ROBORDER

Autonomous Swarm of Heterogeneous Robots for Border Surveillance

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Problem statement

- Border authorities face important challenges in patrolling and protecting the borders.
- Low levels of situational awareness
- Numerous and diverse aspects should be considered
  - Heterogeneity of threats
  - Wideness of the suveyed area
  - Adverse weather conditions
  - Wide range of terrains
  - Comlex operational environments

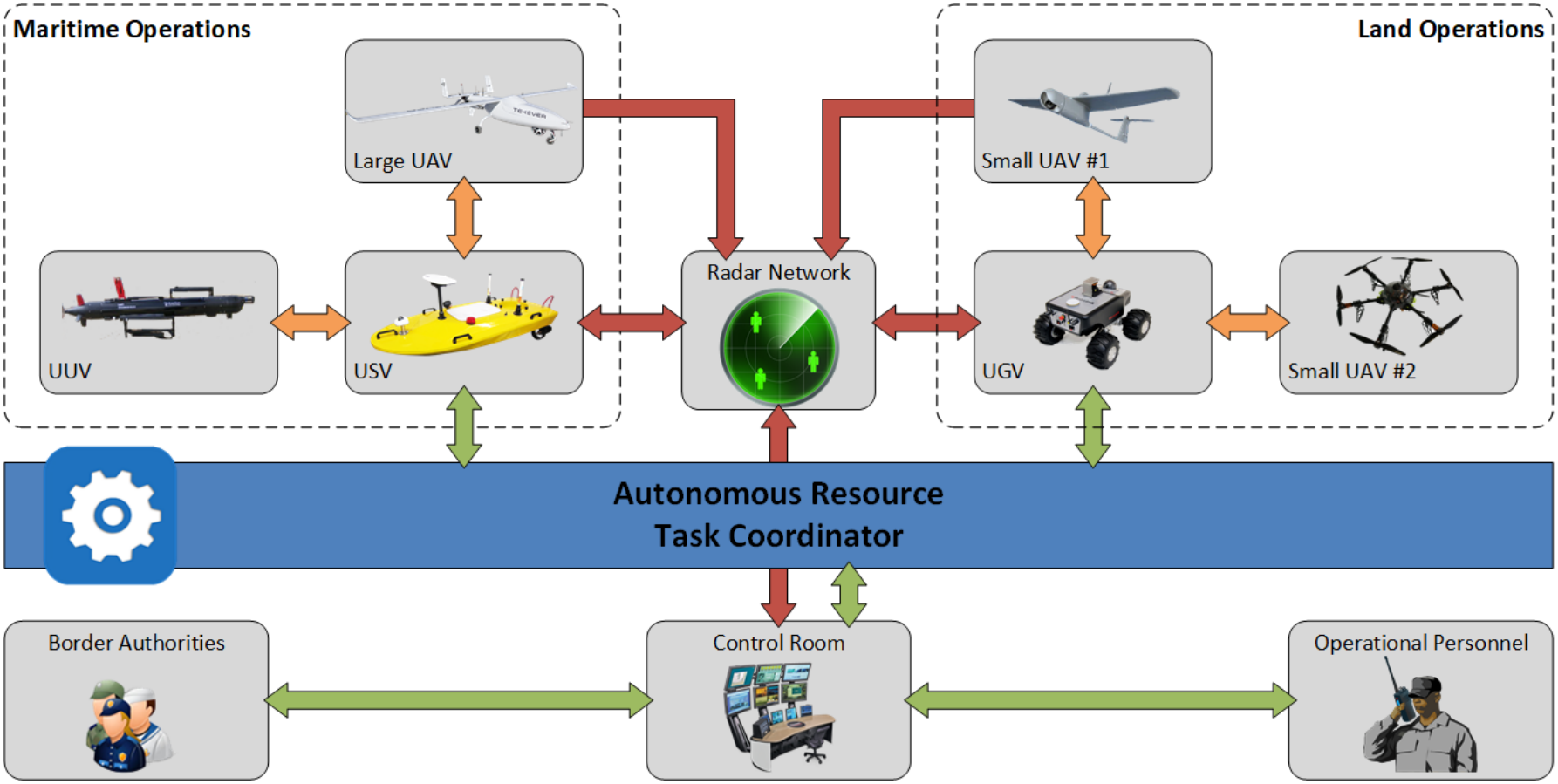
Context & Vision

- The overall framework for the Roborder project includes multiple domains
  - Border surveillance
  - Marine pollution detection
  - Situational awareness
- Vision
  - Develop and demonstrate a fully-functional autonomous border surveillance system
  - Unmanned mobile robots equipped with multimodal sensors
  - Enhanced detection capabilities for early identification of criminal activities and marine pollution events

Objectives

- Main objectives
  - Autonomous border surveillance system with unmanned mobile robots
  - Incorporate multimodal sensors as part of an interoperable network
  - Wide range of operational and environmental settings
  - Enhanced static networked sensors
  - Complete and situational awareness picture
  - Early identification of criminal activities and hazardous incidents
- Innovation objectives
  - Adaptable sensing, robotics, and communication technologies
  - Tele-operation of autonomous agents through a 3D user interface and decision support

ROBORDER Architecture



Use case scenarios

- Early identification and tracking of illegal activities
  - Detecting unauthorized sea border crossing
  - Detecting unauthorized land border crossing and signals trespassers
  - Detecting unauthorized land border crossing
  - Tracking high-tech smugglers
  - Detecting the terrorist attack coming through cross border
  - Early and effective identification of passive boats moving offshore
  - Tracking organized crime activity in remote border areas
- Early identification and tracking of illegal communications
  - Detecting jamming attacks
- Detection of pollution and other accidents occurred in the borders
  - Detecting pollution accidents

Demonstrators

- Unauthorized sea border crossing
  - Monitoring sea passages and islets
  - Plethora of sensors: Coastal radars, optical cameras etc.
  - Interaction of mobile devices with static infrastructure
- Unauthorized land border crossing
  - Patrol hardly accessible territories
  - Tracking illegal activities to mitigate personal risks
- Detecting pollution accidents
  - Tracking pollutants spilled at sea
  - Determining key environmental conditions

Impact

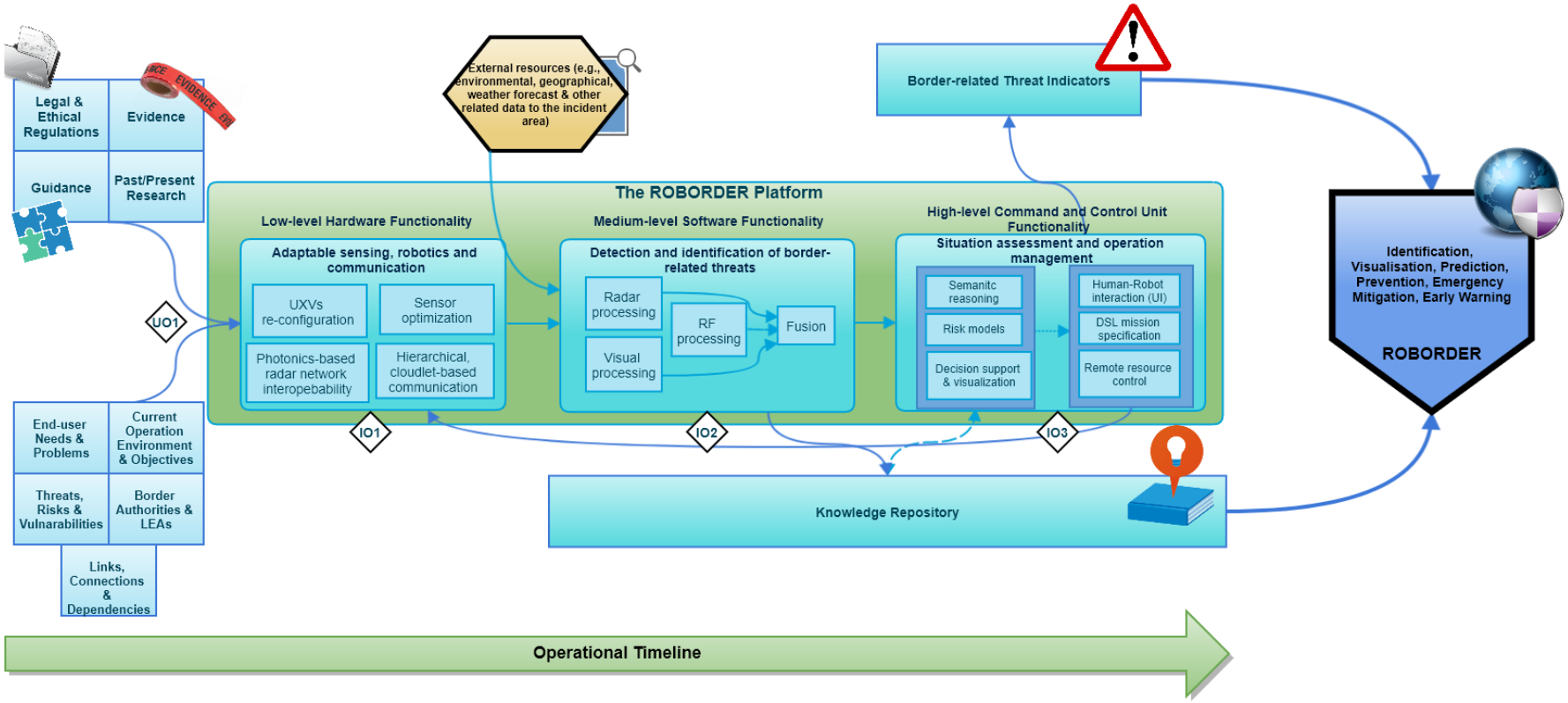
- Expected impact
  - Enhance the protection of human lives exposed at land and sea
  - Improve identification and tracking illegal activities
  - Influence positively anti-drug and anti-smuggling operations
  - Perform improved search and rescue operations
  - Improve environmental protection for governmental agencies
- Expected results
  - Provide an overall border security solution
  - Effective operation of heterogenous multi-asset system
  - Photonic radar network and UAV onboard passive radar
  - Threat recognition and identification of cyber physical attacks

Work plan

IO1 Adaptable sensing, robotics and communication technologies for different operational and environmental needs						IO2 Detection and identification of border-related threats					IO3 Tele-operation of autonomous agents through a 3D user interface and decision support					
IA1.1	IA1.2	IA1.3	IA1.4	IA1.5	IA1.6	IA2.1	IA2.2	IA2.3	IA2.4	IA2.5	IA3.1	IA3.2	IA3.3	IA3.4	IA3.5	IA3.6
WP2 Sensing, robotics and communication technologies						WP3 Detection and identification of border-related threats					WP4 Command and control unit functionalities					

IO4 ROBORDER platform development and integration	UO1 User requirements definition, end-user evaluation and validation			IMO1 Dissemination and collaboration		IMO2 Exploitation and sustainability model		
	UA1.1	UA1.2	UA1.3	IMA1.1	IMA1.2	IMA2.1	IMA2.2	IMA2.3
WP5 Integration of ROBORDER platform	WP1 User requirements and pilot use cases			WP6 Demonstrations and evaluation		WP7 Dissemination and exploitation		

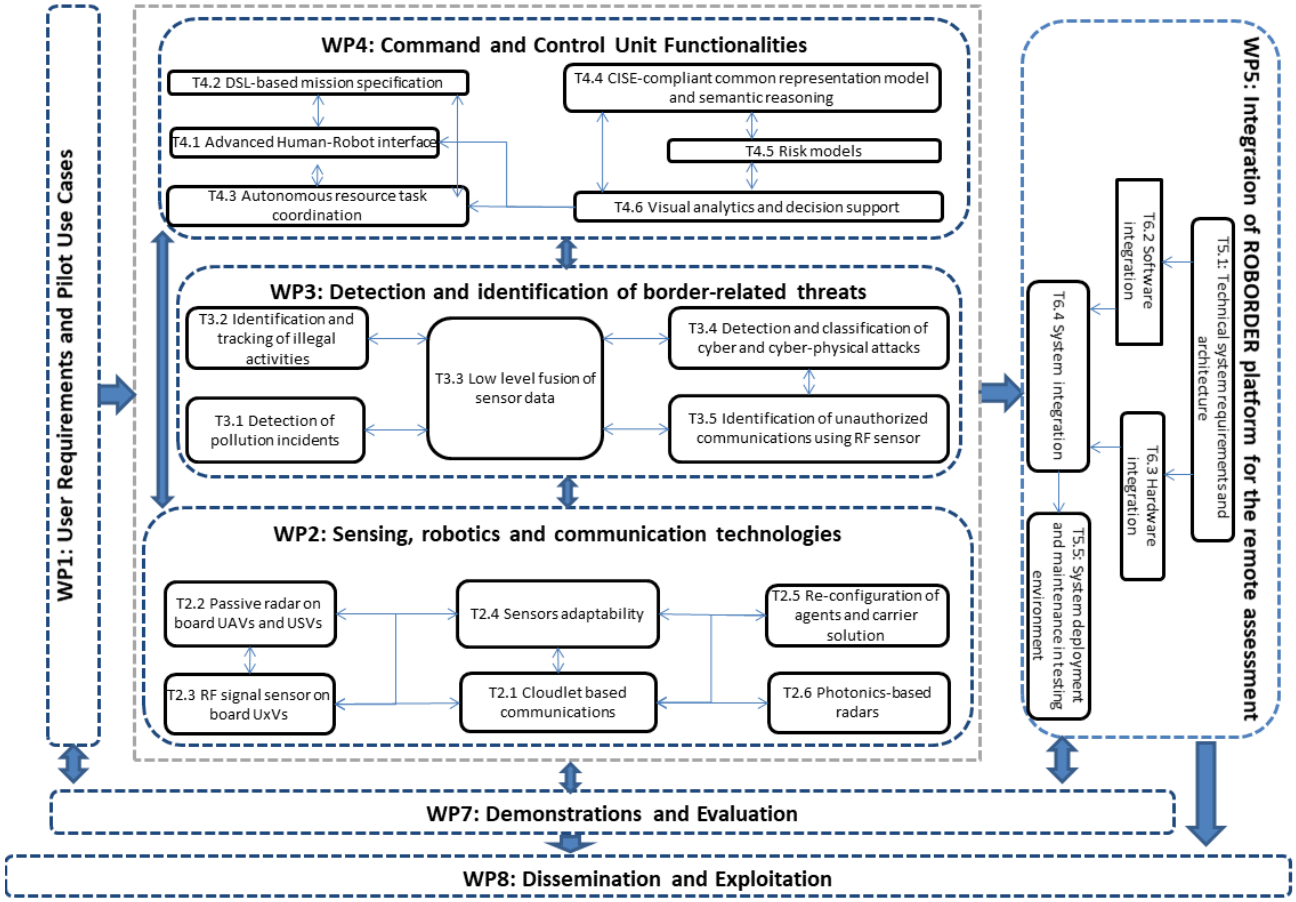
Operational timeline



Overall structure

- Package list
  - **WP1**: User requirements and pilot use cases
  - **WP2**: Sensing, robotics and communication technologies
  - **WP3**: Detection and identification of border-related threats
  - **WP4**: Command and control unit functionalities
  - **WP5**: Integration of Roborder platform for the remote assessment of border threats
  - **WP6**: Demonstrations and evaluation
  - **WP7**: Dissemination and exploitation
  - **WP8**: Project management
- Milestone List
  - **MS1**: Project setup and platform development roadmap
  - **MS2**: Operational prototype
  - **MS3**: 1st prototype
  - **MS4**: 2nd prototype
  - **MS5**: Final system

Work packages interplay



Evaluation & Outcomes

- Prototype and final system
  - User-oriented evaluation (end-users group etc.)
  - System-centric evaluation (metrics, indicators etc.)

- Outcomes
  - Final system dealing with 3 use cases
  - Fully operational and autonomous border surveillance system
  - Enhanced detection and classification capabilities
  - CISE-compliant representation model and sematic reasoning
  - Decision support and situational awareness

Exploitation and Dissemination

- Exploitation of results
  - Development of proper modules and tools
  - Modules to be exploited by the technical partners
  - Business plan to exploit the final system

- Dissemination of results
  - Publications in scientific conferences and journals
  - Visits of website an social media (http://roborder.eu/)
  - Downloads of publicly available online material
  - Participation/attendance in workshops
  - Demonstration of results in end-users group

Consortium

Centre for Research and Technology Hellas		Robotnik Automation SLL		Swiss center for electronics and microtechnology SA	
Romanian border police		Romanian protection and guard service		National interuniversity consortium for telecommunications	
Fraunhofer Institute for high frequency physics and radar techniques		Elettronica GmbH		Policia Judiciaria-Portugal	
Estonian academy of security sciences		Hellenic Ministry of defense		CyberLens Limited	
VTT technical research centre of Finland		Centre of excellence in terrorism, resilience, intelligence and organized crime research			
Everis Spain SLU Succursale Belgique		North Tyrrhenian Sea Port System Authority(AdSP-MTS)			
Police service of Northern Ireland		Oceanscan-Marine systems & technology			
Portuguese national guard		Defence institute “Professor Tsvetan Lazarov”			
NATO STO organization centre for maritime research & experimentation		Copting GmbH			
Hungarian national police		National and Kapodistrian University of Athens			

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Thank You!

Questions?