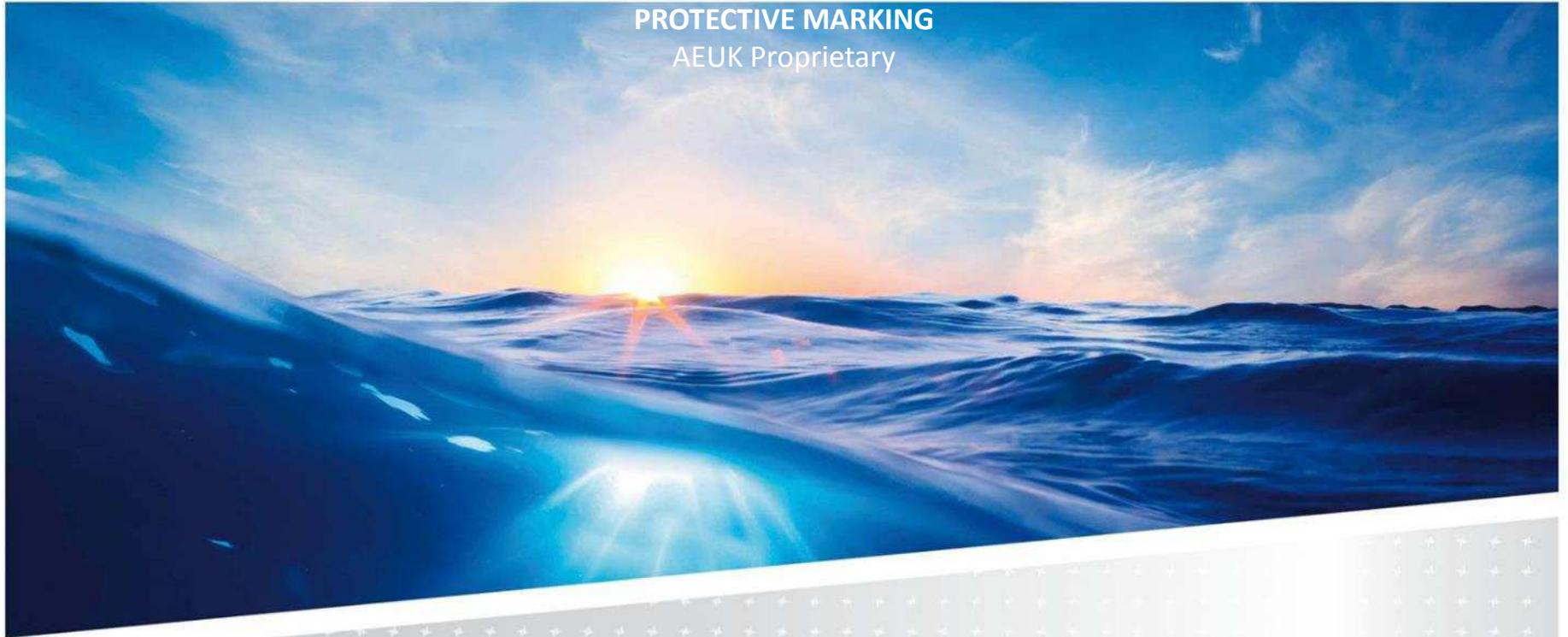


PROTECTIVE MARKING
AEUK Proprietary



Counting the ASW Calories

Maximising Sonar Performance under Weight and Size Constraints

Dr Ewan McCutcheon, System Design Authority

Undersea Defence Technology, 13-15 May 2019

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UNMANNED WARRIOR 16

Anti-Submarine Warfare (ASW) Theme

Industry Assets

Unmanned Surface Vehicles:

Boeing SHARC Glider
Northrup Grumman SHARC Glider
MOST AV AutoNaut
BAe USV

Unmanned Air Vehicles:

Northrup Grumman Proteus
Augusta Westland S4 RUAS

Unmanned Underwater Vehicles:

SAAB AUV62
QinetiQ/MSubs MUST

Other:

ULTRA Sonobuoys
USN EMATT/Wave Gliders
CMRE Wave gliders
SEA Passive Array
GEOINT

RN Assets:

Merlin Mk2 Maritime Patrol
Helicopter
T23 ASW Frigate

Other nations assets:

SSK Submarine
P-3 Maritime Patrol Aircraft
P-8 Maritime Patrol Aircraft
Frigates



MOD Lead
Cdr Gavin Coyle
NAVY MARCAP-ASW

Industry Lead
Bob Mansergh
Boeing Defence UK Ltd

Unmanned Surface Vehicle Selection

- Over 50 USVs on the market or in development
 - 14m to 1.2m in length (ACTUV max. 40m)
 - 14tonnes to 24kg (ACTUV max.122 tonnes)
- None yet in-service in an ASW role (that I could find)



Evologics Sonobot



AEUK ARCIMS



Leidos/DARPA ACTUV 'Sea Hunter'

Not to scale !

ASW Scenarios

- Protected Passage: clearing the way ahead of a task group at speed
- Sea Shield (Picket Fence): clear a static area for a sustained period
- Hold at Risk: monitor a choke point

- How is ASW changing

Future operations will“be centered on dominating near-land combat, rapidly achieving area control despite difficult sound propagation profiles and dense surface traffic” – 2005 US Navy’s Task Force ASW’s document on concepts of operations for the 21st century

- Threats are also changing – smaller, quieter and more of them

Threat Types

- Threats include submarines, mini-submersibles and diver delivery vehicles ranging from:
 - SSK type submarines 2300 tonnes, 70m long, 20knot speed, to
 - Diver delivery vehicles 10 tonnes or less, 10m long, 5knot speed, 30m max. water depth.



An Iranian swimmer delivery vehicle on display at a military parade in April, 2007

Key Parameters for USVs in ASW Roles

- Size: there is a 'sweet spot' in USV size of **10-13m**, that has been driven by MCM programmes, where payload capacity has been balanced-off against transportability by land, sea and air
- Weight: all-up weight of **10-15 tonnes** with payload capacity of **2-4 tonnes**. The capacity for payloads has to be traded with fuel load and thus endurance.
- Endurance: driven by fuel capacity and by tow efficiency (and thus sonar size/drag). Endurance of **12-48 hours** are typical depending on mission profile.
- Range: how far from shore/mothership can the system operate. High data rate comms range, for situational awareness and sonar data transmission, is limited to line of sight unless Satcom can be reliably used. Vessels of this class can typically operate up to **60NM** from a safe haven when manned.

Sensor Options [Acoustic]

- Active or Passive?

Traditional Active Towed Sensors

Long Range

Low Frequency

Heavy

Large foot print

High power demand

Expensive

Traditional Passive only Sensors

Long Range

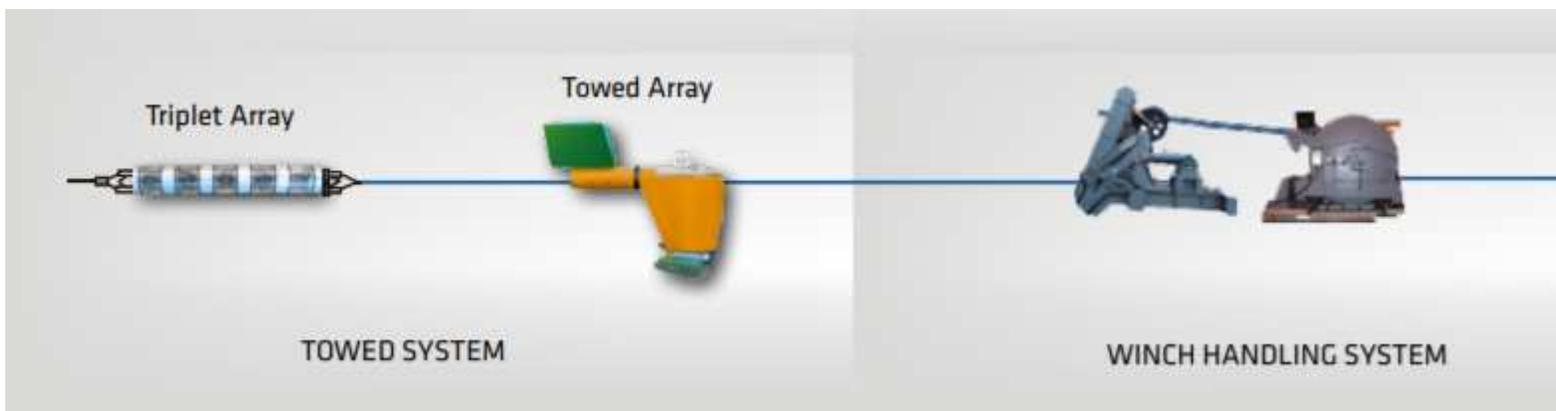
Long aperture

Heavy

Large foot print

Single/Triplet/Quad hydrophones

Expensive



Sensor Options [Acoustic]

- Active or Passive?

USV Active Towed Sensors

Medium Range

Medium Frequency

Lower weight

Compact

Reduced power

Affordable

Dipping Sonar

Variable Depth Sonar
(vertical active source)

Variable Depth Sonar
(in-line active source)

USV Passive only Sensors

Short/limited range

Short aperture

Light

Small diameter

Dual/Triplet/quad

Low cost

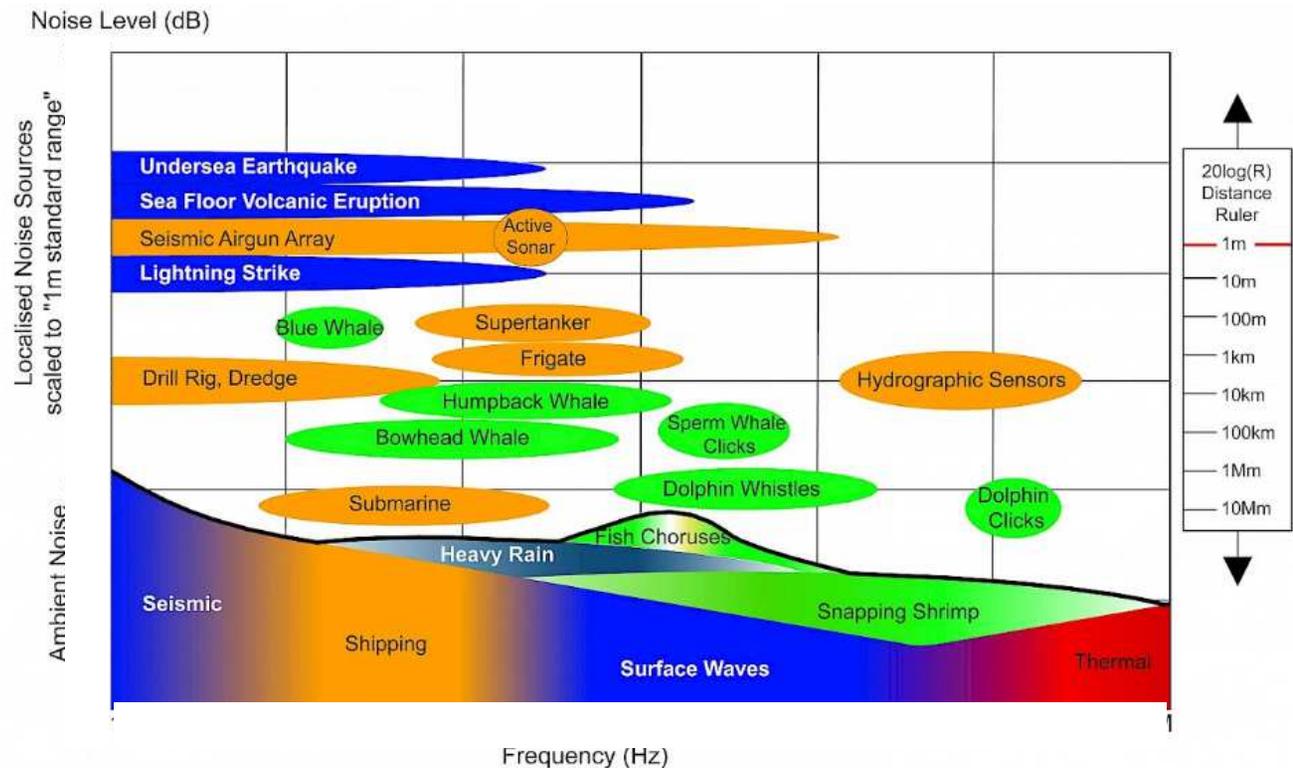
Thin and Ultra-thin line
arrays

USV deployed
sonobuoy

Choice of Frequency

- Typical frequencies associated with underwater acoustics are between 10 Hz and 1 MHz

(open source from
OSPAR Commission)



How many do we need?

- Benefits from numbers:
 - Autonomous, semi-autonomous and unattended operation
 - Sensor netting and cooperative engagement
 - Redundancy of sensors
 - Swarms (shoals) of systems
 - Networked array of systems with a common purpose
- Challenges of numbers?
 - Logistics: transportation, deployment and recovery
 - Big data: transmission, management, analysis
 - ARM: do lots of small systems need more looking after than one big one?
 - Manning: until AI is more widely available and trusted unmanned systems will driving increases in operators before decreases can be achieved.

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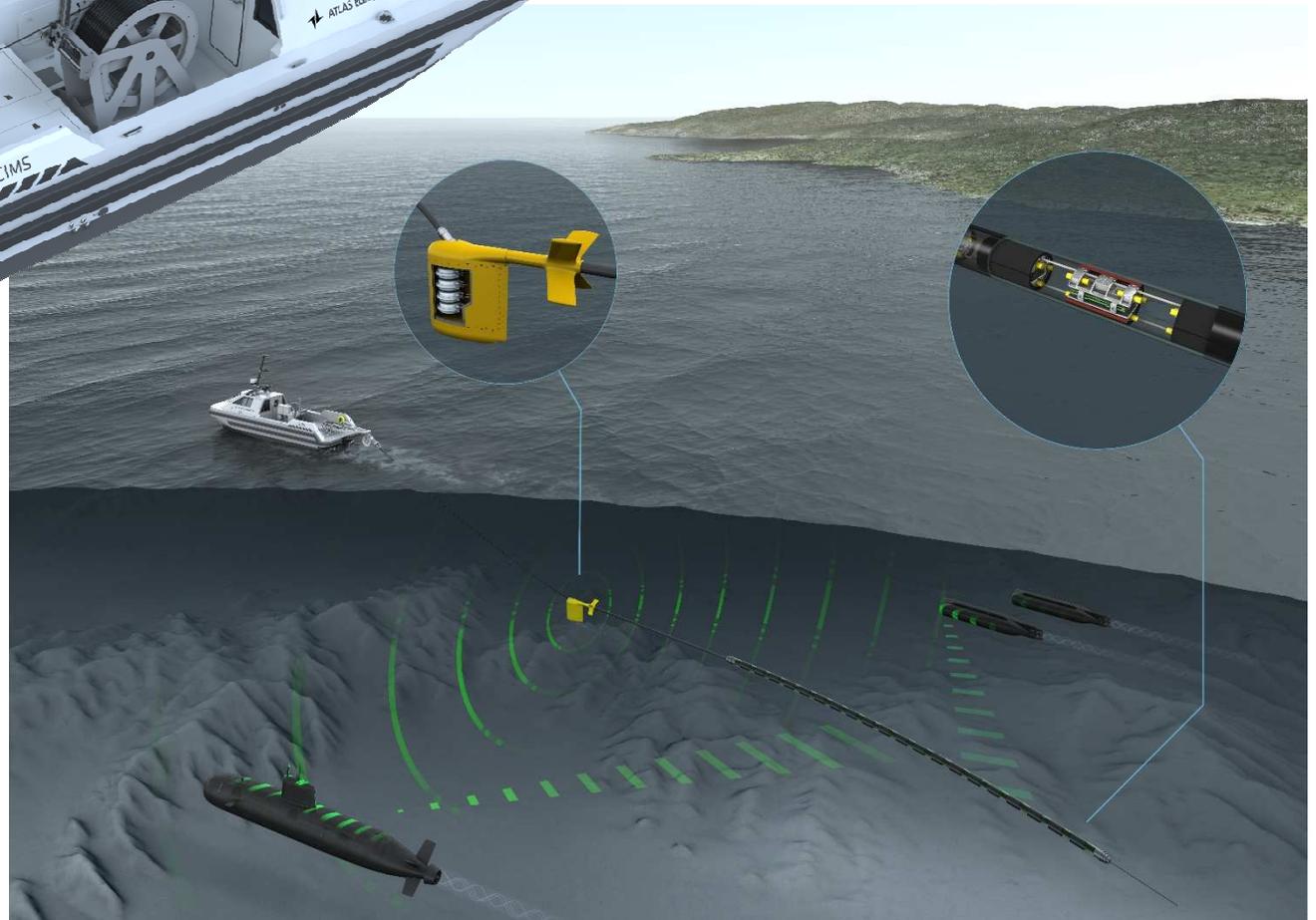
What are Atlas Elektronik doing?

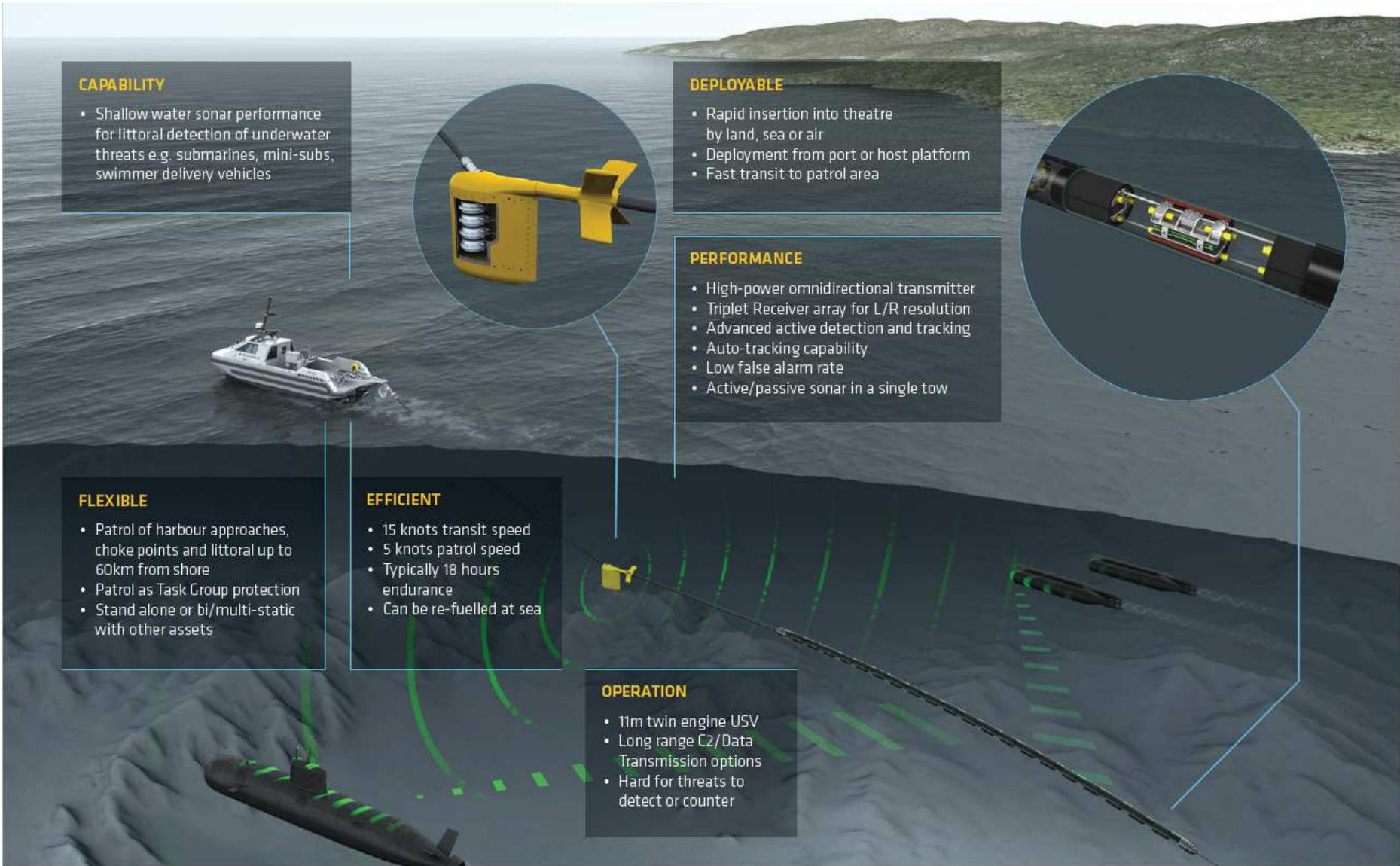
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ARCIMS-SeaSense

Underwater Threat Detection

PROTECTIVE MARKING
AEUK Proprietary





CAPABILITY

- Shallow water sonar performance for littoral detection of underwater threats e.g. submarines, mini-sub, swimmer delivery vehicles

DEPLOYABLE

- Rapid insertion into theatre by land, sea or air
- Deployment from port or host platform
- Fast transit to patrol area

PERFORMANCE

- High-power omnidirectional transmitter
- Triplet Receiver array for L/R resolution
- Advanced active detection and tracking
- Auto-tracking capability
- Low false alarm rate
- Active/passive sonar in a single tow

FLEXIBLE

- Patrol of harbour approaches, choke points and littoral up to 60km from shore
- Patrol as Task Group protection
- Stand alone or bi/multi-static with other assets

EFFICIENT

- 15 knots transit speed
- 5 knots patrol speed
- Typically 18 hours endurance
- Can be re-fuelled at sea

OPERATION

- 11m twin engine USV
- Long range C2/Data Transmission options
- Hard for threats to detect or counter

ARCIMS-SeaSense – Underwater Threat Detection
A proven, military specified, autonomous multi-mission system



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