Fully Reelable Towed Array Systems for SSK Submarines

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Fully Reelable Towed Array Systems for SSK Submarines

Outline

› Comparison – Towed Arrays vs. Hull-Mounted Sensors
› ETAS – Extended Towed Array Sonar
› eTAHS – Electric Towed Array Handling System
› Platform Integration – ETAS and eTAHS on HDW Class 209
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Towed Arrays

ATLAS Sonar Systems for Submarines

› ATLAS ELEKTONIK has experience of over 20 years in towed array development and delivered more than 50 towed arrays
  › line arrays
  › twin arrays
  › triplet arrays
for submarines, frigates and research.

› Most modern sonar systems feature towed arrays or are “fitted for but not with” (FFBNW).
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Towed Arrays

Why you didn’t get a towed array...

- We had no space for it.
- Towed array limits our navigation.
- The flank array will do the job.

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Comparison of Main Sensors

Every sensor has its strengths and field of application.

› Range

› Frequency band

› Panoramic coverage

› Availability
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**Why Low Frequency Detection**

![Acoustic absorption of seawater over 50 kyd](chart)

- Acoustic absorption factor $\alpha$ [dB per 50 kyd]
- Frequency [Hz]

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Towed Array - Advantages

› Dislocated from own submarine
  › very low noise environment, high SNR
  › no narrowband lines from own submarine

› LF Detection - very large acoustic aperture needed
  › high directivity index \(\rightarrow\) long detection range
  › small beamwidth \(\rightarrow\) better target separation

› Maximum LF detection performance
  › against vessels in long ranges (over horizon)
  › against very silent targets like e.g. SSKs
  › detection and classification of airborne threats
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Why Refitting a Towed Array

The current challenge:

› Targets become more silent, oceans become louder
  › Difficult detection situation
› Focus on shallow water operations
  › High shipping density
  › Need for a reelable towed array
› TAS winch *(used to be) too big* for HDW class 209

Our solution:

› Compact electric winch system “eTAHS” fitting close compartments
› Small diameter thin line towed array “DTA-30” for state-of-the-art detection performance
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TAS / ETAS - Configuration

**DTA-50 (TAS)**
- Nested array (varying hydrophone spacing)
- Hydrophone grouping
- Functional sequence of sections

**DTA-30 (ETAS)**
- Linear array (uniform hydrophone spacing)
- Individual hydrophone sampling → Number of channels increase by factor 2...7
- Interchangeable Unified Sections (US)

Modular configuration for refit and newbuilds

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ETAS - Signal Processing

- Towed Array Shape Estimator (TASE)
- Broadband, DEMON, LOFAR detection and classification
- Conventional and adaptive beamforming (ABF)
- Cross-bearing TMA (X-TMA)
- Air threat detection
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eTAHS History

› AEUK: Research and development into different TAHS since 1980’s

› Transition from hydraulic to electric systems “eTAHS”

› Direct drive electric motor technology offers many advantages over hydraulic and gearbox systems:
  › Size reduction
  › Integrated sensors
  › Precision control

› New eTAHS Systems delivered to three different Navies
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eTAHS External Components

EO Converter

Exit Guide Path

Cutter

Flusher

Deployer

Spooler

Winch Motor

Winch Drum

Winch Brake
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System Configuration

- **Towed Array + Cable**
- **Exit Guide Path**
- **Support Structure**

**Casing Modification and Seatings**
- **Flusher**
- **Cutter**
- **Deployer**
- **Spooler**
- **Winch**

**Inboard Electrical Cabinet**
- **Display / Control Unit**
- **Hydraulic Interface**

**Pressure Hull**
- **PHPs**

**Outer Hull**
- **Lamps and Cameras**
- **Maintenance Control Unit**

**Existing Sonar System**
- **TAS Signal Processing**
- **TAHS Control Software**
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Factors to Consider

› Space / Weight
  › Compact system, minor casing modification
  › Buoyancy consideration

› Electric Power
  › AC < 1 kW / DC < 5 kW
    (typically 2-3 kW peak in normal operation)

› Manoeuvrability
  › Deployment and recovery within 30 minutes

› System integration
  › eTAHS control unit
  › Signal processing HW/SW
  › User interface modification

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Installation Process

› Hot works

› Equipment installation of eTAHS

› Installation testing and set to work

› Loading of TAS

› At sea operations
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Conclusion

Why you need a towed array refit:

› Effective upgrade
  The submarine as such is only as good as its detection capability compared to its adversaries.

› Boosting your performance
  Significantly higher detection range and LOFAR capabilities than any hull mounted sensors such as FAS and CAS.

› Compact design - We make it fit!
  New electric winch system eTAHS and ETAS thin line towed array allow refit installation on HDW class 209.
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Thank you
for your attention!

Questions, please!