HENSOLDT Optronics **Submarine Solutions**

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HENSOLDT
Detect and Protect.

HENSOLDT – Submarine Solutions

The complete Submarine Periscope and Optronics Mast portfolio meets all the operational and functional integration requirements of the end user and shipyards.
As part of the aggressive growth strategy in 2010, HENSOLDT decided to retain production of hull penetrating periscopes, whilst our competition shifted to twin optronics mast operation. This decision has benefited HENSOLDT as conventional submarine new build programmes have, with few exceptions, retained a periscope and optronic mast combination.

All systems are under client and own funded R&D modernisation development programmes aimed at continuous improvement and introduction of latest technology.

In recent years, the focus has shifted to the development of a fully integrated solution with innovative real-time image processing and Human-Machine Interface (operator interface) solutions. The portfolio is well-matched to Refit and New Build programmes.

Market Focus – world leader in a highly specialised market

Today…
HENSOLDT is one of the market leaders for Attack Class Submarines in the Conventional (non-nuclear) Platform markets. These include SSK (where refit and modernisation programmes are dominant) and SSP submarines (most of which are newly built).
Through decades of expertise in working with shipyards, combat system integrators, EW suppliers and end users, HENSOLDT can successfully collaborate with all stakeholders of a submarine procurement or modernisation project, ensuring that its products are delivered not only on time and within budget, but are also seamlessly integrated with the platform and other on-board systems.
HENSOLDT also delivers systems and equipment to support its products throughout their life cycle, including maintenance workshops for optronics and periscopes and simulation-based training systems.

SSKs
SSKs are diesel driven submarines such as the Class 209 and Scorpene submarines, which are still operational in most Latin American and APAC navies. These submarines are either in mid-life refit or life extension projects, which are affected by budgets and constraints, as well as the need to limit project complexity and the technical risks of installing new equipment on a naval platform.
HENSOLDT supports end users and shipyards in every phase of the modernisation project, either supporting a system integrator or assuming responsibility to deliver a complete, modernised underwater optronic system.
Additionally, the HENSOLDT underwater optronic portfolio includes products specifically designed for minimising the effort of modernisation while still equipping older submarines with the latest technology.

SSPs
These are submarines equipped with air independent propulsion systems such as the Class 214, Class 212 and the newer generation Class 209 submarines supplied as new build platforms by major shipyards both in Europe and overseas. Newly built submarines often represent the pinnacle of naval technology, and many end users require that they be equipped with the most cutting-edge, high-performance optronic systems. This, together with advancement in platform design and the constant evolution of submarine roles within naval forces worldwide, requires suppliers to constantly innovate and to offer a well-proven yet modular portfolio of solutions.
HENSOLDT has built on its distinguished heritage to develop a diverse portfolio of products and system configurations that is able to respond to all the requirements of a modern submarine force. The latest innovations in sensor technology, data transfer, video processing and optics are an integral part of both our periscopes and optronic masts. Each of our products is design to support several interfaces to and from other on-board systems and to seamlessly integrate with the submarine CMS.

… and Tomorrow
As the maritime subsurface domain becomes ever more relevant and technology allows for deployment of a vast number of diverse submarine assets, HENSOLDT drives its innovation to serve emerging markets and expand existing ones.

Carrying on its traditions of delivering innovative products and excellent performance, HENSOLDT foresees significant growth in the midget submarines (SSM) and unmanned underwater vehicles (UUV) markets, as well as in the nuclear submarines market (SSN).

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A legacy of excellence

For more than 100 years, Carl Zeiss Optronics, the company from which we emerged, has been the world leader in the field of surveillance, periscope and high-performance optronics mast systems. Today, HENSOLDT Optronics continues to build upon this tradition of technical innovation and excellence, having successfully supplied and installed over 3000 periscopes and optronics mast systems. Currently, more than 21 navies trust in the superiority and reliability of our systems. Over the past years, trends in surface and submarine warfare have placed renewed demands on periscope and optronics mast systems. In consultation with submarine end users, HENSOLDT Optronics has invested significantly in meeting the most challenging requirements.

Technical innovation since 1903

Our heritage in submarine systems dates back to the beginning of the 20th century. In 1903 we developed and produced the world's first fully functional periscope for the "FORELLE" submarine. Since then we have aggressively pushed technological boundaries while setting new standards along the way.

Within the last decade, HENSOLDT Optronics invested significantly in the spiral upgrade to existing systems and the development of new systems. This aggressive, self-funded development cycle was driven by the current trends in submarine operations and technological advancements in increased functionality within limited spaces. Most importantly, HENSOLDT Optronics has used the knowledge of experts in the field of maritime and submarine operations to drive the development cycle to meet a wide range of future requirements. For these reasons, HENSOLDT Optronics is ideally placed to offer a complete range of periscopes and optronics masts systems to meet the requirements of a wide range of modern submarines – from midget subs to the largest vessels – and enable them to meet the growing operational challenges of the future.

Within the new-build market, the range of SERO 4X0 family periscopes and OMS (optronics mast systems) offers the end user a combination of systems that best meets their operational requirements, be it a combination of a periscope and optronics mast, or a twin optronics mast solution. Within the retrofit market, HENSOLDT Optronics offers the SERO 250 Series periscopes solution that meets the requirements of extended useful lifetimes of submarines under reduced defence budgets and other contributing factors. Therefore, the 250 solution provides older submarines with state-of-the-art capabilities without the need for expensive alterations to the vessel. This is the true 'drop-in solution'.

Optronic Masts and Panoramic Systems

OMS 150

OMS 300

OCTOEYE 360

Periscopes

SERO 430 *SERO 420* *SERO 250S* *SERO 250A*

SERO 250 Series
The optimal periscope retrofit solution

The SERO 250 is available in an attack (tactical) and search (surveillance) version – SERO 250 A and SERO 250 S respectively. These variants allow submarines to easily adjust to changing operational conditions and to fulfil challenging complex requirements for surveillance and intelligence gathering in all weather and light conditions.

The SERO 250 S is enhanced with improved optics with the addition as standard of high definition and low light level cameras. Night vision capability is possible through the addition of an infrared (IR) camera as a modular add-on. The system is fitted with active laser and passive stadiometric range finding. In order to ease integration, the SERO 250 variants can operate as a stand-alone system or integrate into existing (or renewed) combat management systems.

The periscope system enables the user to monitor surface and air activity so as to collect navigational data and to detect and identify targets. The system also provides video signals for parallel observation either on a bulkhead mounted display, CMS or with a stand-alone console.

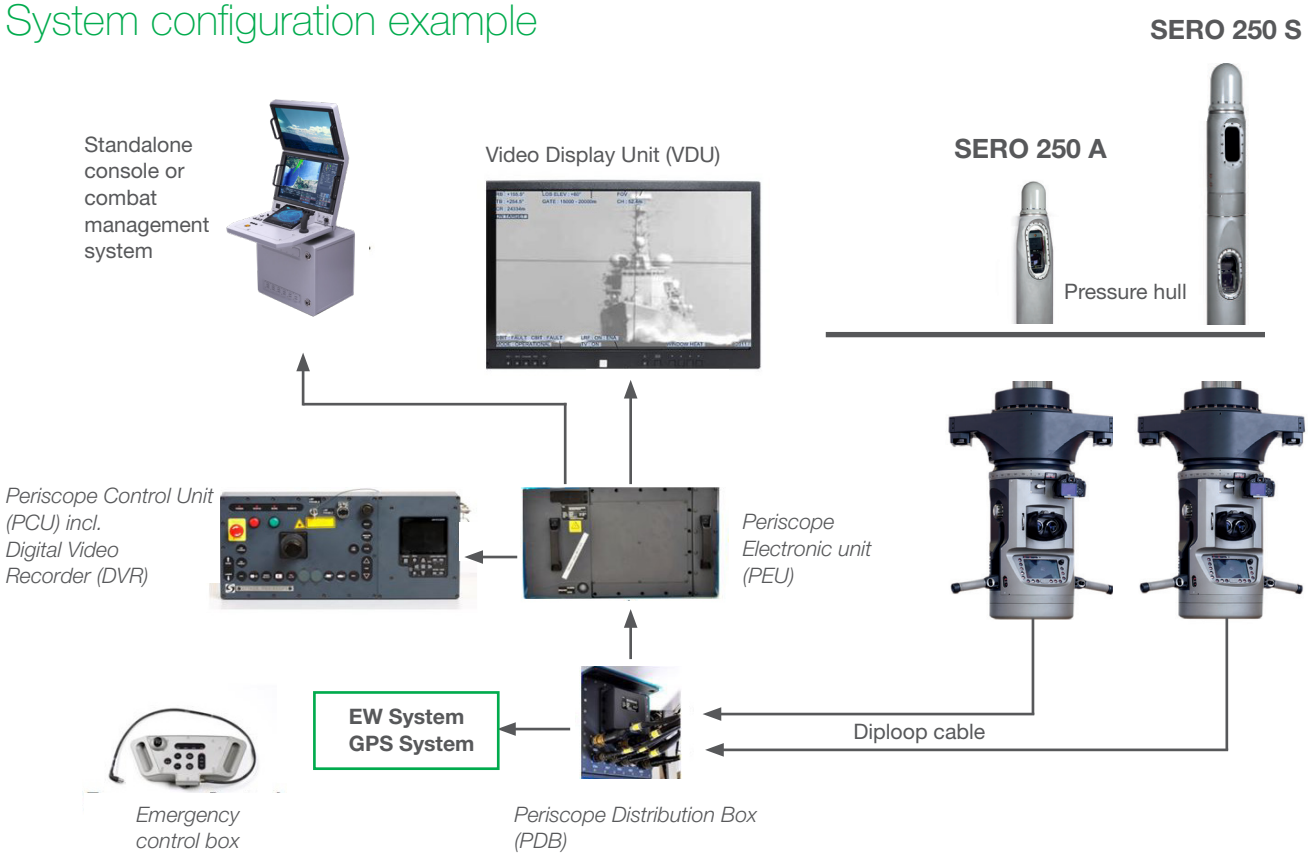
Features & Benefits

- High-performance optics
- True periscope with Direct View glass channel
- HDTV camera
- LLL TV camera
- Eye-safe laser range-finder
- IR camera sensor module (optional)
- Dual-axis, line-of-sight stabilisation
- Drop-in solution: designed for low-impact integration
- 3-stage optical magnification
- Antenna interface (for electronic warfare warning, GPS and V/UHF)

The SERO 250 design philosophy has been conditioned by the requirement to enable a simple, rapid and cost-effective retrofit into any submarine platform. To achieve this, HENSOLDT Optronics has engineered a straightforward ‘drop-in’ installation through the existing hull penetration, in order to avoid the need for hull modifications and retain the existing bearings, seals and hydraulic hoist mechanisms. All SERO 250 human-machine interface (HMI) functionality resides on a compact ocular box display unit, which is mounted directly below the Direct View binocular eyepiece. This self-contained unit includes system settings, camera displays, target information, system status and communication. As an option, a remote HMI console display can be fitted to a bulkhead mount. The SERO 250 can also be integrated into a submarine combat management system for remote control capability.

System Characteristics		
Product	**SERO 250A**	**SERO 250S**
Direct View	1.5x, 6x, 12x	
Cameras	HD daylight camera (CCD) Low light level TV (LLL TV) CCD	
Elevation range	-15° to +75°	-15° to +60°
IR camera		
Type		Medium-wave IR
Wavelength		3–5 µm
Elevation range		-15° to +45°
Passive range finding	Range-finding reticles, range 10 km	
Laser range finder	Class 1M, eye-safe, 400 to ≥ 10,000 m	
Stabilisation	2-axis line of sight stabilisation	
EW antenna interface	Universal antenna interface for EW, GPS and comms antenna from third party vendors	
Human Machine Interface	Collocated display on ocular box for viewing camera images and data, and on remote display	
Integration	Low impact integration to CMS for remote control functions or standalone console	

System configuration example



SERO 4X0 Family
State-of-the-art periscope system

The SERO 4X0 family represents the most successful periscope system for more than a decade. By introducing the SERO 420 with its new sensor unit, featuring cutting edge camera technology, the SERO 400 family is proving to be the leading periscope system.

Moreover, the direct vision optics provide experienced operators with unparalleled detailed recognition, especially with regards to colour fidelity and the recognition of coloured position lights. The binocular eyepiece enables the observer to gain a realistic spatial impression of the environment above the water's surface while the ergonomic design provides easy, reliable and fatigue-proof operation.

The SERO 4X0 family can be fully integrated into the submarine's combat system enabling full remote control and use of automodes.

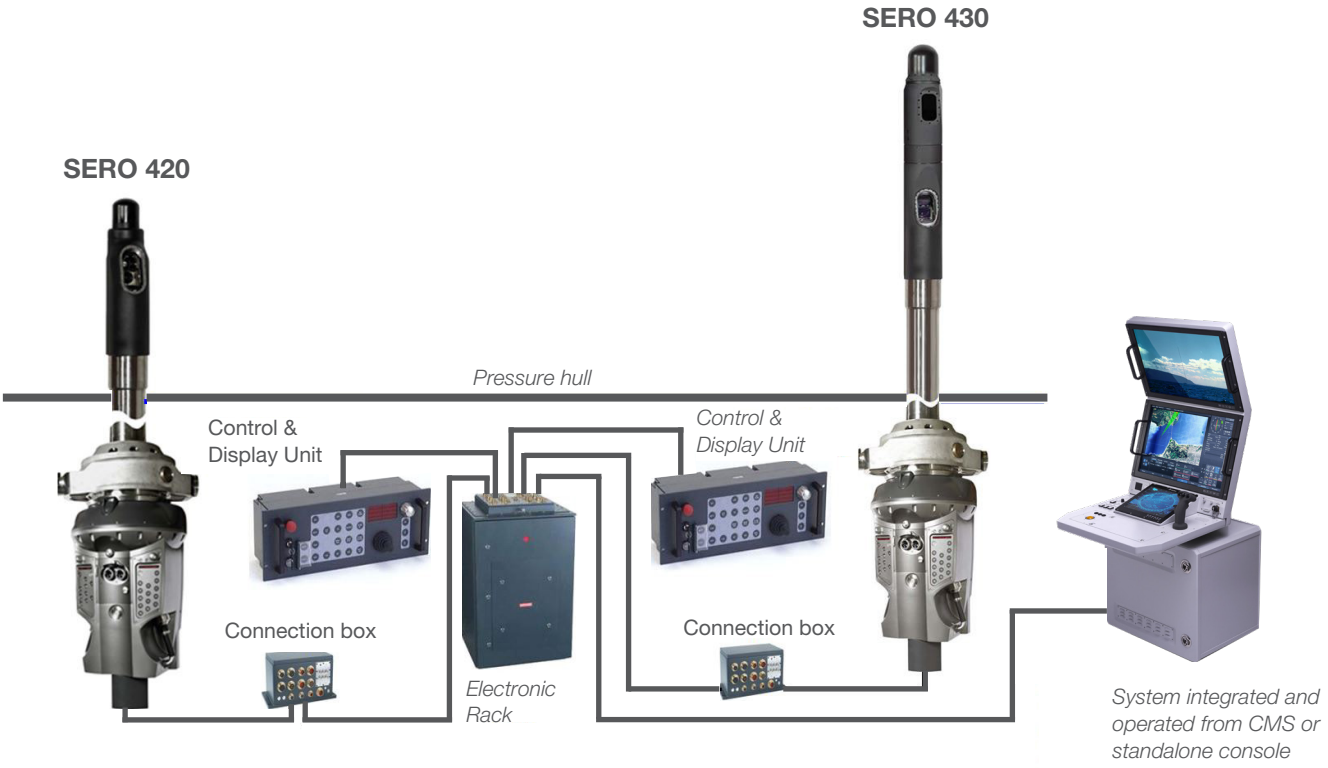
Features & Benefits

- High-performance optics
- Direct View
- 16 MP DigiStill colour camera
- HD LLLTV camera
- HD or 4 K colour camera
- Laser range finder and passive optical ranging
- Dual-axis, line of sight stabilisation
- Modular design
- 3-stage optical magnification
- Full combat system integration
- Antenna interface (Radar Early Warning, GNSS, comms)

The SERO 4X0 family provides an excellent, direct-view, high-performance colour HDTV camera, a high resolution low light level TV camera, a high-resolution digital still picture camera and an optional infrared camera, all of which enable surveillance and reconnaissance in all weather and light conditions.

System Characteristics		
Product	**SERO 420**	**SERO 430**
Direct View	1.5x, 6x, 12x	
Cameras	HDTV daylight camera (optional 4 K camera) HD digital still camera HD low light level TV (LLLTV)	
Elevation range	-15° to +75°	-15° to +60°
IR camera		
Type		Medium-wave IR
Wavelength		3–5 µm
Elevation range		-15° to +45°
Passive range finding	Optical range finding + range-finding reticle	
Laser range finder	Class 1M, eye-safe, 400 to ≥ 10,000 m	
Stabilisation	2-axis line of sight stabilisation	
EW antenna interface	Universal antenna interface for radar early warning, GNSS and comms antenna	
Human Machine Interface	Option of: - Integration into end user-specific HMI - HENSOLDT-specific HMI integrated into standalone console or CMS	
Integration	Operable via MFC's or standalone console	

Twin periscope configuration



OMS 150
The cutting-edge optronics mast system

OMS 150 is the latest enhanced sensor system in the proven OMS 100 family design. It integrates the latest in camera development to include Short Wave Infrared (SWIR) capability. The OMS 150 comprises a unique combination of three cutting-edge optronics sensors aligned in a single objective (lens) design that are all on the same line of sight. This enables a total of five optronics sensors to support a range of new operational potentials, by realising a true all light, all weather visual capability. To minimise the exposure time of the mast, a Quick Look Round (QLR) of 360° can be conducted in three seconds and full panoramic views in less than three seconds. This contributes to the situational awareness of the surface operational environment.

Real-time image enhancement and an intuitive HMI environment including automated functions contribute to an unprecedented level of situational awareness while at periscope depth.

Features & Benefits

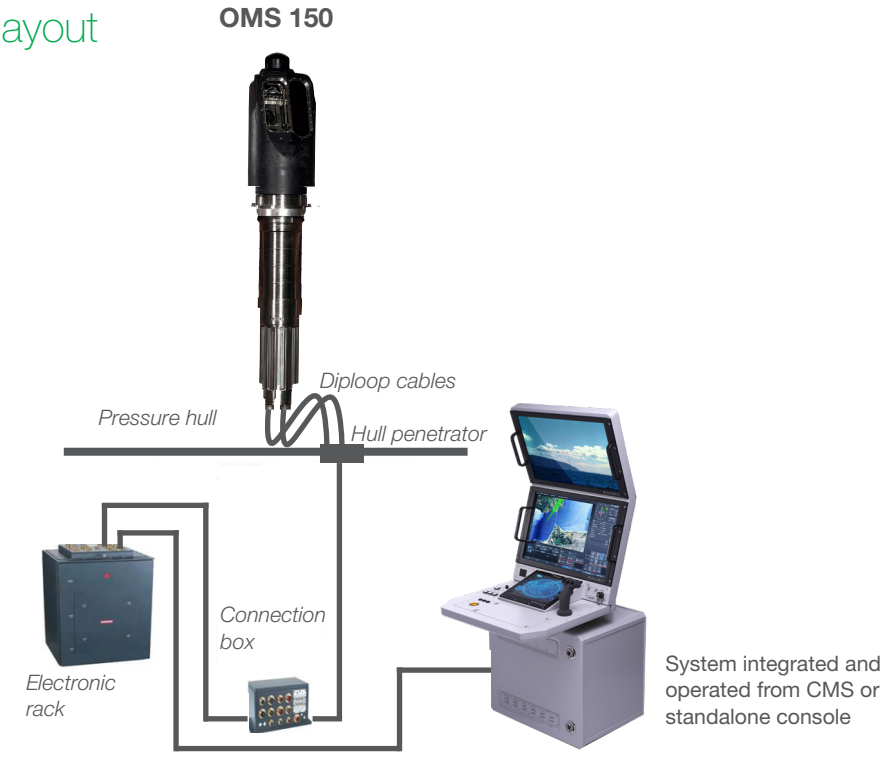
- Daylight 4 K CMOS camera, 8x continuous optical zoom
- HD LLLTV EB-CMOS camera
- 3rd generation medium-wave IR
- Camera, 3x optical zoom
- HD short-wave IR camera (SWIR)
- Eye-safe laser range finder
- High performance line-of-sight stabilisation
- Modular design
- Full combat system integration
- Innovative human-machine interfaces (HMI), which can be integrated into the tactical environment of the CMS or a dedicated standalone console
- Antenna interface for electronic warfare warning and direction finding, GPS and VHF/UHF

HMI examples

The latest sensor technology used in the OMS 150 is complemented by an enhanced digital fibre optic data transfer capability and image processing technology, allowing images to be displayed from up to three cameras simultaneously. The user-friendly, intuitive HMI enables more automated operations of the optronics mast system. Combining sensor data by overlaying images significantly improves situational awareness. Real time image enhancement includes turbulence correction and navigation light detection as well as overlaying image data (alpha-blending) and image fusion. Recorded images and videos also include mission-relevant metadata, such as navigational details and time of recording.

System characteristics	
Product	**OMS 150**
Single LOS cameras	4 K colour TV
	SWIR
	HD LLL TV
	8x continuous optical, additional electronic
Elevation range	-15° to +60°
IR camera	
Type	Medium-wave IR (LWIR option)
Wavelength	3–5 µm
FOV	
Zoom	3x optical zoom
Elevation range	-15° to +60°
Laser range finder	Class 1M, eye-safe, 400 to ≥ 10,000 m
Stabilisation	3-axes LOS stabilisation
EW antenna interface	Universal antenna interface for EW early warning, direction finder, GPS and comms antenna
Human Machine Interface	CMS specific HMI incl. panoramic view and automodes
Integration	Full integration into CMS, operable via MFCs or a standalone console

Optronic mast system layout



OMS 300 ultra-low profile mast

State-of-the-art stealth technology

OMS 300 Ultra-Low Profile (ULP) is the latest enhanced new sensor system in the proven OMS family design. It integrates the latest in sensor technology to include short-wave infrared (SWIR), medium-wave infrared (MWIR) and high-definition TV capability all in a smaller volume to increase stealth. This ultra-thin solution can be integrated into all types of submarines from the newly built to the retrofitted solutions.

The OMS 300 ULP was specifically designed to increase the stealth characteristics in the visual, infrared and radar domains. The high image quality and resolution of the integrated MWIR camera can be complemented with a SWIR system that provides improved vision in hazy and foggy conditions.

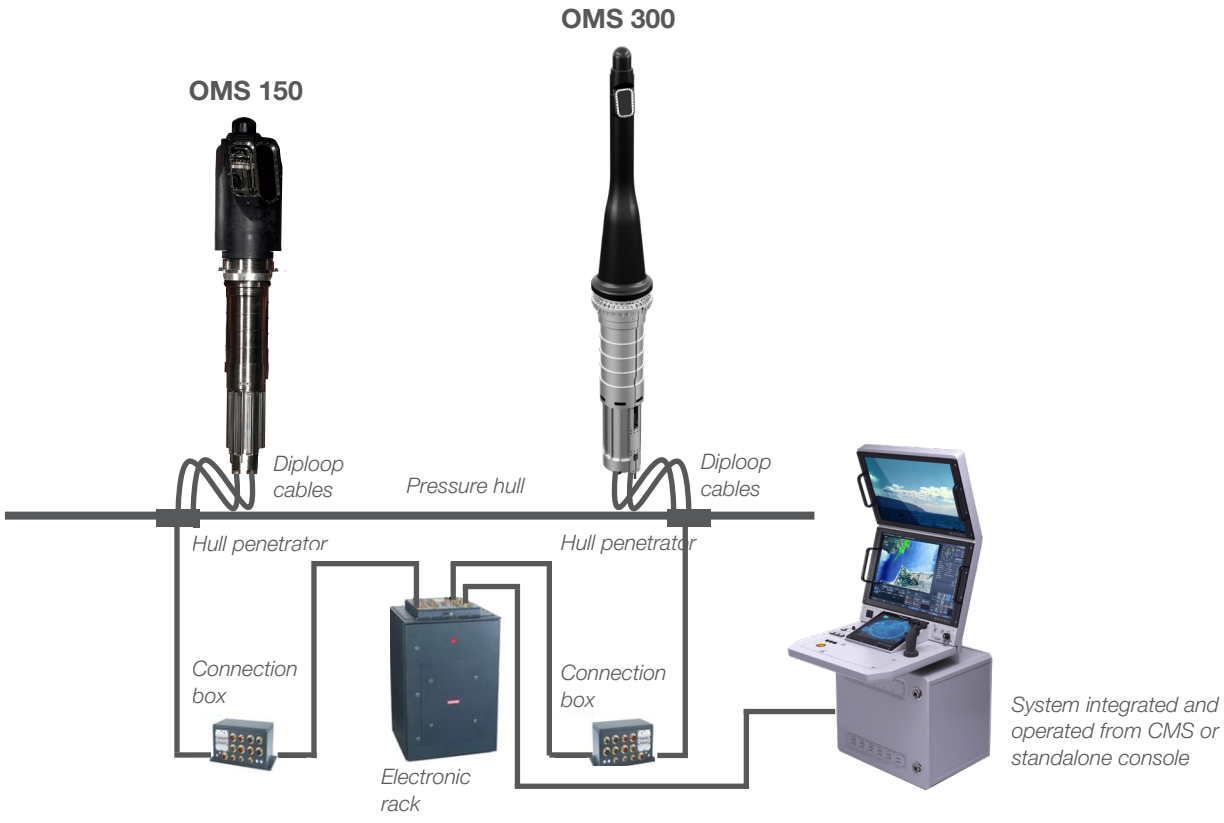
Features & Benefits

- Smallest diameter for ultra-low profile and maximum stealth
- 4 K daylight camera
- HD MWIR thermal imager
- Full combat system integration
- Real-time image enhancement
- 3-axes image stabilisation
- Antenna interface for GNSS

The latest sensor technology used in the OMS 300 LP is complemented by an enhanced digital fibre optic data transfer capability and image processing technology, allowing images to be displayed from up to three cameras simultaneously.

System characteristics	
Product	**OMS 300**
Cameras	4 K daylight camera
	Medium-wave infrared (MWIR)
Elevation range	-10° to +55°
Stabilisation	2-axis line of sight stabilisation 3rd axis stabilisation by image processing
Periscope head diameter	~130 mm
EW antenna interface	Universal antenna interface for EW early warning and GPS antenna
Human Machine Interface	CMS specific HMI incl. panoramic view and automodes
Integration	Full integration into CMS, operable via MFCs or a standalone console

Twin optronics with ULPM configuration



SERO 420 and OMS 150
A periscope and optronics mast solution

Since 2004, more than 50 submarines have been equipped with this classic combination of a direct view periscope and a non hull-penetrating optronics mast. The system combination, SERO 420 and OMS 150, comprises modern electronics and high-resolution sensors, which allow for long-range surveillance and reconnaissance in the most challenging ambient light and weather conditions. This configuration affords both stealth and powerful information gathering capabilities, thus enabling the user to swiftly detect, track, identify and record targets of interest.

While constantly undergoing improvement, this combination includes our cutting-edge optronics technology for modern submarines and also provides the distinctive benefits of a fully-optical, direct view periscope.

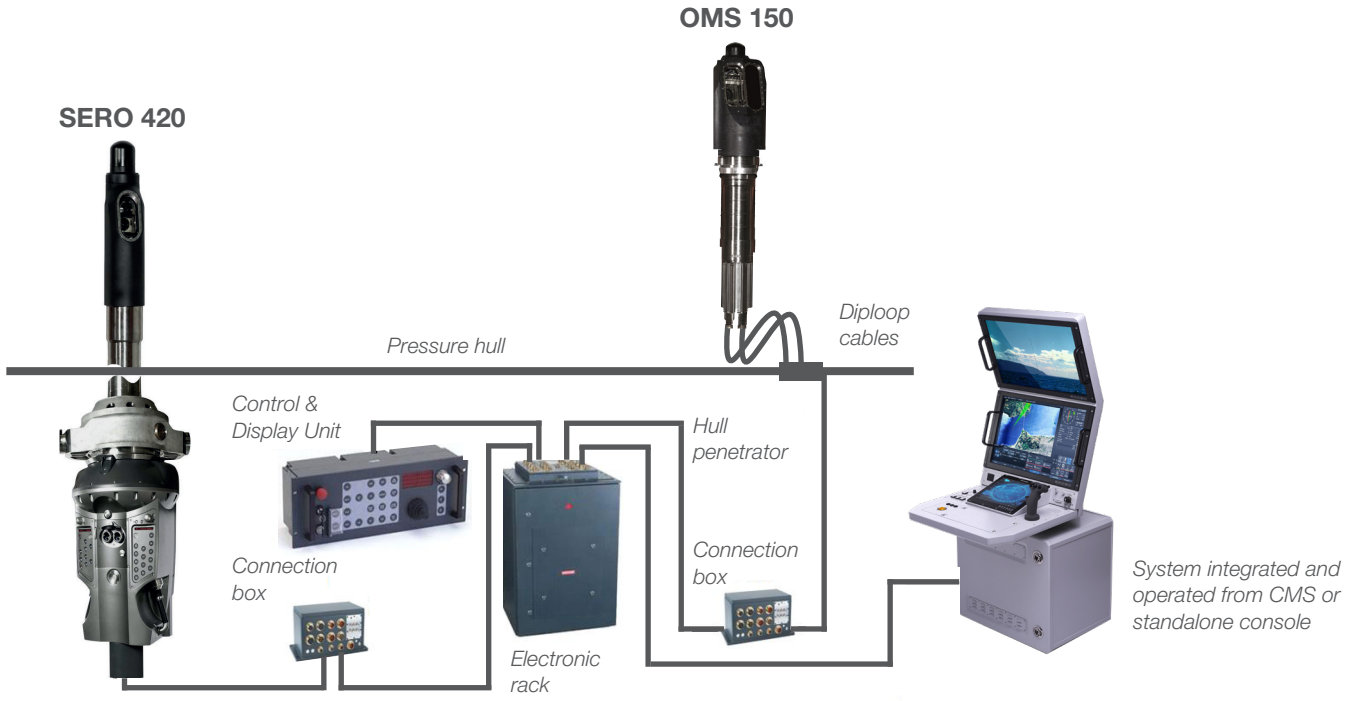
Features & Benefits

- 'Best of both worlds' solution
- High-performance direct view optics
- High-performance optronic sensors both in the OMS and periscope for all light and all weather operation
- Full spectrum capabilities
- HD and 4 K daylight cameras
- High-res DigiStill camera in periscope
- LLLTV cameras
- SWIR cameras
- HD IR thermal imagers
- Eye-safe laser range finders
- Single electronics rack
- Full CMS integration
- Universal antenna interface on both systems

With the installation of the SERO 420 / OMS 150 paired system, today's submariners are able to undertake a wider range of mission specific operations than was previously possible with earlier systems. Optronics masts systems provide submariners with a greater capability in the domain of ISTAR (intelligence, surveillance, target acquisition and reconnaissance) today than ever before.

System characteristics		
Product	**OMS 150**	**SERO 420**
Line of sight	3-axis line of sight stabilisation	2-axis line of sight stabilisation
Camera		
	4 K daylight camera	HD daylight camera
	HD LLLTV camera	Digital still camera
	HD SWIR camera	HD LLLTV camera
Zoom	8x continuous	8x continuous
Elevation range	-15° to +60°	-15° to +75°
IR camera		
	HD medium-wave or long-wave IR	Optional with SERO430
Magnification	2-stage magnification changer	
Elevation range	-15° to +60°	
Range finder	Class 1M, eye-safe LRF	Optical range finding + range-finding reticle
System options		
Antennas	Interface and signal pass-through for ESM-EW, GPS, VHF/UHF on periscope and OMS ESM-DF interface additionally available on OMS	
Operator interface	HMI incl. image enhancement (e.g. turbulence correction, alpha-blending), panoramic view and automodes	
Integration	Full integration of both systems into the CMS, operable via MFCs or a standalone console	

Periscope/Optronic mast configuration



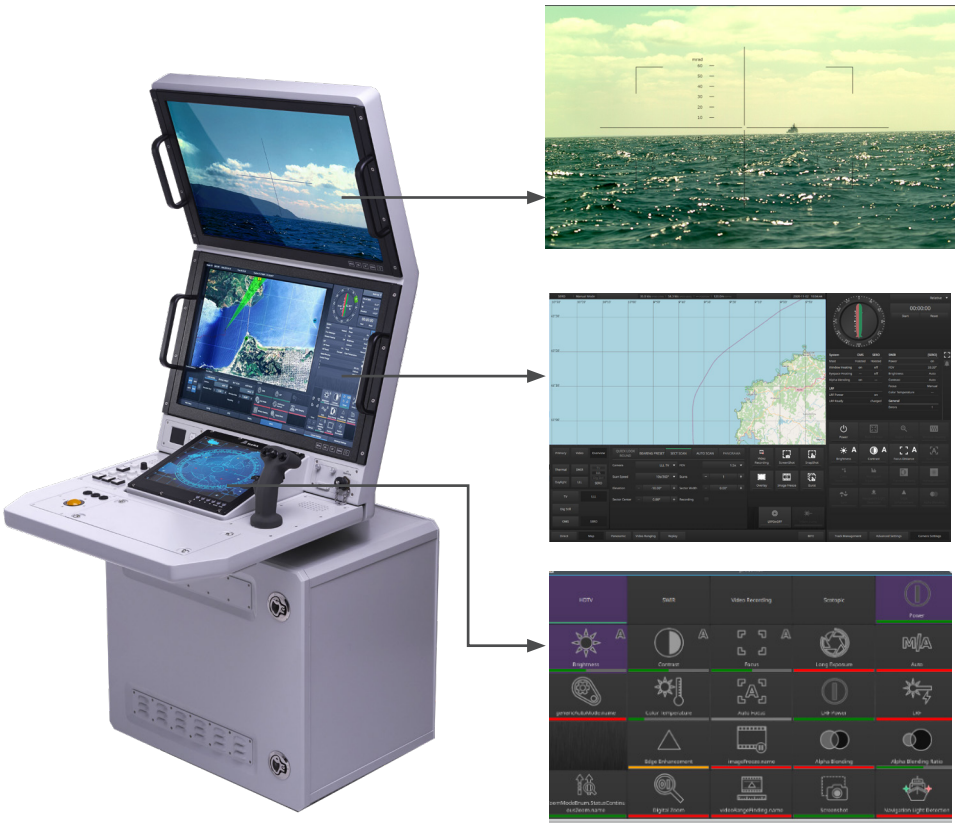
OMS 150 and OMS 300

Twin optronics masts for unprecedented awareness

For modern submarine operations, the unique combination of OMS 150 and OMS 300 represents the peak of technological innovation. The implementation of this twin optronics mast solution enables new operational capabilities in a changing operational environment in all light and weather conditions. Its highly modular and compact design ensures ease of installation, integration and logistic maintainability. The OMS solution can be fully integrated into combat management systems, ensuring full remote-control. The OMS 150 system distinguishes itself through its comprehensive combination of the latest optronics sensor technology available today. Its capability to conduct a 360° Quick Look Round (QLR) in merely three seconds with a resultant panoramic view is unique. The OMS 300 sets itself apart through enhanced stealth (visual, IR and radar) technology in a highly integrated compact design.

Features & Benefits

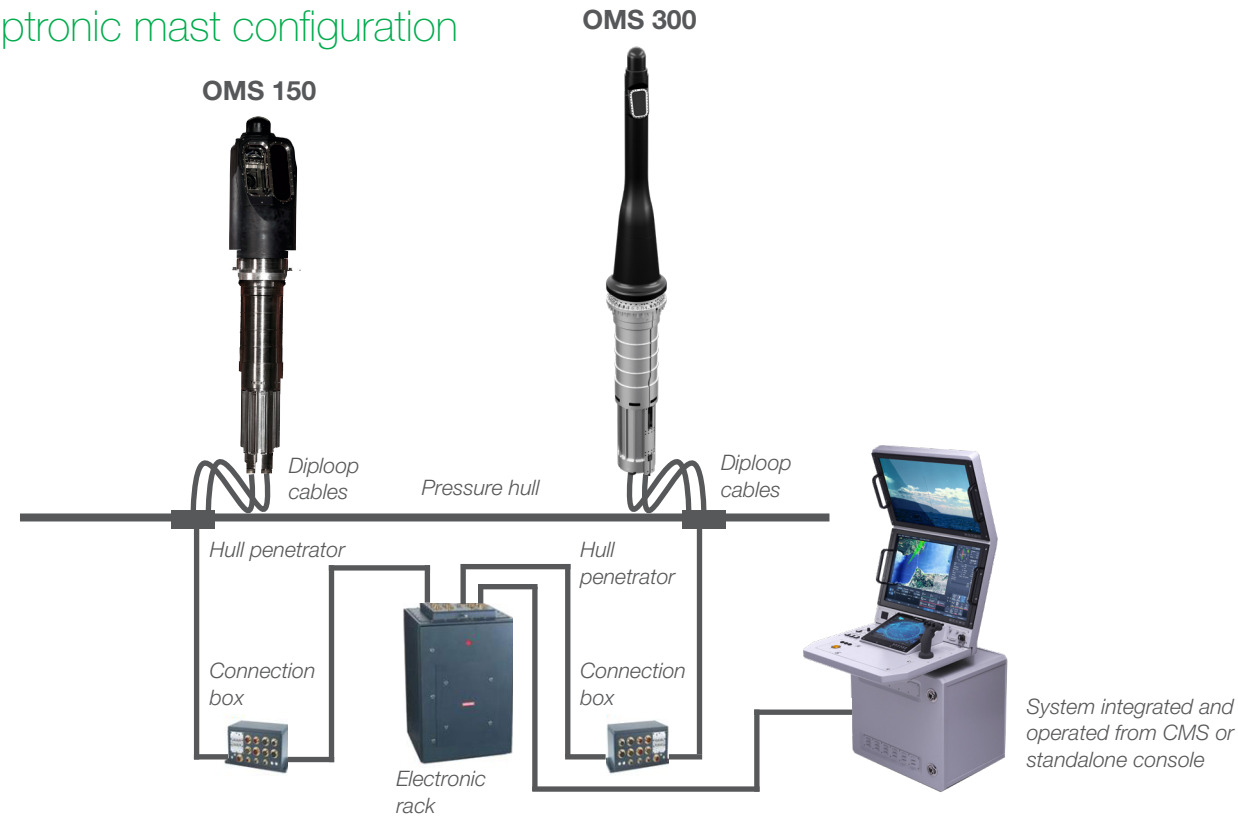
- Configuration with no hull penetration
- Maximum flexibility in platform design
- Operation in all weather and all light conditions on both systems
- HD and 4 K daylight cameras
- LLLTV camera
- SWIR camera
- HD IR thermal imagers
- Eye-safe laser range finders
- Extreme system flexibility
- Single electronics rack
- Full integration with combat management system
- Real-time image enhancement and post-processing
- Universal antenna interface on both masts to accommodate a wide range of EW, positioning and communication systems



The OMS 150 and OMS 300 are a combination of non-hull penetrating optronics mast systems for new-built submarines. The improved human-machine interface (HMI) enables highly automated operations from the ship's combat management system (CMS), but can also be operated independently from a dedicated standalone console. The imagery gathered can be enhanced, recorded, exploited, and analysed within the CMS. Recorded images and videos include mission-relevant metadata, such as navigational details and time stamps, providing true intelligence value. Images can be overlaid with alpha-blending up to complete sensor fusion for a real situational awareness in all weather and light conditions.

System characteristics		
Product	**OMS 150**	**OMS 300**
Line of sight	3-axis line of sight stabilisation	
Camera		
	4 K daylight camera	4K daylight camera
	HD LLLTV camera	
	HD SWIR camera	
Zoom	8x continuous	Multiple fields of view, 6x effective zoom
Elevation range	-15° to +60°	
IR camera		
	HD medium-wave or long-wave IR	HD MWIR
Magnification	2-stage magnification changer	Multiple fields of view, 4x effective zoom
Elevation range	-15° to +60°	-10° to +55°
Range finder	Class 1M, eye-safe LRF	
System options		
Antennas	ESM-EW, ESM-DF, GPS, VHF/UHF antenna	
Operator interface	HMI incl. image enhancement (e.g. turbulence correction, alpha-blending), panoramic view and auto-modes	
Integration	Full integration into CMS, operable via MFCs or a standalone console	

Twin optronic mast configuration



HENSOLDT OctoEye360

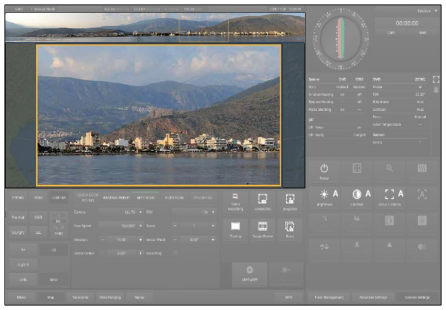
360° observation system for day and night situational awareness

HENSOLDT Optronics is further expanding its portfolio for the submarine market by introducing a 360° panoramic system. This system, called OctoEye360 will provide instant 360 overviews of the surrounding environment both day and night. Positioning and housing the 360 system can be customised to the specific platform. The 360-observation system is based on the well-proven design of a standard HENSOLDT optronics camera configuration and night vision. Innovative post processing such as 'on the fly video stitching', 'dynamic image stabilisation' and 'automatic image enhancement', provides real-time video processing capabilities that can be used during navigation and operations.

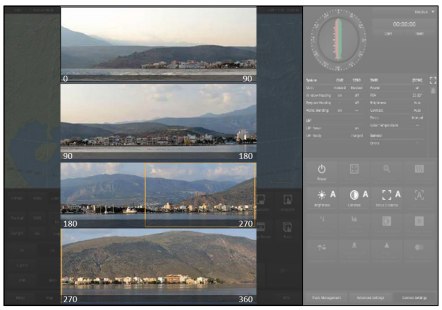
Features & Benefits

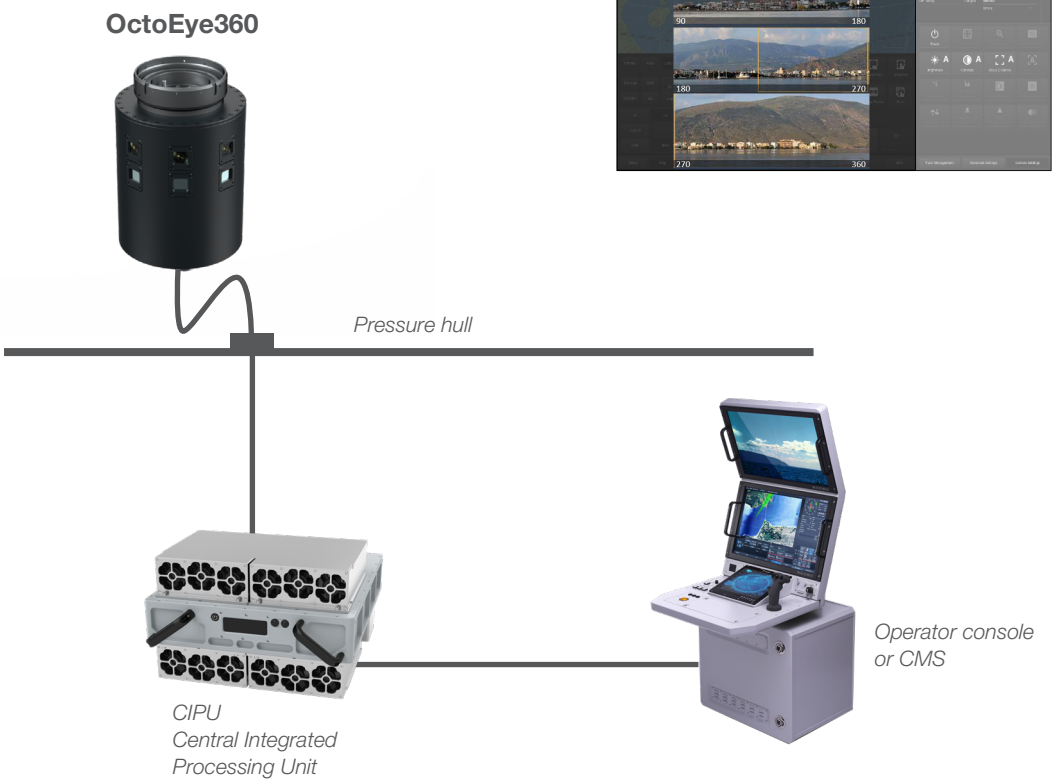
- 360° panoramic view
- 8 high-resolution daylight cameras
- 6 uncooled thermal imagers 8–14 µm
- Real-time video processing
  - Real-time video stitching
  - Dynamic image stabilisation
  - Automatic image enhancement
- Flexible and powerful HMI
  - Surveillance mode in 4 quadrants
  - Situational awareness mode
- Virtual reality goggles option
- Head module can be use on a range of platforms as a standalone system, e.g. submarines snorkel mast

Surveillance mode



Situational awareness mode





Intelligent contact management assistant
Embedded object detection, tracking and identification

Automatic contact management is the next step in assisting the operator when it comes to detecting, tracking and identifying potential threats to safety of navigation and operations. Any surface and/or air contact of interest located within the field of view can be highlighted on screen for the operator, or have its relevant metadata delivered to the CMS.

Each detected contact is tracked and assigned a unique ID. Additionally, and over time, the contact's Plan of Intended Movement (PIM) is estimated based on its Angle on the Bow (AOB), course estimations, and observed speed through the water.

High-resolution videos are processed close to the sensor, implementing the concept of smart sensor technology and data processing at the edge. Our modern approach of implementing deep neural networks and deep learning is based on the latest scientific research and optimised for application in military operations.

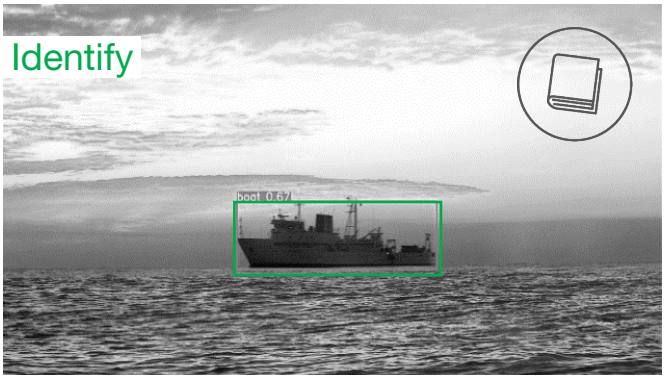
Highly efficient embedded hardware is utilised to deploy the deep neural networks for effective real-time operation at a low latency, power consumption and thermal emission.

Features & Benefits

- Independent contact environment estimations from the video sensors
- Smart sensor technology using small and efficient hardware
- Image processing directly at the sensor
- Supported cameras for processing:
  - Visual-optical
  - Thermal infrared
  - Short-wave infrared
  - Low light level video processing
- Automatic notification / alert for contacts of interest
- Integration into OMS and SERO family
- Innovative display of potential threats using augmented reality concepts
- Extendible object classification database

Detect, track and identify

Object classification with extendible library



After sales

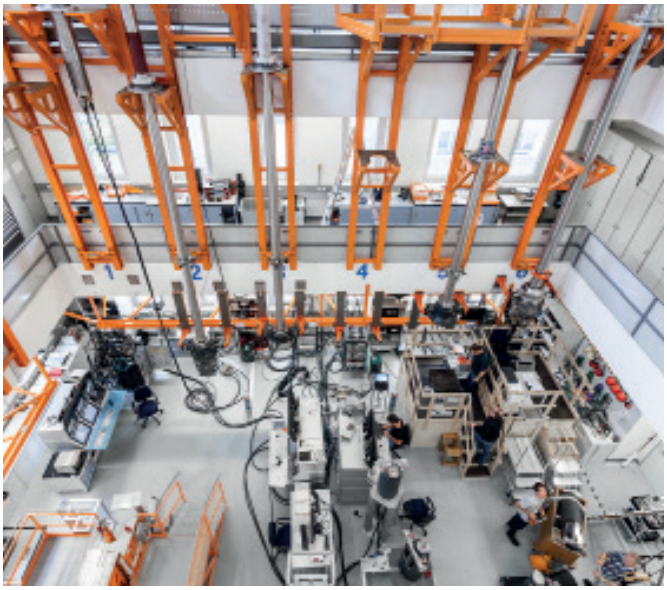
Customer service, workshops and logistic support analysis

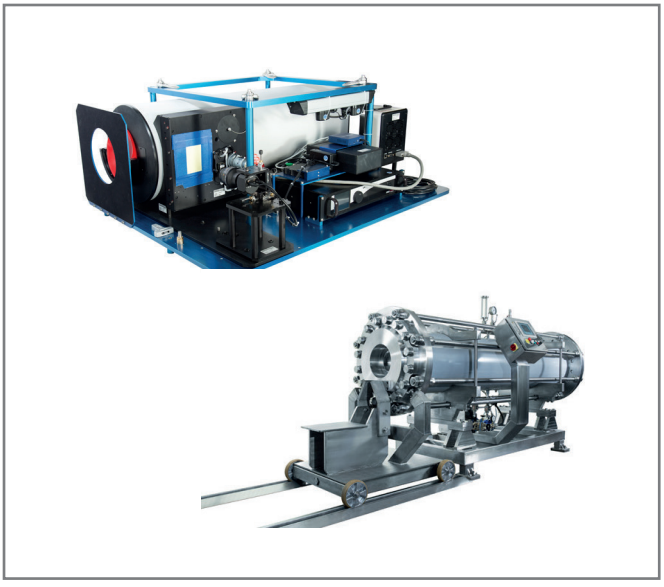
Customer service
With the modular products from HENSOLDT Optronics, the client has the option to upgrade their current systems to the latest sensor technology. The active obsolescence management ensures that spare parts are available to maintain the system in future. Modular overhaul packages are defined to reduce the turnaround times of the systems to be repaired.

Workshops
In consultation with end users, HENSOLDT Optronics has developed support concepts for their system in operation. The support concept extends from basic logistic support based on extended training, spares, etc. to fully functional periscope and optronics mast workshops allowing navies to assure full maintenance and repair responsibility in their country. The equipment will be adapted to the environment of the customer if available.

HENSOLDT Optronics is capable and willing to transfer the technology, know-how and also the infrastructure of the respective systems, allowing naval maintenance facilities to carry out maintenance and repairs up to level 4 (system SRU repair).

Logistic support analysis
HENSOLDT Optronics maintains technical publications using a common source database according the S1000D standard as well the Logistics Support Analysis – LSA according S3000L. Therefore, all logistic data are available in a common, well-known specified format.





Simulation systems
Special applications for product training

To support crew training and mission rehearsal on shore, HENSOLDT Optronics has developed SERO simulator systems which combine representative periscope hardware (comprising ocular box, video display unit and periscope control unit) with a high-fidelity scenario generator controlled from a computer-based instructor station.

The use of a shore-based simulator allows submariners to familiarise themselves with the SERO system. It also supports operator/command training and evaluation, and enables tactical training and doctrine development in a repeatable and controlled environment. Furthermore, it significantly reduces the need to remain at periscope depth while undertaking at-sea training.

Specific mission scenarios and geographies/operating areas can be pre-programmed by the instructor. A bespoke end user library enables virtual representations of various entities – such as surface and air targets – to be displayed in the SERO simulation environment.

Besides managing scenario generation and tasking, the instructor is able to monitor operator performance during the course of the training session.

Operator

Execution of task

Ocular box simulator

SERO 250

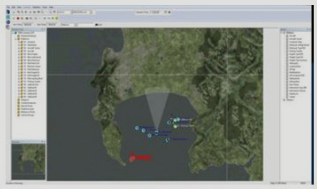
SERO 400

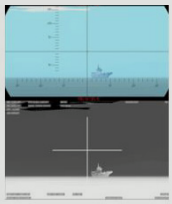
Trainer

Scenario set-up (Tasking)

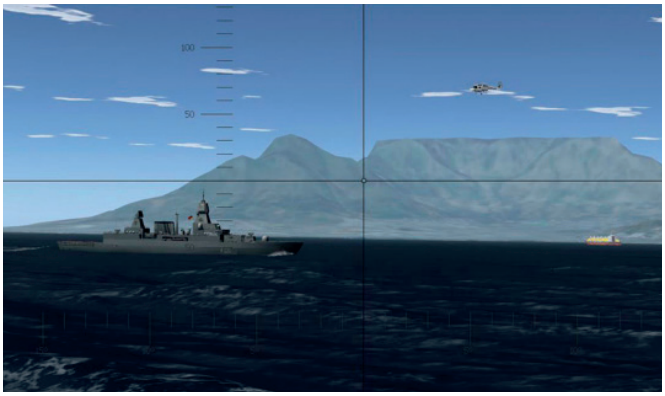
Measurement of response

Instructor workstation

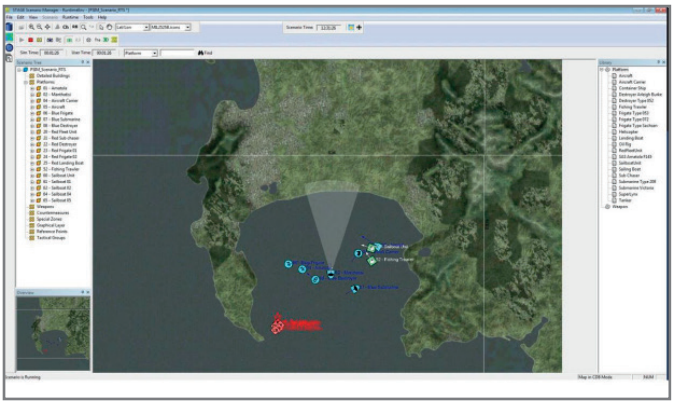




Synthetic environment



Tactical scenario set-up



A global leader

With more than 100 years of experience in submarine optical sensors, HENSOLDT Optronics is the global market leader of periscopes and optronics mast systems today.

The company traditionally maintains close ties with navies around the world. Listening attentively to submariners has led to a profound understanding of their operational demands and requirements. Consequently, a significant, company-financed effort in research and development has resulted in a full-scale, cutting-edge technology portfolio of submarine optronics products. This investment is already paying off – HENSOLDT Optronics has supplied more than 100 periscopes and optronics masts since 2006.

The SERO 4x0 family provides modern periscopes in search or attack versions for new-build submarine projects. As a combined periscope/optronics mast solution, a SERO 4x0 can be complemented by a non hull-penetrating, multi-sensor OMS series optronics mast.

With the introduction of the stealth-designed, low-profile OMS 200 and OMS 300 optronics mast, the twin optronics mast solution is available for submarines regardless of their size.

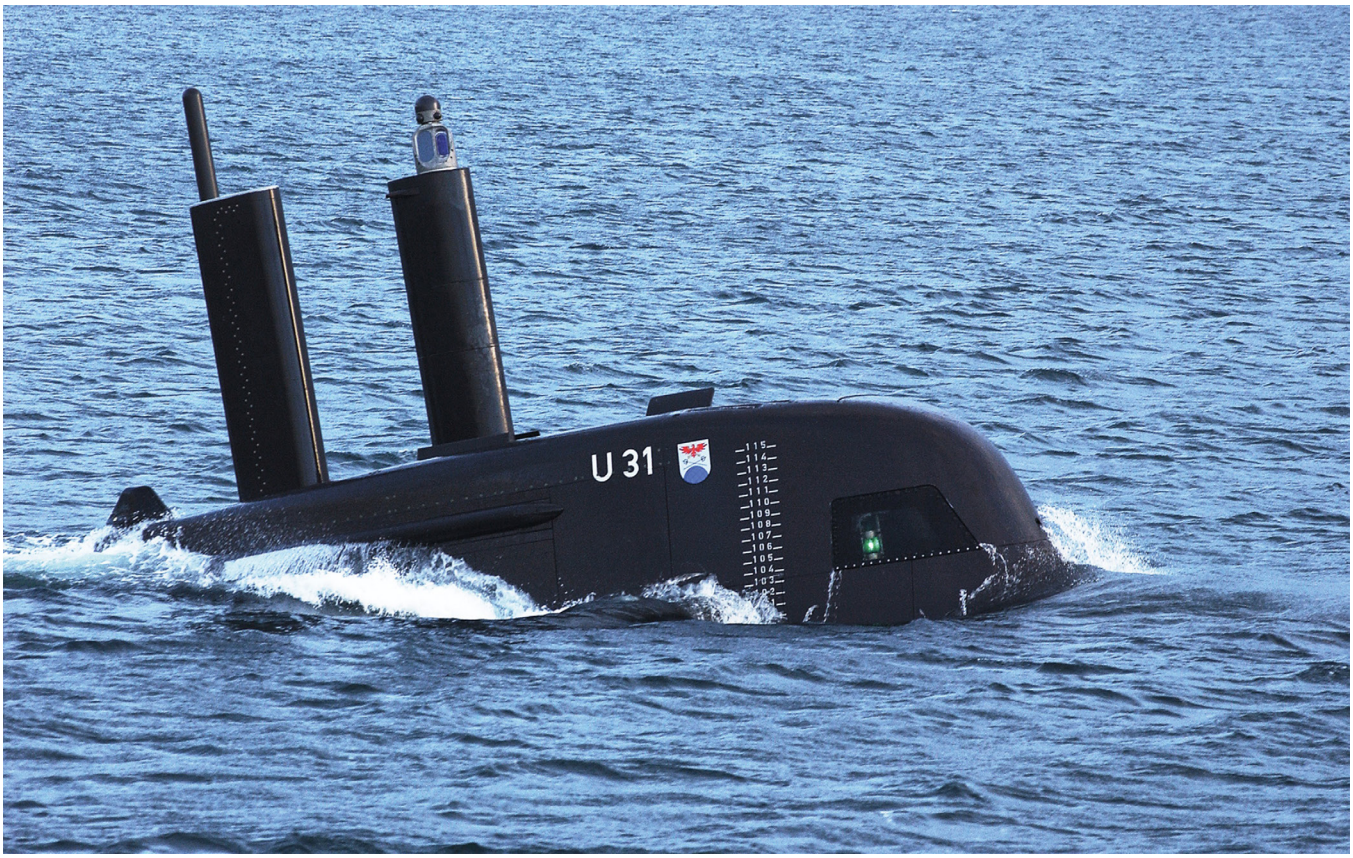
The SERO 250 was specifically designed for the refit of older submarines, providing a sophisticated modern periscope solution that fits into existing submarine structures, with no need for modification.

HENSOLDT Optronics designs, develops and manufactures optronics, optic and precision engineered products for military, civil and security applications for monitoring, identification and classification purposes, as well as for highly precise measurement, evaluation and targeting.

The optronics products are deployed on various platforms, including submarines, vehicles, aircraft, satellites and unmanned aerial vehicles, for sea, land, air and space missions.

In the field of submarine solutions, HENSOLDT is able to offer networked systems. Interoperability and communication between platforms, is the standard for a comprehensive picture of the threatened environment.

Whether submarine, surface vessel, fixed wing or rotary, all HENSOLDT products are compatible with each other and thus support operators in covering a larger area of the operational environment.



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