



euRobotics Forum

Workshop Robots for surveillance and exploration

Steps towards a robotics security

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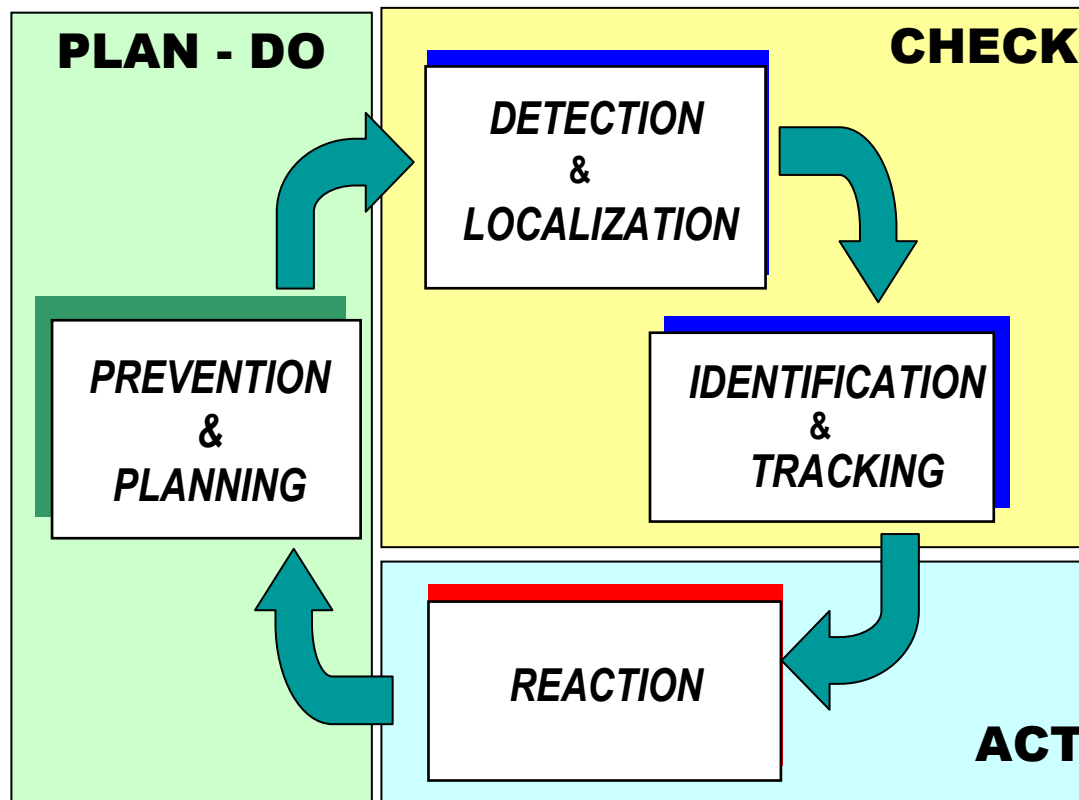
Vasteras, Sweden, 06/04/2011



- Border Surveillance scenario: descriptions and goals
- Border Surveillance scenario: threats & risks, customers' roles and needs
- Initiatives and research projects
- Enabling technologies
- Platforms already available

Border Surveillance scenario: goals

The Border Surveillance System has the main goal to ensure effective protection of borders (blue over sea, green on ground) through detection, localization, identification and tracking of targets that can be classified as a threat to the Homeland moving/entering the border



Examples

- Illegal entering with criminal or terrorist intents of Blue or Green State Borders

- Illegal cross border activities as smuggling, drugs and weapons trafficking, NBCR material trafficking

Border Surveillance scenario

Assumptions

- European countries borders (sea and ground)
- Permanent or mobile infrastructure
- Large area of action coverage
- Continuous, on demand, opportunistic surveillance
- Multiple acting level, variable number of active actors

Environment/ Exploitation Requirements

- High autonomy level
- Mission and vehicle survival

Actors:

- Different range capacity UAVs, UGVs and UUVs
- Immobile systems
- Command station operators / border patrol (manned)

Blue Border



Green Border



Border Checkpoints



Missions: Distributed border surveillance

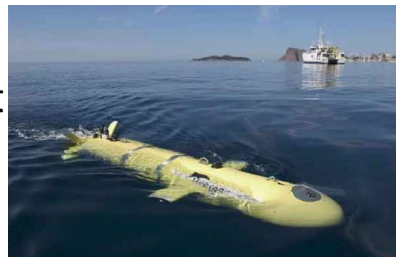
- Surveillance, tracking
- Detection of illegal activity (vehicle, people, merchandise)
- Alerting actors
- Information gathering
- Support to border patrol
- Dissuasive action

Interactions

- Different level of operation management (autonomous and remote controlled)
- Member states authorities & regulation

Basic Functions

- Navigation, mission and vehicle survival, mission flexibility
- Vehicle and people detection, recognition, identification and tracking
- Information gathering, situation awareness
- On-board real time sensor data analysis, data fusion and sorting
- Decision making (planning, send out another actor, abandon / continue tracking)
- Self protection
- Communication



System Requirements

- UAV, UGV, UUV Fleet management
- Mission management
- Real time control
- Power autonomy
- Co-ordinated planning
- Payload modularity
- Collision avoidance
- Safe mission termination
- Self diagnostic capability
- Failure tolerance

Design invariants

- Distributed Information management
- Ad hoc networking
- Local autonomy (perception, planning, navigation, actuation loops)
- Robust control design

Border Surveillance scenario: threats & risks



THREATS	RISKS
Illegal immigration	<ul style="list-style-type: none">▪ Intrusions of elements of international criminal organizations▪ Humanitarian Emergencies (mass immigration by fortune boats)▪ Human beings trafficking
Cross-border criminality	<ul style="list-style-type: none">▪ Intrusions / border infringement by common or organized criminality▪ Suspect crowding along borders, mass violence, piracy
Illegal trafficking	<ul style="list-style-type: none">▪ Illegal weapons trade, drugs and NBCR materials trafficking
Pollution	<ul style="list-style-type: none">▪ Illegal transportation or disposal of dangerous materials (as toxics and nuclear wastes)▪ Intentional pollution events due to chemical products and oil (from ships tanks washing)
Terrorism	<ul style="list-style-type: none">▪ Entering of elements of international criminal or terrorist organizations▪ Trafficking of materials usable in terrorist acts as explosives, toxics, nuclear and radioactive materials,...▪ Intrusion of people or groups with terrorist intents▪ Intrusions of transportation means modified for terrorist aims▪ Piracy acts with terrorist intents

Border Surveillance scenario: customers' roles and needs



Potential customers of Border Surveillance Systems are the governative agencies encharged to ensure the national (homeland) security

CUSTOMER'S TASK	NEEDS
Maritime Surveillance	<ul style="list-style-type: none">▪ Surveillance & Patrolling of sea areas:▪ Territorial Sea (12 NM from coast line)▪ Contiguous zone (12 + 12 NM) and open international sea▪ Exclusive Economic Zone
Air Space Surveillance	<ul style="list-style-type: none">▪ Surveillance of intrusions through air space enforcing the standard Air Traffic Control
Ground & Fluvial borders surveillance	<ul style="list-style-type: none">▪ Surveillance and patrolling of▪ Ground terrestrial border (green border)▪ Fluvial border
Check of people and goods at border crossing points	<ul style="list-style-type: none">▪ Surveillance at border crossing of roads and railroads, in harbours ad airports for▪ Check of people (identification)▪ Check of transportation means (check of goods and freight documents)

Surveillance of areas subject to natural disasters (landslides, floods, earthquakes, ...)

- Continuous monitoring of areas hit by natural disasters
- Support to the intervention forces with the possibility of providing a back-up communication facility to the damaged area

Border patrol

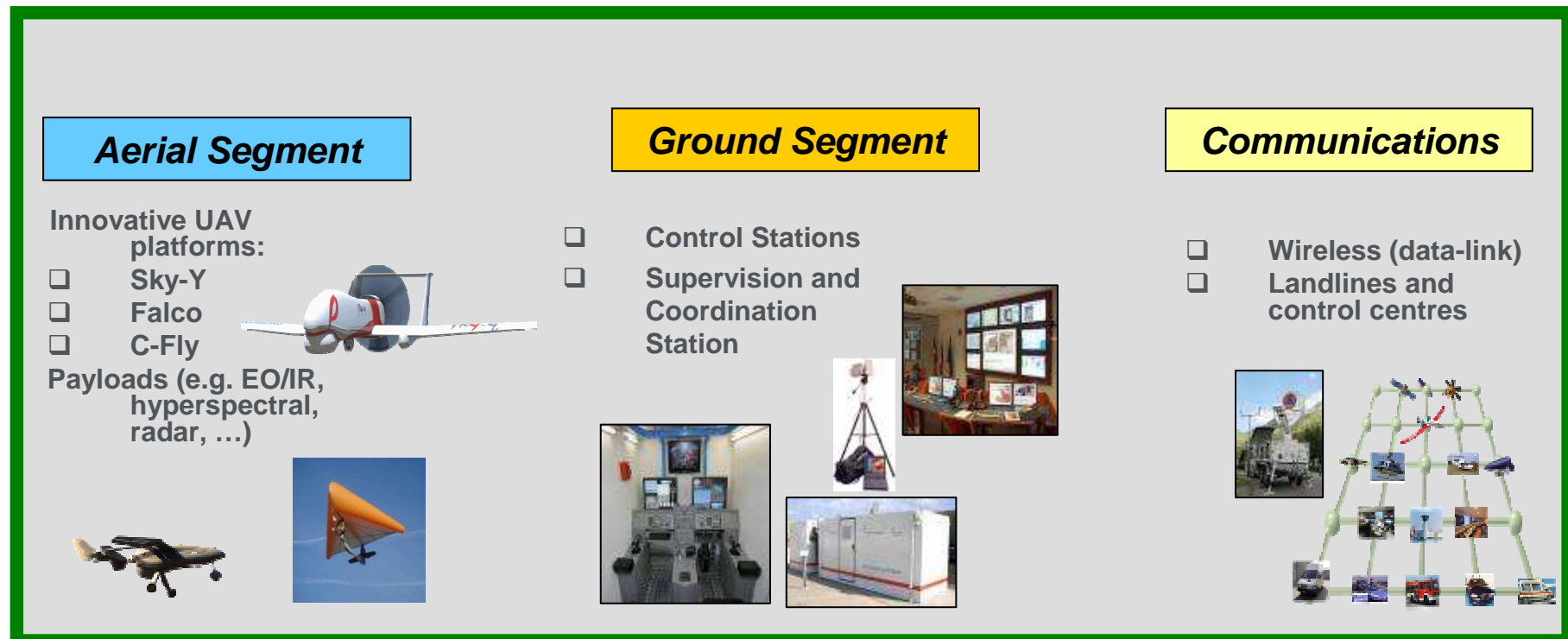
- Border and coastline patrolling against illegal activities and illicit immigration
- Search and rescue support

Surveillance of areas subject to human intervention

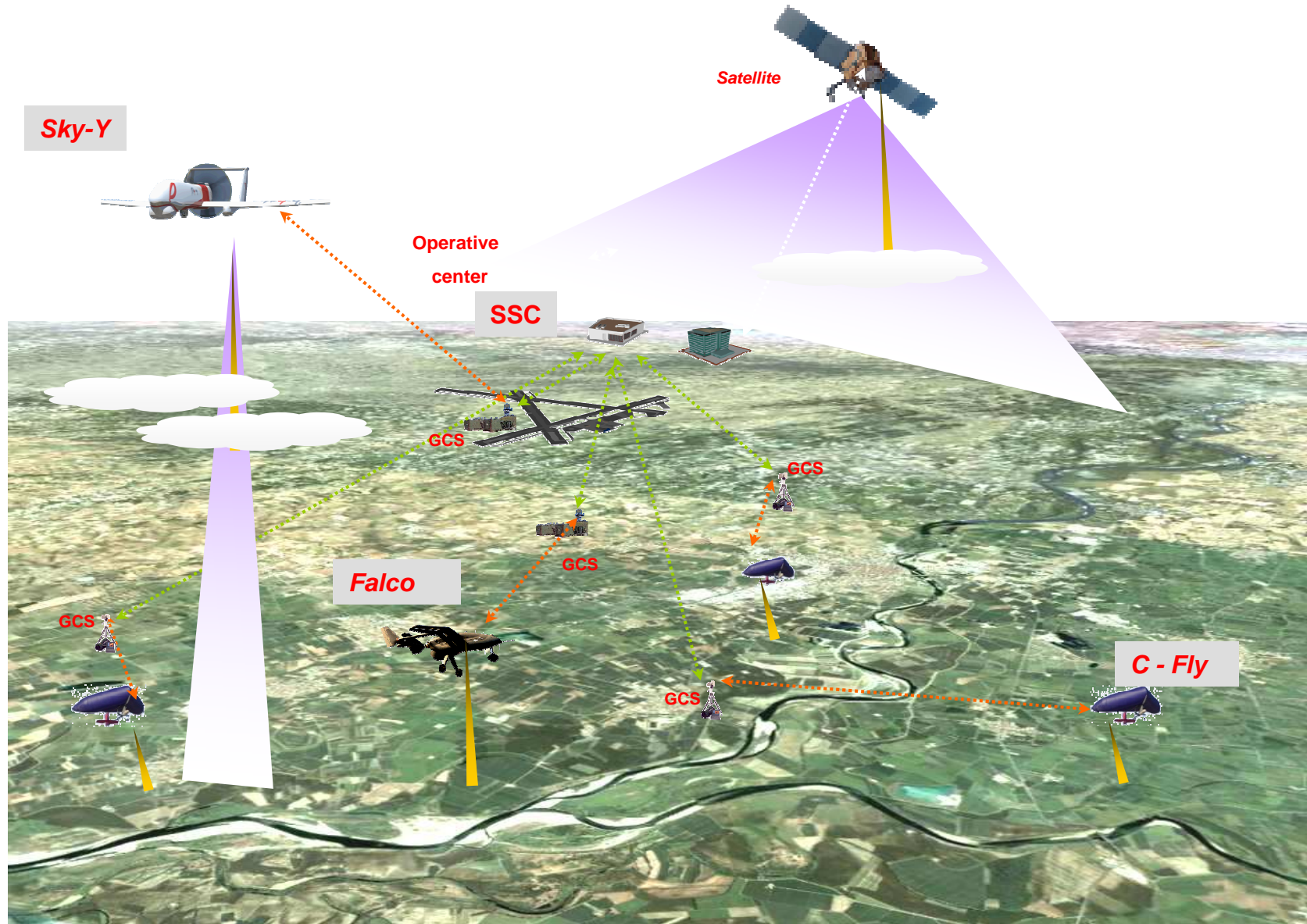
- Areas with high industrialization and high pollution risk
- Surveillance of major events



SMAT is organized into three segments: aerial, ground and communications. Its architecture will be integrated with the existing surveillance network.



SMAT: Operational View



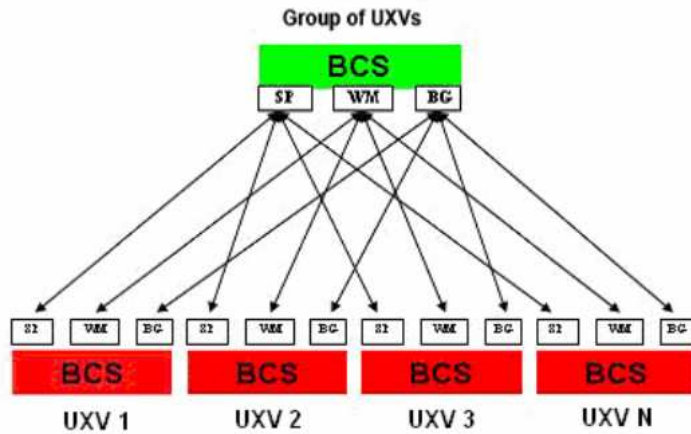
Technologies and Architecture for Autonomy (TA4A) is a Focus Group in the AM&ET Community. ALENIA AERONAUTICA is the leader of the FG.

Objective:

Identification of technologies critical for the **autonomy of the robotic platforms**, with particular attention to the requirements and architectural aspects.



TA4A: output



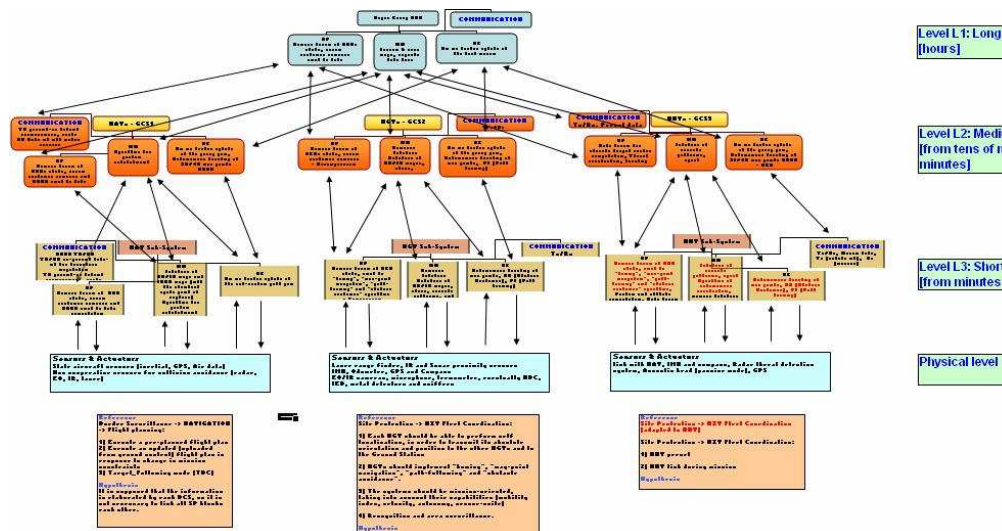
UAV



UGV



UUV



Multi-purpose security architecture



SEABilla Aims to:

- Reduce the number of illegal immigrants who manage to enter the EU undetected
- Increase internal security by contributing to the prevention of cross-border crime
- Enhance search and rescue capacity, to save more lives of migrants who attempt risky ways to cross the border

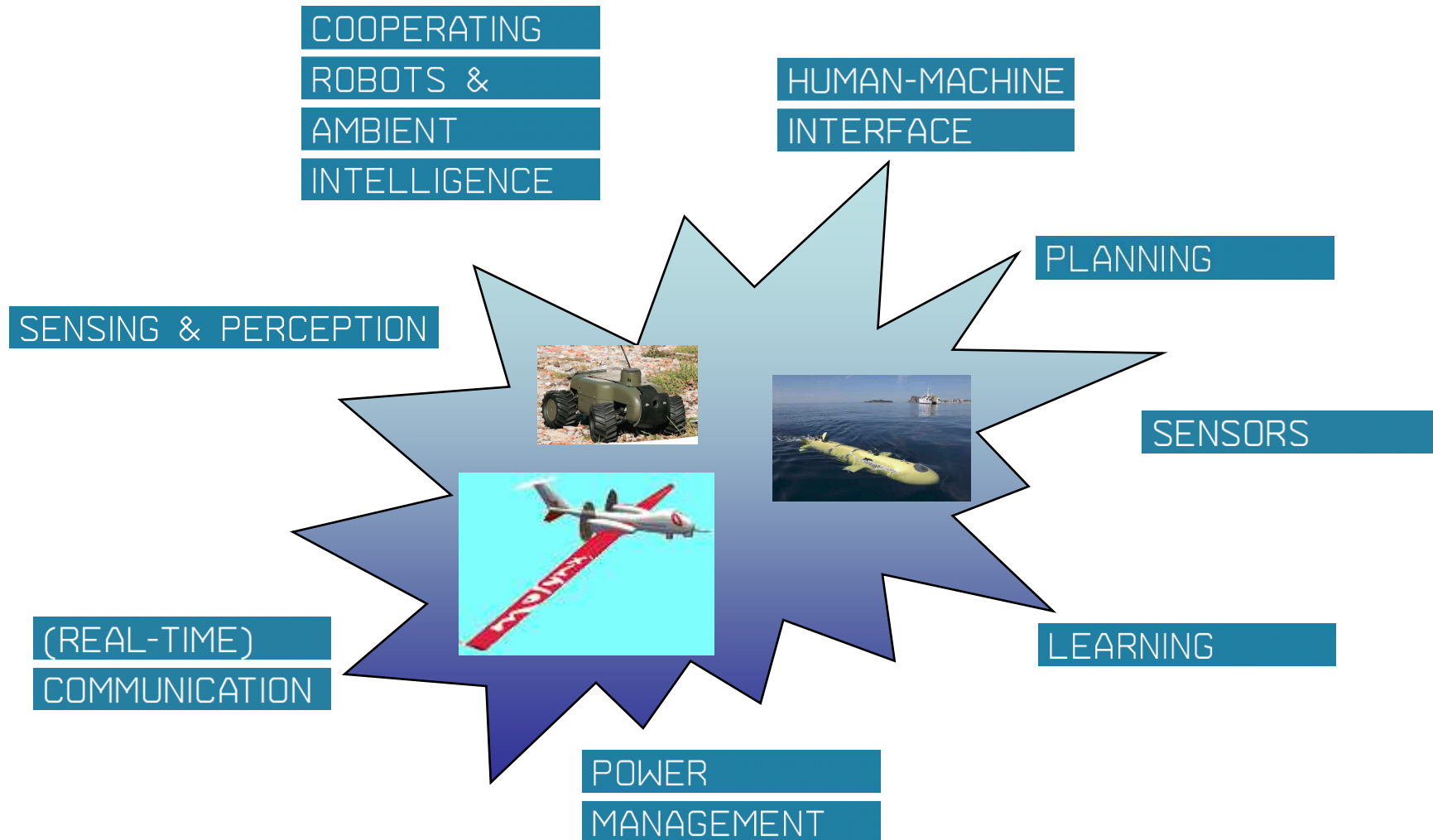


SEABilla Objectives:

Study, develop and demonstrate cost-effective solutions to:

- extend, in general, the areas covered by surveillance
- improve the capability to detect small non-reporting vessels typically used by immigrants and illegal traffickers
- improve the capability to maintain tracks, classify and identify non-reporting vessels
- confirm identity and position of reporting vessels or find out false reporting
- achieve separation between the 'suspicious vessels' and the 'normal vessels',
- minimise the errors (either false alarms or undetected threats)

Security domain: enabling technologies



Dimensions	
Length	9.725 m
Span	9.937 m
Weights	
MTOW	1200 kg
OEW	850 kg
Fuel	200 kg
Payload	150 kg
Performances	
LOS Radius	70 nm
Range	500 nm
Altitude	25.000 ft
Endurance	14 h
Engine	
1 Diesel	160 HP



Dimensions	
Length	6.94 m
Span	5.78 m
Weights	
MTOW	1450 kg
OEW	1000 kg
Fuel max	350 kg
Payload max	150 kg
Performances	
LOS Radius	50 nm
Altitude	25000 ft
Endurance	2 h



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The **Tactical Control Station** is dedicated to:

- the aircraft management (Via Remote Operator Station),
- the sensor management (Via Remote Sensor Operator Station)
- the datalink management
- data exploitation and exportation

Alenia successfully completed a series of tests on its demonstrators:

Basic Capabilities

- Autonomous Operations (automatic take-off & landing, navigation)
- Contingency Management (Emergency)

Mission Capabilities

- Sensor Management
- Image/Data distribution, Ground Target Search and Identification

Additional Capabilities

- Automatic Rendez-Vous
- Close Formation Flight

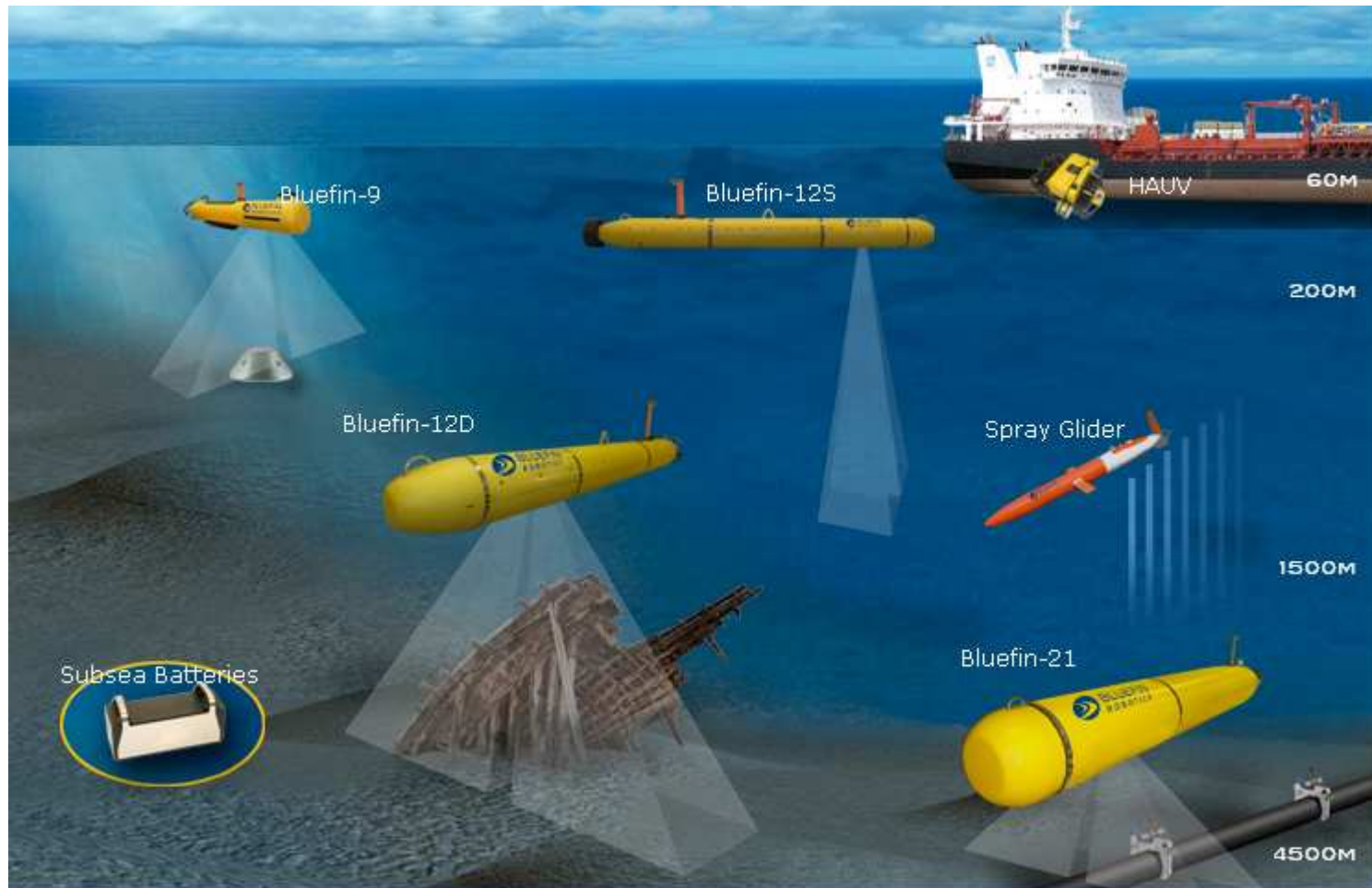




OTO - TRP7 - HS

- Semi autonomous electric-powered tracked vehicle
- Autonomous way point navigation both outdoor (GPS controlled) and indoor
- Obstacle avoidance capability
- Capability to manage information and data provided by the platform sensors
- Capability to cooperate with other manned and unmanned platforms

Example of a UUV system



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Thank you for your attention!