**DISSEMINATION AND EXPLOITATION PLAN DOCUMENT**

**D8.2**

ADVANCING PLUG & PLAY SMART SURVEILLANCE (APPS) PROJECT

**ITEA Contract Number**

**13035**

|  |  |
| --- | --- |
| *Due Date:* |  |
| *Actual Submission Date:* | 28/07/2015 |
| *Project Dates:* | Project Start Date : January 01, 2015 Project End Date : December 31, 2017Project Duration : 36 months  |
| *Leading Contractor Organization:* | ITEA2 |
| **Project funded by the ITEA2**  **(2015-2017)** |
| **Dissemination Level** |
| **PU** | Public |  |
| **PP** | Restricted to other programme participants (including the Commission Services) |  |
| **RE** | Restricted to a group specified by the consortium (including the Commission Services) | X |
| **CO** | Confidential, only for members of the consortium (including the Commission Services) |  |

**Document management**

**Document history**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Version** | **Status** | **Date** | **Responsible** | **Reason for change** |
| V0.1 | Initiated | 28/07/2015 | GMT | Creating Document |

**Change authorization**

|  |  |
| --- | --- |
| **Name** | **Company** |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

Table of Contents

[1 INTRODUCTION 5](#_Toc425861302)

[2 TERMINOLOGY 5](#_Toc425861303)

[2.1 Definitions 5](#_Toc425861304)

[2.2 Abbreviations 5](#_Toc425861305)

[3 APPS RERULTS 7](#_Toc425861306)

[3.1 ASELSAN 7](#_Toc425861307)

[**3.1.1** Technical Evaluation 7](#_Toc425861308)

[**3.1.2** Gap between the Development and a Future Commercial Product 7](#_Toc425861309)

[**3.1.3** Exploitation Plan 7](#_Toc425861310)

[**3.1.4** Start-up & Spin-off 7](#_Toc425861311)

[**3.1.5** Patents 7](#_Toc425861312)

[**3.1.6** Dissemination Plan 7](#_Toc425861313)

[3.2 SRDC 8](#_Toc425861314)

[**3.2.1** Technical Evaluation 8](#_Toc425861315)

[**3.2.2** Gap between the Development and a Future Commercial Product 8](#_Toc425861316)

[**3.2.3** Exploitation Plan 8](#_Toc425861317)

[**3.2.4** Start-up & Spin-off 9](#_Toc425861318)

[**3.2.5** Patents 9](#_Toc425861319)

[**3.2.6** Dissemination Plan 9](#_Toc425861320)

[3.3 Otonom Teknoloji 9](#_Toc425861321)

[**3.3.1** Technical Evaluation 10](#_Toc425861322)

[**3.3.2** Gap between the Development and a Future Commercial Product 10](#_Toc425861323)

[**3.3.3** Exploitation Plan 10](#_Toc425861324)

[**3.3.4** Start-up & Spin-off 11](#_Toc425861325)

[**3.3.5** Patents 11](#_Toc425861326)

[**3.3.6** Dissemination Plan 11](#_Toc425861327)

[3.4 NANObiz 11](#_Toc425861328)

[**3.4.1** Technical Evaluation 11](#_Toc425861329)

[**3.4.2** Gap between the Development and a Future Commercial Product 12](#_Toc425861330)

[**3.4.3** Exploitation Plan 12](#_Toc425861331)

[**3.4.4** Start-up & Spin-off 13](#_Toc425861332)

[**3.4.5** Patents 13](#_Toc425861333)

[**3.4.6** Dissemination Plan 13](#_Toc425861334)

[3.5 Eindhoven University of Technology 13](#_Toc425861335)

[**3.5.1** Technical Evaluation 13](#_Toc425861336)

[**3.5.2** Gap between the Development and a Future Commercial Product 13](#_Toc425861337)

[**3.5.3** Exploitation Plan 14](#_Toc425861338)

[**3.5.4** Start-up & Spin-off 14](#_Toc425861339)

[**3.5.5** Patents 14](#_Toc425861340)

[**3.5.6** Dissemination Plan 14](#_Toc425861341)

[3.6 Microflown 14](#_Toc425861342)

[**3.6.1** Technical Evaluation 14](#_Toc425861343)

[**3.6.2** Gap between the Development and a Future Commercial Product 15](#_Toc425861344)

[**3.6.3** Exploitation Plan 15](#_Toc425861345)

[**3.6.4** Start-up & Spin-off 16](#_Toc425861346)

[**3.6.5** Patents 16](#_Toc425861347)

[**3.6.6** Dissemination Plan 16](#_Toc425861348)

[3.7 Siqura 16](#_Toc425861349)

[**3.7.1** Technical Evaluation 16](#_Toc425861350)

[**3.7.2** Gap between the Development and a Future Commercial Product 16](#_Toc425861351)

[**3.7.3** Exploitation Plan 17](#_Toc425861352)

[**3.7.4** Start-up & Spin-off 17](#_Toc425861353)

[**3.7.5** Patents 17](#_Toc425861354)

[**3.7.6** Dissemination Plan 17](#_Toc425861355)

[3.8 Thales 17](#_Toc425861356)

[**3.8.1** Technical Evaluation 18](#_Toc425861357)

[**3.8.2** Gap between the Development and a Future Commercial Product 18](#_Toc425861358)

[**3.8.3** Exploitation Plan 18](#_Toc425861359)

[**3.8.4** Start-up & Spin-off 18](#_Toc425861360)

[**3.8.5** Patents 18](#_Toc425861361)

[**3.8.6** Dissemination Plan 18](#_Toc425861362)

[3.9 ViNotion B.V. 18](#_Toc425861363)

[**3.9.1** Technical Evaluation 19](#_Toc425861364)

[**3.9.2** Gap between the Development and a Future Commercial Product 19](#_Toc425861365)

[**3.9.3** Exploitation Plan 19](#_Toc425861366)

[**3.9.4** Start-up & Spin-off 19](#_Toc425861367)

[**3.9.5** Patents 19](#_Toc425861368)

[**3.9.6** Dissemination Plan 19](#_Toc425861369)

[3.10 GMT 20](#_Toc425861370)

[**3.10.1** Technical Evaluation 20](#_Toc425861371)

[**3.10.2** Gap between the Development and a Future Commercial Product 20](#_Toc425861372)

[**3.10.3** Exploitation Plan 20](#_Toc425861373)

[**3.10.4** Start-up & Spin-off 20](#_Toc425861374)

[**3.10.5** Patents 20](#_Toc425861375)

[**3.10.6** Dissemination Plan 20](#_Toc425861376)

#  INTRODUCTION

The purpose of the Dissemination & Exploitation Plan is to provide guidelines to partners in terms of establishing their individual Dissemination & Exploitation Plans for the advancing plug & play smart surveillance outcomes. It also provides details for the dissemination and exploitation actions to be undertaken during the project, as well as after it finishes. This work was carried out as part of WP8 Dissemination and Exploitation.

# TERMINOLOGY

## Definitions

The following definitions explain the keywords within the context of the APPS project:

* **Project** hereafter it refers APPS.
* **Partner** is used to refer company, research institute, university that contributes the project.
* **ITEA3** is European research and development programme for developing core competencies of IT makers and users to secure the availability of world-competitive Information Technology for European industry being executed in co-operation by partners in EUREKA countries under mutually agreed projects in areas as described in Blue Book.

## Abbreviations

|  |  |
| --- | --- |
| AIS  | Automatic Identification System |
| APPS | Advancing Plug & Play Smart Surveillance |
| C2 | Command and Control |
| IT | Information Technology |
| LTA | Lighter Than Air |
| UAV | Unmanned Air Vehicle |
| EO/IR | Electro Optical Infra-Red |
| ICDE | Conference |
| SIGMOD | Conference |
| VLDB | conference |
| JAUS | Joint Architecture for Unmanned Systems |
| GUI | Graphic User Interface |
| TSSK | Teknokent Defense Industry Cluster |
| IDEF | The International Defence Industry Fair |
| UUV | unmanned underwater vehicle |
| PTZ | Pan-tilt-zoom |
| ECCV | European Conference on Computer Vision |
| CVPR | Computer Vision and Pattern Recognition |
| LTE | Long Term Evolution |

# APPS RERULTS

## ASELSAN

In scope of APPS project, ASELSAN improves and extends VATOZ C2 system. In this project, ASELSAN integrates following sensors: IR/EO camera, LTA (Lighter Than Air) Balloon, Physicochemical sensor) to VATOZ C2 system. After integration of new set of sensors, VATOZ C2 system more accurately identifies ship classes and tracks the vessels. Not only new set of sensors, but also Plug & Play Layer including semantic and organizational level interoperability will also be integrated to VATOZ C2 system. With the integration of these features, detecting and identifying suspicious behavior and also covering the wide area see borders can be possible in maritime domain. Furthermore vessel recognition method and module developed in APPS project will be integrated as well. By this way VATOZ C2 system has additional information related with vessels even if AIS signal is not available.

### Technical Evaluation

**To be filled after System Design Phase**

### Gap between the Development and a Future Commercial Product

**To be filled after System Design Phase**

### Exploitation Plan

ASELSAN is the largest electronics integrator in Turkey and serves in the defence and homeland security market. ASELSAN also has extensive knowledge and experience in developing sensor, surveillance systems and platforms. ASELSAN is planning to use the results of this project to improve its current portfolio with new features and capabilities. APPS enhances VATOZ®, which is sensor management product-line, with unmanned systems integration, Plug & Play capability and new smart decision support functionality based on image processing and behavioural analysis. ASELSAN expects that these functionalities place the company to a leading position for future business opportunities in maritime surveillance, homeland security and wide area surveillance domain in Turkey.

### Start-up & Spin-off

No start-up and spin-off company is planned as a result of APPS project in near future.

### Patents

**To be filled after Development Phase**

### Dissemination Plan

ASELSAN intends to disseminate project results in many platforms. As being the leader of the homeland security market in Turkey, the company has strong relationships with the main players having surveillance systems in the region. Many of these players are governmental organizations both in national and local level, but some are non-governmental organizations and some in the private sector. The project results will be disseminated to these players by organizing workshops for presenting mid-term and final results and by publishing an annual local APPS Newsletter. This newsletter will be distributed in the Turkish, and aims to increase awareness in the local committee and public. In addition, the company will present the R&D results of the project in various international and national homeland security conferences, once the APPS project results become mature for conferences and journals.

## SRDC

In the scope of APPS project, the commercially viable product developed by SRDC is the Situational Awareness Component. This component decides whether a vessel is suspicious or not, by executing situational awareness rules based on DROOLS rule engine. To be more specific, the component receives track information from VATOZ command and control system (developed by ASELSAN) and then collects information about these tracks from both available Internet web sites such as Equasis.com, MarineTraffic.com, AISHub.com, VesselFinder.com and available national vessel databases (such as Port Management Information System of Maritime Affairs of Turkey and Turkish Coast Guard Database). After that executes the situational awareness rules on the collected data and if the vessel is identified as suspicious send alert information to the corresponding command and control systems including VATOZ.

### Technical Evaluation

The Situational Awareness Component communicates with Command and Control systems based on standards. And this allows the system to be able to talk with any Command and Control system. This ability of the component is also proved in the scope of APPS project. The Situational Awareness Component is able to talk both with VATOZ of ASELSAN and other Command and Control systems. Furthermore, the situational awareness rules used in the Situational Awareness Component is not hard coded. They are developed by DROOLS open source rule engine and necessary tools have been developed to configure these rules for certain situations. It is also possible to add new rules to the Situational Awareness Component. In this respect, the developed system is both generic and extensible.

### Gap between the Development and a Future Commercial Product

The technical evaluation of the Situational Awareness Component will be performed in the scope of APPS Project. Detailed test results will be presented in corresponding deliverables. Furthermore, the system will be tested in real-life settings in the Ministry of Transportation. The following further actions will also be performed:

* Code analysis and optimization
* Code documentation
* Further tests

### Exploitation Plan

The main exploitation of the Situational Awareness Component is planned to be deployed in Ministry of Transportation. Especially the integration of Situational Awareness Component with the Port Management Information System of Maritime Affairs attracted their attentions. The exploitation plan in this direction will be mainly carried out in 2016-2017.

In addition to this, this tool will be used for other projects in other domains such as Emergency Management and Sensor Management. What should be further done in these projects is to extend the rule set used. In this way, Situational Awareness Component's customer base will increase. In this exploitation point, the timeline is 2017-2018.

### Start-up & Spin-off

SRDC Ltd is already a spin-off of the Software Research and Development Center of Middle East Technical University.

### Patents

During the course of APPS project, a patent application has not been realized yet. However, after the system becomes more mature, a patent application will be done.

### Dissemination Plan

SRDC will give preference to those events, which show an industrial orientation and which demonstrate their capability of attracting a large and high-level audience of end-users. While a detailed planning of the dissemination activities and the selection of the target events will be part of project activities, it is anticipated that main dissemination channels will be: Papers in specialized journals and presentations at international conferences and exhibitions addressing industry to describe the components addressing the interoperability and situational awareness. Both scientific/technical and end-user focused events will be targeted.

 The key person from SRDC, Dr. Asuman Dogac, coming from an academic background, is actively involved in the program committees of International Conferences, such as ICDE, SIGMOD, VLDB and eChallenges, which creates opportunities to disseminate the results of the project. Coming from an academic background, she is on the editorial board of following journals:

* Associate Editor, International Journal of Metadata, Semantics and Ontologies (IJMSO), Inderscience Publishing.
* Editorial Board Member, Distributed and Parallel Databases Journal (Kluwer). Covered by Science Citation Index Expanded.
* Editorial Board Member, International Journal of E-Business Research (IJEBR), Idea Group Publishing, USA.
* Editorial Board Member, International Journal of Information Quality (IJIQ), Inderscience Publishing.
* Editorial Board Member, International Journal of Web Services Research (JWSR), Idea Group Publishing, USA. Covered by Science Citation Index Expanded.
* Editorial Board Member, Recent Patents on Computer Sciences, Bentham Science Publishers.
* Editorial Board Member, Journal of Computing Science and Engineering (JCSE).

## Otonom Teknoloji

For persistent surveillance missions, platforms that use Lighter-Than-Air (LTA) technology provide several advantages such as cost-effectiveness, payload capacity and endurance over unmanned aerial fixed and rotary wing platforms. Within APPS project, Otonom Teknoloji will adapt its LTA platform to work in a common surveillance architecture so that the advantages of the LTA systems can be provided within a more integrated and extended surveillance system based on the plug & play smart surveillance concept to be developed in APPS project. The advantages of the LTA platforms are briefly discussed in the following sections.

### Technical Evaluation

Unmanned aerial fixed and rotary-wing platforms can perform on-demand sensing of wide zones of sea area. UAVs do have some advantages with respect to normal manned airborne surveillance. They could even be used as disposable for a one way reconnaissance mission. However, inherently, small/low flying UAVs require a low power, compact and light weight sensor suite. There are also restrictions such as payload weight limitations, restrictions for use in civil airspace and flight times. Therefore, a number of organisations are beginning to explore the use of LTA platforms which utilize a lifting gas for buoyancy at different roles in today's challenging needs from persistent surveillance missions to extending communication network range. Having a higher payload capacity compared to conventional UAVs, a LTA can fly/loiter for many hours, even days and is cheap to operate. With several platforms used in conjunction, it is possible to further increase the coverage area and hence improve the line-of-sight.

Within this project, Otonom Teknoloji adopts a product line concept to identify the common features of different payloads/sensors in terms of operating altitude, power consumption, approximate weight requirements as well as any data processing needs. By this way, it is Otonom Teknoloji’s goal to be able to provide the LTA platform adaptable to a plug&play smart surveillance architecture with identifying and minimizing impact of technical constraints and improving response time of its platform integration to a wider surveillance system. Otonom Teknoloji aims to demonstrate this concept using and adapting one of its existing LTA platforms. Otonom Teknoloji’s generic control unit, MiniSteer, performs the control of sensors and platform payload as well as has the capability to integrate well to a defined external communication network. MiniSteer will be adapted to relay information to a control center in the required format that is to be defined within APPS project. MiniSteer which currently implements Joint Architecture for Unmanned Systems (JAUS) is going to be extended to work inline with plug & play surveillance architecture such that the payload and/or sensor data on the aerial platform will be made available in a common format to a wider network.

### Gap between the Development and a Future Commercial Product

Being a promising concept, the performance of using a LTA platform need to be evaluated in several field tests so that demonstrations are performed with different sensors and payloads in different enviroment. The relay of sensor data and/or pre-processing of data on the platform need to be tested and demonstrated. In order to offer a commercial product, the LTA platform need to be optimized for payload capacity, operating altitude, energy consumption as well as ease-of-deployment, integration and use, so that the offering can be a turn-key solution for plug &play smart surveillance missions.

### Exploitation Plan

Otonom Teknoloji will implement the results of APPS project in its LTA platform as well as in its control unit in order to have a plug and play capability for surveillance. Otonom Teknoloji expects the project to bring new business opportunities to the company both in plug&play systems and unmanned LTA platforms for surveillance missions.

### Start-up & Spin-off

Being a start-up company, Otonom Teknoloji plans no start-ups or spin-offs at this time.

### Patents

No patents are expected as outcome.

### Dissemination Plan

The dissemination plan of Otonom Teknoloji for APPS project shall be in two directions: with the marketing activities and via the notification of project results to its existing and potential stakeholders by:

Company web site: Project shall be placed in Otonom Teknoloji’s web site from the beginning and the improvements about the project shall be given in news section periodically.

Electronic Mailing Lists & Magazines: Otonom Teknoloji is member of Turkish Defense Sector e-mail list. The news after the demonstration of the project shall be given to this list. Also, Otonom Teknoloji shall mention APPS project in the articles about the company.

Conferences, workshops, seminars: Otonom Teknoloji participates in local aerospace & defence sector conferences which are periodically organized. The results of APPS project and good practices in project development life-cycle will be presented at these conferences, workshops or seminars.

Customers: Otonom Teknoloji will introduce the project results to existing and potential customers especially in maritime and public domain in order to encourage them to use the outcome in their systems.

## NANObiz

NANObiz will develop portable systems for monitoring marine water quality and airborne particle counter by;

* providing sensor data from marine (temperature, pH, oxygen, conductivity, turbidity)
* providing sensor data from air (particle load and size distribution) environments

In addition to that, an Early Warning System will be developed which will monitor air and water quality parameters simultaneously.

### Technical Evaluation

Monitoring of coastal ecosystems has become increasingly important. An ideal environmental monitoring program requires continuous, long-term measurement of a variety of physical, chemical, and biological parameters over a wide geographic area to represent the overall health of the ecosystem.

NANObiz aims to develop two kind of systems during APPS Project for monitoring water and air quality.

Water quality monitoring system will be placed on the sea platform and take continuous samles from the sea. System will be designed in a plug-and-play fashion so that any kind of sensors can be integrated to the system. There are three design options that affects the placement of the system on the sea platform; all three of them are analyzed and acoording to end-user requests a portable one has been chosen as final design. Another threshold that will affect the design is the resistance of sensors to salty water, because salty water can erode electronic systems in a short time period or probes may show discoloring or degradation. Therefore, special sensors will be selected and integrated to the system. Finally, system will log the data coming from the sensors and will analyze the data whether they are in the acceptable limits that will be allowed by the system to be set by the user.

In addition to water quality monitoring system, during APPS project two types of airborne particle counters will be developed, one will be placed on the sea platform, the other will be implemented to the airship that will be developed by another partner. Such a setting will enable users to track the air quality and a possible airborne bio-attack at different locations simultaneously. The counters will have the ability to monitor the particle size at two different channels. Furthermore, to be implemented to an unmanned air platform the particle counter system will be miniaturized as much as possible to reduce the payload level.

The early warning system designed by NANObiz will monitor air and water quality parameters simultaneously. The user will have the capability of setting the alarm limits of each of the monitored parameter (pH, temperature, conductivity, particle level) separately. Above or below the set limits the alarm will be triggered. All of the parameters will be displayed on a user friendly GUI. A new sensor type will be easily adopted to the system without the need of a spate development period.

### Gap between the Development and a Future Commercial Product

As APPS being a research project, all protyptes that will be developed will need further reseach to reach commercial rugidized product.

Another important issue related with the prototypes is the sensors that will be used. For example, problem occurs with common water quality sensors with their resistance to saltywater. In this context, as NANObiz , the destructing effects of salt water and salt steam on electronic and mechanical equipment- especially on sensors will tried to be solved. Therefore, suitable sensors that can work in marine environment will be searched.

Due to the complexity of the molecules constituting the biological agents, equipment and methodologies for detection and identification of biological aerosols are still in the phase of development. Another technical gap related with the air particle counter, is the miniaturization process. One of the air particle counters will be placed to air ship that will be developed by another partner. According to requirements of the air ship, total weight of the particle counter system must be lower than 10 kilos.

### Exploitation Plan

NANObiz is a technology developer SME located in the biggest Science Park of Turkey. Company has a variety of alliances witin Turkey and EU. Company has also NATO Level and National level Facility Security Certificates to be used especially in the field of CBRN. NANObiz has managed plenty of R&D projects funded by either national sources or EU-FP/7programmes. Company has a large IP portfolio, and company has developed platform technologies to be applicable its research projects. Therefore, the outcomes of APPS are the applications of backgroung IP of NANObiz. NANObiz is planning to use the results of this project to improve its current portfolio with new features and capabilities concerning maritime monitoring and be a player in this market. In addition to that, APPS project willl give an opportunity to enlarge its business network and form new strategic partnerships.

### Start-up & Spin-off

All commercialization activities will be performed under NANObiz with a different brand name. Currently, monitoring and early warning systems are commercialized under brand name NANOTAKIP within NANObiz.

### Patents

There is already a Utility Model related with monitoring and early warning systems. No further IP is considered.

### Dissemination Plan

The outcomes of the project will be disseminated through;

* Teknokent Defense Industry Cluster: Middle East Technical University (METU) technopark, ODTÜ Teknokent,of Ankara, Turkey is one of the leading technoparks in the country and has initiated the defense industry cluster, namely Teknokent Defense Industry Cluster (TSSK) , as of the end of 2010. This high tech cluster which is formed to improve the cooperation among its members and also increase the role of “Teknokent (Technology Parks) Defence Industry Cluster” in local and export defence & security sector. SSM (Undersecreteriat of Defense), as being major policy maker and implementer in Turkish defence sector, supports this cluster as well as the other clustering movements in other parts of Turkey and in other vertical expertise areas. In order to present outcomes of the projects, TSSK is organizing annual B2B Project Meetings. As a dissemination activity, outcomes of APPS can be presented to TSSK and can be participated annual B2B Project Meetings.
* IDEF 2017 Fair: The International Defence Industry Fair (IDEF) is a defence industry fair held in Turkey and organized by the Turkish Armed Forces Foundation since 1993. IDEF 2017 is a fair dedicated to Euro-Asian defense industry, covering topics in categories including Naval systems(combat and support vessels, fixed and rotary wing platforms, electronic warfare and self-protection systems...). NANObiz will have a boot in IDEF 2017, so outcomes of APPS can be presented by showing prototypes and printed materials.
* NANObiz and NANOTAKIP web pages: Outcomes of the project will be announced through web pages.

## Eindhoven University of Technology

### Technical Evaluation

### Gap between the Development and a Future Commercial Product

### Exploitation Plan

### Start-up & Spin-off

### Patents

### Dissemination Plan

## Microflown

Acoustic vector sensors can be used to detect, localize, track, and clasiffy maritime threats. Microflown acoustic vector sensors have the advantage of being small, lightweight, and being directional independent of frequency. Within APPS, four applications involving these acoustic vector sensors will be explored. Microflown Maritime will work on the development of a sensor buoy and the Hydroflown. Microflown AVISA works on developing an active sonar and a UAV sensor system.

### Technical Evaluation

With acoustic vector sensors on an below a buoy the direction and, depending on the system configuration, the range of sound sources can be determined. Two types of buoy systems will be develloped. The first system can permanently be installed on an existing buoy. The power supply comes from the solar panels and batteries of the exisiting buoy, or an add on power system is used. The second system is a complete system with battery power that is small and rapidly deployable, and can be deployed for several days.

The Hydroflown is a new type of underwater sensor that is small and directional. Considerable efforts have already been invested in developing and characterizing the Hydroflown, but much work is still remaining. E.g. although several early probe prototypes have already been made, their performance has not been validated properly yet because proper testing methods are currently lacking. Initial laboratory and field tests already indicated that probes are directional and that realistic signals can be detected, but that improvements on sensitivity and robustness are needed.

For the first time the possibility is investigated of using Microflown acoustic vector sensors for an active sonar system. Compared with classical systems containing sound pressure transducers, acoustic vector sensors might have advantages because of their inherent directional behaviour and potential to shield sources from certain directions. Whereas conventional systems usually involve high frequencies, low frequency sound waves might now be used, which tend to carry further.

For detecting targets from the air, acoustic vector sensors are also installed on UAVs. The principles of such a sensor system has already been proven on several UAV types. Several prototype UAV sensors have been made already, but further research and testing is required to reach maturity.

### Gap between the Development and a Future Commercial Product

The development of buoy systems has only recently been started. Nevertheless, much knowledge can be used existing from other applications with sensors installed on land. The two buoy systems, i.e. the add-on system for permanent installation and the complete system for short term deployment, will be developed in parallel. Initially, these buoy systems will consist of in-air acoustic vector sensors only. Later, additional underwater (acoustic vector) sensors will be installed. The housing of the sensor needs to be adjusted to be able to resist the tough sea conditions such as the exposure to salt water and strong winds. Furthermore, a sensor mounting needs to be developed to allow installation on existing buoys. The mounting design should accommodate hardware variations amongst buoys as much as possible. For the portable buoy system the entire product needs to be developed, i.e.: the battery system, the wireless communication, and the buoy hardware itself with weight, float, and brackets.

Dedicated algoritms will be developped for localization maritime threats using one or multiple buoys. Several field tests will be performed to acquire data needed for developing such algorithms and to demonstrate the performance of the system.

The ultimate goal is to complete an actual system at the end of the project that is qualify it through test and demonstration.

The research on the Hydroflown sensor is still far from being completed. The basic principle of the sensor are still not understood entirely and the performance of probes needs to be improved. In addition, new laboratory based characterization and calibration methods will be developed for testing packaged sensors. Using these test methods, the probe design will be adjusted in order to improve the robustness and maximize sensitivity. Considerable efforts are still required to be able to install the sensor on large platforms of external parties, such as a submarine. However, at this point of time installation seems realistic on smaller platforms like below a buoy and on a bottom mounted setup. These platforms make deployment and evaluation of different probe configurations rather straightforward. Even installation on small UUVs is considered. This way, current and future probe prototypes can be tested, while knowledge is gained about the installation of probes. The performance of the final probe prototype will be demonstrated in the field

The principles of an active sonar based on acoustic vector sensors are now being explored for the first time. Different sensor and actuator configurations will be investigated to determine system properties like range, accuracy, amount of sources that can be detected, influence of reflecting obstacles and other noise sources. Finally, field tests will be performed to characterize the performance and applicability in a relevant environment. If these investigations eventually prove to be promising additional developments should be initiated to continue the development on an actual end product

Early prototypes of a UAV sensor have already been made and these developments will continue in APPS. Improved sensor configurations will be build. The prototypes will be demonstrated with tests on a UAV.

### Exploitation Plan

As mentioned before, different approaches based on acoustic vector sensors are investigated to localize targets in a maritime environments. Some approaches are more mature, others are being studied for the first time. The aim is to find out in what way these methods can best be used and what proper applications are. Several field tests and demonstrations will be performed to evaluate the performance in a relevant enviroment.

For the buoy sensor system deployment around critical infrastructure and perimiter protection seem most attractive, while installation of Hydroflown sensors below a buoy and on the sea bottem appear best. However, there are many different uses. To expand the use into other domains and open up new markets international conferences will be attended and discussions will be held with potential customers. Coorporation with larger system suppliers offering complete solutions in the field of maritime surveillance will be pursued to find out in what way acoustic vector sensors can be integrated into other systems.

### Start-up & Spin-off

Microflown Maritime is a recently founded sister company of Microflown AVISA. The developements perfomed in APPS with contribute significantly to the extending the product portefolio of both companies. At this point of time, no additional start-ups or spin-offs are expected to emerge.

### Patents

No patents are expected as outcome.

### Dissemination Plan

The outcomes of the project will be dessiminated in several ways, i.e.:

* Present papers and exhibit at international conferences.
* Organize workshop and demonstration.
* Present findings on the websites of the companies, i.e.: www.microflown‑maritime.com and [www.microflown‑avisa.com](http://www.microflownavisa.com).

## Siqura

The detection solution comprises thermal-camera based object detection, multi-sensor fusion, PTZ control and multi-sensor configuration. For this detection system, the most important APPS use-case is the protection of off-shore and coastal areas.

### Technical Evaluation

To develop and test the detection system, we intend to use recorded datasets from the Port-of-Rotterdam, an off-shore location and other locations. Using recorded datasets, we will measure the number of false alarms and falsely missed alarms, which can be combined into a single number via F1 score. We intend to record as many data as possible, 24/7 through all seasons and weather types, to thoroughly evaluate the detection performance.

The multi-sensor configuration solution will be evaluated by evaluating of the localization accuracy (of both objects and sensors), impact on the detection performance (as above) and user-friendliness by hallway usability tests.

### Gap between the Development and a Future Commercial Product

In the project, we will research and develop algorithms in order to prove the feasability of our designs. In follow-up (product-development) projects for thermal, maritime detection, we will need to address:

* The user interface (e.g. the webpage for the embedded device)
* The porting of the algorithms to embedded hardware.
* Integrations with a video management system.
* Non-technical activities such as advertizing, manuals, organize support etc.

The route towards a product from the APPS multi-sensor detection system is longer and less clear. At least, it will require a convenient user interface for its configuration and a more advanced IP-network plan.

### Exploitation Plan

To evaluate the commercial requirements and feasibility, end-users will be involved to deploy realistic situations. On successful completion of these feasibility tests, the existing customer base will be addressed to upgrade the existing video surveillance systems with the developed analytics. Evidently, via the large system integrators (the contractors who build a power plant), we expect new, interested customers who will learn about our products via the usual advertisement channels.

The thermal-based maritime vessel detection is planned to be released as a product in the second half of 2016 provided the detection performance is sufficient. Potentially, a product can be squeezed out faster for applications where the detection performance requirements are relaxed (commercial ships) or the environment posses less challences (harbor, river).

The multi-sensor based maritime vessel detection is planned to be released in 2017. Again, this depends on the results from the field-tests and on the recorded datasets. An intermediate demonstration result will be the fusion of multiple cameras including the ship detection algorithms by ViNotion coupled to PTZ control.

### Start-up & Spin-off

We do not plan to spin-off APPS knowledge in a new company.

### Patents

It is expected that the research will result in more than one patent provided sufficient funds are available. Possible areas of interest are detection, fusion, and sensor configuration.

### Dissemination Plan

Siqura will disseminate its APPS results by publishing its findings in peer-reviewed, international conferences and/or journals. Furthermore, (potential) Siqura customers will learn about the envisioned products and services through exhibitions and customer-specific presentations.

## Thales

Thales is involved in defining the APPS platform architecture, with a focus on dynamic integration support and integrated security as core elements of the system. Within the APPS context, these technologies will be further developed and tested in real world settings with sensor providers, and aligned with other core platform provider technologies, to ensure pratical applicability and compatibility. Results from the project will be used to further mature the security concepts and integration middleware software components.

### Technical Evaluation

The technical evaluation for Thales will consist of the following activities:

* Determine whether the functional requirements with respect to the core of the APPS system have been satisfied by evaluating particular configurations of APPS system in specific use cases. Specifically with respect to security and integration functionality.
* Perform a security analysis of particular configurations of the APPS system in specific use cases.

### Gap between the Development and a Future Commercial Product

### Exploitation Plan

Thales Researsch & Technology NL has no product line of its own, which means that exploitation of the results of APPS will be exploited indirectly via internal dissemination to the Business Units and Product Line Managers.

### Start-up & Spin-off

### Patents

No patents are expected as outcome from the APPS project.

### Dissemination Plan

The results of APPS will be disseminated within Thales through presentations and demonstrations to the Product Managers and System Architects of surveillance and sensor systems such as:

* Commander (coastal surveillance)
* Mirador (area defence)
* Squire (ground surveillance)

## ViNotion B.V.

Within the APPS project, ViNotion has focused on the creation of a novel video database of ships, targeting ship classification. For this purpose, in close cooperation with the leading customer Port of Rotterdam (PoR) and Siqura, multiple cameras have been installed at the harbor in Rotterdam. A first version of the video database is available and will be annotated with ship information in the second half of 2015. ViNotion has started with the algorithmic developments of the classification system but this is still in an early stage.

### Technical Evaluation

At the Port of Rotterdam, three cameras have been installed and coupled into the harbor traffic system. These are two thermal cameras on which Siqura will perform detection and tracking of vessels, plus a third pan-tilt-zoom (PTZ) camera on which ViNotion will perform object classification of detected vessels. The installation has been performed under close cooperation and with great support from the PoR. The installation is future proof, so that it can be extended in the near future to additional cameras, finally covering a full 275 degree view of the harbor waterways. Futhermore, the complete installation has been performed in high-quality materials to withstand the salty/moisty environment of the harbor.

At this stage in the project is is not yet possible to give an evaluation of the algorithmic classification performance since these algorithms are still under development.

### Gap between the Development and a Future Commercial Product

Currently, there is no classification system available yet, so this is not applicable yet.

### Exploitation Plan

The algorithms for ship classification will directly be applied at the Rotterdam harbor demonstration setup. We plan to already couple and integrate the first results of the system in the harbor traffic information system, so that we can continue developments in close cooperation with the Rotterdam harbor.

### Start-up & Spin-off

Since ViNotion is in itself a relatively small company, all technology will be developed and commercialise in-house.

### Patents

Depending on the outcome of the future algorithm research and development and the financial means of the company, multiple patents might be filed. ViNotion is quite certain that several novel ideas will be generated within the APPS project, but it is not yet known if these ideas will be useful for patent applications.

### Dissemination Plan

ViNotion will perform dissemination in two ways. First, the algorithmic research will be published in high-end academic computer vision conferences such as the European Conference on Computer Vision (ECCV), Computer Vision and Pattern Recognition (CVPR).

Second, there will be commercial dissemination of the developed technology. We expect that the developed technology will be made ready for commercial exploitation in several application domains. While we focus on the nautical case within the APPS project, the core algorithms can also be applied for other application domains such as on-road vehicles or pedestrians.

##  GMT

IoT sensor interface device is smart device for establishment of IoT platform. It sends and receives information between sea and land by linking maritime sensors for current, wind, gyro-compass, fire detection, and power detection with communication devices such as AIS, 3G/LTE. In order to analyze troubled vessels, fire detection and abnormal navigation, the device exchanges information between sea and land by linking to land IoT service platform.

### Technical Evaluation

IoT sensor interface device is devided into a sensor node and a sink node. The sensor node collects sensor information by interfacing with a wide range of standard and nonstandard sensors installed on a vessel. The sink node integrates information collected from the sensor node, and then transmits the collected information to the land by utilizing wireless communication network. Simultaneously, The sink node integrates data automatically according to data type, frequency, communication cost, importance, and urgency in order to share the information efficiently. Also, it displays navigation safety information collected from land IoT service platform as well as the data collected in real-time by interfacing with 10-inch navigation device.

### Gap between the Development and a Future Commercial Product

IoT sensor interface device will be the prototype that actualizes IoMT between sea and land by utilizing various heterogeneous maritime sensors and maritime wireless communication network. A future commercial product would require complex algorithm for processing various services and hardware for saving massive data. Also, Standards on vessel communication device equipment should be considered in order to install and operate the device on a vessel.

### Exploitation Plan

In the first year, we will develop a sink node mock-up that displays received data on a vessel navigation device by interworking several sensors such as wind and fire detection. In the second year, we will develop an intelligent analysis of collected data and algorithm for selecting up an optimal communication network. And, in third year, we will improve the device through testing under real-life conditions.

### Start-up & Spin-off

No start-up and spin-off company is planned as a result of APPS project in the near future.

### Patents

GMT will apply for 2 patents for IoT sensor interface device and smart navigation analysis on Sep. 2016.

### Dissemination Plan

GMT will actively perform internal and external dissemination activities as follows:

1. Participate in several exhibitions
* Komarine on May 2015 in Busan
* ITEA3 Co-summit on October 2016
* Korea Maritime Safety Expo on May 2015 in Busan
1. Participate in several conferences
* IALA e-Navigation conference on September 2015 in France
* 9th World Ocean Forum on October 2015 in Busan
* Present results of application of maritime SQA at e-Navigation Underway 2016, New York, on January 2016
1. Publish papers
* Korean Institute of Navigation and Port Research on August 2015
* IMS2015 on August in China (A Study on MSP Support System for e-Navigation Service in Korea)
* Korean Institute of Intelligent Systems on August 2016
* Korean Intitute of Communication and Information Sciences on August 2017
* The 16th International Symposium on Advanced Intelligent Systems on November 2015 in Mokpo Maritime and Ocean University
1. Produce promotional materials
* Pamphlets and posters about APPS project on June 2016
* A promotional video about the project results on September 2016
1. Do standardization Activity
* Participate in an e-Navigation standardization working group in 2015 at TTA.
1. Introduce research activities
* Several maritime workships in 2016
* The KIMST magazine on June 2015
* The university papers in 2016 at Korea Maritime and Ocean University
* APPS project website([www.apps-project.eu](http://www.apps-project.eu) ) on September 2015