SUNNY: **S**mart **UN**attended airborne sensor **N**etwork for detection of vessels used for cross border crime and irregular entr**Y**

COMPUTER VISION Group, School of EECS, QMUL

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1 Overview

Background: Illegal incursions & border crossing problems for European Union Nations over extensive lands and seas

State Of The Arts: legacy sensors and communications systems for military uses with low civil interoperability and cost-benefits, NOT suitable for broad border security surveillance

Solution: SUNNY − develop a heterogeneous network of sensors carried by Unmanned Aerial Vehicles (UAVs) to provide both large and focused capability for effective border control surveillance

Figure 1: Major illegal immigration routes

Situation at the external borders

Drug exchange

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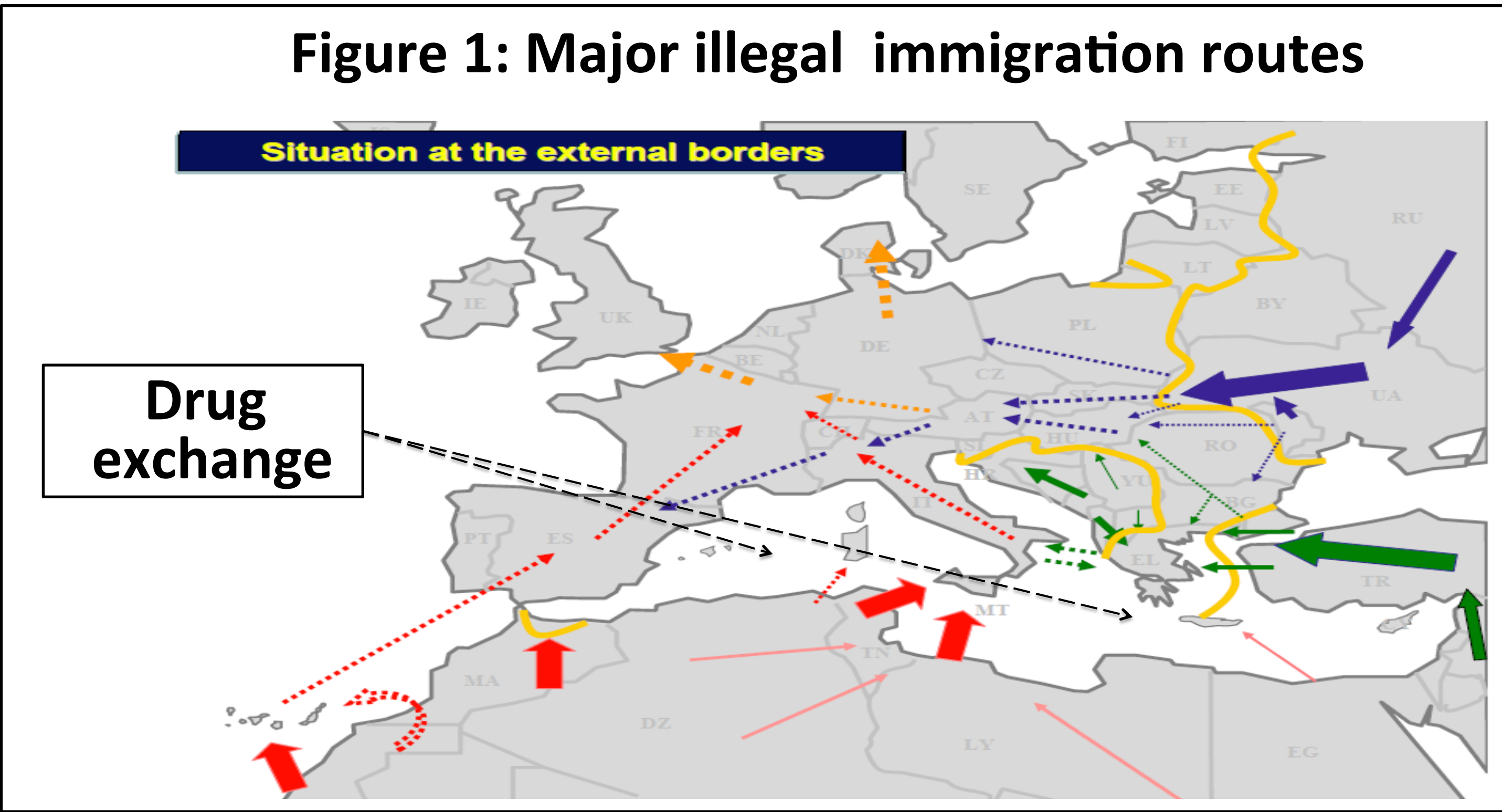
2 Solution — Two tier intelligent heterogeneous UAV sensor network

- Exploit the complementary effects of multi-type sensors deployed on multiple networked UAVs
- Develop efficent data and message communications between UAV agents
- Develop innovative machine algorithms for multi-sensor data analysis across multi-UAVs and Base System
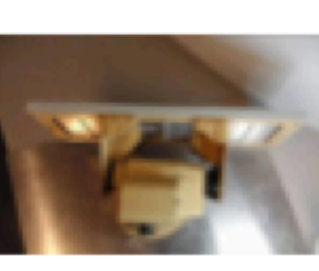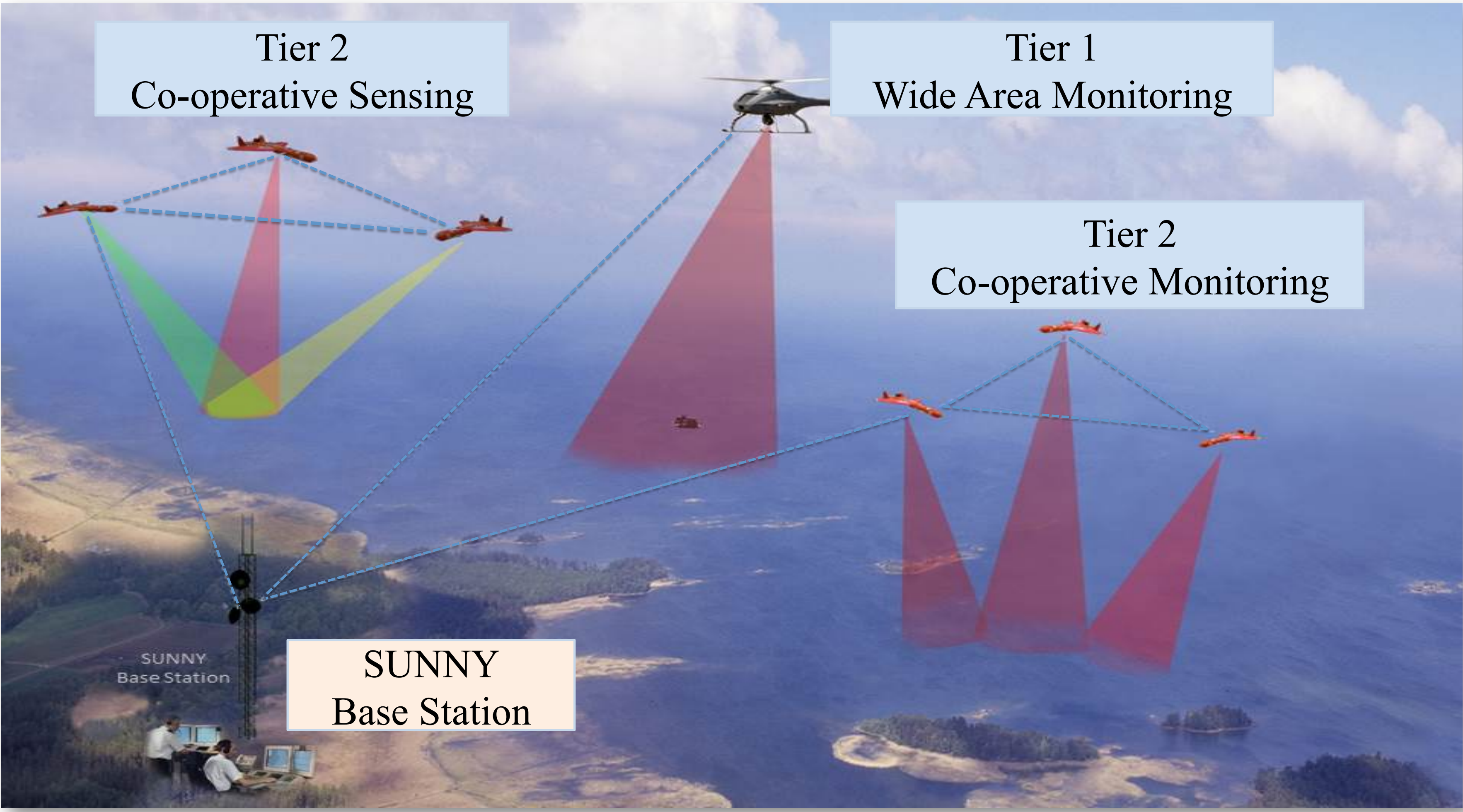
Figure 2: SUNNY Deployment Framework

Tier 2 Co-operative Sensing

Tier 1 Wide Area Monitoring

Tier 2 Co-operative Monitoring

SUNNY Base Station

Table 1: UAVs and Sensors

UAV	Tier	Sensors On-board
ANTEX	Tier 1	RADAR, AIS
ETHERAS	Tier 2	Hyperspectral (KESTREL16)
SCRAB-II	Tier 2	
OURANOS	Tier 2	

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3 Approach, Data, Boat Search Result

Figure 3: Overview of the SUNNY target search system

Automated Target Identification (SUNNY)

Sensors → Temporal Alignment (Component 1) → Single Sensor based Target Identification

No Threat detected

Stage 1 Data Fusion for target Identification

Potential Threat

On-board processing

3D coordinate-based alignment (Component 2) → Retrieve EO, IR, Hyperspectral Data → Stage 2 Data Fusion for target Identification

SUNNY Base Station

Potential Threat

No Threat detected

Final Decision Making

Fishing boat · Rubber boat · Inflatable boat

EO data

IR data

Raw UAV sensor full images

EO — IR

Automatic boat detection and recognition result

Inflatable boat

Fishing boat

EO — IR

SUNNY website:

http://www.sunnyproject.eu/

SUNNY Partners:

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