several nautical miles.
- Clutter removal without picture degradation.
- Pulse compression – provides superior range discrimination across all radar range scales.
- Ultra-high reliability – 100% solid state electronics – NO MAGNETRON – NO MAINTENANCE.

Typical Performance Advantage

- 10m² target, sea state 5 and heavy clutter conditions
- 0.5m² target, sea state 5 and heavy clutter conditions
Kelvin Hughes has developed SharpEye to deliver superior radar performance and reliability. SharpEye is the world’s first affordable navigation and surface search pulse Doppler radar sensor offering high reliability, low cost of ownership and much improved detection ranges, especially of small targets in clutter.

SharpEye is defining new standards in surveillance missions at sea, onshore and on land with transmit powers of up to 300W. It is used by navies, vessel traffic services, border agencies, coastal surveillance, other security agencies and critical infrastructure operators.

Mk11 SharpEye I-band (X-band) and E/F-band (S-band) technology is a fully coherent radar providing situational awareness in all weather conditions and in high sea states.

Mk11 SharpEye I-band (X-band) transmitters are the first in their class to employ GaN (Gallium Nitride) power transistor technology. The significant performance benefits of GaN transistors have been harnessed by SharpEye to directly improve the performance of the radar.

SharpEye technology uses the Doppler effect to determine target radial velocities. This is achieved by processing received echoes into velocity bands, enabling the separation of genuine targets from clutter. Extracting the relative motion of targets by measuring the phase of the received echo relative to the phase of the transmission enables the radial velocity to be determined.

Mk11 SharpEye advantages:
- Much improved radar performance.
- Inherent reliability.
- Range discrimination is maintained over all radar range scales and is equivalent to that obtained in the short pulse in a magnetron radar.
- Low peak power reduces the probability of intercept.
- Graceful degradation.
- Fast switch-on.
- Long maintenance free service life.
- Tuning/retuning not required.
- Interoperability through frequency selection.
- Reduced risk of interference from other radars.
- Built in test equipment for fault detection and diagnosis.
SharpEye X  |  Master  |  TX Set-Up

SharpEye in Heavy Rain

Benefits
- Value: Advanced capability, Affordable, Low cost of ownership
- Ultra-high reliability: Solid state electronics, Graceful degradation, Minimum moving components
- Clutter suppression: Doppler processing, Small target detection
- Incremental capability: Capability enhancements, Mission updates, Useful life extension

Features
- Low power
- Continuous health monitor
- Open architecture
- Fully coherent
- Reduced ESM signature
- Built-in self test system status monitor
- Independent display options
- Camera/sensor interface via display
- Fibre optic gigabit ethernet (Asterix)
- Serial I/O via converters
- Patented pulse sequence
- Doppler processing
- Moving Target detection
- Pulse compression ratios up to 1000:1

Specification

<table>
<thead>
<tr>
<th>Transceiver</th>
<th>Solid state coherent upmast and downmast options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak RF power</td>
<td>Up to 300W</td>
</tr>
<tr>
<td>Power amplifier technology</td>
<td>GaN</td>
</tr>
<tr>
<td>Pulse lengths</td>
<td>0.1µs - 100µs</td>
</tr>
<tr>
<td>Reliability</td>
<td>Up to 150,000 hrs MTBF</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Signal Processor</th>
<th>Pulse compression with Doppler processing for:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clutter discrimination</td>
<td>Up to 16 filters</td>
</tr>
<tr>
<td>Automatic, adaptive clutter suppression</td>
<td>Standard</td>
</tr>
<tr>
<td>Sectorised transmission/processing modes</td>
<td>Optional</td>
</tr>
<tr>
<td>Doppler</td>
<td>Standard</td>
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</tbody>
</table>

I-band (X-band)  |  E/F-band (S-band)
Radar Display

The standard radar navigation display is type approved to the latest IMO radar performance standards. Features include an Enhanced Target Detection (ETD) mode that eases the operator’s ability to differentiate between clutter and targets and a dual Plan Position Indicator (PPI) mode that provides the operator with two independently configurable PPIs. Tactical features are available in non-IMO mode.

The Kelvin Hughes radar display is a software centric platform enabling it to be updated and additional functionality added in the future.

User Experience

- Providing a single platform for radar, chart radar and ECDIS.
- Easy to use and intuitive, with on screen prompts to assist the user.
- Open architecture enabling serial and digital interfaces.
- Twin PPI enables the user to build a complex picture on one PPI while leaving the other clear for collision avoidance.
- ETD mode provides a clearer picture and uses colour to differentiate between moving and stationary targets.
- ETD also helps the user to detect targets before they are strong enough to be tracked.
- WECDis integration.

Features

- Ship data
- AIS target information
- Routes
- User defined profiles
- Target association, vectors and past positions
- Target display and tote table
- Steering information*
- Dynamic clutter
- Depth display*
- Single or dual Plan Position Indicator (PPI) for enhanced situational awareness
- ARPA (Automatic Radar Plotting Aid)
  - 200 Contact tracker
  - Automatic contact acquisition zones
  - Polyzone acquisition exclusion zones
  - Tote table
- Agile tracker option
- Integral simulator
- Personal setup data
- Spyscope
- Radar sensor control
- Serial and analogue interfaces
- Ground stabilised user mapping
- Route display with indication of cross track error
- Man-overboard marker with drift compensation and elapsed time indicator
- Parallel index lines
- Electronic tape measure for rapid range and bearing calculation
- Common reference point
- Two electronic bearing lines
- Two variable range markers
- Displays official Electronic Navigation Charts (ENCs)
- Route planning and monitoring
- ARPA/AIS contact correlation

Benefits

- Ease of operation.
- Decision making tool, that enhances safety and efficiency at sea.
- Manage the interface picture and share information across workstations.
- Dual PPI display and ETD enhance situational awareness.
- Tactical functionality developed with the naval operator in mind.

SharpEye Transceiver

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmitter type</td>
<td>Solid state</td>
</tr>
<tr>
<td>Low power</td>
<td>Up to 300W</td>
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<tr>
<td>Solid state pulse Doppler</td>
<td></td>
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<tr>
<td>Upmast</td>
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<tr>
<td>Onboard preprocessing</td>
<td></td>
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<tr>
<td>No maintenance required</td>
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<tr>
<td>Low through life costs</td>
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<tr>
<td>Navigation and tactical short and long range surveillance</td>
<td></td>
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<tr>
<td>Simultaneous long and short range operation</td>
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<tr>
<td>Pulse Doppler processing for rain and sea clutter rejection</td>
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<tr>
<td>Built-in system monitor</td>
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</tbody>
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* subject to compatible interfaces
**System Configuration**

**Naval Tactical Display**
- High resolution screens: 1920 x 1200 LED
- High Definition: 24" and 26"
- Console Mount: Integrated processor
- Naval Tactical Features: Enhanced Target Detection (ETD), Chart radar, Dual PPI, Helicopter control
- Interfaces: Serial and Digital
- Tracker Options: ARPA, Agile
- Operates as standalone or across workstations

**Optional Tactical Features**
- Helicopter approach path
- Electro Optical Fire Control System (EOFCS) interface
- Jamming detection mode
- Relative velocity calculations
- Anti-submarine warfare - FOC, running torpedo (dogbox), plan cordon
- Navplans/blind pilotage
- Sector transmission/single scan
- Sector screens and plan cordon
- North stabilised transmission sector
- MRATS (Manual Rate Aided Track Facility) and synthetic target
- Operator track labelling
- Operator target identification

**Antennas**
- Standard antenna types include 2.5m and 3.9m low profile designs to reduce wind loading
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