



Project Results

RECONSURVE

A reconfigurable maritime surveillance framework

Executive summary

RECONSURVE is a cost-effective approach to wide-area sea-border surveillance. It addresses the need to control the rapidly increasing number and complexity of maritime surveillance issues such as illegal immigration, interoperability between heterogeneous systems and automated, cost-effective and efficient decision support.

Project origins

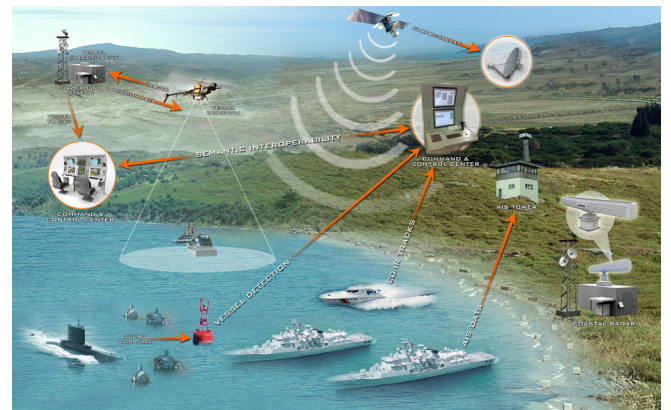
The rapid ongoing rise in the global surveillance and security market was the springboard for the ITEA 2 RECONSURVE project to develop an open interoperable maritime surveillance framework aimed at improving maritime security. The challenges included fragmented surveillance systems, lack of information-sharing on standards, agreements, policies or processes, the difficulty of detecting small vessels used for illegal purposes or in extreme weather conditions, uncoordinated and diverse sensor data, and the unpredictable and constantly changing behaviour of suspicious vessels. So a key objective of RECONSURVE was to achieve interoperability standardisation so that existing systems would be able to share information by creating interfaces between existing systems across domains and borders through an interoperability framework to meet the ever-increasing need to provide a common and recognised picture. This meant tackling a number of scientific and technical challenges.

Technology applied

RECONSURVE drove technological developments forward, specifically related to image processing, interoperability, command and control, specifying the system interfaces for sensor data processing and creating databases for virtual infra-red (IR) images and real IR images. Among the large number of achievements are maritime surveillance systems for situational awareness including a

semantic interoperability layer (SRDC), a fuzzy-based collision analysis system and satellite map server (GMT), integration in the VATOZ C&C centre (Aselsan), a Hyperion C&C (table-top) HMI prototype (ATOL) and a PDDL language with generic solvers for multi-UAV mission planning (Thales). Algorithms were developed for vessel recognition integrated in the ADS ground station for small boat detection and super-resolution (Evitech), vessel type classification (GREYC with (casual) human comparable performances, Aselsan) and vessel behaviour analysis such as vessel intention estimation (ATOL, GMT, SRDC), including threat assessment. Innovation is evident in the actual integration of multimodal sensors (including UAVs) for global maritime surveillance and situational awareness, and in the development of natural HMIs for managing complex C&C systems along with a complete smart system to support command & control centres.

The technical capabilities developed in this Aselsan-led project were demonstrated in a scenario first at the Turkish Coast Guard Command facilities in Antalya, Turkey whereby vessels revealing suspicious behaviour were detected successfully by the situational awareness



Reconfigurable Surveillance System with Communicating Smart Sensors

component of the RECONSURVE system. A second large live demonstration was performed in Brest, France with the participation of the French Coast Guard. The project is the recipient of two prominent Korean awards and 7 patents are pending application (4 Aselsan, 2 Thales, 1 GMT).

Making the difference

The development of scalable, reliable and cost-effective solutions will dramatically improve the effectiveness of maritime surveillance, specifically for monitoring non-reporting vessels, and will reduce the costs of deploying such systems. This project will make it more difficult for lucrative illegal immigration networks to operate across sea borders and so help fight such networks and combat the costs incurred by European economies to deal with illegal immigration. RECONSURVE

will also help make search and rescue operations more successful through early detection of boats in trouble.

The consortium partners benefit significantly from the results of RECONSURVE. Aselsan, for example, is planning to use the results to improve its current portfolio with new features and capabilities, for instance in its VATOZ® sensor management product line, with unmanned airborne system integration, situational awareness capability and a new smart decision support functionality based on image processing and behavioural analysis. The main exploitation of the situational awareness component is planned for 2015-2016 with the Turkish Coastguard. Institut Mines-Télécom/ ATOL will perform an operational evaluation with end-users and cooperate with Thales Airborne Systems to industrialise the expert system, the theoretical principles of which will be used by

Ecole Navale and possibly Institut Mines-Télécom for further research and teaching purposes. The SME Evitech will work with large integrators or camera builders to propose this algorithm for its Jaguar product while in South Korea GMT will use the outcomes and experience to develop a more advanced vessel traffic system and vessel monitoring system. The Korean Coastguard has already upgraded vessel monitoring to intelligent surveillance using some of situational awareness technology. The project's results will also pave the way for Thales to develop a new Navigation Management System for UAVs guaranteeing certification and safety as required for general air traffic and the integration of robust and novel algorithms in Thales' decision support systems. Finally, GREYC intends to continue developing the automatic tool for recognising boat categories in images in new projects involving industrial partners.

Major project outcomes

Dissemination

- More than 20 publications (e.g. ICPR 2014, Journal of Computer Vision and Image Understanding 2015, Proceedings of KIIS Spring Conference 2014, 18th ICCRTS)
- Several presentations/demos at conferences/fairs (e.g. IDEF, COST MOVE Workshop, ITEA & ARTEMIS Co-summit)

Exploitation (so far)

- Maritime Surveillance System: to detect suspicious behaviour in maritime domain and provide extensive coverage in a cost-effective manner through the intelligent allocation of sensors and intelligent routing of UAVs
- Suspicious Vessel Behaviour Detector: analyses the abnormal situations of vessels. It executes flexible and parametric rules defined by using Rule Editor. The module uses external and internal maritime data resources (such as port, route, captain, crew, criminal records information)
- EyeMap-VMS: displays detailed information of each vessel including static and dynamic data by integrating real-time marine and land Integrated location information based on GIS
- S-57+Sat Map Server: Electronic navigational chart based on S-57 international standard with overlay of 1m resolution satellite image
- Boat detection software: embedded in mobile camera: Module provides super resolution and running detection algorithm on super-resolved images.
- EO/IR based Vessel Classification System: has novel method to recognize Ship category, and it has also offline learning capability
- Collision Analysis System provides Risk analysis and identification of ship collision within a specific area/range

Standardisation

- Participation to NATO IST-94 and IST-119 Working Group
- Application completed to be member of OASIS Emergency Management TC

Patents

- 7 Patent Applications (5 International and 2 Local)

RECONSURVE

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Partners

France

Airbus Defence & Space

Ecole Navale - IRENav

Evitech

GREYC

Institut Mines-Télécom ATOL

Thales S.A.

Republic of Korea

GMT

Turkey

Aselsan

SRDC

Project start

January 2011

Project end

June 2015

Project leader

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Project website

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ITEA is the EUREKA Cluster programme supporting innovative, industry-driven, pre-competitive R&D projects in the area of Software-intensive Systems & Services (SiSS). ITEA stimulates projects in an open community of large industry, SMEs, universities, research institutes and user organisations. As ITEA is a EUREKA Cluster, the community is founded in Europe based on the EUREKA principles and is open to participants worldwide.