

# Technology serving **People & Planet**

"WONDER, IMAGINE, DISCOVER"



**aselsan**

**UNMANNED VEHICLE (UxV) SOLUTIONS  
for NAVAL WARFARE**

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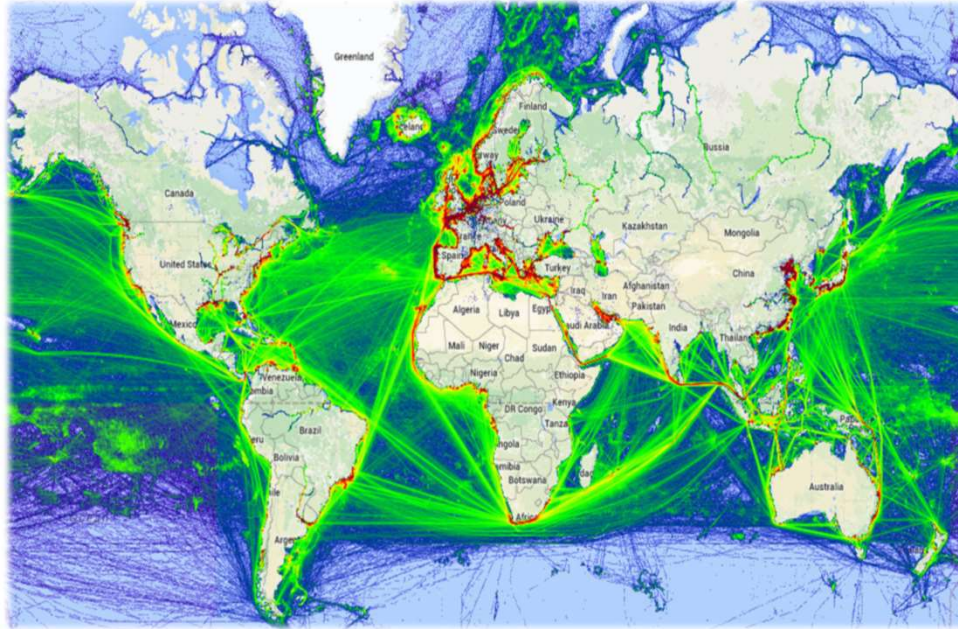
# AGENDA

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- **WHY WE NEED UxVs IN NAVAL WARFARE?** (*Change in the Conduct of Naval Operations*)
- **ASELSAN UXV SOLUTIONS FOR NAVAL WARFARE**
- **COMMON UXV SPECIFICATIONS, ARCHITECTURE AND MAIN PAYLOADS**
- **ANTI-SURFACE WARFARE - ASuW**
- **ANTI-AIR WARFARE - AAW**
- **ANTI-SUBMARINE WARFARE – ASW**
- **MINE COUNTER MEASURES – MCM**
- **ELECTRONIC WARFARE - EW**
- **ASYMMETRIC WARFARE**

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# WHY WE NEED UXV?



- Economy
- Security

## **Main Mission:**

**Protection & Defense of Homeland & National Rights/Interests**

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# WHY WE NEED UXV?



- Limitations for the Navy,
- The number of the ships in the Navy matters,
- Capability & Capacity Shortfalls...

MISSION NEED  
CAPABILITIES

-

OUR  
CAPABILITIES

=

OPERATIONAL  
NEEDS

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# WHY WE NEED UXV?

INCREASED  
PERSISTENCE

FAST DECISION  
CYCLE

ACCURATE DATA  
PROCESS

ACCESS  
DENIED AREAS

BETTER  
SA / RMP

THREE D  
MISSIONS

LOW  
COST

LOW RISK TO  
PERSONNEL



MARLIN USV

**“Understand quicker, act faster, and adapt continuously”**

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# WHY WE NEED UXV?



- Powerful Navy → Manned + Unmanned Systems
- New Technologies & New Operational Concepts

**“TO WIN THE FIGHT”**

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*Exercise Mavi Vatan (Blue Homeland) - 2025 / Türkiye*

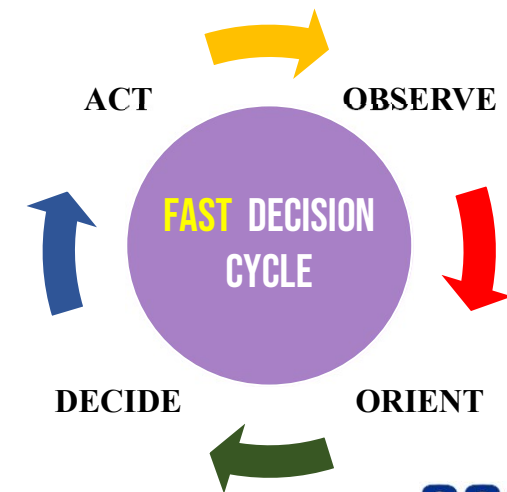
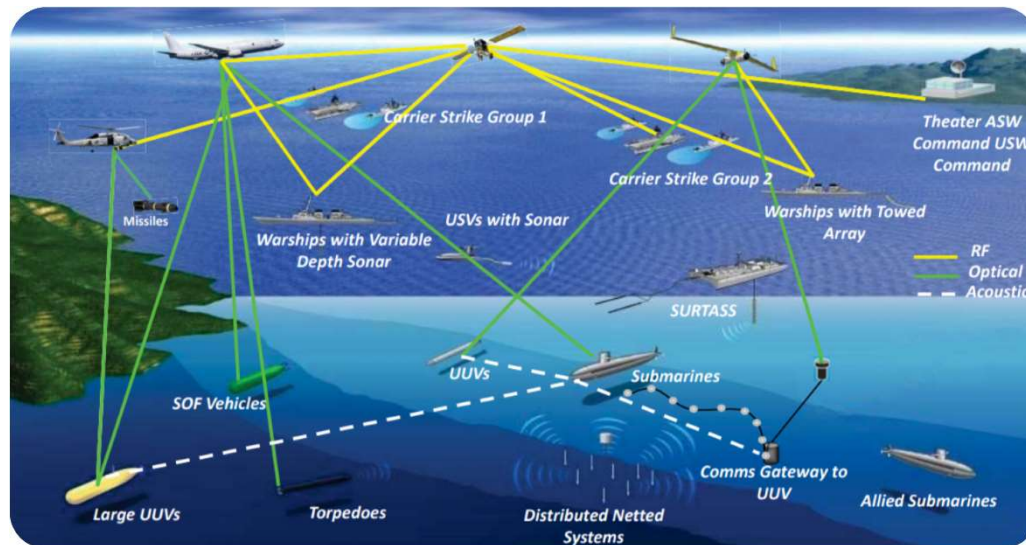
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# WHY WE NEED UXV?

MULTI-DOMAIN OPERATIONS  
(MDO)

DISTRIBUTED MARITIME  
OPERATIONS (DMO)



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# WHY WE NEED UXV?

INTEROPERABILITY

AUTONOMY

SECURITY / RESILIENCE

HUMAN-MACHINE  
COLLABORATION

MTP-01, Vol. I

NATO STANDARD

MTP-01, VOLUME I

MULTINATIONAL MARITIME  
TACTICAL INSTRUCTIONS AND  
PROCEDURES

Edition (H) Version (1)

OCTOBER 2021



NORTH ATLANTIC TREATY ORGANIZATION  
MULTINATIONAL TACTICAL PUBLICATION

Published by the  
NATO STANDARDIZATION OFFICE (NSO)  
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## KEY CONCEPTS

MUS are particularly effective in the Fix, Track, and Assess phases of Dynamic Targeting.

MUS crewmembers should receive the same threat recognition and rules of engagement training as their manned aircrew counterparts.

MUS provide valuable support to a variety of air, surface and subsurface missions.

MUS can be used as spotters for naval fire missions.

Conducting transit operations while flying MUS requires careful pre-planning.

Ship-based MUS have a proven track record in maritime security operations.

Extended covert surveillance of suspect vessels makes MUS a valuable tool when conducting SW, MIO and VBSS.

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# ASELSAN USV SOLUTIONS



**MARLIN ISR  
100**



**MARLIN EW  
100**



**MARLIN  
ASW 100**



**MARLIN  
ASuW 100**



**MARLIN  
ALBATROS**



**MARLIN  
MCM 100**



**MARLIN  
AAW 100**



**XLUSV**

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# ASELSAN USV SOLUTIONS

TCB 1101 (MARLIN EW 100)  
FIRST USV of TURKISH NAVY

19th January 2024



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# ASELSAN USV SOLUTIONS

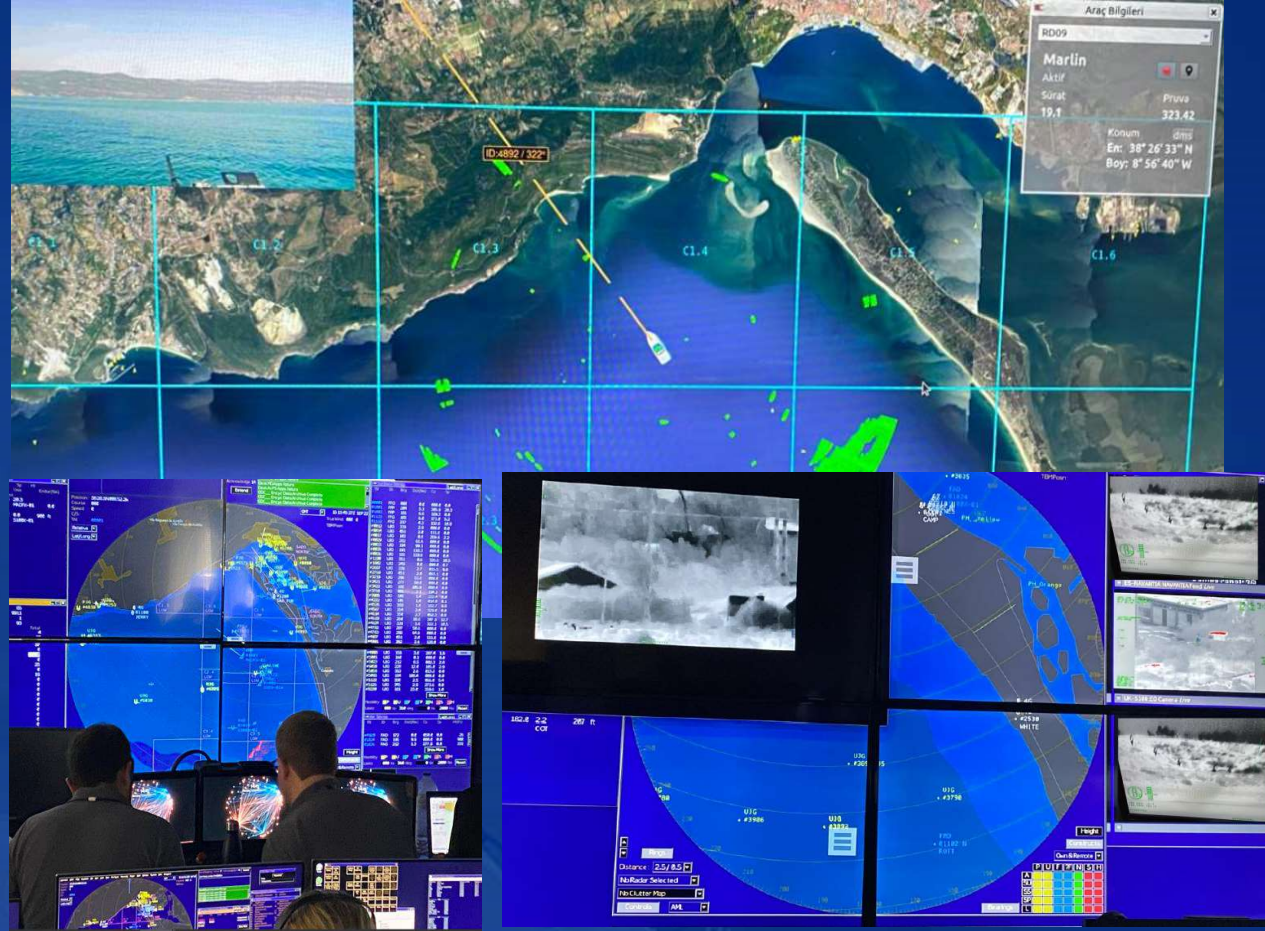
## NAVAL EXERCISES

### MARLIN USV Participated In:

- NATO REPMUS 2022
- NATO DYMS 2022
- EHDEN 2022
- MISSILE-EX 2023

### Demonstrated:

- Suppressing with ECM
- Engagement with SSM to Surface & Shore
- Cooperation with UAV for Targeting
- Engagement with Asymmetric Threats
- Interoperability



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# ASELSAN AUV SOLUTIONS



## DERİNGÖZ (DEEPEYE) 100L/300 & 100M/600

- Medium-Class AUV with modular payloads
- 300 & 600-meters depth rating
- 3.5 – 4.5m length (*configuration depended*)
- + 6 hour mission duration
- + 12 hour mission duration with extra battery
- Custom system configuration options (*Side Scan Sonar (SSS), Synthetic Aperture Sonar (SAS), MBES, Camera options etc.*)
- Obstacle & Mine Avoidance
- Speeds up to 5.5 knots
- Ethernet, Wi-Fi, Iridium and Acoustic communication
- DVL aided INS for navigation
- Emergency features (*ground fault detection, leak detection, emergency strobe, emergency pinger*)

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# ASELSAN UAV PAYLOAD SOLUTIONS



- Wide Frequency and Spatial Coverage
- High output power
- Signal parameter detection and recording
- Digital RF Memory Architecture
- DF Capability
- Identification of emitters via MDF
- Built-In Test Capability (BIT)
- Ease of Integration
- Power Consumption: 1100 W
- Weight: 45 kg



- Different versions for different threat families
- High output power
- Signal parameter detection and recording
- Automated/operator controlled jamming
- Automated or operator controlled identification
- Identification of emitters via MDF
- Built-In Test Capability (BIT)
- Ease of Integration
- Power Consumption: 380 W
- Weight: 11 kg



- Wide Frequency and Spatial Coverage
- High Precision Direction Finding
- High Precision Location Finding
- Signal parameter detection and recording
- Identification of emitters via MDF
- Built-In Test Capability (BIT)
- Ease of Integration
- Power Consumption: 400 W
- Weight: 30 kg

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# ASELSAN UAV PAYLOAD SOLUTIONS

- Air-to-Air Modes
  - Beyond Visual Range (BVR) Missile Guidance
  - All-Aspect Search (AAS)
  - High Aspect Search (HAS)
  - Multiple Target Track (MTT)
  - Multiple Agile Target Track (MATT)
  - Cued Search
  - Weather Mode
- Air-to-Ground Modes
  - Ground Moving Target Indication (GMTI)
  - Ground Moving Target Track (GMTT)
  - Ground Moving Single Target Track (GMSTT)
  - Ground Mapping
  - Fixed Target Track
  - Air to Ground Ranging
- Power amplification using GaN technology
- Agile beam steering using AESA Antenna design with graceful degradation
- Digital beamforming

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# ASELSAN UAV PAYLOAD SOLUTIONS

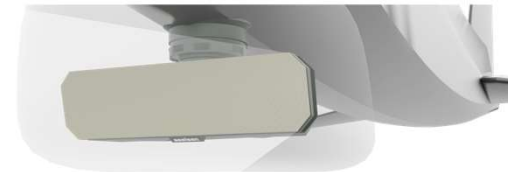
- Capabilities:
  - X-band
  - 360° continuous azimuth scanning
  - Sea Search, Track-while-scan
  - High resolution SAR Imaging
  - Stripmap and Spotlight
  - Ground Moving Target Indication (GMTI)
  - Agile beam steering using AESA Antenna design with graceful degradation
  - Power amplification using GaN technology
  - Can be used in manned and unmanned aerial vehicles
  - Weather mode
  - Automatic Target Classification and Recognition
- Technology readiness:
  - Platform integration in 2026

**FULMAR** | 500-A

LONG RANGE AIRBORNE MARITIME  
SURVEILLANCE RADAR



**AKSUNGUR**



**AKINCI**

**“Frontier UAV Long-range Multi-mission AESA (Active Electronically Scanned Array) Radar”**

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# ASELSAN UAV PAYLOAD SOLUTIONS

- Capabilities:

- A state-of-art, lightweight and compact X-band SAR System
- AESA Antenna design with solid-state amplifiers
- Can be used in manned and unmanned aerial vehicles
- Can be mounted under the wing (which allows E/O payload integration under the belly for co-operation)
- Very low power input requirement,
- Allows quick integration & disassembly

- Technology readiness:

- Flight tested in BAYRAKTAR TB2

- Capabilities:

- Jamming Types: Continuous, Look-through
- Jamming Modes: Spot, Multiple, Barrage, Reactive
- Deception with Audio Records
- Protected Frequencies for Creating Dynamic Communication
- Channels for Allies/Friendly Forces, Activity Recording

- Features:

- V/UHF Operational Frequency Band
- Modular Design, Higher Efficiency With Plug-in Booster
- High Gain Directed Blade Jamming & Detection Antennas
- Combat Proven

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## FULMAR | 200-A

SYNTHETIC APERTURE RADAR POD SYSTEM



## GERGEDAN | 3-U

V/UHF ELECTRONIC ATTACK SYSTEM FOR UAV



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# ASELSAN UXV SPECIFICATION & ARCHITECTURE

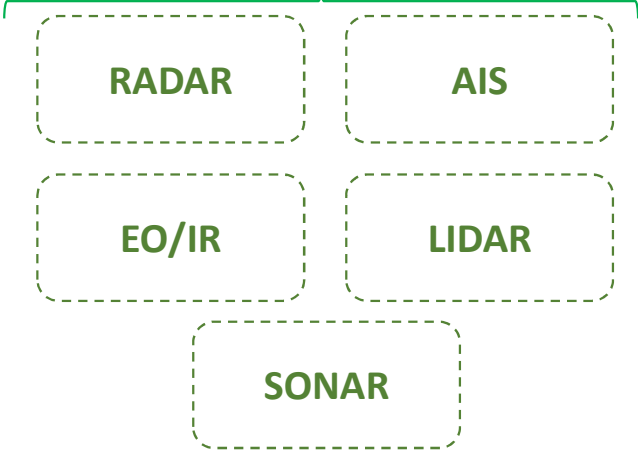
- Reliable Navigational Safety (COLREG, SOLAS, UNCLOS...)
- Mission Autonomy (Principle Warfare Areas, Supportive Warfare Areas...)
- Modular & open system architecture (ROS2, Microservice ...)
- Advanced Data, Network and Communication
- Operations under communication denied environments
- Interoperable C2 and Interchangeable payloads
- Network enabled system
- Flexible deployment and employment capability (individual, joint, task unit/swarm)



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# COMMON USV ARCHITECTURE



Control Station



Portable Control Console(s)

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# MAIN PAYLOADS

- USVs must have some main payloads in order to perform their missions such as Autonomy, Navigation, Communication and Avoidance.

## MAIN PAYLOADs & SENSORs

- |   |  |
|---|--|
| 1 | NAVIGATION RADAR   |
| 2 | EO/IR CAMERA   |
| 3 | LOS ( <i>Line Of Sight</i> ) COMMs                       |
| 4 | BLOS ( <i>Beyond Line Of Sight (SATCOM)</i> ) COMMs      |
| 5 | INS + GPS  |
| 6 | AUTONOMY SENSORs ( <i>LIDAR, ECHOSOUNDER, FLS etc.</i> ) |
| 7 | ANTI-JAM GPS/GNSS  |

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# ANTI-SURFACE WARFARE - ASUW

- “**Surface Warfare**” is the type of warfare in which our own sea/air/land units are used against enemy surface elements.
- The ASuW engagement capability expectation of the Navy is to inflict loss/damage to targets of opportunity, especially near shore targets in littoral waters, and/or to disable them from operations.
- Other capabilities may include Force Protection, Asymmetric/ Anti-Asymmetric Threat, Base/Port Defense and Engaging Land Targets close to the coast.



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# ANTI-SURFACE WARFARE - ASUW

MISSION PAYLOAD		EXPLANATION	PRODUCTS
1	12.7 mm Machine Gun	Defence, Close Range Engagement	SMASH 200 12.7 L (ASELSAN)
2	SSM	Surface/Land Targets, Assymetric Threat	KUZGUN (TÜBİTAK SAGE) CİRİT, UMTAS, L-UMTAS, ÇAKIR (ROKETSAN)
3	Laser Designator	Laser Guided Missiles	DENİZGÖZÜ-PİRANA (ASELSAN)



SMASH 200 12.7 L

- The NAVY's engagement expectation from USVs is to cause loss/damage targets of opportunity especially in littoral, shoaling/near-shore waters and/or to disable them from operations.

Laser Designator  
EO/IR Camera  
DENİZGÖZÜ-PİRANA



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# ANTI-AIR WARFARE - AAW

- **“Anti-Air Warfare”** is a type of warfare consisting of measures taken to defend a naval force against the attack of air assets & weapons launched from aircraft, ships, submarines and positions on land.
- The AAW engagement capability expectation of the Navy is to cause loss/damage to low altitude UAV, Rotary and/or Fixed Wing (*Helicopter/Marine Patrol Aircraft*) air targets.
- Other capabilities are considered to be *“Low Altitude Air Defense”* within the scope of HVU Force Protection, Asymmetric/Anti-Asymmetric Threat, Base/Port Defense especially against FPVs/UAVs.



**BORA**



**SUNGUR**

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# ANTI-AIR WARFARE - AAW

MISSION PAYLOAD		EXPLANATION	PRODUCTS
1	12.7 mm Machine Gun	VSHORAD, Anti-Asymmetric Threat	SMASH 200 12.7 L (ASELSAN)
2	SAM	VSHORAD/SHORAD	Göksur IIR (TÜBİTAK-SAGE), Sungur (ROKETSAN), LMM (Thales), Mistral Simbad RC (MBDA)
3	Air Search Radar (AESA)	Search & Track	AURA (ASELSAN)



SMASH 200 12.7 L



AESA Radar

- *The AAW engagement capability expectation of the Navy is to cause loss/damage to low altitude UAV, Rotary and/or Fixed Wing (Helicopter/Marine Patrol Aircraft) air targets.*



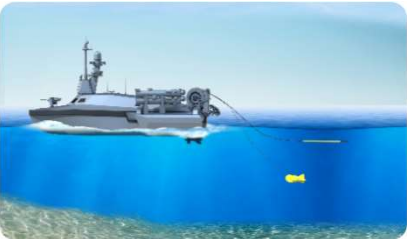
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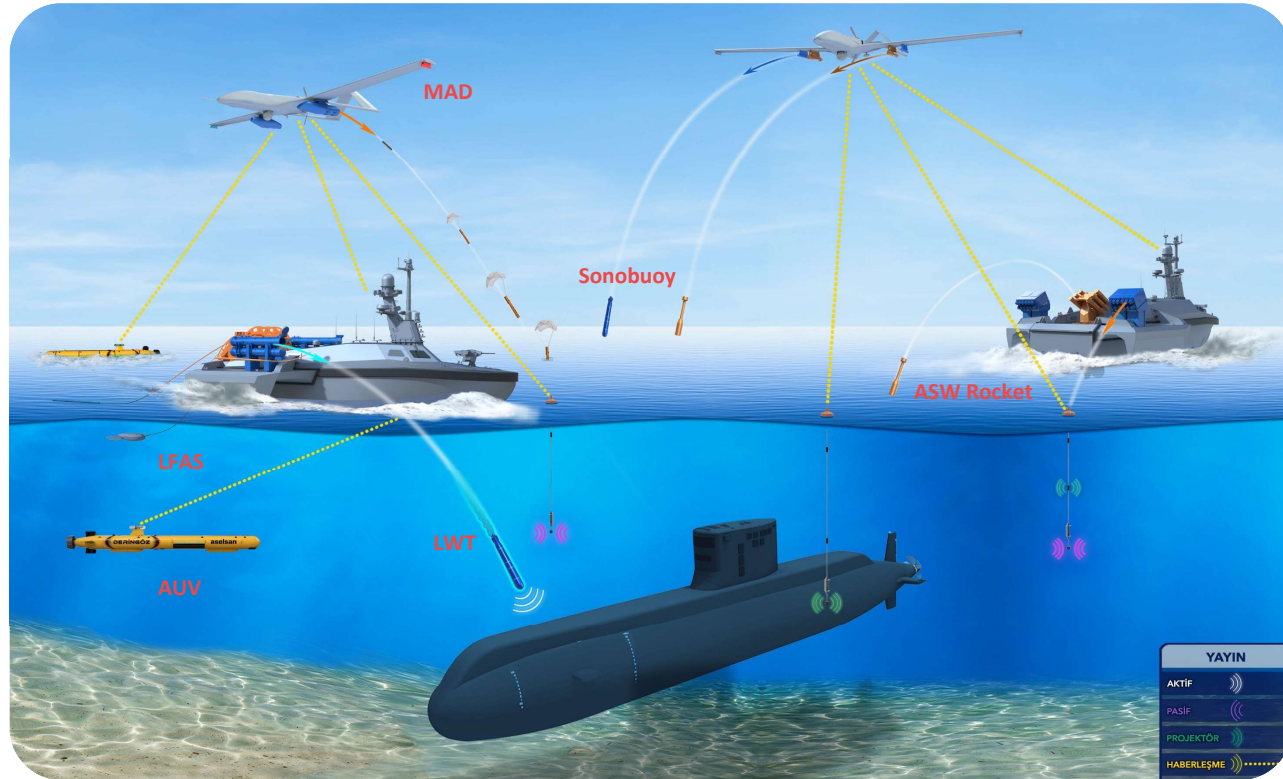
# ANTI-SUBMARINE WARFARE - ASW

- **“Anti-Submarine Warfare”** is an important type of naval operation that aims to detect, track and neutralize submarines.
- The ASW engagement capability expectation of the Navy is to detect, classify, track and/or cause loss/damage to enemy submarines.
- Other UxV capabilities are considered to be ASW Training Asset, Force Protection, ASW within the scope of Base/Port Defense and ASW Pressure element missions.



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## Operational Concept

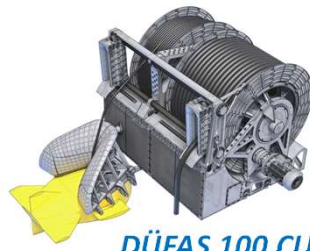
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# ANTI-SUBMARINE WARFARE - ASW

	MISSION PAYLOAD	EXPLANATION	PRODUCTS
1	LWT & Launcher	Submarine Engagement	ZIPKIN 100D (ASELSAN), ORKA (ROKETSAN)
2	LFAS	Submarine Detection, Classification & Tracking	DÜFAS 100 CU (ASELSAN)
3	Dipping Sonar	Submarine Detection, Classification & Tracking	ORKUN 2053 (ARMELSAN)
4	Sonobuoy (Launcher & Signal Processing)	Submarine Detection	aselBUOY 100P (ASELSAN)
5	ASW Rocket	Submarine Engagement	ASW Rocket (ROKETSAN)

ZIPKIN 100 D



DÜFAS 100 CU (LFAS)

- The ASW engagement capability expectation of the Navy is to detect, classify, track and/or cause loss/damage to enemy submarines.



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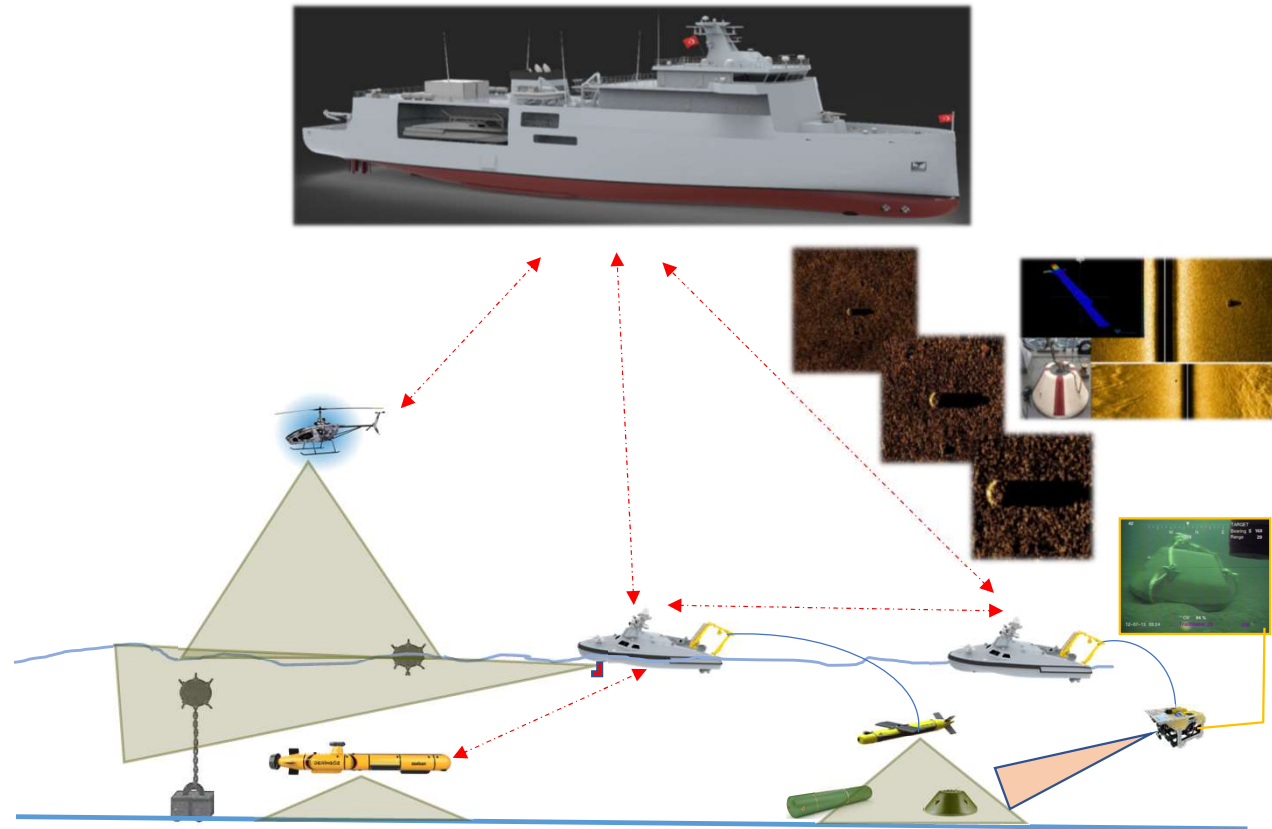
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# MINE COUNTER MEASURES - MCM

- “**Mine Warfare**” is a strategic, operational and tactical form of warfare in which sea mines are laid against surface and underwater platforms and Mine Counter Measures (MCM) systems are used against mines.
- The MCM capability expectation of the Navy for UxVs is to eliminate the mine threat by conducting “Mine Hunting Operations” in littoral waters.
- It is considered that other capabilities can be MCM within the scope of Route Surveys of National Canals / Anchorage areas, Force Protection, Critical Facility-Infrastructure and Base / Port Defense.

## Operational Concept



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# MINE COUNTER MEASURES - MCM

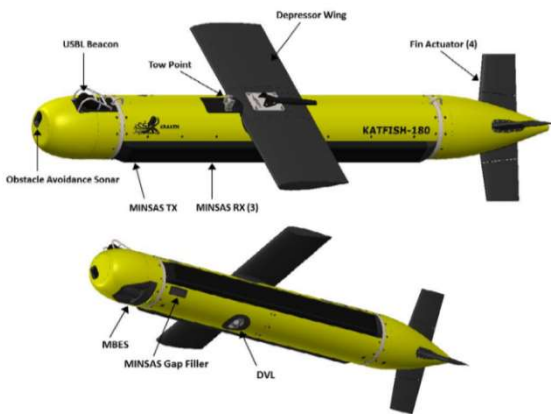
MISSION PAYLOAD		EXPLANATION	PRODUCTS
1	T-SAS & LARS	Mine Search/Detection/Classification	KATFISH & ALARS (Kraken Robotics/CAN)
2	ROV & LARS	Mine Identification/Neutralisation	Myra/Demre ROV (HOYTEK/TR)
3	Mine/Obstacle Avoidance Sonar	Detection & Avoidance from Moored/Drifting Mines	COTS



Multi-Shot ROV (MSR)  
(HOYTEK-Türkiye)



LARS  
Kraken Robotics  
(CANADA)



T-SAS KATFISH  
Kraken Robotics  
(CANADA)

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- The MCM capability expectation of the Navy for UxVs is to eliminate the mine threat by conducting “Mine Hunting Operations” in littoral waters.

# ELECTRONIC WARFARE - EW

- **“Electronic/Electromagnetic Warfare (EW)”** is a supportive type of operation that aims to control the electromagnetic spectrum by searching for and detecting/diagnosing electromagnetic transmissions (ESM); preventing or reducing the use of spectrum by the enemy; attacking using electromagnetic energy (EA); and ensuring the most effective use of spectrum by our own forces (EP).
- The EW capability expectation of the Navy is to contribute to the Recognized Maritime Picture (RMP), HVU Protection and to act as an EW Support element.
- Other capabilities are considered to be jamming / soft-kill, especially against drones within the scope of Force Protection.



*MARLIN EW 100*

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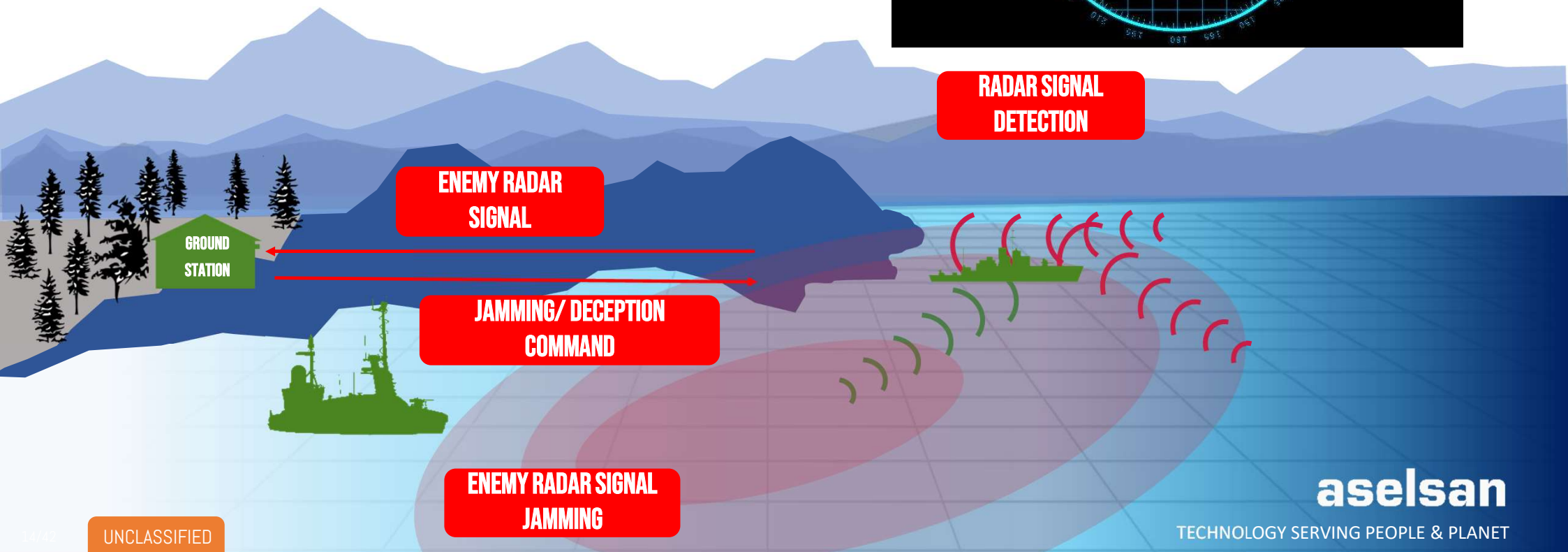
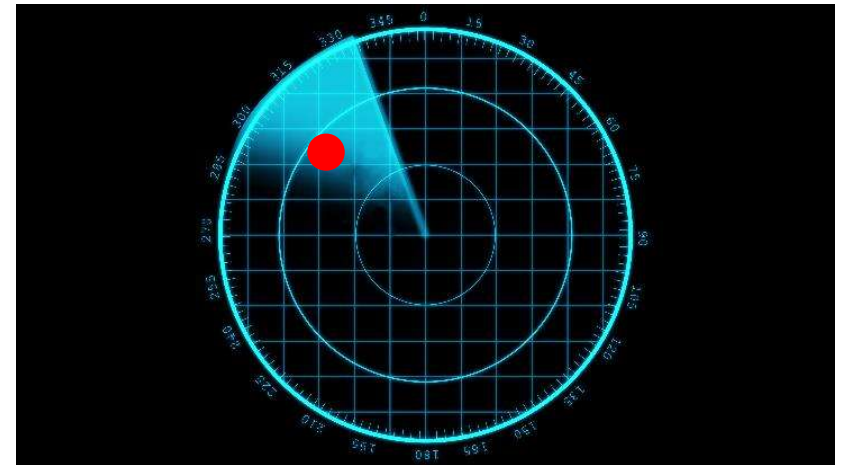
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# RADAR EW CAPABILITY

## Operational Concept

ENEMY RADAR



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# ELECTRONIC WARFARE - EW

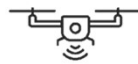
## C-ESM SUPPORTED JAMMER SYSTEM



(RCIEDs) jamming



Search, detection & direction finding (DF)  
of mini/micro UAVs and remote controllers



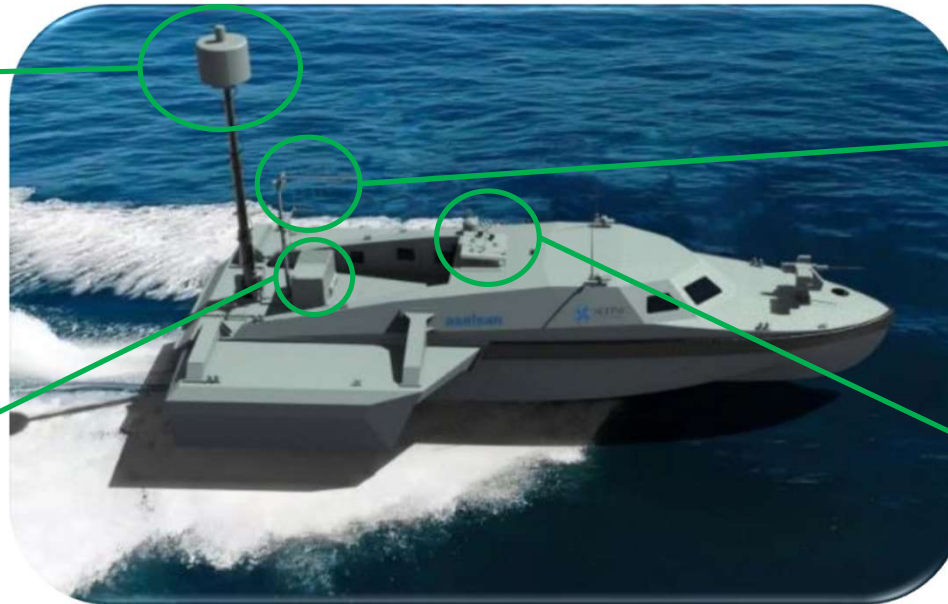
Mini/Micro UAV  
detection & jamming



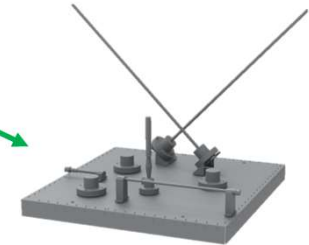
Effective jamming with the aid of C-ESM  
subsystem



C-ESM Antenna



Jammer System  
Directional Antenna Set



Jammer System Omni-  
Directional Antenna Set



C-ESM & Jammer  
Main Units

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# ASYMMETRIC WARFARE

- **“Asymmetric Warfare”** is defined as the struggle of units with weaker military power against units with superior and more advanced equipment, which also includes elements of irregular warfare.
- **“Unconventional Warfare”** is a form of warfare conducted with small but highly functional units instead of regular and large units in order to wear down, demoralize, inflict casualties and break the resistance of the enemy.
- The capability expectation of the Navy for Kamikaze USVs is to create an asymmetric effect on enemy surface elements and cause loss/damage.
- Other capabilities are considered to be the ability to affect critical facilities and infrastructures such as bridges, oil-natural gas filling facilities, etc. that have access from the sea (*strategic impact*).

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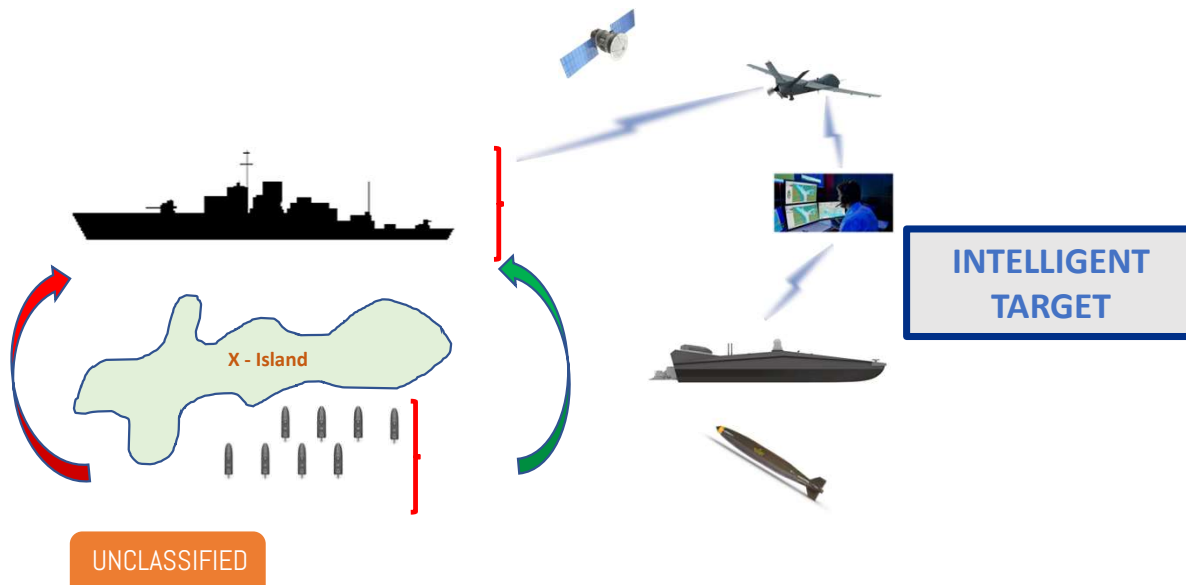
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# ASYMMETRIC WARFARE

## AI BASED TASK AUTONOMY

SWARM  
ENGAGEMENT

- AI Based engagement methods for multiple USVs.
- Decentralized solution.
- Developed agents are applied for the target as well.
- Can be used for other platforms.



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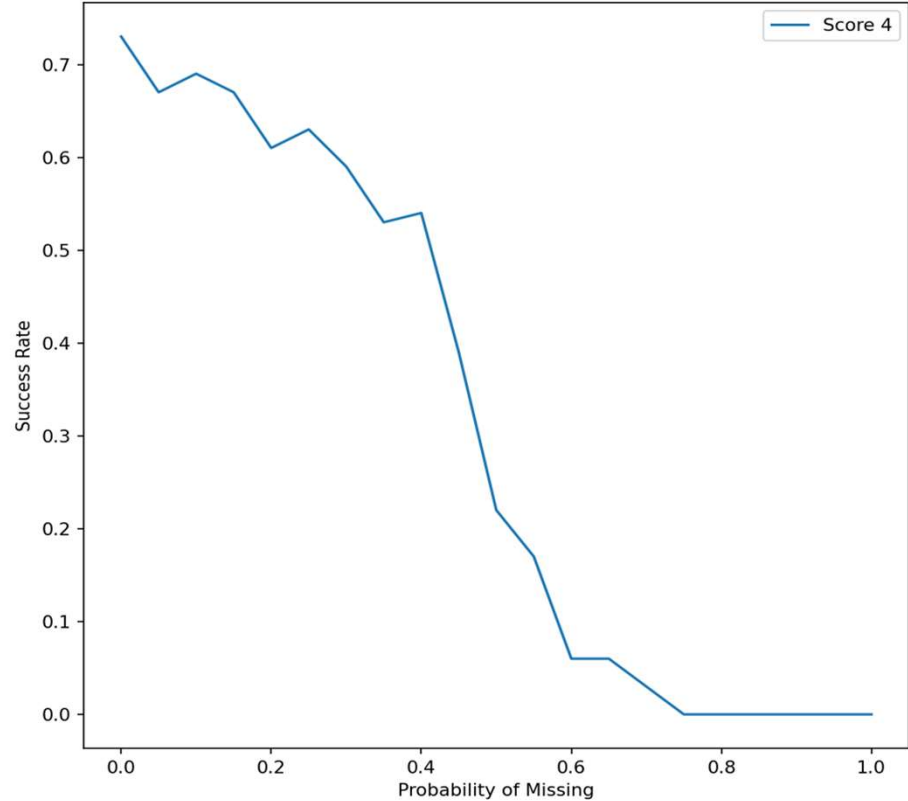


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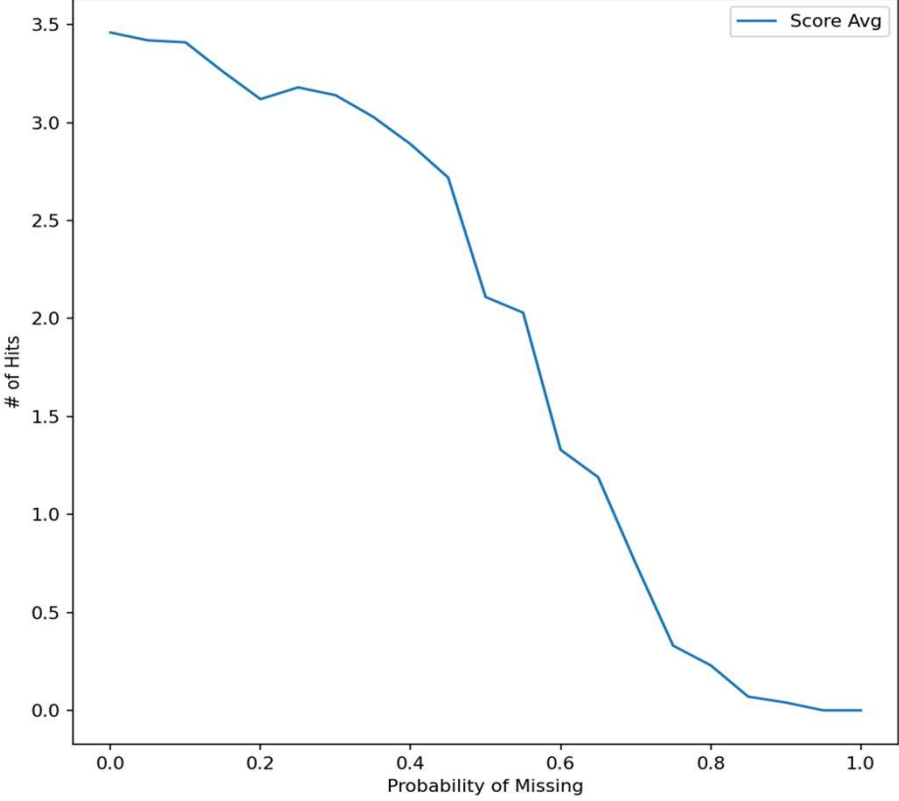
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# ASYMMETRIC WARFARE

## AI BASED TASK AUTONOMY-Loss Observation



Loss Probability vs Hit Ratio w/ 4 USV

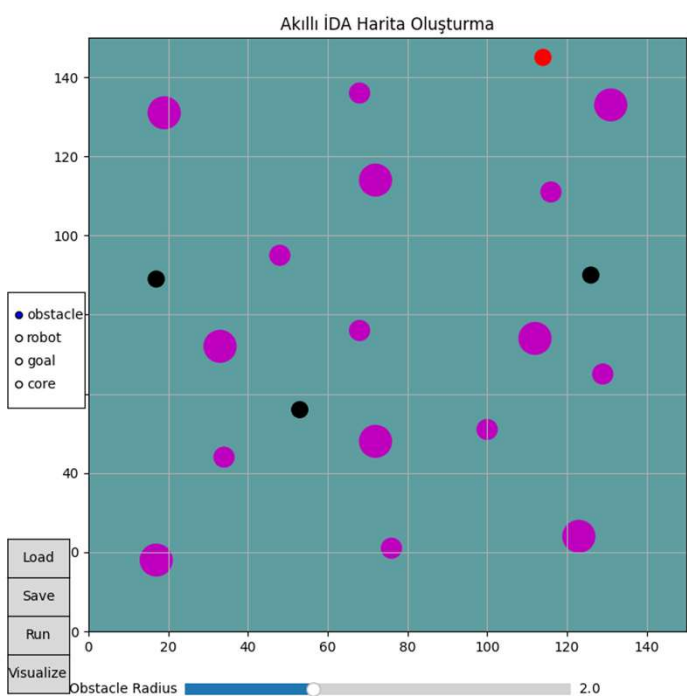


Loss Probability vs Hit Count

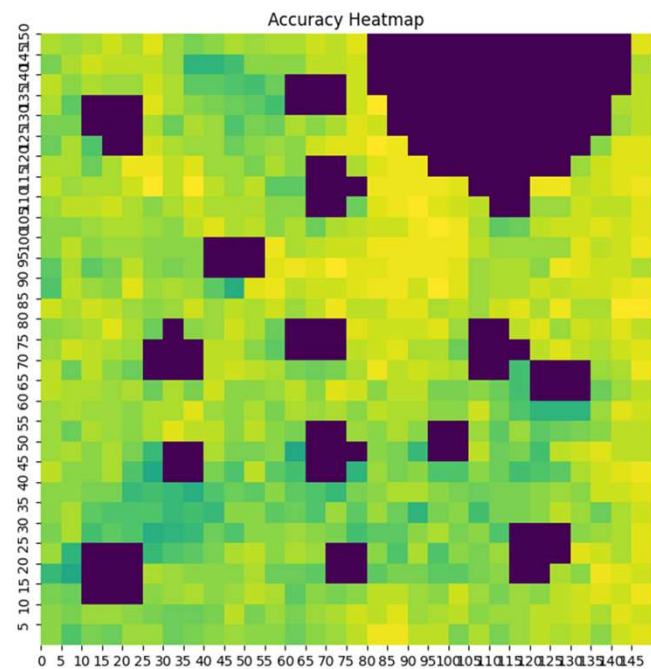
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# ASYMMETRIC WARFARE

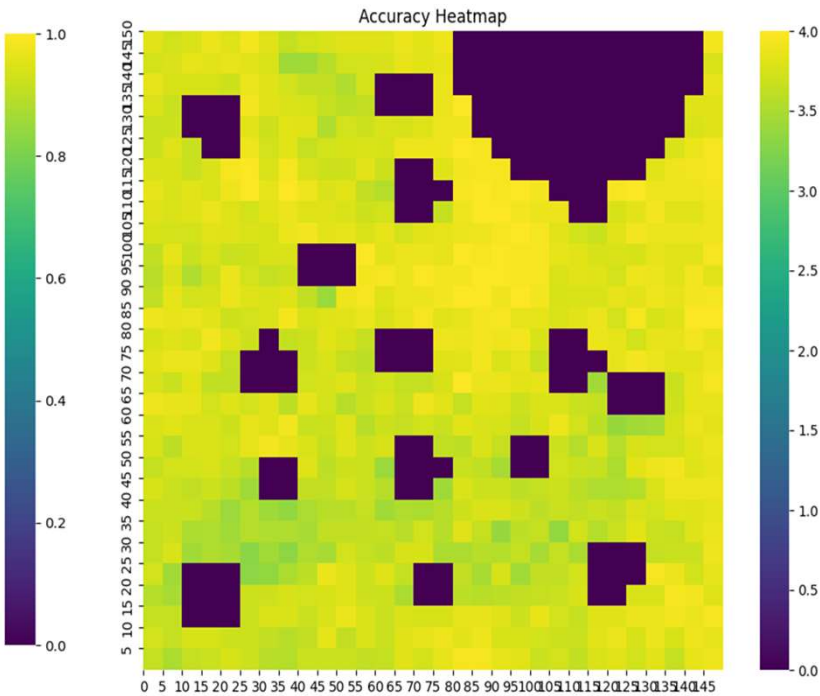
## AI BASED TASK AUTONOMY- Scenario Interface & SweetSpot Analysis



Scenario Interface



Success Analysis (Hit Ratio w/ 4 USV)



Success Analysis (Hit Count)

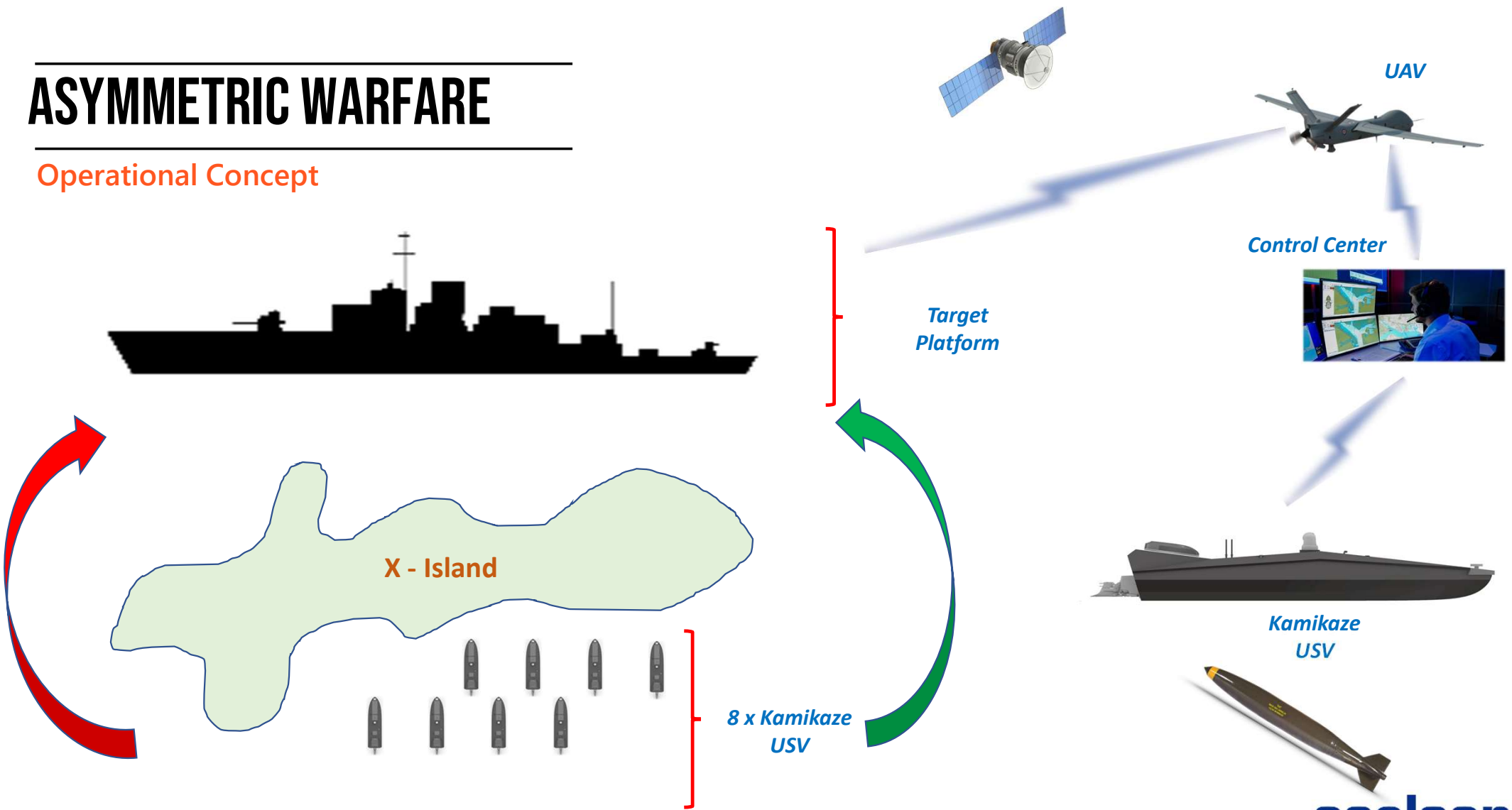
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# ASYMMETRIC WARFARE

## Operational Concept



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