Developments of multidimensional UxV motherships

Navy Tech 2025

Helsinki, 12th February 2025

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DEVELOPMENTS OF MULTIDIMENSIONAL UXV MOTHERSHIPS

MAIN TOPICS

1. UxV MOTHERSHIP DEVELOPMENT CHALLENGES
2. CURRENT FLEET TRANSFORMATIONAL VECTORS
3. NEXT GENERATION UXV MOTHERSHIPS

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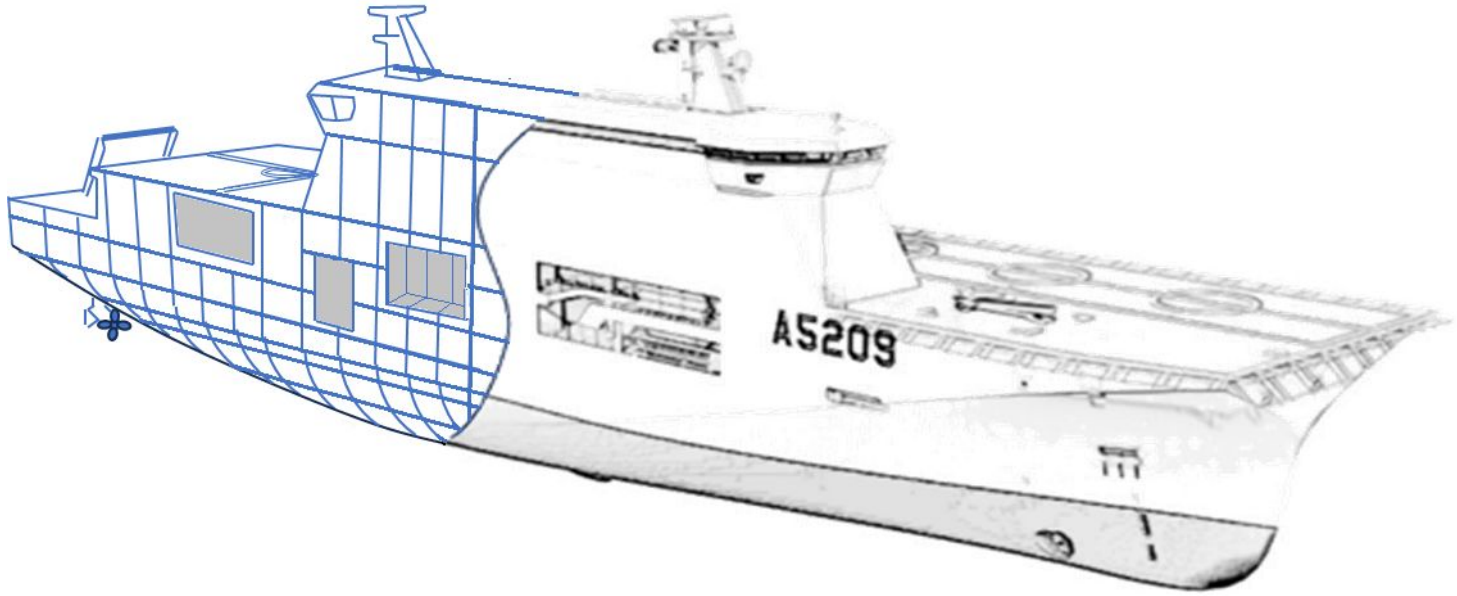
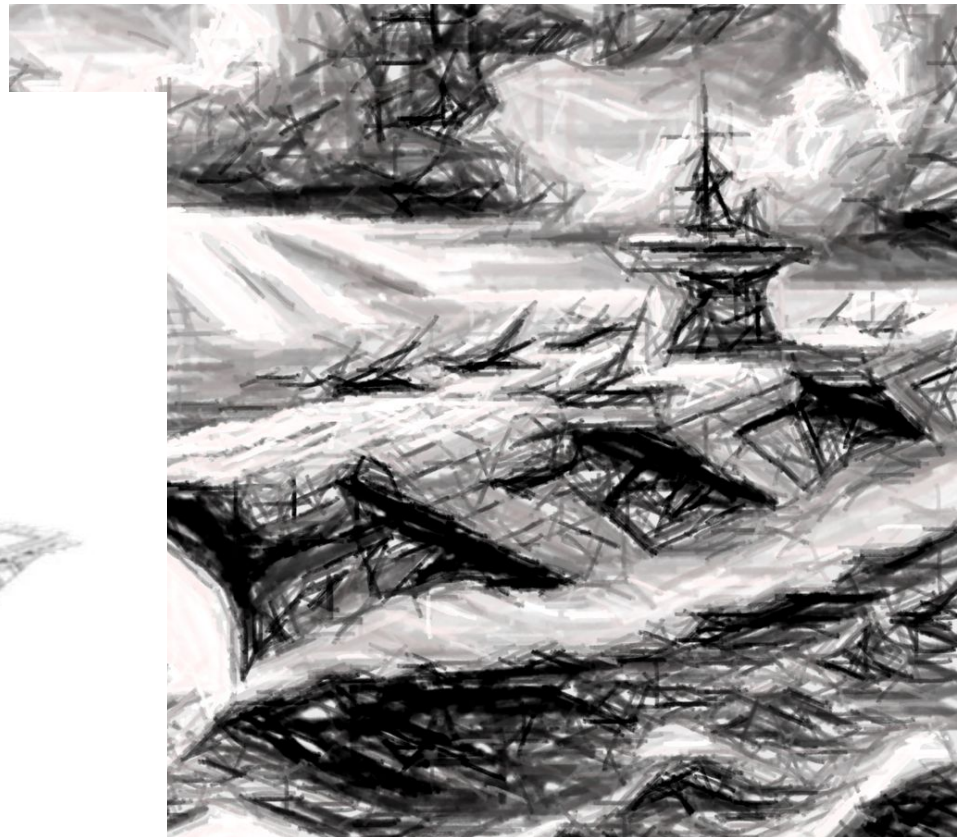




UxV Motherships…

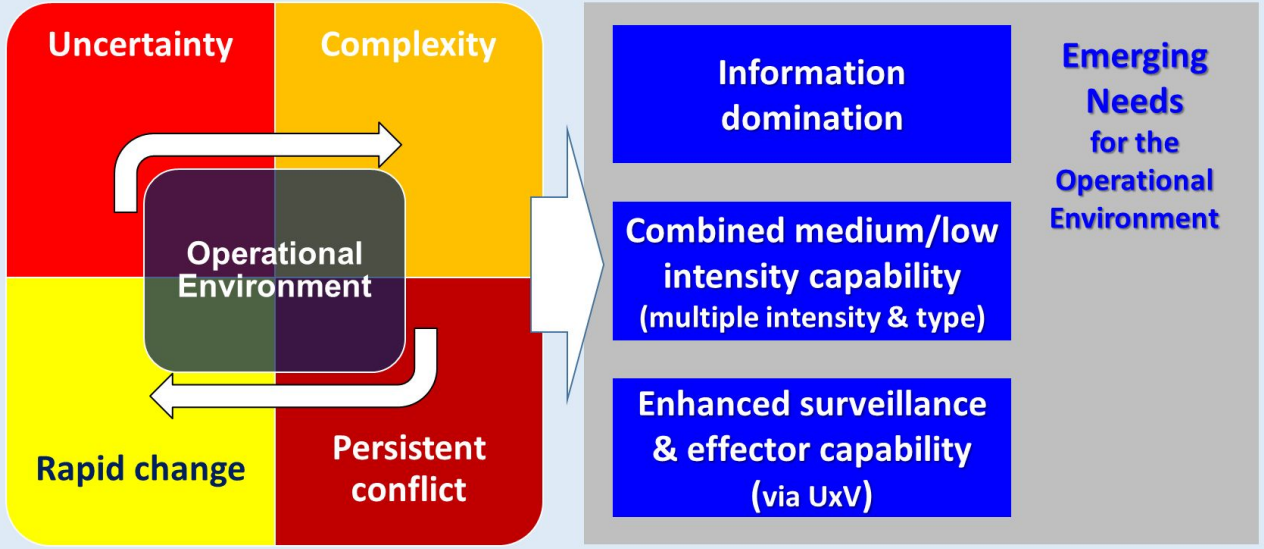
The present,…aiming at the future…

DEVELOPMENTS OF MULTIDIMENSIONAL UXV MOTHERSHIPS

THREATS AND EMERGING NEEDS SHAPING FLEET REQUIREMENTS

10 YEARS AGO…
THREATS & EMERGING NEEDS

Operational environment Threats & emerging Needs



- Information domination
- Combined medium/low intensity capability (multiple intensity & type)
- Enhanced surveillance & effector capability (via UxV)

Emerging Needs for the Operational Environment

…this was the assessment.

… THE PRESENT…AND THE FUTURE
THREATS & EMERGING NEEDS

- ???
- ???
- ???
- ???

…what to be foreseen?

DEVELOPMENTS OF MULTIDIMENSIONAL UXV MOTHERSHIPS

KEY EVOLVING NAVAL THREATS VS. EMERGING OPERATIONAL NEEDS

Threat Category	Emerging Operational Needs
Anti-Access/Area Denial (A2/AD)	▪ AI-driven counter-A2/AD tactics.
Missile Warfare	▪ Cyber disruption of missile guidance.
Unmanned Swarm Attacks	▪ AI-coordinated UxV defence.
Underwater Threats	▪ AI-coordinated ASW.
Cyber & Electronic Warfare (EW)	▪ Real-time counter-EW systems.
Space & Multi-Domain Warfare	▪ Quantum-secure communications.
Hybrid & Grey Zone Warfare	▪ Multi-layered ISR; ▪ AI-predictive threat analysis.
Energy & Infrastructure Attacks	▪ Hardened cyber-physical infrastructure.

DEVELOPMENTS OF MULTIDIMENSIONAL UXV MOTHERSHIPS

KEY EVOLVING NAVAL THREATS VS. EMERGING OPERATIONAL NEEDS

Correlation of Threat Evolution, Operational Needs, and Critical Technologies

1. **Rise of Hypersonic & AI-Guided Threats**
   - Faster Decision Loops
   - **AI-Driven Defensive Systems**
2. **Increase in UxV Swarm Warfare**
   - Manned-Unmanned Teaming (MUM-T)
   - **AI-Swarm Countermeasures**
3. **Cyber & Space-Based Warfare**
   - Multi-Domain Operations
   - **Quantum-Secure Communications**
4. **Underwater Autonomous Threats**
   - **Persistent ISR & UUV-ASW**
5. **Hybrid & Asymmetric Attacks**
   - **Predictive AI for Situational Awareness**

The future **operational environment** will require capabilities on:

- **High speed decision-making**
- **Distributed and autonomous defences**
- **Multi-domain dominance**

Raising as **critical technologies** to naval superiority:

- **AI**
- **Directed Energy**
- **Unmanned Integration**

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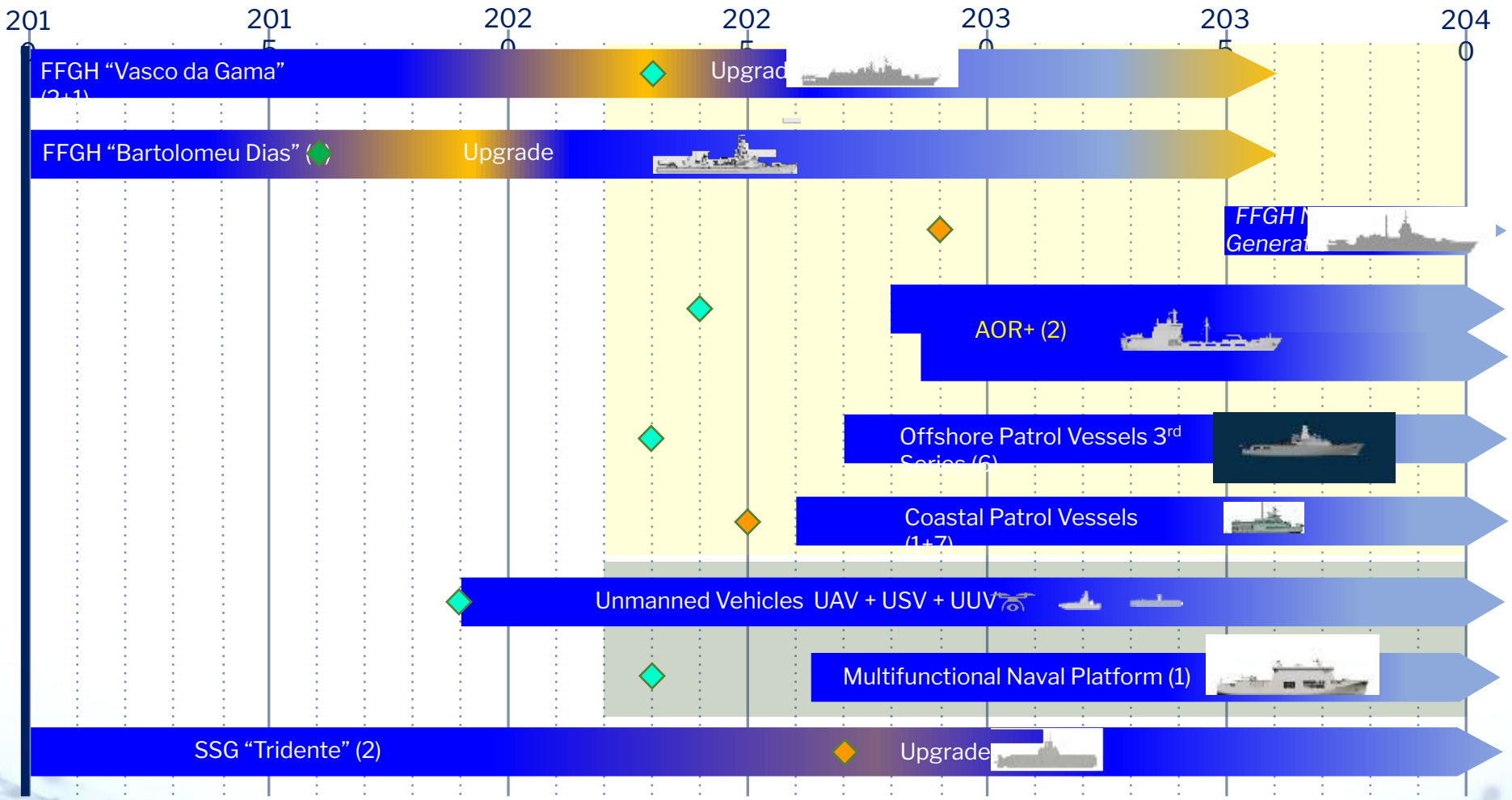
DEVELOPMENTS OF MULTIDIMENSIONAL UXV MOTHERSHIPS

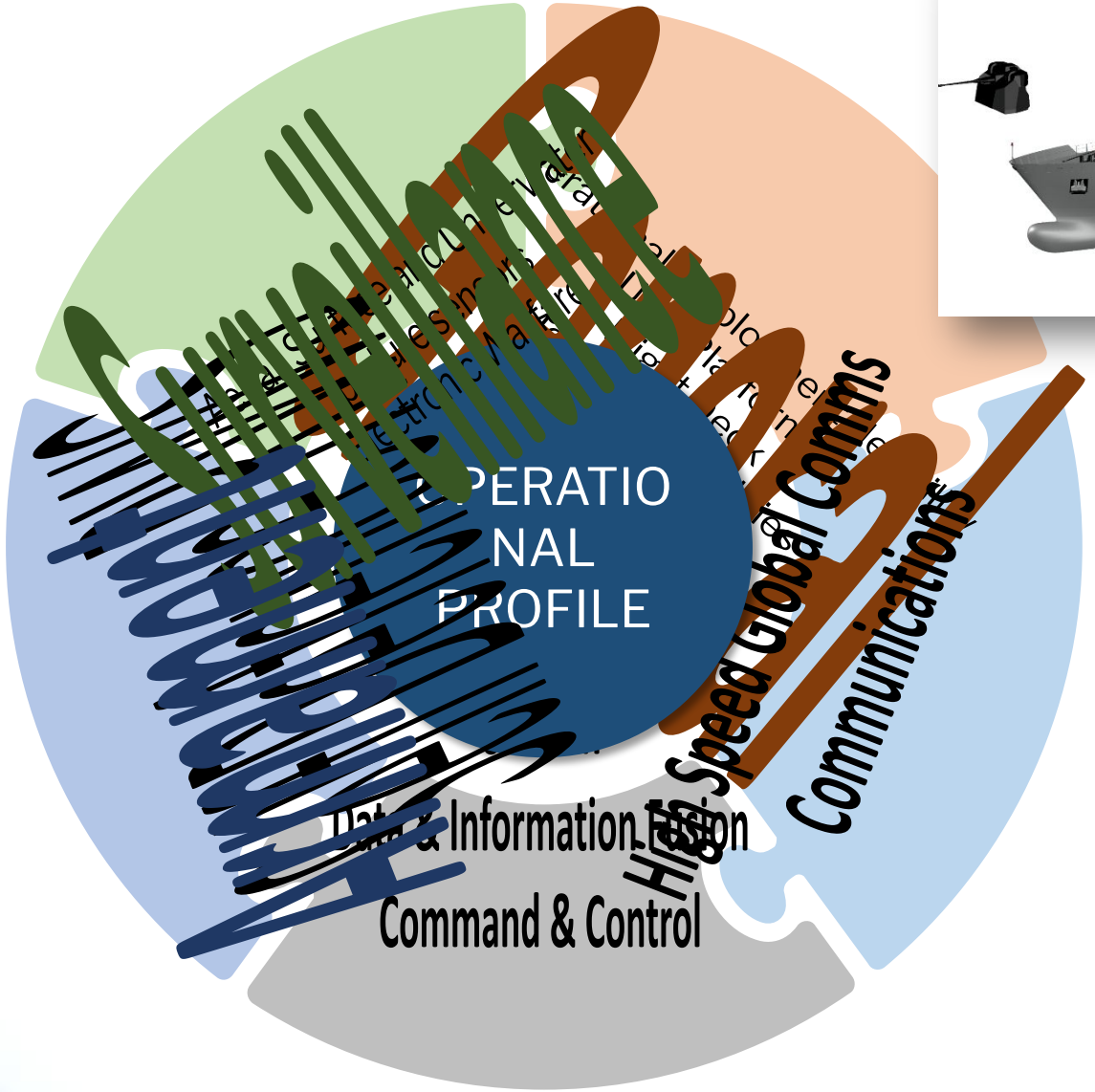
GENETIC PROGRAMS AS VECTORS FOR TRANSFORMATION



Offshore Patrol Vessel 3rd Batch

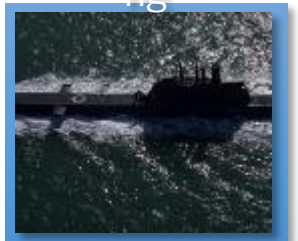
DEVELOPMENTS OF MULTIDIMENSIONAL UXV MOTHERSHIPS

OFFSHORE PATROL VESSELS 3RD BATCH: CAPABILITIES

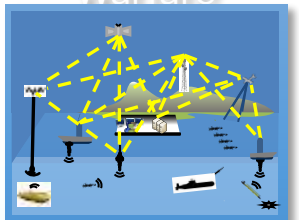


Mine Launching

Anti-Mine Warfare



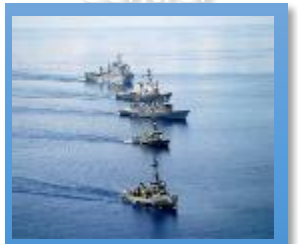
ASW



Unmanned Vehicles

Pollution Control

Special Operations



Naval Operations

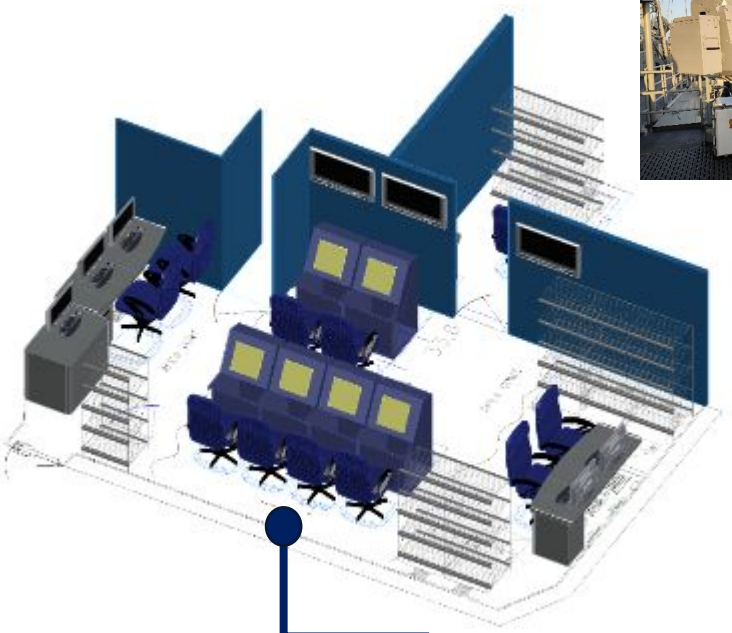
Force Projection

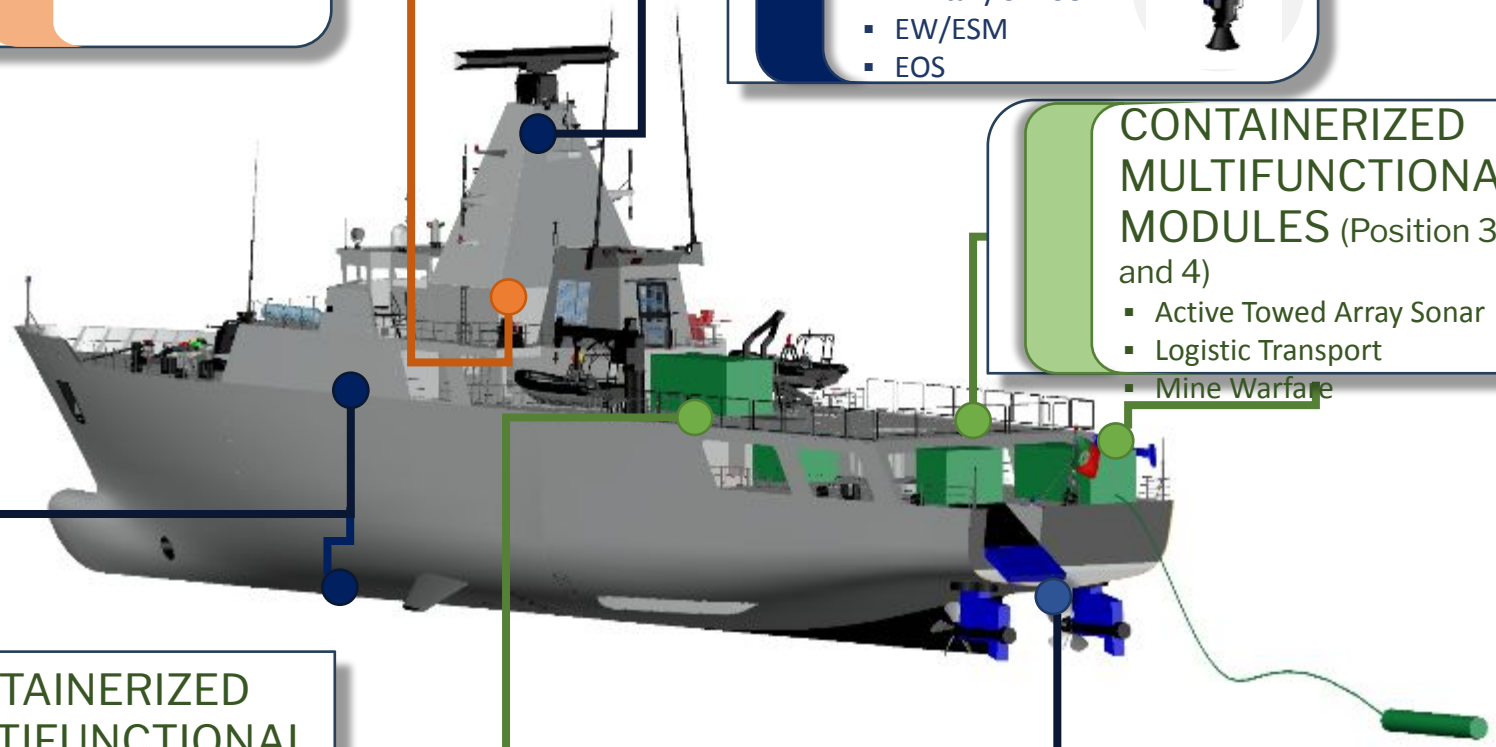
DEVELOPMENTS OF MULTIDIMENSIONAL UXV MOTHERSHIPS

OPV 3RD BATCH: SURVEILLANCE & MODULAR CAPABILITIES

WEAPONS
2x 12.7mm RWS
w/EOS Director

SENSORS
- Navigation Radars
- Combined Warning Radar
- IFF & ADS-B
- Tactical Data Link
- Military SATCOM
- EW/ESM
- EOS





CONTAINERIZED MULTIFUNCTIONAL MODULES (Position 3 and 4)
- Active Towed Array Sonar
- Logistic Transport
- Mine Warfare

COMMAND & CONTROL
- Combat Management System (CMS)
- UXV Command & Control
- Internal Battle Management System
- Integrated Comms Control System (ICCS)
- Underwater Comms

CONTAINERIZED MULTIFUNCTIONAL MODULES (Position 1 and 2)
- Hyperbaric chamber
- Assault craft

MULTIUSE RAMP
- Mine launching
- Inflatable boat launch
- UxV deployment

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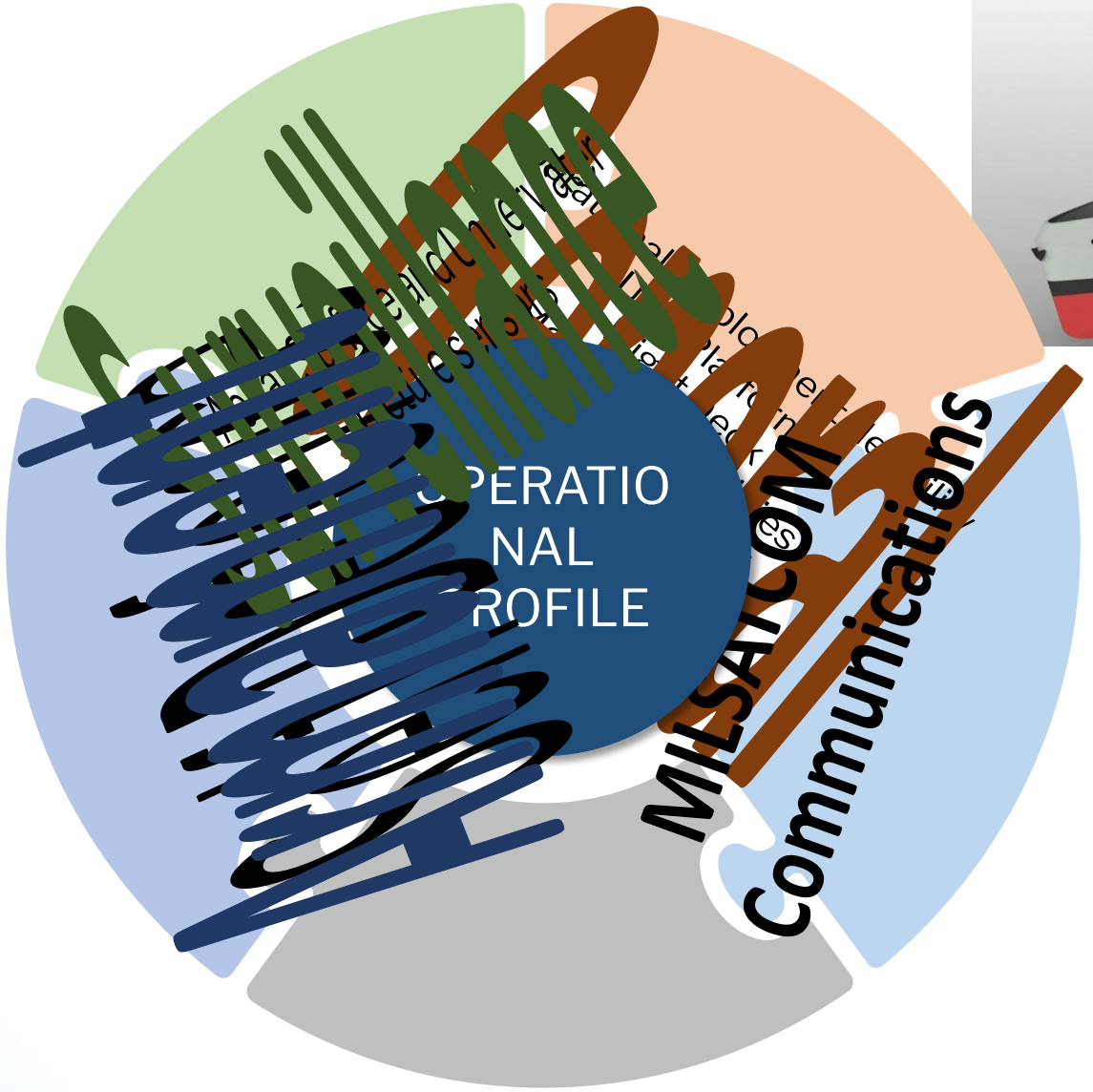
DEVELOPMENTS OF MULTIDIMENSIONAL UXV MOTHERSHIPS

FLEET TRANSFORMATIONAL VECTORS

Coastal Patrol Vessel

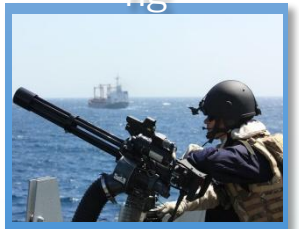
DEVELOPMENTS OF MULTIDIMENSIONAL UXV MOTHERSHIPS

COASTAL PATROL VESSELS: CAPABILITIES

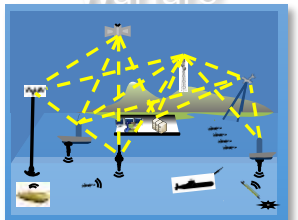


Mine Launching

Anti-Mine Warfare



Anti-Piracy



Unmanned Vehicles

Pollution Control

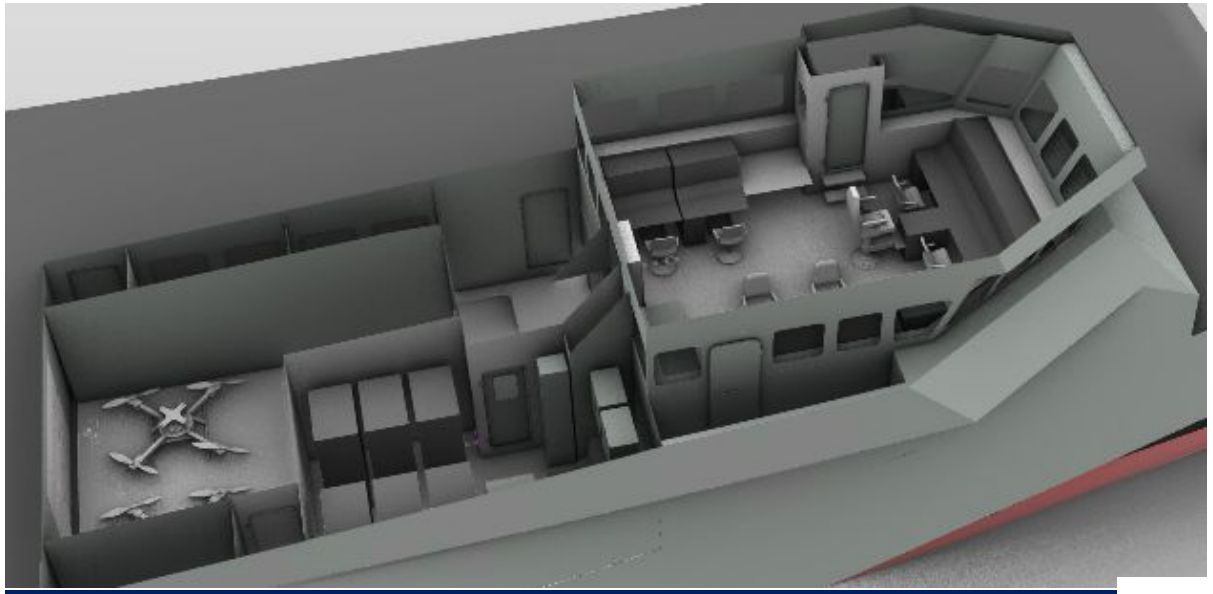
Special Operations

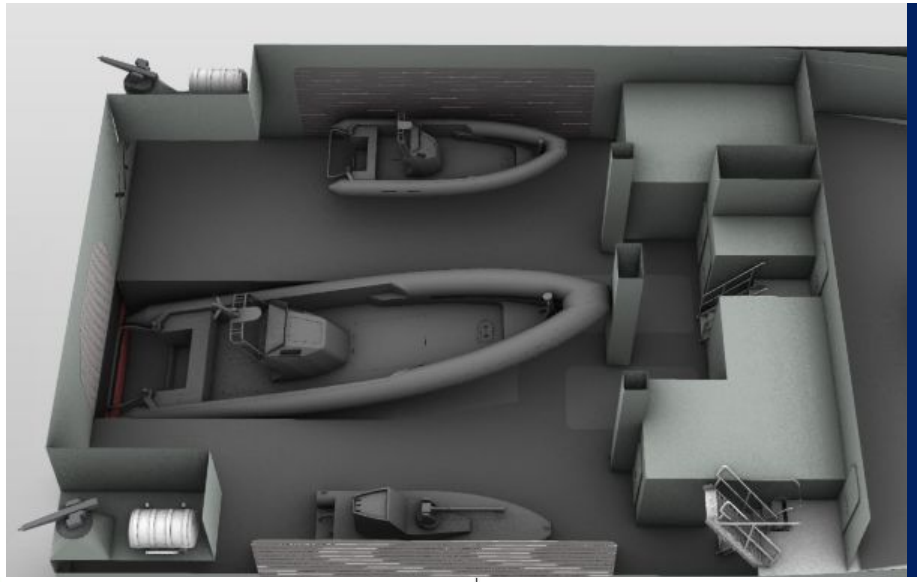
Naval Operations

Force Projection

DEVELOPMENTS OF MULTIDIMENSIONAL UXV MOTHERSHIPS

COASTAL PATROL VESSELS: CONCEPT FEATURES

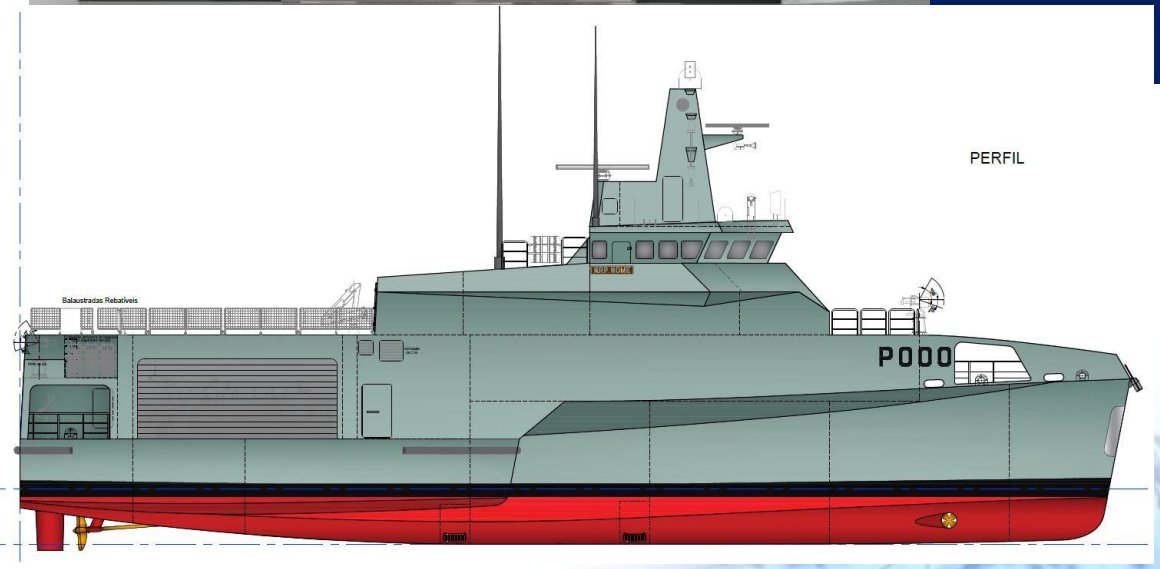




Fast deployment & projection of:

- Large interceptor RHIB
- two 7 metre-long RHIB / USV

- ❑ Disruptive and innovative conc
  Multi-task surveillance vessel;
- ❑ Fast deployment of large interceptor RHIB up to 13m;
- ❑ Fast deployment of 7m long U
  Landing/take-off runway 25 meters long for U
  Integrated bridge with 360 vis
  Hangar for U
  Multimission bay;
- ❑ Hybrid propuls
  Small crew (13 pax) + 16 pax extra-crew;



DEVELOPMENTS OF MULTIDIMENSIONAL UXV MOTHERSHIPS

FLEET TRANSFORMATIONAL VECTORS

DEVELOPMENTS OF MULTIDIMENSIONAL UXV MOTHERSHIPS

AOR+: CAPABILITIES

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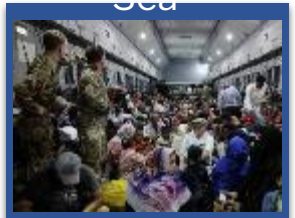
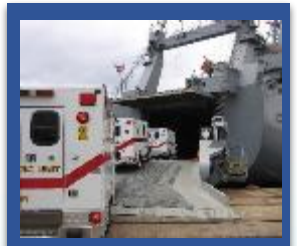
Humanitarian Assistance

Search And Rescue at Sea

Disaster Relief

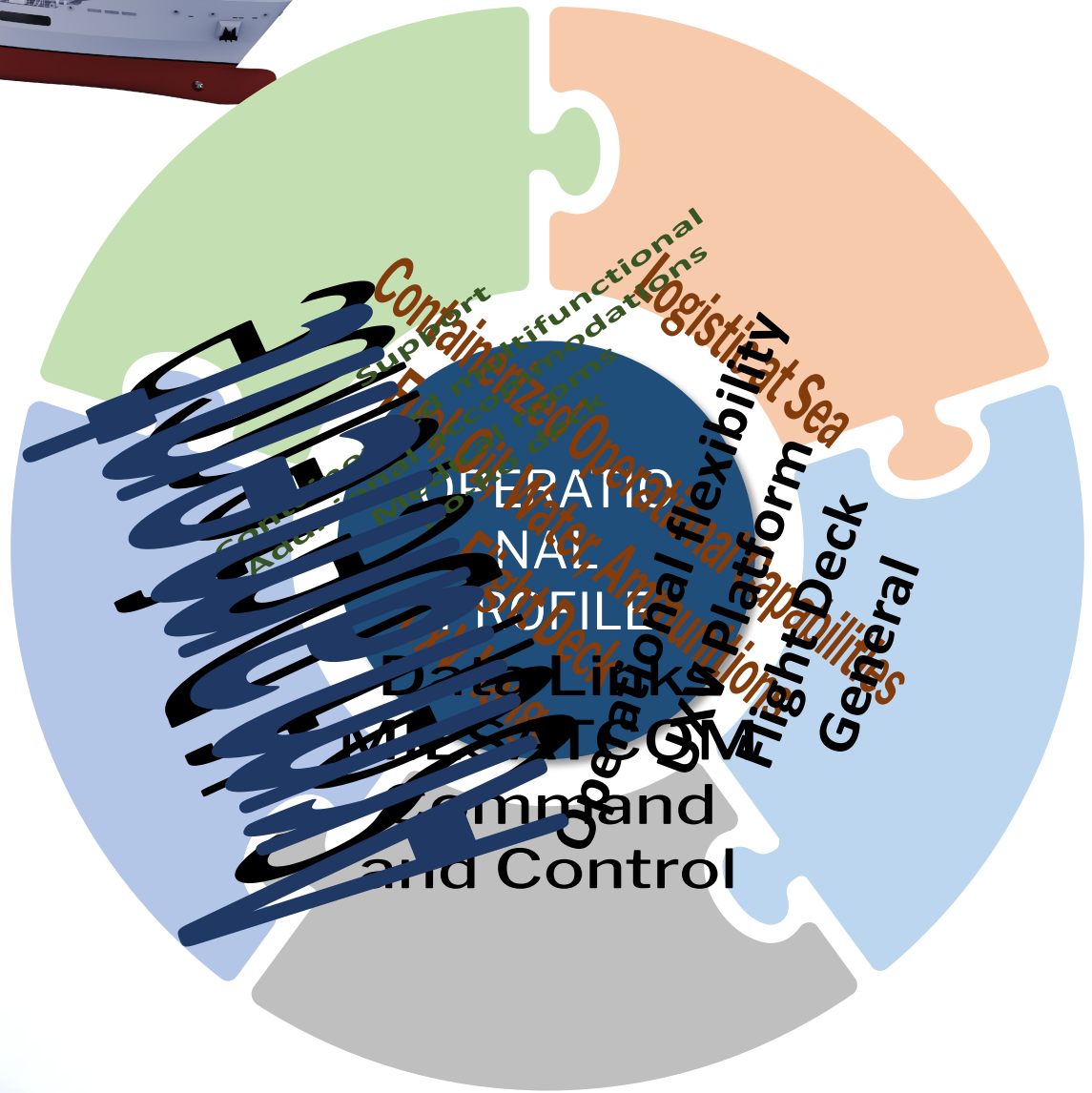


Citizens Evacuation



Medical Evacuation

Sanitary Support



Replenishment At Sea

Naval Operations

Diving Support

Helicopter Operations

Unmanned Vehicles

Force Projection & Special Ops

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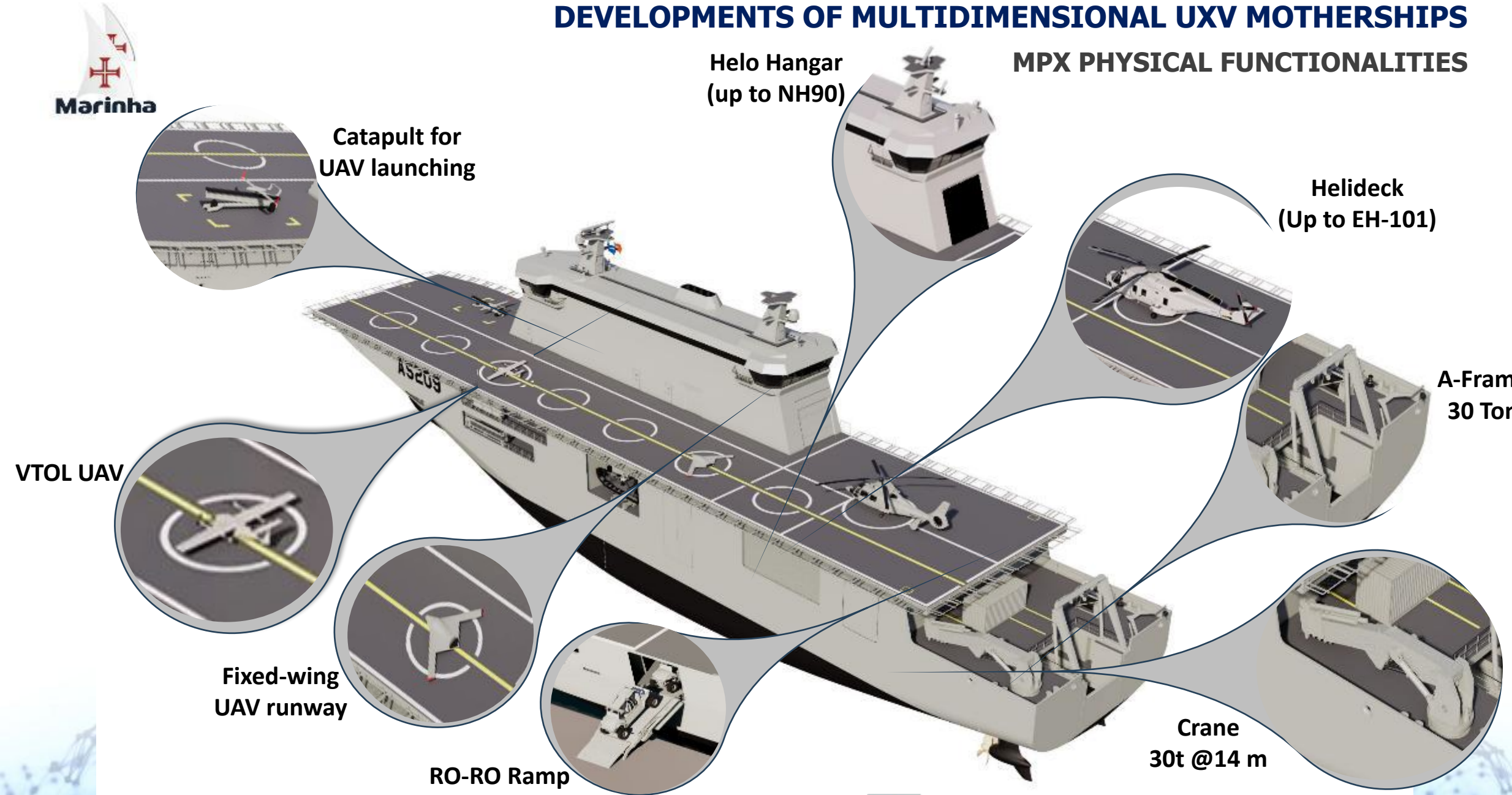
DEVELOPMENTS OF MULTIDIMENSIONAL UXV MOTHERSHIPS

FLEET TRANSFORMATIONAL VECTORS

MULTI-PURPOSE SUPPORT SHIP (MPX)

DEVELOPMENTS OF MULTIDIMENSIONAL UXV MOTHERSHIPS

MPX PHYSICAL FUNCTIONALITIES



* Vertical take-off and Landing

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DEVELOPMENTS OF MULTIDIMENSIONAL UXV MOTHERSHIPS

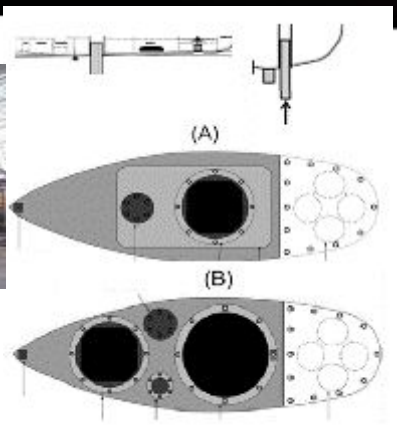
MPX FUNCTIONALITIES

Stern Slipway

Dynamic Positioning DP 1

Azimuthal thrusters

Drop Keel for Scientific Equipment deployment



Bow thruster

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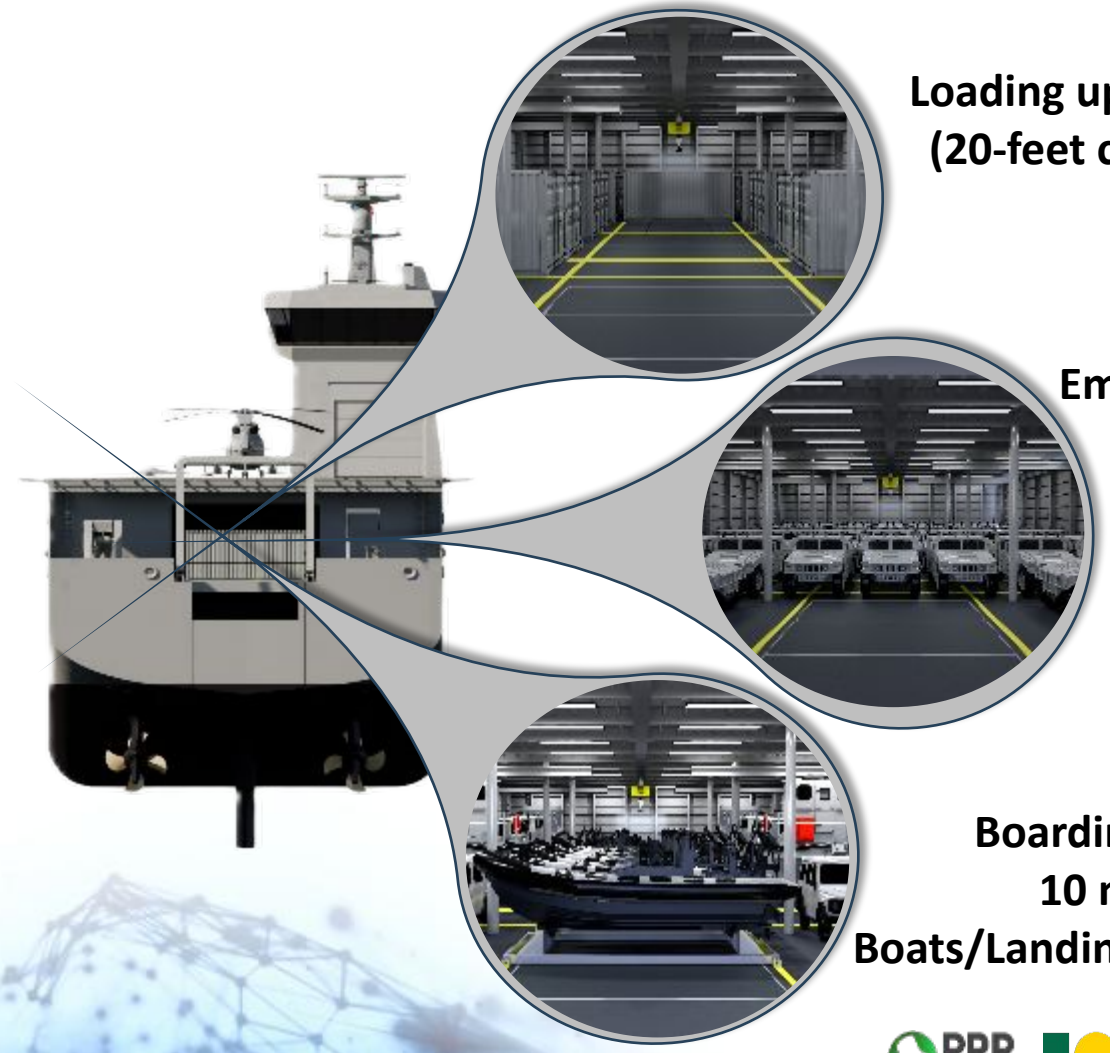
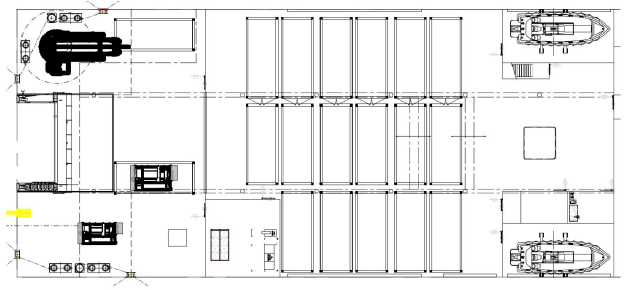
Ship's capabilities to embark and transport material



Loading up to 18 TEU (20-feet containers)

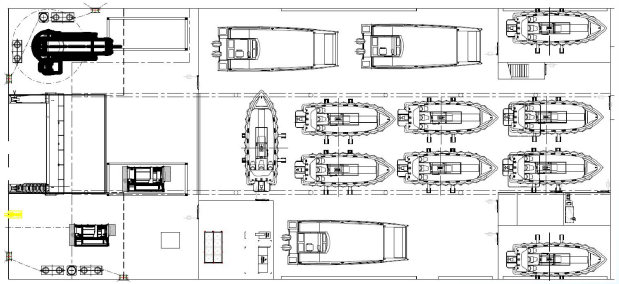


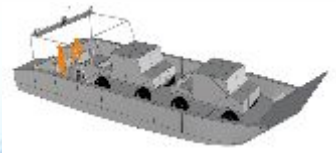
Or

Embarking up to 18 Vehicles (ambulances)

Or

Boarding up to 10 more Boats/Landing craft/RHIB's





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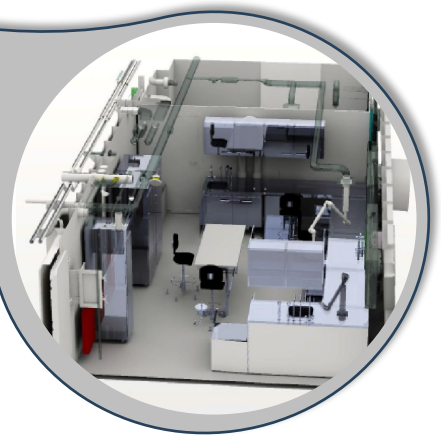
DEVELOPMENTS OF MULTIDIMENSIONAL UXV MOTHERSHIPS

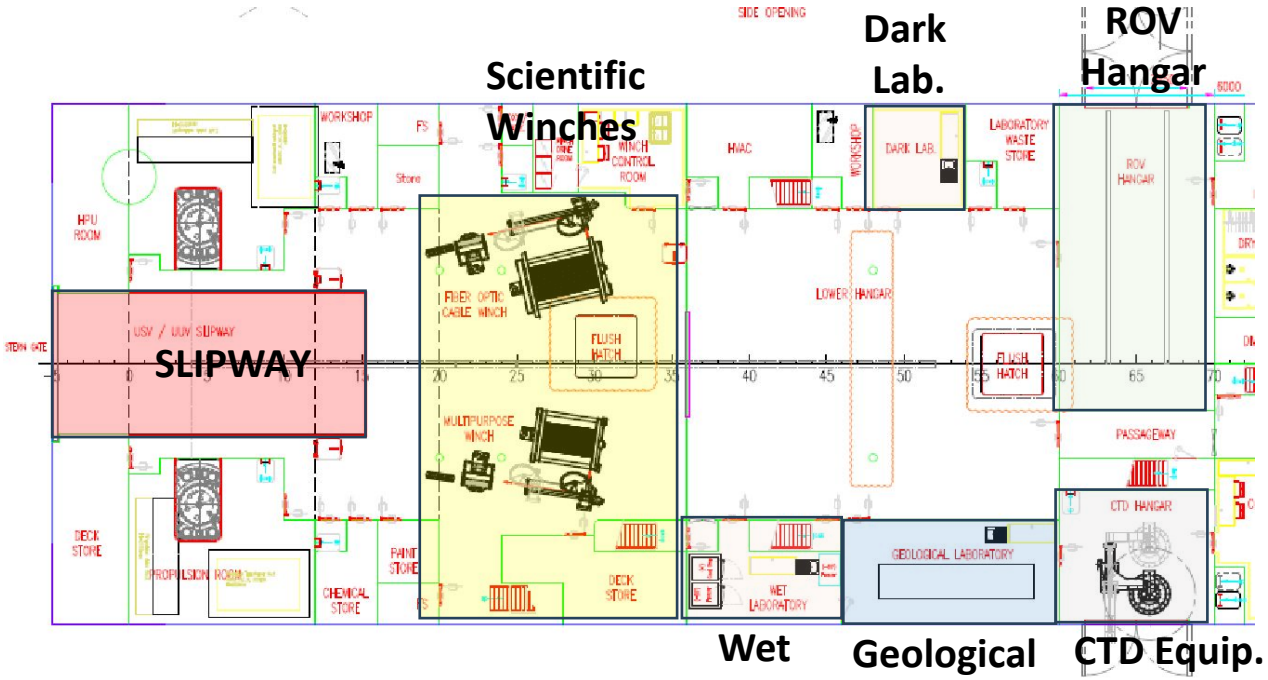
Scientific capabilities

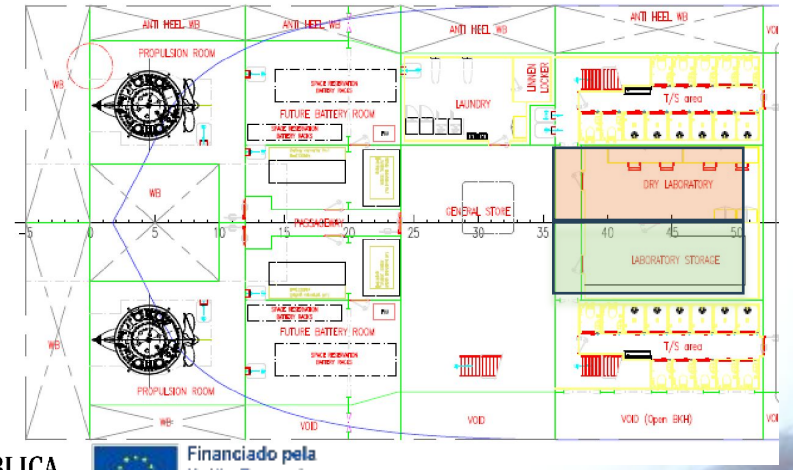
ROV Luso

CTD Equipment *



MPX CAPABILITIES





Dry Lab.

Storage Lab.

* **C**onductivity, **T**emperature and **D**epth

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DEVELOPMENTS OF MULTIDIMENSIONAL UXV MOTHERSHIPS

MPX EXTERNAL INTEGRATION

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EMODnet
European Marine Observation and Data Network

Dig

GPS
GALILEO
GLONASS

Copernicus
Europe's eyes on Earth

GALILEO

Marinha
CEOM / ZLT
DN

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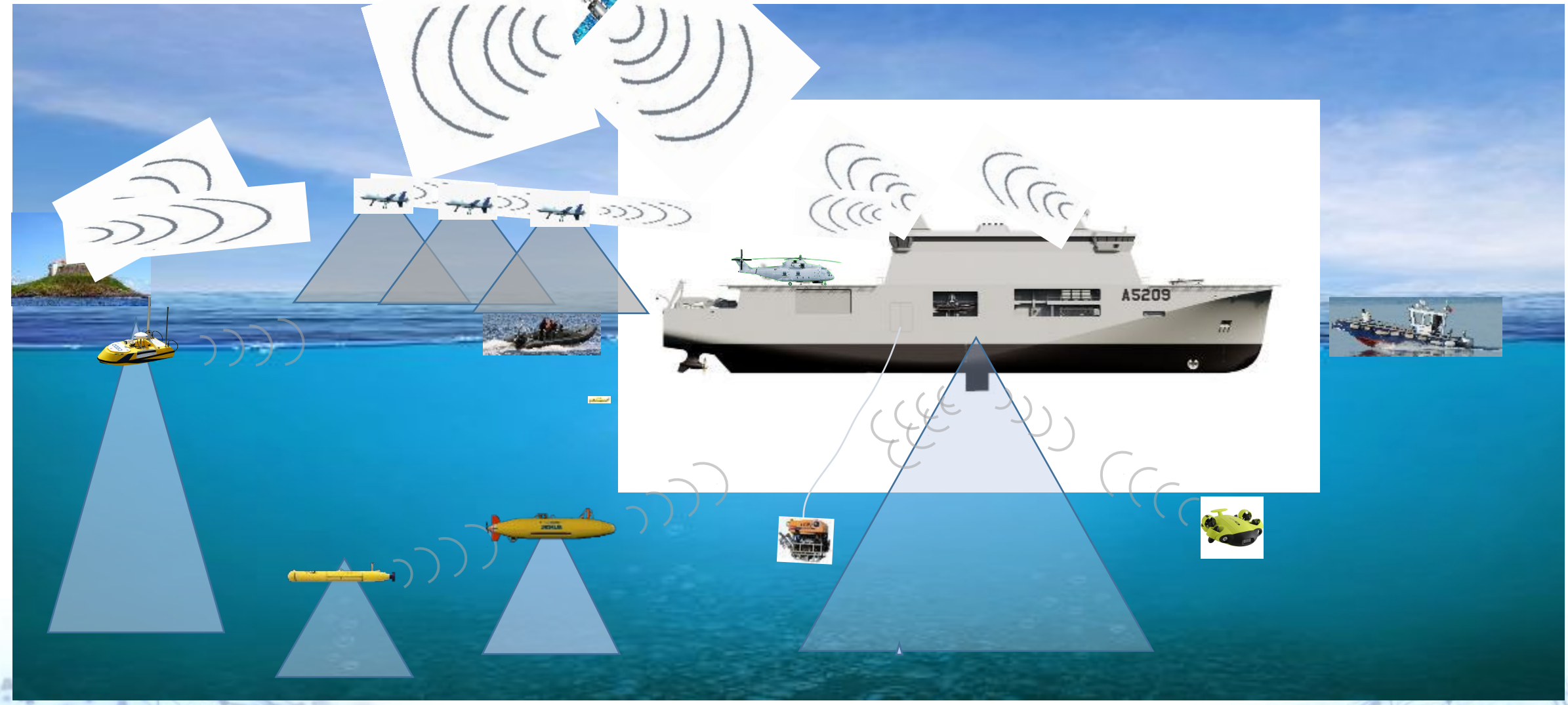
DEVELOPMENTS OF MULTIDIMENSIONAL UXV MOTHERSHIPS

MPX MULTI-DOMAIN OPERATIONS



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DEVELOPMENTS OF MULTIDIMENSIONAL UXV MOTHERSHIPS

MAIN TOPICS

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2. CURRENT FLEET TRANSFORMATIONAL VECTORS
3. NEXT GENERATION UXV MOTHERSHIPS

DEVELOPMENTS OF MULTIDIMENSIONAL UXV MOTHERSHIPS

KEY EVOLVING WARSHIP REQUIREMENTS

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Requirement	Present (2020s)	Future (2030s-2050s)
Fleet Structure	▪ Large, centralized battle groups with multi-role ships.	▪ Distributed, networked fleets with modular, unmanned assets.
Hull Design	▪ Traditional steel-based;	▪ Lightweight composites; ▪ Adaptive modular hulls, reconfigurable platforms.
Stealth & Survivability		▪ self-healing materials.
Propulsion & Power Systems		▪ AI-optimized hybrid-electric.
Crew & Automation		▪ Minimal or autonomous ships;
Weapons & Firepower		▪ UM-T). ▪ AI-coordinated swarm attacks.
Sensor & Detection Systems		▪ s); ▪ ng, quantum radar;
C4ISR & Decision-Making		▪ AI-driven real-time decision-making, predictive analytics;
Unmanned & Autonomous Systems		▪ Full integration of UxV swarms for combat, logistics, ISR, and cyber warfare.
Cyber & Electronic Warfare (EW)		▪ Cognitive electronic warfare.
Logistics & Sustainment		▪ ce; ▪ Predictive AI-based maintenance; ▪ Self-repairing systems.
Cost & Construction	▪ Long, expensive shipbuilding cycles (10+ years).	▪ Agile, modular production; ▪ 3D printing, automated shipbuilding; ▪ Cost-effective UxV motherships.

Requirement	Future (2030s-2050s)
Hull Design	▪ Adaptive modular hulls, reconfigurable platforms.
Propulsion & Power Systems	▪ AI-optimized hybrid-electric.
Crew & Automation	▪ Minimal or autonomous ships;
Weapons & Firepower	▪ AI-coordinated swarm attacks.
C4ISR & Decision-Making	▪ AI-driven real-time decision-making, predictive analytics;
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Logistics & Sustainment	▪ Predictive AI-based maintenance; ▪ Self-repairing systems.
Cost & Construction	▪ Cost-effective UxV motherships.

DEVELOPMENTS OF MULTIDIMENSIONAL UXV MOTHERSHIPS

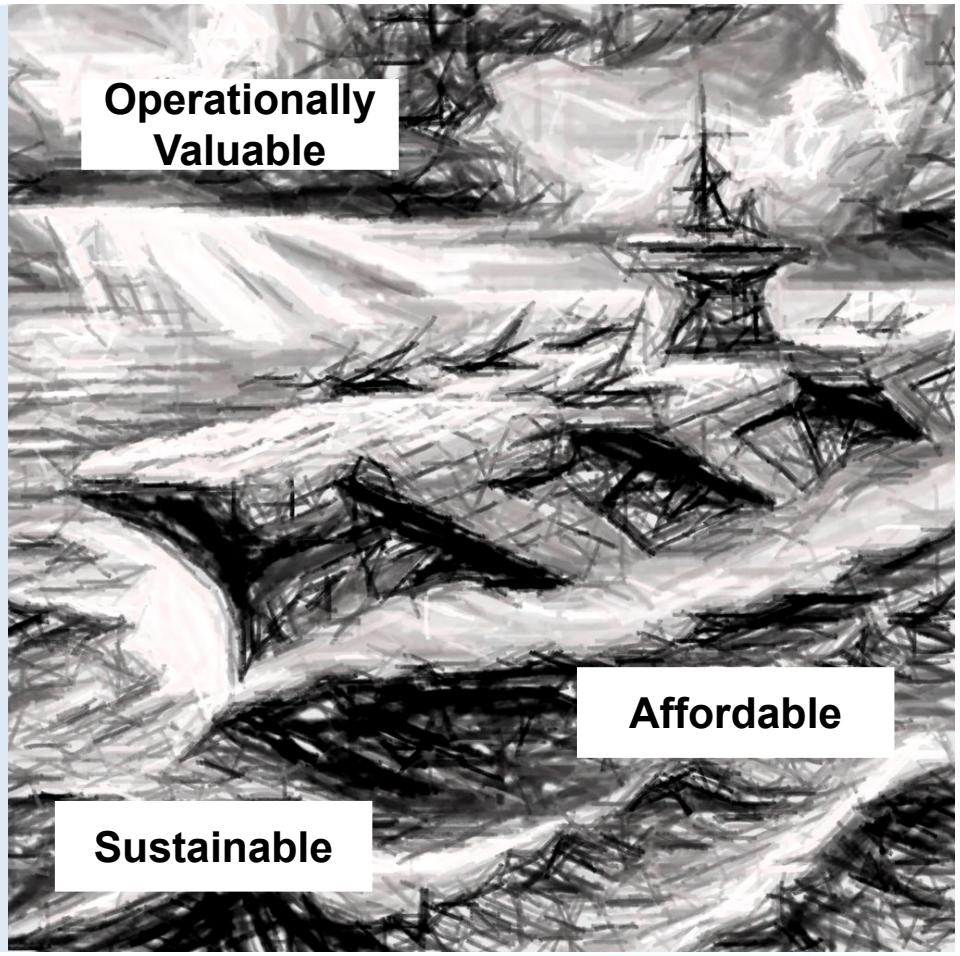
FUTURE AFFORDABLE, SUSTAINABLE, AND OPERATIONALLY VALUABLE UXV WARSHIP

Future UxV Warship

(Based on the **correlation of evolving naval threats and emerging operational needs**)

- Cost-effective
- Scalable
- Multi-domain warfare operation
- Force multiplier

- Autonomous naval platform
- Cost-effective modularity
- AI-driven decision-making
- Light-crewed

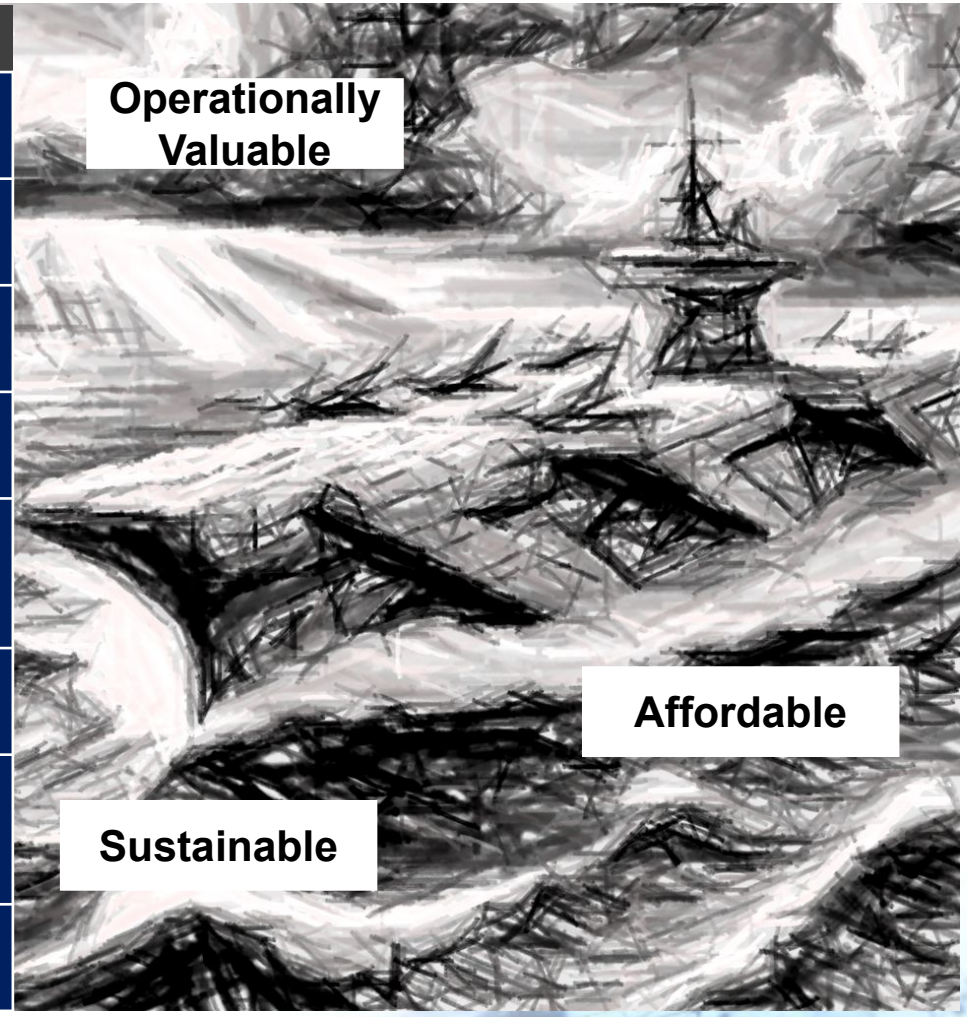


DEVELOPMENTS OF MULTIDIMENSIONAL UXV MOTHERSHIPS

FUTURE AFFORDABLE, SUSTAINABLE, AND OPERATIONALLY VALUABLE UXV WARSHIP

Future UxV Mothership Key Design Characteristics

Design Factor	UxV Warship Features
Hull & Structure	Modular, lightweight composite hull for reconfiguration and longevity.
Size & Crew	80-150 crew (depending on profile mission); Minimized via AI & automation.
Propulsion & Power	Hybrid-electric or next-gen battery tech for endurance.
Stealth & Survivability	AI-driven electronics; Countermeasures.
Weapons & Defences	Directed energy weapons (DEWs); UxV swarms; AI-coordinated soft-kill EW.
Unmanned System Integration	Carrier for UAV, USV and UUV; Autonomous launch & recovery systems.
C4ISR & Decision-Making	AI-driven battle management; Real-time predictive analytics; Quantum-secure communications.
Autonomous Logistics & Maintenance	AI-monitored self-repair; Autonomous predictive maintenance.

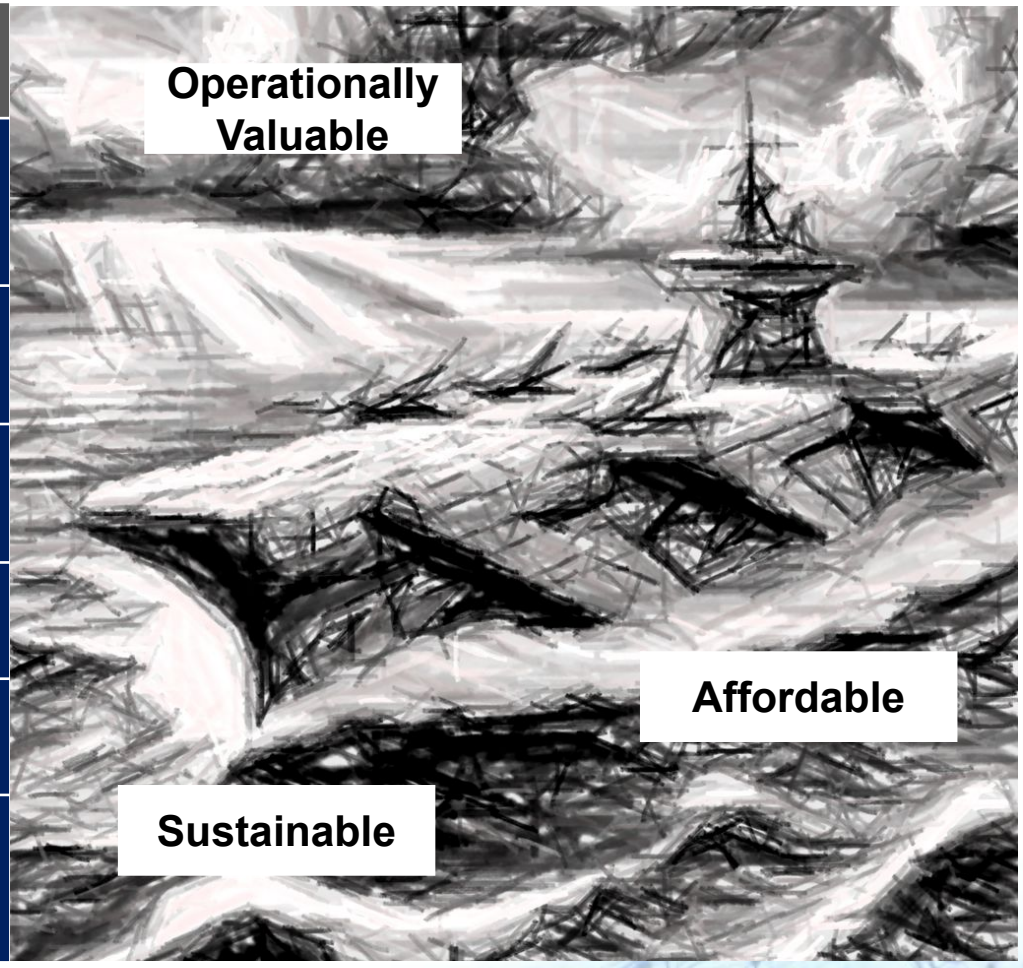


DEVELOPMENTS OF MULTIDIMENSIONAL UXV MOTHERSHIPS

FUTURE AFFORDABLE, SUSTAINABLE, AND OPERATIONALLY VALUABLE UXV WARSHIP

Future UxV Mothership Procurement Cost

Cost Component	Cost (%)	Cost Optimization Strategies
Structural, Auxiliary, Outfitting (incl. Design)	15%	Lightweight composites; **Modular construction;** 3D printing.
Propulsion & Power Systems	10%	**Hybrid-electric; AI-optimized fuel efficiency.**
Unmanned Systems (UxV)	20%	UAVs, USVs, UUVs with AI coordination and swarming capabilities.
Weapons & Defence Systems	20%	Directed energy weapons (DEWs); **AI-based CIWS.**
C4ISR & AI Battle Management	20%	**AI-driven real-time analytics;** Quantum-secure communications.
Cyber & Electronic Warfare	15%	**AI-driven EW;** Autonomous cyber defence; **Multi-domain operations.**



DEVELOPMENTS OF MULTIDIMENSIONAL UXV MOTHERSHIPS

NEW GENERATION FFG (OR UXV MOTHERSHIP) CHALLENGES

1. Command, Control & Autonomy
- Seamless UxV Integration with Ship Systems
- Advanced Autonomy & Human Oversight
- Unmanned-Manned Teaming (UMT).

2. Communication & Network Security
- Secure & Resilient Communication
- Interoperability Across Platforms
- Cybersecurity & Electronic Warfare Resilience

3. Launch, Recovery & Handling of UxV
- Safe & Efficient Deployment and Retrieval
- Adaptability for Different UxV

4. Power & Energy Management
- High Power Demand for UxV
- Energy-Efficient Propulsion

5. Modularity & Future-Proofing
- Rapid Technology Evolution
- Space Optimization

6. Survivability & Self-Defence
- Low Observability & Stealth
- Defence Against Swarm Attacks
- Damage Control & Redundancy

7. Logistics & Sustainment
- Onboard Maintenance & Repair of UxV
- Replenishment at Sea (RAS) for UxV

8. Cost & Scalability
- Affordability vs. Capability
- Scalable Fleet Integration

DEVELOPMENTS OF MULTIDIMENSIONAL UXV MOTHERSHIPS

FUTURE AFFORDABLE, SUSTAINABLE, AND OPERATIONALLY VALUABLE UXV WARSHIP

The Future UxV Mothership???

Final Thoughts

The UxV Naval Mothership concept represents a **massive technological leap**, requiring advancements in:

- **AI**;
- **Autonomy**;
- **Modularity**;
- **Stealth**, and
- **Power systems**.

AI-Generated…

Developments of multidimensional UxV motherships

Navy Tech 2025

Helsinki, 12th February 2025

Marinha