ESABALT D8.2
P1 Progress Report

Scientific/Technological Report

Project acronym	ESABALT
Project title	Enhanced Situational Awareness for Improved Maritime Safety in the Baltic Sea
Period covered	1st March, 2014 – 28th February, 2016
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Contents

1 Introduction

This 1st periodic scientific / technological report will summarize briefly the progress of the ESABALT project implementation during the reporting period 1 March, 2014 – 28 February, 2015. The outcomes will be described in the context of the original description of work and the schedule of deliverables.

Presented here are the main deliverables produced and milestones passed. It will discuss issues encountered, and the solutions found. If any deviations from the description of work and schedule of deliverables have happened or are expected to happen in the next reporting period, these will be explained in this periodic report.

Please note that the reporting period addressed in this document is 1 March, 2014 to 28 February, 2015. However, this report was prepared in the month of April, 2015. There have been a number of project achievements during March and April, 2015 which will be included in the next progress report (P2).

1.1 ESABALT Project in Brief

The project Enhanced Situational Awareness to Improve Maritime Safety in the Baltic (ESABALT) is a research and development project funded by the BONUS program for studying the feasibility of a novel system for enhancing maritime safety, focusing on the Baltic Sea as a test-bed for the system and service concept. The partners in the ESABALT consortium include the Finnish Geospatial Research Institute (FGI), Furuno Finland Oy, SSPA Sweden, and Maritime University of Szczecin (MUS), Poland.

The overall objective of ESABALT is to assess the feasibility of providing an enhanced situational awareness solution for all ships operating in the Baltic, including real-time maritime traffic monitoring and a marine environment observation system relevant for maritime navigation and accident prevention. This solution will include information for assessing sea ice, oil spread (in the case of an oil spill), wave heights, currents, as well as wind speed and direction. In addition, three specialized services will be studied on top of the situational awareness solution, including intelligent marine navigation and routing information, efficient emergency response, and environmental monitoring and reporting with emphasis on cross-border functionality. Due to the crowdsourcing nature of this solution, it is inherently user-driven. Authorities operating in the Baltic will be encouraged to monitor and verify information supplied by users and also contribute to the information, but the primary focus will be collaborative user-generated situational awareness.

2 Progress in comparison with the original research and financial plan, and the schedule of deliverables

Table 1 describes the list of mandatory deliverables planned to be completed as part of the first reporting period against their completion status. As can be observed, all the deliverables and requirements were submitted to BONUS within the reporting period.

Table 1. List of mandatory deliverables in the first reporting period against their completion status

Deliverable	Completion Status (within the first reporting period)
Project website and BONUS page	Completed and accepted by BONUS
Kick-off meeting	Completed
WP1 Deliverable 1.1	Completed and accepted by BONUS
WP2 Deliverable 2.1	Completed and accepted by BONUS
Project Meeting 1	Completed
WP4 Deliverable 4.1	Completed and accepted by BONUS

During the first reporting period, ESABALT project deliverables from WP1 (ESABALT System Overview and Concept Refinement), WP2 (User/Stakeholders overview and Requirements Specification) and WP4 (System Architecture Definition and Associated Services Specification) have been successfully concluded within the reporting period. This is in accordance with the planned schedule of deliverables. Furthermore, these deliverables have been accepted by BONUS.

In addition, during the first reporting period, ESABALT has also successfully implemented the project website, arranged the kick-off meeting and 1st (in person) Project Status Meeting. The project participants also arrange regular virtual meetings over skype. Other dissemination activities include presenting ESABALT at several meetings of interested stakeholders, especially at the Finnish Traffic Safety Authority and the EU Strategy for Baltic Sea Region's Finland coordinator for the priority Area – PA SAFE. As a result of this successful meeting, the project is currently in the application stages for the status of EU Strategy for the Baltic Sea Region (EUSBSR) Flagship Project under the Priority Area PA Safe.

3 peer-reviewed international journal manuscripts, 2 conference papers and 1 non-scientific magazine article have been accepted for publication during the first reporting period.

In February 2015, members of the Finnish Geospatial Research institute (who were part of the ESABALT project) undertook two maritime test and data collection campaigns onboard the VikingLine cruise ship 'Amorella' between Turku, FI and Stockholm, SE. The aim was to study the operation of the maritime bridge systems, interview the crew, and collect maritime, communication, navigation and sensor data during the voyage in the Baltic Sea.

In general, the technological progress within the ESABALT project during the first year of implementation has been substantial, rapid and promising for the next phase of implementation.

Progress in comparison to original financial plan:

Maritime University of Szczecin: During the first reporting period MUS' tasks for the ESABALT project incurred expenses in the amount of 31 299,54 euro. This amount was reported to the project coordinator via BONUS Electronic Proposal Submission System and a hard copy was sent too. All expenditures were incurred according to the original financial plan. The ESABALT project incurred all expenses in currency polish zloty PLN. When the reporting period was finished all these expenses were recalculated using the euro exchange rate of 2 March 2015 which was announced by the European Central Bank.

A major part of the ESABALT project's expenses were remunerations for the project's personnel. According to the original financial plan the ESABALT project reported salaries for an assistant of the project within the management personnel category of costs and salaries for RTD personnel within the industrial research personnel. During the implementation of WP2, two people participated in the kick off meeting in Helsinki in March 2014 and one person participated in the meeting of the project's partners in Helsinki in September 2015. All travel expenditures were reported in the other cost category of costs. The ESABALT project bought a computer for the industrial research activity. The beneficiary accounting policy this purchase is categorized not as outright purchase but only the depreciation is eligible in our cost accounting. This cost will be reported in a next reporting period. MUS made one minor budget change connected with the implementation of WP2. We changed allocation of finances from organizing of meetings with end-users/stakeholder, to organizing of the project partner's meeting in September 2015 in Szczecin. The ESABALT project informed Polish national organization about this necessity and received an approval of this minor budget change. Subsequently the project coordinator was informed too.

(Financial reports for FGI and SSPA are available separately under the BONUS EPSS 'Periodic Financial Report' section of this 'Periodic Report' webpage).

3 Scientific and/or technological results achieved during the reporting period

During the first reporting period, WP1, WP2 and WP4 were successfully concluded and the respective deliverables have been accepted by BONUS. The following sub-sections describe the technological achievements made during the specific work packages.

In addition, members of the Finnish Geospatial Research Institute conducted a maritime test and data collection campaign as part of the ESABALT project onboard the Viking Line's cruise ship 'Amorella', plying the Turku – Stockholm – Turku route. The aim of this test campaign was to collect data generated by the ship's own electronic systems, and also to determine the availability and performance of navigation and communication signals along the maritime route. Over the course of three days, data from the ship's Differential GPS and AIS systems, engine room sensors, navigation satellites, the Finnish Reference GNSS network (FinnRef), local FM, Digital TV (DTV), 3G and LTE stations was collected.

In-person interviews were also conducted with the on-bridge crew responsible for navigating the vessel through the challenging Turku and Stockholm archipelagos. The results, observations, analysis and conclusions from this campaign will be summarized in a conference publication accepted to the Institute of Navigation's GNSS+ conference in Autumn 2015 in USA. The results are expected to enable distillation of the most critical information for crowdsourcing in the maritime scenario and to enable devising strategies for automated data crowdsourcing from the vessels to make this process autonomous of crew/manual intervention.

3.1 WP1

The WP firstly refined the ESABALT concept from its initial formulation and then validated this initial concept by reaching out to the maritime community—the potential users of the ESABALT system—to gauge the need and willingness to adopt such a system, as well as to gather general feedback on the operational needs and constraints of maritime stakeholders. Lastly, several activities were conducted with the aim of generating initial conceptions of how the ESABALT system and associated services could be implemented.

During the early phase of the project, a user survey was prepared through cooperation between all consortium partners. The results of the user survey mainly validated the overall ESABALT concept, i.e. such a system would contribute to improved maritime safety and that mariners would, for the most part, be willing and have the capability to participate in the crowdsourcing aspects (if given the technical capability).

Meetings and field trips with potential stakeholders where conducted in order to get a practical understanding of the maritime communication systems as well as informing about the ESABALT project. During the reporting period

VTC-central in Södertälje Stockholm and the Swedish Coast Guard operations and command central in Stockholm were visited.

The innovation of this WP is that an overall system architecture has been designed, which is envisioned as a distributed work in which different user and data-source groups are connected via the internet. The different types of users have been considered, e.g. the small boat systems (i.e. pleasure boats), professional vessel systems and authorities' vessel systems, as well as ESABALT sensor station systems and the authorities onshore control center system. Different communication protocols and standards can be used to link these different nodes within the overall system.

Three different associated ESABALT services were refined: (1) intelligent marine navigation and routing, (2) efficient emergency response, and (3) environmental monitoring and reporting, with emphasis on cross-border cross-sector functionality. From the technical viewpoint, examples of user-interface screens have been designed and ten functional analyses have been proposed to meet the requirement of the associated services.

3.2 WP2

The aim of this WP is comprehensive identification and analysis of stakeholders in maritime information exchange processes and user requirements for proposed ESABALT system. There were formulated three lists:

- stakeholders in maritime sector processes,
- stakeholders involved in maritime information exchange processes, especially in maritime transport processes,
- system users.

The performed list of the system users was analyzed. On this basis six basic user profiles were identified. The next step was identification of system requirements. The sources for this step were:

- electronic survey for potential users of ESABALT system to provide users requirements; it was prepared and populated as web-based questionnaire,
- interviews with specialists in navigation, law and computer science to provide system and domain requirements,
- analysis of ESABALT documentation (project assumptions, deliverable of WP1),
- review of maritime safety approaches (state of the art analysis, R&D projects).

The analysis results of the survey as well as other sources of requirements made possible to formulate the lists of:

- user requirements,
- system requirements,
- domain requirements.

The system assessment criteria in term of situational awareness and maritime safety improvement were formulated. They are: innovation, feasibility, usability, availability, reliability, safety, security, credibility and measurability. A set of queries concerning each of assessment criterion was formulated.

The three innovations of this WP are:

1. Overall analysis of the potential stakeholders and users lists to identify the system user profiles: main, additional, support, administration, educational and other users.
2. Analysis and formulation of user, system and domain driven requirements for detailed system specification.
3. Formulation of the system assessment criteria in term of situational awareness and maritime safety improvement. These criteria will be used for evaluation of system prototype as well as for comparison to other existing devices, systems and R&D projects.

The results of WP2 will be used in WP4, *System Architecture*, where the ESABALT system will be specified in greater detail. Further, the results of WP2 will be used in packages WP5, *Proof of concept*, and WP6, *Economic and Non-economic Viability Analysis*, to make possible: modifications to the system architecture, testing most critical aspects of the solution, defining quantitative or/and qualitative values for assessment of the ESABALT system and comparison with other existing systems.

3.3 WP4

This WP proposes a design for the ESABALT system architecture satisfying the refined concept developed in WP1 and user and system requirements developed in WP2. The system is designed to consist of a central data and web server which will process all the crowdsourced information from the individual ESABALT terminals, and in turn cater to their service requests. The terminals are onboard vessels, which may include pleasure craft, commercial vessels and authority vessels. The onboard terminals are the primary interface to the ESABALT system and their operation is supported by the three primary technology pillars of the system – Navigation, Sensing and Communication. Also integrated into the system architecture are the land-based or sea-based sensor stations (to contribute to the information provided by users about the environment around the Baltic Sea), external databases providing maps, vessel information, and earth observation images, and a central control station for administrative oversight. Next, the various functionality of the proposed system are further refined, which can be grouped under the three specialized services mentioned earlier. 15 example functions are described with the aid of functional flow block diagrams, also showing the interaction and data interface between the different modules of the system. The outcomes of this WP will influence substantially the progress of WP5 – Proof-of-concept software platform development.

An innovative concept that was developed as part of this WP was the **‘Autonomous Vessel Data-Crowdsourcing’**. This includes interfacing and integration of novel sensors with the ESABALT terminals onboard the vessels or in automated sensor stations so that relevant data is crowdsourced to the server with minimal, if not zero human intervention. One example is to install a very sensitive inertial measurement unit (IMU) which measures accurately the pitching and heaving of the vessel as it travels through the waves. This data

(when merged with geolocation) will give an estimate of the roughness of the sea over time. The sensor is interfaced with the ESABALT terminal where its raw data is sampled (to reduce data overload) and aggregated with other sensor/AIS information using automated algorithms to present a human readable plot of the sea conditions encountered along the vessel route. This information can be uploaded to ESABALT and thus available to vessels following on the same route, and beneficial to plan their own speed, engine power, course etc. This leads to overall situational awareness along the future route of vessels, thus leading to improved maritime safety.

This WP also proposes solutions for integrating state-of-the-art Sentinel-1 data to a situational awareness system, such as ESABALT. Two possible solutions have been identified: First option is to acquire the SAR data from the Sentinel-1 data centers and process the data in ESABALT servers into value added data (e.g. sea ice maps) to aid in the decision making within the specific functionality. The second option is to utilize and integrate data from already operational services utilizing EO data. The results indicate that state-of-the-art SAR data can be integrated to a maritime navigational system improving situational awareness and maritime safety. Major challenges in implementation of these solutions have been identified and they have been compared based on their cost-benefit ratio. The results of this activity were published and presented at the 2015 European Navigation Conference (ENC) in Bordeaux, France in April. This paper was honored with the **Best Student Paper Award** at the conference.

The WP further defines the data server system, which is the central module for handling the crowdsourced maritime data within ESABALT project. It consists of two components: the data storage system and the server control system. The main function of the storage system is to save and update the information from land based authority users, the authority vessels, the commercial vessel and the sensor station. The sever control system is designed to manage and control all the information in the data server. The details of the storage system and the server control system have been designed and described as part of the results of this WP.

4 Promoting an effective science policy interface to ensure optimal take up of research results

The following is a description about the number of times the scientists working in the project have served as members or observers in stakeholder committees, e.g. ESA, EC, etc.

Prof. Heidi Kuusniemi (Coordinator for the ESABALT project) was selected to become a member of the **GNSS Scientific Advisory Committee (GSAC) of the European Space Agency (ESA)** for a period of four years, starting from the beginning of 2013. ESA's GSAC includes leading scientists in the field of global navigation satellite systems (GNSS) to foster interaction with the scientific community and to support ESA in setting priorities and selecting proposals for the scientific exploitation of the Galileo satellite navigation system and the EGNOS space-based augmentation system. The committee also recommends and advises improvements to Galileo and EGNOS for scientific applications. GSAC is the main interpreter of the views and needs of the European scientific community as regards uses of the GNSS programme for research in Earth, navigational and physical sciences. The GSAC acts as an advisory body to the ESA Programme Board for Navigation and the ESA Executive.

Prof. Kuusniemi also serves on the **Mobility as a Service Finland Committee**. Through the actions of this Committee, the first personal mobility operator has been introduced, and one of the participants is the National Land Survey's Finnish Geospatial Research Institute. With the help of a mobility operator, it is possible to combine traffic services (possibly including maritime services) of several service providers into integrated travel chains, packages that travelers can order as needed. The mobility operator consists of 23 private enterprises and organizations from the public sector. Mobility as a Service (MaaS) is a completely new view on mobility. With one order and payment it would be possible to gain access to a wide variety of traffic services. The MaaS service concept, first launched in Finland, has attracted a lot of interest around the world. Even in mobility, it is possible to take advantage of digitalization, servicing, sharing economy and automation. The idea is to develop new ways of travelling and to decrease the dependence on private transportation by combining the services of different service providers. One of the aims is to reduce transport costs and carbon footprint. The goal of the mobility operator is to have a million subscribers worldwide by 2018.

Prof. Kuusniemi is also the President of the **Nordic Institute of Navigation** and with Dr. Sarang Thombre (ESABALT Technical Project Manager) is in its Administrative Board. The Nordic Institute of Navigation is a non-profit, independent and non-political organization for professionals working within the field of navigation from the Nordic Countries - Denmark, Finland, Iceland, Norway, and Sweden. The focus of NNF is on all aspects of positioning and navigation related to marine, air, land, and space based applications. NNF activity is regulated by Statutes annually evaluated at the General Assembly. NNF is working to: improve qualifications of professionals within navigation, among other things by aiming at better educational opportunities, improve

safety for personnel, the environment, and for financial assets dependent on positioning and navigation, and improve efficiency and thereby to reduce costs within applications relying on positioning and navigation. NNF arrange conferences, symposia, and courses to inform on subjects, ideas, and experiences related to the field of navigation. Internationally, NNF is working for coordination of activities and initiatives with corresponding organizations in other countries. NNF is a member of the "European Group of Institutes of Navigation" (EUGIN) and of the "International Association of Institutes of Navigation" (IAIN), and members of NNF obtain discounts when participating in international conferences arranged by these bodies.

Prof. Zbigniew Pietrzykowski (leader of the project team from Maritime University of Szczecin) participated as a member of Polish delegation in the first (30.06 - 4.07.2014) and second (9.03 - 13.03.2015) session of **IMO Sub-committee on Safety of Navigation, Communication, Search and Rescue NCSR** session in London. He was a member of **Correspondence Group of e-navigation**, whose work was aided also by Polish representatives, on "Implementation plan of e-navigation strategy". He participated also on work of Correspondence Group on Harmonization of Guidelines related to e-navigation, which resulted with Guideline on Software Quality Assurance and Human Centred Design for e-Navigation. Both mentioned issues concern activities directly related to the ESABALT project.

Prof. Janusz Uriasz is a member of polish delegation to **International Maritime Organisation** and the work of **Sub-Committee on Human Element, Training and Watchkeeping**. He has been involved in amendments of Standards of Training, Certification and Watchkeeping for Seafarers Convention. He has been coordinator of recently completed comprehensive review of Polish maritime legislative instruments concerning coastal waters and internal waters. He is co-author of MET curriculums and ECDIS IMO model course. He was an **expert in arbitrage** case after sinking of m/v Angeln at New York court and expert for international requirement standards related to ship’s voyage data recorders in the arbitration case ad court in Hong Kong. Prof. Janusz Uriasz is a member of **Council of Polish Navigation Forum** and a member of **Polish Nautical Society**.

We understand that ESABALT is currently in its initial phases of implementation and therefore, there is a period of incubation before its results are significant enough to transform into recommendations for new policy initiatives. However, in each of the above instances, the project members continually strive to identify opportunities for influencing European and also Nordic policy and scientific strategy directions based on the best practices (especially in the maritime and navigation domains) learnt during the implementation of the ESABALT project.

The following is a description of the number of international, national and regional stakeholder events organized by the project or its participating consortium members.

The Finnish Geospatial Research Institute in collaboration with the Tampere University of Technology arranged the **2014 International Conference on Localization and GNSS** (ICL-GNSS 2014) in Helsinki, Finland in June. ICL-GNSS is an annual conference, arranged presently and previously in Gothenburg, Sweden (2015), Helsinki, Finland (2014), Turin, Italy (2013), Starnberg, Germany (2012), Tampere, Finland (2011). It is concentrating on localization (including in the maritime domain) and Global Navigation Satellite Systems. It provides a high-quality publishing forum with peer review, and emphasizes at the same time quick turn-around time through its dedicated peers working as reviewers. ICL-GNSS addresses both satellite-based and complementary technologies. The event is based on a balanced mixture of world-class invited keynote presentations and contributed peer-reviewed papers. The programme in 2014 included one special session: MULTI-POS Special Session on Multi-technology Positioning. The event had technical co-sponsorship by: IEEE (Communication Society) and Project MutliPOS.

5 Collaboration with relevant research programmes and the science communities in the other European sea basins and on international level

The members of MUS project team are involved in number of European Projects. These projects are focused on maritime safety and security matters, mariner's qualification and skills, development of new technologies, introducing existing technologies into maritime field. The current projects are listed as follow:

- Critical Maritime Routes Gulf of Guinea, under the instrument for contributing to Stability and Peace (EuropeAid),
- Framework Contract for the Instrument for Stability Lot 3 – Critical infrastructure and Counter-terrorism.

Project members from SSPA are currently participating in parallel related projects involving route optimization and collision avoidance based on statistical collection of global AIS information, in the MONALISA 2.0 project.

6 Amendments to the description of work and schedule of deliverables

The work package deliverables expected during the first reporting period have all been submitted to BONUS (and accepted) with the reporting period. There has hitherto not been any delay that would adversely influence the future progress or research quality of the ESABALT project.

Henceforth, in the upcoming phases of the project as well, the consortium and the project coordinator do not foresee any major deviation from the planned schedule. The future work packages are already under implementation and regular project meetings (over Skype) help to ensure that the deliverables are following the time-plan.

The consortium did, however request for additional time of one month to prepare the WP 5 (Proof-of-Concept Demonstrator) and the financial reports as part of the overall P1 – Progress Report (of which this Technical Report is one component).

The reason for the delay in the financial reports is that the project coordinator (earlier called Finnish Geodetic Institute) was merged with the National Land Survey of Finland to form the Finnish Geospatial Research Institute. The consequences of this change have also altered the financial reporting processes and personnel within the overall organization. Additionally, the deadline extension has also been welcomed by other project partners for streamlining their financial reports as well.

Both the abovementioned extensions were conveyed to the BONUS liaison for the ESABALT project, who agreed to the requested extensions.

7 ESABALT Project Meetings, External Dissemination Activities, and Status of Publications

ESABALT project schedule also describes the plan for **meetings** within the consortium members. The project has successfully organized the kick-off meeting at the onset of the project (20 March, 2014 in Helsinki) and the Project Meeting 1 (26 September, 2014 in Helsinki) as per the planned schedule. In addition, the consortium members organize regular virtual meetings over Skype (approximately once every month) in order to keep everyone abreast of the recent developments within the project and to resolve any outstanding issues. These virtual meetings are managed by the project coordinator (FGI) and there is atleast one participant from every partner entity. The minutes of meeting are prepared for every meeting with special emphasis on 'Action Items' for each partner. The progress of work on these action items is followed-up during the successive meetings.

Internet-based **dissemination** is the primary medium for communicating ESABALT project achievements to any interested external stakeholders. This includes preparing the project website (http://www.ESABALT.org), and the ESABALT page on the BONUS website (http://www.bonusportal.org/esabalt). The consortium is in the process of creating an improved website for the project, which is expected to be operational before summer 2015. For internal dissemination the project uses BaseCamp, which is an online tool for project management and sharing of information and documents within the participating members. Additionally, the members are free to publicize their achievements resulting from the activities of ESABALT on their personal/organization's LinkedIn and Facebook profiles.

MUS has continuously informed about project and its progress on the University web page:

- http://www.am.szczecin.pl/298-amen/3000-international-esabalt-project
- http://portalcttm.am.szczecin.pl/3834/esabalt-enhanced-situational-awareness-to-improve-maritime-safety-in-the-baltic/?lang=en
- http://www.am.szczecin.pl/298-amen/2999-project-esabalt
- http://www.am.szczecin.pl/298-amen/2998-esabalt-project

Dissemination of ESABALT achievements during the first reporting period were also conducted by showcasing the project in the following events:

- Kick-off meeting of the BONUS projects starting in 2014, August 2014 in Riga, Latvia.
- Geoilwatch Workshop in January 2014 in Tallinn, Estonia.
- Test and data collection campaign onboard VikingLine 'Amorella' between Turku-Stockholm, February 2014.
- Meeting with the Finland Coordinators of the EU Strategy for Baltic Sea Region Priority Area on Maritime Safety and Security "PA Safe" at the Traffic Safety Authority in February, 2014 in Helsinki, Finland. During this meeting, ESABALT was invited to formally initiate an application for the EUSBSR Flagship Project Status, and to attend the next

Steering Committee meeting of the EUSBSR PA Safe in Riga in June 2015.

- GIS Expo (Paikkatietomarkinnat) in November 2014 in Helsinki, Finland.
- Seminar on 'Space Opportunities for Marine Industry in the Arctic', November 2014 in Helsinki, Finland.
- Meetings and field trips with potential stakeholders were conducted in WP1. For example, VTC-central in Södertälje Stockholm and the Swedish Coast Guard operations and command central in Stockholm were visited.

ESABALT is a scientific research and innovation project and therefore, **publication** of its results and achievements in international conferences and journals is an integral activity for the partner members. In this regard, ESABALT has a very positive record in the first reporting period as shown here:

1. ESABALT project is presented in "Bonus in Brief", May 2014 edition, available here.

2. BONUS Bulletin, May 2015 edition – News about **Best Student Paper Award** to the ESABALT paper on how SAR Earth Observation satellites can contribute to maritime safety and security.

3. Viisari – periodical from the National Land Survey of Finland – "NLS Goes to Sea", article about the ESABALT project and how it helps NLS expand its competencies towards the maritime domain.

4. One peer-reviewed journal article published in the International Journal on Marine Navigation and Safety of Sea Transportation (TRANSNAV), Vol. 9, No. 1 in March 2015:

   P. Wołejsza, S. Thombre, R. Guinness, "Maritime Safety – Stakeholders in Information Exchange Process", pp. 143-148, http://www.transnav.eu/Journal_Vol._9_No._1-March_2015,33.html

   (The other article "*Navigators' Behavior in Traffic Separation Schemes"*, pp 121-126, concerns another issue and was not included in reporting ESABALT performance statistics).

5. Two peer-reviewed journal articles accepted to the International Journal on Marine Navigation and Safety of Sea Transportation (TRANSNAV) (latest update: to be published in Vol. 9, No. 2 in June and Vol. 9, No. 3 in September 2015 respectively).

6. Two conference papers accepted to:

- 2015 European Navigation Conference (ENC), Bordeaux, France (latest update: this paper was successfully presented in April 2015, published and was awarded the **Best Student Paper Award**).
- 2015 Institute of Navigation's GNSS+ in Tampa, USA, to be published in autumn 2015.

8 Conclusion

This document presents the achievements and status of the ESABALT project during the first reporting period between 1st March, 2014 and 28th February, 2015. The work package deliverables and other commitments planned during this period have been successfully concluded within their respective deadlines and accepted by BONUS. The project implementation has resulted in the development of a design for the ESABALT system architecture (software platform, data server, integration and communication methodologies, and data crowdsourcing techniques) after successful concept refinement and user/system requirement identification phases. During these phases several innovative concepts and observations were made which have been compiled in the WP deliverables, and also disseminated to stakeholders in the maritime and navigation domains through virtual/online mediums, stakeholder meetings, and also through high quality research publications.

The project consortium members are in regular communication with each other and are pleased with the progress of the project implementation. The goals of next phases of the project (proof-of-concept demonstrator, viability analysis and future roadmap development) are clear and work in realizing them is proceeding steadily.