MEETING THE UNDERWATER CHALLENGE

Securing your future
Undersea environments afford cover for a wide range of potentially destructive threats. Undetected, near-silent submarines and advanced influence mines can deny access to theatres of operations, restrict freedom of movement and inflict devastating damage.

As the naval battlespace moves from the high seas to the littoral, commanders need more and better data from shallow littoral waters. Meanwhile, the proliferation of unconventional threats from the sea calls for enhanced homeland security, including improved protection for ports and harbours.

Thales offers unparalleled capabilities and a unique range of products to meet the challenges of undersea warfare. In the United Kingdom, France and Australia, Thales has a proven track record in designing high-performance defence solutions that deliver excellent value for money.
Proven expertise in open system architectures and a recognised capacity for innovation brings Thales a unique position in anti-submarine warfare and mine countermeasures.

With more than 50 years’ experience and a history of success in the provision and integration of naval systems, equipment and services, Thales offers unparalleled expertise as a supplier and partner to over 50 navies worldwide. The company leverages unique understanding of maritime environments to develop tailored responses to its customers’ operational requirements.

Multi-domestic footprint
Thales is an international company with operations all over the world. We work locally with customers to understand the exact requirements and constraints of each programme. We operate through a multi-domestic network of local subsidiaries, industry partners and joint ventures, each an active contributor to its home economy.

Cutting-edge technologies
Thales invests actively and consistently in research and technology to develop new signal processing techniques, underwater acoustics and undersea warfare concepts. The company is recognised as an all-round leader in undersea warfare for its advanced technologies and ability to adapt to fast-changing operational contexts. Naval forces all over the world rely on Thales solutions to counter undersea threats in all maritime environments and to gain or maintain operational superiority in their spheres of influence.
Thales’s expertise spans the entire spectrum of sonar systems and technologies from acoustics, electronics, signal processing and mechanical engineering to data fusion and single- and multi-platform operating systems.

Thales experts constantly explore new methods and techniques to develop innovative world-class products.

**Towed VLF active arrays**

Over almost 20 years, Thales has built up unparalleled expertise in towed VLF (very low frequency) active arrays. Leadership in wideband free-flooded ring transducers and triplet receive arrays (to resolve left-right ambiguity) enabled the company to develop the Captas family of towed active arrays selected for several ASW frigate fleets.

Another new technology, the VLF omnidirectional linear transmit array led to the development of the revolutionary Captas Nano lightweight Variable Depth Sonar.

**Data fusion and multistatic sonar**

As a long-standing developer of multi-array sonar suites for submarines and ASW surface combatants and aircraft, Thales has gained a vast experience in acoustic data fusion.

This expertise is being applied to network-centric warfare (NCW) concepts combining active and passive VLF systems, multistatic operating systems and data fusion to provide naval force units with a battlespace-wide tactical picture.

**Unmanned vehicles for undersea warfare**

Thales’s long experience in sonar technologies and operations is directly applicable to the fast-growing field of unmanned underwater vehicles (UUVs/ALVs) and unmanned surface vehicles (USVs).

Synthetic-aperture sonar arrays, automatic detection and classification, acoustic navigation and mission planning and management are just a few of the technologies that Thales is developing to market world-class drones for undersea warfare.

DRIVEN BY TECHNOLOGICAL EXCELLENCE
UNITED KINGDOM
> Astute - and Trafalgar-class SSNs:
Under the Royal Navy’s 2076 Stage 5 programme, Thales has been selected to replace existing inboard sonar processing equipment with a COTS-based OSA system. The company is also developing a new visual system for the Astute class featuring dual optronic masts instead of hull-penetrating periscopes.

FRANCE
> Barracuda SSN programme:
Thales will supply UMS 3000 integrated sonar systems.

INDIA
> Scorpene SSKs:
Thales will supply sonar suites and communications and electronic warfare equipment for the six submarines. After Chile and Malaysia, India is the third country to choose the Scorpene submarine.
As threats evolve, so do Thales technologies. The open system architecture adopted for the new S-Cube family is a case in point.

**SUBMARINE SYSTEMS**

**OPEN SYSTEM ARCHITECTURES**

*S-Cube* — an evolution of the successful TSM 2233 line selected for the Scorpene submarines ordered by Chile, Malaysia and India — is the latest-generation Thales sonar for conventional propulsion submarines (SSKs).

**Future-oriented multimission sonar suite**

*S-Cube*’s decisive strength lies in its open system architecture (OSA) and the resulting ease of integration of COTS-based upgrades. Standard interfaces, protocols and services are used to build interoperable, scaleable architectures that deliver the best value for money throughout the programme life cycle.

With the OSA-based *S-Cube* family, Thales gives customers the option of upgrading initial suites by adding COTS hardware and ported software functionalities to yield truly multimission capabilities. For the first time, customers can prioritise capabilities and plan phased upgrades — an unprecedented flexibility.

**A winning combination**

The sea-proven performance of Thales multimission sonar suites hinges on simple, intuitive operator interfaces and sophisticated signal processing.

Adaptive beamforming and polyvinylidene difluoride (PVDF) transducers together ensure excellent acoustic efficiency.

PVDF transducers are ideal for submarine flank arrays as they are thin, lightweight and easy to install and maintain. The ‘planar flank array’ solution made possible by this technology has demonstrated consistently high performance in both deep and shallow water.

**Special acoustic products**

Thales also offers a range of high-performance acoustic products for integration with submarine sonar suites or as stand-alone devices. Examples include the VELOX-M8 wideband sonar interceptor, the TUUM-5 and TUUM-6 digital underwater voice-and-data communication systems and the SNM40/120 clean noise analyser.

All these products feature high-speed connectors for easy integration with a wide variety of systems.

**Other products for submarines**

Thales non-acoustic products for submarines include optronic sensors, ESM (electronic support measures), radars and communication systems.
Thales advanced-technology hull-mounted and towed array sonars give naval forces the capabilities they need to counter underwater threats. Sonars for unmanned vehicles are the next step.

Variable-depth towed array sonars

Improvements in sonar performance are driven by the changing challenges facing client naval forces including the shift to littoral waters with their complex acoustic environments and the emergence of new generations of near-silent submarines. Increasingly, navies are opting for low-frequency active sonar systems enabling them to track, classify and locate threats in any environment. Towed arrays can be deployed along with other sonars for use in multistatic mode.

The two- and four-ring versions of the Captas variable-depth sonar (UMS 4229 and 4249, respectively) enjoy considerable international success. Captas Nano, a new low-frequency omnidirectional sonar featuring a linear transmit array, was recently added to the range. Designed to meet a wide range of operational requirements, this compact, lightweight system is suitable for surface ships of many types and sizes. Automatic 'wet end' deployment and recovery make Captas Nano an economical, easy-to-use alternative to conventional hull-mounted sonars, with superior performance as a fringe benefit.

Over the last 20 years, Thales has developed the LFAS low-frequency
active sonar concept through five generations. Captas Nano builds on this experience with a sophisticated, high-performance design.

**Hull-mounted sonars and torpedo defence systems**

Thales torpedo detection and automatic classification systems use a linear towed array to resolve left-right ambiguity, a concept selected by the Royal Australian Navy.

Thales hull-mounted sonars complement the company’s range of towed array sonars and are designed around a modular architecture. These multi-function sensors combine torpedo detection with mine and obstacle avoidance capabilities.

**Drones are coming**

Working with some of the world’s leading research organisations, Thales is designing and developing unmanned vehicles for next-generation anti-submarine warfare: unmanned underwater vehicles (UUVs/AUVs) and unmanned surface vehicles (USVs).

Thales is contributing to the exploratory Spartan programme, an excellent example of Franco-American cooperation in unmanned surface vehicles. The aim is to demonstrate the operational efficiency of USVs for littoral patrol missions, particularly ASW patrols.

Spartan can carry a range of payloads, including an ASW module featuring a FLASH dipping sonar, a mine warfare module and a force projection module with a precision assault capability using a laser-guided missile. The system is installed on a remotely controlled RIB (rigid inflatable boat).
No escape for submarines below the surface! FLASH sonars and TMS 2000 processors are actively working.

AIRBORNE ASW SYSTEMS

EYES AND EARS IN THE SKY

FLASH, the gold standard in dipping sonars

With FLASH (Folding Light Acoustic System for Helicopters), Thales offers complete ASW solutions for threat detection, tracking, location and identification, including stealthy submarines operating in challenging environments.

The US Navy chose FLASH for its MH-60R Seahawk helicopters, the Royal Navy chose FLASH for its Merlins and the United Arab Emirates chose FLASH for its Naval Cougars. France, Norway and Sweden have also chosen FLASH and FLASH-S for their NFH90s.

FLASH dipping sonars are often used in combination with Thales-designed sonobuoy processing systems.

TMS 2000 high-performance processor

Whether integrated with a heliborne FLASH system or used as a primary system by ASW maritime patrol aircraft, the Thales TMS 2000 processor offers exceptional signal processing and display performance.

TMS 2000 processes data from active sonobuoys in mono or multistatic mode. Signals from passive sonobuoys are processed in a range of optimised modes depending on the nature of the noise radiated by the target submarines. The system includes a full set of signal processing and analysis tools as well as embedded training and mission playback functions.

The MPA (maritime patrol aircraft) version has been selected by Turkey for its Meltem programme. TMS 2000 has also been selected by France, Norway and Sweden to equip NFH90 helicopters.

Thales also designs, produces and markets both active and passive sonobuoys, including the Barra, Rassputin and LFAS lines.

EUROTORP, a global leader in lightweight torpedoes

Once a threat has been detected, action must be taken to neutralise it. Torpedoes remain the most effective weapons we have against submarines. Lightweight torpedoes can be launched by surface combatants, helicopters and maritime patrol aircraft. Heavyweight torpedoes are typically deployed by submarines. Despite their complexity, lightweight torpedoes are the underwater weapon of choice. They are, however, complex because they have to pack range, speed, agility and lethality into a small hull. They also have to withstand extremely harsh environments.

Thales designed, developed and currently produces acoustic heads for the Eurotorp MU90. This type of torpedo consists essentially of a sonar (acoustic head), an electric motor module and a warhead, all designed to operate under extremely demanding conditions. It is manufactured by the Eurotorp consortium comprising WASS/Finmeccanica (50%), DCNI (26%) and Thales (24%). To date, over 1,000 MU90 torpedoes have been produced for NATO and other allied navies.
Thales is supplying FLASH dipping sonars and FLASH Sonics processors.

Thales is supplying FLASH-S dipping sonars, a variant optimised for conditions in the Baltic Sea.

Thales is upgrading the acoustics systems of Royal Navy EH101 helicopters under contract to Lockheed Martin.

Thales has been selected by Raytheon to supply over 200 FLASH dipping sonars for US Navy MH-60R Seahawk helicopters under the ALFS programme.

Thales is supplying TMS 2000 systems for CN235 and ATR-72 maritime patrol aircraft.

Thales to supply a technology demonstrator for Australia’s Ministry of Defence.

preliminary study contract in preparation for functional and technology upgrade for acoustic system
Drawing on vast expertise, Thales designs and integrates complete mine countermeasures systems. Wideband and SAS synthetic aperture sonars can detect and locate even the stealthiest mines.

Given their low cost and massive destructive power, sea mines present a clear and present danger, particularly if deployed by asymmetric forces. Because they remain active for many years after a conflict is over, mines can pose a long-term threat to commercial shipping and warships alike.

Risk reduction
With over 300 mine warfare sonar systems in service worldwide, Thales is a leading expert in mine countermeasures. The Thales product portfolio includes minehunting and mine avoidance sonars, influence sweeps, tactical systems and multi-influence measurement stations.

Thales leads large-scale mine countermeasure programmes and assumes total responsibility for the chosen solution, from prime contracting and system engineering through to shipboard installation and at-sea qualification, as well as equipment supply and combat system integration.

World-class innovation
Responding to changes in the operational context, Thales is harnessing its capacity for innovation to develop the technological and algorithmic building blocks for future mine countermeasures.
Specifically, the company is developing demonstrators of an autonomous
Thales is advancing the upgrade of Éridan-class tripartite minehunters with the new TSM 2022 Mk3 wideband hull-mounted sonar and propelled variable-depth sonar (PVDS). Replacement of the mine warfare system for surveillance of the approaches to Brest and protection of the French SSBN fleet, as well as power projection and fleet support missions.

United Kingdom
> Combat System Prime contractor for the upgrade of Hunt class minehunters with the new type 2193 sonar and upgraded command & control system, all installed in fleet time.

Malaysia
> Upgrade of two Lerici-class minehunters with service entry of the new type 2022 Mk3 wideband hull-mounted sonar.

Norway
> Upgrade of sonars on Oksøy-class minehunters and Alta-class minesweepers, including delivery of six TSM 2022 Mk3 N hull-mounted sonars, plus logistic support for 15 years.

India
> Four AMAS mine sweeping systems

Thales is advancing underwater vehicles (AUV) and the VAMA* autonomous vehicle for mine countermeasures roles. These demonstrators will validate the concept of AUV deployment for mine countermeasures and provide valuable operational experience.

Alongside these studies, Thales continues to improve its mine detection and classification algorithms and technologies while working on their optimisation for future AUV applications.

For the NATO Undensea Research Centre in La Spezia, Italy, Thales has developed a synthetic aperture sonar and integrated it with an AUV. Spin-offs from this work will reinforce the company’s technological leadership in AUVs.

*VAMA: Véhicule Anti-Mines Autonome
> **Special acoustic products:** Thales also offers a range of products, including embedded training software, for integration with submarine sonar suites or stand-alone applications.

> **Mosaic is a future-oriented system** for the interactive classification of acoustic signals from passive sonars carried by aircraft, surface vessels, submarines, sonobuoys, etc. Mosaic is designed for both shore-based and shipboard applications.

> **IP-based and wireless communication systems** (TULIPNet and SyRTE).
ATTENDING TO LOCAL CUSTOMER NEEDS

A three-pillar strategy:
> Systems and equipment are designed from the outset for reliability, modularity, upgradeability and ease of maintenance. This ensures that in-service support can be provided flexibly throughout every product’s life cycle.
> A dedicated support organisation with its own methods and resources to respond quickly and efficiently to customer needs.
> Proactive policies promoting innovative products and services.

**Contractor logistic support**
Contractor logistic support (CLS) offers customers a guaranteed level of system operational availability for a fixed fee. In the UK, Thales has signed CLS contracts to support most of the Royal Navy’s sonar systems. A similar contract was signed with the French Navy in 2006 to ensure the guaranteed availability of Éridan-class Tripartite minehunters. The sonars for the French Navy’s FREMM frigates will also be covered by CLS contracts.

**Equipment modernisation**
Thales can replace the electronics of older sonar systems with state-of-the-art components and subassemblies, incorporating the latest COTS technologies within flexible, open system architectures. This type of modernisation brings customers the benefit of new functionalities at optimum cost.

**Customer-on-Line portal**
This service gives Thales customers personalised access to technical datasheets and real-time tracking of orders for spares and repairs as well as discussions forums. Thales also offers a video e-maintenance service ensuring improved maintenance efficiency, faster turnaround and lower costs.

**Training and simulation**
Dedicated products and solutions include:
> Calas autonomous training sources and Star towed training sources emulate submarine behaviour and noise for crew training as well as torpedo development and qualification.
> Osatis OSA for naval training simulators. Simulators based on Osatis are ideal for crew and operator training, performance assessment and mission planning and evaluation.