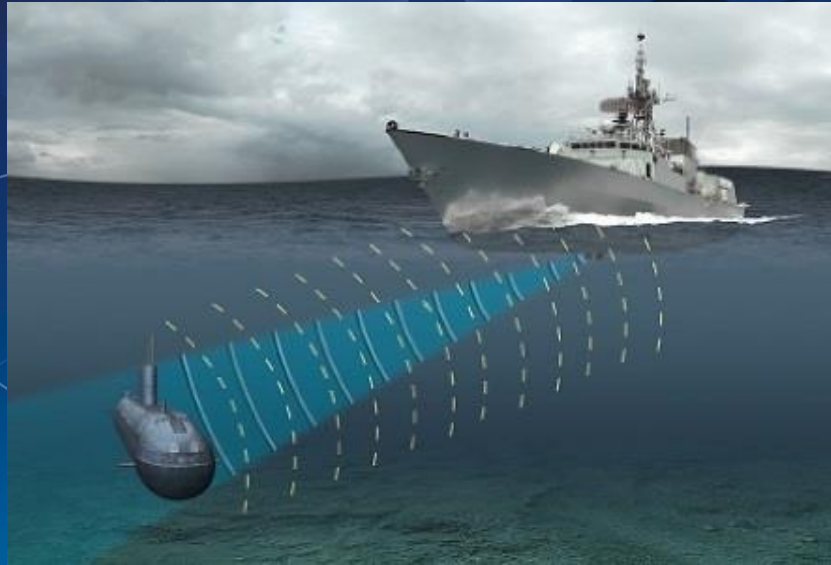


Sensor Alert (TechVision)

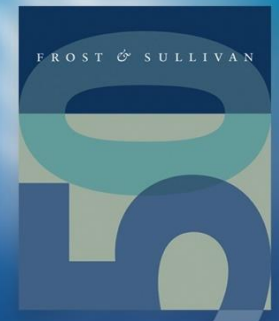


Sonar in Defense

Sonar sensors poised to impact unmanned vehicles

D727-TV

March 25, 2016



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Innovations in Sonar

Hull Mounted Mine Hunting Sonar

Thales Group, France—2193 Sonar for Shallow Waters

Unmet Needs

Reverberation is the biggest problem for active sonar in shallow waters because surface and the bottom interaction is so strong that the return echo is dominated by the backscattering. The effect is scaled with the output power and cannot be easily overcome. This further makes it difficult for the sonar system to identify mines in the littoral underwater.

Technology Profile



Who

In 2014, Thales received a 5-year contract with the UK Ministry of Defense to support the Sonar 2050 anti-submarine sensor on the Royal Navy's Type 23 frigate fleet.

Where

Thales Group is based in France with offices around the world.

Innovation Attributes

The Sonar 2193 can be fitted quickly by replacing existing hardware with ease, causing minimum disruption to the vessel.

1000 m detection range with 80 m of water depth capability with horizontal field of view 90 degrees or 60 degrees, or over 120 degrees in LF horizontal field of view at long range.



The operating modes of Sonar 2193 include detection, search, classification, mine avoidance and route survey..

The Sonar 2193 provides robustness and coverage rate for detection of the obstacles and mines. The system is reliable and meet capability requirement of navies

Deployments

- ✓ UK hunt class mine hunters.
- ✓ Lithuania M-Cube combat system



What

- ✓ Thales has developed a very high resolution hull mounted mine hunting sonar.
- ✓ Thales' underwater sonar system is now in service with the Royal Navy Hunt class MCMVs (Mine Countermeasures Vessels)
- ✓ The sonar system has the wideband transducer array which allows to use the highest bandwidth while achieving maximum performance.
- ✓ The sonar system employs non linear image compression to provide a clear picture in multiple contact environments.

Analyst Perspective

The Thales Sonar 2193 provides fully integrated performance prediction with low update rate; and long range detection and classification of mines with low target generation strength.

Potential Applications

- Littoral Ships
- Destroyers
- Frigates
- Aircraft Carriers
- Support Ships
- Amphibious Ships

Main Contracts for Mine Hunting Sonar

- France
- United Kingdom
- Netherlands
- Belgium
- Malaysia
- India

Propelled Variable Depth Sonar

Thales, France—Multi frequency wideband hunting SONAR system

Unmet Needs



- It is very difficult to counter the threats of modern stealthy mines underwater because of the harsh environment and high sea state. This requires divers to jump into the water and detect the mines. There is a need for a system that has enhanced operational abilities to detect mines in both deep and shallow water and reduce the risk on crew members.

Innovation Attributes

Range 100m deep and 150m in front of the mother ship. With 300m of water depth capability and speed of 4 knots.

60 degree horizontal field of view and over 60 degrees at long range.

12 degrees of horizontal sector to assess the shape of the shadow to identify the target accurately

Future Plans

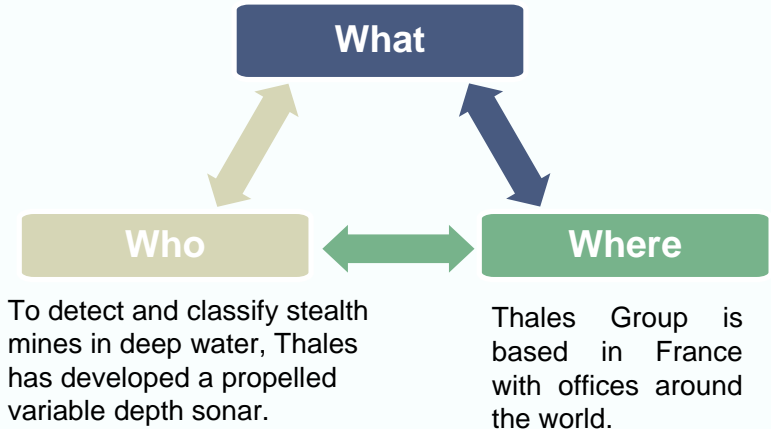
Thales is expected to increase the range of its propelled variable depth sonar system.

Deployment

- France Eridan Class Mine Hunter Sonar
- UK Royal Navy CAPTAS 4

Technology Profile

Thales has developed a wideband hunting sonar system which can operate on multiple frequencies and is used to detect mines in deep waters. The sonar system, the TSM 2022 Mk III PVDS, is also able to perform efficiently in shallow water.



Applications

- Submarines
- Littoral Ships
- Destroyers
- Frigates
- Aircraft Carriers
- Support Ships
- Amphibious Ships

Main Characteristics

- HF (high frequency) detection.
- VHF (very high frequency) Shadow Classification
- Data recording and replay
- Route Survey
- Mine Classification

Undersea Sonar Surveillance

Kongsberg, Norway – Integrated underwater coastal surveillance Sonar

Technology Profile

Kongsberg is focused on supplying high technology systems to customers in aerospace and defense, oil and gas and the merchant marine industry.

Who

Where

Kongsberg is a Norway-based company having multiple undersea sonar products. The company has offices worldwide.

What

The PASAR 1250 is part of the C-Scope family of Kongsberg 's underwater sensor portfolio. The sonar system is designed to perform coastal surveillance beyond the range of an active sonar system.

Applications

- Submarines
- Littoral (refers to the part of a lake, sea or river close to the shore) Ships
- Destroyers
- Frigates
- Aircraft Carriers
- Support Ships

Characteristics

- Low false alarm rates with high probability of detection
- Tracking and classifying multiple targets
- Passive mode capabilities

Innovation Attributes

Detection range for submarines is 20000 m and for the swimmer delivery vehicle, it is 5000m . The water depth capability is 100m.

The PASAR 1250 is developed for multi sensor network integration with a wide bandwidth and low frequency. The system can provide a high detection and classification range.

Total weight of 18kg with dimensions 130mm x 482mm x 588mm and power of 350W

Business Areas

- Defense
- Oil and Gas
- Maritime
- Remote Weapon Station

Analyst Perspective

Kongsberg 's vision is to become the leading defense supplier. Toward fulfilling this vision, the company has acquired a 49.9% share in Finland-based Patria, which has, for example, aircraft composite expertise and a 50% share of ammunition manufacturer Nammo.

Common Broadband Advanced Sonar System

Lockheed Martin, USA – Sonar system for heavyweight torpedoes

Technology Profile

The company is focused on various segments such as aeronautics, information systems and global solutions, missiles and fire control, mission systems and training, and space systems.

Who

Where

Lockheed Martin is based in the USA (Bethesda, MD), with offices worldwide.

What

The MK 48 Mod 7 CBASS heavyweight torpedo is the US Navy's most capable and potent anti-surface and anti-submarine weapon in use in the US Navy and allied submarines and has been designed to be exceedingly lethal and effective against threats operating in deep and shallow waters.

Applications

- Submarines
- Littoral Ships
- Destroyers
- Frigates
- Aircraft Carriers
- Support Ships

Government Contracts

In FY 2013, Lockheed Martin was the contractor to the US Government, accounting for over \$44B in obligated dollars.

Innovation Attributes

MK48 maximum effective range is 5 miles with maximum depth of 1200ft.

The MK48 has a 650-lb high explosive warhead and a diameter of 21 inches.

With 3500 lbs of weight, the CBASS can operate with the speed of >28 knots; has a maximum depth of >1,200 feet and a range of over 5 miles

Sonar Family

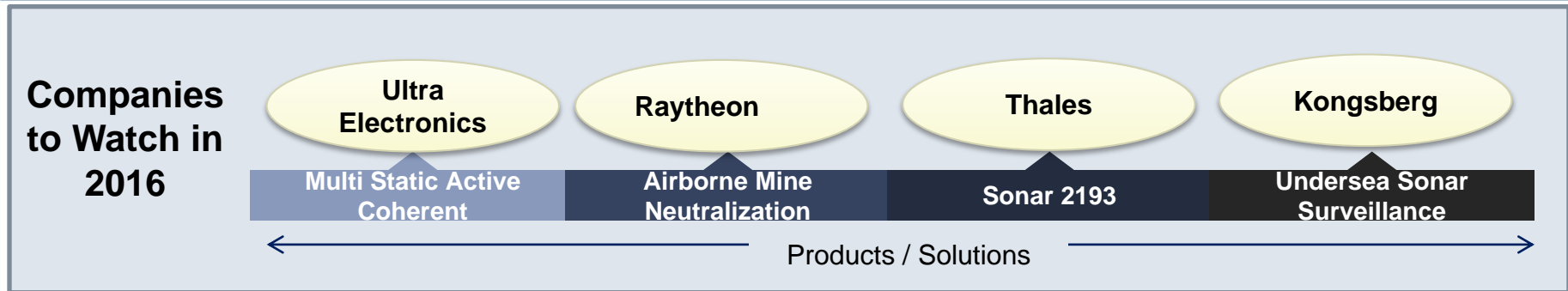
- Common Broadband Advanced Sonar System
- Thin Line Towed Array Sonar
- Tape Cast Multilayer Sonar Transducer

Analyst Perspective

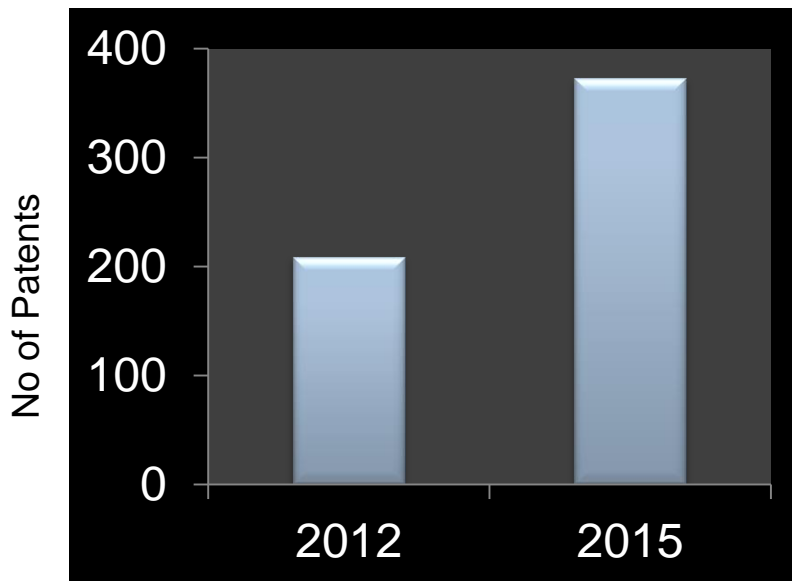
The interoperability offered by CBASS is a force multiplier for MK 48 Mod 7 CBASS partner nations. CBASS has allowed for upgrading the MK48 heavyweight torpedoes to more accurately strike targets in littoral waters and deep seas.

Strategic Insights

Strategic Insights



Intellectual Property (IP)



Source: WIPO/Frost & Sullivan

- Anti-Submarine Warfare (ASW) remains a core mission of the US Navy's concept of operations. Program goals, requirements, and technologies are meant to sustain an operational advantage.
- R&D activities are increasing with an aim to reduce the cost and improve the range, water depth capability and detection efficiency.
- The US has filed the highest number of patents in sonar followed by China and the UK.
- Some of the top patent assignees in sonar are Atlas Elektronik GmbH, the US Navy, Denso Corporation, Thales, NEC Corporation, Institute of Acoustics, Chinese Academy of Science and many more.

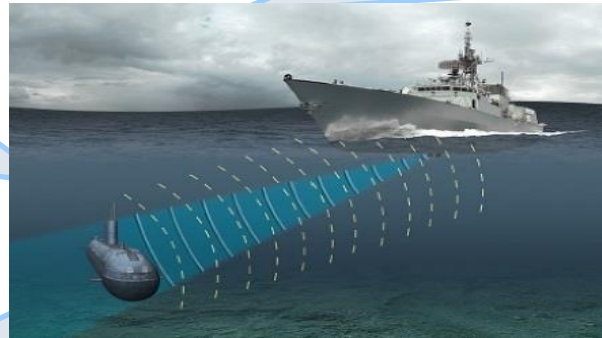
Strategic Insights

Key R&D Focus Areas: Very accurate sensor arrays, improved signal processing, high frequency sonar (allows for smaller sensors), and so on

- Détection Range
- Water Depth Capability
- Signal enhancement and noise reduction
- Vector (directional) sensors
- Single crystal hydrophones and transducers that are less expensive with less flaws

Growth Factors:

- Design flexibility
- New product development
- Strong R&D efforts
- Technology advancements
- Greater demand for enhanced capabilities for anti-submarine warfare
- Pervasive awareness



Adoption Barriers

- Technological barriers such as processing limitations and update rate
- Fewer platforms; budget and program scrutiny
- System Reliability
- High Cost

Government Initiative:

Governments across different countries intend to fully exploit the rapidly increasing computing power of sensors and networks to gain pervasive awareness of the battle area. The concept envisions thousands of small sensing and computing devices that will give a very detailed picture of the operational environment.

The 2020 Scenario

- The Navy's future vision is an integrated network of sensors coupled to stand-off weapons to compress the detect-to-engage sequence, to maximize their advantages in persistence, speed, and precision.
- Expected future littoral environments will have difficult shallow water sound propagation profiles, cluttered, chaotic, and dense surface traffic.

Key Patents

Key Patents

No.	Patent No.	Publication Date	Title	Assignee
1	US20160077199	17.03.2016	Alert zones for a marine environment	Navico Holding AS
	<p>Various implementations directed to alert zones for a marine environment. In one implementation, a marine electronics device may include a memory having a plurality of program instructions which, when executed by the sonar signal processor, cause the processor to determine one or more alert zones for a marine environment proximate to a vessel, and to receive sonar data from a transducer array disposed on the vessel, where the sonar data corresponds to the marine environment. The memory may further have program instructions which, when executed by the sonar signal processor, cause the processor to analyze the received sonar data to determine a depth line, where the depth line is a representation of one or more depths of an underwater floor of the marine environment, and to provide one or more alerts if at least a portion of the depth line is positioned within the one or more alert zones.</p>			
2	WO/2016/030604	03.03.2016	Automatic method for identifying a shadow generated by an actual target in a two-dimensional image from sonar	Centre National de la Recherche Scientifique
	<p>The invention relates to a method for identifying a shadow of an actual target in an image from sonar, this method comprising a) producing (70) a search area within which the shadow of the actual target is intended to be identified, said step comprising: producing (71) an outer envelope of a bright spot generated by the reflection of an acoustic wave on a surface of the actual target; and producing (74) an angular detection sector that is contained in the plane of the image, has the position of the sonar transmitter in the image as the vertex thereof, and has two edges, each edge adjoining the outer envelope of the bright spot at at least one respective point, the entirety of the outer envelope being contained between said two edges, the produced search area being the portion of the angular detection sector located on the side of the bright spot furthest from the vertex of the angular detection sector.</p>			

Key Patents (continued)

No.	Patent No.	Publication Date	Title	Assignee
3	EP2989610	02.03.2016	Method for identifying or detecting an underwater structure, computer and watercraft	Atlas Elektronik GmbH
	<p>In order to identify or detect an underwater pipeline, for example, template-based methods are used according to the prior art, in which the total solution space with the individual synthetically obtained images is calculated in advance and an image obtained using sonar is then compared with each individual synthetic image of the total solution space. This is extremely intensive in terms of computation and/or main memory, with the result that these solutions cannot be used in AUVs (Autonomous Underwater Vehicles). The invention therefore relates to a method for identifying or detecting an underwater structure, wherein the method comprises the following steps of: determining an original image using a (Synthetic Aperture) Side Scan Sonar mounted on a watercraft, in particular an underwater vehicle, determining a watercraft position and/or an underwater structure position, with the result that there is additional information, determining a reference image space with associated reference images using the additional information and known geometry of the underwater structure, with the result that there is a reduced reference image space, and comparing the original image with the determined reference images of the reduced reference image space, with the result that the underwater structure is detected and/or identified.</p>			
4	EP2986998	24.02.2016	Sonar method and apparatus	Kongsberg Geoacoustics Ltd.
	<p>A method of calibrating a side scan sonar system by allowing the sonar transducer to roll with respect to the plane of a reference surface to be scanned; measuring the roll angle of the transducer during collection of backscattered sonar data; using backscattered sonar data from a range of transducer roll angles and the measured roll angle to decouple the operating characteristics of the transducer from the angular backscatter characteristics of the reference surface; thereby obtaining an estimate of the operating characteristics of the transducer.</p>			

Key Patents (continued)

No.	Patent No.	Publication Date	Title	Assignee
5	US20160047906	18.02.2016	Marine multibeam sonar device	Garmin Switzerland GmbH
	<p>A marine multibeam sonar device comprises a processing element and a transmitter. The processing element generates a plurality of transmit transducer electronic signals and inverts a polarity of a first portion of the transmit transducer electronic signals. The transmitter is in communication with the processing element and includes a plurality of transmit electronic circuits and a plurality of transmit transducers. Each transmit electronic circuit receives and processes one of the transmit transducer electronic signals, wherein a first portion of the circuits re-inverts the polarity of the first portion of the transmit transducer electronic signals. The transmit transducers receive the processed transmit transducer electronic signals from the transmit electronic circuits and generate a sonar beam.</p>			

Industry Contacts

Industry Contacts

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