# CNE 24

## NATO ASW Barrier Project

## ASW in REPMUS



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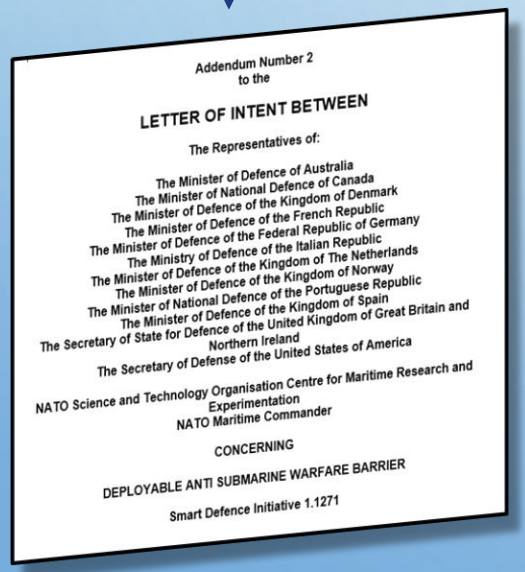
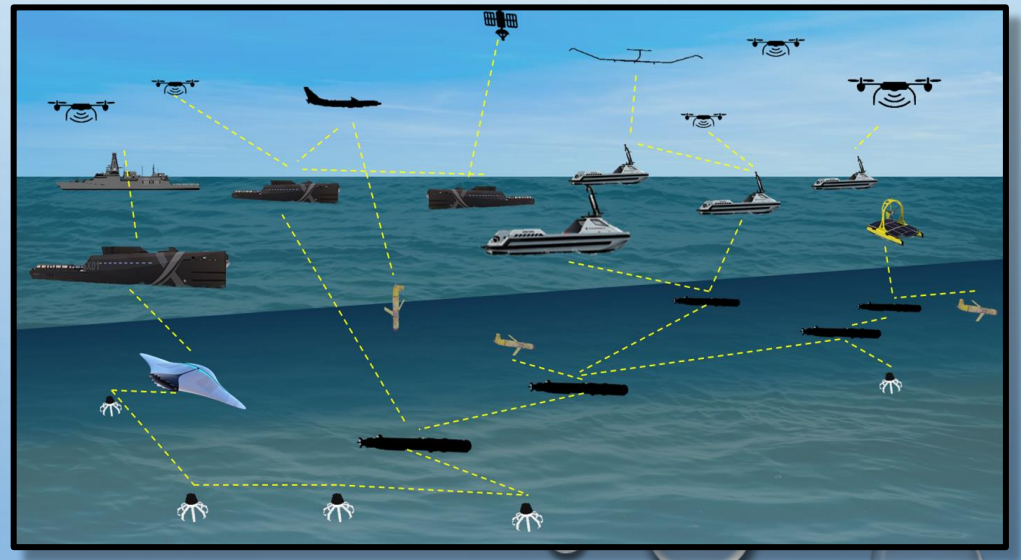
# NATO ASW Barrier Project

JCG MUS @32

SDI 1.1271
NATO ASW Barrier Project

- ASW - A NATO priority area
- Threat vehicles - Increasingly difficult targets
- Cross domain by nature
- Conventional capability – complex & expensive
  - MUS provides - Mass / Persistence / Innovation
- Barrier of multiple heterogeneous systems
- Need Allied collaboration to be effective
  - Not always intuitive with ASW


Addendum Number 2
to the
LETTER OF INTENT BETWEEN
The Representatives of:
The Minister of Defence of Australia
The Minister of National Defence of Canada
The Minister of Defence of the Kingdom of Denmark
The Minister of Defence of the French Republic
The Minister of Defence of the Federal Republic of Germany
The Minister of Defence of the Italian Republic
The Ministry of Defence of The Netherlands
The Minister of Defence of the Kingdom of Norway
The Minister of National Defence of the Portuguese Republic
The Minister of Defence of the Kingdom of Spain
The Secretary of State for Defence of the United Kingdom of Great Britain and Northern Ireland
The Secretary of Defense of the United States of America
NATO Science and Technology Organisation Centre for Maritime Research and Experimentation
NATO Maritime Commander
CONCERNING
DEPLOYABLE ANTI SUBMARINE WARFARE BARRIER
Smart Defence Initiative 1.1271

Enhanced ASW capability via Allied MUS Teaming

# Common Intent

- Recognize that NATO has identified a requirement for a deployable Anti-Submarine Warfare (ASW) barrier utilising unmanned system components,

- Consider that multinational cooperation in this capability area could enable them to reach national capability targets more efficiently and close specific NATO capability shortfalls and national commitments,

- Acknowledge that there is a diverse range of technical solutions,

- Acknowledge that several Signatories, as well as the NATO Strategic Commands and the CMRE, have existing programs or aspirations to develop technologies and components that could comprise solutions to an effective deployable barrier,

- Acknowledge that it would be of mutual benefit to all interested signatories to establish a formal cooperation to standardize requirements, demonstrate and share capabilities, set priorities and apportion future work on a basis of mutual benefit and burden sharing,

Project lead nation

Project Director – Cdre (Rtd) David Burton

# Key UW Operational Problems

- Retention of ASW Advantage in SACEUR's AOR.
- Detection / Classification and Tracking of new generation peer competitor submarines and UUVs.
- Deter peer competitor submarines and UUVs from specific areas and from conducting specific activities.
  - Maintain NATO Freedom of Action.
- Wide Area Ocean Surveillance - re-instating maritime mass.
- Difficulty of Integrating MUS into Maritime Operations.

# NATO ASW BARRIER SDI PROGRAMME

## Work Package A
ITA

MUS Capabilities Systems Analysis & Performance Assessment

## Work Package B
UK

Command & Control (C2) Architecture and Interoperability

## Work Package C
ESP

Data Management, AI, Security

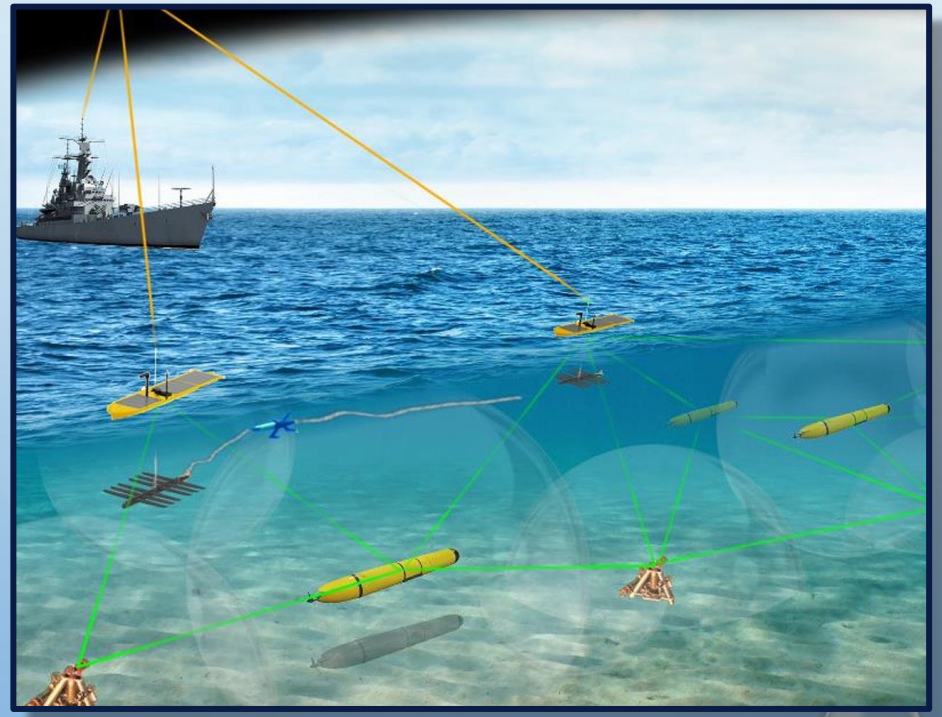
## Work Package D
All

Maturity Framework, Analysis Tools and M&S

## Work Package E
CJOS

Concepts, Doctrine and Key User Requirements

**Mission:** To develop a technical demonstrator comprising both legacy and interoperable MUS solutions to securely provide a force multiplying ASW capability. **'Hold at Risk'**



## ASW SDI Nations
Australia, Canada, Denmark, France, Germany, Italy, Netherlands, Norway, Portugal, Spain, Sweden, UK, US, + *Finland*

## ASW SDI NATO Bodies as signatory stakeholders
NATO STO CMRE / COM MARCOM

## Approach
Collaboration - National Programmes

Exploiting Operational Experimentation

Funded Industry Challenges

## Benefits
Accelerating capability delivery

Realising economies of scale

Sharing cost and risk

Developing common standards

Ensuring interoperability

Reducing stove-pipe solutions

Developing common tools

# Deployable ASW Barrier – Unified Concept

- Defines a set of high-level Concepts, which form the basis for designing and implementing a Deployable ASW Barrier (DASWB)
- The Concepts form the guidance for the design, implementation and conduct of DASWBs, harnessing the evolving operational advantage of maritime unmanned systems (MUS).
- It is an essential foundation document for all NATO ASW stakeholders and future doctrinal development.
- Concepts correlated with a set of key user Requirements.

# Concepts


Barrier Hold at Risk
Sea Shield – Protecting High Value Assets
Protected Passage
Underwater Infrastructure Protection
MCM
Seabed warfare

# ASW Barrier – Hold at Risk Concept

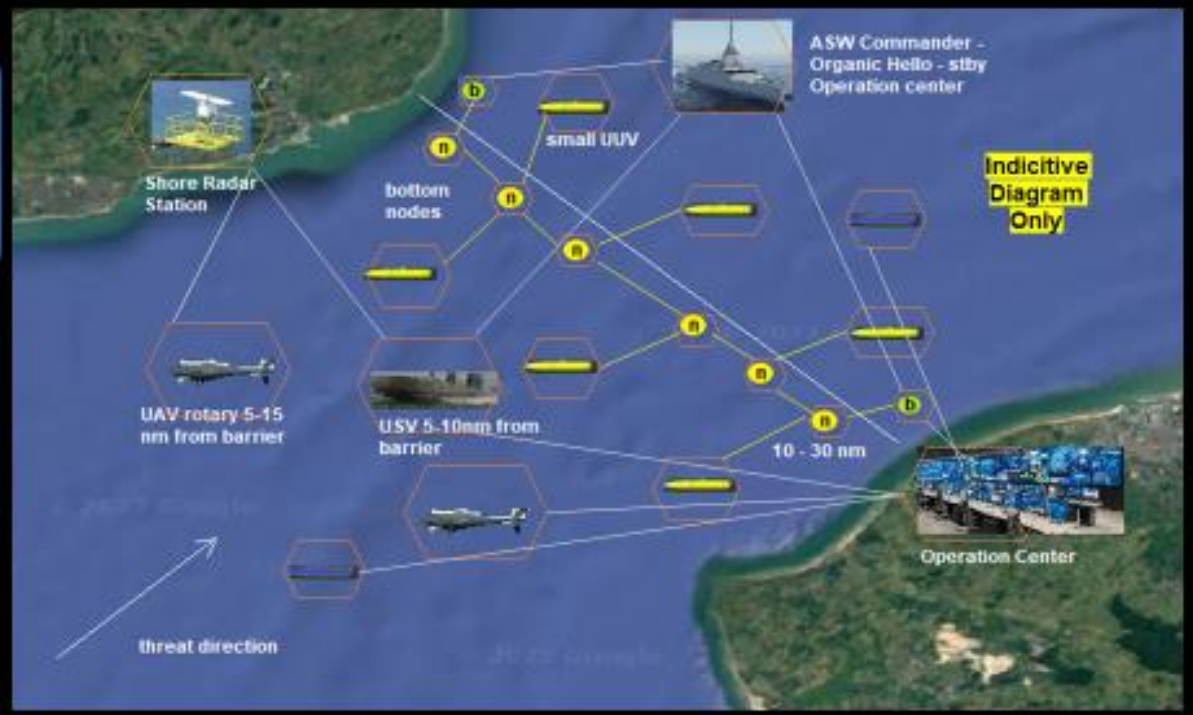
**'ASW Barrier**
**Hold at Risk Concept'**
**Choke Point (Straight line) Static barrier/net**

**LAUNCH – RECOVERY**
Launch / Recovery from shore, time factor to attain initial positions ….

**BARRIER DURATION**
Max Duration … months (possible substitution of various elements for check)

**Communication & Data exchange**
Underwater elements communicate with bottom nodes and gateway boys. UAV, USV, Shore radar, Gateway Buoy using RF or Satcom with MOC and Ship. Gliders use RF or Satcom with MOC and Ship.

Scenario: Enemy Subs or UUVs are using a choke point before reaching their area of deployment. Maritime Commander has ordered the deployment of Unmanned ASW Barrier along with capable ASW unit to detect and track enemy assets.




**ACTION:** Upon ASW Commander's order Barrier's network is active and gradually all elements take initial positions. UAVs covering forward XXX nm from line of the barrier towards enemy threat axis, USVs covering from XXXX nm from barrier. UUVs are patrolling in different depths on either side of barrier from XXX nm. Radar station is feeding neutral, suspect surface targets de-conflicting the underwater recognized picture. ASW Commander is changing if needed tasking and mission parameters from threat assessment. Weapon use only from Legacy units or USV upon ASW Commander order (ROE approved).

## Possible Elements

- Operation Center (MOC Troia)
- ASW Frigate (Legacy Helo)
- LUUV with Towed Array
- Bottom nodes (passive, active, underwater comms)
- Surface gateway buoys
- UAS rotary (EO/IR/ESM/Radar)
- USV Acoustic gateway and ISR
- USV (Towed array)
- Sonobuoys
- Small UUVs (passive –active)
- Gliders (REA & ASW)
- Shore Radar Station (TBC)

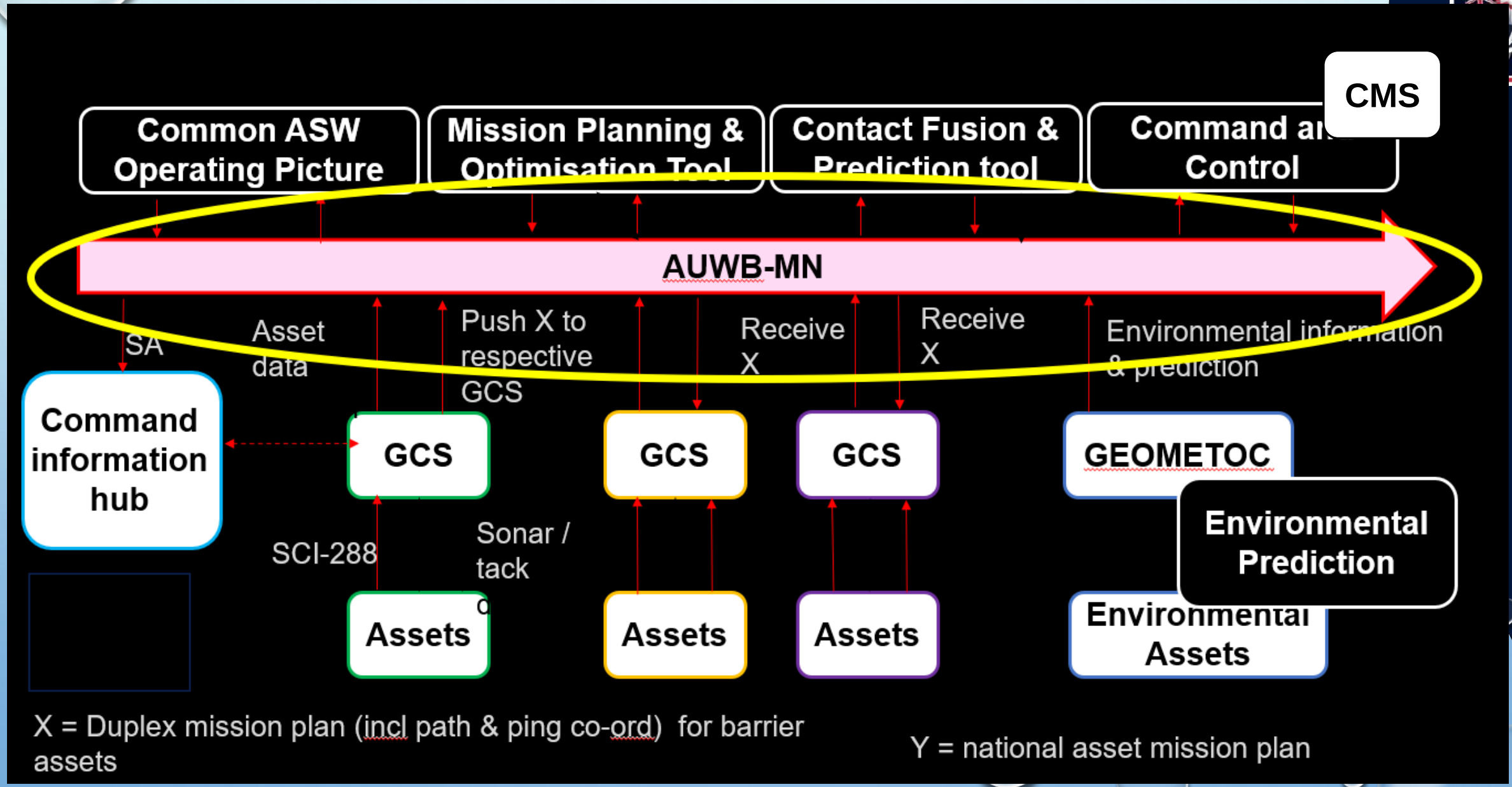
## Co-Operation

ASW Barrier has one MOC (shore) stby onboard ASW units.
ASW units have organic Helo in ASW mode notionaly armed.
ASW units provide local AAW-ASUW protection to ASW barrier elements.

## ASW Characteristics

Overt Operation, Peace Time or Crisis ROE, ASW is Commander feeding threat assessment, Mission: Detect, Track & ready to Shoot. No other enemy unit in AOO.

# C2 Architecture



# AUWB - MN

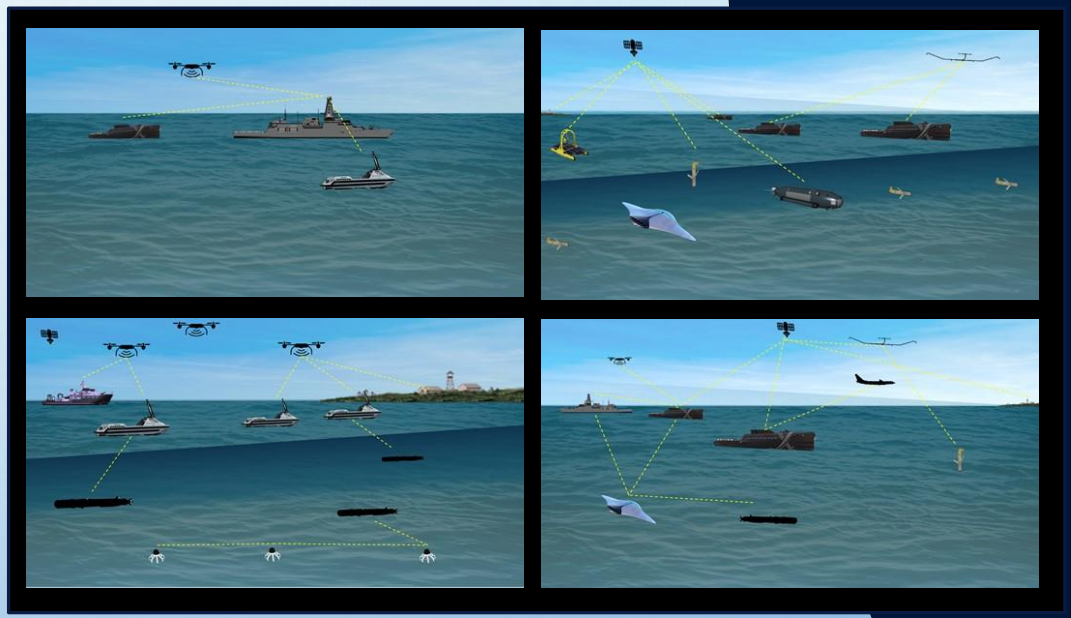
**The Allied Underwater Battlespace Mission Network (AUWB-MN) is an essential feature of any future NATO underwater MUS capability.**

**It will exploit both acoustic communication and more novel techniques to provide:**

- **Reliable underwater communications.**
- **Interfaces to above water terrestrial and satellite comms.**
- **Deliver effective C2.**
- **Act as the conduit for data harvesting, data fusion, and exploitation.**

# AUWB-MN – Industry Challenge

- 1x unit of National investment results in multiple units of  overall investment.
- Supports NATO C3 Board's Digital Exploitation Framework Strategy & NATO Digital Ocean project.
- Interoperability is a collective free good.
- Secure by design.
- National industry and R&D will be furnished with a set of standards which guarantee interoperability – increased sales.



# AUWB-MN Outputs - 2 Phases

A REFERENCE ARCHITECTURE

A REFERENCE ENVIRONMENT

## Phase 1 - 1M Euro Challenge

- Reference Architecture (RA)
- Test and Reference Environment (TRE)
  - simulated & live demonstration.
  - physical instantiation of systems to interface with National MUS capabilities.
- Priority use cases
  - ASW
  - MCM
  - REA
  - Seabed Warfare

# AUWB-MN Challenge - Phase 1 Timeline

- White Papers Invited - SOR & Guidance Documents Issued Nov 23.
- White Papers Evaluated and feedback sent Apr 24.
  - Industry conference held,
- Formal ITT Full Submission issued end May 24.
- Industry develop full submissions - submit by Aug 24.
- CEVB evaluate proposals until Oct 24.
- Early Nov 24 Winner Announced. Contract Awarded.
- November 24 work commences. Phase 1 Contract completion Feb 25.
- Phase 2 Dedicated TRE demonstration in REPMUS early 2026.

# Common Maturity Framework

## How to measure progress

**Concept**
What can it do?

**Minimum Viable Product**
Will it do the job?

**Minimum Viable Capability**
Make it useful?

**War Winning Capability**
Make it threatening?

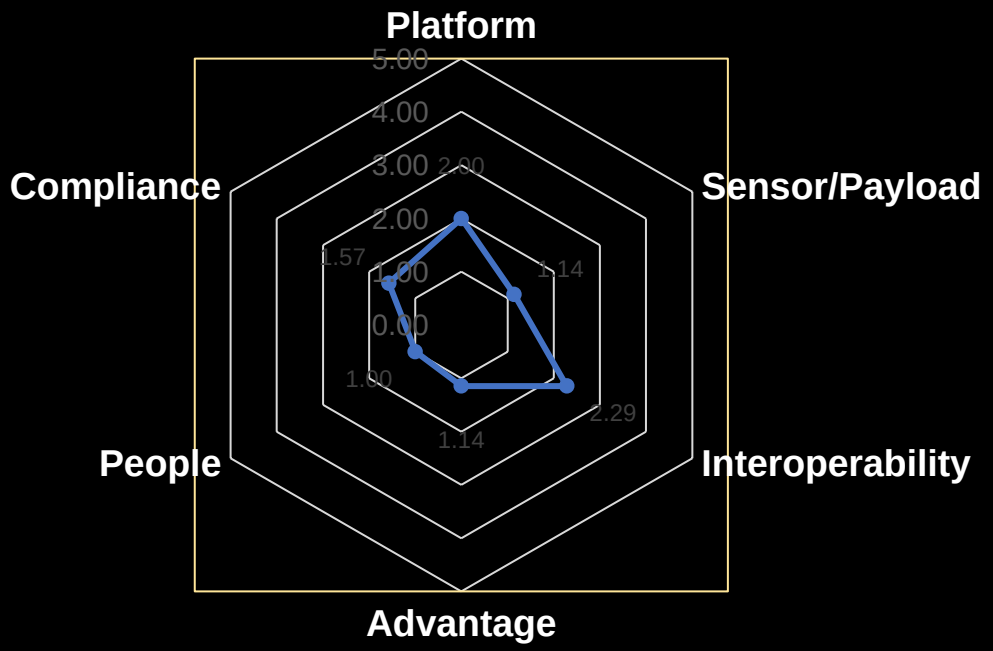
**CMF is a discussion handrail to establish a collective understanding of maturity and development priority for human and technology factors that must be, at some point, addressed to deliver an end vision involving Autonomous Systems**

# Assessment Factors

| Advantage | Consent & Confidence | Platforms & Payloads | Data & Algorithms | Integration & Interoperability | Expertise & Enterprise |
|---|---|---|---|---|---|
| CONEMP & Mission Adaptability | Legal & Regulatory | Deployability | Data Requirements | Open Architecture & Standards | SQEP |
| Benefits | Policy & Risk Appetite | Power & Propulsion | Availability & Access | Human-Autonomy Teaming & Control | Organisational Readiness & Governance |
| User Needs | Security | Persistence | Autonomous Functions (AI & Algorithms) | Communication & Networks | Support & Infrastructure |
| Risk | Trust | Reach | Data Processing | Command & Tasking | Cultural Acceptance |
| Cost | Resilience | Accuracy | Data Quality | Allied Interoperability | Ethics |
| Scalability | Survivability | Reliability | IX & Decision Support | IP & Sovereignty | Acquisition & TLCM |

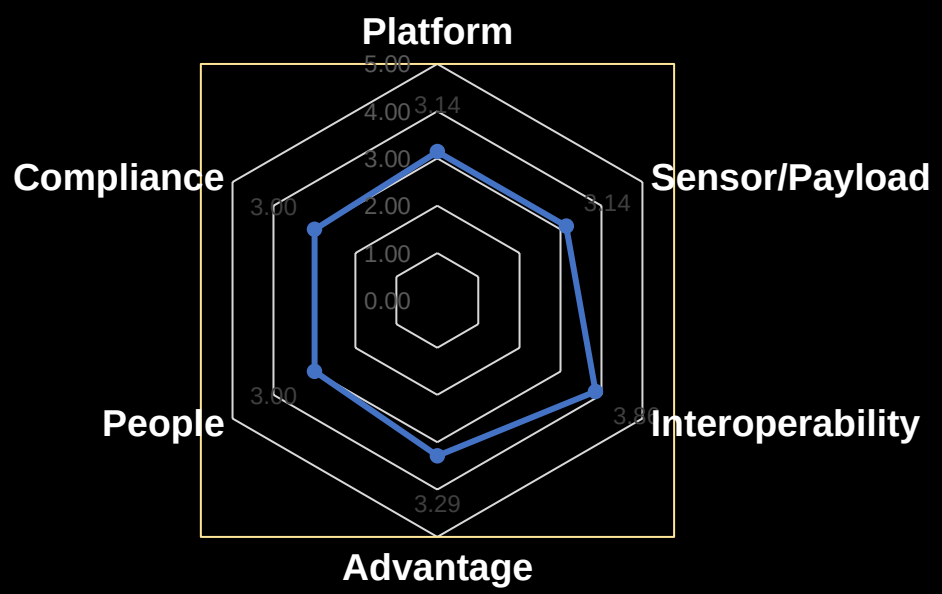
# Baseline to Full Capability

## OPEX Events




REPMUS 23

REPMUS 24




Maturity

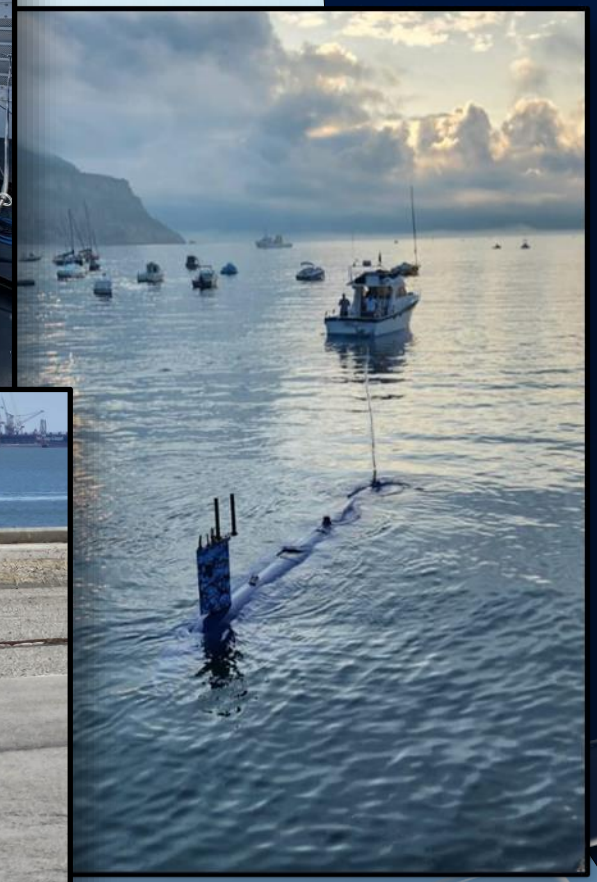
# Priority View Example

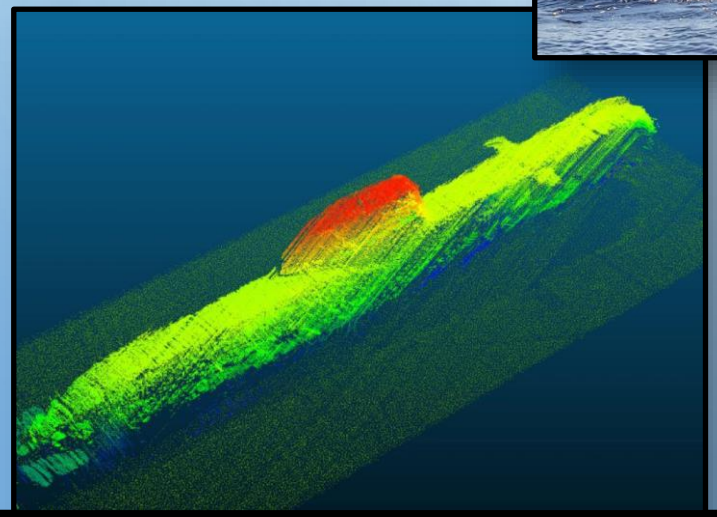
| Advantage | Consent & Confidence | Platforms & Payloads | Data & Algorithms | Integration & Interoperability | Expertise & Enterprise |
|---|---|---|---|---|---|
| Concept Definition & Adaptability 4 2 | Legal & Regulatory 3 1 | Deployability 4 4 | Data Requirements 4 1 | Open Architecture & Standards 4 2 | People & Training 2 1 |
| Benefits 3 2 | Policy & Risk Appetite 4 1 | Power & Endurance 2 3 | Availability & Access 3 3 | Human-Autonomy Teaming & Control 3 2 | Organisational Readiness & Governance 1 4 |
| User Needs 2 1 | Security 1 1 | Persistence 3 4 | Autonomous Functions 5 4 | Communication & Networks 5 1 | Support & Infrastructure 2 1 |
| Risk 2 2 | Trust 4 2 | Reach 4 2 | Data Processing 3 1 | Physical Integration 4 1 | Cultural Acceptance 3 3 |
| Cost 4 3 | Resilience 3 2 | Accuracy 3 1 | Data Quality 4 2 | Command & Tasking 2 2 | Ethics 4 4 |
| Scalability 1 3 | Survivability 1 3 | Reliability 2 1 | IX & Decision Support 1 1 | Allied Interoperability 1 2 | Acquisition & TLCM 1 4 |

| Factor Name | |
|---|---|
| Maturity Score 1-5 | Priority Score 1-5 |

# ASW at REPMUS

- REPMUS 23 Re-Cap
- REPMUS 24 Planning





REPMUS is a Portuguese-led experimentation exercise which focuses on Maritime Unmanned System (MUS) experimentation, capability development and interoperability.

It is conducted annually and is designed to allow large-scale operational experimentation (OPEX), where operational communities engage with industry and academia to promote the integration of MUS in maritime operations.

The experimentation activities comprise the test of systems during sea trials as well as the test and validation of experimental tactics (including EXTACs) on MUS to address key operational problems (KOP).

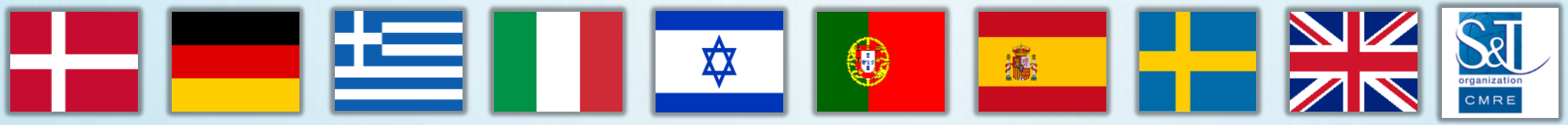
The 2024 edition will be conducted in the North Atlantic Portuguese Exercise Areas, from 09-27 September 2024.

**Organisation**

**PRT-N**
**Oporto University**
**JCGMUS (was MUSI)**
**NATO CMRE**

**Multinational Led Working Groups**

# REPMUS 23 UW Nations and Industries



- SAAB (UK)
- SAAB (SWE)
- SOTIRIA
- BLUE OASIS
- ELTA
- ATLAS ELEKTRONIK
- SHIEBEL
- TEKEVER
- TELEDYNE
- RS AQUA
- IQUA ROBOTICS
- INESCTEC
- NOKIA _ ASN
- QINETIQ
- GRAALTECH
- LEONARDO
- FINCANTIERI
- SONARDYNE
- SEEBYTE
- DSTL

# REPMUS 23 UW (ASW & CUI) Assets and Capabilities


ITS CARABINIERE

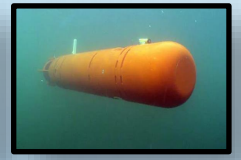

XV PATRICK BLACKETT


NRP SINGE


NRP DOM CARLOS


NRP ANDROMEDA

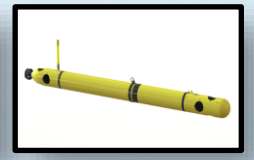

Blue Whale with LFAS Sonar System


AUV 62 ASW Target


Gavia ASW Target


SPARUS II AUV

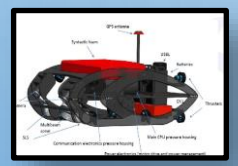

OSPREY AUV


X300 AUVs


Sea Falcon ROV


Sea Wasp ROV

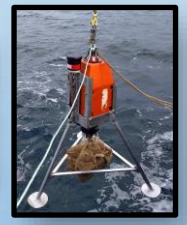

Recall ASW Target


EVA ROV


SAND


CAMCOPTER S-100 (with Sonobuoys)

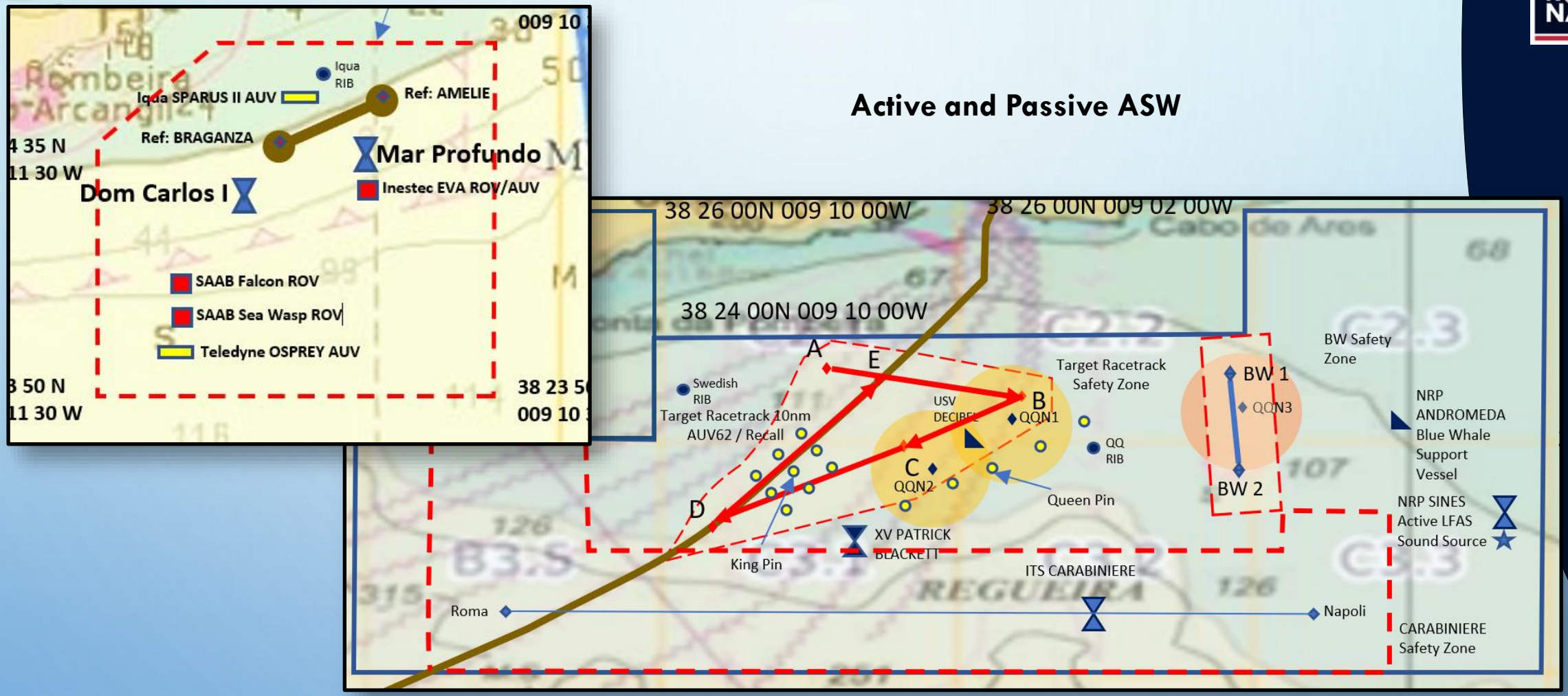
AR 5 (with Sonobuoys)


Bottom Node


DECIBEL

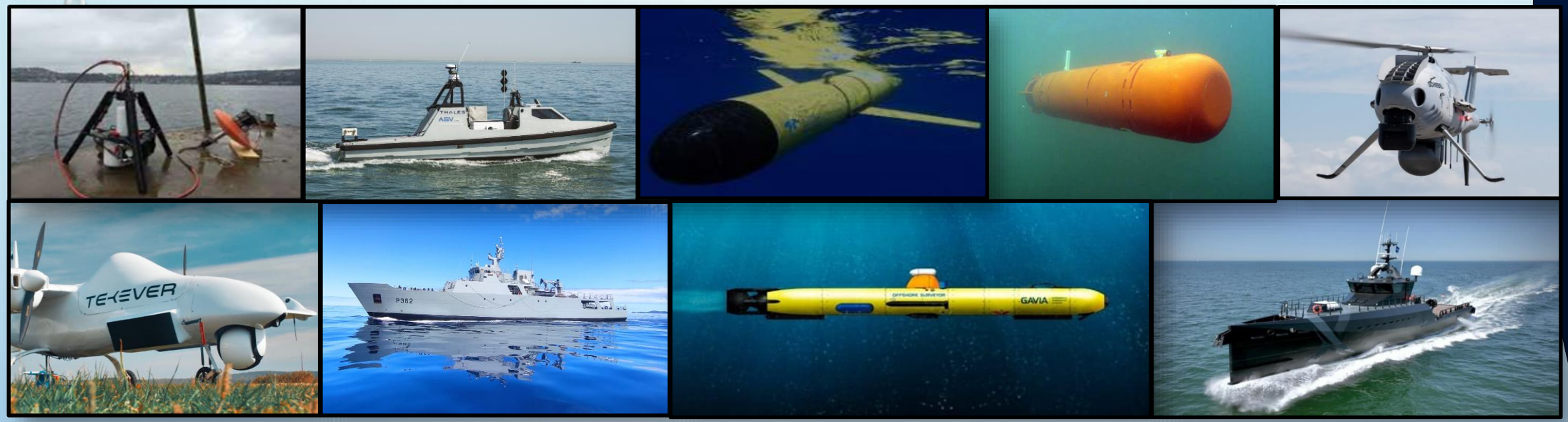
- MIRAYA Exercise reconstruction and analysis
- OPTO_DAS Cable monitoring and detection system
- Hydrophones & magnetometer systems
- Data Fusion Cell
- Sonobuoy relay, recording and processing systems
- Data analysis and C2 tools for ASW

# Trials and Vignettes




**Active and Passive ASW**

# REPMUS 24




| UAVs | USVs | UUVs | UGVs | Warships | Research Ships |
|---|---|---|---|---|---|
| 37 | 20 | 36 | 2 | 15 | 10 |

# REPMUS 24 ASW Timeline

| | Mon 16 | Tue 17 | Wed 18 | Thu 19 | Fri 20 | Sat 21 | Sun 22 |
|---|---|---|---|---|---|---|---|
| AM | Passive ASW Test Bottom Node connectivity / comms<br><br>Test ASW Sensors & Sound Sources<br><br>Test ASW Targets<br><br>Simple target presentations | Passive & Active ASW Barrier testing NLD / DEU / DNK / NOR / FIN / PRT / SWE / UK multistatic (Scenario A)<br><br>Simple alerted Target presentations by various targets in advance of sensor arrays | Passive & Active ASW Barrier testing NLD / DEU / DNK / NOR / FIN / PRT / SWE / UK multistatic (Scenario A)<br><br>UAS & Sonobuoys<br><br>Complex unalerted Target presentations by various targets in advance of sensor arrays | Passive & Active ASW Barrier testing NLD / DEU / DNK / NOR / FIN / PRT / SWE / UK<br><br>multistatic (Scenario C )<br><br>UAS & Sonobuoys<br><br>Complex unalerted Target presentations by various targets in advance of sensor arrays | Passive & Active ASW Barrier testing NLD / DEU / DNK / NOR / FIN / PRT / SWE / UK<br><br>multistatic (Scenario C )<br><br>UAS & Sonobuoys<br><br>Complex unalerted Target presentations by various targets in advance of sensor arrays | SMER<br><br>SM UW Comms<br><br>MAD Detection Serials | Integrated Tactical Serial<br><br>Deep Water CUI Survey / Change Detect / Intervene<br><br>ASW Barrier – Detect / Track to screen CUI<br><br>Build realistic Barrier test with complex presentation of multiple targets<br><br>AWW Threat - Provision of FP to ASW Activity |
| PM | Passive & Active ASW Barrier testing NLD / DEU / DNK / NOR / FIN / PRT / SWE / UK multistatic (Scenario A)<br><br>Simple Target presentations by various targets in advance of sensor arrays | Passive & Active ASW Barrier testing NLD / DEU / DNK / NOR / FIN / PRT / SWE / UK multistatic (Scenario A)<br><br>UAS & Sonobuoys<br><br>Complex unalerted Target presentations by various targets in advance of sensor arrays | Passive & Active ASW Barrier testing NLD / DEU / DNK / NOR / FIN / PRT / SWE / UK multistatic (Scenario A & B )<br><br>UAS & Sonobuoys<br><br>Complex unalerted Target presentations by various targets in advance of sensor arrays | Passive & Active ASW Barrier testing NLD / DEU / DNK / NOR / FIN / PRT / SWE / UK multistatic (Scenario C )<br><br>UAS & Sonobuoys<br><br>Complex unalerted Target presentations by various targets in advance of sensor arrays | Passive & Active ASW Barrier testing NLD / DEU / DNK / NOR / FIN / PRT / SWE / UK multistatic (Scenario C )<br><br>UAS & Sonobuoys<br><br>Complex unalerted Target presentations by various targets in advance of sensor arrays | | |

# REPMUS 24 ASW Timeline

| | Mon 23 | Tue 24 | Wed 25 | Thu 26 | Fri 27 |
|---|---|---|---|---|---|
| | **Integrated Tactical Serial**<br><br>Deep Water CUI Survey / Change Detect / Intervene<br><br>ASW Barrier – Detect / Track to screen CUI<br><br>Build realistic Barrier test with complex presentation of multiple targets<br><br>AWW Threat - Provision of FP to ASW Activity | **AM**<br>**Amphibious Serial**<br><br>ASW Barrier – Detect / Track to screen CUI<br><br>Build realistic Barrier test with complex presentation of multiple targets<br><br>Support Amphibious Ops with ASW Barrier protect | **Spare** | DV Day | |
| | | Evening / Night<br>**Amphibious Serial**<br><br>ASW Barrier – Detect / Track to screen CUI<br><br>Build realistic Barrier test with complex presentation of multiple targets<br><br>Support Amphibious Ops with ASW Barrier protect | **DV Day Rehearsal** | | |

# REPMUS 24 ASW

- 6 x ASW Target Systems
- 9 x Bottom Nodes
- 1 x Hydrophone and magnetometer array
- 3 x Communications gateway Buoys
- 3 x Underwater Gliders with Spatial Arrays
- 1 x Surface towed acoustic array systems
- 1 x Surface towed optical thin line array system
- 2 x ASW ISR capable UAS with sonobuoy dropping capability
- 1 x Airborne Sonobuoy relay
- 1 x Sonobuoy processing system
- 1 x LAUV with hybrid sensors
- 3 x ASW sound Source
- 1 x Acoustic vector sensor
- 3 x Magnetic Anomaly Detector
- 1 x USV with Dipping Sonar
- ASW Data Processing systems
- Hydrophone buoys
- Opto DAS fibre optic system
- Remote connectivity to live USVs with ASW sensors in Australia

## FOCUS

1. Multi-static Active ASW
2. Bi-Static and Passive ASW
3. ASW C2 (Barrier Concept)
4. ASW C2 and Data connectivity (STANAG 4817 – COP)

# REPMUS 24 UW Placemat – 20 Sep 24 (Fri)

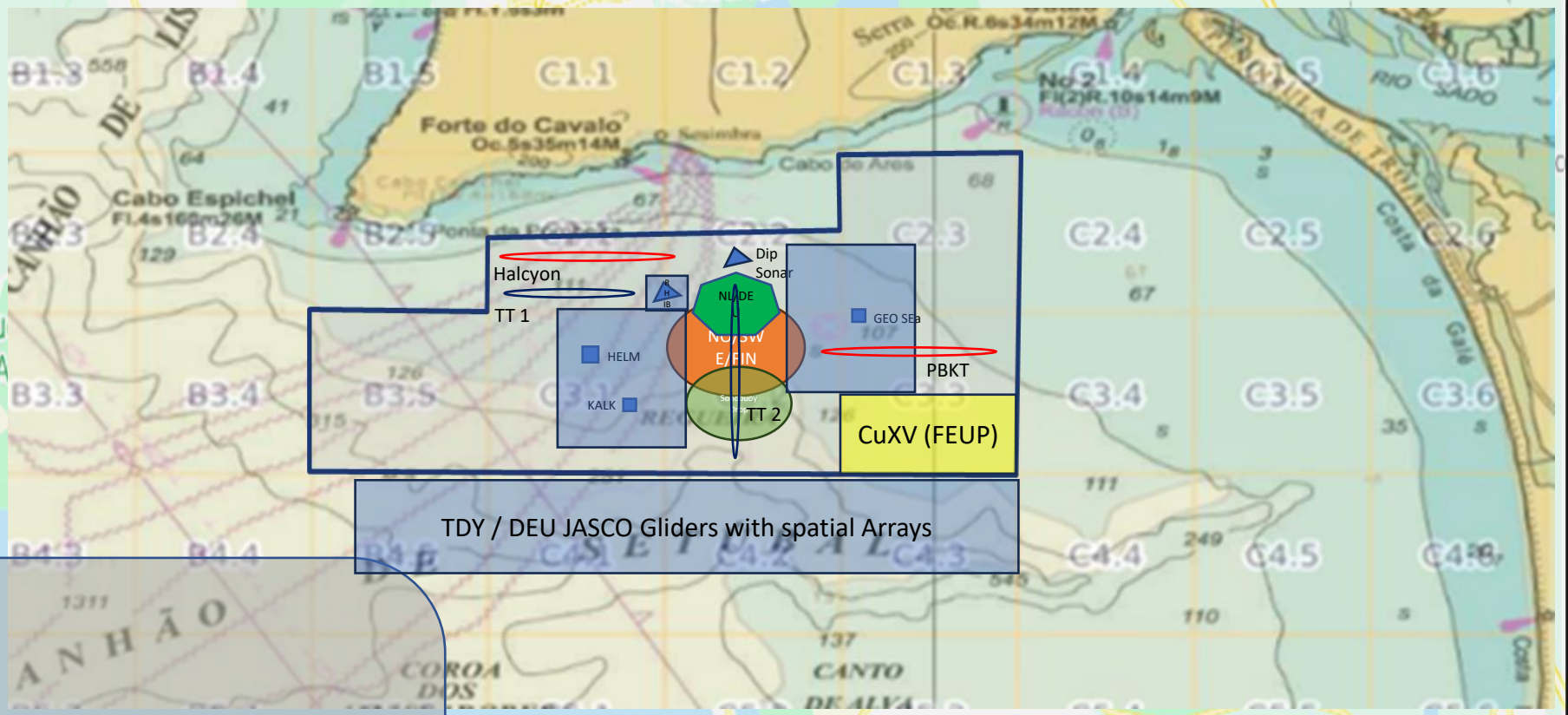
**TASKS:**
Passive & Active ASW Barrier testing NLD / DEU / DNK / NOR / FIN / PRT / SWE / UK

Multistatic (Scenario C )

UAS & Sonobuoys

Complex unalerted Target presentations by various targets in advance of sensor arrays

**Supported REPMUS Goals & Objectives:**
G: 1.1 1.2 1.3 1.4
O: 1.1 1.2 1.3 1.4
D: 3.3 4.1 4.2 5.1 5.3




**Considerations:**
AUV62 Corridor (NMW) (Coordinate)
Active tgt to remain south of node field
NLD / DEU Recover nodes O/C
o/c tracking runs with SEMA.
All in water activity to be iaw the SOE
Organic Rhibs from HELM and KALK for PAX tx from Sesimbra and recovery of Nodes
Nodes to be laid E-W orientation.
Sound source to be in NMT 100m water
Halcyon with OPTI 11 Array fitted to do a circuit of Nodes area fm Sesimbra
Patrick Blackett with JASCO array tbc.
Patria Tgt to run E/W. Patria controlled via DEU Gateway
EDA SALSA CAPTEC Demo Harbour container (Strangle All emitters)
Gavia test and passive target for Nodes.
Gavia provide LF frequency for OPTODas.
HLEM/KALKJ TX IFS signals overnight. 10NM W.
Portuguese Authority - Risk Managed
Overnight "Buoy Sitting" vessel – if required
NLD Recopver nodes Friday pm
Gavia not available

**Assets:**
1 x DEU GW Buoy (DEU)
4 x Bottom Nodes (DEU/NL) 750m spacing
2 x SEACAT (Deu)
2 x SEMA (DEU/NL) (2)
OPTO Array (SWE)
Patria (FIN)
1 x Rhib (Dipping Sonar) (NL)
Patrick Blackett (Array)(UK)
Recall / Patria (2)
2 x GW Buoy
Norway (3) and Sweden (3) Bottom nodes
OPTO Das
1 Passive Vector (DEU)
HELMSAND and KALKGRUND (DEU)
Sound source (NOR/SWE/FIN/DEU)
GEO Sea (NL)
OPTI 11 array on Halcyon USV.

# QUESTIONS