

What's the importance of EFFECTOR system for EU member states located in the Mediterranean Sea basin?

The EFFECTOR project, after 24-months of scientific research, delivers to maritime and border security authorities of Europe a valuable tool for more effective response to illegal activities and threats occurred at EU's external sea borders.

Political instability in the **East Mediterranean Sea** has led to significant **migratory pressure** and **smuggling incidents** across **European Union's external sea borders**. National and European authorities ought to enhance their **situational awareness**, optimizing responses to maritime threats. The **European Union** has given strong emphasis in the last decade in improving the **integrated maritime picture**, the information sharing and the organizational cooperation for enhancing the **safety at sea** and the **security of maritime borders**.

The EFFECTOR offer to Maritime and Border Security authorities of Europe

The **EFFECTOR project** allows a seamless cooperation between the operating authorities and on-site intervention forces in real time, through a secure and privacy protected network. The users can exchange **situational awareness data** (e. g. enhanced pictures) in **isochronal manner** and **obtain data** from different maritime systems scaling from local to regional, to national and up to transnational level.

For **example**, the operator of the **EFFECTOR system** can know easily if a vessel enters to a **protected zone** and detects **automatically** any **suspicious** or **abnormal behaviour** of vessels. In case of a weak or fake signal, the **exchange of information** with other authorities or agencies via the **CISE link** facilitates its verification.

"Thanks to the data lake and the associated analytics developed during EFFECTOR, this capability to detect weak signals and to gather pieces of information coming from the large number and range of resources is also unique, and is a major result of the EFFECTOR project", Mr. Alexis Blum (SGMer), the EFFECTOR project coordinator, stated.



Demonstrating the EFFECTOR system's capabilities through fictional scenarios in front of representatives of European Maritime Authorities, Frontex and practitioners in Alexandroupolis, Greece

The concept of EFFECTOR System

The **EFFECTOR System Architecture** is based on a distributed system that offers scalability, availability and security capabilities, as required according to the end-users. The core of the system is designed in a flexible and modular framework so that implementation of **new functionalities** is **easy** and **cost-effective**. The part of the **EFFECTOR System** that was implemented in **France, Portugal and Greece** is mainly consisted of **six modules** that were developed along the different work packages of the project:

- The **CISE Adapter** that transposed / adapted different data models / services from and to CISE model.
- The **Input and Output layer** which was strongly linked to all EFFECTOR system modules, which harmonized the data incoming, ingest and also export the data inside and outside the system (*to the CISE Network and*



possibly **EUROSUR**), and finally to be able of routing the data inside the system.

- The **Data Lake** itself that stored the data efficiently for the different kind of usages.
- The **Analytics and Ontology** that were supplied directly by the Data Lake and works on data.
- The **Data Management layer** that provided security and rules inside the EFFECTOR system and data Lake storage and accessibility.

Being Interoperable with lots of Data

One of the **main technical challenges** in the project was about managing the **data ingested** from **various sources** in order to make those data available to the services that need it, in the format they can read it and, in the means, they expect it. This can be classified as a hard requirement, while a soft requirement was to manage this process in one environment, that can handle the throughput and have the ability to trace where the data is now. The available data moved through **different stages** such as a **flow of running water** and was affected as it moved. An action or function performed:

- **Ingestion**, e.g. connect to AIS, read file, call web service.
- **Filtering**, e.g. location, privacy concerns etc.
- **Transformation**, e.g. to another data model.
- **Routing**, e.g. send to a message bus.
- **Augmentation**, e.g. add additional data from another source.
- **Storing**, e.g. store the message.

The functions mentioned above needed to be linked together in a logical flow and various technical challenges were put through.

UAVs contribution in Data Collection

The EFFECTOR system has also evolved an **autonomous object detection and tracking module**, carried on-board a UAV. Specifically, this component is composed of a specially built **octocopter UAV**, the **pilot's station** and the **intelligence officer's station**.

The UAV was equipped with a pair of **daylight** and **thermal cameras** providing a **video stream** for the UAV's **pilot**, enabling **Extended Visual Line-of-Sight (EVLLOS)** flight capability.

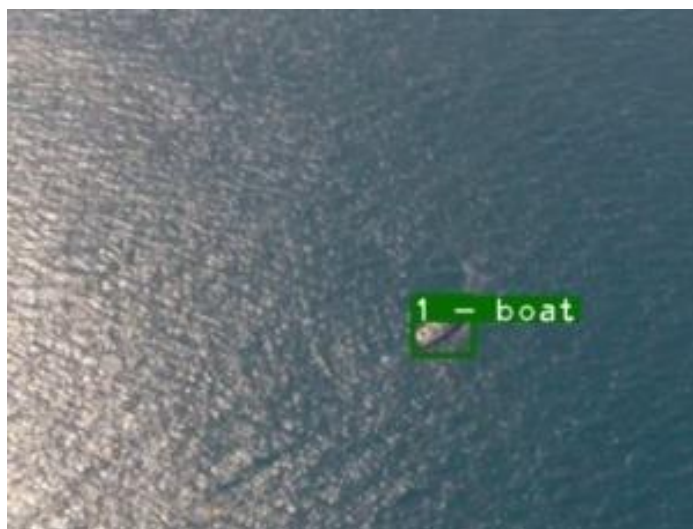


The octacopter UAV, component of the EFFECTOR system

The **main features** derived by this component are:

- The ability to **detect objects**;
- The ability to **track the motion** of detected object;
- **Timely information** (*live transmission of data*);
- **Fast deployment** (*minimal delays when an event has been reported and needs to be verified*);
- **Interoperability** (*compliance with existing communication protocols*);
- **Independent and self-sufficient** operation;
- **Cost effectiveness**.

The **on-board AI module** was responsible for scanning the camera feed and detect specific types of objects (*such as vessels*). The detected objects are assigned a unique key and they movement is consequently tracked. Once a vessel was detected, the results of the onboard processing were overlaid on the **Full HD video** stream and transmitted to the **Intelligence Officer's workstation**. At the same time, the on-board adapters created a message compliant with the expanded version of the **Common information sharing environment (eCISE)** protocol that could be forwarded to any eCISE compatible system.



A detected vessel as it appears on the Intelligence officer's station

EFFECTOR Trials

The capabilities of the **EFFECTOR system** were tested, validated and demonstrated in real operational scenarios that took place in **France, Portugal and Greece** during the project's lifecycle. In these activities, **European maritime authorities, Frontex, practitioners** as well as other **end users** participated and experienced the valuable contribution that this system is able to provide for a more effective response to illegal activities that occur at EU's external sea borders, particularly the ones located at the Mediterranean Sea basin.

- French Trial & VIP Day -

The **French trial** took place on **May 10th – 11th, 2022**. Two fictional scenarios (*4 hours each*) were organized and coordinated by the **French MRCC in La Garde**, nearby Toulon. The purpose of the **first scenario** was to process the data coming from different sources and check the interoperability between multiples European systems.

The **second one** aimed to measure the responsiveness of the **EFFECTOR system** when facing abnormal situations such as **AIS spoofing** (*emission of fake AIS signal*), suspicion of a meeting at sea, or even an intrusion in a protected or restricted area.



The Intelligence officer's station while deploying two fictional scenarios at French MRCC in La Garde, France. At the same time a video production crew was filming the demonstration for the EFFECTOR VIP event

Following the French trial, the **EFFECTOR's VIP Day** was organized in **Toulon (France)** on **May 17th, 2022** in order to showcase to a wide range of **European stakeholders** from industrial and maritime authorities to administrations and scientific and technological institutions. Representatives from the **French Republic** attended this event and particularly the **Navy, Customs, Maritime Affairs, the Mediterranean Maritime prefecture** and other administrations. Among the guests of VIP Day included also representatives from the **European commission** (*i.e. DG Home and DG Mare*) as well as **European Maritime Agencies** (*i.e. EMSA, Frontex*).



EFFECTOR VIP Day | Toulon, France



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- Portuguese Trial -

The **Portuguese trial** was hosted by the **Portuguese Navy** in **April 2022** where **three different relevant scenarios** were tested: **a) naval control and guidance**, **b) illegal activity**, and **c) oil spill**. Besides the enrollment of **Maritime Operation Center of the Portuguese Navy**, a fast patrol boat was employed, allowing the simulation of abnormal activities to be detected by the systems and modules developed in the project. The objectives of the trial were accomplished by the enhancement of the **prediction**, **survey capability** and the **faster reaction** to incidents that are related to illegal activities.



Maritime Operation Center of Portuguese Navy while testing the three PT scenarios

- Greek Trial -

The **Greek trial** was held on **June 8th-9th, 2022** where two scenarios were tested in the coastal zone from **Alexandroupolis to Evros River Delta**. The **first scenario** detected and apprehended irregular migrants, concluding to a **Search & Rescue** operation in Evros River Delta. **Greek authorities** analyzed the high possibility of **mass migration** in the nearby cities and with the **help of the EFFECTOR system**, migrants' departure details were estimated. The **second scenario** focused on the detection of vessels' suspicious activity between **Samothraki Island** and **Alexandroupolis** where only fishing vessels and passenger ships usually occur. A notification for **collision avoidance alerts** and a **rendezvous** was automatically identified by the

EFFECTOR system. According to the fictional scenario, the smaller vessel **offloaded cargo** to a bigger vessel and local authorities were alerted to track the route and expect for its arrival to Alexandroupolis port.



Collision avoidance alert scenario tested during the Greek Trial

The importance of trials in test sites

The **EFFECTOR trials** enabled training of end users over their own capacities in order to be prepared for various **real-time events** at sea. Thus, during the interactions, the user community exchanged knowledge, technical capacities, and practical experiences in vessel surveillance, maritime traffic control, SAR and safety domain concluding with an overall positive appreciation of the highly developed **EFFECTOR system** for maritime authorities' interoperability framework.

The **impact observed** in end-users' operational capabilities was significant both **at cross-border level** and **cross-sector** by sharing information with other fellow member states or sectorial entities respectively. Furthermore, the **Artificial Intelligence** utilized by **EFFECTOR**, significantly supports decision-making, and reduces the resources that need to be assigned in order to obtain an **enhanced situational picture** for maritime surveillance.



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Hellenic Police while participating in the fictional scenarios of the Greek Trial for testing the EFFECTOR system

Those **benefits** would have never been observed and assessed if it were not for the **trials** that took place in **France, Portugal** and **Greece**, where capabilities and functionalities of the **EFFECTOR system** were put into use against **realistic** and **well prepared scenarios** and the improvement of the operational practice in terms of information exchange, system interoperability, joint operational management and reporting was incontrovertible.

With an Eye to the Future

The **EFFECTOR project** completes its lifespan on **September 30th, 2022** after **24-months** of scientific research and delivers to maritime and border security authorities of Europe a valuable tool for more **effective response** to illegal activities and threads occurred at **EU's external sea borders**. The project's results provide a **robust baseline** to build on, either by further developing the EFFECTOR system infrastructure or further enhancing its **individual functionalities** and in this way the overall capacity of the system or even bring inspiration for **future innovative** relevant projects.

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At a Glance

Acronym: EFFECTOR

Title: An End to end Interoperability Framework For
MaritimE Situational Awareness at StrategiC and TacTical
OpeRations

Call identifier: H2020-SU-SEC-2019

Topic: SU-BES03-2018-2019-2020 Demonstration of
applied solutions to enhance border and external security

Total Budget: € 4,999,529.50

Project duration: 24 months

Start Date: 1st October 2020

Project Coordinator:
SECRETERIAT GENERAL DE LA MER, France (SGMER)

Consortium:

- CENTER FOR SECURITY STUDIES, Greece (KEMEA);
- NAVAL GROUP SA, France (NAVAL);
- THALES RESEARCH & TECHNOLOGY, France (THALES);
- SATWAYS – PROIONTA KAI YPIRESIES TILEMATIKIS DIKTYAKON KAI TILEPIKINONIAKON EFARMOGON ETAIRIA PERIORISMENIS EFTHINIS EPE, Greece (SATWAYS);
- INSTITUTE OF COMMUNICATION AND COMPUTER SYSTEMS, Greece (ICCS);
- INOV – INSTITUTO DE ENGENHARIA DE SISTEMAS E COMPUTADORES INOVAÇÃO, Portugal (INOV)
- ENGINEERING – INGEGNERIA INFORMATICA SPA, Italy (ENG);
- UNIVERSITÉ TOULOUSE 1 CAPITOLE, France (IRIT);
- COLLECTE LOCALISATION SATELLITES, France (CLS);
- MINISTRY OF MARITIME AFFAIRS AND INSULAR POLICY, Greece (MMAIP);
- HELLENIC POLICE, Greece (HPL);
- MINISTERIO DA DEFESA NACIONAL, Portugal (PTN);
- EXECUTIVE AGENCY MARITIME ADMINISTRATION, Bulgaria (EAMA);
- MINISTRY OF NATIONAL DEFENCE, Greece (HMOD);
- ADMINISTRATION FOR MARITIME SAFETY AND PORT MANAGEMENT OF MONTENEGRO, Montenegro (AMSPM).



Editorial content

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EFFECTOR H2020 Project



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