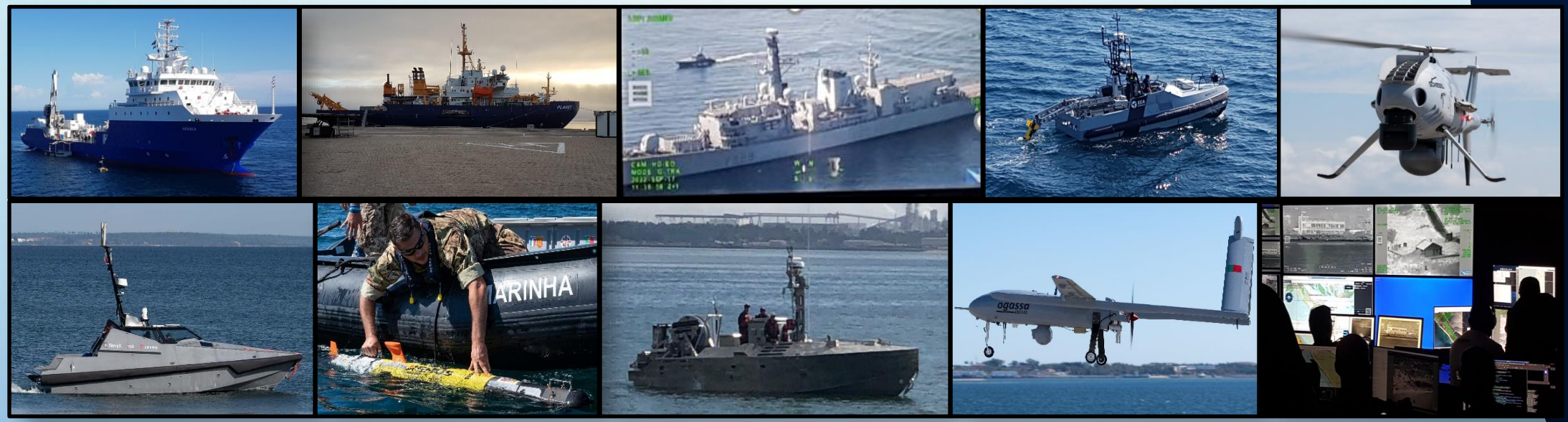
PORTUGAL's REPMUS 22 EXERCISE
MUS Innovation and impact on Defence



Cdr Ian Danbury RN (Rtd) – Royal Navy ASW Spearhead Team
NATO SDI & OPEX
Formerly NATO DDir MUSIC^2 & REPMUS Coordinator
Ian.Danbury314@mod.gov.uk

CNE 2023

- MUS as Force Multipliers
- Feedback from REPMUS 22
- Future Integration and Interoperability with MUS

THE RATIONALE FOR UNMANNED

A FORCE MULTIPLIER

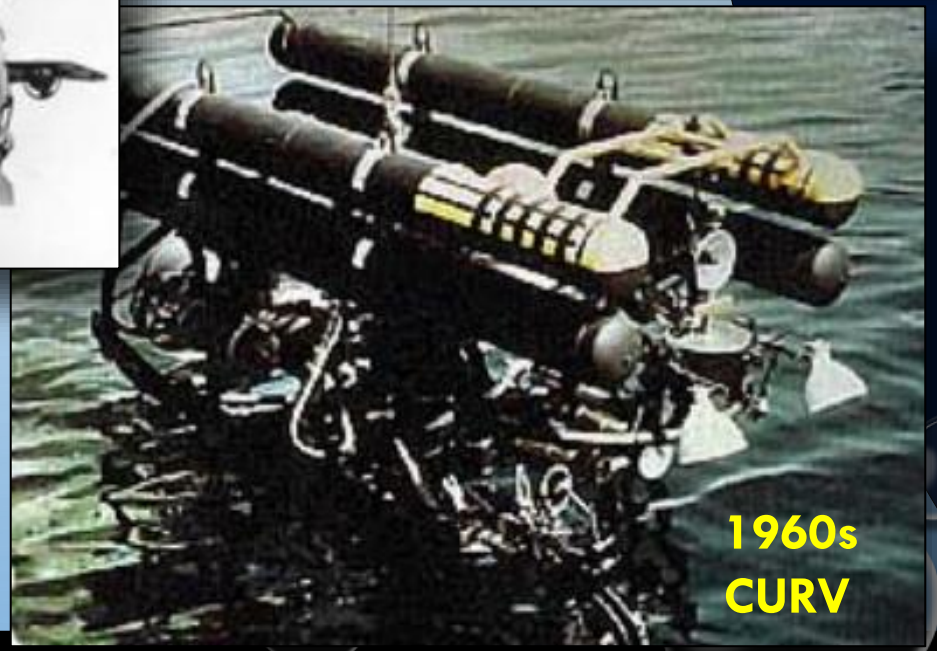
- Mass
- Persistence
- Safety
- Innovation
- Cost

THE RATIONALE FOR UNMANNED
A FORCE MULTIPLIER

- Mass
- Persistence
- Safety
- Innovation

- Cost ?
- Vulnerability
- Integration
- Interoperability

Unmanned - Not New



What makes it so difficult?

What's Missing?

- **Technology Development** (AI / Power / Data Analysis / Bandwidth / DDE)
- **Platform Integration**
- **C2 Integration**
- **C4 Data Flow & Integration**
- **Domain Integration**
- **Interoperability**
- **Interchangeability**

MUS Integration into Operations

Unique Challenges for Force Design and Integration (FDI)

- Transitioning stand alone C2 nodes and data dissemination to an integrated approach
  - Vertically across domains
  - Horizontally across Allies (Interoperability and interchangeability)
- MUS not currently routinely embarked in Operational Warships
  - Accreditation of MUS integratrion into Secret High Combat Management Systems is difficult
  - Transition requires either bespoke trials Combat Management Systems or specific platforms with levels of accreditation for specific MUS platforms and integrator interfaces.
  - C2 and data sharing integrators require complex interfaces with CMS systems.
  - Legacy ICS systems do not support MUS network bearers.
    - Bespoke communications and safety nets - often commercial in nature often needed
  - Integration into operational units requires long lead times
- Complex Air and Waterspace management and regulatory landscape

MUS Integration into Operations

Unique Challenges for Force Design and Integration (FDI)

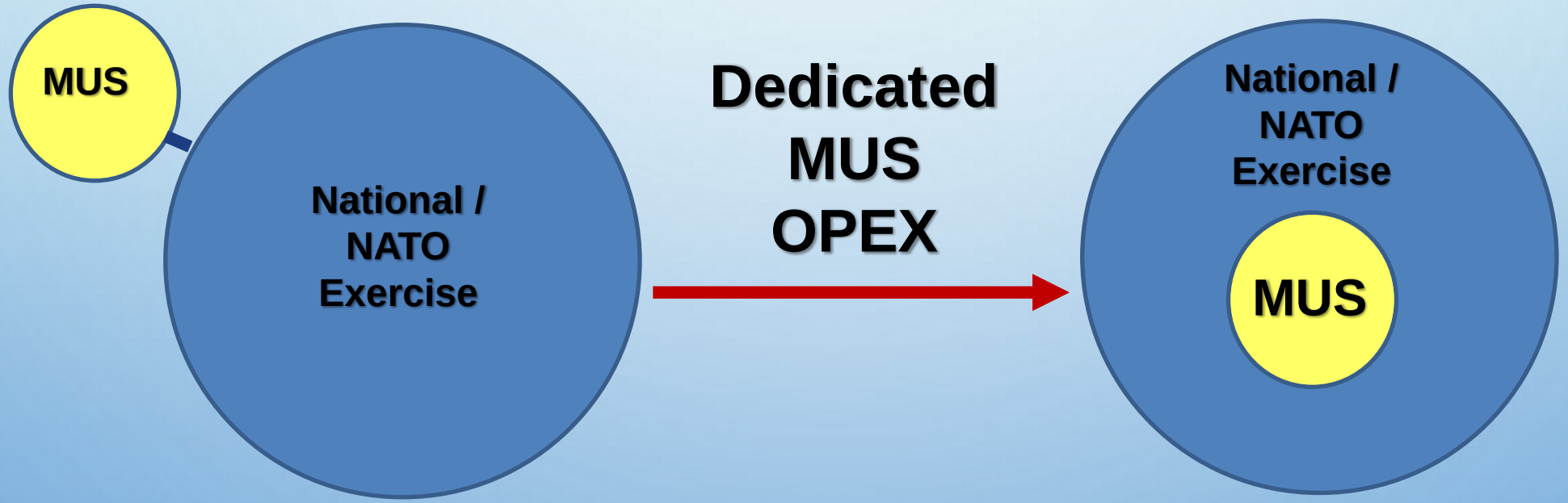
Bridging the “Valley of Death” (Bringing MUS into the Operational Environment)

- Getting the Scientist out of the Ops Room ! - MUS systems into the hands of the warfighter

MUS Integration into Operations

Unique Challenges for Force Design and Integration (FDI)

Trust in MUS



OPEX

An Exponential Accelerator for:

- Proving Technology
- Innovative Ideas
- Capability Development
- Operational Testing
- Concept Development
- Developing Doctrine & TTPS
- Driving Interoperability and Interchangeability

“It is no good just examining technology, you have to put things in the water and run them against an operational problem set”

Mr Michael Stewart

Head US Navy Unmanned Task Force / Chair NATO Naval Armaments Group

REPMUS 22

Robotic Experimentation and Prototyping augmented by Maritime Unmanned Systems

Portuguese Exercise – annual – Troia peninsular / Sesimbra Portugal

NATO Headmark - Day 0 Integration

NATO & Partner participating Nations

Troia Peninsular

Portuguese Navy
Centre for Maritime Operational Experimentation

REPMUS 22 Scope









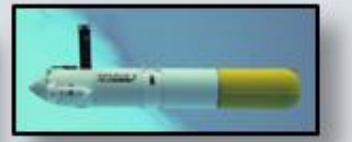



11 Warships
6 Trials Ships
Approx 45 UAS
Approx 40 UUVs
Approx 18 USVs











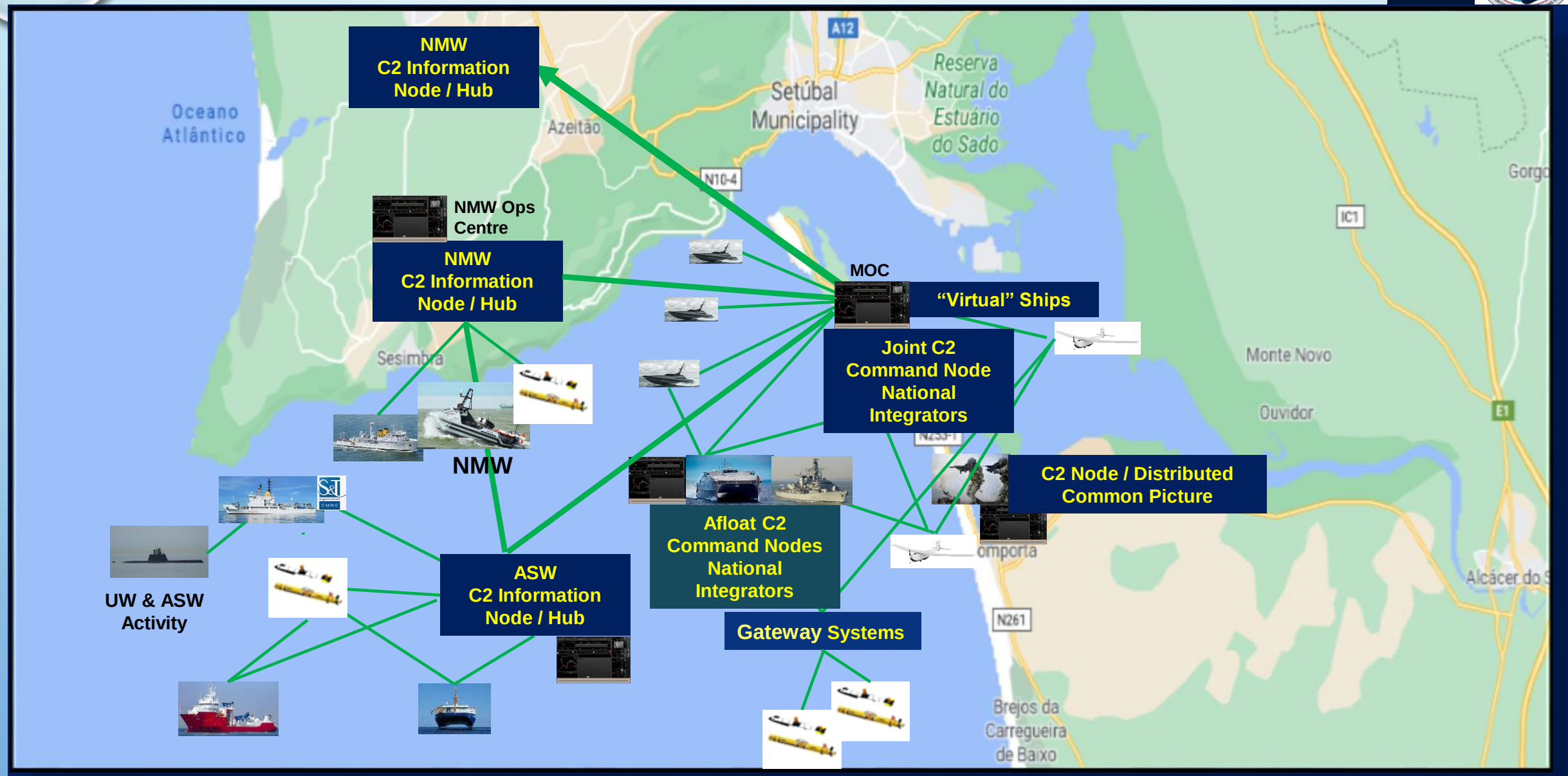



MARITIME UNMANNED SYSTEMS INITIATIVE

REPMUS Overarching NATO Goals;

- Acceleration of Allied MUS development programs.
- To experiment with new and emerging technology in the field of MUS (including sensors, C3, autonomy AI and others) by testing and evaluating them in live scenarios.
- To develop, experimentation and refining MUS platform, systems and enablers concepts of operation.
- To enable through trials testing and experimentation, interoperability and standardization between Allied MUS systems and between them and manned assets.
- To develop the technological exploitation of MUS capabilities to fulfil the NATO maritime capability gaps, aligned with the NATO Defence Planning Process (NDPP) capability targets.

REPMUS 22 C4 Laydown



REPMUS Activity

- 121
  - NMW
  - ASW
  - REA

REPMUS I2I - Overarching Aims

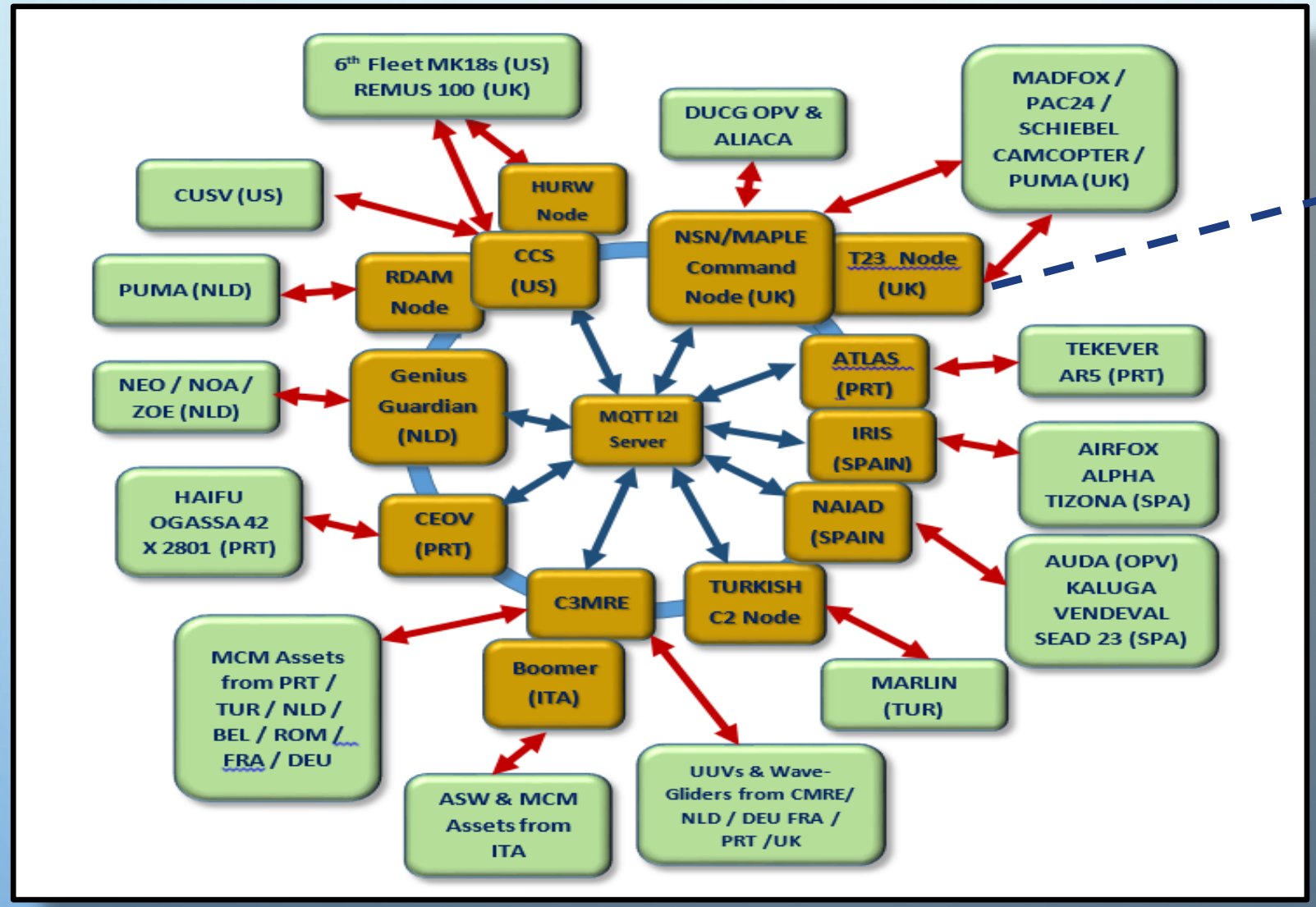
- Develop MUS technical capabilities to support Allied Warfighting Concepts in a collaborative environment sharing info and best practice and stressing systems.
- Use framework vignettes based on warfighting concepts to establish C2 Interoperability to Interchangeability goals and objectives across a range of allied assets and across domains.
- Establish a Common Operating Picture with Complete Blue and Red COI tracking of ALL REPMUS assets.

REPMUS I2I - Vignettes

Demonstrate Allied collaborative use of MUS in the following:

- Specific ISR collect
- Extending maritime organic ISR / MSA reach
- Detect and Intercept Contacts of Interest
- Force protection of High Value Units
- Intercept and engage asymmetric threats (Lethal & Non Lethal)
- Preparation of amphibious battlespace
- Support to amphibious operations
- Anti Submarine Warfare

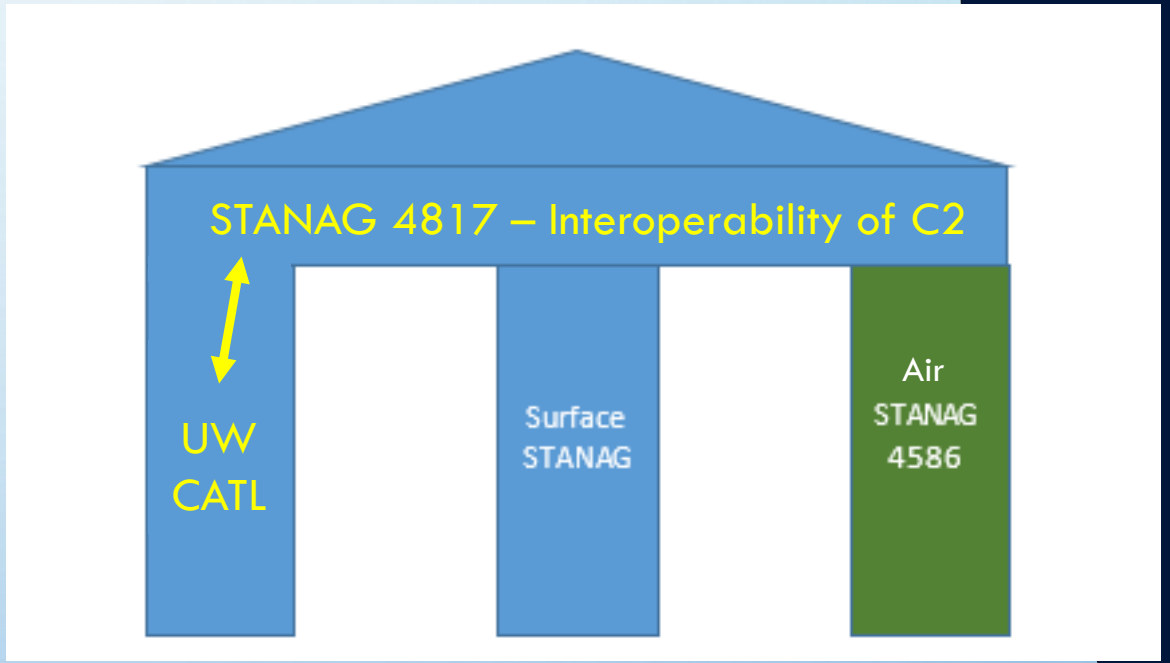
REPMUS I2I – Connectivity Achieved



Link 11

			I2I Mission Types			
Nation	Asset type (UAV, USV, UUV, UGV)	Asset Name	Patrol	Shadow	Inspection	Survey
UK	USV	APAC24 (BAE)				
UK	USV	MADFOX	y	y	y	
UK	UAV RWUAS	Schiebel S100			y	y
US	USV	CUSV	y	y	y	
US	UUV	REMUS 600 MK18				y
US	UUV	REMUS 300 Lionfish				y
NL	UAV Octocopter	Acecore NEO			Voice / Mumble ONLY	
NL	UAV Octocopter	Acecore NOA				
NL	UAV Quadcopter	Acecore ZOE				
PT	UAV FW	Tekever AR5				
PT	UAV	UAVision Ogassa				
PT	UAV	UAVision Spyro				
PT	USV	X2801				
ES	UAV FW	M5D AirFox	y		y	y
ES	UAV RWUAS	Alpha	y		y	y
ES	UAV FW	Tizona (swarm)	y		y	y
ES	USV	KALUGA	Arriving for Dynamic Messenger			
ES	USV	SEAD 23				
ES	USV	VENDAVAL				
TR	USV	RD09 Marlin Sefine	y	y	y	y
FR	UAV	ALIACA				

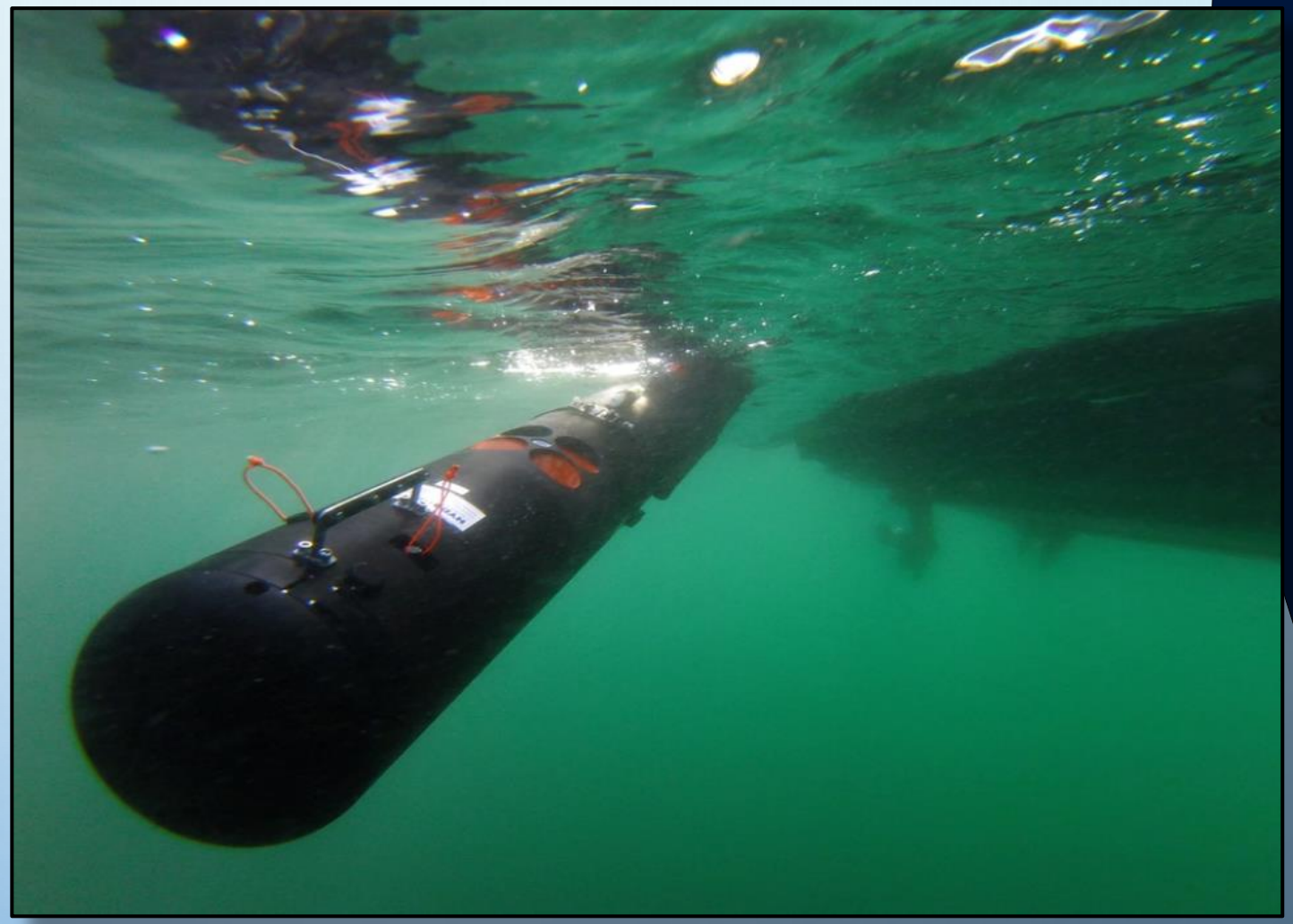
REPMUS I2I – Mission Planning and Tasking Message compatibility



MUS Interoperability “Temple”

Activity

- I2I
- NMW
- ASW
- REA



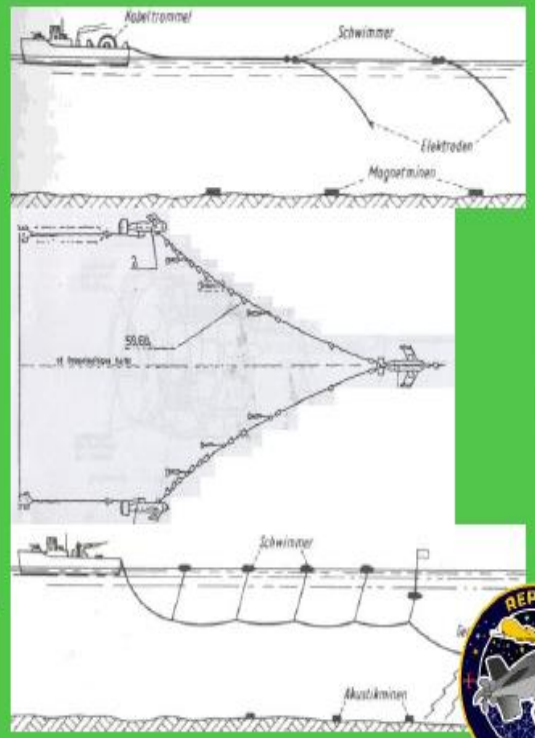
NMW Objectives

- Contribute to enhancement of planning and evaluation of MUS in NMW
- Contribute to development of NATO CONOPS for evolving and disruptive technology for NMW system of Systems
- Contribute to the integration of new MUS into the tactical C2 structure
- Contribute to algorithms to improve detection and classification process in NMW mine hunting with side looking sonars, including derivation of 3D object representation.

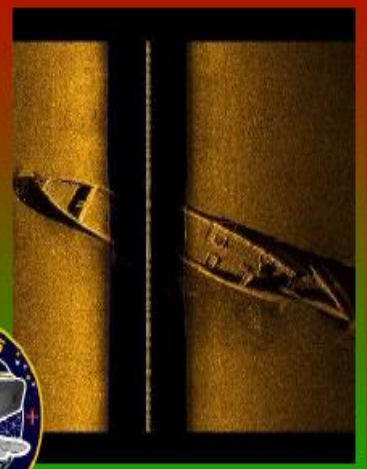
MCM Interoperability/Concept development

Minehunting

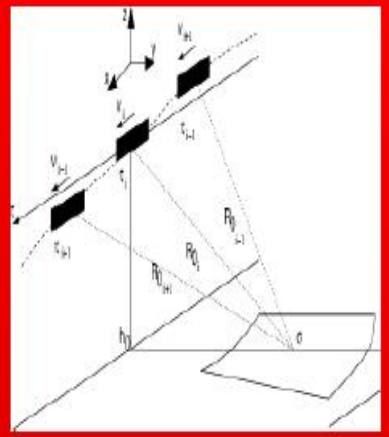
Minesweeping

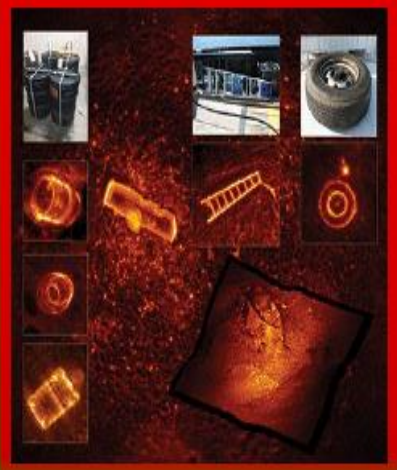


Side Scan Sonar

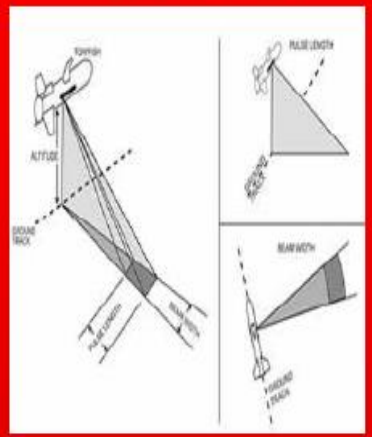


Synthetic Aperture Sonar

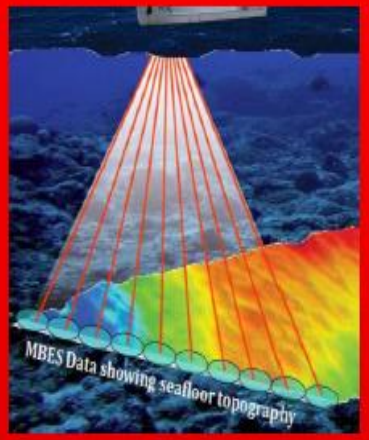




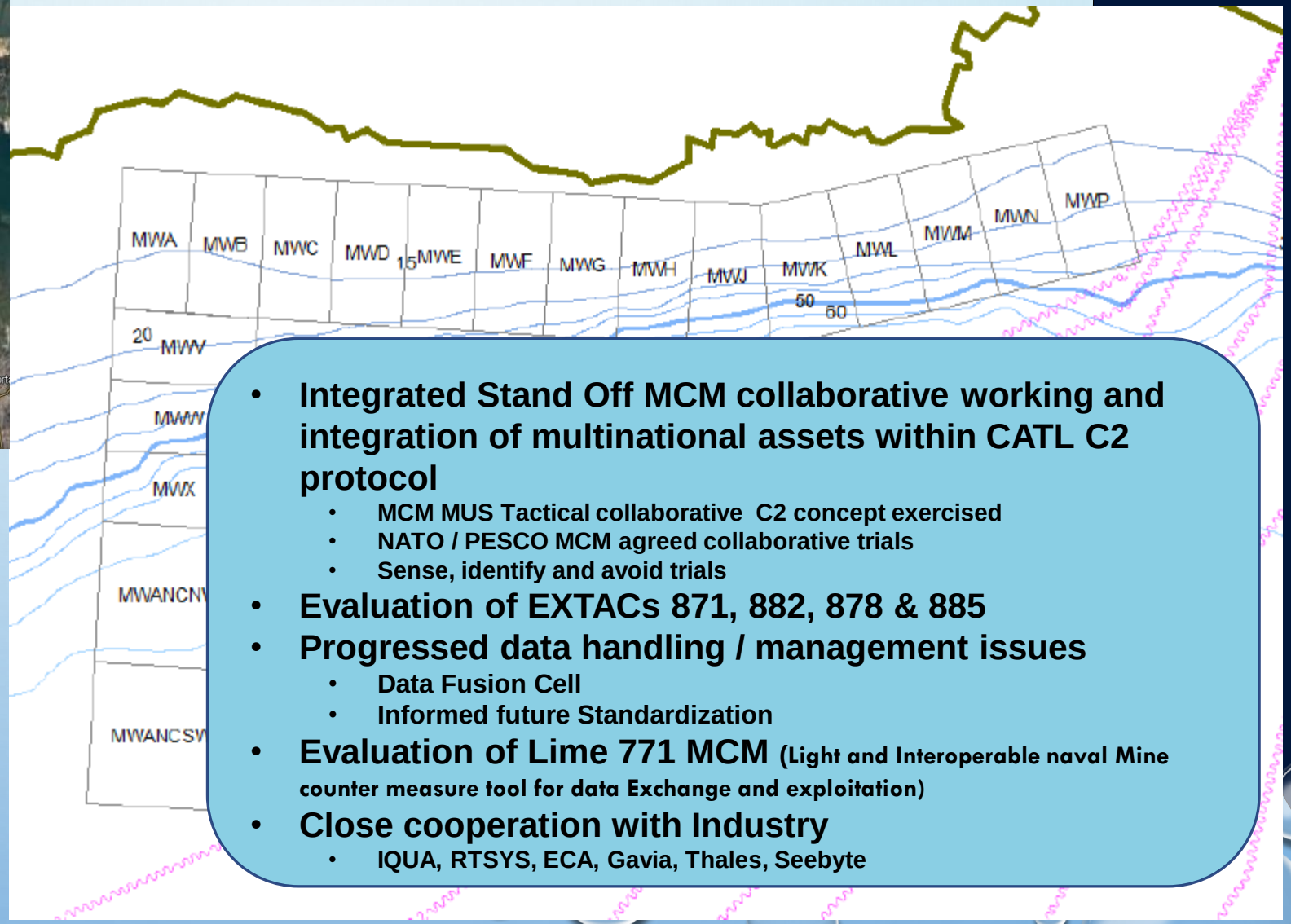
Interferometric Side Scan



Multi Beam Sonar



MCM Ops



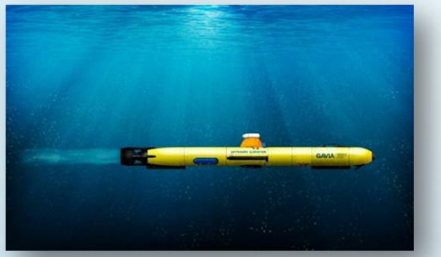
Exercise Mines

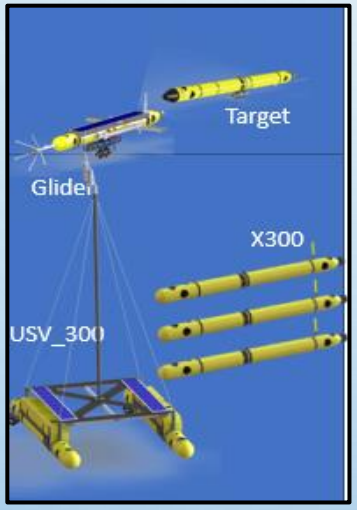
- MANTA
- ROCKAN
- Mk 36
- Cylindrical shape
- Moored mines
- Sonar reference targets

- **Integrated Stand Off MCM collaborative working and integration of multinational assets within CATL C2 protocol**
  - MCM MUS Tactical collaborative C2 concept exercised
  - NATO / PESCO MCM agreed collaborative trials
  - Sense, identify and avoid trials
- **Evaluation of EXTACs 871, 882, 878 & 885**
- **Progressed data handling / management issues**
  - Data Fusion Cell
  - Informed future Standardization
- **Evaluation of Lime 771 MCM** (Light and Interoperable naval Mine counter measure tool for data Exchange and exploitation)
- **Close cooperation with Industry**
  - IQUA, RTSYS, ECA, Gavia, Thales, Seebyte

Activity

- I2I
- NMW
- ASW
- REA





ASW ASSETS AT REPMUS/DYMS22

- Denmark
- Italy
- Netherlands
- Portugal
- Turkey
- UK
- US
- CMRE








- **Bottom nodes**
  - NLDs and CMRE
- **UUVs - 7**
  - XLUUV
  - IT UUV x 3
  - IT / CMRE Gliders
  - CMRE 2 x OEX UUV
- **USV - 4**
  - CUSV
  - CMRE Wave Gliders
  - IT USV x 1
  - MARLIN
- **UAS - 1**
  - Thales Schiebel/Sonobuoys
- **Targets - 3**
  - SEMA, GAVIA, SPARTA

REPMUS/DYMS 22 – ASW & UW OBJECTIVES

- Collect Passive and Active sonar data of representative target and evaluate sensor performance of unmanned ASW sensors
- Assess networked sensors ability to create effective surveillance zone
- Demonstrate C2 of unmanned systems and management of autonomy levels
- Demonstrate digital 2 way submarine / surface communications
- Develop AUWB-MN requirments

ASW ACHIEVEMENTS

- **Detections and Contacts - Real time detections fed to MOC via C3MRE**
- **Full tactical picture developed –** tracks and contacts
- **UW Seabed Network Nodes (CMRE / NLDs)**
- **CUSV/TRAPS –** deployment with passive and active sonar
- **Marlin USV –** Sonobuoy Detection and Relay
- **Schiebel - Comms Relay** from sonobuoy to MOC
- **XLUUV –** Deployment of Sensor suite
- **AUWB-MN -** SOR developed

Activity

- I2I
- NMW
- ASW
- REA

REPMUS22 - REA WG

MGEOMETOC COE

CMRE

FRA NAVY

ALSEAMAR

ITA NAVY

GRAALTECH

NDL NAVY

PRT NAVY

FEUP

UAVISION

TECNOVERITAS

CEIIA

INESCTEC

ROU NAVY

ESP NAVY

SEADRONE

ROYAL NAVY

TELEDYNE

MTS

TRUST

MUS in a “safe” place away from the “real” work

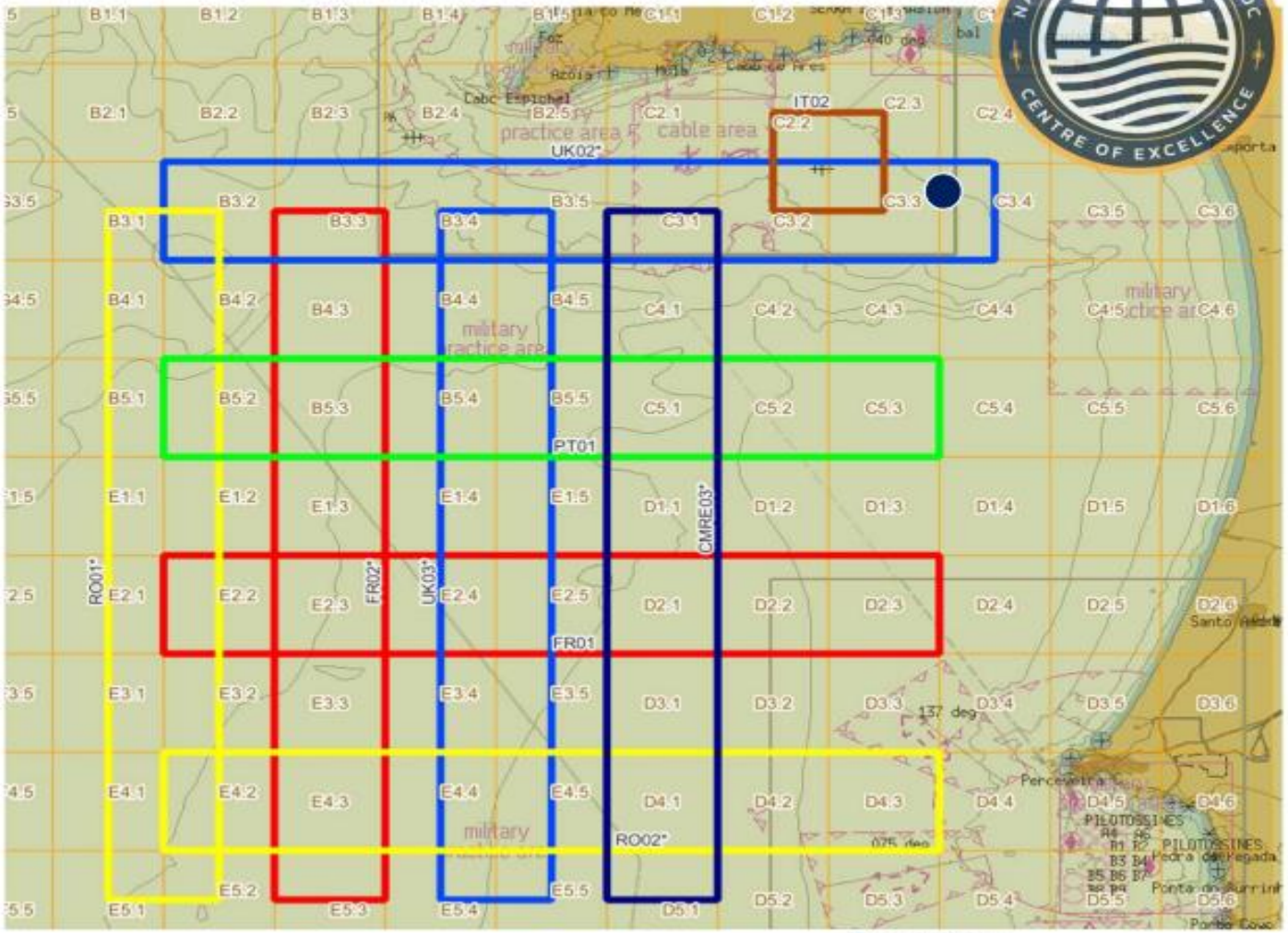
REA UXVs

REA

Vignette 7.1 REA – Supporting ASW

Oceanographic survey

- **2x POR** Gliders
- **2x FRA** Gliders;
- **1x ROM** Glider;
- **1x GBR** Glider;
- **1x CMRE** Glider;
- **1x ITA** UUV;
- **1x CMRE** Wire walker;

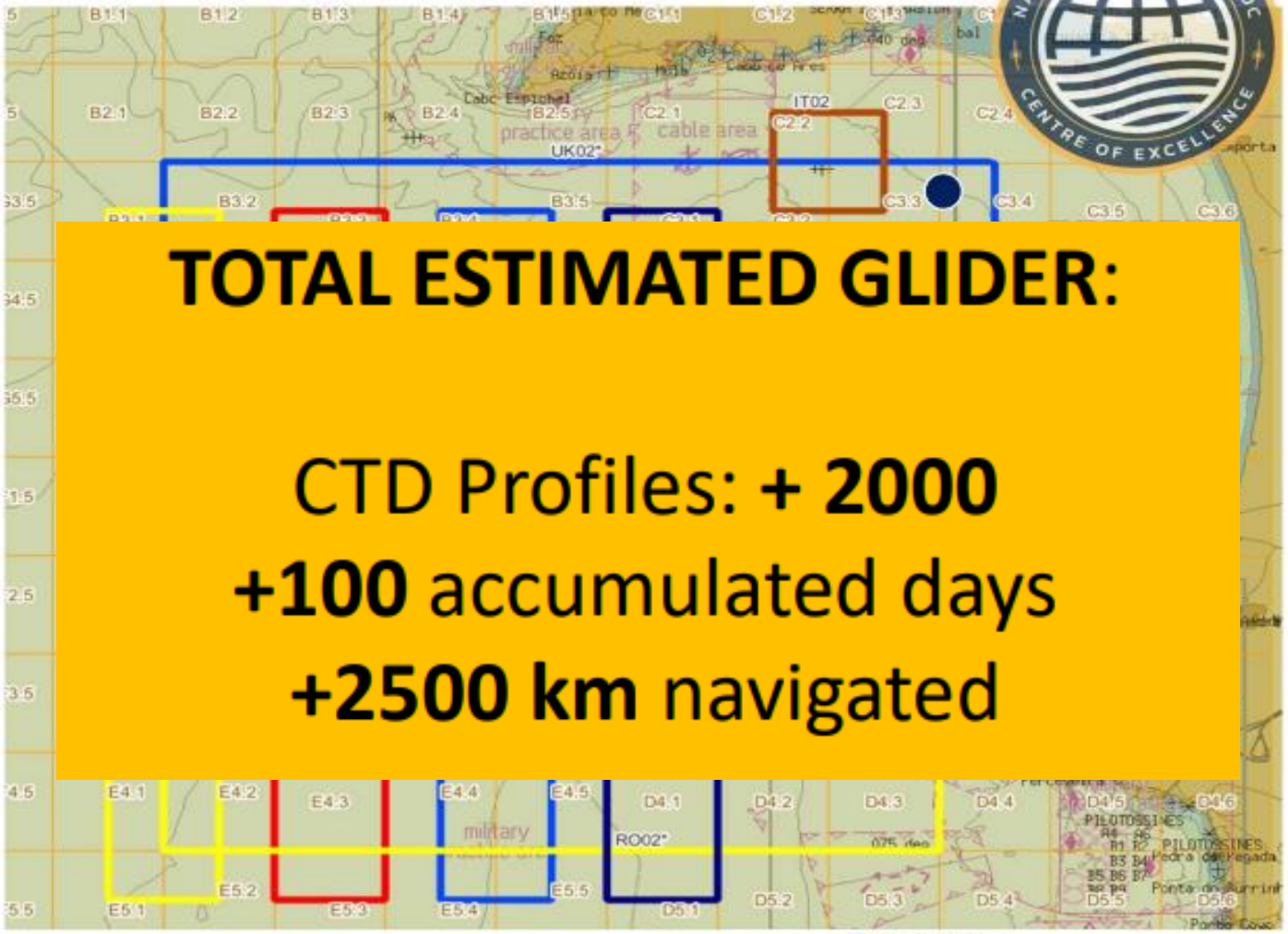


REA

Vignette 7.1 REA – Supporting ASW

Oceanographic survey

- **2x POR** Gliders
- **2x FRA** Gliders;
- **1x ROM** Glider;
- **1x GBR** Glider;
- **1x CMRE** Glider;
- **1x ITA** UUV;
- **1x CMRE** Wire walker;



TOTAL ESTIMATED GLIDER:

CTD Profiles: **+ 2000**

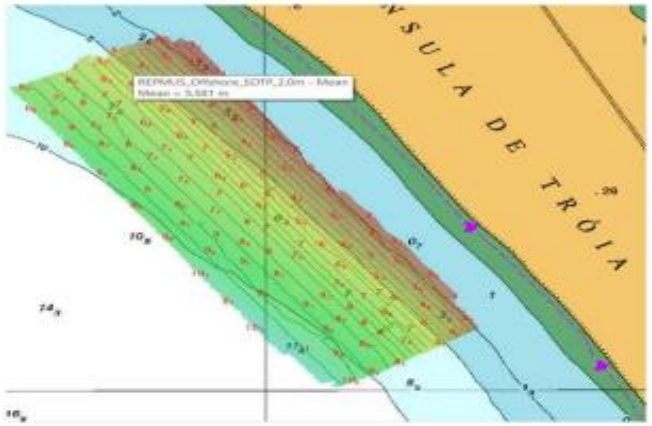
+100 accumulated days

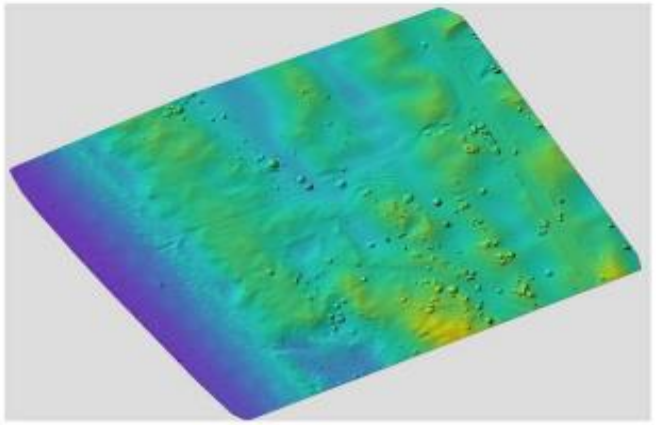
+2500 km navigated

REA

REA

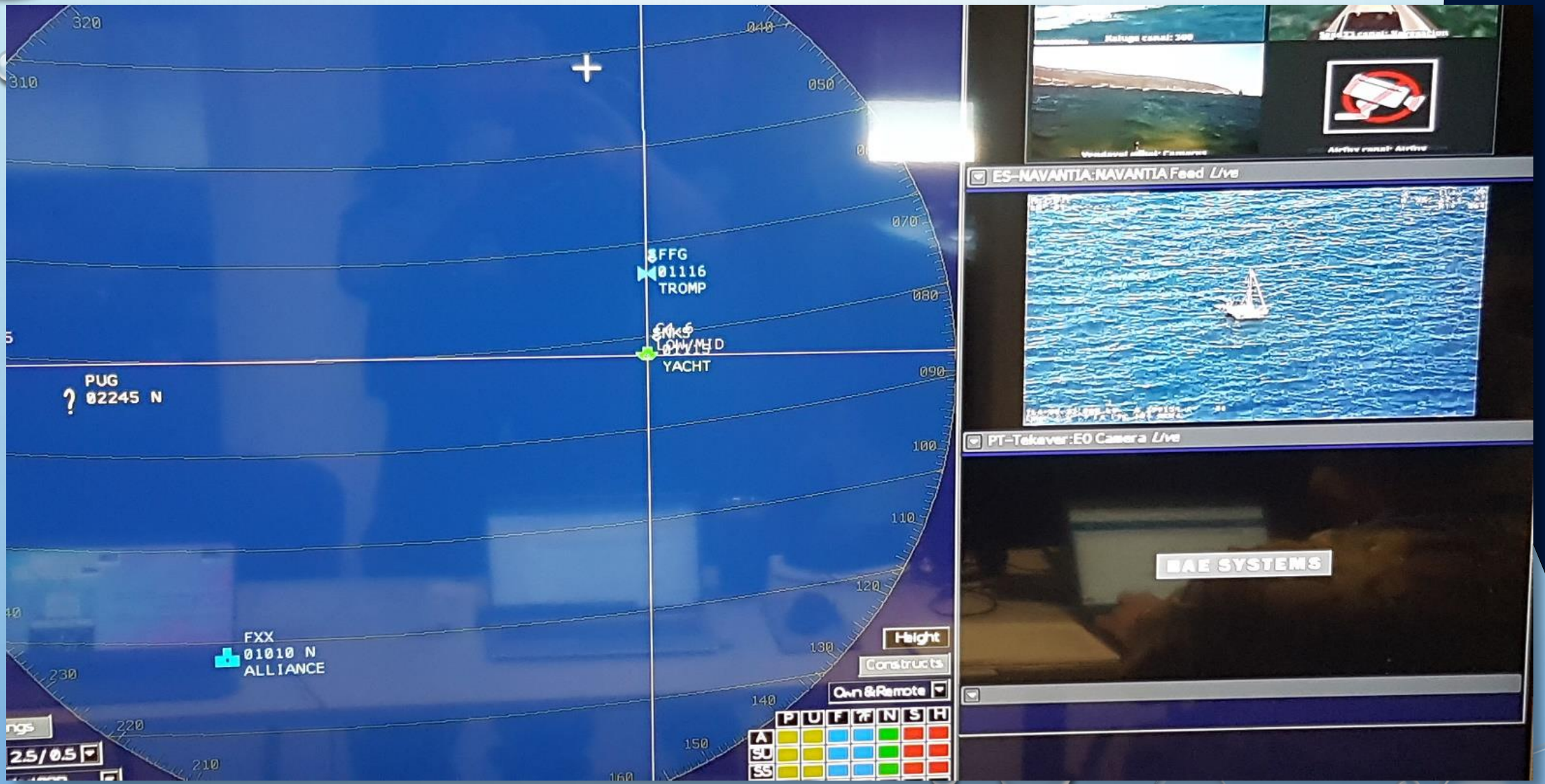
Vignette 7.2 REA – Supporting AMPHIBOPS





REA

MRCC Support to Killer Whale Attack



REPMUS 23 Timeline

04th - 09th Sep 2023	REPMUS 23 Week 1 - Set Up and Integration Week
08th Sep 2023 (TBC)	REPMUS Pre-Sail Conference(PSC)
11th - 16th Sep 2023	REPMUS 23 Week 2 – Live Serials IAW the SOE
17th – 21st Sep 2023	REPMUS 23 Week 3 – Live Serials IAW the SOE in conjunction with DYMS set up week
22nd Sep 2022	Combined REPMUS & DYMS Distinguished Visitor (DV) days

REPMUS 23 NATO Thematic Areas

- Interoperability to Interchangeability and the development of associated standards (STANAG 4817 (I2I) / NATO CATL).
- Underwater Operations, including ASW & UW communications.
- Oceanographic support including Rapid Environmental Assessment (REA).
- Stand-off Naval Mine Warfare.
- Seabed Warfare.
- Joint Common Operational Situation Awareness and C2.

Questions