Paper for Consideration by TSMAD27

Information paper on the ongoing work in the MONALISA 2.0 project

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Executive Summary:	Information paper on the ongoing work in MONALISA 2.0 project, with special focus on the voyage plan exchange format and Maritime Spatial Planning sides of the project.
Related Documents:	S-100
Related Projects:	S-100

Introduction / Background

The MONALISA 2.0 project is a follow up investigation of solutions set forward in the preliminary EU TEN-T MONALISA project which ran from 2010 to 2013. It provided insight and prototypes of how initial route exchange can be done, together with optimization based on inputs such as under keel clearance and traffic density. Furthermore the MONALISA project resulted in better high resolution bathymetry around the Swedish coast. One of the main objectives of MONALISA 2.0 is to investigate the concept of "Sea Traffic Management" (STM) – similar to "Air Traffic Management", as well as better flow of maritime information. It runs in parallel with ongoing aviation projects like SESAR. While "Sea Traffic Management" is a controversial concept, especially relating to UNCLOS, solutions that improve collaboration between ships, and ship-shore, are believed to be welcomed. Especially solutions for Dynamic route planning, exchange and collaboration, and common voyage plan information exchange. As part of the project development, work on a voyage plan route exchange format and integration of Marine Spatial Planning areas (MSP) is under development. This papers' intention is to a) Inform the IHO TSMAD working group on ongoing work in the MONALISA 2.0 project that relates to ongoing work within IHO, and b) invite the IHO working groups to take into consideration and support the development of S100-based product specifications using the relevant outcome of the work being done in MONALISA 2.0.

Analysis/Discussion

MONALISA 2.0 is organized into 4 Activity groups, which are the following;

> Act. 1 – Sea Traffic Management Operations and Tools;

> Act. 2 – Sea Traffic Management Definition Phase Study;

> Act. 3 – Safer Ships;

> Act. 4 – Operational Safety.

MONALISA 2.0 takes the results and experiences from the MONALISA project (2010-EU-21109-S) as it's starting point. MONALISA 2.0 will also make use of relevant results from earlier Motorways of the Sea projects, maritime R&D projects and re-use best practises from other areas in an effort to bring these further towards deployment in the maritime sector. The goal is that this will foster innovations and deployment of new technologies and systems to increase efficiency effectiveness and environmental sustainability of Motorways of the Sea and its integration in the Trans-European Transport Network. In MONALISA 2.0, the demonstrated results of Sea Traffic Management from MONALISA will be taken a step further towards deployment trough:

- testing of concrete applications and services which would allow rapid commercial deployment;

- integration of route planning tools with additional environmental information and maritime spatial planning for the purpose of improved maritime safety and environmental protection;

- joint private-public action to elaborate better standards for route information exchange through a common interface and common data format allowing equipment from all manufacturers be used for Sea Traffic management;

- demonstrating concrete/hands-on services using new technology to enhance maritime safety, making Search and Rescue and mass-evacuations more efficient than today and by addressing the urgent issue of safety in ports;

- re-using results of previous EU investments in Air Traffic Management as well as from other sectors and their application into the maritime domain.

MONALISA 2.0 – Activity 1 – Sea Traffic Management Operations and Tools

The Activity will contribute to the development of Sea Traffic Management (STM) through developing Dynamic and Proactive Route planning. This will be achieved by the development of Standard Operational Procedures, guidelines and recommendations for route construction, the further development of route planning and risk mitigation tools, and the integration of MSP activities into route planning tools. The work is envisaged to greatly contribute to the development of the STM concept and will be carried out in close cooperation with the Technical

Advisory Group for better results and for addressing the necessity of technical integration between system manufacturers.

Activity 1: STM Operations and Tools; details

Activity 1 is divided into the following sub activities and milestones;

Sub-activities:
1.1 Baseline for the activity;
1.2 STM Standard Operating Procedures and Human Machine Interface;
1.3 STM Common Technical Protocol;
1.4 Extended Test-bed;
1.5 Shore-based Deep Sea Assistance;
1.6 Integration of tools for decision support, route planning and anomaly detection;
1.7 Further integration of Maritime Spatial Planning in Dynamic and Proactive Route planning;
1.8 Conceptual test and demonstration;

Milestones:
- Activity baseline report produced;
- Simulator network operable;
- Test methodology and test plan decided;
- Support tools and MSP functionality integrated in test platform;
- Pilot SOPs, guidelines and HMI delivered;
- STM common technical protocol test run;
- Simulator and field tests conducted;
- Final report delivered.

Activity 1 focuses on the operational and technical aspects of Sea Traffic Management (STM) for the purpose of demonstrating the concept of STM in a functional manner. The work within the activity will be pursued in close cooperation with the Technical Advisory Group. The purpose of the Technical Advisory Group is to develop the STM concept in cooperation with system manufacturers, and moreover to secure international cooperation and harmonization with the IMO e-Nav Correspondence Group, IALA and CIRM. The main task of the Technical Advisory Group is to contribute to the development of the STM concept through addressing the necessity of machine-to-machine interoperability. The envisaged result is the development of a common protocol for the exchange of information between different manufacturers' systems.

Work within the activity will initially focus on a foundational work in order to form a baseline from which to continue the following sub-activities. The baseline, sub-activity 1.1, will evaluate results from MONALISA 2.0, in particular results from Activity 1, as well as results from previous and parallel projects, such as MarNis, EfficienSea, TrainMoS and ACCSEAS. Following the completion of sub-activity 1.1, work will continue within sub-activities 1.2 and 1.3, with establishing Standard Operating Procedures and Human Machine Interface and a Common Technical Protocol. The work within these activities will be pursued in close cooperation with the Technical Advisory Group. The purpose of establishing these aspects is for these to be taken into account as work proceeds with sub-activity 1.4 – 1.8. These sub-activities will specifically work on presenting conceptual studies of various aspects of STM.

The purpose these conceptual studies is to verify and further develop operational and technical aspects that support the MONALISA 2.0 concept of ships monitoring and coordination, e.g. route exchange between ships and shore centres, dynamic separation schemes and time slot allocation through congested waters. This will be achieved through establishing a virtual Sea Traffic Coordination Centre (STCC) and engaging several European maritime simulator facilities, which will be interconnected in macro simulations with a large number of simulated ships. Simulating an entire traffic environment in selected test areas makes it possible to study effects on navigational behaviour, safety and efficiency, thereby identifying needs for further development before the MONALISA concept becomes operational. The macro simulations will be evaluated after which field tests will be conducted. The latter will involve an estimated 10 merchant ships in realistic conditions during their normal operations.

Within the Activity, extended testing and validation for MONALISA Dynamic and Proactive Route planning and the Verification System for officer´s certificates in other sea areas than the Baltic Sea from the on-going MONALISA project will be carried out. The activity encompasses both operational tests on vessels in close cooperation with shipping companies and extended concept tests by extensive use of simulators around Europe.

Coordinating large numbers of ships over vast geographical areas, calls for the use of anomaly detection support at the STCC. In developing operational procedures, existing anomaly and risk identification tools will be integrated and evaluated in the STCC.

Dynamic and proactive route planning gives information on optimal ship routes at sea, primarily to increase safety, save fuel and reduce emissions. However, dynamic route planning should also include information on the environmental sensitivity to shipping and how the sensitivity may change over the year. Maritime Spatial Planning (MSP) is a tool for planning and managing human activities at sea, while protecting the marine ecosystem. By combining Dynamic Route Planning with the environmental information provided through Maritime Spatial Planning, it will also be possible to optimize the route planning from an environmental perspective. The European Union encourages compatibility of MSP between member countries, to avoid conflicts and support cooperation. Projects like the BaltSeaPlan and Plan Bothnia have established frameworks for dealing with MSP in border areas. In MONALISA 2.0, MSP will be integrated in route planning and optimization for ships.

Extended testing of the verification system for officers certificates elaborated in the previous MONALISA project will be conducted in Activity 1 of the MONALISA 2.0 project: Smart card readers and MONALISA certificate software modules will be installed in the ship borne MONALISA consoles and communicate with a server system at STCC to further explore the findings of the previous project.

After testing and evaluating the various tools, system aspects and procedures of MONALISA Sea Traffic Management individually within each respective sub-activity, a holistic test and demonstration will be conducted. The test and demonstration will incorporate all developed components in conjunction, creating a complete simulated traffic environment with all the properties that will result from the MONALISA concept.

Route/Voyage Plan exchange format and Marine Spatial Planning areas as potential for development of new S-100-based product specifications.

The partners in MONALISA 2.0 activity 1 believes it is specifically three sub-activities that may have potential to be considered with potential for new S-100-based product specifications:

- Sub-activity 1.3; STM Common Technical Protocol and common route/voyage plan exchange format
- Sub-activity 1.6. Integration of tools for decision support, route planning and anomaly detection
- Sub-activity 1.7, Further integration of Maritime Spatial Planning in Dynamic and Proactive Route planning

Sub-activity 1.3; STM Common Technical Protocol and common route/voyage plan exchange format (Anders Rydlingen/ Konstantin Ivanov, Transas International)

In parallel with the ongoing work in IEC TC80/MT7 (IEC61174 ed4), the MONALISA 2.0 team is working on further development of effective route and voyage plan exchange between marine stakeholders.

Prerequisites and Objectives
The main objective is to develop a common route exchange format that support all processes inside the MONALISA 2.0 project where the route can be used:
- Onboard for save navigation (ECDIS etc)
- Onboard for route-, schedule- and speed optimization
- By service provider for route optimization services
- A shore for Sea Traffic Management and Deep Sea Pilotage
- A Shore by other stake holders who have an interest in the vessels route and schedule Vetting, Ships-operator, Port Authorities among others.

It has been agreed that the route format should;

- Be open and aligned with International Standards.
- Allow easy customization so that project goals can be achieved
- Allow easy and safe exchange of routes between ship and shore

In an e-Navigation concept such as the Sea Traffic Management System where dynamic routing is supposed to be used, more information related to the route must be shared compare to what traditional is included in a route

plan, as the route will be used in electronic systems onboard vessels and ashore. This information can be divided in four groups.

- General Route Information and vessel static data
- Route geometry and waypoint data
- Schedule and environmental data
- STM Information – Voyage Information

Today there is no international standard available for a route exchange format. What exist is low level information i.e. Way Point data used for peer to peer communication between different systems on the vessel but those formats does not cover the needs in this project. There are discussions within IEC TC80/MT7 about additional route data elements to be included in the ongoing revision of IEC 61174ed 3 (Maritime navigation and radio communication equipment and systems - Electronic chart display and information system (ECDIS) - Operational and performance requirements, methods of testing and required test results).

A preliminary conclusion for SubActivity 1.3 is that the work being addressed in MONALISA 2.0 and IEC seem mature enough to be developed further into a S100 product specification. This effort would also make use of the work described in; IALA Information paper, e-NAV10/INF/7; "The IHO S-100 Standard and e-Navigation Information - Concept Exploration with Ship Reporting Data and Product Specification" by Mr. Jarle Hauge and Mr. Rafael Malyankar. See Annex A for the current application schema for route exchange format.

Sub-activity 1.6: Integration of tools for decision support, route planning and anomaly detection

The sub-activity aims to further develop the route optimization platform developed in MonaLisa 1, which has up to now been developed towards the management of environmental concerns such as lowering emissions and keeping vessels out of environmental protection areas. In MonaLisa 2 the platform will be further enhanced with more modules to support STCC with route checking/validation, fast routes and time separated route between ships for reducing collision risks (compare with aviation/SESAR). The sub-activity also aims at integrating risk minimization parameters into the route construction, such as a quantitative measurement of how much margins a ship has in its present situation, calculations of a risk index of an already created route.

The work will incorporate a study on Dynamic Separations as related to Traffic Separation Schemes (TSS) and the use of time slot allocations in congested waters, where the purpose is to investigate how the frequency of near situations is changed with respect to Dynamic control. The study will be evaluated with respect to: Risks and safety; Effectiveness, efficiency and economy; Legal aspects; and Stakeholders' opinions.

A preliminary conclusion for SubActivity 1.6 is that some of this work may have potential to be included in an S100 product specification, and will be elaborated further upon within the project.

Sub-activity 1.7, Further integration of Maritime Spatial Planning in Dynamic and Proactive Route planning (Jonas Paalson, Geir Lyngheim Olsen)

This sub-activity aims to integrate environmental sensitivity data and dynamic route planning within Maritime Spatial Plans. In each of three focus areas; the Baltic, Norwegian and Mediterranean Seas, extensive datasets on environmental sensitivity exists. Data will be formatted and combined with Dynamic Route Planning to obtain more environmentally sustainable routes. Such an integrative planning tool will provide valuable data in the focus areas and aid the shipping industry to act within the context of emerging Maritime Spatial Plans. What information to include, how to visualize, manage and verify data will be demonstrated, and directions for development of the planning tool will be provided.

The developed tool will incorporate environmental data in Dynamic Route and will be evaluated with respect to: Risks and safety; Effectiveness, efficiency and economy; Legal aspects; and Stakeholders' opinions.

There is a big gap in understanding between the MSP community and the shipping community. This need to be bridged and the two communities would benefit from a better understanding of each other. MSP could understand the needs of the industry better and take foreseen market development into consideration for plans and the industry could better predict market impacts from MSP and plan business strategies accordingly. This work would probably best be done through the international shipping and navigation organizations.

Ports are more national and commercially competitive actors and would also benefit from being better involved in city planning as well as MSP.

Ultimately, most ports and shipping companies lack interest, resources and competence to be part of the MSP process and are left to react to the changes incurred by MSP. To better this situation, new ways or forums to communicate between the sectors are needed.

Marine Spatial Planning information can very soon end up in "information overload"; meaning the level of data content for different users will have to be disseminated.

An important issue is performed that Managing data on board and communication of data is a key issue; that implies integration and harmonization of nautical data, and especially the need to keep things simple: Not too much info should be handled by onboard mariners.

Preliminary conclusion for SubActivity 1.7 is that Marine Spatial Planning areas have potential of being integrated as part of a S-100 product specification, and thus bridging the information gap between the marine spatial planning community (Environmental, Area planning, Port planning), and the shipping and navigation community. This effort can also be linked to work on the IHO Marine Protected Area Product Specification. Work is under way to study these possibilities, and when the work is more mature starting a dialogue with IHO-SNPWG, which is responsible for the MPA product specification.

Conclusions

MONALISA 2.0 will make use of S-100 to draft product specifications within the context of navigation and traffic management. The lessons learned from these activities may be of benefit to the wider S-100 community.

Recommendations

It is recommended that TSMAD take note of the activities within MONALISA 2.0, and look to incorporate any lessons learned from the project.

Justification and Impacts

Providing input and guidance is within the Terms of Reference for TSMAD. This input and guidance can serve to make the developments within the MONALISA 2.0 project better adhere to the overall direction of the S-100 community.

Action Required of TSMAD
The TSMAD is invited to:

      a.   Note this paper

      b.   Comment on the development of MONALISA 2.0

      c.   Provide input and guidance to the MONALISA 2.0 project through its duration.

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