OpenSonarSuite KaleidoScope
Full-Spatial and Full-Spectral Coverage

Specifications and Technical Data
OpenSonarSuite KaleidoScope at a Glance

KaleidoScope processes separate sonar arrays by analog to digital conversion of all hydrophone signals with very high dynamic range and without the need of variable gain control.

KaleidoScope is able to passively detect, track and analyse surface and sub-surface objects, by use of broadband analysis, narrowband analysis, DEMON analysis, intercept analysis, transient analysis and range calculation. The tracking process is based on both automatic initialization and operator initialization of tracks. It includes broadband, narrowband line, DEMON line and pulse tracking. Contact data are forwarded to the Combat Management System (CMS) via Ethernet. The system has a classification capability that enables the operator to classify the objects detected by the system based on their sound signature. The classification system allows comparison of relevant information for a detected object.

The system allows storing of raw data for reprocessing in the system and external post-processing for later analysis.
**OpenSonarSuite KaleidoScope**

Ready for Third-Party Algorithm Implementation

L-3 ELAC Nautik’s OpenSonarSuite KaleidoScope is an advanced, totally integrated sonar system that meets the mission requirements of modern diesel-electric submarines. KaleidoScope performs integrated surveillance by using acoustic sensors (CAS, PRS, FAS, IS, MAS) that provide the channels for automatic contact tracking. It includes integrated detection, tracking and analysis for full-spatial and full-spectral surveillance functionalities.

**General**

The OpenSonarSuite KaleidoScope is based on COTS hardware and performance tested software for sonar processing. The wet end parts (hydrophones) are in-house developed, produced and tested by the German Navy. The modular design allows uncomplicated incorporation for future improvements.

The detection and tracking functionality includes all passive sonar narrowband, passive broadband for contact detection, contact tracking and contact correlation. The analysis functionality integrates all passive narrowband, acoustic intercept features, and customer provided intelligence libraries and tools of classification features for track and contact classification.

The HMI application runs on a PC based third party Multi-Function Control console (MFC). The OpenSonarSuite KaleidoScope is centered around the hydrophone arrays which transform the acoustical data into electrical data and the sonar processor which processes the acoustical data to contact information.

KaleidoScope contains four main passive sonar functions (cylindrical array sonar, flank array sonar, own ship noise measurement equipment and acoustic intercept sonar).

**System Overview**

**Full-Spatial and Full-Spectral Coverage**

**Cylindrical Array Sonar (CAS)**

The cylindrical array sonar provides medium range surveillance. This includes broadband and narrowband detection, narrowband and DEMON analysis as well as broadband and narrowband tracking.

**Own Ship Noise Measurement Equipment (ONA)**

The own ship noise measurement equipment monitors the noise generated by the own ship.

**Acoustic Intercept Sonar (IS)**

Detection and analysis of active sonar pulses. The intercept sonar determines the bearing, performs tracking and analysis of contacts.

**Flank Array Sonar (FAS)**

The flank array sonar provides long range surveillance. This includes broadband and narrowband detection, narrowband analysis as well as broadband and narrowband tracking.

**Mine Avoidance Sonar (MAS)**

Detection and localization of mines or obstacles is performed by the mine avoidance sonar. It estimates range, bearing and depth information of the detected and tracked objects.

**Active Ranging Sonar (AS)**

Detection and localization of targets is performed by the active ranging sonar. It estimates range and bearing information of the detected and tracked objects.

**Passive Ranging Sonar (PRS)**

The passive ranging sonar provides a medium range surveillance and passive range estimation based on detected and tracked contacts. This includes broadband detection.

**Towed Array Sonar (TAS)**

The towed array sonar provides long range surveillance. This includes broadband and narrowband detection, narrowband analysis as well as broadband and narrowband tracking. The towed array sonar is made up of the towed array itself, the winch and the array deployment system.

**Sonar Processor**

The sonar processor is responsible for all kind of sonar processing. This includes the beamforming, detection, frequency domain processing, analysis, display processing, interfaces to the navigation system, combat system, and other.
KaleidoScope

The OpenSonarSuite KaleidoScope performs integrated surveillance by using acoustic sensors which provide the tracking channels allowing automatic tracking of contacts. The integrated surveillance functionality includes detection, tracking, analysis and classification.

The detection and tracking functionality includes all passive sonar narrowband, passive broadband for contact detection, contact tracking and contact correlation. The analysis functionality integrates all passive narrowband, acoustic intercept features, and customer-provided intelligence libraries and tools of classification features for track and contact classification.

The contact motion analysis functionality, to integrate all passive sonar bearings for contact position and motion analysis, is part of the CMS.

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System Design

KaleidoScope is based on COTS hardware and performance tested software for sonar processing. The wet end parts (hydrophones) are in-house developed, produced, and tested by the German Navy. The modular design allows uncomplicated incorporation for future improvements.

KaleidoScope is based on proven design utilized in previous projects (see reference list). It includes open interfaces to other sensors and is ready for integration into a third party combat management system.

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Key Features

- Open Architecture
- Commercial standards
- COTS
- Military hardened
- Opportunities to include technical innovation
- Allowing rapid change and insertion of new capabilities

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