I2C

Integrated System for Interoperable sensors & Information sources for Common abnormal vessel behaviour detection & Collaborative identification of threat

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Executive Summary

The I2C project is ending. This document is the Third reporting period document. It keeps track of all the cumulative work done from RP1 to RP3.

It depicts in easy to identify separate paragraphs what as been achieved during the periodic report n°3.

It contains all elements required as part of the electronic project periodic report requirements.

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PROJECT PERIODIC REPORT

Grant Agreement number: 242340
Project acronym: I2C
Project title: Integrated System for Interoperable sensors & Information sources for Common abnormal vessel behaviour detection & Collaborative identification of threat
Funding Scheme: Collaborative project
Date of latest version of Annex 1 against which the assessment will be made:
Periodic report: 1st ☐ 2st ☐ 3st ☒
Period covered: from 01/10/2010 to 30/09/2014
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I, as scientific representative of the coordinator of this project and in line with the obligations as stated in Article II.2.3 of the Grant Agreement declare that:

- The attached periodic report represents an accurate description of the work carried out in this project for this reporting period (see Annex I of the Grant Agreement);
- The project:

  ☒ has fully achieved its objectives and technical goals for the period;
  ☐ has achieved most of its objectives and technical goals for the period with relatively minor deviations;
  ☐ has failed to achieved critical objectives and/or is not at all on schedule.

- The public website, if applicable

  ☒ is up to date
  ☐ Is not up to date

- To my best knowledge, the financial statements which are being submitted as part of this report are in line with the actual work carried out and are consistent with the report on the resources used for the project (see section 2.4) and if applicable with the certificate on financial statement.

- All beneficiaries, in particular non profit public bodies, secondary and higher education establishments, research organisation and SMEs, have declared to have verified their legal status. Any changes have been reported under section 2.4 (Project Management) in accordance with Article II.3 of the Grant Agreement.

Name of the scientific representative of the Coordinator: Michel MOREL. P.i. Henry-Pierre Audubey

Date:30/09/2014

For most of the projects, the signature of this declaration could be done directly via the IT reporting tool through an adapted IT mechanism and in that case, no signed paper from needs to be sent.

1 Summary

1.1 Publishable summary

I2C is a 4-year European research project funded by the European commission under FP7, which started the 1st of October 2010.

The project, coordinated by DCNS, is involving 20 European partners including 5 research centres, 6 industrial companies, and 9 SMEs as well as representatives from operational organisations such as the CeCLAD-M, Gendarmerie Maritime, Affaires Maritimes, FRONTEX, etc.

In the framework of EUROSUR (European external border surveillance system) programme guidelines, I2C project aims at setting-up and experiment an end to end integrated innovative maritime surveillance system. This project allows to:

- Test ways of data fusion from a set of new and conventional sensors deployed at sea shore and on board assets at sea, and other available information such as meteorological forecasts, vessel and harbour files, regulated zones and geo data, intelligence, etc. to carry out intelligent situational picture including documented alerts on detected suspicious vessels.
- Develop and integrate innovative capabilities to generate alert on detected suspicious vessel from operational rules and tools for identification of the most plausible associated threats to early keep informed decisional authority to plan relevant actions.

With this integrated project, in the future, scaling studies / designs can be performed that propose the functional architecture of advanced generation of maritime surveillance systems at any specific shore locations, so authorities can commission their end to end information system based on the I2C project innovative capabilities, the operational architecture and campaign exercises feedbacks.

I2C integrated demonstrator is a unique deployed technical platform for interoperable multi sensor data process refinement and management, and correlation of many other information of interest for reliable, continuous, permanent and all weather surveillance of any vessel tracks and activities over wide maritime territories and process with success irregular migration and serious crimes at sea.

1.2 Description of the work performed since the beginning of the project and the main results achieved so far

During the first period of the project, the main documentation has been elaborated such as the user needs, the functional requirements and the design architecture of the integrated system. These documents have been validated by the consortium beneficiaries and users committee which has been set up to support the project in order to satisfy operational missions (as defined in EUROSUR guidelines).

Also, methodology has been defined to assess the integrated system performances during the planned exercises at sea in the third project period. For the exercises, preliminary scenarios and story boards have been detailed to demonstrate the I2C integrated system capabilities when fully deployed and tested (in the second period).

In the first period, anticipated sensors deployment happened to perform mandatory emission measurements to get the required installation agreement from French authority. Then, the "St Mandrier" shore sensors platform has be partly deployed (radar Furuno, radar Rockwell Collins, AIS receiver and satellite communication station).

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In the second period of the project, the shore based sensor platform has been completed and all Electromagnetic studies and measurements have been performed in order to enable transmission. Each effective transmission is nonetheless following a strict coordination process taking into account all transmission needs on the site to ensure personnel safety and avoid equipment mis-functioning or damages as well as non desired electromagnetic .environment.
The HFSW radar installation (part of another project) has not been performed due to extra administrative delays as:

- Validation of the precise location,
- Validation and procurement of additional means to be in compliance with NATURA 2000 (environmental organisation) and Government local and regional authorities requests all along this project phase.

The satellite communication means have been extended in order to support all necessary nodes. Several reliability / performance / statistics tests have been conducted to validate the architecture.

For the mobile platforms, the detailed analysis of the constraints, capabilities of the assets themselves along with their payload have been evaluated.
These studies have enabled to verify that they where meeting requirements for the campaigns to prepare.
All actions have been taken to mitigate the risks evaluated regarding the payload. This has been carefully conducted by one or several pré-tests in order to take maximum benefit of the payload on board the assets (Zeppelin airship, Unmanned Surface Vehicle, instrumented Aircraft Falcon 20) as they are only available on a short period.

All integrations aspects have been covered from physical integration to exchange of data, software versions and configuration:
- Select/validate the choice of sensors available for the project to be installed and operated on board.
- Study how to integrate these equipment (hardware, software, cable, power supply, etc.) in optimal ways and meeting the eventual regulation to apply.
- Integrate on ground the equipment for preliminary testing and eventual impacts on already installed equipment.
- Prepare training for operating the equipment (if required)
- Perform setting to work (STW) of the equipment.
- Prepare the candidate dates of flight for the aircraft and the aerostat.
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- Get all needed authorisations/clearance
- Select definitive exercises slots / dates.

In order to fulfil those actions, organization of pre-tests has been planned as follows:

- One test in factory at Lorient site for the USV (focus on communications, physical integration)
- One test on site dedicated to remote control, power supply (electrical considerations), and communications for the USV
- Two tests in (pre-integration then full integration) in Friedrichshafen for the airship physical/mechanical/electrical validation
- Full test of the shore platform in St Mandrier (Sesda) with radars, camera and AIS.

Several provisions have been taken to be sure to get maximum data from the short period of availability of the assets (a few days for the 2013 and 2014 campaigns). Therefore, the recording of data will place at several places in case of a failure of a communication mean (satellite or 3G or regular internet).

- The aerostat (Zeppelin) with a sensor payload (Wescam MX-15 Camera, FMCW radar and AIS transponder, communication 3G and Wescam VHF downlink) will record on board data from FMCW, Camera and AIS. The communication with the ground will enable a dual recording of the Radar and AIS data. Camera will be displayed on the shore station and recorded on the ground if possible (depending on ground video recorder availability).

- The aircraft (Falcon 20) with a sensor payload (multi band synthetic aperture radar, an optical pod and AIS transponder). No data communication mean is available with the ground. The recording will be done locally (in the aircraft) only for further processing.

- The patrol vessel (PEGASE) with a sensor payload (navigation radar and AIS transponder) and a satellite telecommunication link with the ground. Record or radar and AIS will be done locally also,

- The unmanned surface vehicle (USV) remotely controlled with a sensor payload (navigation radar, surveillance radar (if available), night & day light camera and AIS transponder) and communication links with the ground. The recording of AIS, navigation radar video and tracks, surveillance radar and differential GPS will be done locally. The recording of AIS, navigation radar tracks and will be done on shore also.

The availability of satellite images to perform post analysis of the campaign will be assessed.

For the first I2C campaign (2013), 5 trials are planned in two exercises:

- One exercise with the equipped aircraft to assess the multi bands SAR to detect small boats during day and also night flight depending on operational constraints)

- One exercise of **4 trials** with the equipped Zeppelin and USV to assess aerostat and USV support in setting up exhaustive situation maritime picture jointly with the deployed shore stations. Zeppelin will be also used as mobile platform to evaluate the FMCW (identical to FMCW radar deployed on St Mandrier coastal station) to perform detection and tracking of small boat from stable platform in altitude.

For Zeppelin, we had to take into account the following constraints:

- A long process to integrate the equipment was required. Indeed, the Airship has equivalent certification constraints to aircrafts certification for both hardware and software especially as we where experimenting prototypes (except the WESCAM).

- Logistics issues to solve as: parking the balloon take off and landing, an airport (Cuers) as well as the agreement from the Maritime Prefet, the military command in charge of the place in the Cuers Airport where the Airship will be located, the air traffic management authority in Hyères airport/control area and ZONEX deconfliction in the military area around Toulon to operate the Zeppelin flights.

The 2013 exercises feedbacks (technical and operational) will be organized:

- Hot debriefing,
- Preliminary debriefing to share common information and improve the analysis and understanding of the data collected. This debriefing also to highlight all lessons learned from the 2013 campaign to save time and derisk the second campaign
- Final debriefing (if required) with final reports on the campaign.

The 2014 campaign will enable to evaluate full I2C integrated system and the assets with payload chosen and available for the last campaign of the project. One of the main objectives will be to demonstrate and evaluate the overall system performances and complementarity of the assets and their payload versus individual contribution and compared to existing systems performs while available.
The challenge for this period was not only technical or due to innovation, but also co-ordinations to solve some administrative issues (missing certificate, authorization to fly in a given area/Zonex to accommodate with other constraints in the area as the exercices conducted by military ships or aircrafts).

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In the third period of the project, the main focus was to evaluate the system as a whole in different environments. 3 main types of tests have been performed:

- Integration and validation tests to evaluate performances of the system with recordings (or synthetic data if recorded data is not sufficient or adapted)
- Specific tests with part of the equipment or capabilities, relying on real data, opportunity targets and tracks.

Well structured exercises have been prepared and executed (one in 2013 and one 2014): more than 7 months of preparation, 50 participants, a combination of assets, targets, users, etc…

The version v1 was set up for the first campaign with part of the capabilities ready. The version V2 was set up for the second and large campaign.
Obviously, some related and derived versions V1.x and V2.y have been produced to integrate Trouble Shooting reports corrections.
In all case, the tests were relying on a complete set of equipment deployed permanently for most of them (e.g. St Mandrier sensor Shore platform). All the permanent authorizations to operate and radiate have been granted.
The HFSW got the permission to transmit (radiate). But, due to missing permanent internet High Bandwidth connexion (delay by the French administration through another contract, outside the scope of I2C), the FMCWR was not integrated in real time, but recordings have been made from all radars and AIS source enabling further analysis.

The objectives of the first campaign were to conduct exercises in real situation to:
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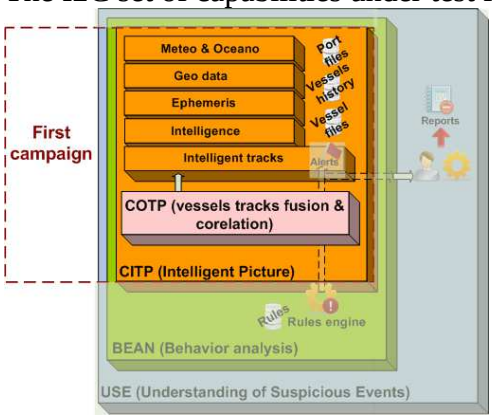
- Validate overall integrated system performances (surveillance of >50 000 tracks, alerts on suspicious activities) and added value of such deployed system for operational users
- Evaluate new sensors (HFSW long range radar and FMCW small boats detection)
- Evaluate assets at sea and above the sea (aircraft and ship, Zeppelin, USV) with equipment on board and connected to a shore centre (real time and postpone analysis)

For the first I2C campaign (2013), 5 trials are planned in two exercises:
- 25-26 June 2013 Falcon flight, shore platform
- 17-22 July 2013 USV, Zeppelin, shore platform

The I2C set of capabilities under test for the first campaign was as follows:



The mains results of the first large campaign are:

- 3 days of trials with the Airship (330-2000 feet ; 0-20 Nm from shore)
- 8 days of trials with the USV (0-6Nm)
- 2 days of trials with the Falcon/ONERA Radar
- 10 days of trials with the ground segment

- Furuno Radar tracks available for post analysis only (10 days of recording)
- WESCAM (Zeppelin payload): 200 Gb of video recording (3 days - 4 hours)
- FMCW on shore and a second radar as Zeppelin Payload (partial integration): 3 days of recordings on board and 5 days on shore.
- Communication issues solved by settings and antenna positioned on the roof of the operational centre
- Use of concept of USV validated for Identification & prepararing of the interception, or also as target for the campaign (to be detected by other means (FMCW on shore, FMCW on board,…)

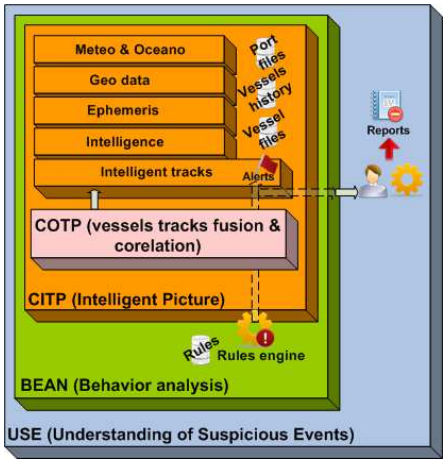
Power supply issues with the USV platform occurred but were solved a few days before the campaign

The objectives of the second large campaign were to:

- Evaluate fully integrated system to detect suspicious vessel behaviours in realistic scenarios:

- Check the elaboration of vessels operational picture from innovative and conventional sensors (coastal and airborne FMCW, AIS, HFSW, Furuno, space-borne AIS and SAR)
- Exploit the intelligent picture (vessel correlation with heterogeneous information sources)
- Exploit the conditions and rules to detect suspicious behaviours and raise alerts
- Continuously track the tagged vessel with pending alert and identify the associated threat:
- Detect small boats and to elaborate a complete picture
- Identify ships with coastal and on board cameras
- Generate a semi-automatic standardized report on the alert

The I2C set of capabilities under test for the second campaign was as follows:



<u>The mains results of the second and last large campaign are:</u>

- 4 days of trials – 10 hours flight of Zeppelin
- Two scenarios (Drug trafficking and Irregular migration) to evaluate suspicious small boats detections and raise alerts
- Observations on tracks fusion process from AIS and radar
- Activation of rules and raise alerts
- Management of end to end system
- Evaluation of FMCW airborne version (full integration to Zeppelin platform)
- Detection of vessels (cooperative and opportunity targets)
- Detection of very small objects
- Operational observers (Gendarmerie Maritime, Navy, Customs users)

The two campaigns feedbacks (technical and operational) have been well organized:

- Hot debriefing at the end of each day,
- Preliminary debriefing to share common information and improve the analysis and understanding of the data collected. This debriefing also to highlight all lessons learned from the 2013 campaign to save time and derisk the second campaign
- Final debriefing (if required) with final reports on the campaign.

Other tests (sample):

The **satellite communication means** have been extended in order to support all necessary nodes. Several reliability / performance / statistics tests have been conducted to validate the architecture to prepare the campaigns.

All actions have been taken to mitigate the risks evaluated regarding the **Zeppelin payload** and the limited slots of availability on the campaign area (a few hours). This has been carefully conducted by one or several pre-tests in order to take maximum benefit of the payload on board the assets (Zeppelin airship, Unmanned Surface Vehicle, instrumented Aircraft Falcon 20) as they are only available on a short period.

The order of **satellite images** has been placed in time in order to synchronize the campaign with the satellite footprints. Some post campaign analysis has been performed.
The challenge for this period was to perform all the tests and validation required at both functional and technical innovation levels.

1.3 The expected final results and their potential impact and use (including the socio-economic impact and the wider societal implications of the project so far)

Maritime threats are increasingly developing at a regional level, necessitating a common policy and a collaborative system in order to properly increase the level of security. If, for some reason, some countries do not participate in a collaborative security policy, security will be drastically far less improved as malevolent minds will always benefit from that.

The I2C project is based on a cooperative approach: Its purpose is not to develop an isolated system for sea border surveillance, but an interoperable and scalable system based on a distributed architecture that allows participating States to connect – or not – their own version of the system to that of the other participants, thus preserving their national sovereignty. The architecture of the system allows each participant to retain control over its own EEZ (Economic Exclusive Zone), and to choose precisely which information it wishes to share with the other participants and which information it wishes to withhold. It also ensures compliance with the different legal systems and the various international, European and national regulations. I2C therefore allows cooperation even with States that are reluctant to relinquish the least bit of control, because such a relinquishment is not necessary. I2C enables participating States to work with one another in a coherent devoted space where efficiency is maximised by the selective pooling of capacities. This approach is especially relevant to the challenge currently faced by the EU: establishing a common policy for European sea border surveillance based on national means and efforts.

To achieve this goal, the system will be:

- Customisable: the system is able to adapt to the specific legal and organisational features of the State that implements it. Also, the system can be installed in any coastal sites to optimise continuous sea border coverage.
- Interoperable: The system is able to be connected to other existing surveillance systems and other existing sensors systems.

- Fault/failure tolerant: Failure of one or more components has not to bring down the entire system, and is to be isolated. No State could indeed allow its system to be incapacitated because of a fault or failure occurring in another State.
- Concurrent: Shared access to resources is made possible according to each entity's willingness to transmit or withhold selected information. This is the best and the least an efficient system can achieve: it is not possible or desirable to force member States to share more information or resources that they are willing to share, and it is also the bottom line of what the system should allow, because cost-efficiency concerns demand that resources be pooled to avoid unnecessary redundancies.

I2C prototype is the first prototyped system, dedicated to maritime surveillance, in Europe to perform end to end data processing, in close to real time, from all vessel type detections to early identification of threats and report to authorities (decision aid). Therefore, I2C can be considered as the precursor of the system required in 2015 to secure European sea borders.

1.4 The address of the project public website, if applicable

www.i2c.eu (with free public access and private access for only beneficiaries)

1.5 Diagrams illustrating and promoting the work of the project, as well as relevant contact details

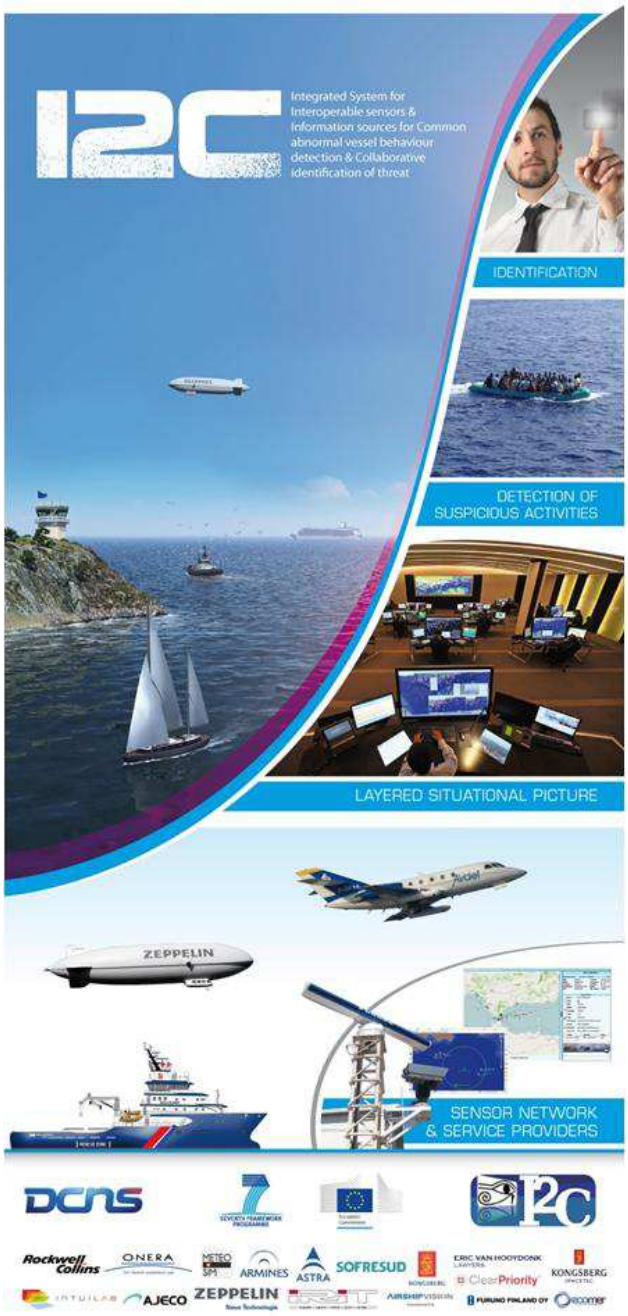


Fig 1: Diagram illustrating and promoting the work of the project

Fig 2: Diagram illustrating the mid-term conference Flyer (save the date)

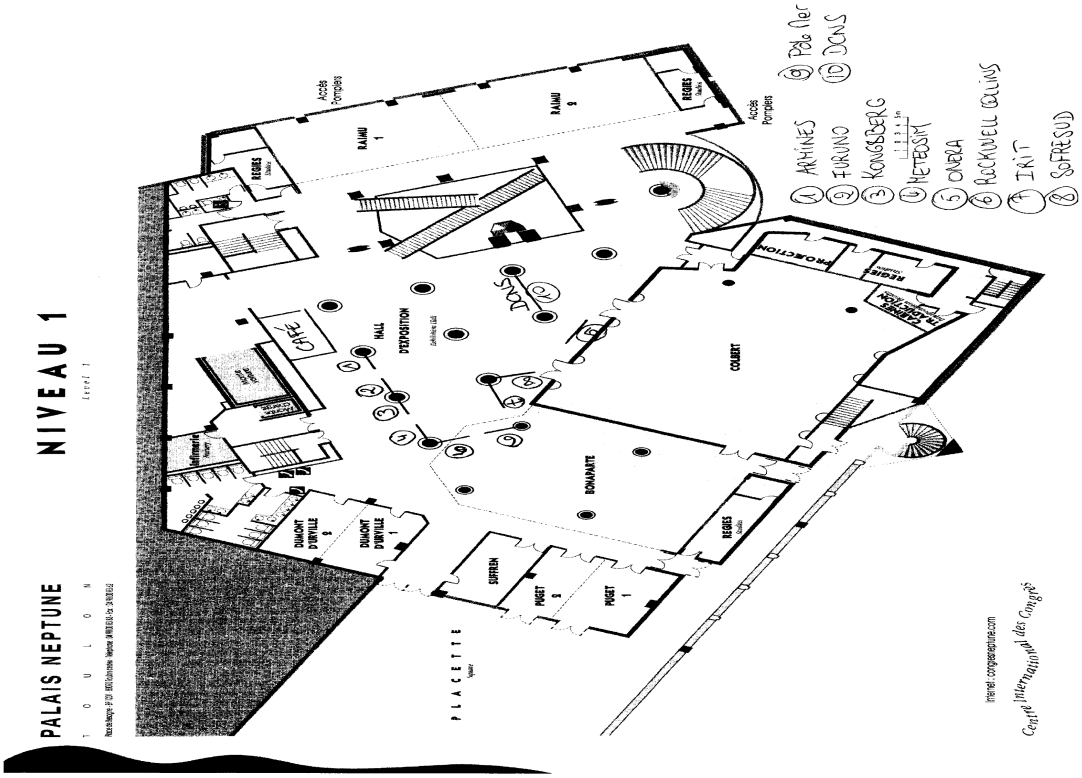


Fig 3: Diagram illustrating the Floor boots for partners during the mid-term conference

Fig 4: Picture depicting the I2C centre

Fig 5: Diagram illustrating the final conference Flyer (save the date)

List of I2C partners, contact names and E-mail addresses:

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DZR	Same as ZEPPELIN	

2 Core of the report for the period

This section encompasses the Project objectives, work progress and achievements, as well as the project management.

This second periodic report is issued according to the Guidance Notes on Project Reporting (version 2) for FP7 collaborative projects.

2.1 Project objectives for the period 1

2.1.1 Overview

As we face varied threats of terrorism and other lucrative criminal activities, in 2015, innovative solution shall be set up to permanently track and monitor all type of ship traffics, in vulnerable trading lanes and zones in order to detect abnormal vessel behaviour (or suspicious vessel activity) to understand and to early identify threatening situations. This future generation of maritime surveillance system must allow:

- Permanent and all weather coverage of border maritime areas.

- Continuous collection and fusion of heterogeneous data provided by various types of sensors deployed on coastlines and on mobile platforms and other information from external sources.
- Supervised automatic detection of abnormal vessel behaviours (in track and performed activity) and generate justified alarms.
- Understanding of suspicious events and early identification of threats from series of detected spatiotemporal abnormal vessel behaviours (alarms).
- Generate electronic and formatted interpretation reports on the suspicious event to keep periodically informed decisional authorities.

No equipment and maritime information system[1] deployed are currently able to answer all these requirements. However, in the horizon of 2015 significant technical progresses have been made in wide maritime area coverage by different sets of sensors, heterogeneous data processing and fusion, and detection of abnormal vessel behaviours methodology that could be usefully integrated together to set up an new generation of sea border surveillance integrated system for efficient security applications in high density traffics.

2.1.2 Objectives

According to the above context, the **objectives** of the proposed I2C integration project are:

- To prototype a complete test system (end to end information acquisition and processing system).
- Purpose of this test system is to test ways of integration of data from networked of existing and new maritime surveillance sensors and other valuable information sources in order to obtain optimal maritime security awareness.

In the project first period to achieve these objectives, the main milestones, when major results are expected, are:

- The validation of the user needs specifications.
- The validation of the functional and operational requirements specification.

Both above documents are input for the architecture design of the complete system in technical components.

Validation of that documentation and the architecture design are needed to start the I2C project second period of 18 months to develop the prototype.

In addition to that main milestones, the following:

- Interface between the architecture components.
- Methodologies to assess the performances of the prototyped system and its components.
- Scenarios (with story boards) to be experimented to demonstrate the system values to the users community have been studied, fixed and documented.

[1] *Most advanced sea surveillance operational systems in Europe are Spationav (France), S.I.V.E (Spain) and MEVAT (Finland). All these maritime surveillance systems are limited to perform traffic picture from conventional coastal radars and collected AIS data (version 2 in implementation) over only territory waters (up to 20 nautical miles from the shore).*

As the consortium anticipated a long and complex process in getting from french authority the needed agreements (environmental and electromagnetic impacts as well as health safety compatible with the regulations), the WP 31 (Shore bases sensors platform deployment) has been started in the first period and will continue in the second phase as nominally planned at the beginning.

As also on site emission measurements were required by the above French “radio frequencies” authority to provide installation agreement, the WP 33 (Satellite communication network deployment) was partly done in order to be able to remote control the sensor operations during the emission measurement campaigns.

To benefit that the FMCW radar (first prototype) was ready earlier than planned (due to the above emission campaign to get authority installation agreement), to mitigate the risk of this new sensor operation with other closer conventional radar (assess emission perturbation and low quality of radar output data), fusion into the common operational traffic picture, the WP 41 has been started in the first period and will continue in the second period.

Also, mocks up of the Human Machine Interfaces have been developed for the common intelligent operational traffic picture and for analysis of detected abnormal vessel behaviours, in order to support the user committee to specify and illustrate their user needs.

- WP 42 (Common intelligent operational traffic picture) has been started to collect and format geographical data to map the tracked vessels as well as other information layers such meteorological forecast, alert on detected suspicious vessel activities, etc.
- WP 43 (Detection of abnormal vessel behaviour (or suspicious vessel activities) has been started to support user committee to express user needs to HMI design and illustrate it.

Finally, Zeppelin has started their task in WP 32 (Deployable sensor platform; task 3.2.2), because it was absolutely necessary to:

- Check and assess for the equipment to be installed on board the Zeppelin (airship), to carry out the defined exercises in the first period, which ones were requiring certifications from air authorities.
- Check and assess for equipment requiring certifications, procedures to be applied and assess the delays to get the certifications.

Such above effort, to know which equipment that can either be or not to be certified and then the installation constraints, was needed to define achievable scenarios (WP 25 performances / scenarios, exercises and story boards) using instrumented ZEPPELIN airship.

For the planned WP in the first period and also WP of the second period that have been started (WP 31, 32 and 33, 41, 42 and 43) the section “work progress” provides the progresses and achievements done.

In 2011, JRC and METEOSIM (through the Coordinator) have sent to REA letters to change their person-months allocations per WP, but keeping constants their allocated global person-months. Amendment has been promised (see in Annex I of that report, e-mail) by REA (M. Ambroziewick).

2.1.3 Recommendations from the previous reviews

As this report is the first one, no recommendations have been yet issued.

2.1.4 Work progress and achievements during the period 1

For each work package (excepted management) the following tables provide synthesis progresses, during **the first period**, in line with the **Annex I** of the Grant Agreement.

The work packages fully completed in period 1 are WP 21, 22, 23, 24 and 25.

The work packages started earlier, so in period 1, are WP 31, 33, 41, 42 and 43 in order to anticipate from period 2 and mitigate the risks on delays for some aspects (authorizations to transmit, etc…).

WP 21 User Needs specification

Summary

The main objective is to issue and validate the user needs specification.

Task 2.1.1 To coordinate the specification and its validation.

Task 2.1.2 To define threats and regulation violations (suspicious activities).

Task 2.1.3 To define the needed data / information to detect suspicious activities to be layered in maritime situational picture.

Task 2.1.4 To define needs and processes for identification of threats associated to detected suspicious activities.

Task 2.1.5 To define scenarios modelling suspicious activities and threats.

Task 2.1.6 To define Human Machine Interface (IHM) to handle the maritime situational picture, detection of suspicious vessel activities and identification of associated plausible threats.

Task 2.1.7 To define the structure of the operator report (interpretation file) on identified threats.

Task 2.1.8 To maintain the user needs specification up to date during the project life cycle.

Task 2.1.9 To organise validation of the user needs specification by the user committee and the consortium beneficiaries.

All the planned Tasks during the project first period have been done.

Results

Task 2.1.1 Result was the issue of the user needs specification (D21.211).

Task 2.1.2 Results were included in the above deliverable as well as a technical note issued by VANHOODONK on the regulation violations and proofs for criminal activities.

Tasks 2.1.3 and 2.1.4 Results were included in the above deliverable.

Task 2.1.6 Results were a mock up IHM for the detection of the suspicious vessel activities and a mock up for the identification of associated threats.

Task 2.1.7 Result was a model of interpretation report set up with the user committee.

Task 2.1.8 Issue first version of the user needs specification (D21.211). Maintenance up to date is applicable in first period, but it was checked that user needs are satisfied by specified functional requirements and components in the architecture design.

Task 2.1.9 Result was the validation of the user needs specification (D21.212).

Deviations No deviations in achieving above tasks in first period.
Critical objectives Critical objectives achieved in first period.
Statement on the use of resources Cf Form C.
Corrective action As performed tasks were nominal, no corrective action foreseen

WP 22 Functional & operational requirements specification

Summary

The main objective was to issue and validate the functional and operational requirements specification.

Task 2.2.1 To coordinate the specification and its validation.

Task 2.2.2 To issue common definition, standard and norm; as well as that technical used terms.

Task 2.2.3To issue the functional requirements specification.

Task 2.2.4 To issue technical note on shore based sensors functions.

Task 2.2.5 To issue technical note on deployable sensors functions and performances.

Task 2.2.6 To define shore platforms deployment.

Task 2.2.7 To define mobile platforms deployment.

Task 2.2.8 To define the common operational traffic picture.

Task 2.2.9 To define the common intelligent operational picture.

Task 2.2.10 To define the detection of abnormal vessel behaviour (or suspicious vessel activities).

Task 2.2.11 To define the understanding of suspicious event & early identification of threats (associated to detection of suspicious vessel activities or events).
Task 2.2.12 To define satellite communication network to acquire the data and information and exchange various situational pictures.

T2.2.13 To define the I2C system administration and monitoring.

T2.2.14 To define data bases used in the maritime situational pictures.

T2.2.14 To define testing methods and procedure for the I2C system (integrated prototype).

T2.2.15 To validate the functional & operational requirement specification.

All the planned Tasks during the project first period have been done.

Results

Task 2.2.1 Result was the issue of all deliverables and the validation of the functional & operational requirements specification by the user committee and the consortium beneficiaries.

Task 2.2.2 Results were included in the deliverable D22.221.

Task 2.2.3 Results were includes in the deliverable D22.221.

Task 2.2.4 Results were included in the deliverable D22.223.

Task 2.2.5 Results were includes in the deliverable D22.224.

Task 2.2.6 & Task 2.2.7 2 Results were included in deliverables D22.223 and D22.224

Task 2.2.8, Task 2.2.9, Task 2.2.10 and Task 2.2.11 Results were included in deliverable D22.221.

Task 2.2.12 Results were included in deliverable D22.225

Task 2.2.13, Task 2.2.14 and Task 2.2.15 Results were included in deliverable D22.221.

Task 2.2.16 Results were included in deliverable D22.222.

Deviations

No deviations in achieving above tasks in first period.

Critical objectives

Critical objectives achieved in first period.

Statement on the use of resources

Cf Form C.

Corrective action

As performed tasks were nominal, no corrective action foreseen

WP 23 Architecture design
Summary The main goal is the system architecture matching the specified user needs (WP 2.2).and the functional & operational requirements (WP 2.2). Task 2.3.1 To design the I2C capacities in the architecture. Task 2.3.2 To design the data flows between the capacities. Task 2.3.3 To design the coastal sensor data processing and study the sensor deployments. Task 2.3.4 To design the sensor on board platform integrations. Task 2.3.5 To design the processing to generate the common operational traffic picture. Task 2.3.6 To design the processing to generate the common intelligent operational traffic picture. Task 2.3.7 To design the rules to detect suspicious vessel activities (based on first outcomes of previous project ScanMaris to I2C). Task 2.3.8 To design the processes to identify threats (based on first outcomes of previous project TaMaris to I2C). Task 2.3.9 To design the satellite communication network. Task 2.3.10 To design the administration and monitoring of the I2C system. Task 2.3.11 To draw the overall data circulation scheme and characteristics. Task 2.3.12 To define the system tools for testing. All the planned Tasks during the project first period have been done.
Results Task 2.3.1 Result was the issue of the deliverable D23.231. Task 2.3.2 to Task 2.3.8, Task 2.3.10, Task 2.2.3.11 Results were in the deliverable D23.231. Task 2.3.9 Results were in the Deliverable D23.232. Task 2.3.12 Results were in the developed UML model of the integrated I2C capacities and data circulation.
Deviations No deviations in achieving above tasks in first period.

Critical objectives Critical objectives achieved in first period.
Statement on the use of resources Cf Form C.
Corrective action As performed tasks were nominal, no corrective action foreseen

WP 24 Interface definitions
Summary The main goal is to define the interfaces between the capacities (in the architecture) to exchange data / information as designed in the architecture. Task 2.4.1 To define the sensor platform interfaces. Task 2.4.2 To define the common operational traffic picture interface. Task 2.4.3 To define the common intelligent operational traffic picture interfaces. Task 2.4.4 Define the detection of suspicious vessel activities and identification of threats interfaces. Task 2.4.5 To define the interface to organisation where the demonstration (third period) / exercises will be done. Task 2.4.6 To Define the satellite communication interfaces. Task 2.4.7 To define the user interface to the I2C integrated system. All the planned Tasks during the project first period have been done.
Results Task 2.4.1, Task 2.4.3, Task 2.4.4 & T2.4.5 Results were included in the deliverable D24.244 Task 2.4.2 Results were included in the deliverables D24.241 (Shore sensor platforms) and D24.242 (Deployable platforms). Task 2.4.6 Results were included in the deliverable D24.243. Task 2.4.7 results were included in the mock up of the user interface to the capacity to detect suspicious vessel activities and the mock up of the user interface to identify threats.
Deviations No deviations in achieving above tasks in first period.
Critical objectives Critical objectives achieved in first period.
Statement on the use of resources Cf Form C.
Corrective action As performed tasks were nominal, no corrective action foreseen

WP 25 Performance evaluation methodology & scenarios
Summary The main goal is to define the methodology and achievable scenarios (for the exercises) to be able to assess the I2C deployed prototype performances. Task 2.5.1 To define the approach and methodology for assessing the I2C prototype performances. Task 2.5.2 To prepare scenarios for the exercises done in third phase. Task 2.5.3 To define the performances to be assessed for the shore base sensors platforms. Task 2.5.4 To define the performance to be assessed for the deployable sensor platforms. Task 2.5.5 To define how to assess the common operational traffic picture. Task 2.5.6 To define how to assess the common intelligent operational traffic picture. Task 2.5.7 To define how to assess the detection of suspicious vessel activities and identification of threats. Task 2.5.8 To define how to assess the deployed satellite communication network Task 2.5.9 To plan the schedule of the assessment steps as well as the reporting. All the planned Tasks during the project first period have been done.
Results Task 2.5.1 and Task 2.5.3 up to Task 2.5.9 Results were included in the deliverable D25.251. Task 2.5.2 Results were included in the deliverable D25.252. All work and deliverables completed in the first period.
Deviations No deviations in achieving above tasks in first period
Critical objectives Critical objectives achieved in first period.
Statement on the use of resources Cf Form C.
Corrective action As performed tasks were nominal, no corrective action foreseen.

2.2 Project objectives for the period 2

2.2.1 Overview

Same as for period 1, except that we focus on the core of the future generation of maritime surveillance system, taking into account best combination of means with the following aspects:

- Optimized surveillance of maritime areas,
- Continuous collection and fusion of heterogeneous data (real time or close-to-real-time or intelligence), from local or external sources
- Supervised automatic detection of abnormal vessel behaviours and generate pertinent alarms.
- Understanding of suspicious events and early identification of threats from series of detected spatiotemporal abnormal vessel behaviours (alarms). Mainly provides decision aids.
- Semi-automatic generation of electronic and pre-formatted (templates by organization) interpretation reports on the suspicious event to keep periodically informed the decisional authorities (to enable targeted intervention).

2.2.2 Objectives

According to the above context, the **objectives** of the proposed I2C integration project in the second phase are:

- To complete a first version of a prototype, illustrating the complete targeted test system as described in the Overview.
- Propose and set up testing exercises and campaigns (2013, 2014) to illustrate, evaluate and propose recommendations in terms of architecture and combination for the system and all its components (assets, payload, software components, etc…)

In the project second period, in order to achieve these objectives, the results expected are:

- The availability of all components developed separately in compliance with the needs defined in the first period. Those components need to be ready for integration at the end of period 2 as there is only a short time from delivery of all components to the first campaign (2 days in June 2013 and 4 days in July 2013). This campaign will enable to validate some of the user needs (functional and operational requirements specification).
- The practical validation of the component architecture design and the interfaces (between the components and external interfaces) defined in period 1
- Scenarios (with story boards) to be experimented to demonstrate the system values to the users community..
- Training of the users on version V1 of the system to enable maximum use of the system in real situation and short loop feedback on the system to improve during the project.

The authorizations from French authorities (National Frequency Clearance Authority for civil and military sites, DIRISI for military sites) are now almost fully granted (HFSW will be granted in period 3, after on-site measurements). This enables full and nominal use of all St Mandrier shore sensors coordinated each week by the DGA (responsible for co-located activity on the same SESDA site)..

Satellite nodes and architecture has been completed to ensure best connectivity of the equipment deployed.
FMCW and FURUNO are operated, improved and maintained regularly during the second period and were demonstrated during the mid-term conference.

WP51 (system integration) has been started during the second part of period 2 in order to limit the risks on delays for the overall integration and the first campaign.

For the planned WP in the first period and also WP of the second period that have been started (WP 51) the section "work progress" provides the progresses and achievements done.

Deployment of mobile platform validation was driven to propose equipment to be deployed on board and optimize the choice to take into account integration **and** certification constraints. As some equipment where prototypes and not COTS (equipment requiring certifications, procedures to be applied and assess the delays to get the certifications)

2.2.3 Recommendations from the previous reviews

None.

2.2.4 Work progress and achievements during the period 2

For each work package (except management) the following tables provide progresses synthesis, during the **second period**, in line with the **Annex I** of the Grant Agreement.

The work packages fully completed in period 2 are WP 31, 32, 33, 41, 42, 43, 44.
The work packages started earlier, so in the second period in order to anticipate from period 2 and mitigate the risks on delays for some aspects (integration and assembling of the version V1 of the system) is the WP 51.

Regarding W11 (project management), WP12 (users committee coordination), and WP13 (dissemination), they are continued all along the project.

WP 31 Shore based sensors platform deployment

Summary

To deploy physically sensors and communication network in coastal site. This WP has been started in first period instead that in second period, see justification in above section "objectives".

Task 3.1.1 To perform electromagnetic interference study taking into account the other instruments on site and neighbouring infrastructure for optimising the instrument installations.

Task 3.1.2 To study and prepare the installation site: Achieve concrete base plates, tripod towers, power supplies, etc.

Task 3.1.3 To deploy the shore bases sensors:

- Deploy conventional radar (Furuno navigation radar) and testing.
- Deploy FMCW radar (Rockwell Collins radar to detect small boats) and testing.
- Deploy HFSW radar (ONERA long range radar) and testing.
- Deploy AIS station and testing.
- Deploy high resolution camera and testing.

Task 3.1.4 To manage the acquired sensor data and tune the DSiP to collect and ingest the data flow in the communication network.

The tasks achieved in the first period were preliminary Furuno and Rockwell Collins radar installations for effective emission measurements mandatory to get French authority installation agreement. Communication network (satellite telecommunication station) has also bee partly installed to remotely operate the sensors and acquire the sensor data.

Results

<u>Period 1:</u>

Task 3.1.1 A documented study (French version) on electromagnetic compatibility to French regulations has been done. This document was needed to get back the French authority agreement to install on site the bench of active sensors. This document (in English version) will be consolidated and delivered in second period.

Task 3.1.2 The deployment on site of the sensors and communication facility as well as power supplies have been studied and documented. This document was needed to get back the French authority agreement to install the set of active sensors. This document (technical note will be translated in English in second period).

AJECO start to study the high resolution camera anticipating external procurement delay as well as in order to meet the second period commitment.

ASTRA & AJECO studied the deployment of the needed telecommunication network to be able to remotely operate the deployed (see Task 3.1.4) sensors for the emission measurements Campaigns.

Task 3.1.4 The deployment of the Furuno and Rockwell Collins radars has been done to be able to perform emission measurements campaigns to satisfy the French authority in verifying that the simulated data (task 3.1.1) were correct by performing effective emission measurements on site. As well as, one satellite telecommunication station has been installed to remotely operate / control the sensors and collect the sensing data (to verify that the sensor data were not corrupted by closest other sensors on site).

Task 3.1.1, Task 3.1.2 and Task 3.1.4 will continue in second period, because request from French authority would be possible to change the sensors configuration on site. Indeed, other existing and new ones military sensors are / will operating on the same site.

Task 3.1.5 The management of the sensor data flows will start in second period as planned in delivered project management plan.

Period 2:

All tasks have been completed. The consortium has started the maintenance/improvement on the equipment deployed.
Task 3.1.1 An English version of the electromagnetic compatibility document has been issued taking into account studies and measurements on site.
Task 3.1.2 All the work prior to deployment has been performed (procurement of equipment, adaptation kits, etc..)..

Task 3.1.3 (To deploy the shore bases sensors) is completed except the HFSW for administrative (DGA) reasons as explained in the first part of this document.
The deployment of the high resolution camera and testing is done on lab, not yet on site.

Tasks 3.1.4 and 3.1.5 are completed as planned.

Deviations

WP started earlier in period 1 (DCNS, Rockwell, Furuno, Ajeco).

Critical objectives

The critical objective was to get the French agreement for sensor installation on site meeting the regulation for electromagnetic compatibilities and emission levels. Indeed, from previous experience such as mandatory agreement may take more than one year.

Statement on the use of resources

Cf Form C

Corrective action

The only corrective action was to update the I2C tasks schedule and perform more work in the first period that planned in the offer for some beneficiaries (DCNS, Furuno, Rockwell Collins and SES ASTRA TechCom).

WP 32 Deployable sensor platform

Summary

Review and study all technical aspects to define, prepare and achieve exercises.

Task 3.2.1 Define the overall approach for exercises: goals, concept, requirements, constraints, etc.

Task 3.2.2 To study and evaluate, for ZEPPELIN airship, sensors integration and testing, installation constraints for mobile landing site, fly meteorological conditions, observation data management, availability periods for the phase 3 (third project period), etc.

Task 3.2.3 To study and evaluate, for patrol vessel and USV:

- Vessel; sensors, POLARIS, integration and testing, observation data management, availability for the phase 3, etc.
- UVX; pilot – control station, gyro stabilised IR camera, operation testing, etc.

Task 3.2.4 To study and evaluate, for aircraft, sensors integration, installation constraints, observation data management, availabilities in phase3, etc.

Task 3.2.5 To define criteria sets to select satellite radar images in provider archives:

- To extract intelligence.
- To support assessment of I2C performances.
- To Support the selection of the exercise areas.

Task 3.2.6 To compare space based AIS to shore bases AIS station and perform common operatinal traffic picture including space borne AIS messages.

Results

Period 1:

Only Task 3.2.2 has been achieved, indeed airship is a new asset and the constraints to prepare (install on board certified equipment) , deploy and operate were needed to set up scenarios compatible with all planned assets (Tasks 2.5.1, 2.5.2 2 and 2.5.3 in WP 2.5)

Period 2:

Task 3.2.1 Define the overall approach for exercises: goals, concept, requirements, constraints, etc. has been completed.

Task 3.2.2 was completed.

Task 3.2.3 (To study and evaluate, for patrol vessel and USV): completed. Definition and planning of the assets and its payload is done. Then the search for rent, buy or free use of pay load equipment has been assessed.

Task 3.2.4 All integration constraints for the aircraft have been assessed and description in the documentation.

Task 3.2.5 Satellite radar images in provider archives to select: some hypothesis have been proposed and taken to be applicable for Campaign 2013 and/or 2014.

Task 3.2.6 Space based AIS availability has been assessed. Comparison to shore based AIS station will be done through the campaigns.

Deviations

WP started earlier in period 1 (ZLT).

Critical objectives

The critical objective was to check and assess for which equipment to install on board the airship are required certifications from authority and how to get it. Also such as constraints were needed to know to define exercises (WP 25) to demonstrate and evaluate the I2C system performance.

Statement on the use of resources

Cf Form C.

Corrective action

The only corrective action was to update the I2C tasks schedule and perform more work in the first period that planned in the offer for ZLT beneficiary.

WP 33 Satellite communication network deployment

Summary

Deployment of the communication network for all project periods. The communication network is to collect and disseminate all data flows (sensor data and remote control data).

Task 3.3.1 To define the data communication scheme and data flow circulation for period 2 and 3.

Task 3.3.2 To study, deploy and test the satellite telecommunication network for second and third project periods:

- To procure the satellite telecommunication sets.
- To install and configure the telecommunication sets.
- To install power supplies and other facilities on sites.

Task 3.3.3 To integrate and configure the DSiP in the communication network for periods 2 and 3.

Results

Period 1:

Task 3.3.1 A preliminary study has been done on data circulation for the measurement campaigns (see WP 32) by DCNS. This study will be consolidated in second period for the complete deployment of the I2C system.

Task 3.3.2 To be done in second period.

Task 3.3.3 To be done in second period, except that initial study has been done by AJECO on the DSiP dimensioning as preliminary inputs were available from Task 3.3.1.

Period 2:

Task 3.3.1 This task is completed.
Task 3.3.2 (study, deploy and test the satellite telecommunication network) done. Network is available for the second and third project periods
Task 3.3.3 (integrate and configure the DSiP in the communication network for periods 2 and 3) has been performed under the technical coordination of ASTRA. In lab tests have been performed to verify the end-to end communication schemes.

Deviations

WP started earlier in period 1 (DCNS, ASTRA, AJECO).

Critical objectives

The critical objective was to get the French agreement for sensor installation on site meeting the regulation for electromagnetic compatibilities and emission levels. Indeed, from previous experience such as mandatory agreement may take more than one year. Also, as sensor data

and preliminary deployments were available, preliminary dimensioning studies have been started, mainly for the data dissemination scheme and encryption by the DSiP (innovative intelligent router).
Statement on the use of resources Cf Form C.
Corrective action The only corrective action was to update the I2C tasks schedule and perform more work in the first period that planned in the offer for some beneficiaries (DCNS and AJECO).

WP 41 Common operational traffic picture

Summary

Development of the upgraded versions and testing / validation of the capacities (sensors and architecture component) to output the common operational traffic picture (geographical mapping of the fused vessel tracks from all sensors).

Task 4.1.1 To generate the senor vessel tracks:

- FMCW vessel tracks, from radar plots.
- HFSW vessel tracks from radar plots.
- Furuno radar vessel tracks.
- AIS messages.

Task 4.1.2 Sensor data cross calibration to improve the detection of most vessels at sea.

Task 4.1.3 To generate the common operational traffic picture.

Task 4.1.4 To set up the vessel characteristics base.

Task 4.1.5 To set up geo server for geographical data and meteorological forecasts.

Task 4.1.6 Testing and validation of the component to generate the, near real time, common operational traffic picture.

Results

Period 1:

Task 4.1.1 Only FMCW preliminary generation of vessel tracks (on site using opportunity small boats) has been experimented by Rockwell Collins to check that closest other active sensors on site are not corrupting the data. Indeed FMCW is unique new scientific prototype which was not yet tested against effective electromagnetic environment.

For the other installed sensors tasks will be done in second period.

Task 4.1.2 up to Task 4.1.6 will be done in second period as initially planned.

Period 2:

Task 4.1.1 completed.
Task 4.1.2 to Task 4.1.6 has been done in second period as initially planned.
The validation of the capability COTP is done in pre-integration tests.

Deviations

WP started earlier in period 1 (Rockwell)

Critical objectives

The critical objective was secure the operation of the prototype FMCW radar and check earlier it in effective electromagnetic environment, to be known if protecting device would be or not necessary. Such as development / procurement (protective device) may induce some delay in the FMCW configuration fitting the site conditions and then, the system integration schedule in the second period.
Statement on the use of resources Cf Form C.
Corrective action The only corrective action was to update the I2C tasks schedule and perform more work in the first period that planned in the offer for one beneficiary (Rockwell Collins).

WP 42 Common intelligent operational traffic picture

Summary

Development of the upgraded versions and testing / validation of the capacities to set up the common intelligent operational traffic picture (multi layered and correlated information sets).

Task 4.2.1 To develop the capacity to generate the common intelligent operational traffic picture from the:

- Common operational traffic picture.
- Geographical and meteorological data.
- Vessel characteristics base.
- Plausibly from processed satellite imagery.

Task 4.2.2 To provide the gate to collect the meteo / oceano forecasts according to the format in the data model.

Task 4.2.3 To provide processed satellite imagery such as detected vessel plots (locations, instantaneous speeds and caps) .

Task 4.2.4 To provide intelligent information from analysed satellite imagery.

Task 4.2.5 To provide vessel characteristics base.

Task 4.2.6 To provide remote geo server for the geographical data and meteo / oceano forecasts.

Task 4.2.7 To provide Human Machine Interface (HMI) to display and exploit the common intelligent operational traffic picture.

Results

Period 1:

All WP 42 Tasks are performed in second period, excepted preliminary development for the Task 4.2.6 and Task 4.2.7.

To support the users committee to express needs (on which information to be layered in the common intelligent operational traffic picture and how to exploit this information by the operator), mock up of the HMI (Intuilab, Task 4.2.7; see section “objectives”) has been achieved. Then a preliminary version of geo server (ARMINES, Task 4.2.6, see section “objectives”) was implemented and populated with electronically charts and representative meteorological forecasts in order to be able to map vessel tracks in geographical / meteorological conditions.

From mock up, users committee has the opportunity to get display of the main situational product generated by the I2C integrated system (the common intelligent operational traffic picture), to better review, assess and complete needs to fulfil maritime security missions.

Period 2:
Task 4.2.1 , 4.2.2, 4.2.3, 4.2.4, 4.2.5 have been performed completely during this period and the associated documents provided.
Task 4.2.6 and Task 4.2.7 have been completed.
The validation of the capability CI(O)TP is done in pre-integration tests.

Deviations

WP started earlier in period 1 (Intuilab, Armines).

Critical objectives

To support the users committee to express all needs (for the common intelligent operational traffic picture which is in any existing maritime surveillance systems in Europe) in order that the developed and experimented I2C integrated system meet the operational missions (as defined in EUROSUR guidelines). In other terms, to avoid that important user needs are neglected, so the architecture and the developed system will not perform the operational missions.

Statement on the use of resources

Cf Form C.

Corrective action

The only corrective action was to update the I2C tasks schedule and perform more work in the first period that planned in the offer for two beneficiaries (ARMINES and Intuilab).

WP 43 Detection of abnormal vessel behaviour

Summary

Development of the upgraded versions and testing / validation of the capacity to detect the abnormal vessel behaviours (or suspicious activities).

Task 4.3.1 To develop and test the capacity.

Task 4.3.2 To develop the rule engine based on Adaptive Multi Agent System (IRIT) to process all information in the common intelligent operational traffic picture.

Task 4.3.3 To develop the rule engine based on Bayesian methodology (CLEAR PRIORITY) to process all information in the common intelligent operational traffic picture.

Task 4.3.4 To define set of rules to detect suspicious activities (violation of regulations as well as criminal / illegal activities).

Task 4.3.5 To define the data base structure / contents to archive issued alerts on detected suspicious vessel activities.

Task 4.3.6 To provide geographical data (in the geo server) to be able to spatio-temporally locate le issued alerts.

Task 4.3.7 To develop HMI to display the issued alerts and exploit it by operator to generate on line alert files.

Task 4.3.8 To perform tests and validate the capacity before integration in the complete I2C system.

Results

Period 1:

All WP 42 Tasks are performed in second period, excepted preliminary development for the Task 4.3.7.

To support the users committee to express needs (on how to issue and exploit alert on detection of suspicious vessel activity), mock up of the HMI (Intuilab, Task 4.3.7; see section “objectives”) has been achieved.

From mock up, users committee has the opportunity to get display of the main situational product generated by the I2C integrated system (the common intelligent operational traffic picture), to better review, assess and complete needs to fulfil maritime security missions.

Period 2:

Task 4.3.1 to 4.3.6 and 4.3.8 has been fully achieved.
The validation of the capability BEAN is done in pre-integration tests.

Deviations WP started earlier in period 1 (Intuilab).
Critical objectives To support the users committee to express all needs (for the detection of suspicious vessel activities from rules defined by the operational which is in any existing maritime surveillance systems in Europe) in order that the developed and experimented I2C integrated system meet the operational missions (as defined in EUROSUR guidelines). In other terms, to avoid that important user needs are neglected, so the architecture and the developed system will not perform the operational missions.
Statement on the use of resources Cf Form C.
Corrective action The only corrective action was to update the I2C tasks schedule and perform more work in the first period that planned in the offer for one beneficiary (Intuilab).

WP 44 Understanding of suspicious events & identification of threats

Summary

Task 4.4.1 Capacity: modify, develop software upgrades and integrate in the TaMaris capacity - DCNS.

Task 4.4.2 Alarms: management of set of alarms, documents, status of the suspicious event interpretations files and displays – INTUILAB and IRIT for alarms interface. This task focuses on the interactions between the detection engine, identification of threats and the operator.

Task 4.4.3 Multi-Hypothesis process: upgrade the TaMaris process (decisional tree / ontology branches) to new suspicious event and new threats (TaMaris is limited to ScanMaris suspicious event, see previous WP 4.3) - ONERA.

Task 4.4.4 Geographical data tools: upgrade the TaMaris tools to new surveillance zone and threats – ARMINES.

Task 4.4.5 Information indexation in interpretation file: upgrade the forms, contents, indexes, etc. – ONERA.

Task 4.4.6 Elements for prosecution: for each of the identified threat types, a list of elements that are useful for the purpose of prosecution is drawn up. - HOOYDONK.

Task 4.4.7 Data base: structure, content (data & meta-data), catalogue to archive and access interpretation files, knowledge model of suspicious events, etc. – SOFRESUD + ARMINES.

Task 4.4.8 HMI: upgrade the TaMaris HMI to advanced tactile device (multi-users, multi-pointers; in TaMaris the tactile interface is mono-user), new surveillance zone, new suspicious events and threats and improved tools developed in the tasks 4.4.2 to 4.4.6 – INTUILAB.

Task 4.4.9 Capacity testing & validation: perform tests according procedure and validate the capacity – DCNS + ARMINES

Task 4.4.10 Training: prepare training document and supports for user during the I2C system exploitation phase 3 - ECOMER with JRC & HOOYDONK supports.

Results

Period 1:

-

Period 2:

Task 4.4.1 to 4.4.9: all work performed and deliverables available.

- D4.4.1; Delivery of the capacity (i.e.; software modules)for understanding of suspicious event & identification of threats (all WP task)
- D4.4.2; Technical note on the capacity for understanding of suspicious event & identification of threats (all WP tasks)

The validation of the capability USE is done in pre-integration tests.

Task 4.4.10: Production of the D4.4.3; Training document.
This training plan is applicable to all the training courses to be dispensed on the systems or equipment supplied as part of the I2C project.

Deviations

None observed.

Critical objectives

To support the users committee to express all needs (for the detection of suspicious vessel activities from rules defined by the operational which is in any existing maritime surveillance systems in Europe) in order that the developed and experimented I2C integrated system meet the operational missions (as defined in EUROSUR guidelines). In other terms, to avoid that important user needs are neglected, so the architecture and the developed system will not perform the operational missions.

Statement on the use of resources

Cf Form C.

Corrective action

None

2.3 Project objectives for the period 3

2.3.1 Overview

- Same as for period 1 and 2, except that we focus on the experimentation of the core of the future generation of maritime surveillance system, taking into account best combination of assets, equipment, capabilities
- Most of the work for the period 3 is focusing on the organization and execution of several tests of the system prototype including 2 large campaigns (over 7 months to prepare for each, 50 participants, a complex coordination, and recordings for analysis and evaluation)

2.3.2 Objectives

According to the above context, the **objectives** of the proposed I2C integration project in the third phase are:

- To use a first (partial) version of a prototype in 2013 , then use a second improved and complete prototype, illustrating the system as a whole
- Plan, execute and capture lessons learned for testing exercises and campaigns (2013, 2014) to illustrate, evaluate and propose recommendations in terms of architecture and combination for the system and all its components (assets, payload, software components, etc…)

In the project third period, in order to achieve these objectives, the results expected are:

- The availability for the campaign and other specific tests of all components developed separately in compliance with the needs defined in the first period, and the design and development done on the second period. The 2013 campaign enabled to validate some of the user needs (functional and operational requirements specification) and improved some aspects for the 2014 campaign (including an improved navigation and data integration for the Zeppelin payload).
- Validation of adapted scenarios for the campaign (with story boards) to the real experience the users have by enabling to participate and not only to be present as observers.
- A specific training of the users on version V1 and V2 has been performed to enable maximum use of the system in real situation and close short loop feedback on the system to improve during the project.

The authorizations from French authorities have been granted. Satellite has been optimised.
WP51 (system integration) has been started during the second part of period 2 in order to limit the risks on delays for the overall integration and the first campaign. This is the reason why period 3 enabled to organize the first campaign in **time.**

2.3.3 Recommendations from the previous reviews

None.

2.3.4 Work progress and achievements during the period 3

For each work package (except management) the following tables provide progresses synthesis, during the **third period**, in line with the **Annex I** of the Grant Agreement.

The work packages fully completed in period 3 are WP 11 and WP13 (completed), WP 52, WP53, WP54, WP 61, WP62, WP63 and WP64.

For RP3 WPs started in RP2 or even RP1, the cumulative progresses and achievements with separate section by WP and by period is provided for clarity reasons.

Regarding W11 (project management), WP12 (Users committee coordination) and WP13 (dissemination), they progress all along the project.

WP 12 Users committee coordination

Summary

This Work Package is performed during all the I2C project life cycle (48 months).

The main goals are to coordinate, organise support and participate to users committee tasks, meeting and seminars during the I2C project three periods.

Task 1.2.1: To implement the User Committee outcomes into the I2C system.

Task 1.2.2: To support the User Committee to specify needs in terms of applications and performances, to review the documentation, to define scenarios for exercises, to exploit and evaluate the prototype and finally collect user feedbacks / recommendations to improve the I2C prototype.

Task 1.2.3: To organise two large conferences with users / stakeholders at 24 and 45 months

Task 1.2.4: To report on user meetings, conferences, training sessions, publications, etc.

All the planned Tasks during the project first period have been done..

Results

Period 1:

Task 1.2.1 results were the set up of a user committee (Affaires Maritime, Gendarmerie Maritime, CeCLAD-M and Frontex representatives). In the first period two meetings with the user committee happen to specify the user needs and review the functional and architecture design of the I2C system.

Task 1.2.2 results were the validation by user and consortium beneficiary of the I2C functional 1 operational specification, the architecture design and the scenarios for the exercises to be performed in I2C project third period.

Task 1.2.3 none applicable for I2C project first period.

Task 1.2.4 user committee meetings were reported in minutes available in I2C web site and also reported in the EU implementation group FP7 project s conducted by Frontex.

Period 2 & period 3

Task 1.2.3 applicable for I2C project second period and third period. Organisation of the Mid-term conference (in Toulon) and Final conference (in Brussels) have been performed successfully.

Deviations

No deviations in achieving above tasks in first period.

Critical objectives

Critical objectives achieved.
Statement on the use of resources Cf Form C.
Corrective action As performed tasks were nominal, no corrective action foreseen.

WP 13 Dissemination

Summary

This Work Package is performed during all the I2C project life cycle (48 months).

The main goal is the exploitation of the project results to promote I2C as an integrated system as well as beneficiary developed components.

Task 1.3.1 To issue a dissemination plan covering all I2C project life cycle and including conference, material to promote the project, demonstrations of the prototype, articles, etc.

Task 1.3.2 To organise and perform the actions listed in the dissemination plan and benefit from opportunities.

Task 1.3.3 To set up a project Web Site.

Task 1.3.4 To report on the main performed actions to promoter the project.

Task 1.3.5 To publish articles / present peculiar scientific / technical beneficiary component to scientific event.

All the planned Tasks during the project first period have been done.

Results

Period 1:

Task 1.3.1 Result was the issue of the deliverable dissemination plan (D13.131).

Task 1.3.2 Results were I2C presentations done in OCOSS 2010 Brest, MAST 2011, SEATIMED 2011 and Frontex workshop 2011.

Task 1.3.3 Results was the I2C Web Site (www.i2c.eu) which is maintained up to date and is on line (D13.134).

Task 1.3.4 No applicable in first period, final report shall be issued at the end of the project.

Task 1.3.5 Result was not yet issued scientific articles in specific events, but any events have been identified during the first period.

Period 2:

The dissemination is a continuous process. Below is depicted the main different dissemination activities (presentations, publications) performed during period 2.

[1] Christophe IMBERT [RCF, lead], Jean-Philippe WASSELIN, Eric ITCIA, Marie-Annick GIRAUD,
Michel MOREL, Henry-Pierre AUDUBEY: « Système radar FMCW pour la détection et la classification de petites embarcations par mer formée », Presented to plenary session

Workshop WISG 2012, Université de Technologie de Troyes, 24-25/01/2012

[2] Jean-Philippe WASSELIN [RCF, lead], Sébastien MAZUEL, Eric ITCIA, Albert HUIZING, Arne
THEIL: « FMCW Radar System for Detection and Classification of Small Vessels in High Sea State Conditions », Présentation en session plénière de la conférence EuMC 2012, Amsterdam, 28/10 - 02/11/2012

[3] ONERA: L. Petrillo, F. Jangal, M. Darces, J.-L. Montmagnon, and M. Hélier, "Towards a better excitation of the surface wave," Progress In Electromagnetics Research M, Vol. 13, 17-28, 2010.

[4] ONERA: L. Petrillo, F. Jangal, M. Darces, J.-L. Montmagnon, and M. Hélier, "Negative permittivity media able to propagate a surface wave," Progress In Electromagnetics Research, Vol. 115, 1-10, 2011.
[5] ONERA: Menelle, M.; Jangal, F.; Sellin, O.; , "Towards operational use of surface wave radar," REE. Revue de l'électricité et de l'électronique, 2011, no. 4, pp. 48-57.

[6] ONERA: Nicolas Payet, Muriel Darces, Marc Hélier, Jean-Louis Montmagnon and Florent Jangal. "Cylindrical near-field far-field transformation in a half-space with conditions of dielectric and lossy ground". International Journal of Microwave and Wireless Technologies, 4, pp 45-50.2012.
[7] IRIT: N. BRAX, JP. GEORGE, MP. GLEIZES, E. ANDONOFF, JP. MANO. Détection de comportements illicites par SMA adaptatif: application à la surveillance maritime. Journées Francophones sur les Systèmes Multi Agents, JFSMA 11, Valenciennes, France, Septembre 2011.

[8] IRIT: N. BRAX, E. ANDONOFF, MP. GLEIZES. A Self-Adaptive Multi-Agent System for Abnormal Behavior Detection in Maritime Surveillance. International KES Conference on Agent and Multi-Agent Systems: Technologies and Applications, pp. 174-185, Dubrovnik, Croatia, June 2012.

[9] IRIT: N. BRAX, E. ANDONOFF, JP. GEORGÉ, MP. GLEIZES, JP. MANO. MAS4AT: un SMA auto-adaptatif pour le déclenchement d'alertes dans le cadre de la surveillance maritime. Revue d'Intelligence Artificielle, à paraître, Juin 2013.

Different presentations to FRONTEX, Implementation Group have also been performed.

Period 3:

Different presentations to FRONTEX, ED4BG in Crete, COMINFOR (Marine nationale RETEX), MILIPOL Paris (commission booth), Maritime Surveillance and Security (Hellenic European Council) etc have been performed.

Deviations

No deviations in achieving above tasks in the first period.

Critical objectives

Critical objectives achieved.

Statement on the use of resources Cf Form C.
Corrective action As performed tasks were nominal, no corrective action foreseen.

WP 51 Integrate the system, perform the testing & data flows validation

Summary

Integration of capacities into I2C system and to perform system testing.
Task 5.1.1 Engineering test files: prepare, complete test files and expected results from the testing files used in phase 2 for each capacity – DCNS.

Task 5.1.2 Integration system: delivery of beneficiary capacities and integration system either on the shore based sensor platform or on remote location as DCNS site – DCNS with support from the capacities providers (most of the beneficiaries).

During the integration, hot line is maintained with beneficiaries to support DCNS in its task and solves most of the encountered problems in interfacing capacities and overall data flow circulations.

During the integration, beneficiary reference capacities shall be operational to replay encountered malfunctioning and test corrective solutions to be implemented.

Eventually, if necessary, collocation period is organised to overcome integration severe difficulties.

Task 5.1.3 Factory acceptance: perform preliminary exploitation tests using shore based sensor data and suspicious event scenarios – DCNS with all beneficiaries.

During the factory acceptance, all involved beneficiaries are on site to support ultimate fitting and capacity tuning.

The factory acceptance is concluded by a closing meeting and declaration of the I2C system ready for exploitation / experimentation.

Task 5.1.4 Satellite communication network: communication network is configured for the phase 3 – ASTRA.

- Input: real traffic source or simulated with similar characteristics as final operational service: SLA, rate, formatting, similar TRF destination
- For Astra, as these tests will be performed on site it is similar to a SAT
- Tests will be about the integration and the service procurement: configuration validation and compliance with service quality requirements.
- No specific test about system functionality and internals will be performed if this system is already used to provide similar operational service elsewhere in Europe and in similar operational conditions.

Results

Period 1:

-

Period 2:

In order to by on time to deliver the version 1 (D5.1.1) and its FAT datasheet, the work during this phase has been to anticipate as soon as possible the integration pod the component by setting up pre-integration and integration tests in parallel. This was to enable

and de-risk an availability of the system for the campaigns to come by mid 2013 and 2014.
It was also to enable sufficient feedback to produce the version 2 with limited number of software bugs that all SW projects have to handle.

Period 3:

Each capability has been evaluated first in a testing environment adequate for the capability under test. The environment used enabled to provide the capability with all necessary input to perform the first level of tests.
For the integration phase, a set of testing periods has been established to enable overall testing before the delivery to the users in different pilot sites. The configuration set up was encompassing the shore based sensor platform as well as the remote locations (e.g. AIS, DCNS server platform)
During this integration phase, some of the partners that contributed to the capabilities have put in place a kind of "hotline" making available some resources to investigate problems encountered (both e-mail and chat). Some directions to record all necessary data have been put in place to enable further analysis of data flows exchanges within the system and in different nodes for investigation and performances analysis or replay.
Most of the integration phase has been performed remotely. Nonetheless, for some limited periods, physical integration tests have been organized in order to have most of the contributors directly around the table.

The FATs relative to Task 5.1.3 have been organized by setting up real data from shore based sensors to match suspicious event scenarios both with targets of opportunity while feasible or by assets hired in support.
The FATs enable the tuning of the system to get a system ready for the campaigns. Some Trouble Reports have been issued on the V1, then analyzed and corrected either immediately or before the V2 is delivered. The end of each FAT is the delivery of the contents of the versions (and limitations while applicable). This decides the level of readiness of the version to be available for the experimentations (campaigns/exercises).

Concerning the Task 5.1.4 (Satellite communication network), the network has been tuned based on performances measurements and analysis in order to support the architecture chosen and set up for the third period (mainly the campaigns/exercises).
.The communication networks support several types of traffic:

- data sources and providers to servers in Le Mourillon through a Data Hub
- from servers in Le Mourillon to users workstations.

Deviations
WP started earlier in period 2 (Intuilab).

Critical objectives

Integration of capacities into I2C system and to perform system testing as early as possible.

Statement on the use of resources

Cf Form C.

Corrective action

The only corrective action was to update the I2C tasks schedule and perform more work in the second period that planned in the offer (DCNS).

WP 52 Exploit the system to assess performances

Summary

To exploit the I2C system and organise user exploitation sessions to assess the performances

Task 5.2.1 Maintain the I2C system: during 1.5 years, to maintain I2C system in operation and correct malfunctioning are reported (standard form) – DCNS and most of the beneficiaries.

During the exploitation lifecycle, beneficiaries maintain reference capacities in order to replay detected malfunctioning, develop and test corrective solutions.

Group of corrective solutions are, time to time, implemented in I2C system and associated test processes are performed – DCNS.

At mi–exploitation period a beneficiaries seminar is organised with user committee members to review the outcomes. This seminar is organised by JRC & ECOMER.

Task 5.2.2 Assess performances:

- Assess satellite communication network – ASTRA. As communication media provided is transparent to partners, Astra's task in this package will limit to partner's support, traffic report, service availability and quality monitoring:
  - ✓ Traffic report (accounting) will be provided.
  - ✓ Signal quality and data formatting (TOS bit) will be cross-checked.
  - ✓ Network access monitoring.
  - ✓ Support of other partners.
  - ✓ Fine-tuning of the service / system configuration based on overall performance assessments.
- Simulate scenarios for suspicious events – DCNS with support of JRC, ECOMER and users committee.
- Ingest scenarios in common operational traffic picture – FURUNO with AJECO support (this can be done as input from additional virtual sensor of the shore based sensors platform).
- Assess common operational traffic picture performances – FURUNO with AJECO.
- Comparison between common operational traffic pictures and vessel plots extracted from satellite radar images – JRC & SPACETEC.
- Assess common intelligent operational traffic picture performances – KONGSBERG.
- Assess abnormal vessel behaviours detection, suspicious events understanding and early identification of threats – DCNS with supports from IRIT, CLEARPRIORITY, ONERA, INTUILAB, SOFRESUD, ECOMER & JRC.
- Overall performances evaluation – DCNS.

The performances are evaluated for different weather conditions, day and night, traffic densities, etc.

Task 5.2.3 Exploitation by users:

- Train user – DCNS with JRC & ECOMER supports.
- Prepare training scenarios – JRC & ECOMER.

- Organise and manage session with users – JRC & EOMER.
- Play scenarios – DCNS.
- Training debriefings – DCNS with JRC & ECOMER supports.
- Legal support – HOOYDONK.

Task 5.2.4 Performances evaluation report: at the end of the exploitation period evaluation reports (versions 1 & 2) are issued (includes all malfunctioning forms and descriptions of corrective solutions, compliance matrix between user needs and achieved performances, real suspicious events processed and interpretation files, etc.) – DCNS with all beneficiary supports.

Results

Period 3:

The main tasks for this WP have been to maintain operational the I2C system for 18 months, assess the performances, enable the proper exploitation by the panel of users and finally produce a Performances evaluation report

Everything went in accordance with the plan.
The I2C system was robust enough and enabling some redundancy to maintain a quality of service and an availability throughout this 18 months period.
Several interventions have been performed to the different AIS sites to enable a good level of geographical coverage. Some Servers, workstations have also been maintained / replaced. Satellite dishes have been replaced from metal to fiver glass ones.
Some SFR/orange 3G data providers have been adjusted has not well suited to the need and with a poor coverage on the area they were used.
Some trouble reports (concerning the VPN for instance, or requiring a new Workstation software update) have been solved most of the time remotely.
Several training sessions have been organised with the users on the system. Each time, a period was planned enable lessons learned from the use of the system. This was put in a document to keep track of the request for change (evolutions), Trouble Reports, or missions related remarks to help for the overall use of the system.

Concerning the assessment of the performances, here are the key objectives that have been met:

- Evaluate the communication media supported (including satellite, 3G and ADSL/SDSL). Some specific tools to enable traffic report, service availability and QoS monitoring. Based on those measurements, it is proposed some updates/tunings for the service to improve the QoS.
- Prepare and use real data whenever possible, build realistic scenarios for suspicious events (based on real recordings or on synthetic data).
- Enable COTP performances, and evaluate the added value of satellite data. The 2014 campaign has been planned careful to enable some slots where it is possible to compare the satellite data (SAR pictures) processed with other sources (AIS, FMCW, FAR, HFSW) even if it cannot be done on the fly.
- Assess CITP performances.
- Assess BEAN and USE.
- Evaluate overall performances.

For each test/trial/campaign a description of the environment (e.g. area of the operations, weather conditions, time slot of the trial, traffic density) • In order to enhance the realism of the evaluation of the system, the exploitation is done for all the 18 months periods by users who are trained and that participate to elaboration and execution of the scenarios. A legal support is available to perform the matching between the legal framework and the scenario put in place in order to perform realistic operations. The performances evaluation report, at the end of the exploitation by the users of both versions V1 and V2 provides compliance between the user needs and achieved performances with the available versions of the system.
Deviations None
Critical objectives Critical objectives achieved.
Statement on the use of resources Cf Form C.
Corrective action None**.**

WP 53 Prepare exercise plans and perform exercises

Summary

With the users committee prepare deployable platforms, plan and perform exercises.

Task 5.3.1 Define exercise requirements: define surveillance missions, select local nodes, deployable platforms involved, surveillance periods, payload composition, etc. – JRC, ECOMER & users committee.

Task 5.3.2 Deployable platforms setting:

- Aircraft, sensors integration, flight characteristics, etc. – ONERA.
- Zeppelin sensor integration, flight characteristics, etc. - DZR with AIRSHIPVISION and ROCKWELL COLLINS support.
- Vessel, POLARIS and NAOS MS2 integration, navigation characteristics, etc. - DCNS.
- Equipped USV and remote pilot-control station, etc. – DCNS.

Task 5.3.3 Deployable platforms testing / malfunctioning corrections:

- On ground and on flight equipped aircraft testing – ONERA.
- On ground and on flight equipped zeppelin testing - DZR with AIRSHIPVISION support.
- At harbour and at sea vessel patrol and USV testing - DCNS.

Task 5.3.4 Carry out exercises:

- Exercise decisions – DCNS with support ECOMER, JRC and users committee.
- Aircraft exercises – ONERA.
- Zeppelin exercises - DZR with AIRSHIPVISION support.
- Vessel exercises - DCNS.

Tasks 5.3.5 Exercises debriefing: review of results, list of malfunctioning, improvement for next exercises, etc. – DCNS with ONERA, ROCKWELL COLLINS, FURUNO, DZR, AIRSHIPVISION, JRC, ECOMER and users committee.

Tasks 5.3.6 Ingest exercise data in the common operational traffic picture: replay the common operational traffic picture from shore based sensors platform and ingest exercises traffic pictures – FURUNO.

Tasks 5.3.7 Evaluate shore + deployable platform common operational traffic picture: assess the combined shore + deployable common operational traffic pictures and evaluate the added values in terms of:

- Understanding of the traffic and activities – DCNS with FURUNO support.
- Number and types of vessels not plotted by shore based sensors – DCNS with FURUNO support.
- Identification of non reporting vessels – DCNS.
- Compare deployable sensors derived common operational traffic pictures with vessels plot extracted from radar satellite images – JRC.

Task 5.3.8 Exercises report: assess the exercise outcomes and issue recommendations for next exercises – DCNS with all involved beneficiaries.

Results

Period 3:

The objective was to prepare deployable platforms, then plan and execute campaigns. This was done with the support of the users in order to match the scenario with realistic test cases.

The preparation of sites (fixed platforms of sensors) , assets (deployable platforms), payloads, system nodes, and trial slots has been well anticipated ahead from the trials.
This enabled to limit to the minimum the uncertainty and just perform some small adjustments.

Aircraft used by ONERA to evaluate their SAR pod was tasked by the operator. The pod was prepared and tuned specifically for the mission. The crew was briefed towards the objectives by the team. Minor correction/adjustments have been possible and done on board to optimize the system to the flight conditions and to the environment.

The Zeppelin payload integration was done also in several steps. From the integration in RCF factory to integration in Friedrichshafen (on ground first, then low altitude Air tests were conducted). This was the key to de-risk the integration and avoid loosing critical aircraft availability slots.

Vessel (Pegase) was prepared with a slaved satellite antenna to enable transmission of tracks to Le Mourillon Server. Several trips to St tropez (harbour of the Pegase) to tune the system.

For the USV, some preliminary integration tests of the payload have been run in Lorient naval base.

For the execution of the exercises themselves, a staffing has been prepared to define and decide who is doing what and where.
The required decisions have been taken at different levels in order to optimize the scenario, integrate assets last minute constraints and the conditions of the trials.
Priority has been chosen to comply to safety of the personnel first, then the assets.
A tight interaction with the other activities (in the Air and at sea) has been set in place.
Meteorological conditions were optimal on the first campaign (2013), but in 2014, we had to manage with 3 days late arrival on Cuers for operations.
We have set up a close decision loop to re-compute in real time all the systems, authorizations and actors depending on last news on the Zeppelin ETD and ETA

Debriefing method:
We have put in place a principle of short briefing at the beginning of each day to decide the Fly or no Fly day for the Zeppelin. We performed hot debriefing at the end of each day. A full debriefing day was done the day after the campaign with representatives of each contributor to the exercises.
Based on those lessons learned, improvements were defined in 2013 for 2014 campaign and most of the recommendations, corrections, and evolutions have been implemented.

COTP and CITP have been evaluated for the 2013 campaign. In addition, BEAN and USE

have been also evaluated during the 2014 campaign. The COTP has been evaluated towards the density of the traffic (number and type of ships) and served as the basis of the interpretation. The complementarity of the sensors has been evaluated; the cooperative and non cooperative targets detection has been also evaluated. The added value of satellite post-processed images from SAR satellite has been also analysed. At the end of each main exercises/campaigns, a report that is the synthesis and compilation of all the information related to lessons learned has been produced.
Deviations None
Critical objectives Critical objectives achieved.
Statement on the use of resources Cf Form C.
Corrective action

WP 54 Collect user feedbacks to improve capacities and operational procedures

Summary

Collect user feedbacks on system exploitation to evaluate the I2C capacities added values and update the user needs specification for operational sea border surveillance system of second generation.

Task 5.4.1 collect user feedbacks: during the period of the I2C system exploitation and training sessions, members of the users committee as well as representatives from European organisation centres issues comments, recommendations and advices that are to be summarised in a report in order to:

- Validate I2C concept and capacity functions for sea border surveillance missions.
- Update user needs in light of exploitation outcomes.
- Review geo collaboration procedures to understand suspicious event and early identify threats.
- Comment HMIs and propose improvements.

The task is performed by DCNS with JRC & ECOMER support.

Task 5.4.2 End of project user seminar: organise, manage and animate dedicated user committee at the end of the project to present user feedbacks and prepare main guidelines for future sea border surveillance system – JRC & ECOMER.

Results

Period 3:

In order to collect some useful feedback, an exchange loop has been put in place.
This enabled to collect continuously comments, Trouble reports and evolution Request.
But also, during the training sessions (delivered in Le Mourillon premises, 3 during the 18 months), a specific slot has been kept to enable discussions around lessons learned from operational users to capture and refine their need. This enabled the possibility to upgrade, enhance some capabilities or at list to keep them for the future potential operational system (a surveillance system of second generation for improving operational sea border surveillance).

Together with the 2014 exercise debriefing, as users were tightly involved, a dedicated session enabled to sum up all the lessons learned, various feedbacks from the project and prepare main guidelines for future sea border surveillance system.

Deviations

None

Critical objectives

Critical objectives achieved.

Statement on the use of resources

Cf Form C.

Corrective action

WP 61 Satellite communication network for demonstration to organisations

Summary

Configure and test the communication network to transfer document alarms and interpretation files to remote organisations.

Task 6.1.1 Communication links configuration: configure the communication network to link organisations within I2C system and perform data flows circulation testing – ASTRA:

- Required inputs: communication destination(s) and quality / class of service.
- Organisation receipt for the flow is responsible for the configuration of its infrastructure to successfully receive information flow.

When required, provide access to the I2C system for remote organizations through satellite communications network.

Results

Period 3:

Based on the system architecture set up, the mapping of this architecture on the exercises, a dynamic statistics tool has been used in order to show the bottlenecks and propose optimizations.
The QoS of the communication has therefore been improved during all the 18 months to enable exchange of tracks, alerts, reports trough the network.
The network has been evaluated towards different contexts in terms of tracks, alerts, service providers, etc
The client workstations installed in the users have also been evaluated in different contexts, either satellite, or 3G or ADSL/SDSL to evaluate optimal configurations.
An optimization of the bandwidth using 2 separate modems and a DSIP has been evaluated in St Mandrier site. The improvement was not that impressive. The recommendation and implementation have therefore been to group a subset of equipment on each of the two modems.

Deviations

None

Critical objectives

Critical objectives achieved.

Statement on the use of resources

Cf Form C.

Corrective action

WP 62 Perform demonstration to organisation and potential prospects

Summary

Perform demonstration to organisations on monitoring suspicious event and early threat identification for decision making.

Task 6.2.1 Organise and monitor the demonstration: issue note on how the demonstration is performed, and how I2C system is configured and operated to carry out the demonstration. – DCNS.

Task 6.2.2 Prepare organisation to demonstration: install visualisation consol (based on COST) on organisation site, perform testing and present demonstration goals and operation to organisation representatives – DCNS with ECOMER & JRC supports.

Note: the goals and contents of the demonstration are defined with the users committee and organisation representatives – JRC & ECOMER.

Task 6.2.3 Perform the demonstration – DCNS with supports from JRC & ECOMER and users committee.

Note: two types of demonstration are performed:

- Replay of past detected suspicious event, understanding and early identification of threats as well as generation of interpretation files.
- Real time simulated suspicious events (scenarios).

Task 6.2.4 Debrief on demonstration: review the demonstration operation, analyse results, issue comments and recommendations – DCNS with supports from JRC, ECOMER & users committee & organisation representatives.

Results

Period 3:

During this period, several demonstrations to organisations have been performed. The focus was mainly on monitoring suspicious event and early threat identification for decision making.

All necessary preparation of various means (systems, workstation, tools for replay/predefined scenarios, and staff) to operate the system has been done carefully.
The execution on site has been performed (St Mandrier, Mourillon or as mobile remote configuration in several locations).

Each demonstration is followed by a debriefing with lessons learned integrated consolidated with the exercises.

Deviations

None

Critical objectives

Critical objectives achieved.

Statement on the use of resources Cf Form C.
Corrective action

WP 63 Issue final report (public & confidential)

Summary

Writing of the final reports (public and confidential industry versions) which presents an overview of the project achievements and results.

Task 6.3.1 Report table of contents: propose table of contents with content writing allocations to beneficiaries - DCNS.

Note the table of contents would be as such:

- Executive summary.
- Introduction and objectives
- User needs and expectation.
- System solutions and key technologies.
- Capacity implementations.
- Exploitation and results.
- User feedbacks.
- Recommendations for future operational product.
- Annexes; (1) I2C project beneficiaries and (2) users committee members.

Task 6.3.2 Report issues: each beneficiary is writing its contribution and DCNS finalises report (public and confidential) – DCNS and all beneficiaries.

Task 6.3.3 Final review: the project final review is organised and performed to present to Commission representatives I2C achievements and results – JRC & ECOMER for the organisation and all beneficiaries involvement for the review.

Task 6.3.4 Final user committee meeting: is organised to present and demonstrate the I2C system operation and outcomes. Users from other organisation that are involved in the users committee are invited – Organisation by JRC & ECOMER and beneficiaries.

Results

Period 3:

The document D6.3.1 (final report) has been produced according to the table of contents planned. It is the synthesis of all significant work that has been conducted during the 4 years I2C project. The main results reached are sum up in this document that can be distributed to show the I2C project at a glance.

The final review has been organized on the 13-14th November 2014 to present to the commission all the main results reached, focus on the last period.

The D6.3.2 (Final user committee report) is compiling all the user committee meetings and conclusions. The final meeting for users was organized for efficiency together with the lessons learned of the 2014 campaign.

Deviations

None

Critical objectives

Critical objectives achieved.
Statement on the use of resources Cf Form C.
Corrective action

WP 64 Issue industrial report (including costing)

Summary

Writing the industrial document for industrialisation of I2C system and promotion to potential commercial prospects.

Task 6.4.1 Report table of contents: propose table of contents with content writing allocations to beneficiaries – DCNS.

Note the table of contents would be as such:
- Capacities.
- Interfaces.
- Communications & data flows.
- Data bases.
- Integration scheme.
- Operational constraints.
- Cost estimates (procurement, installation and operation).
- Maintenance scheme.

Task 6.4.2 Report issues: each beneficiary is writing its contribution and DCNS finalises reports (public and confidential) – DCNS and all beneficiaries.

Task 6.4.3 Industrial consortium agreement: an agreement between consortium beneficiaries is drafted for the industrialisation phase of the I2C system.- DCNS (legal service). This agreement is not delivered to Commission (confidential industry).

Results

Period 3:

The tasks of this WP 6.4 are mainly to compile the position of the different partners and the position of the consortium as a whole concerning the industrial phase to come relative to all results obtained in the scope of I2C.

The table of contents contains at least the main topics proposed in the DOW dealing with all major topics of concern.

Concerning the Industrial consortium agreement, the work that has been performed was much more to discuss and agree on the position of the different partners relative to industrial phase first (who is funding this phase?) and also what is the ways towards procurement of such a solution. Due to the unclear environment about the procurement phase of all or parts of the I2C prototyped solutions,
This agreement itself is integrated in the industrial document D6.4.1 for the releasable part.
As mentioned in the DoW, the agreement itself has not to be delivered to the commission (confidential industry/consortium only). The D6.4.2 document put on the commission site will therefore be only a one page or so document mentioning that the document itself is confidential industry/consortium only.

Deviations

None

Critical objectives Critical objectives achieved.
Statement on the use of resources Cf Form C.
Corrective action

2.4 Project management during the 3 reporting periods (synthesis by period)

The following table summaries the management activities during the first period.

Management issues	Achievements
First Period	
Consortium management	The main achievements were to issue all deliverables as initially planned, as well as to set up the user committee. JRC and MEEOSIM sent letters to REA to reallocate their allocated global person-months (see Annex I of this report).
Problems which have occurred and how they were solved or envisaged solutions	No problems were encountered during the first phase.
Changes in the consortium, if any	No changes occurred.
List of project meeting , dates and venues	See above jointed meetings table.
Project planning and status	In first period, all nominally planned tasks have been completed with, in addition, some other tasks scheduled in the second period. These tasks were needed to secure the further periods and support the users committee in specifying needs for operational missions (see section “objectives” and justification in WP results).
Impact of possible deviations from the planned milestones and deliverables, if any.	No deviations occurred in the first period.
Any changes to the legal status of any beneficiaries, in particular non-profit public bodies, secondary and higher education establishment, research organisations and SMEs.	SME AJECO changed is postal address and informed EU.
Development of the project website, if applicable.	Done, see www.i2c.eu, Website management and maintained by ARMINES beneficiary.
Second period	
Consortium management	The main achievements were to issue all

Management issues	Achievements
	deliverables as initially planned and prepare all tasks relative to integration and organization of the campaigns.
Problems which have occurred and how they were solved or envisaged solutions	No problems were encountered during the second phase.
Changes in the consortium, if any	No changes occurred.
List of project meeting , dates and venues	See above the meetings table.
Project planning and status	In the second period, all nominally planned tasks have been completed with, in addition, one task scheduled in the third period. These tasks were needed to secure the further periods and prepare the integration of the full system (see section "objectives" and justification in WP results).
Impact of possible deviations from the planned milestones and deliverables, if any.	No deviations occurred in the second period.
Any changes to the legal status of any beneficiaries, in particular non-profit public bodies, secondary and higher education establishment, research organisations and SMEs.	None
Development of the project website, if applicable.	Done, see www.i2c.eu, Website management and its maintenance are done by ARMINES beneficiary.
Third Period	
Consortium management	Establish Industrial document and discuss industrial agreement
Prepare an amendment	for several topics including subcontracting issues, change in terms on MM between 3 partners, electronic signatures to validate Form C
Project planning and status	In line with the planning of RP3 tasks. Coordination of the partners to ensure good execution of the project, the exercises, etc…
Impact of possible deviations from the planned milestones and deliverables, if any.	No deviations occurred in the second period.

Beneficiary Working Meeting	Date	Venue	Output
First Period			
First consortium working meeting	20/10/2010	DCNS premises, TOULON, FR	Day after the kick off.
First EU implementation group meeting	29/03/2011	EU BRUXELLES	I2C status
Second EU implementation group meeting	15/06/2001	EU BRUXELLES	I2C status

Beneficiary Working Meeting	Date	Venue	Output
Third EU implementation group meeting	19/07/2011	EU BRUXELLES	I2C status
I2C working meeting	08/08/2011	JRC, premises ISPRA	I2C scenario definitions
I2C working meeting	27/02/2011	DCNS premises, BAGNEUX	I2C overall technical progresses.
Second Period			
Meeting on installation / integration	oct 2011 to jan. 2012	PACA area	Actions items or MoM
Meeting for on site tests (St Mandrier)	jan 2012 to april 12	PACA area	Actions items or MoM
Meeting for on site tests (St Mandrier)	may 2012 to august 12	PACA area	Actions items or MoM
Meeting for on site tests (St Mandrier)	august 2012 to nov. 12	PACA area	Actions items or MoM
Meeting for on site tests (St Mandrier)	nov 2012 to jan. 13	PACA area	Actions items or MoM
Adjust scenarios for campaign	12/02/2013	PARIS	MoM
Install & valid capacity in Harbour Ladroit	25/10/2011	LORIENT	Installation sheet
Integration with clearpriority / IRIT (BEAN) WP 4.3	18/10/2012	BRUSSELS	Actions items or MoM
Integration with clearpriority / IRIT (BEAN) WP 4.3	23/01/2013	TOULOUSE	Actions items or MoM
Integration WP 4.2 / WP 4.3 / WP 4.4	13/12/2012	TOULOUSE	Actions items or MoM
Technical coordination meeting with partners	Feb. To sept 2012 2012	TOULON	Actions items or MoM
Mid-term conference	20-21 october 2012	TOULON	MoM
Working meeting with DG entreprise for I2C	09/09/2012	BRUSSELS	Actions items or MoM
Presentation of I2C progress in Implementation group	20/09/2012	BRUSSELS	Actions items or MoM
Meeting I2C	03/10/2012	TOULOUSE	Actions items or

Beneficiary Working Meeting	Date	Venue	Output
interface (HMI) WP 4.4			MoM
Meeting I2C in SGMer	19/01/2012	PARIS	Actions items or MoM
Third Period			
Integration meetings			Only 1/6 months physical meetings. All other conf call or phone meetings.
Main milestones for campaigns, demonstration to users			Participation of relevant partners to ensure cost effective travels.
User Committee Meeting	**Date**	**Venue**	**Output**
First Period			
Preparation first user committee	27/01/2011	DCNS premises, TOULON	Review of user needs
First user committee	31/01/2011	Gendarmerie Maritime, FOS sur MER	User needs specification
Preparation second user committee	11/05/2011	DCNS premises, TOULON	Detection of suspicious vessels
Second user committee	12/05/2011	Gendarmerie Maritime, MARSEILLE.	Detection of suspicious vessels
Second Period			
Training of users/ user committee	20-22/02/2012 + 10/04/2012	TOULON	Deployment of new version + quick user manual/guide
Third Period			
Synthesis of users committees feedback/lessons learned	01/07/2014	TOULON	Users lessons learned compilation
Project Review Meeting	**Date**	**Venue**	**Output**
First Period			
Kick-Off meeting	19/10/2010	DCNS premises, MOURILLON	Review of the project tasks and schedule.
End of first period	20/10/2011	DCNS premises; MOURILLON	Review of the tasks performed in the first period and proposed plan for the second period.
Second Period			
Mid term review meeting	20-21/10/2012	DCNS premises; MOURILLON	Review of the tasks performed in the

Beneficiary Working Meeting	Date	Venue	Output
			first mid-term and proposed plan for the second mid-term.
Third Period			
Final review meeting	13-14/11/2014	TOULON+MARSEILLE	Review of the tasks performed in the last Reporting Period.

Concerning the Conference, Seminar and Symposium, I2C has been demonstrated in the following contexts.

Conference, Seminar & Symposium	Date
ED4BG (Frontex Border Guards) - Warsaw	22/05/2014
COMINFOR – Naval base Toulon	01/04/2014
Hellenic Presidency of the Council Seminar on Maritime Surveillance and Security – Chania (Crete)	22/03/2014
MILIPOL - Paris	13/11/2013
Maritime Security Event Euro Parliament - Brussels	18/09/2013
CWIX Nato – JFTC Bydgoszcz (Poland)	22/06/2012
OCOSS - Trois (France)	01/10/2012
SPACEMAR - Toulon (France)	27/09/2011
SAFERSEA – Brest (France)	11/05/2011

Prospect demonstration in I2C data processing centre in Mourillon	Date
Ecole de Guerre students	14/11/2013
Brazilian Parliament representatives	31/10/2013
French President Strategic adviser	25/07/2013
Var region Prefet	22/03/2013
DGA/SQ team	19/02/2013
Var Regional Assembly elected representatives	30/10/2012
Vietnamese marine delegation	30/07/2011
Marine General Staff	26/04/2011
SGMER (Secrétaire Général de la Mer) Secretary	22/02/2011

Coordination activity has been performed:

Period 1:

- To set up I2C presentations for conferences (i.e.; OCOSS, MAST and SEATIMED).
- To contribute to the EU maritime security implementation group where I2C periodically (every two months) progresses are presented to EU representatives (DG Mare, DG Entreprise, DG Move, Frontex, EUSC, EMSA, etc.) and I2C consortium contribute to working document such as the CONOPS (CONcept of Operation Specification) for small boat detection. In this multi disciplinary implementation group, all major FP7 maritime

projects (I2C, PERSEUS & SEABILLA) and GMES projects (NEREIDS, DOLPHIN, etc.) are reviewed.

Period 2:
In full continuity with period 1,

- To contribute to the EU maritime security implementation group
- To promote scientific and technical conferences

Period 3:
Basically, the same approach as for period 1 &2.

- To contribute to the EU maritime security implementation group
- To promote scientific and technical conferences
- In addition, it shall be noted that i2c management has organized on the 11th of September 2014 afternoon in Brussels, just after the I2C final conference, a neutral half day workshop to provide some discussions with the major stakeholders (companies other than in the I2C project consortium have been invited). This workshop has been placed under an European common interest for the security and safety umbrella. Therefore, it has been decided to chose the EOS (European Organisation for Security) website to provide also all the presentations slides used during the workshop.

2.5 Deliverables and milestones tables

Deliverables

All planned deliverables, listed in the Annex I of the Grant Agreement, have been approved by the project Coordinator that uploaded the files in SESAME.

The following tables provide the status of the deliverables issued and validated in the first and second periods.

First period:

TABLE 1. DELIVERABLES

Deliverable number	Deliverable name	Version	WP number	Lead Beneficiary	Nature	Dissemination level	Delivery date from annex I	Actual delivery date	Status	Comments
D11.111	Management plan	1	11	1	R	PU	2	2	Submitted	No
D13.131	Disemination plan	1	13	19	R	PU	3	3	Submitted	No
D13.134	Project Web site	1	13	19	R	PU	3		Submitted	www.i2c.eu
D21.211	User needs specification	1	21	19	R	RE	6	12	Submitted	The acceptances of the two specifications were only done when the three deliverables were available to perform cross checking between needs (D21.211) , requirements (D22.221) and system component designs (D23.231).
D21.212	User nedds specification form acceptance form	1	21	19	R	RE	6	12	Submitted	
D22.221	Functional & operational requirements specification	1	22	1	R	RE	9	12	Submitted	
D22.222	Functional & operational requirements specification acceptance form	1	22	1	R	RE	9	12	Submitted	
D23.231	Architecture design document	1	23	1	R	RE	12	12	Submitted	
D22.223	Technical note on shore based sensor platform	1	22	1	R	RE	9	12	Submitted	No
D22.223	Technical note on deployable platform	1	22	1	R	RE	9	12	Submitted	No
D22.225	Technical note on telecommunication VPN	1	22	1	R	RE	12	12	Submitted	No
D23.232	Satellite communication network architecture	1	23	1	R	RE	12	12	Submitted	No
D24.241	Shore senor interface definitions	1	24	1	R	RE	12	12	Submitted	No
D24.242	Deployable platform interface definitions	1	24	1	R	RE	12	12	Submitted	No
D24.243	VPN interface definitions	1	24	1	R	RE	12	12	Submitted	No
D24.244	Capactity interface definitions	1	24	1	R	RE	12	12	Submitted	Capacities designed in the architecture
D25.251	Performance evaluation methodology document	1	25	1	R	RE	12	12	Submitted	No
F25.252	Scenarios descriptions	1	25	1	R	RE	12	12	Submitted	These scenarios may be reviewed in second period to respond to requirements expressed by the EU implementation group to satisfy specific European event conducted by the Commission

Second period:

All deliverables for the second reporting period have been delivered.

Third period:

All the deliverables of this period have be posted on the participant/ECAS web site and submitted for verification the REA. At the time this document is delivered, only the industrial report is not available in Final version, but has been delivered in draft.

2.6 Milestones

The table gives the planned milestones and their achievements for the first and the second periods.

Table 2 Milestones

Milestone number	Milestone name	WP number	Lead beneficiary	Delivery date from Annex I	Achieved	Actual achievement date	Comments
First period							
MS1	Kick Off	WP11	1 (DCNS)	1	Yes	1	None
MS2	Validation of specifications	WP21, WP22 & WP23	1 (DCNS)	12	Yes	12	None
Second period							
MS3	End of satellite communication network deployment	WP33	4 (ASTRA)	18	Yes	18	None
MS4	End of shore based sensors platform deployment	WP31	18 (ONERA)	21	Yes	21*	* Except HFSW deployed only in intermediate version for 1 week. Delay due to administrative authorizations (DGA).
MS5	Mid term review	WP11	1 (DCNS)	24	Yes	24	None
MS6	First users/ stakeholders conference	WP12		24	Yes	24	In Toulon
Third period							
MS7	Prototype Version 1	WP51	1 (DCNS)	33	Yes	33	None
MS8	Prototype Version 2	WP51	1 (DCNS)	36	Yes	36	None

Table 2 Milestones							
Milestone number	**Milestone name**	**WP number**	**Lead beneficiary**	**Delivery date from Annex I**	**Achieved**	**Actual achievement date**	**Comments**
MS9	Demonstration to organisations	WP62	1 (DCNS)	43	Yes	43	None
MS10	Second users / stakeholders conference	WP12	1 (DCNS)	45	Yes	45	In Brussels
MS11	Final Review	WP11	1 (DCNS)	48	Yes	48	In Toulon, 13-14/11/2014 to the request of the commission.

3 Explanation of the use of the resources and financial statements

Forms C (filled in by each I2C project beneficiary) and Annex VI are provided diretly with Sesame (Form C and its annexes for the Use of Resources.

In 2011, JRC and METEOSIM (through the Coordinator) have sent to REA letters to change their person-months allocations per WP, but keeping constant their global allocated person-months. Change has been promised as it has no impact on the project by REA.

An amendment is in progress for RP3 (discussions started in April 2014) to:

- Enable subcontracting by KONGSBERG
- Enable a transfer of some M.M from KNC to DCNS/RCF to permit improved integration of navigation on board the ZEPPELIN and in the system on shore (not planned in the initial DOW)
- Enable electronic signatures by workflow for RP3 Form C and Form D (CFS) submission.

4 Conclusions

The project has reached all the objectives that were established at the beginning of the project. Four years later, I2C has been able to build a prototype enabling evaluation of assets, equipment and capabilities integrated and combined in such a way that they propose real improvement and innovation compared to the existing Border surveillance systems.

I2C is integrating data processing and exploitation capabilities for detection of all types of vessels (small, medium and large) for early identification of threats at sea in order to quickly report to authorities and plan relevant actions.
During the achieved campaigns in 2013 and 2014, the I2C deployed full prototype in user centres has collected real time data from networked coastal stations, data service providers and deployed patrols at sea (aircraft, vessel, zeppelin and unmanned surface vehicle) to continuously track suspicious small boats locally and merchant / fishing ships widely over the Mediterranean basin. The EEZ objective is therefore met by the proposed solutions raised during the I2C project demonstrations and campaigns.
The I2C prototype is therefore “operation” proven as it has been used for more than 3 years at different level of completeness.
A special focus has been performed on the “Small boats” detection improvement required by existing threats. They have been detected either from new coastal radar technology; Frequency Modulation Continuous Wavelength (FMCW) radar (in its shore version as well as its airborne version), and identification has been possible using high resolution optical cameras. To provide efficient surveillance of their Economic Exclusive Zone (EEZ), countries can also install new sensors such as High Frequency Surface Wave (HFSW) radar.

I2C integrated project, as new generation of maritime surveillance and security prototyping solution, seeks to further enhancement of existing border surveillance systems and promote relevant collection of standardised information, advanced exploitation of them to detect on going threats and sharing between involved users from coastguards and navies to port authorities, fisheries controls, customs authorities and environmental monitoring and control bodies
I2C deployable solution can use existing infrastructure, means (detection equipment, computers, (secured) communication networks LAN and WAN, surveillance systems). It can bring some rationale to existing investments and