

# ROBORDER

Autonomous Swarm of Heterogeneous Robots for  
Border Surveillance

This project has received funding from  
the European Union's Horizon 2020  
research and innovation programme  
under grant agreement No 740593



# ROBORDER as a project

## Project information

# ROBORDER

Grant agreement ID: 740593

[Project website](#)

Status  
Ongoing project

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1 May 2017 28 February 2021

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**EU contribution**  
€ 7 999 315,82



Coordinated by:  
ETHNIKO KENTRO EREVNAS KAI  
TECHNOLOGIKIS ANAPTYXIS  
 Greece



# Problem in Border Management

- 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 surveyed area
  - Adverse weather conditions
  - Wide range of terrains
  - Complex operational environments

# Context and Vision for Border Surveillance

- 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

# ROBORDER's Objectives

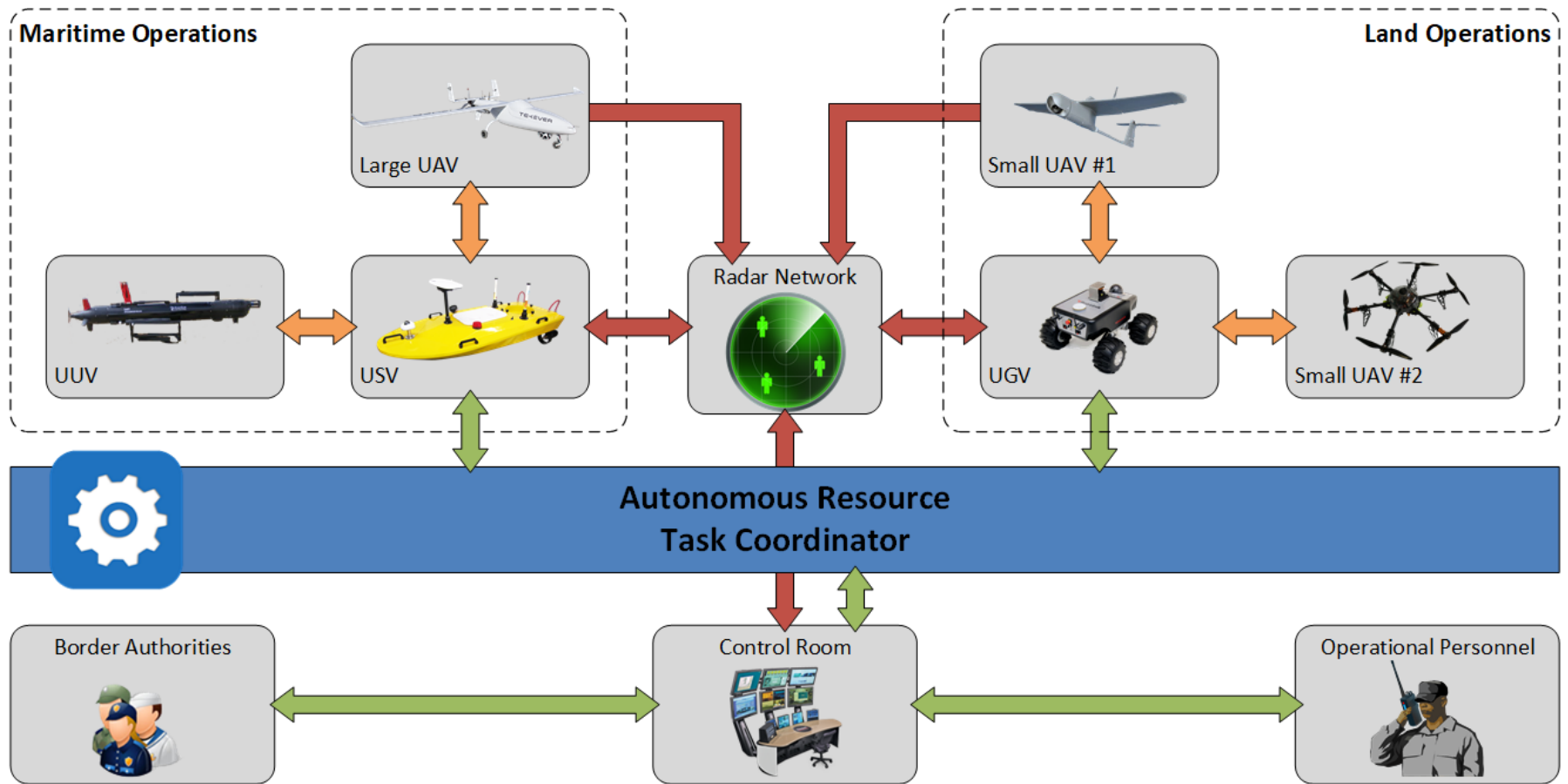
## ■ Main objectives

- 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



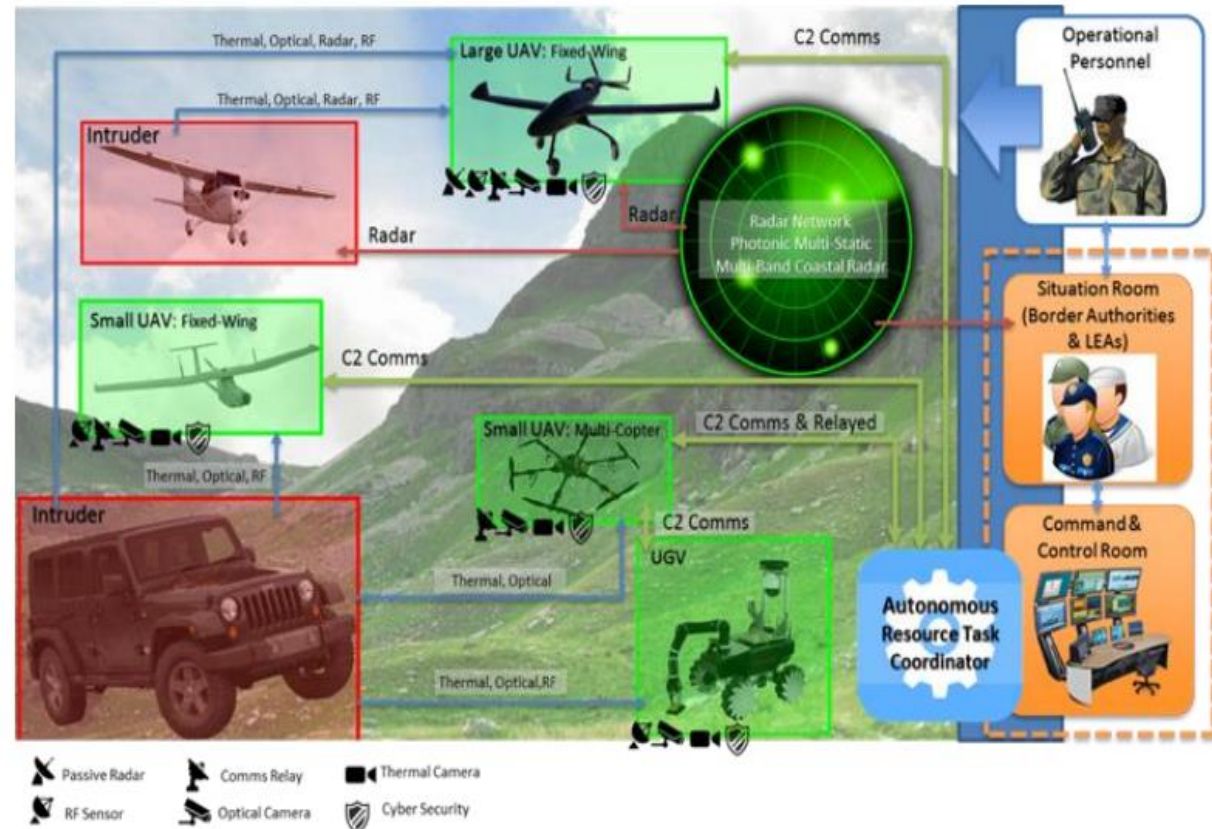
# Use Case Scenarios

- **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 land border crossing**
  - Patrol hardly accessible territories
  - Tracking illegal activities to mitigate personal risks





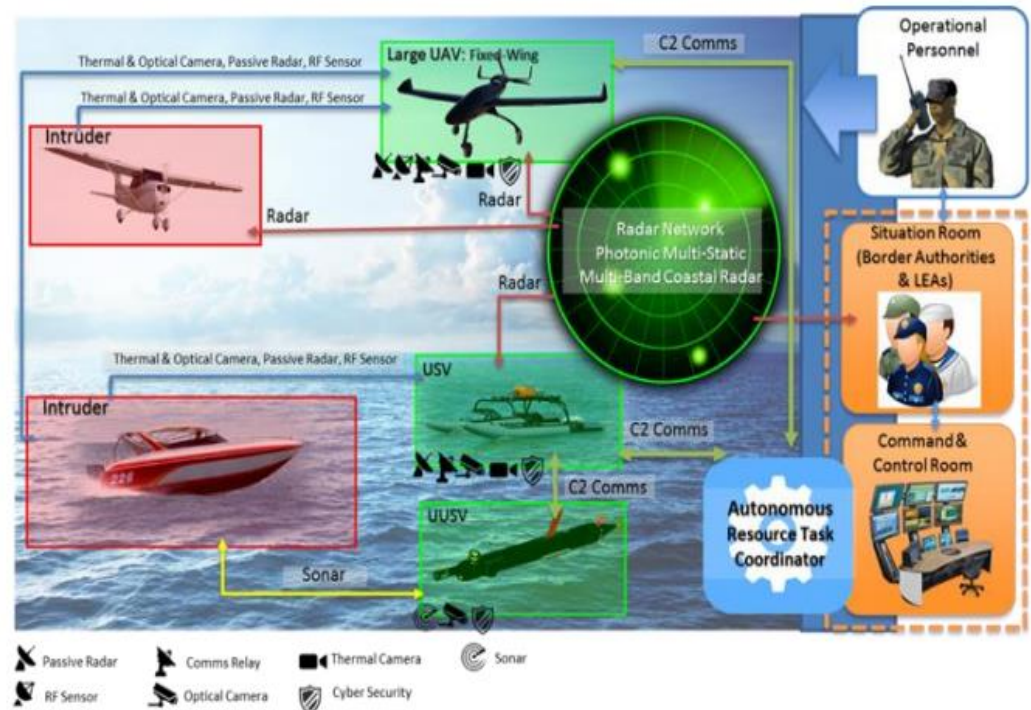
# Demonstrators

## ■ Unauthorized sea border crossing

- Monitoring sea passages and islets
- Plethora of sensors: Coastal radars, optical cameras etc.
- Interaction of mobile devices with static infrastructure

## ■ 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
  - Enable response time within minutes
  - 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 by a single operator
  - Photonic radar network and UAV onboard passive radar
  - Threat recognition and identification of cyber physical attacks

# Work plan

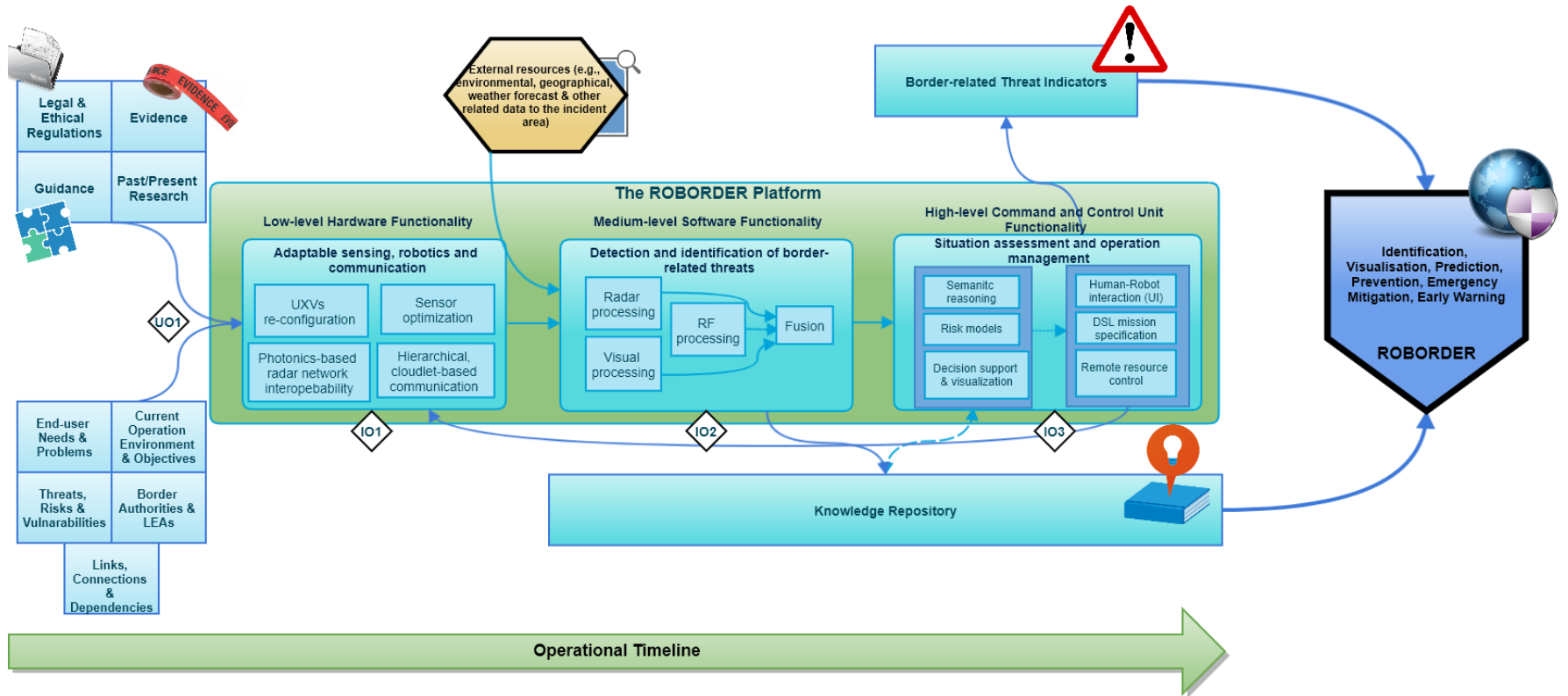
| IO1 Adaptable sensing, robotics and communication technologies for different operational and environmental needs |       |       |       |       |       | IO2 Detection and identification of border-related threats |       |       |       |       | IO3 Tele-operation of autonomous agents through a 3D 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         |        |        |

WP8 Management and Coordination

WP9 Ethics Requirements

# Operational timeline



# Evaluation and 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 semantic 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 (<http://roborder.eu/>)
  - Downloads of publicly available online material
  - Participation/attendance in workshops
  - Demonstration of results in end-users group

**RO****BORDER**

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