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The Transversal Aspects Description
**Document Status**

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**Review**

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**TEN-T PROJECT NO**: 2012-EU-21007-S

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1 Executive Summary

Transversal Report of MONALISA 2.0 project takes the following subjects into consideration:

- Legal framework of fundamental regulations within shipping;
- Safety issues of shipping;
- Security within shipping;
- Securing transportation and logistics chain;
- Environmental aspects of shipping.

Subsequent analysis of possible interactions of Sea Traffic Management (STM) proposals with above mentioned subjects has been carried out, aiming to identify any contradictions might be expected, as resulting from possible implementation of STM concept.

The key point to note is that possible implementation of STM-project proposals shall be considered on voluntary basis only. Thus, this fact should be seen as prerequisite for possible application of the subject proposals within shipping. Expected incentives and benefits for stakeholders might be convincible for them once giving consideration to participation in the STM.

High level of interaction has been found within area of legal framework, particularly in relation to such a fundamental regulations as the International Convention for the Safety of Life at Sea (SOLAS) and the Convention on the International Regulations for Preventing Collisions at Sea (COLREGs).

It is noteworthy, that STM-project proposals do not counteract SOLAS neither in any point nor in any way. On the contrary, proposed solutions and measures are in line with provisions of Convention and, in some case, should be seen as extension of contemporary procedures.

It should be also emphasized that STM-project proposals do not affect COLREGs in any way, but aim at enabling realising strategic and operational planning, in order to avoid a ship ending up in a close-quarters situation.

More information follows with chapter 4.1. Introduction to legal framework of shipping in scope of safety, security and environment.

Safety issues of shipping, taken into consideration, have been grouped into two subchapters, namely:

1. Safety of navigation at sea and in port;
2. Human aspects of safe navigation.

Safety at sea and in port has been analysed with consideration given to many-sided aspects of navigation, e.g. weather as well as various characteristics of water areas.
ships might operate. Particular consideration has been given to various traffic specific conditions and circumstances. It has been found, that STM-project proposals would contribute to increased level of safety in surface navigation by e.g. route exchange, shore based surveillance and advising as well as through improved ship-to-ship, ship-to-shore and shore-to-ship communication.

In addition, human-related aspects of safe navigation would be influenced by possible implementation of STM-project proposals. It is expected, that qualitative development of Situational Awareness (SA) will take place, allowing participants, both at sea and ashore, to enhance it, achieving new level of Common Situational Awareness (CSA). However, very positive, some adverse effects could occur, related mainly to individual traits of navigators as a human being. In this case such adverse effects can incline distraction and loss of attention of watch keepers or their ability to embrace and to observe simultaneously. Furthermore, a risk of damping positive effect of STM might occur if some officers will be too reliant to the equipment and validated voyage plans provided by Shore Centre (SC) service. Indeed, a proper training program would contribute to diminishing of mentioned difficulties, in particular under start of operational phase of STM.

Development of common situational awareness and expected reduced workload on board would also enhance safety on board.

In regard to security aspects it should be noted, that no high interactions have been identified. Security at sea for STM-participating ships could gain improvement in the area of security-related communication ship-to-shore and shore-to-ship. Moreover, a high level of convergence has been identified with shipping best practice and recommended procedures for navigation within areas characterised by high risk of pirate incidents.

In the scope of securing transportation and logistics chain, high interaction grade has been identified, both on contractual as well as on operational level. Appropriate measures are worked out by shipping industry, however further steps need to be taken in order to make the STM-project proposals more convenient and applicable for parties involved in seaborne transportation. Here, the vital role would be played by PortCDM.

Positive environmental effects due to possible implementation of STM are expected to be attained through reduced fuel consumption at sea and in ports, thus reduced emissions of exhaust gases. Furthermore, the STM-proposed tools and procedures would contribute to enhanced level of prevention against marine pollutions. Through surveillance and other emerging services, route exchange and CSA, the marine environmental prevention would be more effective. Enhanced level of navigational safety would be also a positive contributory factor.

Needless to say, that even health and social aspects of environmental issues of shipping would be influenced in a positive way.

More insight can be gained by reading the transversal report.
Table of contents

1 Executive Summary .................................................................................................................... 3
2 Background ............................................................................................................................... 6
   2.1 Aims and objectives ............................................................................................................... 6
3 Methodology .............................................................................................................................. 8
   3.1 Purpose ................................................................................................................................. 8
   3.2 Approach .............................................................................................................................. 8
   3.3 Strategy and research design .............................................................................................. 8
   3.4 Analysis of findings ............................................................................................................. 8
   3.5 Data collection ..................................................................................................................... 9
4 Results and analysis ................................................................................................................ 10
   4.1 Introduction to legal framework of shipping in scope of safety, security and environment.... 10
   4.2 Safety .................................................................................................................................... 19
   4.3 Security ................................................................................................................................ 43
   4.4 Environment ....................................................................................................................... 57
5 Limitations, observations and recommendations ................................................................... 65
   5.1 Limitations ........................................................................................................................... 65
   5.2 Legal issues ......................................................................................................................... 65
   5.3 Safety of navigation ............................................................................................................. 65
   5.4 Security ................................................................................................................................. 66
   5.5 Environment ....................................................................................................................... 66
6 References ................................................................................................................................ 68
   6.1 Books ................................................................................................................................... 68
   6.2 Journals and/or conference materials .................................................................................. 68
   6.3 Project internal reports ....................................................................................................... 68
   6.4 Internet sources ................................................................................................................... 68
7 Appendices ................................................................................................................................ 72
   7.1 Appendix 1 VTS and VHF communication procedures on approach and in the Port of Rotterdam.................................................................................................................. 72
   7.2 Appendix 2 Anti-piracy planning and pirate activity statistics in the High Risk Area 2011-2015 74
   7.3 Appendix 3 Glossary: Terms and Definitions ..................................................................... 76
2 Background

2.1 Aims and objectives

2.1.1 Aims
The aims of Transversal Report (later abbreviated as TR or named report) are to investigate:

1. The impact of the proposals developed by the STM-concept on shipping activities with focus on previously identified and selected Key Performance Areas (KPA); Safety, Security and Environmental issues;
2. How the standard procedures of shipping within its selected KPAs would be affected by the STM-concept proposals;
3. How proposed changes could be implemented and absorbed by shipping as a part of transportation and logistics chain;
4. The scope of changes resulted by possible implementation of the STM-concept proposals for each part of the selected KPAs;
5. Any operational consequences of STM-concept proposals for shipping and other parties involved in seaborne transportations.

2.1.2 Objectives
Above mentioned points will be furtherly investigated and considered by the report in close relation to the Key Performance Objectives (KPO), identified by the project, as appropriate to previously mentioned KPAs. Attention will be given even to economic aspects and shipping market condition, as such directly corresponds to environmental issues (KPA) of shipping. Furthermore, relevant operational procedures and appropriate documents or agreements, e.g. contracts of carriage of goods by sea, will be investigated and analysed.

Therefore the predominant attention of the report will be focused on these operational aspects of shipping as a part of transport and logistics chain and identified procedures, which are expected to be influenced by the proposals of the STM-concept in the scope of selected KPAs.

The objectives of subject Transversal Report are to:

• Identify and select these proposals of STM-concept, which are influential on shipping seen as a link in the transport and logistics chain within area of safety, security and environmental issues;
• Identify the area of influence of these proposals on recognised regulations, documents, procedures and common practice in shipping;
• Identify operational and procedural consequences to these of stakeholders identified by the project, who are involved in contracts of carriage of goods by sea such as, but not limited to e.g. carrier, charterer, shipper, consignee as well as ports and agents;
• Determine which laws, regulations, formal requirements, documents would be affected by the project proposals and which procedures need to be amended or farther investigated;

• Investigate the way such changes might be implemented, aiming for seamless implementation and evolutionary process of adaptation by shipping.

This report aims to identify how the proposals of STM-concept within its selected KPA interact with current legislation, regulatory aspects as well as operational procedures of shipping. Further, the report will identify and examine the proposals of STM-concept, considered to be influential to shipping seen as a link in the logistics chain.

Following the advices given by Wilson (2010), the main research questions the report is expected to answer are:

• Do the MONALISA 2.0 project proposals and its STM-concept make any impact on existing legislation, regulations, practice and procedures in shipping?

• What would be the main area of impact on shipping activities within selected KPAs in case of implementation of the STM-concept proposals?

• How would the shipping be influenced by the proposals?

• What factors, procedures or documents would be affected by the proposed STM-concept outcomes?

• What would be the consequence of implementation of the STM-concept proposals to the shipping?

• What would be the consequence of implementation of the STM-concept proposals to the operational procedures and requirements of shipping within the KPAs?

• How far (in what grade?) any legislative, regulatory or operational requirements and procedures would interact with the STM-concept proposals?

• What needs to be done to get the STM-concept proposals accepted by the market?

• How these proposals could be possibly implemented?

The MONALISA project has identified the stakeholders and main actors, involved in and affected by the project and its STM-concept proposals. This report will focus on some of them, namely ship owners, charterers (understood as a party placing an order of seaborne transportation) and legislative and regulatory bodies, such as but not limited to, maritime administrations, port authorities etc.

These parties are expected to be main beneficiaries of this report.
3 Methodology

3.1 Purpose

The purpose of the Transversal Report is, as described by Saunders et al (2009), to perform descriptive and exploratory research as an analysis in the topic. According to Wilson (2010), the descriptive research is carried out to describe existing or past phenomena. Indeed, for purpose of this report, currently existing laws, regulations, procedures and practices within selected area of shipping have been identified, investigated and analysed.

Above described part of analysis has been carried out as a forerunner to subsequent exploratory analysis, aiming to gain a better insight into the topic and then to find out how the proposed changes would interact with shipping within the area of safety, security and environmental issues.

3.2 Approach

An inductive approach, as described by Wilson (2010) has been applied for this report, in order to make observations about the STM-concept proposals. Assumption has been made such proposals will be scheduled for implementation within previously specified time perspective. Then, a new theory, conclusions or interdependencies will probably develop. Starting a theory-building process with observations of specific processes and procedures and then seeking to establish a general view to build a theory (Wilson 2010), has been identified as most applicable approach here and more relevant, than deductive approach.

3.3 Strategy and research design

Qualitative research is likely to be most appropriate here, given it is usually linked with an inductive study, as argued by Wilson (2010). A mix of two strategies, i.e. case study analysis and grounded theory, as described by Sounders et al (2009), has been applied, allowing to “gain a rich understanding of the context of the research and the process being enacted”, by answering the questions “why?”, “what?” and “how?” (case study strategy) and “to predict and explain behaviour” (grounded theory) as described by Sounders et al (2009). To some extent, these strategies have been complemented by archival research, as described by Wilson (2010).

3.4 Analysis of findings

In order to interpret the research findings, a set of steps has been taken out, following the principles of grounded theory, discourse analysis (Wilson, 2010) and process tracing (Collier, 2011).
3.5 Data collection

For purpose of this report both the internal reports, elaborated for STM-concept within the MONALISA and MONALISA 2.0 projects, as well as external sources have been considered and analysed. As resulting from, only the data obtained from sources classified as secondary and tertiary had been taken into consideration and analysed for purpose of the report. Where accessible, some manuals, instructions or guides have been analysed and taken into consideration as tertiary sources.

Resulting from adopted methodology and chosen approach to the process of analysing, some non-scientific materials and information from the shipping business related sources, such as e.g. official websites of maritime bodies, authorities, recognised organisations and institutions as well as thematic blogs or internet forums, have been utilised for collecting of information for further analysis presented in the report.
4 Results and analysis

Note: The following presentation of results and analysis of STM-project proposals in scope of safety, security and environment has been carried out in consideration of possible implementation of subject proposals on voluntary basis only and as prerequisite for possible application within shipping. Hence, any reference in this report made to mandatory application of STM-project proposals should be seen as indicative ones only for conceivable further works with development of STM concept.

Moreover, possible implementation of STM might be considered to take place in selected areas or regions and could be initially considered for segmented appliance only.

4.1 Introduction to legal framework of shipping in scope of safety, security and environment

Legal documents and regulations in form of conventions, related to shipping as well appropriate set of codes, fundamental for analysed area of shipping activities, has been identified and analysed. As resulting from these analyses, pertinent areas or categories of interaction has been identified and classified, followed by evaluation of the extent grade. Resulting from these works, further conclusions have been drawn and, where possible, recommendations made.

4.1.1 International Convention for the Safety of Life at Sea, SOLAS

The International Convention for the Safety of Life at Sea (SOLAS) regarded as the most important of all international treaties, concerning the safety of merchant ships (IMO 2015 a), has been analysed and found as interacting with STM-project proposals in extensive range of regulations in regard to safety of shipping. Following categories have been identified (see Table 1 below) as:

- Chapter V: Safety of navigation
Table 1: Interaction analysis of SOLAS Chapter V

<table>
<thead>
<tr>
<th>Category</th>
<th>Regulation</th>
<th>Type of interaction</th>
<th>Interaction Grade*</th>
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<tbody>
<tr>
<td>Nautical charts, publications, library</td>
<td>R 2.2, R 27</td>
<td>STM-project proposals embraced in provisions of SOLAS.</td>
<td>Low (R2.2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High (R27)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Information available through STM should be considered to some extent as a navigational publication/library, thus follow the provisions of R27. Appropriate procedures and requirements should be worked out by the project.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Harmonisation of procedures, applied to STM, with provisions of SOLAS. Further consultations with IMO on formal and working levels.</td>
<td></td>
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<tr>
<td>Navigational/meteorological warnings,</td>
<td>R4, R5,</td>
<td>STM-project proposals are embraced in provisions of SOLAS, but also extend it. STM-project communications platform as a tool for broadcasting and distribution of appropriate warnings and service messages.</td>
<td>High</td>
</tr>
<tr>
<td>communication and services</td>
<td></td>
<td>The essence of DVM is to create communication platform and procedures for updating ships with current information during the voyage. Appropriate procedures and requirements should be worked out by the STM-project.</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>As above.</td>
<td></td>
</tr>
<tr>
<td>Hydrographic services</td>
<td>R 9</td>
<td>Updating of data and information provided for services proposed by STM-project</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Appropriate procedures and requirements should be worked out.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Harmonisation of procedures, applied to STM, with provisions of SOLAS. Further</td>
<td></td>
</tr>
<tr>
<td>Ships routeing</td>
<td>R 10</td>
<td>Recommending of ships’ routing system and surveillance of mandatory ships’ routing system</td>
<td>High</td>
</tr>
<tr>
<td>Ship reporting systems and procedures</td>
<td>R 11</td>
<td>Reporting procedures and reporting platforms. The way of ship-to-shore, shore-to-ship communication and reporting. Ship-to-ship communication procedures (protocol?)</td>
<td>High</td>
</tr>
<tr>
<td>Ship Traffic Services</td>
<td>R 12</td>
<td>New, extended role of VTS services. Reporting procedures and reporting</td>
<td>High</td>
</tr>
<tr>
<td>Problem</td>
<td>R 13</td>
<td>Aids to Navigation</td>
<td>STM proposals possibly considered as AtoN, causing legal and formal consequences.</td>
</tr>
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<td>----------------------------------------------------------------------------------</td>
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<tr>
<td>Technical design, maintenance, surveys, performance standards, etc</td>
<td>R 15, R 16, R18, R 19,</td>
<td>Existing regulations to be followed.</td>
<td>None/ /Low</td>
</tr>
<tr>
<td>Record of navigational activities</td>
<td>R 28,</td>
<td>STM assures function of recording and traceability</td>
<td>Mediu to high</td>
</tr>
<tr>
<td>Danger and distress communicatio n,</td>
<td>R 31, R 32,</td>
<td>STM-project proposals are embraced in provisions of</td>
<td>High</td>
</tr>
<tr>
<td>Requirements and procedures</td>
<td>R 33, SOLAS, but also extend it. STM-project communication platform as a tool for broadcasting and distribution of danger and distress communication.</td>
<td>to be included in regulations; appropriate procedures need to be updated.</td>
<td>procedures, applied to STM, with provisions of SOLAS. Further consultations with IMO on formal and working levels.</td>
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<tr>
<td>Safe navigation and avoidance of dangerous situations</td>
<td>R 34 New tool and platform, which is fully in line with provisions of R34. New value in safe navigation and avoidance of dangerous situations</td>
<td>High Developing of guidelines, criteria and STM regulations need to comply with international regulations. New procedures should be worked out if/prior to consideration of mandatory STM.</td>
<td>Harmonisation of future regulations, applied to STM, with provisions of SOLAS. Further consultations with IMO on formal and working levels.</td>
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<tr>
<td>Master’s role</td>
<td>R 34.1 Responsibility, human role</td>
<td>High Fully in line with STM-project proposals</td>
<td>STM to refer to provisions of SOLAS. Consultations with IMO on formal and working levels</td>
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*Interaction grade: none, low, medium, high.

- Chapter IX: Management for the safe operations of ships

Due to complexity of issues covered by the International Safety Management Code (ISM) it is expected that ISM-code would absorb the STM-concept proposals with its innovative attribute. Possible implementation of STM-project proposals is considered as making high impact on ISM issues, as a new ways of operating ships in regard to entirely operational as well as safety aspects of shipping activities.
Worth pointing out, that STM-project proposals do not counteract SOLAS neither in any point nor any way. On the contrary, proposed solutions and measures are in line with provisions of Convention and, in some case, should be seen as extension of contemporary procedures.

Thus, the STM-project proposals need to be harmonised with the provisions of the Convention in order to be covered by the Convention prior to its possible implementation. Therefore a continuous consultation with IMO and its specialised bodies is farther recommended on formal and working levels.

4.1.2 The Convention on the International Regulations for Preventing Collisions at Sea, COLREG

The convention appoints a set of regulations for ships conducted in any condition of visibility. A part of the rules apply to ships in sight of one another, whilst other rules are provided for ships navigating in restricted visibility. Furthermore, COLREG provides with terms and appropriate regulations in regard to safe speed, risk of collision and way of acting in various situations, to mention a few, as well as technical details of required equipment (IMO(2015b)).

It can be concluded, that possible implementation of STM-concept proposals would be supportive of COLREG. Nevertheless, it must be pointed out, that further steps needs to be taken, aiming to ensure these proposals not to evoke any doubts or uncertainty in regard to overriding role of the Convention, particularly in assuring such proposals do not interfere with Rule 6, 7, 8, 17 or 19:

Rule 6: Safe speed - here a specific consideration needs to be taken, as any advices from the STM-system shall neither diminish the importance of this term for safe navigation nor interfere with it. The question if any advice from STM may reduce ship’s liability and responsibility imposed on her staff or replace it in part or whole needs to be addressed and furtherly investigated.

Rule 7: Risk of collision
1. (a) - consideration should be taken if “all available means appropriate to (…)” includes even any of the STM-concept proposals or services. Thus, further legal analysis is recommended;
2. (b), (c), (d) – any of STM-concept proposals shall neither diminish these statements nor be considered as contradictory to the Convention.

Rule 8: Action to avoid collision – Attention should be made by the project that under no circumstances shall any of the STM-concept proposals or future services make any impact or interfere with any provisions of the Convention.

Rule 17: Action by stand-on ship – The STM-concept proposals shall neither lighten nor be considered as contradictory to the provisions of the subject rule. On the contrary, enhancing Situational Awareness (SA) and emergence of Common Situational Awareness (CSA), resulting from possible implementation of STM-
concept proposal, would expand possibility to act in early stage, thus avoiding development of circumstances leading to uncertainty or belated action taking.

Rule 19: *Conduct of ships in restricted visibility* - The STM-concept proposals shall neither lighten nor be considered as contradictory to the provisions of subject rule. On the contrary, enhancing Situational Awareness (SA) and Common Situational Awareness (CSA), resulting from possible implementation of STM-concept proposal, would expand possibility to navigate and to direct ship in accordance with provisions of the subject rule. Overriding and superior role of COLREGs shall not be questioned and consideration needs to be taken into legal steps in order to avoid any perplexity.

It should be also emphasized at this stage that STM-project proposals do not affect COLREGs in any way, but aim at enabling realising a strategic and operational planning, in order to avoid that a ship ends up in a close-quarters situation.

4.1.3 **International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, STCW**

The Convention sets standards for crews of seagoing ships, by establishing minimum requirements relating to training, certification and watchkeeping (IMO, 2015c).

However the reference to STCW 95 had been taken into account, the analysis for purpose of this report has been carried out with focus on provisions of the STCW Manila. New competence requirements, related to leadership, teamwork and managerial skills, among others, have been added for deck officers in 2010. From the STM-project proposal point of interest it should be noted, that the Manila provisions addressed the need for deck officers to be competent in the use of ECDIS. Thus, as the STM-project proposals are technically based and develop an ECDIS-platform, it would be justified to consider an extension of training program for deck officers in order to accommodate them with appropriate knowledge and skills before possible implementation of subject proposals. Therefore further steps might have been considered, aiming to develop training programme for VTS or other personnel involved in possible STM-operations ashore, in order to accommodate them with appropriate knowledge and skills before possible implementation of STM-project proposals.

4.1.4 **International Convention for the Prevention of Pollution from Ships, MARPOL**

It has been recognized by the report, that implementation of STM-project proposals would not be constrained by provisions of MARPOL. The key point to note is that enhanced situational awareness and the more CSA, resulting from possible implementation of STM-concept proposal, would increase safety of seaborne transportation, thus reduce risks of pollutions from operational or accidental causes within shipping. It is obvious, that reduced fuel consumption during sea voyage will also contribute to lessening of air emissions, as demonstrated by the MONALISA project.
4.1.5 International Convention on Load Lines (ICLL)

No any direct interactions area of influence has been found with STM-project proposals. However, attention should be made by STM to the provisions of Convention in regard to zones, areas as well as seasonal periods and load lines and thus, appropriate load lines, thus submersions, “corresponding to the season of the year and the zone or area in which the ship may be shall not be submerged at any time when the ship puts to sea, during the voyage or on arrival.” (ICLL convention Art.12) when developing and operating SVM and DVM as well as any service, emerging from STM.

4.1.6 Search and Rescue Convention, SAR

Presumption has been made, that new level of enhanced situational awareness (or CSA), resulting from possible implementation of STM-concept proposal, would expand possibility for SAR-operations to act in early stage as well as encompass a sort of operational advantages. It can be expected, that possible implementation of STM-project proposals would to some extent interlink with following:

- Chapter 2- Organisation and Co-ordination;
- Chapter 3 – Co-operation between States;
- Chapter 4 – Operating procedures;
- Chapter 5 – Ship reporting systems.

The report has identified that possible implementation of STM-project proposals could practically interface with International Aeronautical and Maritime Search and Rescue (IAMSAR) Manual, as e.g. quality of information about accuracy of the position of ship in distress influences the search pattern. It has been also assumed, that development of Common Situational Awareness, resulting from possible implementation of STM-concept proposals, would enhance safety at sea in general as well as bring an operational advantages to any SAR-operations by providing the rescuers with more valuable and exact information.

New form of cooperation between RCC (JRCC) and Shore Centres could be established and thus communication in emergency enhanced. For this reason information exchange procedures and formats need to be worked out prior to possible implementation of STM.

Common Situational Awareness (CSA) within area of responsibility would expand possibility for SAR-operations to act in early stage as well as giving a sort of operational advantages as well as improved cooperation and coordination. New form of cooperation between RCC (JRCC) and Shore Centres should be taken into consideration.

Bearing in mind limitations of this report, further deepening investigations in SAR-topic are recommended.
4.1.7 International Convention on Oil Pollution Preparedness, Response and Co-operation, OPRC

It might be argued, that possible implementation of STM-project proposals would interact with provisions of OPRC in its part related to duties of ships, which are requested to report incidents of pollution to coastal authorities. The Convention details the actions to be taken then as well as requires the parties to provide assistance to others in the event of pollution emergency. Assessment has been made that possible implementation of STM-project proposal would contribute to more efficient communication and co-ordination in case of emergency. Needless to say, that Common Situational Awareness would also contribute to decreased risk for oil pollution.

Continued contacts and consultancies with IMO representatives are recommended in the subject area.

4.1.8 International Safety Management Code, ISM and Safety Management System, SMS

The objectives of the ISM code are aimed at ensuring safety at sea, preventing of human injury or loss of life and avoiding of damage to the environment (maritime environment in particular) and to property (IMO, 2015d). These objectives are fully in line with STM-project proposals and tasks. Thus, assessment has been made, that possible implementation of STM-project proposals would be accommodated by the Code.

It is evaluated by the report, that possible implementation of STM-project proposals would probably interlink with following parts of ISM-code:

- 1.3 Application;
- 1.4 Functional requirements for a safety management system;
- 5. Master’s responsibility and Authority (please refer to chapter 4.2.1.1. "Master’s authority, responsibility and overriding position” in this report);
- 6. Resources and Personnel;
- 7. Shipboard Operations;
- Maintenance of the ship and equipment (in case any STM-project proposed operational systems need it).

According to IMO (2015e), “The Company should establish procedures, plans and instructions, including checklists as appropriate, for key shipboard operations concerning the safety of the personnel, ship and protection of the environment”. Thus, presumption has been made, that appropriate action needs to be undertaken by the companies prior to possible implementation of STM. Further consultation within shipping cluster with focus on STM issues is recommended as well as consultations with IMO on formal and working levels.
4.1.9 International Ship and Port Facility Security Code (ISPS Code)

In case a risk or security threat has been identified, the coastal State concerned is obliged to advice the ships concerned of the current security level, of any security measures to be put in place by the ships, aiming at protecting themselves from attack as well as of the security measures that the coastal State has decided to put in place. It is anticipated, that some attributes of STM-project proposals, e.g. communication and information sharing, reporting, would interact with the Code, as well as new communication platform and tools could be used for ship-to-shore and shore-to-ship communication in security aspects. New services emerging from STM-project proposals, aiming at supporting shipping in these aspects could be supplied if demanded by shipping. Thus, the STM-project is strongly recommended to take necessary steps and to ensure, that the technical platform of the project could be customised or developed in order to fulfill possible demands of security infrastructure, as required by ISPS.

4.1.10 Codes related to peculiarity of specified cargo type

Specific set of codes for shipping, related to peculiar traits of particular cargoes or cargo types, such as, e.g. but not limited to, International Maritime Dangerous Code (IMDG Code), International Maritime Solid Bulk Cargoes Code (IMSBC Code), Code of Safe Practice for Ships Carrying Timber Deck Cargoes (TDC) or International Code for the Safe Carriage of Grain in Bulk (IGC) are also provided by IMO.

It is likely that in many cases, an enhanced situational awareness, resulting from possible implementation of STM-concept proposal, would increase possibility to perform seaborne transport of specific cargo types in a safe way as well as improve communication both on operational level and in emergency. No direct interlinks between STM-project proposal and such a codes have been identified during the analysis performed for purpose of the report. It is however anticipated, that some attributes of STM-project proposals could result in emerging of new services, aiming for supporting shipping in aspects related to safe carriage of specific cargoes by sea.

4.2 Safety

Safety in shipping is a very broad subject, which historically can be linked, but not limited to, safety of navigation, safety of life, safety of cargo or cargo operation as well as physical safety of ship and her construction under different circumstances and conditions (e.g. weather) as well as limitations (e.g. construction of ship), both whilst proceeding from/to as well as in a port. The content of this chapter has been therefore grouped into two subchapters, namely:

- (I) Safety of navigation at sea and in port;
- (II) Human aspects of safe navigation.

4.2.1 Safety of navigation at sea and in port

Sea Traffic Management concept sets a focus upon enabling safe, sustainable and efficient sea transports. Project proposals are expected to contribute to enhanced
level of safety of navigation. Moreover, the STM idea is to bind seamlessly safety aspects with planning and execution of sea voyage as well as of port operations, which is expected to gain positive effects on safety.

Safety of navigation

While the MONALISA project idea is to bind it seamlessly with planning and execution of sea voyage as well as of port operations, the one person is intended to play important role in phases, being placed in the centre of all activities at sea and having impact on these ashore, namely the master.

1. Master’s authority, responsibility and overriding position

Master’s overriding authority is instituted by the ISM Code, Part A. 5.2. As the ISM Code is evoked in the SOLAS convention, Master’s authority and position is assured by the international treaty. According to SOLAS Ch.V, Regulation 34-1:

“The owner, the charterer, the company operating the ship as defined in regulation IX/1, or any other person shall not prevent or restrict the master of the ship from taking or executing any decision which, in the master’s professional judgement, is necessary for safety of life at sea and protection of the marine environment.”

Shipowners and shipping companies are therefore obliged to acknowledge the role and position of the master officially in company’s Safety Management System:

“The Master onboard managed ships has the ultimate authority on all matters affecting the safety of the ship, her crew, her cargo and the environment. (…) No commercial consideration should ever interfere with the ultimate authority of the Master and his responsibilities and decisions for the safety of the ship, her crew, her cargo and the environment.” (Transmar Shipping Co.S.A. 2015).

Possible implementation of STM-project proposals would imply many significant changes in shipping industry and its operational procedures. Intention of the project is neither to compromise or to diminish master’s role at any stage of the project or at any operational and managerial level. Therefore it is strongly recommended to introduce a broad consultancy process with organisations, agglomerating persons, occupied in commanding the ships for further cooperation. It is also recommended to take steps aiming at working out change management policy and procedures. It would be of vital importance to attract attention of masters and give rise to their benevolence for STM-project proposals and thus to avoid resistance of this circle. The project needs to stress the fact, that the master’s role and overriding authority would not be compromised, but inversely, new functions and means would support him/her in commanding the ship. STM would be a tool at master’s disposal, further securing the safety of navigation. Thus, masters would be given support by SC function and emerging new services.

Master’s liability is rather intricate and complex issue, remaining behind the scope of this report and thus juridical assistance should be sought after further exploring or insight into the subject.

2. Perils of the sea
The term "peril of the sea" refers to exceptional forces of nature, which might be encountered by ships during sea voyage (IRMI, 2015) and to the natural accidents, peculiar to the sea.

Under provisions of SOLAS Ch.V Reg.31 a ship is bound to communicate information by all means at her disposal to ships in vicinity and to the competent authority. The STM communication platform would be the convenient tool, facilitating the promulgation of correct and prompt information. However, further consideration in order to meet the contain standards required for such information, as provided in Ch.V. Reg.32, would be recommended for purpose of ship-to-ship and ship-to-shore communication within STM. Thus, it is crucial for the project to keep a continuous reference to appropriate provisions and regulations of SOLAS convention.

3. Navigation

Sea navigation is both an art and a technical knowledge (science) (Maloney, 1978), used for process of planning, monitoring, control and execution of movement of the ship from an initial point (position) to a final destination. Navigation can be performed in "classic way", using celestial and terrestrial navigation or by using more sophisticated methods and electronic equipment (electronic navigation). Nowadays, due to rapid development of new technologies, the celestial navigation can be seen as a skill or an art rather, than a part of navigational procedures, however being still obligatory ability for sea navigators.

3.1. Aids to Navigation, AtoN

An Aid to Navigation, commonly abbreviated AtoN, is, according to SeaSources.net (2014), “any device external to a ship or aircraft specifically intended to assist navigators in determining their position or safe course, or to warn them of dangers or obstructions to navigation.”

The standards for marine aids to navigation are set by the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) under provisions of the IMO’s SOLAS convention.

Implementation of the STM-project proposals would raise the question about the status of Shore Centre, SC (or similar service provided). In case the future SC function and service would be seen as an aid to navigation, the provisions of appropriate regulations (SOLAS Ch.V.Reg.13 and IALA’s standards) should be considered as applicable for STM-project proposals. It is clear, that a reliable, efficient and cost effective AtoN service might be implemented for the benefit and safety of all mariners as well as seaborne transportation, as stated by General Lighthouse Authorities (2015, p.4). Nevertheless, such services, as proposed by STM, would result in a new set of obligations, responsibilities and liabilities, to be imposed on both Contracting Governments and regulatory bodies. It would also mitigate risks and protect the marine environment and thus, support and amplify the shipping interests and business.

By implementation of STM-project proposals and classification of SC service as AtoN, the shipping business would be equipped with legal tools, allowing
for taking legal measures as e.g. suing the governmental bodies for maritime
torts in accordance with US law (Russo & Johnston, 2014). Further analysis of
legal issues, such as but not limited to, liabilities and responsibilities, its
allocation, legislative schemes as well as possibly changed level of legal
exposure for parties involved, should be taken into consideration in relation to
so called international maritime law, i.e. a set of main legal systems, applied
in shipping business (mainly Admiralty Law, Common Law and maritime law
in the UK legislation, but also USA or Singapore law systems).

The amount, type and configuration of AtoN, as per applied principle, shall
commensurate with volume and nature of traffic and should be appropriate
for the degree of risk as well as cost effective and compliant with
internationally accepted standards, as argued by GLA (2015, p.5). Principles of
STM are mainly in common with mentioned principles, except the last one,
which need to be defined and developed in the works within the subsequent
project, i.e. STM-Validation.

In December 2008 the e-Navigation strategy has been approved by the IMO’s
Maritime Safety Committee (MSC). However, in order to get e-Navigation fully
viable, secure and reliable, the appropriate positioning, navigating, timing as
well as communications systems must be in place, complemented by secure
and accurate electronic charts and chart displays. These aspects have been
taken into consideration under the works with STM-project proposal.

Presumption can be made here, that STM-project proposals could be
considered as a system fulfilling both requirements for AtoN as well as these
set for future e-Navigation equipment.

For best and unhampered future development of the global shipping industry,
such technological advancement must be coordinated, in order to put on
place the standardisation on board and on land as well as compatibility
between ships. At the same time an increased and unnecessary level of
complications and costs should be avoided.

Here the question might be addressed if the STM-project is capable and ready
to carry this coordinating function in close co-operation with IMO, IALA and
other international organisations or authorities?

3.2. Weather and meteorological aspects of safe navigation

Ship’s navigation could be affected by weather conditions hence in 1983 IMO
adopted resolution A.528(13) “Recommendation on Weather Routing”.

Ships are constantly exposed on weather and meteorological factors under
whole voyage, both at sea and in the ports. Navigation in certain waters can
be affected by e.g. currents, waves and swell, tidal streams, to mention some,
to various extents, making availability of proper and updated information very
desirable and important. In ports it can be a question about availability of
berth due to sufficient/insufficient depth there or on approaching it, about
sufficient/insufficient water depth on channel or river, thus possible
occurrence of time restrictions, due to tide etc. This kind of issues is even
regulated by appropriate notations or clauses in charterparties (in both meanings of contract of carriage and contract of hire).

For navigating both inshore and at sea, the proper and updated weather information is very important, having impact on safety in general and on safety of navigation. Under provisions of SOLAS (Ch.V. Reg.5) the Contracting Governments undertake to carry out proper and reliable shore-to-ship, ship-to-shore and ship-to-ship communication, conforming to the provisions of Radio Regulations. The STM-project proposals take into consideration the same kind of communication ways. Thus, possibility to synchronize these and stream it through the STM communication platform could be worth pondering. However, with reference to provisions of Ch.V. Reg. 5.4, the question must be addressed about the formal mandate for (e.g. commercial) actors, i.e. other than national meteorological service to provide this kind of service within STM-project proposals. Even the formal question about liability of service provider must be highlighted.

Aiming at proper judgement of weather conditions, the master on ship shall obtain forecast for an actual area as a base for further aspects of safe navigation. Considering expected weather, the passage plan need to be checked and, if necessary, updated in order to avoid navigation in heavy weather and to keep it safe away from any risky area. Preparation and selection of reasonable route need to be taken into account, based on updated weather forecast. In case the heavy weather can not be avoided, the master shall take necessary countermeasures before entering heavy weather area, as argued by ShipsBusiness.com (2009a). Any changes in ship’s draft or trim, resulting from ballasting due to heavy weather conditions, should be taken into consideration while working with updating of voyage plan and route.

Mention should also be made of fact that variability of meteorological factors or weather elements, leads to certain changes in applicability of maritime rules, e.g. navigation in restricted visibility induces application of certain actions and conducts, as provided in the COLREGs, Rule 19 and 35.

Possible implementation of STM-project proposals would presumably result in significant changes in the way the nautical and weather publications library is organised and maintained, making own “electronic library” continuously updated in real time.

Nothing can detract from the fact, that possible implementation of STM-project proposals would essentially affect the safety of navigation in any weather conditions by enhanced situational and Common Situational Awareness (CSA), as well as due to lifting navigational procedures up to digital age.

3.3. Navigation in confined waters and high density traffic areas

Navigation in confined waters requires application of navigational techniques of higher precision and frequency than that in use during coastal navigation.
Weather, sea condition, tidal streams and tides as well as other traffic, among others, can be considered as contingencies affecting position of ship. In voyage planning phase and once underway, the master shall consider many nautical aspects and factors, both external and internal, particular for own ship. In case of navigation in coastal and confined waters, some restrictions on navigation due to available width of channel, depth of water, heavy traffic areas, IMO traffic separation schemes etc. shall be considered by the master. In addition, existence of Cautionary Zones, so called "No-Go-Area", where the ship can not navigate safely (ShipsBusiness.com (2010)) must be taken into consideration and properly communicated to the OOW.

According to ShipsBusiness.com (2015) confined waters means an area of the sea where the Width of the Safely Navigable Waterway is not more than about 2 miles, such as a Strait, considering the Draft of the ship and Water Depth.

Mention should also be made of that under whole voyage the master shall take consideration to specific draft of the ship and required Under Keel Clearance (UKC) on passage in relation to the area of navigation, particular parameters and manoeuvring ability as well as dynamic movement of ship, see Figure 1 and Figure 2.

*Figure 1: Ship movements in a seaway (Source: NOREL Review May 2014)*
It should also be emphasised that ships dimensions are subject of apace grown. Figure 3 shows rapid development of container ships’ size, observed last decades.

The aspects, considered above, are of changeable nature. Information shall be obtained from identified and trustworthy source and information flow to the ship needs to be updated continuously. Growing dimensions and rising density of traffic may cause that in busy waters off headlands, shoal patches and within Traffic Separation Schemes, many ships might be following similar tracks and altering course at waypoints plotted in very close proximity to one
another, causing incremental tendency of close approach situations in confined waters. In the age of globalisation and IT-technology pace, shipping is in the need of development of system and appropriate procedures, which would allow improving safety of navigation and transport efficiency as well as making possible achieving better situational awareness and CSA. Here the STM-project proposals with SVP and DVP could be the right solution, addressing adequate infrastructure and relevant procedures.

It is expected, that STM function of route exchange would result in risk reduction, according to SSPA (2015). In addition, both route optimization and speed optimisation would contribute to prevention of collisions and groundings.

A workshop has been carried out with participation of maritime safety experts from the MONALISA 2.0 partners and experienced navigators from the Kattegat area in order to estimate potential hypothetic reduction of the recorded collision and grounding accidents if STM-project proposals had been in place, as provided by SSPA (2015). An cautious estimation has been made, that in case of “simple” grounding, with only single ship involved, the reduction factor could be expected to be as high as around 90%, while in case of more complex collisions with more ships involved in or affecting occurrence, the potential reduction could counts for 25-50%.

With STM-project proposals on place, the mariners would be given efficient support, reliable working platform and tool to use in voluntary or obligatory reporting systems. Today, ships are obliged to report to numerous reporting points, to follow various reporting patterns, to transmit various and often abundant information. Instead of such time and resource consuming activities, the STM-participating ships would report only once and to one point, allowing the STM further distribution of relevant information or data to specific reporting systems and to appropriate receivers. Thus, possible implementation of STM would lead to reduction of currently high workload and burden on bridge staff, allowing nautical officers to concentrate and focus on navigating ships to even safer standard.

Yet, the important point to note is, that the Situational Awareness (SA) is meant as attribute and ability of an officer on watch (OOW) to percept and understand the environmental elements, related to space and time around own ship and critical for decision-making in process of navigating.

The term of Common Situational Awareness (CSA) refers, in turn, to a new meaning of SA, where sharing of “own” SA amongst all participants (both at sea and SC ashore), contributes to raise of new quality, allowing all parties to gain a knowledge about intentions of other participants in the actual area in real time. Thus, beside “own” SA, an OOW or SC operator, gains the whole situational picture within area of consideration, including elements related to other ships, other possible constraints or other dynamically appeared elements, which might be influential for safe navigation of the own and the other ships within the area.
3.3.1. Traffic Separation Schemes, TSS

“Traffic separation schemes (TSS) and other ship routeing systems have been established in most of the major congested, shipping areas of the world and the number of collisions and groundings has often been dramatically reduced”, according to IMO (2015f).

Where the situation repeatedly arises in which a ship is likely to collide with another ship and an action to avoid a collision is limited by the existence of a third ship or fixed structure, or where such situation is expected to arise (ShipsBusiness.com (2009b)), the STM-project proposals are expected to contribute to improved safety and optimisation of passage. Reporting, exchange of information, surveillance and traffic coordination systems, etc. together with CSA on board the ships and ashore, would lift up the quality of navigation to new standards. All changes and new information would be available for bridge staff without delays, in real time. Moreover, SCs would be able to surveil and actively assist ships and coordinate traffic in considered area, as STM will provide shipping with reporting, communication, surveillance, coordination as well as advisory service.

Implementation of dynamic TSS should be widely discussed with IMO.

3.3.2. Areas of Approach

Approaching port can be very challenging for ships, depending on standards in the port, its location, organization, size, characteristic and of course, density of marine traffic, both outside and inside the port area.

In some ports, like e.g. Gothenburg, the initiative has been taken by the Swedish Maritime Administration and the Port of Gothenburg, to bring the VTS and pilot ordering services, managed by SMA, together with port’s ship planning, provided by the port, resulting in “faster, simpler arrival of ships” (Port of Gothenburg, 2015), but also in environmental gains, as the ships can adjust speed, in order to optimise arrival, at an early stage. Both partners argue that this solution, called Gothenburg Approach, benefits customers and promotes safe, sustainable shipping through effective processes and safer, innovative mode of operation.

Increased risk of collisions and dangerous occurrences can be expected in areas of approach due to:

- Dense traffic;
- Large accumulation of ships lying at anchor;
- Ships manoeuvring for anchor or heaving up anchor and entering traffic;
- Ships manoeuvring for embarking/disembarking of pilots;
- Possible draft restrictions;
- Restricted area available for navigation;
- Existence of natural dangers or shape of fairways;
- Supply traffic outside the port and on roadstead, amplifying density of traffic;
- Local and pleasure traffic;
- Weather context and possible specific conditions, navigators might be unfamiliar with.

Indeed, the ships’ traffic in such area needs special care and attention, both from shore as well as ship’s side. Thus, specific rules and appropriate procedures, peculiar for specific area of approach, can be established. STM-project proposals are expected to contribute to improved safety of navigation by:

- Providing updated and verified information to ships about rules and approach procedures;
- Providing updated and verified nautical information, warnings etc.;
- Managing ships’ reporting;
- Assisting and facilitating communication ship-to-shore, shore-to ship and ship-to-ship;
- Managing ships’ traffic flow;
- Surveillance of traffic and assistance;
- Issuing warnings for/to ships;
- Initiating intervention in order to force proper ships’ “behaviour”;
- Providing ships with navigation assistance (e.g. Navigation Assistance Services in port of Rotterdam);
- Assisting in emergency and managing emergency communication and coordination of appropriate action.

It can be argued that interaction grade of STM and current practice would be high within the areas of approach. However, some parts of STM-project proposals are, to some extent, on place and operational already in case of many leading ports. These elements of STM-proposals need some minor works with harmonisation, “cosmetic” and formal touch only, while the other, constituting a forward movement, such as e.g. scope of power and liability of SC, are in need of further legal clarification and consultations, both within formal bodies in shipping and with maritime cluster.

Furthermore, the question about the future functions and the role of VTS centres must be discussed.
A diagram, depicting VTS and VHF communication procedures on approach and in the Port of Rotterdam is provided in Appendix 1.

3.4. Other areas of special consideration (e.g. environmentally sensitive waters)

Navigation in environmentally sensitive waters can lead to serious consequences in case of incidents, resulting in pollutions.

Protection of the environment should be seen as secondary benefit of the enhancement of navigational safety. Additional measures for the safety and security of maritime traffic contribute to prevention of environmental hazards. Yet, the important point to note is that under provisions of SOLAS, IMO may adopt any ships’ routeing measure as mandatory, if such is considered as appropriate, thus for purpose of safety of navigation, thus for protection of environment. Both VTS and reporting systems play crucial role in safety of seaborne transportation.

Ship movements on approaching port, groundings, towages, bunkering, marine accidents and collisions, oils spills, sewage discharge and emissions etc. are elements of environmental footprint of shipping. Here STM with SC would play similar role as above (4.2.1-3.3.2 Areas of approach). Increased shipping activities in specific areas, in some cases in environmentally sensitive sea areas (ESSA), implies higher degree of safety and thus environmental risks. In order to manage mentioned risks in proper way, the review of preventative maritime safety and environment protection measures in the areas of responsibility should be monitored or reviewed by appropriate authorities.

Considering Maritime Spatial Planning, the infrastructure and future services provided by SC could play crucial role as a “relay” between shipping and other “users” of the seas.

Maritime Spatial Planning is fully in line with provisions of the United Nations Convention on the Law of the Sea (UNCLOS) and engages stakeholders involved in management of marine and maritime activities such as, but not limited to, renewable energy, aquaculture, fishery and seaborne transportation.

Moreover, the representatives of STM administrating institutions could be a part of spatial planning national teams.

3.5. Pilot

It can be argued that estuary navigation, manoeuvring in confined waters, in ports or canals in various weather conditions, imposes high requirements regarding great nautical skill on the navigators. Pilot provides shipping with special competence, bringing important knowledge of local waters and specific conditions, prevailing in the subject waters.

Pilot ordering procedures include specific reporting procedures, allowing pilot centres for planning and proper distributing of human and technical resources. Together with port planning, STM-project proposal would decrease
administrative burden as well as contribute to better planning in regard to
distribution of resources as well as efficient time management.

3.5.1. Pilotage

It is evident that ability to communicate and exchange information is
essential to a safe transit of ship when pilotage and pilot services are
provided. Clearly, maritime pilotage and pilots play an important role in
promoting safety of shipping as well as contributing to protection of the
marine environment. Pilot service and pilots are an essential part of Ports
Safety Management System, as argued by European Maritime Pilots’
Association (EMPA, 2012a). It is out of doubt that pilotage services have
to adapt continuously to the traffic condition and any dynamic change in
it (EMPA, 2012b). Extension of areas the pilotage can be provided and
implementation of deep-sea pilotage would enhance the safety and
efficiency of maritime traffic.

Thus, the following aspects have been identified as having high
interaction grade with STM-project proposals:

- Pilot ordering procedures;
- Pilot planning;
- Management of human and technical resources;
- Reporting and advisory functions of pilot;
- Communication ship-to-shore and shore-to-ship prior to and after
  pilot boarding/dismounting;
- Communication ship-to-shore and shore-to-ship prior concerning
  availability of port infrastructure and services (e.g. tugs, linemen
  etc.);
- Facilitation of the promulgation of correct information to/from pilots
  and to/from ships regarding pilot and pilot service, including
  updating of factors related to navigational/weather.

In this point STM-project proposals would contribute to enhanced
effectivity of communication, thus increased level of safety and
improvement efficiency of operational planning. Needless to say, that all
onshore planning in regard to pilotage would be streamlined, allowing
time-savings and labour-optimising by using the relevant tools and
services proposed by STM-project.

3.5.2. Deep-sea pilotage

Deep sea pilotage (DSP) is a service, offering pilot assistance and
nautical support to ships proceeding within specific water areas
considered as onerous or even dangerous to navigation due to several
reasons, such as density of traffic, prevailing adverse weather conditions,
extremely intense industrial offshore activities, to mention a few. So far,
this kind of service is recommended to some types of ships, some types of cargo or for navigation within specific area and offered on voluntary basis for masters not familiar with these waters. STM-project proposal would extend operational scope of required services for deep-sea pilotage as well as make them managed in more efficient and latter-day way.

Opportunity to extended supporting services may arise for:

- Port Approach Services;
- Administrative service;
- Distribution of Port Information;
- Distribution of ship traffic information;
- Ship Database for pilots;
- Maritime Safety & Security;
- Maritime advises and call-centre,

to mention a few, which are really very similar to these provided by some specialised provides even today. Assumption can be made, that such kind of services, supported by appropriate and standardised infrastructure, would be appreciated by shipping business. It is worth noting, that improved deep-sea pilotage is in many cases provided on demand to ships not familiar with local conditions in the area. Improved communication and management of deep-sea pilot service would make DSP more available, thus enhancing safety of shipping and situational awareness outside areas with compulsory port pilotage.

3.5.3. Pilot exemptions

Use of pilot is strictly regulated by appropriate legislation of each Member State and under supervision of respective administrative body. Under provisions of appropriate regulations, the pilotage may be compulsory for certain type or size of ships or it can be voluntary or recommended only. Detailed regulations on compulsory pilotage, concerning the areas where it is in force and ships, to which it applies, should be available for ships. In case of Sweden, it is the Swedish Transport Agency (STA) acting as a regulator. Insight into appropriate regulations can be obtained from the STA’s homepage.

Pilot Exemption Certificate (PEC) can be granted to a master of ship or other signed on nautical officer, who gained specific knowledge, by fulfilling appropriate requirements and passing adequate tests, allowing navigating particular waters without compulsory pilot. In such a case a PEC holder is a nautical adviser, replacing the pilot and taking his/her specific duties. The PEC holder needs to be familiar with the nautical conditions, circumstances, regulations, characteristics of the subject water as well as updated with current information, related to nautical
safety and any other aspects, arising from the fact the ship uses the fairway, including participation in reporting. Appropriate services, provided by SC would support PEC holder in similar way as the service do for pilots, complemented by any other specific information required. Emerging services would be able to adjust levels of service by adding extended services in accordance with individual customer requirement and order.

3.5.4. Navigating without pilot

Ships not obliged to take a pilot can use pilot service on voluntary basis, however such a practice is usually not appreciated by owners due to economic effects on company’s costs. Mostly these “not pilotage obliged” ships are smaller ships, with dimensions under limit of compulsory pilot service. Simplifying, such ships are considered as being easier in maneuvering, less encumbering to traffic, so that safety of navigation in actual area would not be compromised. Regardless this fact, masters in command of such ships are fully liable and responsible for safe navigation and are not exempted from obligation to fulfill safety requirements, imposed on the ships under provisions of appropriate regulations. Similarly to PEC case, masters are obliged to follow general and local regulations, to be up to date in regard to specific nautical aspects of navigating actual area.

Safety and safe navigation on ships carrying passengers on board

Safety of passenger ships is very complex issue. Many of the passenger ships are cruise ships, but also ferries—all from big ships to small working horses, as e.g. these running between islands of Stockholm archipelago. Beside strictly operational and nautical issues, discussed already in this report, additional area of consideration for owners/operators of passenger ships arises from peculiarity of “the cargo”, namely the passengers.

1. Carriers responsibility

Taking passengers on board of ship in both national and international traffic creates a set of liabilities and rights imposed on carriers by sea and on their passengers.

It is beyond the scope of the report to make a full analysis of legal and other duties, liabilities, responsibilities or rights of parties involved in the carriage of passengers by sea. Without going into details, it would be worth mentioning some basic responsibilities of the carrier, such as for passengers’ safety, their luggage, proper and in good time given information to the passengers etc.

The purpose of this section of the report is to present some selected issues related to mentioned aspects of this segment of shipping activities, without striving for depicting full and comprehensive view of mentioned subject.

1.1. Navigational issues
Navigational issues connected to passenger ships are related to a type and area of shipping activity. Both cruising and passenger ferry traffic are performed on schedule basis, thus particular ship’s call at particular port is related to a time spot. A range of ports is very ample, starting from small, remote ports, through the range of attractive, but not extremely active as a sea-ports locations, to ports characterized by hectic seaborne activity. Level and quality of services, available and provided by such wide realm of port can vary, setting additional requirements regarded to safety of navigation. These giant ships navigate in restricted waters with increased level of traffic and with seasonal peak under a period of massive activity of experienced and unexperienced sailors of pleasure crafts. Apparently, that must be very challenging for pilots, bridge navigational staff, administration as well as for other users of the fairways. As previously mentioned, STM-project proposals would accommodate here providing of many types of services, such as, but not limited to:

- Pre-arrival nautical services;
- Updating of navigational/weather/port information;
- Pre-arrival and pilot arrangements;
- Management of communication and reporting system;
- Real-time updating of navigational and safety information;
- Arrangement of appropriate port facilities and services.

Piloting giant passenger ships in confined waters or fairways is challenging for the pilots, thus proper procedures and reporting must be followed and appropriate information given to other ships, navigating same waters. As in case of commercial ships, any specific demand of services would result in emerging of such ones, enhancing situational awareness as well as contributing to improved safety of navigation and procedural as well as operational improvement.
1.2. Technical means and issues

Operational aspects as well as construction of passenger ships are subject to a broad range of regulations and standards. If any new nautical equipment or operational system is expected to be introduced or implemented on passenger ships, it is obvious that such one must be consistent with provisions of the SOLAS Convention.


The EU Regulation (EC) No 392/2009 lays down a harmonised regime of liability of carriers of passengers by sea in the event of accidents and insurance for the carriage of passengers by sea, based on:

- Athens Convention relating to the Carriage of Passengers and their Luggage by Sea 1974, as amended by the Protocol of 2002 on the carriage of passengers; and

In addition, the EU directive 2009/20/EC sets the scope of the liability of carriers of passengers by sea in the event of accidents (Eur-Lex 2009b).

No direct interaction has been found between above mentioned regulations and STM-project proposals.

2. Crew (Resolution 5 and 6 STCW)

The STCW Convention includes specific training requirements for crew on passenger ships, such as training in crowd management, for use in emergency evacuation (IMO 2015g). The STCW Manila provides additional requirements relating to training in modern technology, such as electronic charts and information systems (ECDIS), which, in current case, should concern nautical officers on board of passenger ships.

3. Peculiarity of safety issues on passenger ships

It could be argued that peculiarity of safety issues on passenger ships results from two below mentioned fields:

- Nautical issues related to navigating large ships in various fairways and water areas and;
- Management of general safety as well as safety and emergency procedures for handling actual number of passenger in any case of emergency on board.

Safety of navigation on passenger ships (defined as in IMO 2015g) is an operational matter, covered by a set of international regulations and codes, but also is a matter of prestige and marketing.

Di Lieto (2012) provides with analysis of the organizational accident of Costa Concordia, arguing that the accident resulted from a set of six significant errors of
various nature. Today, more than three years after the incident, it can be argued, that implementation of STM-project proposals would eliminate or significantly reduce occurrence of these errors, which are related to nautical aspects. Employment of experienced seafarers is one of measures, enhancing maritime and general safety, but even most advanced navigational technology and systems, used by expertly trained officers, comprehensive bridge team management system on place, as well as STM-project proposals, would contribute to enhanced safety of navigation due to new technical solutions and procedures (SVM, DVM), surveillance, advisory services and improved communication.

4. Inspections, drills, training and exercises

Safety inspections, emergency drills, training and exercises shall be conducted in accordance with the provisions of regulations of SOLAS Chapter I-1, Chapter II-2, Chapter III, Chapter V. No direct interaction has been found between mentioned regulations and STM other than aspects related to improved ship-to-ship and ship-to-shore communication.

However, innovative role of new technologies, such as e.g. People Tracking System, ensuring a quick response to ship emergencies in terms of rapid automatic detection of crew presence in ship’s sensitive areas, would be appreciated by shipping, especially cruise and passenger sector of industry.

Safe carriage of goods by sea

SOLAS Chapter VI and Chapter VII provides with provisions regarding carriage of cargoes, respective carriage of dangerous goods by ships.

1. Codes of safe carriage

In the current phase, the STM-project proposals do not take cargo-related issues into consideration. However, assumption can be made, that improved and simplified reporting system and procedures would accommodate even a part of information in regard to cargo specific attributes. Carriage of any kind of cargo, covered by appropriate conventions and codes, implies specific procedures, requirements, formalities and actions, imposed on ship from one side and on responsible administrative bodies or duties from the other.

For a ship, carrying specific type of, e.g. harmful substances, marine pollutants or dangerous cargo, this fact can mean even recommendations, restrictions or additional procedures imposed when navigating within special areas. This in turn, can result in need of detailed and updated information about ship’s route and ship’s movement. In such a case Dynamic Voyage Planning with all procedures, as proposed by STM-project, would be very usable tool, both for SC and on board the ship, for collecting updated and actual information as well as for following reporting procedures as required. Before arrival, upon entering the port area and under cargo operation in the port, some additional requirements and obligations are imposed on ship and on port/terminal operator, such as but not limited to, emergency response plans, notification procedures on various circumstances,
coordination of arrangements for release of ship in case of emergency, decisions about pilot and tug assistance, etc. Thus, a proper communication and reporting is required form ships towards port and other authorities, aiming at appropriate decision making ashore, where such elements as e.g. common and particular traffic situation, weather state, currents and tides, water level, visibility, wind force and ship’s specific characteristics and traits as well as port specific and environmental precautions have to be considered.

2. Codes for ships empowered by engine with a special fuel

Ships, powered by engines used non-conventional fuels, are subject to specific regulations. For instance, the requirements for nuclear-powered ships are given in provisions of Chapter VIII of SOLAS, while Code of Safety for Ships using Gases or other Low-flashpoint Fuels (IGF Code) has been recently adopted by IMO for ships powered by e.g. LNG or methanol.

It can be expected, that STM-project proposals would contribute to enhanced safety of navigation and efficient communication and reporting for ships governed by provisions of IGF Code. Specific safety and operational procedures and requirements may be established locally by appropriate administrations and port authorities for ships using non-conventional fuels, as well as for relevant bunkering.

3. Carriers/shipowners scope of liabilities and responsibilities within legal framework of governing regimes of contracts of carriage

Seaborne transportations of goods take place under provisions of appropriate agreements, i.e. contracts of carriage, settled mutually between parties involved in the subject carriage, such as charterer (or shipper, as the case can be, as owner of cargo or party representing) and carrier (understand as owner or commercial operator of ship performing the carriage). A relevant contract of carriage, which governs the carriage, imposes on involved parties a variety of requirements, conditions and obligations to be followed, as well as limitations of liability which may apply under certain circumstances.

The legal regimes, governing contracts of carriage of goods by sea are Hague or lately Hague-Visby Rules (HVR) and Hamburg Rules (HR). The third one, called Rotterdam Rules (RR), adopted by UNCITRAL, is still not in force, according to BIMCO (2015a).

Under provisions of HVR and HR protection is granted to third parties only if a Bill of Lading (BL) is issued and is endorsed to a third party, while the RR would apply in respect of parties other than original contracting party, as argued by Berlingieri (2009). This condition must be considered in regard to application of STM-project proposals, which otherwise would not be applicable once the cargo is sold under sea voyage.

Amongst the range of obligations, liabilities and its limitations, concerning the carrier, following are important to be mentioned from the STM-project proposals point of view:
- To exercise due and reasonable dispatch under voyage;
- To exercise due diligence to make the ship seaworthy;
- To take care for the cargo under voyage;
- To exercise due diligence to properly man, equip and supply the ship;
- Limitation of liability for cargo damage if due diligence was exercised.

One of the carrier’s main duties applies to “utmost dispatch” obligation, meaning that the ship is obliged to proceed “by a usual and reasonable route without unjustifiable departure from that route and without unreasonable delay.” Under some circumstances, slow steaming and even adjustment of speed under sea passage in order to arrive “just in time” can be considered as unjustified deviation or unreasonable delay, thus as a breach of carrier’s duty to proceed with due and utmost dispatch. This approach can result in serious consequences to the carrier (i.e. shipowner/operating owner) and as the matter of fact can be seen as a breach of contractual obligations, as the proof of “exercising of utmost dispatch” can be rejected. Incorporation of proper liberty and deviation clauses, both to appropriate contract of carriage and to BL, can be seen as a solution. However, liberty clauses should be treated with caution, as any ambiguity would be construed against the party seeking to incorporate the clause, i.e. the owners (carrier), as argued by Zerman (2011). This aspect should be taken into further consideration, as having direct impact on contracts of carriage and legal consequences. Further consultations with IMO and BIMCO are recommended.

Under provisions of HVR the carrier is obliged to make the ship seaworthy only before and on commencement of voyage, but the care for the cargo must be exercised under whole voyage. HR states that the carrier is obliged and liable for the same unless it has been proved that he/she and his/her servants or agents took all reasonably required measures to avoid the occurrence and its consequences. Obligation to exercise due diligence to protect the cargo under provisions of HR appears at all times and all stages of the voyage. Undoubtedly interesting and important for shipping, the topic of cargo claims and defense against such extends beyond the scope of this report, as being of legal rather than operational matter.

Seaworthiness of ship as well as obligation to properly man, equip and supply the ship is often very close connected to later defense and, in consequence, limitations of liabilities, in case of damage caused to cargo. Under actual litigation it must be decided by the court “whether the cargo loss or damage results from: a) a lack of due diligence to make the ship seaworthy; b) improper care of the cargo (...)”, as argued by Tetley (2001)

Possible implementation of STM-project proposals, however not directly related to these obligations, could be seen as interacting with these. Assumption can be made, that participation in STM would be advantageous to carriers, as being a traceable proof of exercising due diligence and proper care for cargo under voyage. In case of damage occurrence to the cargo and, in consequence, rise of
cargo claims, it could be salutary to the carrier in defence against the claimant. Proof of exercise of due diligence under voyage may result also in limitation of carrier’s financial liability.

Obligation to properly man the ship means also to educate and train the crews. In case of participation of ship in STM her staff should be able to perform appropriate duties, to handle STM-based equipment and to follow procedures as required.

Designation of ship for participation in STM, in accordance with appropriate contractual commitments, would entail the need of proper equipment, enabling use of STM operational systems and relevant procedures. High grade of interaction of STM-project proposals with contractual issues of carriage of goods at sea has been identified.

Further analysis of the legal aspects and expected interaction with regimes, governing the contracts of carriage of goods by sea, is recommended to be carried out in further studies on impact of STM-project proposals.

4.2.2 Human aspects of safe navigation

Good seamanship

"Any precaution which may be required by the ordinary practice of seamen" has been formulated as definition of good seamanship by the free dictionary by farlex (2015).

It is a knowledge and experience, grown up to nautical skills, to ships- and cargo-handling knowledge and experience up to the recent days. It is about experiences and about ability to assess risk at sea, aiming at avoiding such unnecessary and about calculating the best and safe way to deal with challenges. The term of good seamanship accommodates even cooperation and collaboration amongst seamen, sharing own experience and information, but also ingenuity and good advice, given for those who need it, or ask for. Development of modern technology opens up for an access to contemporary means of communications, navigation, safety and safety management systems, services and materials, aspiring to achieve improved safety at sea and predictability of seaborne transportation as far as possible. Modern technology and systems must not compete or supersede good seamanship, but may and should complement it, contributing to development of and adding value to modern traits of good seamanship. STM-project proposals would supply shipping with contemporary technology, infrastructure and tool, influencing the safety through development of and change in the way of thinking about. So called good seamanship would be thus taken to the new dimension of the digital age.

Competency and competence

New way of thinking and acting, would be challenging for old habits of staff ashore and on board of ships. It will probably result in change of professional mentality, making e.g. captains ready to work and add certain values to achieve goals in new way. But will also result in need of competency, allowing working out a set of new procedures and measures in order to allow achieving goals of STM. A need for a framework of possible new courses and training requirement for human resources
will probably appear. Continued close cooperation with IMO’s appropriate bodies, academic as well as maritime education centres and the shipping industry would be required.

**Human elements and errors**

Significant human resources, both on board and ashore, are involved directly and non-directly in a broad spectrum of activities, connected to shipping and seaborne transportation. Operational aspects entail execution of certain activities, required by specific procedures and regulations. Such execution requires, in turn, a myriad of decision-making processes, which need to be harmonised, synchronised, properly coordinated and executed.

It is assumed by the project (FSA and workshop), that implementation of STM system would contribute to decrease of maritime accidents, resulting from human errors, when the new services, verification and coordination of ship movement will be available and put into practice. Sharing of information about route plan will result in development of Common Situational Awareness, thus higher level of nautical safety, thus diminished press on an OOW.

However, precautionary steps should be taken in order to avoid undesired effects of implementation of STM, as argued by SSPA (2015). Additional new bridge equipment installed and availability of data and services might lead to overflow of information, thus might cause distraction and loss of attention of watchkeepers or their ability to embrace and observe simultaneously. Furthermore, a risk of damping positive effect of STM might occur if some officers will be too reliant to the equipment and validated voyage plans provided by the SC service. Indeed, a proper training program would contribute to diminishing of mentioned difficulties, in particular under start of operational phase of STM.

Very important goal to achieve through implementation of STM would be reduced workload and administrative burden, which currently is higher than a few decades ago. It can be expected, that implementation of STM-project proposals would allow dealing with some of the human-related aspects of safety of shipping directly and indirectly by contributing to alleviation of occurrence of human errors. Key interaction areas: surveillance, assistance, advice, communication and new procedures.

**Increasing safety at sea through the Common Situational Awareness (CSA) on board and ashore**

It is assumed by the MONALISA project, that implementation of STM system would contribute to decrease of maritime accidents resulting from human-related aspects and errors by way of:

- Voyage plan verification;
- Surveillance of execution of verified VP;
- Correction and adjustment of verified VP;
- Shared information about intention of ships;
• Access to updated navigational information;
• Giving recommendations and advices based on verified, reliable and updated information and information flow;
• Assisting in decision making process during the voyage;
• Control of execution of agreed action.

According to The Swedish Club (2014,p.1), 50% of costs of Hull and Machinery claims (H&M) are related to Navigational claims, defined as collisions, contacts and groundings. Many of such a claims occurred due to fact that appropriate procedures were ignored and the people involved did not communicate one another in effective way.

Some of causative issues are recurring ones, such as
• Poor lookout;
• Lack of situational awareness;
• Complacency.

One of identified deficiencies is also failure in following approved passage plan. In this case STM and DVM, as well as shore-based surveillance, would benefit the safety of navigation.

According to The Swedish Club, most cases of collisions have occurred relatively close to land (not at open sea), often within territorial waters as well as in restricted or confined areas. About 70% of the collisions have occurred in congested waters. With coastal waters included, the number increases to 80%. Thus, it can be concluded, that most ships will be at highest risk during approaching or leaving port (The Swedish Club, 2014, p.6). It should be also noted, that whole 38 incidents occurred due to lack of situational awareness, while third position, 12 and fifth, 8, has been identified as arisen from insufficient watch-keeping respective collision regulation. 2 occurrences of collisions have been identified as failure to utilise available data and resources.

Poor communication, incomplete risk analysis and a loss of situational analysis are other contributing factors in case of collisions, but also in regard to causes of ships’ contact with stationary object.

The Swedish Club noted, that groundings in port approach, in ports, rivers, canals, coastal and inland waters, anchorage areas and archipelagos, counts for over 80% of all analysed groundings. It is worth noting, that navigational error from Master/officer/Pilot, inaccurate charts or nautical publications, maneuvering to avoid collision with other ship, miscalculation or ignoring of tidal level, excessive ship dimension, unavailability of nautical charts or publications prevail (about 60%) among above identified causal categories of grounding.
In performed analyses The Swedish Club has also recognised the role of deficiencies in planning and in passage plans, making such ones insufficient. Additionally, for some reasons, the OOW had even disregarded the passage plans. This founding allows The Swedish Club to discuss reasons why and to argue, that the consequences can be severe, as these stated in the publication (The Swedish Club, 2014, p.21).

It needs to be highlighted at this point, that all available information has to be used by OOW during the passage and all navigation equipment has to be utilized for risk assessment in both planning and execution phases. Any critical areas should be identified and verified, so even any need for additional resources.

Taking into consideration the context of report presented by The Swedish Club, it is difficult to escape the conclusion that safety of navigation would benefit from implementation of STM-project proposals. Most of causal factors or contributors, identified by the report, are also main areas of consideration of the project, being embraced by proposed actions, services, procedures, established infrastructure and ideas. STM-project is convergent with the Swedish Club’s report, offering solutions and measures, which can be seen as both remedial, as well as, to some extent, preventive.

It should be also emphasized, that enhancement of situational awareness, the STM-project aims for, would be achieved, above all, on board of ships. The way to achieve it yet will be through improved information sharing ship-to-shore, shore-to-shore and shore-to-ship. Thus, the new quality of Common Situational Awareness (CSA) could be achieved.

Updated and validated information flow would contribute to development of CSA and clear traffic picture even ashore as well as on board, allowing providing the participating ships with right and accurate guiding and advising, but also opening for developing of other services. Adequate documentation from the tests performed in VTS Sound has been collected by the MONALISA project, allowing ascertaining improved operational efficiency of VTS. After the tests, participating operators expressed their opinion, that the route exchange function of STM improved their situational awareness. The time lapse from the moment a ship deviated from her route until the moment of detection has been reduced. In consequence, the time the VTS to evaluate and take decision in a threatening incident as well as executing required action, would be shortened. Furthermore, reduced VHF traffic and diminished risk of misunderstanding in verbal communication, has been pointed out by operators. The operators expressed the need to integrate the route exchange system into VTS operational systems in order to achieve positive effects in accident and dangerous occurrence prevention and action. It is noteworthy, that VTS could take also the duty and act as SC in case of implementation of the STM-project proposals.

The key point to note is, that common data, obtained, accessed and shared by appropriate state administration, would contribute to improved exchange of nautical information and to swift distribution to ships, thus allowing avoiding delay and alleviating administrative burden ashore and, obviously, on board.
4.3 Security

Security of shipping is a complex issue due to specific characteristics of the seaborne transportation. It has been commonly known, that shipping is one of activities of global range and so can be even voyages performed by ships. Security matters of shipping should be considered with very individual approach, determined by voyage specific factors and circumstances, but also in consideration to general condition of shipping and individual shipping company.

Security issues of shipping industry are mainly related to threats of terrorism and piracy, both at seas and within coastal waters or ports.

For purpose of this report the security of shipping will be considered as:

- (I) Security in port/port approach;
- (II) Security at sea.

4.3.1 Ships’ security on port approach and in port

The International Ship and Port Facility Security Code (ISPS Code), as a comprehensive security regime for international shipping, forms the international framework through which Governments, ships and port facilities are required to cooperate to detect and deter acts, which threaten security in the maritime sector. The ISPS Code includes adoption of amendments to SOLAS Convention in a mandatory section (Part A). In its non-mandatory section (Part B), the Code provides with guidelines about how to meet these requirements.

EC Regulation (EC) No 725/2004 of the European Parliament and of the Council provides with appropriate legislation in regard to unlawful acts and security aspects of international and domestic shipping as well as port facilities.

Procedures

According to The Federation of European Private Port Operators (2015), the main objectives of the ISPS Code are:

- To detect and assess security threats;
- To take preventive measures against security incidents affecting ships or port facilities;
- To establish roles and responsibilities of concerned parties for ensuring maritime security on national and international level;
- To ensure the early and efficient collation and exchange of security-related information;
- To provide a methodology for security assessments so as to have in place plans and procedures to react to changing security levels;
- To ensure confidence, that adequate and proportionate maritime security measures are in place.
The ISPS code does not detail any specific measures to take by the ship or the port in order to ensure the safety of the facility against security threats due to particularity of each facility in size and type of it. The Code outlines rather a framework for evaluation of risks, enabling Governments to undertake appropriate steps against identified threats.

**Documents, formal and other requirements**

1. **Ship and shipping company (shipowner)**
   Ships/shipping companies are required:
   - To develop and carry on board of ship a specific Ship Security Plan (SSP), approved by the Administration;
   - To designate a Ship Security Officer (SSO);
   - To designate a Company Security Officer;
   - To supply and to carry on board of ship certain security equipment.

   No interaction with STM-project proposals has been identified at this stage.

2. **Ports**
   Ports are required:
   - To develop and maintain a Port Facility Security Plan;
   - To designate a Port Facility Security Officer (PFSo) for each port facility;
   - To supply and make available certain security equipment.

   No interaction with STM-project proposals has been identified at this stage.

3. **Ports and ships**
   Additional requirements for both ships and ports include:
   - Monitoring and controlling access;
   - Monitoring the activities of people and cargo;
   - Ensuring availability and readiness of security communications.

Specific monitoring and controlling functions and activities are required by ISPS code from port and ships. Both are obliged to ensure availability and readiness of security communications. Assumption has been made, that STM-communication platform might be appropriate communication mean, providing adequate security level of transmitted information assured and accepted by parties involved.

**Reports and reporting systems**

Chapter XI-2 and part A of the ISPS Code require Contracting Governments to provide certain information to the International Maritime Organization. Furthermore, information is to be made available to allow effective communication between Contracting Governments and between Company/Ship Security Officers and the Port Facility Security Officers. (ISPS Code, Annex 1: 1.22). Provisions of ISPS Code set
requirements and framework of reports and other communications in regard to ships’
and ports’ security. In addition, Contracting Governments may authorize a
Recognised Security Organisation (RSO) to undertake certain security related
activities, as provided in Annex 1.

It is assumed, that STM communication platform could be applicable means of
communication for assuring and management of appropriate
communication, taking for granted required level of security for information
exchange can be ensured.

**Authorities and functions**

Authorities and functions provided by provisions of above mentioned regulations are:

- Contracting governments and “Designated Authority”;
- Contracting governments appropriate Administration;
- Recognized Security Organization (RSO);
- Company Security Officer (CSO);
- Ship security officer (SSO);
- Port facility security officer (PFSO).

No interaction has been found in this aspect between STM-project proposals and
appropriate regulations.

To sum it up: above mentioned legislation, adopted for international shipping by IMO,
supported and consolidated by EU, is of vital importance for security of both shipping
and port industry. Thus, the question may arise, if the STP-project infrastructure
might be even used for operational reporting within ISPS system, provided that
security of communication system is assured. This, in turn, would furtherly be
beneficiary to ships reporting procedures as well as could be seen as contributing
factor to reduced burden of administrative workload on board and ashore. In
addition, information flow could reach all parties involved at the same time.

**4.3.2 Ships’ security at sea**

Beside acts of terror, other kind of unlawful activity against ships and shipping is a
piracy. Both mentioned are subject to the provisions of ISPS Code and EC Regulation

**Human and other aspects arising from acts of piracy**

Considered as one of serious challenges to international security, maritime piracy is
usually located in specific regions of the world. Being direct threat against life of
crew, acts of piracy are also safety issues for surface navigation, as often having
place near strategic paths of seaborne transportation in confined waters or in
proximity of coast. Beside imminent danger to human life and health, acts of piracy
induce also economic implications on world trade and significant costs on shipping
and world community. As a consequence, insurance companies increase premiums for ships entering high risk areas, as pointed out by Prins et al (2014).

**Security regulations, policies and procedures**

The ISPS code provides shipping and port industry with framework for evaluation of risks, enabling respective part to act, when a threat identifies and undertake any further appropriate steps against further security threats. It means that appropriate policies and procedures are specific and individual, with consideration to specific needs of the parties involved and available resources. Thus, particular company policies and procedures refer to vital and vulnerable issues and are usually classified as secret ones. It can be expected, that STM-project proposed infrastructure, including communication systems and procedures, would be useful for transmission and further exchange of security-related data amongst verified users.

Security practices and procedures within shipping are considered as related to nautical aspects and safety of navigation within high risk waters.

**4.3.3 Ships’ security during passage through high risk areas (HRA)**

Security policies and procedures, implemented by shipping, take into consideration vital and vulnerable issues and are usually classified as secret ones.

**Navigational aspects of proceeding through HRA**

Being direct threat to life of crew, acts of piracy are also safety issues for surface navigation, as often having place near strategic paths of seaborne transportation in confined waters or in proximity of coast. IMO's Maritime Safety Committee (MSC) circulars provide mariners with information about the High Risk Areas (HRA). The UK Maritime Trade Operations Office (UKMTO) in Dubai acts as the primary point of contact for shipping and liaison with military forces in the region as well as administrating the Voluntary Reporting Scheme (VRS) for merchant ships. Positional information about tracked ships is passed to appropriate responsible military forces and European Union Maritime Security Centre Horn of Africa (MSCHOA).

Nevertheless, notation must be made at this point, that the number of acts of piracy has been decreased in Africa’s horn last years, counted for total number of 3 incidents 2014 and for 0 so far in 2015, as provided by NATO Shipping Centre (2015). Judged by these criteria, the statement could be made, that measures, taken by MSCHOA have been effective. More insight into appropriate NATO’s statistics can be gained in Appendix 2.

Industry Best Management Practices (BMP) for Protection against Somalia Based Piracy has been produced and supported by many international shipping industry organisations, together with UKMTO and EU Naval Force (EU NAVFOR) among others, aiming at assisting ships to avoid, deter or delay piracy attacks in HRA. With reference to the Master’s overriding authority to protect his crew, ship and cargo, BMP guides and advises mariners and shipping companies, providing them with a set of recommendations and instructions.
Some high risk piracy areas are located in confined waters, narrowed passages and thus often challenging from navigational and safety of navigation context. Moreover, possible presence of other ships in vicinity should be taken into consideration as well as traffic density, when taking action, aimed at avoiding imminent act of piracy. According to BMS recommended Ship Master’s Planning, the master is allowed to “define the ship’s AIS policy”, allowing making decision of switching of the AIS, which can possibly lead to additional nautical challenge.

Appropriate recommendations, planning, procedures and actions, provided by BMS, are in its idea and principles very similar to these constituting STM, including reporting scheme and procedures, as well as verification, updating and execution of a voyage plan. High grade of interaction has been identified.

In above mentioned context, assumption is made by this report, that possible implementation of STM-project proposals would positively contribute to effective exchange of information and intentions between ships as well as enhancement of communication between ships and anti-piracy centers or forces. Information exchange should include security related messages to/from verified users. In longer time perspective harmonisation of procedures of STM and anti-piracy security services should be considered, allowing unification of provided services with SC within STM.

Protection and cooperation

Protection of ships and seaborne transportation during passages through HRA can be enhanced by Private Maritime Security Companies (PMSC), employing privately contracted armed security personnel (PCASP) on board ships as well as by participation of ships in voluntary reporting system, recommended by IMO’s MSC and industry’s Best Management Practices (currently Version 4, August 2011).

1. Armed guards on board

Flag States provide shipping companies with appropriate national regulations regarding the use of PMSCs, employing PCASP on board the ships in the High Risk Area. The PMSCs should hold a valid, accredited certification or meet applicable national requirements. In order to harmonise terms of engagement of PMSC’s and to simplify the process of vetting and approval of appropriate contracts, BIMCO (2015b) has developed a standardized contract, GUARDCON.

Given the legislative and operational conditions of presence of armed guards on board, the assumption is made here, that possible implementation of STM-project proposal would not induce other interaction than communication aspects, if such is required by involved parties.

2. Military forces and cooperation (reporting)

“Three Fundamental Requirements” provided in BMP are:

- Register at MSCHOA;
- Report to UKMTO;
- Implement Ship Protection Measures (SPM), described in BMP.
Participation, thus registration, in the system is voluntary and ship’s reporting system comprise of initial, daily and final reports of certain format. BMP provides masters and ship operators with detailed guidance regarding “post incidental” reporting of piracy attacks or suspicious activities in accordance with standardised reporting forms and procedures.

BMP provides masters and shipping companies with advices, recommendations and instructions, concerning planning of various phases of voyage, i.e. prior to, upon and once transiting HRA or International Recommended Transit Corridor (IRTC). These planning phases concern both company planning as well as ship master’s planning on board.

**Summary**

It is not surprising to find, that navigating within HRA is challenging for both crew and shipowners’ operational staff ashore. It is now clear, that functions and services developed and available under STM-project proposals, are very convergent with these actions and functions, recommend by BMP. Looking at STM-project proposals of:

- Route planning;
- Route validation;
- Route verification;
- Route exchange;
- Updating of information;
- Reporting ship-to-shore, ship-to ship and shore-to-ship;
- Traffic coordination;
- Navigational vs. Security Assistance;
- Interacting ship-to-ship, ship-to shore and shore-to ship;
- Traffic monitoring (surveillance) via shore- or ship-based centres;
- Communication,

it is evident, that the role of SVM/DVM and SC within STM would be very similar to appropriate functions, both UKMTO and MSCHOA play in area of ships-security and anti-piracy.

High level of functional similarity and procedural convergence has been identified between BMP’s recommendation, tasks and functions of MSCHOA and UKMTO from one side and STM proposed functions of SVM/DVM as well as SC mission and tasks, proposed by STM, from the other. Therefore, the STM-project is strongly recommended to undertake initial steps for establishing working and formal contacts with UKMTO and EUNAVFOR (MSCHOA), aiming at development of cooperation. The scope and area of such possible collaboration could result in formal partnership in the STM-project.
The anti-piracy centres or anti-piracy naval force command, acting within STM as SC for HRA, could be furthermore examined and discussed within frame of upcoming cooperation.

Here noteworthy statement needs to be made, highlighting importance of ensuring proper level of IT security within STM. Needless to say, how devastating for shipping it could be, if the access to route exchange would have been gained by unauthorised users. In case the Sea Swim code had been cracked, the security of participating ships would be dramatically worsened with serious threats to security of shipping as consequence.

4.3.4 Securing transportation and logistics chain

In the movement of goods in global and international scale, all of the major modes of transport need be taken into consideration. Thus, the selection of the most appropriate transport mode is of fundamental importance, as argued by Rushton et al (2010). Selection of a suitable mode of transportation depends on physical nature of the product and should take into account such aspects, as operational factors, characteristics of transport mode, consignment factors as well as cost and service requirements.
The role of shipping in transportation and logistics chain

Logistics and shipping includes such activities, as material handling, warehousing and packaging, transportation, shipping security, inventory management, supply chain management, procurement and customs service. Shipping is a part of logistics, being involved in managing the transfer of products from the place of origin to the place of consumption. Containerisation and container shipping have made significant contribution to the development of multimodality and setting global supply chains. The shore and sea-based infrastructure is a vital part of economic growth and development of any country, according to Businessvibes.com. Ports with appropriate infrastructure are housed here as inseparable, integrated part of shipping.

1. Shipping market

Shipping is controlled by four markets: the shipbuilding, the sale and purchase, the freight and the demolition market. These four markets are closely related to each other and the players on shipping are active in all or in any of mentioned areas.

The role of shipping in transportation and logistics chain will not be directly influenced by STM, neither the four markets of shipping. Assessment has been made that STM-project proposals would not affect mentioned parts of shipping market, i.e. no interaction has been identified.

2. Drivers of shipping market

Cyclical nature of shipping market results in high volatility of freight rates, which depend on demand and supply in the markets. Drivers of demand arise from growth of trade on a global scale as well as geographical trade patterns. Supply drivers can be defined as interaction between ordered newbuildings as well as scrapping and losses of existing ships.

STM-project proposals would not affect drivers of shipping market, i.e. no interaction has been identified. However, possible implementation of STM could make an impact on demand for properly equipped ships, able to fulfil formal and technical requirements of STM and thus, of interest for shipping companies and charterers.

3. Competitiveness

The economic downturn in 2008 and financial crises in Europe have made an impact on global trade and thus, demand drivers of shipping market. Due to oversupply, the market has turned down with falling freight rates. Resulting from, the owners have started reducing their costs (mainly capital and voyage costs) and undertook some operational measures, as lay-up ships, slow steaming or running ships on economic speed, to mention some of them of operational aspects.

Financial performance is the key to survival in the shipping market, with the following variables important to shipowners’ (Stopford, 2009):
The revenue received from chartering/operating the ship;
The cost of running the ship;
The way of financing the shipping business.

The revenue received from chartering/operating a ship and the costs of running ships are the aspects the STM-project proposals are expected to make an impact on. Important to mention, from the STM point of view, that the basic factors, which the cost of running the ship depends on, are fuel consumption and operational efficiency of the shipowner. As argued by SSPA (2015) and Merkel (2015), significant reduction of voyage costs can be achieved by optimising ships routes (depending on operational area and type of shipping) and optimisation of speed, aiming at “just in time” arrival at port of destination for commencement of port operations. Thus, implantation of STM with SVM/DVM and PortCDM concept would probably have direct influence on above mentioned factors.

High interaction grade has been identified.

Further investigations of the topic and close consultations with shipping are recommended in future STM project activities.

Contracts of carriage of goods by sea

The terms “charter” and “Charter party” (CP) can be referred either to agreement of hire of ship, e.g. time charter, bare boat charter, or to agreement of carriage of goods by sea. This fact should be taken into consideration, once discussing relevant issues and clearly distinguished to avoid confusions.

Main types of contracts of carriage are:

- The voyage charter;
- The contract of affreightment (CoA).

Contracts of carriage may be carried out as a charterparty contract or a bill of lading contract, i.e. with or without issuance of Bill of Lading (BL), which has specific legal consequences, as e.g. framework of governing regimes.

Interaction grade between STM and contracts of carriage has been assessed as high. Appraisal has been made, that implementation of STM would make an impact on clauses of contracts and on the scope of rights and responsibilities, as well as on operational tools, procedures and facilities.

Continuation of working and official contacts with BIMCO, legislative organisations, as well as shipping cluster, is strongly recommended for further consultations within mentioned area.

To some extent, STM could have impact on contracts of hire of ships (hire charterparties), where minimal service speed has been defined by appropriate clauses. In some cases of slow steaming or low speed proceeding, inability to ensure
minimum speed performance was reported by ships, which, in consequence, can lead to accusation of breach of contract against the carrier.

1. Parties involved

Carriage of goods by sea takes place under provisions of appropriate agreements, set between parties involved in the subject carriage, such as a charterer (or shipper, as the case can be), as an owner of cargo (or party representing), and as a carrier (understand as owner or commercial operator of ship, performing the carriage). In cases the receiver of goods is known, a consignee would be mentioned in contract.

A ship agent at loading/discharging port(s) is usually named, representing the interests of charterer or shipowner (or both) and providing assistance, advice as required. Not being a part of the contract, the ship agent plays vital role, aiming at best service done, while the ship is in port.

The agent’s role and functions had been examined by the STM-project. It can be argued, that STM-project proposals are expected to make significant impact on the role of ship agent, amending not only agents role and functions, but also the way of acting and relevant procedures.

High grade of interaction has been identified, particularly, in regard to the agent.

2. Rights and responsibilities

Agreed and signed, Contract of carriage (or charter party) imposes a variety of requirements, conditions and obligations on involved parties. Specific rights, responsibilities or liabilities, imposed on parties of contract, are negotiated and stipulated in appropriate contract by adding or withdrawal of clauses or adding specific clauses (rider) or notes.

Appraisal has been made, that implementation of STM would make an impact on the set of obligations, imposed on carrier, as well as on operational procedures and tools (LayDays, NoR, Laytime calculations, demurrage/dispatch) applied in shipping. The former may arise from clauses, stipulated in appropriate contract, as well as being implied, e.g. by framework of governing regime. Some of the main implied obligations (please compare with 4.2.1. “Safe carriage of goods by sea”, subchapter 3.), imposed on the carrier, are:

- Obligation to perform the voyage with reasonable dispatch;
- Obligation not to deviate (unjustifiably) from agreed route.

The questions, if speed optimization and its adjustment to “JIT” arrival, would be considered as breach of reasonable dispatch, thus raising the question about liberation clauses, need to be addressed.

By the common law deviation is justified for saving life at sea, while the Hague-Visby Rules allow deviations to save life or property at sea.
Assumption has been made, that STM-project proposals would not constitute ground for possible deviations from usual route with negative consequences. On the contrary, subject route would be optimized for carrier's best performance.

Continuous consultations are recommended with BIMCO and IMO in legislative issues, as well as with shipping cluster with reference to use of operational tools and applied procedures. Efforts should be made, aiming at identification of these procedures, which may be found constrained by STM-project proposals, in order to continuously adapt and harmonise proposed solution to expectations and requirements of shipping.

3. Documents

Taking STM-project proposals into consideration, the pertinent documents can be categorized in two groups:

- The document, constituted the contract or being evidence of such contract agreement;
- The documents, mentioned in or evolving from appropriate contracts.

The former one comprises of:

- Contract of Carriage of Goods by Sea;
- Bill of Lading (BL), in most cases.

Notification about possibility to initiate STM standards and procedures under or during certain voyage should be inserted into appropriate clause in subject contract of carriage as well as relevant notes/clauses set in BL, if such will be issued. This additional setting in BL is necessary, because the actual cargo can be sold during time of sea voyage. If this would be the case, the CP is not any valid document for the new owner of the cargo, as the latter is not any party in the contract of carriage, which was agreed and signed mutually by the Owner (carrier) and the Charterer.

The second group has been identified consisting of:

- Notice of Readines;
- Statement of fact (SoF);
- Various official reports and notices (e.g. ETA, ETD, pre-arrival notices, among others);
- Laytime and demurrage (sometimes even dispatch) calculations.

Here the consideration should be made to ensure that proper functions of mentioned documents are secured by STM before possible implementation of project proposals.

Relevant clauses and notes, applicable for contracts and BLs, should be discussed and worked out as early as possible for further consultation and verification within STM Validation project.
Appraisal has been made, that implementation of STM would make an impact on set of obligations, imposed on carrier, as well as on operational procedures and tools (NoR, Laytime calculations, demurrage/dispatch), applied to shipping. Thus, such functions within STM should be discussed and operational functionality ensured. For this reason the Virtual Arrival (VA) concept could be applicable.

Contractual aspects and interdependencies in shipping

Every contract of carriage is negotiated by carrier and charterer, with consideration paid to background of the custom and commercial usage. Furthermore, a contract of carriage of goods by sea, may cover particular needs of parties of such mutual agreement, expressed in additional clauses or notes, incorporated to the contract or withdrawn from it, if such clauses, provided in standard forms of contracts, are found obsolete or inadequate. Beside contractual obligations, arising directly from specific clauses, imposed on the parties of agreement, a set of implied obligations is automatically incorporated into the contract in the absence to the contrary. In general, the parties of such mutual agreement enjoy the freedom of contract.

Slow steaming and especially virtual arrival, are seen as being of mutual benefit to owner, charterers and the environment, because of reduction in emissions and costs. Nevertheless, provided the details are agreed between the parties and contracts being properly drafted, none of them should expose owners and charterers to an increased risk.

As highlighted above, several different factors must be taken into consideration, once it has been decided to reduce the engine load and slow steam the ship.

However inconceivable is to take any possible application of additional clause, further consideration should be made by the STM project in its validation phase to legal aspects of contracts of carriage and consequences expected to arise thereof. High grade of interaction and interdependency has been found between contractual issues of shipping and STM-project proposals.

1. Notice of Readiness (NoR)

Historically, the NoR with notice time, was a kind of notification to the shipper / receiver, aiming at allowing concerned a time to prepare the loading or unloading work in the harbor. With modern means of communication, this role has lost its original meaning.

Readiness is understood in both the physical and the legal meaning. The first one means that the ship will be physically present at the port or within the port limits and will be ready to receive / unload the cargo, i.e., cargo space must be ready for it. The legal part means, that certain formalities must be completed before any cargo operation commences. NoR is, if previously agreed in CP, a formal notice of arrival of the ship at port/port limits and thus about her readiness for commencement of cargo operations. Even in case the tendering of NoR is not obligatory (subject of statement in appropriate CP), the masters are often instructed to tender it, due to its formal significance in further calculation of a laytime.
Resulting from a certain agreement between parties of contract, the carriage of cargo by sea is laden with specific risks, connected to and split between parties involved. One type of risks meant here are the risks related to time (which in turn may be related to costs, because of "ship costs per time unit"). The time-related risks can be specified as time-risk at sea and time-risk in port. These risks are, in practice, shared between carrier and charterer. In common practice, time-risk at sea lies on the shipowner (carrier), while the time risk in port is shared in different ways, as stated in appropriate contract of carriage.

Furthermore, by tendering NoR, master informs the charterers on behalf of shipowner, that the ship has arrived destination, as provided in appropriated contract of carriage, thus the risk of delays passes from the carrier (shipowner) to the charterer.

Assumption has been made for purpose of this report, that all functions of NoR could be superseded by STM and Virtual Arrival (VA).

NoR function has to be operationally sustained by STM and VA, or similar service incorporated. High grade of interaction has been identified.

2. Demurrage and dispatch as operational tool in contemporary shipping

The time span, allowed for performing of cargo operations, is defined by specific clauses, providing with a contract-specific time framework. Loading/discharging rate or time, as well as a laytime, i.e. the period agreed between the parties, during which the owner makes the ship available for charterer for performing the loading or discharging without any fees, additional to the agreed freight, is stated in the appropriate contract. Laytime is defined by Layday and Cancelling day, determining both commencement respectively completion of mentioned period.

Demurrage, as well as dispatch, is a remuneration / compensation to that party in contract, which suffered from a higher costs at port, e.g. the Charterer can be liable for demurrage to the owner (Carrier), in case the ship was served longer time than agreed, or a kind of reward to that party, which contributed to time savings, e.g. the Carrier (shipowner) can pay the Charterer dispatch, in the case the ship "used" a shorter time, than that specified in the contract.

Both legal and operational aspects of NoR and demurrage/dispatch tool need to be considered in further works within the validation phase. High grade of interaction has been identified.

**Just in time (JIT) concept versus “Maritime JIT”**

To optimise the seaborne transportation is not the same, as to do the similar in case of the whole transportation chain, with links extended far in to the hinterland on both sides (door to door concept).

It has been agreed, that maritime JIT (as a JIT concept, considered for purpose of STM) is narrowed to the following links: port->seaborne transportation-> port, with all actors and stakeholders embraced in this term and involved in carriage of goods by sea.
It is crucial for any kind of carriage of goods by sea under STM that all parties of agreement would be guaranteed all usual rights they enjoy now, aiming at get them satisfied with the STM proposal.

Striving for best efficiency of the chain, ships need to arrive at the right and well defined time range (slot), subordinated to final delivery to the consignee, but with close reference to access to a port, fairway, availability of berth, readiness of port services (pilot, tugs, linemen, stevedores). Last, but not least, cargo must be ready and available for loading. Upon arrival discharging port, availability of proper storage place or repository, should be ensured, providing with sufficient space and resources for efficient discharging. Thus, a special consideration and reference should be given to the PortCDM part of STM-project proposals.

Basic rights and needs of parties of contracts of carriage of goods by sea, as well as main stakeholders, involved in seaborne transportation, have to be satisfied by STM concept proposals, in order to make the project operable and accepted by the shipping.
4.4 Environment

A demand for reduction of harmful particles and exhaust gases emission, resulting from burning of the fossil fuels, is commonly recognised. Shipping, as one of major industries, counted 2007 for about 3,3% of estimated global CO\textsubscript{2} emissions (Merkel, 2015). With a 4,3% growth rate (2012), and rather low possibility to make an eager transition into renewable fuels, shipping transport is expected to remain a significant source of carbon emissions, resulting from burning of marine fuels, as argued by Watson et al (2015).

Beside economic impact, even the environmental aspects of fuel savings need to be highlighted. These should be considered from climate effects and health effect point of view.

4.4.1 Environmental aspects of fuel savings as resulting from STM

Air pollutants, emitted by ships, resulting from burning of maritime fuels, are: nitrogen oxides NO\textsubscript{x}, PM (fine particulate matter), sulphur oxides SO\textsubscript{x} and carbon dioxide CO\textsubscript{2}.

The unit values of emitted air pollutants in EUR per kg are provided in Table 2.

Table 2: Unit values of air pollutants in euros per kg

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Low unit value</th>
<th>Main unit value</th>
<th>High unit value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nox</td>
<td>3.08 (CAFE)</td>
<td>9.23</td>
<td>9.23</td>
</tr>
<tr>
<td>PM2,5</td>
<td>0</td>
<td>0</td>
<td>41.32 (CAFE)</td>
</tr>
<tr>
<td>SO2</td>
<td>3.11</td>
<td>3.11</td>
<td>12.97 (CAFE)</td>
</tr>
<tr>
<td>CO2</td>
<td>0.07 (Stern)</td>
<td>0.12</td>
<td>0.40 (ASEK, high)</td>
</tr>
</tbody>
</table>

Source: Merkel (2015)

Based on IMO report, global emissions of CO\textsubscript{2} from shipping, could potentially be cut by 25% to 75% below current levels, if cost effective technical and operational measures are taken, as argued by Merkel (2015,p.1).

It can be assumed, that positive impact on environment, as proposed by STM, could be achieved in three ways:

- Reduction of emissions, resulting from optimised speed of ships on sea-leg of maritime transport (green steaming);
- Reduction of emissions, resulting from route optimisation (green routing);
- Reduction of emissions, resulting from optimisation of port operations, thus decreased turnaround time in port.

In the first way, the emission reduction could be achieved by adjusting speed of subject ship within certain operationally accepted distance from a port of destination and applicable range of speed, as far as practicable and allowed by any technical requirements or constraints.
The speed reduction rates and CO2 emission rates have been presented in Table 3.

Table 3: Speed reduction rates and CO2 emission reduction rates

<table>
<thead>
<tr>
<th>Reduction in speed (%)</th>
<th>Reduction in fuel consumption and CO2 emissions (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>18</td>
</tr>
<tr>
<td>20</td>
<td>34</td>
</tr>
<tr>
<td>30</td>
<td>49</td>
</tr>
<tr>
<td>40</td>
<td>61</td>
</tr>
<tr>
<td>50</td>
<td>71</td>
</tr>
</tbody>
</table>

Source: Merkel (2015)

Farther, the analyse, carried out by Watson et al (2015) for ships entering port of Gothenburg in August 2014, indicates potential energy and emissions saving of 34%, if ships could proceed with lowest safe speed, in order to minimise anchor time. Taking all commercial ships, entering port of Gothenburg in August 2014 into account, the relevant emissions and fuel saving are estimated to 4.1%.

However, some limitations should be taken into consideration, e.g. as to the speed profile of a ship, among others.

Here, the PortCDM function would be vital for achieving maritime fuel savings, thus environmental effects.

The second way results from implementation and application of SVM/DVM, making ships able to verify, optimize and continuously update actual route. Possible shortcuts or reduction of detours within applicable extent and with consideration taken into appropriate safety margins could be found applicable for shipping and optimisation of ships’ routes.

The study on transit traffic through the shallow waters in Kattegat, carried out by Markström & Holm (2013) for the MONALISA project, found the fuel saving potential of 12%.

Again, the route optimiser tool and service, aimed for optimising the ship’s route by adding, moving and removing waypoints has been combined with speed adjustment in order to ensure that the ETA is still preserved in.

The third way of emission reduction could be achieved by harmonisation and coordination of ships’ berthing and unberthing with optimising of port operations, thus in consequence, diminish emissions from manoeuvring ships, as well as form
operations in port. Merkel (2015, p.11) argues, that in case of short-sea shipping, the conservative estimates shows a 1 to 4 hours’ time saving potential in port, if factors, identified as causing unnecessary waiting time, would be addressed.

Merkel (2015, pp.13-14), argues, that the greenhouse gas emission producing activities in port, can be identified coming from:

- Port direct sources (directly under control of port, e.g. vehicles, port equipment, etc.);
- Port indirect sources (from external services and sources purchased by port for e.g. running the port or its infrastructure);
- Other indirect sources (from operation of port tenants, e.g. emissions from ships under cargo operations or idle time spent in port).

A shorter turnaround time in port means also shorter run-time of ships’ auxiliary engines, thus lower emissions from the ships. This effect, however, should be compared with longer time ME-run, if ship adjusts her speed at sea leg, thus possibly higher emissions at sea.

As a consequence of ships’ participation in STM, decreased level of NOx and SOx emissions in the urban areas or nearby of such might be expected, as ports usually are located in relatively short distance to urban agglomerations.

Furthermore, shorter or no time at anchor, allows to expect lessening of light and sound pollutions from ships, especially in sometimes “idyllic” areas, where anchorages can be located. Needless to say, that usual maintenance works (e.g. rust-chipping), could be very onerous for surroundings.

Further attention should be given to recent studies (Westerlund, 2015) about emissions of nanoparticles (called also aerosol particles), from shipping, which are considered as having adverse health (carcinogenic), as well as various climate effects (Westerlund, 2015, p.6). Nanoparticles are emitted by all combustion engines, but depend on combustion conditions, exhaust aftertreatments, the fuel and ship/vehicle variations. Manoeuvring of a ship in the port areas was found to contribute to up to a factor of 64 times higher particle number emissions, than during stable engine load at open sea (Westerlund, 2015, p.iii). Thus, reduction of manoeuvring time in ports would be important for reduction of mentioned emission. In such a case, the PortCDM could be seen as a very useful tool and procedure.

However being relatively new, this topic has led to discussions between scientists and Swedish shipping (e.g. published in Swedish by Sjöfartstidningen), arguing the data processed in actual and other studies (showing higher concentration of nanoparticles in port areas), had been collected prior to implementation of SECA directive in the Baltic Sea.

4.4.2 Technical issues arisen due to slow- or eco-steaming

The main technical issues making possible impacts on ships abilities to save bunker are
• Constraints arising from limited operational range of main engine (ME);
• Fuel consumption characteristics, specific to a particular ship.

In the first case, limited operational range of ME arises from temperature of exhaust gases and characteristics of catalyst equipment of ME.

In the second case, attention should be paid to the fact, that speed optimisation should be specified by and applied within a range of minimal consumption, with consideration given to speed, i.e. proceeding with speed beyond this range doesn’t result in fuel savings. Thus, calculation of desired speed should be made in regard to fuel consumption per distance unit, not per time unit.

In addition, further consideration should be given to possible limitation of shaft generator in order to avoid situation, required running auxiliary engine at sea.

Worth noting, that from the whole voyage perspective, reduction of time at anchor results in reduction of runtime of auxiliary engine, if the ship speed remains within operational range of shaft generator.

Traditionally, main engines are constructed for operational load range of 70%-85% during continuous operation. It has been argued, that damage occurs and becomes imminent, when running ME at full operational load after long period of slow steaming, as argued by Sanguri (2012, p.10).

Consideration should be also made to the fact, that operating ME beyond the range of operational load requires technical modifications (e.g. “de-rating”) or any other action, which may decrease expected fuel saving, thus diminish positive environmental effects.

Mentioned technical limitations, however beyond the scope of report, need to be taken into consideration prior to possible implementation and during operational phase of STM.

Moreover, slow/eco-steaming beyond recommendations and instructions of ME manufacturer, can lead to further consequences, such as e.g. lost guarantee or service agreement, mentioning some of them.

4.4.3 Legal aspects and consequences of slow/eco-steaming under contracts of carriage and contracts of hire

In some cases slow or optimised steaming could entail undesired contractual consequences for carrier or owner, if such lead to accusations of breach of contractual obligations, such as obligation to perform the voyage with reasonable dispatch under contract of carriage.

Furthermore, running ME beyond the range of recommended load could result in accusation of breaching other possible contractual obligations, namely minimal service speed, if such has been agreed in appropriate contract of carriage or contract of hire.
Running ME beyond recommendations of manufacturer could lead to serious damages or/and consequently, loss of guarantees or service agreement if such was the case (for further insight please refer to 4.3.4. and 4.4.2. above).

Therefore, operational consideration should be taken by parties involved in appropriate contract as well as SC.

High interaction grade has been identified, however, mainly of operational aspect, beyond direct influence of STM.

4.4.4 Prevention of marine pollution

Preventing maritime pollution could be achieved by validation of voyage plan and ships route optimisation with focus on safety of navigation, as well as by surveillance of traffic by SC.

Appropriate data proving this statement is provided by in FSA and workshop.

Resulting from appropriate evaluation of accident statistics, the compilation of indicative estimations of risk reduction rates has been made. Assumptive risk reduction effect of STM is expected to range 50%-70% for collisions caused by human error (SSPA 2015, p.25).

In case of grounding, evaluation has been made in the FSA that ML2 services, with active or passive voyage surveillance (Dynamic Voyage Management) of deviations from validated and checked voyage plans, may significantly contribute to reduction of grounding frequencies.

During a workshop, eleven maritime safety experts from the project partners and experienced navigators from the Kattegat area participated in a structured discussion, allowing estimating potential hypothetic reduction rate of the recorded grounding accidents as much as 90%-100% for simple grounding case, if STM had been in place. For more complicated cases of grounding accidents, where e.g. unexpected urgent anti-collision or give way manoeuvres took place, the STM-project proposals may lead to reducing effect of 25%-50% on grounding occurrences.

It is difficult to estimate the scope of any potential effect of risk reduction on marine environment pollutions due to fact, that such a risk may be connected to various factors, such as, but not limited to, leakage of marine fuel from ships, as well as pollutions caused by spillage or loss of cargo carried on board. Furthermore, such a pollution may occur many years after accident happened, in case the source of pollution had not been successfully neutralised (e.g. due to excessed deep an actual wreck is situated at).

4.4.5 Navigation within environmental-protected and special areas

Navigating within environmental-sensitive or protected area, stipulates similar nautical conditions and limitations as these mentioned for constraint waters (see safety of navigation), but any consequences resulting from any failure or nautical error would be devastating for environment.
Essentially, the year 2013 case of grounding of containership m/v Rena on her way to Tauranga can be evoked here, as an example of such ecological disaster for maritime sensitive environment of Astrolabe Reef (New Zealand), leading to spill of about 200 tonnes of heavy fuel oil, as well as loss of substantial amount of cargo in the containers and, as consequence, to maritime environmental disaster.

According to information, gained by the MONALISA 2.0 project, the consequences of M/S Rena’s disaster have been traced even in Australia. Containers and cargo debris (even dangerous cargo), were found on seafront and on land. To the project knowledge, the case was also to build waste and debris treatment plant, in order to decontaminate the area, to render harmless all dangerous materials and to utilise other rubbish and scrap.

According to New Zealand’s Transport Accident Investigation Commission final report (2014, p.1), the following factors, directly contributing to the grounding, related to the crew:

- Not following standard good practice for planning and executing the voyage;
- Not following standard good practice for navigation watchkeeping;
- Not following standard good practice, when taking over control of the ship.

With reference to above stated (ref.to 4.2. and 4.4.4.), assumption can be made, that with STM proposals on place, the grounding could have been avoided, as the two of three factors would had been detected (and probably eliminated) by SC.

Ship’s route is depicted on Figure 4.
Thus, such STM functions and services, as route verification, traffic monitoring and surveillance, weather routing, as well as proper reporting and ship-to-ship, ship-to-shore and shore-to-ship communication, would foster protection of environment.

Furthermore, as in case of navigation in restricted or areas of dense traffic, the Common Situational Awareness would contribute to improved safety of navigation, thus decrease of risk of pollution in marine environment.

4.4.6 Health and social aspects of environmental issues of shipping

Both emissions of exhaust gases and particles from shipping, lead to pollution of air, contributing to negative consequences, related to social and health aspects, causing increased number of diseases and fatalities. Any improvement of environmental performance or diminish of footprint on the environment achieved by shipping, would be beneficiary to social and health aspects.

As argued by CEEH (2011, p.8), international shipping was responsible for annual death cause of approximately 50000 people in Europe. However, the figure is based on a Danish study from 2011, i.e. prior to implementation of SECA 2015. The annual cost to society is counted for more than 58 billion EUR, according to the same study.

Reduction of average distance, run on the ships routes in the Baltic Sea, by 1% would result in annual gains for society, counted for as much as about 100 million EUR, as argued by Andersson and Ivelhammar (2014).
Optimisation of ships’ speed in accordance to PortCDM principles, would lead to reduced emissions of air pollutants, which are quantifiable and can be monetarised, as argued by Merkel (2015). In case of port of Gothenburg, annual emission costs savings could vary from 2.13 million EUR (10% reduction in speed for 1 hour) up to 23.21 million EUR (30% reduction in speed for 4 hours) (Merkel, 2015, p.44).

Reduced emissions from the shipping, both at sea and in ports, resulting from STM (SVM/DVM and PCDM), would contribute to positive social and health aspects.

It is not surprising, that even social effects of the m/v Rena grounding have been observed. Information has been gained by the MONALISA project about the areas, where indigenous peoples’ sacred places were covered by debris and dangerous or harmful substances, making the area inaccessible for people and thus their rites.
5 Limitations, observations and recommendations

5.1 Limitations

Possible implementation of STM-project proposals shall be considered on voluntary basis only. Thus, this fact should be seen as prerequisite for possible application within shipping. Expected incentives and benefits for stakeholders might persuade them to decide to participate in STM.

Moreover, possible implementation of STM might be considered to take place in selected areas or regions and initially considered for segmented adoption only. Hence, any reference in this report made to mandatory application of STM-project proposals, should be seen as indicative ones for conceivable further works with development of STM concept only.

5.2 Legal issues

Due to principal character of maritime conventions on one side and STM-concept proposals’ cross-sectional, technical and legal complexity, as well as its breaking-through attributes on the other, it is crucial for the project to keep a continuous reference to the provisions of appropriate conventions (SOLAS). Thus, it would be highly advantageous for the STM-project to maintain and extend current consultations with IMO’s appropriate bodies, both on formal levels, as well as within advisory scope of work.

5.3 Safety of navigation

Essentially, it should be emphasized, that STM-project proposals are not in contradiction to current rules or regulations, governing safety of shipping. It should also be noted, that STM project proposals do not affect COLREGs in any way, but aims at performing strategic and operational planning, in order to avoid, that ship ends up in a close-quarters situation.

Thus, further efforts should be made by the STM-project to reach broad spectrum of seafarers’ community and recognised organisations, e.g. The International Federation of Shipmasters’ Associations (IFSMA), to present the project proposals, as well as discuss effects of its implementation on safety of shipping and diminished workload on board. In particular, the STM-project is recommended to pay special attention in highlighting the master’s overriding position in commanding the ship. Furthermore, shipping companies and its recognised organisations, e.g. The International Chamber of Shipping (ICS), need to be consulted by the STM-project in the wide extent of operational issues, where possible benefits and incentives, but also expected costs of implementation of STM-project proposals, should be discussed.

Last, but not least, the review of existing procedures in regard of safety of shipping and harmonisation of future procedures, applied to STM, with provisions of SOLAS, is recommended. Thus, further consultations with IMO, EMSA, IHO, IALA, Nautical
Institute etc. on formal level are recommended to carry out by the STM-project and farther maintain on working level.

It is clear, that a development of Situational Awareness (SA) to the new, higher level, as Common Situational Awareness (CSA), would allow the parties involved in safe navigation, both at sea (i.e. ships) and ashore (i.e. SC and/or similar service provider), to gain the whole picture within area of consideration. Participation in STM would include management of information, which might be crucial for safe navigation, as well as support in decision making process, where CSA would be vital part of safety of shipping.

5.4 Security

STM-project is recommended to establish formal and working contacts with EU Naval forces (EUNAVFOR) and/or The UK Maritime Trade Operations (UKMTO) office in order to discuss possible operational gains within shipping security, arising from participation in the STM, as well as possibilities to establish appropriate common procedures and communication platform for HRA. Elimination of IT-security risks or minimising such to accepted level should also be lifted up and taken into consideration upon occasion of working meeting.

In regard to securing transportation and logistics chain, further consultations and working contacts should be maintained and cooperation developed with ICS, The Baltic and International Maritime Council (BIMCO), The Federation of National Associations of Ship Brokers and Agents (FONASBA) in particular, as well other recognised organisations as e.g. The International Association of Independent Tanker Owners (INTERTANKO) and/or specialised forums, e.g. Oil Companies International Marine Forum (OCIMF), in order to discuss issues related to contracts of carriage.

The STM-project is recommended to discuss practical and operational issues, related to assuring rights and liabilities of the parties involved in contracts of carriage, evolved from possible participation in STM. Furthermore, establishing of working contact with legal advisory or maritime insurance companies is strongly recommended, aiming at perform consultation in the scope of contractual issues of shipping in relation to STM-project proposals.

5.5 Environment

Environmental benefits of participation in STM have been reported in research work and various reports within the MONALISA and Monalisa 2.0 projects. Thus, further steps are recommended for the STM-project, aiming at making the shipping industry familiar with appropriate results.

In addition, the STM-project is recommended to discuss environmental issues in context of enhanced safety standards and CSA in maritime navigation, as arising from participation in STM.
Subsequent works with estimation of possible environmental gains in extension to European waters and worldwide, would be recommended for taking into consideration by the STM-project.
6 References

6.1 Books


6.2 Journals and/or conference materials


6.3 Project internal reports


6.4 Internet sources

Berlingieri, F., (2009), A comparative analysis of the Hague-Visby rules, the Hamburg rules and the Rotterdam rules, Paper delivered at the General Assembly of the AMD, Marrakesh 5-6 November


70


7 Appendices

7.1 Appendix 1 VTS and VHF communication procedures on approach and in the Port of Rotterdam

The rules and appropriate procedures, valid for area of approach to Rotterdam, can be obtained from e.g. appropriate nautical publications. To make information more accessible, the Port of Rotterdam has edited a Port Information Guide 2015 and made it available via port’s website. The guide describes shortly the main bodies and their functions, but even provides seafarers with checklists, arrival/departure procedures, reporting, and security requirements. Moreover, the publication provides ships with information regarding safety of navigation as well as anchor and emergency areas, prohibited anchorages, precautionary areas. Mentioned guide informs about recommended keel clearance, gives insight into rules and procedures and recommendations for peculiar areas, for fairways, for the traffic crossing approach channels. VTS communication procedures are clearly described in publication “VHF Communication Procedure VTS and HCC”.

Fig. A.1. VTS service and VHF communication procedure port of R-dam (Source: Port of Rotterdam)

Mandatory reporting is imposed on ships once arriving the VTS area, within it and for preparation for departure or shifting of sea-going ships. In addition, all ships should report in the event of accidents; to request assistance from the emergency services, such as the ambulance service.
All ships should also report to The Harbour Master’s Coordination Center (HCC) in case a permission/exemption for executing activities and/or exercises, e.g. lowering sloops, diving work, work involving sheerlegs, bunkering etc. Reports should be made upon commencement and completion of certain activity or exercise. HCC is also reporting point regarding hazardous substances.

In addition, appropriate reporting procedures are imposed on inland ships within Rotterdam nautical control area.

Sources and references:


7.2 Appendix 2 Anti-piracy planning and pirate activity statistics in the High Risk Area 2011-2015

Fig. A.2.1. Anti-piracy planning chart and statistics (Source: NATO)
Fig. A.2.2. Pirate activity in the High Risk Area 2011-2015 (Source: NATO)

Sources and references:

7.3 Appendix 3 Glossary: Terms and Definitions

1. **Aid to Navigation (AtoN)**
   - “any device or system, external to a vessel, which is provided to help a mariner determine position and course, to warn of dangers or of obstructions, or to give advice about the location of a best or preferred route.”

2. **Bill of lading (BL)**
   - is “a contract for the carriage of goods by a carrier. Usually issued by a carrier to a shipper upon surrendering of the “mate's receipt”, it becomes the receipt of goods for transport and specifies the terms of delivery. The document has the following functions:
     • A receipt for goods, signed by a duly authorised person on behalf of the carriers.
     • A document of title to the goods described therein.
     • Evidence of the terms and conditions of carriage agreed upon between the two parties.”
   or
   - “means a document which evidences a contract of carriage by sea and the taking over or loading of the goods by the carrier, and by which the carrier undertakes to deliver the goods against surrender of the document. A provision in the document that the goods are to be delivered to the order of a named person, or to order, or to bearer, constitutes such an undertaking.”

However, a BL can be considered as a contract
“in cases where the goods of a shipper form only part of the cargo which ship is to carry. (…) When the agreement is for the carriage of a complete cargo of goods, or for the provision of a ship for that purpose, the contract is almost always contained in a document, called a “charter-party”."
3. Charterparty (CP)
- "a formal contract document in which the shipowner agrees to place his vessel or a part of it at the disposal of a third party, the charterer, for the carriage of goods for which he receives a freight per ton cargo, or to let his vessel for a definite period or trip for which a hire is paid. (...) Long-term charters for several vessels over a period of time for steady continual business are usually performed under a Contract of Affreightment or COA.”

4. COLREGs- Convention on the International Regulations for Preventing Collisions at Sea.
- "the COLREGs include 38 rules divided into five sections: Part A - General; Part B - Steering and Sailing; Part C - Lights and Shapes; Part D - Sound and Light signals; and Part E - Exemptions. There are also four Annexes containing technical requirements concerning lights and shapes and their positioning; sound signalling appliances; additional signals for fishing vessels when operating in close proximity, and international distress signals.”

5. Common Situational Awareness (CSA)
- refers to a new meaning of situational awareness (SA), where sharing of “own” SA amongst all participants (both at sea and SC ashore), contributes to upraise of new quality, allowing all parties to gain a knowledge about intentions of other participants in the actual area in real time. Thus, beside “own” SA, an OOW or SC operator, gains the whole situational picture within area of consideration, including elements related to other ships, other possible constraints or other dynamically appeared factors, which might be influential for safe navigation of the own and other ships within the area.
(Source: Transversal report of the MONALISA 2.0 project).

6. Confined water
- “an area of the sea where the Width of the Safely Navigable Waterway is not more than about 2 miles, such as a Strait, considering the Draft of the vessel and Water Depth. The Master shall assume control of the vessel on the Bridge and shall increase officer(s) and/or lookout(s) as required.”
7. **Contract of carriage by sea**

   - **According to the Hamburg Rules** - “means any contract whereby the carrier undertakes against payment of freight to carry goods by sea from one port to another; however, a contract which involves carriage by sea and also carriage by some other means is deemed to be a contract of carriage by sea (…) only in so far as it relates to the carriage by sea.”


   - **In the meaning of the Hague-Visby Rules** – “Contract of Carriage applies only to contracts of carriage covered by a bill of lading or any similar document of title, in so far as such document relates to the carriage of goods by sea, including any bill of lading or any similar document as aforesaid issued under or pursuant to a charter party from the moment at which such bill of lading or similar document of title regulates the relations between a carrier and a holder of the same.” (*The Hague-Visby Rules, Article I*).


8. **Demurrage**

   - “shall mean an agreed amount payable to the owner in respect of delay to the Vessel once the Laytime has expired, for which the owner is not responsible. Demurrage shall not be subject to exceptions which apply to Laytime unless specifically stated in the Charter Party.”


9. **Despatch money or Dispatch**

   - “shall mean an agreed amount payable by the owner if the Vessel completes loading or discharging before the Laytime has expired.”

10. **ECDIS—Electronic chart display and information system**

- "is a computer-based navigation system that complies with IMO regulations and can be used as an alternative to paper navigation charts. Integrating a variety of real-time information, it is an automated decision aid capable of continuously determining a vessel’s position in relation to land, charted objects, navigation aids and unseen hazards."


11. **Eco-speed (or steaming)**

- "that speed of a means of transport (in case of ship even steaming-tk) which produces the best possible financial result for the owner. Such speed should not be in excess of the maximum or minimum output allowed for the engine(s)".


12. **Environmentally Sensitive Area (ESSA)**

- "is a generic term which may be used to describe a wide range of areas, considered sensitive for a variety of environmental reasons. The implications which each of these have for charting and navigation may be different.(...) There are two broad types of Environmentally Sensitive Sea Areas (ESSAs): a). those established to protect specific types of nature from disturbance (usually close inshore and established under national legislation); (....) b). those specifically designated in response to wider environmental considerations, potentially ‘the total environment’, (usually including some degree of risk from shipping, possibly covering extensive sea areas, and established under national or international legislation)(...)”.


13. **Hague-Visby Rules**

- is a set of regulations and amendments to International Convention for the Unification of Certain Rules of Law Relating to Bills of Lading (Hague Rules), being one of main regimes, governing international carriage of goods by sea.

(Source: Transversal report of the MONALISA 2.0 project).

- is a set of regulations and one of main regimes, governing international carriage of goods by sea.
(Source: Transversal report of the MONALISA 2.0 project).

15. High Risk Areas (HRA)
- “is an area within the UKMTO* designated Voluntary Reporting Area (VRA) where it is considered there is a higher risk of piracy and within which self-protective measures are most likely to be required.”

* UKMTO- United Kingdom Marine Trade Operations (please refer to the explanatory note No.30 below).

- “is a set of measures to enhance the security of ships and port facilities. It was developed in response of the perceived threats to ships and port facilities after the 9/11 attacks. The ISPS Code is part of the Safety of Life at Sea Convention (SOLAS) and compliance is mandatory for the 148 Contracting Parties to SOLAS.”

17. ISM Code (International Safety Management Code)
- “an amendment to SOLAS in 1994 which requires vessel owners and operators to have an approved system for operating, managing, and manning, vessels under their control in a process oriented fashion.”

18. Laydays
- “can be defined as the days kept aside in a ship’s voyage schedule for loading and unloading of the cargo. Laydays represent the time at which a ship must reach the charterer for cargo operations.”
19. Laytime
- “shall mean the period of time agreed between the parties during which the owner will make and keep the vessel available for loading or discharging without payment additional to the freight.”

20. Maritime Spatial Planning (MSP)
- “It's about planning when and where human activities take place at sea – to ensure these are as efficient and sustainable as possible. Maritime spatial planning involves stakeholders in a transparent way in the planning of maritime activities.”

21. MARPOL (The International Convention for the Prevention of Pollution from Ships)
- “is the main international convention covering prevention of pollution of the marine environment by ships from operational or accidental causes.”

22. Notice of Readiness (NoR)
- “shall mean the notice to the charterer, shipper, receiver or other person as required by the Charter Party that the Vessel has arrived at the Port or Berth, as the case may be, and is ready to load or discharge.”

23. Shore Centre (SC)
- is a joint term for a centre where one or more categories of service can be provided. The centre could be operated by private entrepreneurs or by authorities. Depending on the nature of the service it could be limited to a certain area or a specific time interval.
(Source: Transversal report of the MONALISA 2.0 project).
24. Situational Awareness (SA)
- is an attribute and ability of an officer on watch (OOW) to percept and understand the environmental elements, related to space and time around own ship and critical for decision-making in process of navigating.
(Source: Transversal report of the MONALISA 2.0 project).

25. Slow steaming
- “reducing vessel operating speed (…) (which might be) especially attractive at a time of overcapacity of tonnage in the market, since slower transit times can increase the employment of vessels.”

- “In most cases the slow-steaming is attractive to ships-owners/operators as a way to lower costs by reducing fuel consumption. On the other side, the slow-steaming can generate increased costs for shippers, due to longer transit time, thus increased inventory costs.”

26. SOLAS (the International Convention for the Safety of Life at Sea)
- “is generally regarded as the most important of all international treaties concerning the safety of merchant ships. (…) The main objective of the SOLAS Convention is to specify minimum standards for the construction, equipment and operation of ships, compatible with their safety.”

27. Statement of facts (SoF)
- “a document usually prepared by the agent which lists the significant times and events during a vessel’s port call. This document is signed by the preparer, the vessel master, and the terminal’s, or shipper’s, or receiver’s, representative. The times on a Statement of Fact are then used to calculate the laytime usually using a calculation sheet called a laytime statement.”
28. STCW Convention
- International Maritime Organization’s Standards of Training, Certification and Watchkeeping for Seafarers Convention 1978. (STCW is) an international agreement on the standards for certification and qualifications for certification of Seafarers.

29. Under Keel Clearance (UKC)
- “is the vertical distance between the lowest part of the ship’s hull and the seabed.”

30. United Kingdom Marine Trade Operations (UKMTO)
- “is the Position Reporting and Emergency Incident Response Interface with merchant ships at sea. UKMTO coordinates all oral communications with a ship’s Bridge in an emergency in order to make a quick and accurate assessment of the incident which is then disseminated immediately on the shared communications systems monitored by Counter Piracy Naval Operations operating off Somalia.”

31. Virtual Arrival (VA)
- is a process, which “analyses weather patterns and uses algorithms to calculate and agree a notional vessel arrival time, so that ships arrive ‘just in time’. It involves a system that connects ships with their port of arrival enabling them to be slowed down when there is a delay to ensure they do not arrive before their allotted slot. This new approach reduces bunker fuel consumption and emissions, while easing congestion and enhancing safety. (...) waiting time compensation, or what is known as ‘demurrage’, is calculated as if the vessel had arrived at the originally stipulated time, hence the name Virtual Arrival. After the voyage, any savings in bunker costs or carbon credits are calculated and shared between the counterparties.”

32. Weather Routing
- "an optimum track for ocean (and sea, TR of ML 2.0) voyages based on forecasts of weather, sea conditions, and a ship's individual characteristics for a particular transit. Within specified limits of weather and sea conditions, the term optimum is used to mean maximum safety and crew comfort, minimum fuel consumption, minimum time underway, or any desired combination of these factors.
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