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STM VALIDATION 5.26 – CATALOGUE OF NEW COMPETENCES
RELATED TO THE STAKEHOLDERS INVOLVED IN STM SHORE,
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1 General Information

Over the past 10 years, parts of shipping industry have been introduced to automated information exchanges through the adoption of AIS (Automatic Identification System). One of AIS’ major purposes is to increase situational awareness during navigation through the automatic exchange of key ship data. However, although it provides data about a ship’s current position and destination, AIS does not provide details on a ship’s route or estimated time of arrival, which results in a lack of situation awareness by maritime stakeholders. VHF Data Exchange System (VDES) and other potential technologies for marine aids are GMS/GPRS and SigFox (IoT), which can be seen as the next generation AIS with 30 times higher band width, are currently under development.

The digitisation of shipping industry is still under implementation through different projects, initiatives and policies (STM, e-Navigation, etc.). At present, a vessel’s voyage information is produced, as well as held, by a number of institutions, organisations, and individuals in different formats and exchange protocols, highlighting the need for standardization as a common demand in different maritime forums. A ship’s master typically facilitates the information flow between these stakeholders while the ship is at sea. As a ship nears its port of destination, responsibility for information flow moves to a shore-based ship agent. In both cases, most information is retrieved and distributed manually by the use of radio, emails and phone calls.

Better use of information has many benefits like potential savings due to route exchange and route optimisation (parts of the STM concept) and socio-economical cost savings when sailed distances per ships are reduced moderately in accordance with optimal route alternatives offered to the shipping companies. Approximately half of these savings would come from fuel and other expense reductions for ship owners and the other half would come from fewer emissions costs for society\(^1\). Since Baltic Sea traffic makes up approximately 10% of European total sea traffic\(^2\), these projections can be extrapolated after they can be demonstrated, to indicate substantial potential savings within the whole European maritime transport industry.

Sea Traffic Management (STM) will overcome many of the challenges of communication and information sharing between stakeholders in the maritime transport industry and create significant benefit as a result in particular, for ship- and cargo-owners and for shipping in the transport chain.

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Based on MONALISA (2010-EU-21109-S) and MONALISA 2.0 (2012-EU-21007-S), significant steps have been taken in bringing advancements in technology and innovation into the maritime sector for the future STM, creating a more sustainable shipping industry, reduced environmental impacts and improved safety and efficiency.

Both projects have defined and tested core STM components and shown very promising results. STM Target Concept has been defined, and within MONALISA 2.0, a Common Technical Protocol for route exchange has been developed and is in the phase of international standardisation. This is a huge achievement and a pre-requisite for further development and deployment of Sea Traffic Management. Europe is in lead in the development of traffic management solutions and e-Navigation globally, and the potential to explore the benefits of STM the deployment of its Services is a great challenge.

One of the outcomes of the STM project is to deliver a huge Analysis and Evaluation (A&E) study in order to provide a detailed analysis of data and lessons learned with regard to long-term feasibility of the STM concept as tested and demonstrated in the other Activities of the project. Regarding the “Competence and Training” study, it is intended to analyse the related effects of STM on maritime operations, including the safety of navigation, land operations and response in case of incidents/accidents. The study also includes an analysis of the need for competence and training of operational staff, both on-board as well as shore based systems and tools for providing professional and operational skills to the staff involved in all types of traffic scenarios. Based upon identified effects, proposing changes to the STM concept, covering both conceptual and technical aspects, where deemed necessary as well as to propose further development in terms of competences and training.
2 Executive Summary

The Sea Traffic Management concept has meant from the first moment, the introduction, implementation and deployment of e-navigation strategy as a public-private initiative with the European Commission's support and was defined within the MONALISA and MONALISA 2.0 projects through the Innovation and Networks Executive Agency - INEA.

The extension to other fields such as port operations and the logistics chain management has meant that within the context of transport and international trade, maritime navigation should not be thought of as an isolated link and therefore becomes the bridge between two points distant and separated by a large body of water, connecting ports, cities, regions and states with a wide range of actors and parties involved.

To face this complex and interoperable business, procedural and operational chain, human element plays the most important role as never before. Digitization of international trade and transport require of a new generation of staff and the updating of the former generation of professional already active, covering different job positions where decision making processes and the management of large amounts of information are key tools to optimize procedures, reducing time and costs and guaranteeing standards of quality, safety and security.

This document, raises the perspective in terms of training and competence that will involve the deployment of the Sea Traffic Management concept and all the services that have been developed during three years of project in the fields of navigation, port operations, safety, and logistics.

Some interesting and valuable results have been gathered by using a survey methodology considering the existing international education and training rules provided by IMO, ILO, IHO and IALA. A multidisciplinary team, covering all of the aspects of STM project has provided a wide spectrum of opinions and recommendations in order to meet the competences and training that the Maritime Transport will require in the mid and long terms based on the next generation navigation and port strategies, where STM demonstrated services are crucial. The stakeholders, the clusters and the international forums have been also consulted in order to provide suitable solutions promoting the engagement of qualified professionals and staff into the maritime and port industries in the coming years.

The survey employed was divided in five tematic blocks covering the main pillars of STM Validation project:

- New technologies and connectivity
- Ship navigation
- Communications
- European Maritime Simulator Network
- Port CDM
STM sub-activity 5.7 has been defined as a way to know the industry’s training needs for navigating and Non-navigating staff, previously to the future implementation and deployment of the concepts contained in STM validation project. A summary of the most relevant study results are listed below:

**New technologies and connectivity:** One of the most intricate debates when analysing the behaviour of bridge officers in collision avoidance is the VHF communications. In this sense we found two positions after analysing the results:

- Those who consider that the ships must govern according to COLREGs not to the VHF, in the sense that they understand that the rules are precise and therefore any radio-communication between people of different cultures and languages can be ambiguous.
- Those who consider that knowing the intentions of the other vessel in advance is very positive in collision avoidance.

While it is true that on many occasions the courts have criticized the excessive time that bridge officers lose contacting the other ship instead of taking effective measures. We think that if the radio-communication is made in due time we can consider it as a good practice. We must not forget that COLREGs, in its Rule 7, obliges the officer on duty to use all available means on the navigating bridge to assess the risk of collision.

**Ship navigation:** new integrated information systems (ECDIS/AIS/RADAR) should be always understood as "Aids to Navigation" and/or "extra - information provided by technologies in the decision-making at risk situations" by the Duty Officer, as long with his/her knowledge of traditional navigations skills. If not, new techs can be an added stress factor. All the aids to navigation are good, but the new generations of sailors should complement their safety skills with common sense and not just based on new systems.

The use of AIS, VHF and other aids to navigation are increasing by poorly trained ‘white paper’ officers who should not have a white paper certificate.

**Communications:** small crafts can carry a VHF (walkie-talkie or radio system installed) on board and when DSC fault in larger ships it’s good to know that somebody is watching in VHF Ch.16. AIS signals displayed on screens are not such reliable about the real situation, especially in congested areas. They provide more info to the OOW and allows him/her the decision-making advance, but could be a bit confusing if it is understood as the real situation and not a mere Aid to Navigation. By the other hand, satellite communications are useful at open seas where VHF is out of range. Internet access must be cheaper in order to maintain good communication service during the whole voyage or route.

**European Maritime Simulator Network:** even not all of the simulations sessions were completed as covered, the answers reflected the high level of acceptance on the quality improvements of training.
Around 40% of respondents give a score between 4 and 5 and these results express a high acceptance of the professionals from the different simulator centres who are highly qualified and experienced. After participation on some EMSN simulation sessions, we can conclude that this is one of the main successful tools of STM project.

**PortCDM:** A concurrent situational awareness and the means of getting information from all stakeholders in a Port-call heightens the possibility to Just in Time operations. In order to be a Professional actor the stakeholders in the port needs to know the "window of opportunity" from the ship (The "latest possible time" and the physical "earliest time" (of ETA and ETD) that the vessel can Accept from the port and its service providers/actors).
3 Methodology

This task has identified skills/competency gaps affecting organisational performance at three different levels e.g. industry needs - to be industry leaders; company needs - to achieve market share; team needs - to improve teamwork, or individual needs and to increase STM related services, decision making processes and response efficiency. The methodology to collect the required information has consisted of a series of interviews, questionnaires and open discussions with external stakeholders and the project partners, as they also are part of the industry spectrum related with all of the STM concepts.

The work developed has considered the well-designed existing training programs and has contemplated new needs from the outcomes of this study by including the identified skills/competency needs in the STM project for the future training programs specification if required. Some basic definitions and aspects to be covered are:

- professional Development: skills and knowledge attained for both personal development and career advancement
- training Needs Analysis (TNA): also known as a gap needs analysis, identifies skills/competency gaps by isolating the difference in and between current and future skills/competency. This has been achieved by collecting both qualitative and quantitative data for analysis.
- vocational Education Training (VET) and Assessment: formal learning and assessment against units of competency and qualifications from National, Regional and International Training Plans or accredited courses through a Registered Training Organisations.
- workforce skills development: all forms of learning and skills acquisition
- workforce development: bridges the gap between the current workforce and the desired workforce forecast
- workforce planning: analysing workforce profile data and trends; forecasting demand; analysing supply, and undertaking a gap analysis.

This task has been carried out according to the following sub-tasks as part of the methodology:

Subtask 5.7.1 Defining training and competence needs of new STM services for shore operations: ports and voyage management and monitoring.

Subtask 5.7.2 Defining training and competence needs in Port CDM

Subtask 5.7.3 Defining training and competence needs of new STM systems carried on board ships: crew and on board staff, and shipping companies
Subtask 5.7.4 Defining training and competence needs of new STM services to support operational safety and SAR operations: it is referred to the Search and Rescue and Coast Guard organisms.

![Diagram of STM Project Activities](image)

*Figure. 1. Relationship of the different STM Project Activities with the Sub – Activity 5.7. Source - own elaboration*

All the 5.7 sub-activity partners contributed to the questionnaires exchange and data collection during the different activities planned under the STM project. **SASEMAR & Jovellanos Centre** leaded the sub-activity work and enabled the link with the different project activities to get feedback. Activities 1 to three relates the main pillars of STM project in terms of operational issues at navigational, port and simulation providing inputs from land and sea functions and services where training is required. Even some aspects of activities 4, 5 and 6 do not reflect any training dependence, the results from sub-activity 5.7 may be validated by them.
4 Current Situation and State of the Art

With increasingly robust communication networks, sea and ports digitalisation is now a reality, helping to optimise maritime services, safety and world trade including the sustainability of maritime and port industries, in fact, IMO now has a sustainability mission for the world’s oceans, which complements the UN’s own programme for planet Earth. We now live in an era of unprecedented communication choices and sharing of information and experiences opportunities where technology is not a limitation. E-navigation strategy supported by IMO sets new challenges to face within these industries and “despite advances in bridge resource management training, it seems that the majority of watch keeping officers make critical decisions for navigation and collision avoidance in isolation, due to a general reduction in manning3”. The IMO Resolution A.989(25) states a Strategic Plan for the Organization for the period 2008-2013 and recognizes that technological developments have created new opportunities, but may also have negative consequences. New opportunities therefore exist to further develop various IMO initiatives, from safety and security to environmental protection. Developments in communications and information technology will provide opportunities to develop knowledge management to increase transparency and accessibility to information. In this way, the challenge for IMO is to:

- ensure that the technological developments adopted are conducive to enhancing maritime safety, security and protection of the environment, and take into account the need for their global application;
- ensure the proper application of information technology within the Organization and to provide enhanced access to that information for the shipping industry and others; and
- ensure that new equipment for use on board ships is designed and manufactured with the needs, skills and abilities of all users in mind.

However, although e-navigation may be able to face the challenges described above, there is also a need to recognize the role of the practice of good seamanship, the provision of suitable training and the use of procedures.

During the MONALISA 2.0 Project, the training instrument was considered as an important tool to complement the “operational safety” activity. The training was conceived as a part of a series of specific topics related to the concepts studied under the operational safety in ports, at sea and on board ships. The sea traffic management concepts did not cover this issue in ML 2.0 and that’s the reason to include a wider training analysis under the STM project. It is expected that new challenges in maritime transport evolution consider the impact from the staff skills and the training required in parallel to face the human element impact as it continues being the most important

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3 IMO MSC 85/26/Add.1, ANNEX 20 STRATEGY FOR THE DEVELOPMENT AND IMPLEMENTATION OF E-NAVIGATION
factor maritime accidents. If decision-making processes supported by suitable tools on board, at land and in ports are applied, the negative impacts of a maritime incident can reduce the loss of lives, goods and money in the shipping industry. A reduction in the occurrence of accidents may also be reached and the optimisation of the different processes in the supply chain will be gained.

The introduction of the new technologies and the strategies in decision-making processes in the maritime transport and port fields must be faced by means of training. Standardisation of training is a real need because of the global dimension of this industry.

Sea Traffic Management will provide standards in Sea Traffic Management and Port Operations with the adoption of e-navigation components, cloud-based services and collaborative decision making. The challenge of the human element involved is to adapt and introduce the new know-how and knowledge in a proper way. The three aspects of maritime transport – Sea – Ship – Port need to be integrated into different ways. This training approach must be the first step forward and toward to these purposes.

Training, competency, language skills, cultural issues, workload, leadership and motivation are identified as essential by IMO to adopt next generation concepts into the maritime and shipping industries. Such future is the so-called e-navigation. Data and information management is the prominent concern under this concept and staff on board, ashore and within the transport chain will be required to work coordinately. These aspects of e-navigation will have to be taken into account in accordance with IMO’s Human Element work.

According to the IMO Report “IMO adopts e-navigation Strategy for developing an implementation plan”, best practices, training and familiarisation relating to aspects of e-navigation for all users should be effective and established in advance of technical implementation. The use of simulation to establish training needs and assess its effectiveness is endorsed. E-navigation should as far as practical be compatible forwards and backwards and support integration with equipment and systems made mandatory under international and national carriage requirements and performance standards. The highest level of interoperability between e-navigation and external systems should be sought where practicable.

“It has been stated that the major challenge for the implementation of e-Navigation is the human element. ¿How is IMO taking this into account?”

The role of the STW Sub-Committee is very important in developing the e-Navigation strategy and in ensuring that training and the human element considerations are taken into account. It is this Sub-Committee that has the remit to review all aspects of e-Navigation from the human element perspective, including training issues.
Everyone seems to agree that training will be crucial for the safe implementation of new e-Navigation technology. Are the newly implemented Manila Standards for Training and Competences in line with e-Navigation users’ needs?

The Manila amendments were adopted in 2010 and were, therefore, up-to-date at that point. Clearly, training needs relating to e-Navigation need to be considered, which is why the STW Sub-Committee has a key role to play in this work.4

Sea Traffic Management project envisages in many aspects such Strategy and is the starting point for this analysis.

In the port sector International Labour Organization (ILO) rules, the ILO Guidelines on training in the port sector present a competency-based framework for port workers’ training methods and are the first ILO sector specific training guidelines.

Regarding the vessel traffic services (VTS), sea traffic regulations, lighthouses and aids to navigation issues, VTS general training should be conducted in accordance with model courses developed by the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA). Organisations providing VTS training should provide training services within the framework of a training management system which fulfils the requirements of an approved quality system standard. Training institutes must be accredited in accordance with These "IALA Guidelines for the Accreditation of VTS Training Institutes" in order to be approved as an Accredited Training Institute.

Finally, search and rescue and coast guard services, The International Convention on Maritime Search and Rescue (SAR) adopted on 27 April 1979 and that entry into force on 22 June 1985, adopted at a Conference in Hamburg, was aimed at developing an international SAR plan, so that, no matter where an accident occurs, the rescue of persons in distress at sea will be co-ordinated by a SAR organization and, when necessary, by co-operation between neighbouring SAR organizations.

Although the obligation of ships to go to the assistance of vessels in distress was enshrined both in tradition and in international treaties (such as the International Convention for the Safety of Life at Sea (SOLAS), 1974), until the adoption of the SAR Convention, there was no international system covering search and rescue operations.

The technical requirements of the SAR Convention are contained in an Annexe, which was divided into five Chapters. Parties to the Convention are required to ensure that arrangements are made for the provision of adequate SAR services in their coastal waters. Parties are encouraged to enter into SAR agreements with neighbouring States involving the establishment of SAR regions, the pooling of facilities, establishment of common procedures, training and liaison visits.

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4 e-Navigation for Increasing Safety, Hydro International Interviews, Gurpreet Singhota Durk Haarsma, publishing director, Hydro International. - 02/05/2012.
In general terms, next generation maritime industry instruments shall require the updating of skills based on training applying new concepts coming from the application of electronic navigation, maritime cloud and collaborative information exchange, especially in SAR operations.

### 4.1 Competences and training requirements in maritime operations

Training results from the application of a regulation that a staff must have to hold the job position and in which his training is required. For example, in the maritime industry, to work as a deck officer on a ship registered in any recognised Flag State, seafarers must have Marine Safety Skills training or get it no later than six months after being hired.

Generally, employers require workers to have this training before they are hired.

Besides classical competences such as navigation, manoeuvring and cargo handling, the following topics should deserve extra attention within Maritime Education and Training (MET) according to the seafarers:

- general safety competences,
- maritime law and regulation knowledge,
- security skills,
- cross-cultural management and understanding,
- leadership and team management,
- health care and medical first aid,
- decision making and problem-solving,
- general IT and computer competences,
- shipping’s environmental impact and sustainability.

The basic knowledge that Captains, Chief engineers and watch keeping officers and engine officers, should comply with, are exhaustively contemplated in STCW convention, whose main purpose is to promote safety of life and property at sea and the protection of the marine environment by establishing international standards of training, certification and watchkeeping for seafarers. (See also references made in Activity 5.4).

The different skills or competences required by their ranks are contained in the training syllabus also established under this hierarchy. To get those competences, pass under the international certification of the training centres and schools; accepted and respected by the Administrations of the contracting states.

The STCW Convention’s scope of training, covers all aspects considered previously in the MET topics considered in this point, providing different levels of training according to the size and type of the vessel and the role of the seafarer on the ship.

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The STCW Code is organised according to 7 functions and 3 levels of responsibility. The levels of responsibility on board are:

1. Management Level: Master, Chief Mate, Chief/ Second Engineer officer
2. Operational Level: Officer in charge of Navigational or Engineering watch
3. Support Level: Operating under directions of Management or Operational

Additionally to this, there is an exhaustive list of training courses for revalidation purposes to all seafarers in active. In fact, the purpose of the IMO model courses is to assist maritime training institutes and their teaching staff in organizing and introducing new training courses, or in enhancing, updating or supplementing existing training material where the quality and effectiveness of the training courses may thereby be improved. Because educational systems and the cultural backgrounds of trainees in maritime subjects vary considerably from country to country, the model course material is designed to identify the basic entry requirements and trainee target group for each course in universally applicable terms, and the skill necessary to meet the technical intent of IMO conventions and related recommendations.

4.1.1 The challenges of e-navigation within the STM context

E-navigation is the harmonised collection, integration, exchange, presentation and analysis of marine information on board and ashore by electronic means to enhance berth to berth navigation and related services for safety and security at sea and protection of the marine environment.

E-navigation is intended to meet present and future user needs through harmonisation of marine navigation systems and supporting shore services combined and supported by a wide information exchange architecture or maritime cloud. STM Project is a test bed e-navigation project integrating on board, ashore and communications infrastructures interoperability based on information exchange.

There is a clear and compelling need to equip shipboard users and those ashore responsible for the safety of shipping with modern, proven tools that are optimised for good decision making in order to make maritime navigation and communications more reliable and user friendly. The overall goal is to improve safety of navigation, to reduce errors, and to optimise shore services by synchronizing ships operations with port operations and services. However, if current technological advances continue without proper coordination there is a risk that the future development of marine navigation systems will be hampered through a lack of standardisation on board and ashore, incompatibility between vessels and an increased and unnecessary level of complexity.

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6 STCW/CONF 2/34, Resolution 2, Annex Part A, Section A-I/1
Many researches and studies indicate that around 60 per cent of collisions and groundings are caused by direct human error. Despite advances in bridge resource management training, it seems that the majority of watch keeping officers make critical decisions for navigation and collision avoidance in isolation, due to a general reduction in manning.

In human reliability analysis terms, the presence of someone checking the decision-making process improves reliability by a factor of 10. If e-navigation could assist in improving this aspect, both by well-designed on board systems and closer cooperation with vessel traffic management (VTM) instruments and systems, risk of collisions and grounding and their inherent liabilities could be dramatically reduced.

However, although e-navigation may be able to improve the situations described above, there is also a need to recognise the role of the practice of good seamanship, the provision of suitable training and the use of procedures.

The vision of e-navigation within the context of STM project is embedded in the following general expectations for the on board, ashore and communications infrastructures elements:

- on-board: Navigation systems that benefit from the integration of own ship sensors, supporting information, a standard user interface, and a comprehensive system for managing guard zones and alerts. Core elements of such a system will include, actively engaging the mariner in the process of navigation to carry out his/her duties in a most efficient manner, while preventing distraction and overburdening;
- ashore: The management of vessel traffic and related services from ashore enhanced through better provision, coordination, and exchange of comprehensive data in formats that will be more easily understood and utilised by shore-based operators in support of vessel safety and efficiency; and
- communications infrastructures: An infrastructure providing authorised seamless information transfer on board ship, between ships, between ship and shore and between shore authorities and other parties with many related benefits.
4.1.2 Training as a strategy to face the challenges of e-navigation

E-navigation is a major IMO initiative to harmonize and enhance navigation systems and is expected to have a significant impact on the future of marine navigation. The IMO has mandated that this initiative be led by user needs.

New opportunities therefore exist to further develop various IMO initiatives, from safety and security to environmental protection. Developments in communications and information technology will provide opportunities to develop knowledge management so as to increase transparency and accessibility to information. STM Project is aligned with this statement and follows the challenges for IMO which are to:

- ensure that the technological developments adopted are conducive to enhancing maritime safety, security and protection of the environment, and take into account the need for their global application;
- ensure the proper application of information technology within the Organisation and to provide enhanced access to that information for the shipping industry and others; and
- ensure that new equipment for use on board ships is designed and manufactured with the needs, skills and abilities of all users in mind.

After IMO has assessed the user needs, functions and system architecture of e-navigation, --and expecting the future development, one may predict a variety of scenarios for the personnel on board and for skills, competencies, qualifications and training needs. To illustrate the wide spectrum of possible e-navigation related developments, the two following scenarios may be of special relevance:

- The navigating navigator
  This is a scenario where the monitoring equipment is kept relatively traditional on board and ashore. The navigators' own skills will still be essential to the safe navigation of the ship, and the bridge team will be the main backup to the safe functioning of the ship. This will have to be reflected in the principles of the training and certificates required, – which should combine de facto skills and competences with the formal documentation of having fulfilled authorized training programmes. "There is, however, also a question of whether one should emphasize assessment of the de facto skills and competences, or alternatively if assessment should include a more formal documentation of having fulfilled authorized training programmes.

- The monitoring navigator"
  In this scenario the data solutions and monitoring equipment are much more sophisticated. The navigator will have to rely more heavily on automated processes, standardized and harmonized procedures and equipment. Data structures, displays and services will have to be interoperable. A main task will be to monitor the system displays and the indicators of the system's health or resilience. This scenario will include an even closer cooperation with

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8 COMSAR 15/11 3 December 2010. DEVELOPMENT OF AN E-NAVIGATION STRATEGY IMPLEMENTATION PLAN. Report of the Correspondence Group on e-navigation, Submitted by Norway
organizations ashore to assist a safe voyage from berth to berth. A consequence of this scenario is that “the required competence of the seafaring professional could be affected, and there would be implications for the development of the training, education and required competencies for seafarer certificates”.

An important question in this relation might be how the navigating navigator and the monitoring navigator scenarios would influence the user needs on communications.

4.1.3 Current courses and certificates aligned with e-navigation

There are a number of training courses on offer, which utilise ‘e-Navigation’ as a hidden term because of its application on new generation bridges, aids to navigation and communications, and provide training under this umbrella term. The following list provides an overview of the landscape of the courses on offer under the term of e-navigation:

4.1.3.1 IMO Model Courses

The review of e-navigation training provision begins with a review of the IMO model courses. The IMO is a specialised agency of the United Nations organisation specifically addressing Maritime safety, security and protection of the marine environment. The organisation addresses training needs of seafarers via the STCW (1974, as amended) (Standards of Training Certification and Watch Keeping) convention.

The IMO has no model training courses specifically pertaining to e-navigation for seafarers. The IMO model courses address operation of individual stand-alone equipment like radar (IMO model course 1.07), AIS (IMO model course 1.34), ECDIS (IMO model course 1.27) etc. The courses that come close to/or are related to e-navigation are:

- 1.32 IMO Model Course: Operation Use of Integrated Bridge Systems
- 1.27 IMO Model Course: Operation use of ECDIS
- 1.22 IMO Model Course: Ship Simulator and Bridge Team Work

IMO has propounded the e-navigation strategy for consideration in the Maritime domain, however the IMO has no training in place related to e-navigation for seafarers. IMO only caters to seafarers as end-users and other stakeholders in the e-navigation strategy like the VTS operators are not addressed by the IMO but by IALA-AISM.

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9 ACCSEAS Training Needs Analysis Report. Review of the Present Situation and Approach to Training Needs Analysis. Project supported by the INTERREG IVB North Sea Region Programme
4.1.3.2 IALA-AISM Model Courses

International Association of Lighthouse Authorities (IALA) is a non-profit organisation that is primarily concerned with training and capacity building, particularly for the VTS operators, who are a key shore based stakeholder in the e-navigation strategy.

The only model course pertaining to e-navigation is the one put forth by IALA-AISM. The course is an introduction to e-navigation and as of now is not being provided by any training provider. For the full course details, see appendix.

- L1.4 Introduction to e-navigation
  - duration – 6 hours/1 day
  - modules – 5
    - module 1 – The background to e-navigation; inception, adoption and development of concept
    - module 2 – Electronic nautical charts and ECDIS; importance of valid electronic chart data to support e-navigation
    - module 3 – Position navigation and timing; uninterrupted determination of position, navigation and coordinated time is essential to the navigation
    - module 4 – Communications and AIS; communication systems necessary to support e-navigation
    - module 5 – Information systems; existing and developing information systems designed to improve the flow of information between ship to shore, ship to ship and shore to ship.

This course is for aids to navigation managers to introduce the concept of e-navigation to this group. This course is not for frontline providers of navigation services who are the VTS operators.

4.1.3.3 USCG Approved Courses

The review of training regimes pertaining to e-navigation include courses offered in different countries including the United States of America (USA). In the US, the United States Coast Guard (USCG) is the responsible government organisation addressing maritime training requirements.

The USCG lists courses on Bridge Resource Management (BRM) and ECDIS and electronic navigation. The search revealed that the USCG lists and approves a limited number of courses titled electronic navigation, which is in addition to the ECDIS courses on offer.

A review of select Electronic Navigation courses approved by USCG, follows.

- course name – Electronic Navigation – OICNW
duration – 40 hours
end user – Officer in Charge of a Navigational Watch
content – covers theory and practical use of electronic navigational aids. Possible errors and limitations are identified including methods for resolving position ambiguity. Content includes basic principles, GPS, echo sounders, speed logs, Loran C, radio direction finders, radar navigation, ECDIS, navigation software.
• course name – Electronic Navigation  
duration – 40 hours  
end user – Officer in Charge of a Navigational Watch  
course objectives – ability to use ECDIS for navigational watch, operate ECDIS equipment, use its navigational functions, select and assess relevant information and take appropriate action. Possess knowledge of electronic charts and legal aspects related to use of ECDIS. Further objectives include the planning and conduct of passage and determining position. The course is designed to meet the requirements of electronic navigation. The course provides basic theory and use of ECDIS and understand its potential as aid to navigation and increased situational awareness in real navigational environment.

• course name – Voyage Planning and Electronic Navigation (VPEN)  
duration – 35 hours (5 days)  
end user – Officer in Charge of a Navigational Watch (experience in Maritime navigation)  
course objectives – to provide knowledge, understanding and proficiency in appraising and planning a voyage and using bridge electronics like GPS, gyro compass and autopilot in the voyage plan. Practical knowledge emphasised in magnetic and gyro compasses, Mercator and great circle sailings, GPS, stewarding and control systems, integrated bridge systems, voyage planning and navigation.

• course name – Voyage Planning and Electronic Navigation (CMM-VPEN)  
duration – 5 days  
end user – 3rd and/or 2nd Mate upgrading to Chief Mate/Master  
course content – great circle and Mercator sailing, tidal calculations, ocean routing, voyage planning, GPS, DGPS, magnetic compass, gyro compass, adaptive autopilots and integrated bridge systems.

4.1.3.4 E-navigation training provision in other countries
The review of e-Navigation training provision involved review of training regimes in other countries like the United Kingdom (UK) and a developing country such as India. The UK has no course pertaining to e-Navigation but has an approved list of providers for the ECDIS course.

UK, MCA approved ECDIS courses range from 1 day to 5 days –

- ECDIS generic training – 40 hours (4-5 days)  
- ECDIS type specific training – 8 hours  
- ECDIS on-board familiarisation – 1 day  
- ECDIS management – 16 hours (2 days)  

Courses on Bridge Team Management (BTM) and Bridge Resource Management (BRM) are provided by private training providers in the UK, however the courses are not approved by the MCA.
In India, the Directorate General of Shipping, under the Ministry of Shipping addresses seafarers’ training and certification. DG, Shipping, India approves ECDIS courses but private training providers also provide Bridge Team Management and Bridge Resource Management Training as required.

In India, a private training provider like the Anglo Eastern Training Academy, provides DG, Shipping approved ECDIS courses where it is conveyed that the ECDIS is the focal point of the Integrated Navigation System.

An overview of one such course is provided below:

Course name – ECDIS
Duration – 5 days
End user – Masters, Deck Officers, Deck Cadets and Pilots
Course content:

- legal requirement for the carriage of ECDIS and backup systems
- structure of ECDIS and ENC
- performance standards for ECDIS (IMO Resolution 817 (19) including revised performance standards for ECDIS, MSC 232 (82) adopted on 5/12/2006
- revision of SOLAS Chapter V
- setting of ECDIS and back-up ECDIS
- principle type of electronic charts – vectorised, raster, S57 vectorised
- formats used for the database S57/S52
- descriptions of the projections used for ENC
- ECDIS as the focal component of an Integrated Navigation System
- raster charts – limitations and comparisons
- updating ENC methods – automatic loading, semi-automatic and manual corrections
- possible errors in displayed data
- input sensors to ECDIS
- radar and ARPA interface and overlay
- AIS targets display and information
- passage planning and logbook function
- SAR operation
- additional database information such as tidal streams, true wind and weather overlay
- recording and playback of voyages performed on ECDIS
- dangers of over reliance on electronic systems
- course provider – Anglo Eastern Maritime Training Centre
4.2 New fuels in shipping industry and their impact in firefighting – the case of LNG – Results from PICASSO Project\textsuperscript{10}

PICASSO is a European Project whose overall goal is to achieve a modern and developed maritime sector with a capable and up-to-date workforce that enables the sector to become greener, safer and more efficient seas and navigation.

During the Picasso project, the need to deliver a voluntary supplement to the IMO/STCW standard was detected, focusing on how to behave, respond and communicate (in emergency situation occurring in port) to the ship’s crew, the port personnel and the other shore-based agencies involved in a 2025 scenario where non-ordinary operations will take place - e.g. LNG refuelling - and the ship-shore high degree of connectivity will be a consolidated reality.

4.2.1 Introduction to Marine firefighting & LNG emergencies

A fire on board a ship is the worst nightmare of a seafarer; the vessel’s own crew is well trained to control the emergency, but if they were not able to extinguish that fire and rescue the casualties, external assistance (land-based firefighters) would be required.

The use of LNG as fuel in the maritime industry has a great future due to recent restrictions imposed by the IMO (MARPOL ANNEX VI) in the control of emissions and air pollution from ships.

LNG is basically a safe fuel but the knowledge and awareness of its dangers is critical.

4.2.2 Purpose of Firefighting and LNG Training

Apart from northern European fire brigades which join forces in a specialized Maritime Incident Response Group (MIRG-EU, Baltic sea MIRG), other rescue teams lack standardized procedures and training for marine firefighting, resulting untrained firemen for this purpose.

Due to the significant increase in the movement of passengers by sea and the recent fires on vessels, the importance of this training has been considered.

4.2.3 Training Contents

The training contents covers the general syllabus, the training topics the training delivery and the course plan and the methods for provide evaluation and qualifications. In many cases it is also recommended to provide the schedule according to the hours or courses duration following the IMO model courses guidelines.

\textsuperscript{10} PICASSO Project - 2015-EU-TM-0108-S under CEF Call 2015. Preventing incident and accident by safer ships on the oceans
4.2.3.1 General syllabus

The methodology of the course is based on the teaching-learning procedure.

The great value of this course was the practical part, which had previously been explained in the classroom during the theoretical part.

We have divided the training into four modules:

**Firefighting module**

The aim is to provide firefighters with knowledge and skills to act in case of fire in a distressed vessel that is moored alongside in a harbour or that is anchored or sailing through waters.

**LNG module**

The aim is to provide firefighters with knowledge on the properties of LNG and special risks associated with this fuel in potentially predictable scenarios, as well as the technical options and tactics to mitigate any incident.

**Sea survival**

The aim is to provide firefighters knowledge of the actions to be taken in case of abandoning a damaged ship and also the access techniques that should be used to transfer personnel and equipment to the distressed ship if that is necessary.

**HUET module**

The aim is to provide firefighters with knowledge and skills and with the safe working practices appropriate to the aircraft being used. They must practice helicopter winching in a realistic scenario and know and practice the actions to be taken in preparation for a helicopter ditching and emergency landing using Emergency Breathing Systems (EBS).

**Special operations at sea with firefighters**

The aim of this module is to enhance and practice the maritime communication between firefighters and the rest of parties involved (distressed ship, Rescue Coordinator Center).

Special Operations at sea with firefighters can be carried out with the support of powerful salvage tugboats.
4.2.3.2 Training topics

- Sea Survival. Lifesaving appliances.
- Rescue boat embarkation operations and procedures in the water.
- The role of the shore-based firefighting services.
- The fire control plan on board vessel.
- The ship stability.
- The firefighting system onboard ship.
- Maritime Communications. Technical English for port firefighters.
- VHF communication during the approach to the vessel on fire.
- Communications between the fire-fighting team leader and the Master after embarking the vessel on fire.
- Safety and fire plan (IMO signs).
- Salvage tugs Operations.
- Heli-borne operations. Material and personnel transfer to the distressed vessel.
- Firefighting techniques and tactics in various parts of the ship.
- Dangerous Goods Emergency Response.
- LNG fires control using water, foam and dry chemical powder.
- Types of incidents involving LNG.
- LNG characteristics and LPG comparison.
- Helicopter travel; the procedures and requirements for pre-boarding, safe boarding, in-flight and safe disembarkation.
- Helicopter emergencies: In flight procedures, aircraft escape routes for ditching and emergency landing.
- Actions in preparation for a helicopter ditching and emergency landing.
- Emergency equipment onboard the helicopter.
- Stowage location of helicopter life-raft.
- Deploying, operating and breathing from the Emergency Breathing System (EBS).
- Dry evacuation, escaping through a window opening which is under water from a capsized helicopter (with/without deploying EBS system)

4.2.3.3 Training delivery and management plan

Methods for the Course Delivery:

Theoretical part – classroom (15 hours)

Practical part – fire-ground, swimming-pool, HUET simulator (20 hours)

Course intake limitations:

The maximum number of trainees will be 16 in order to allow to each trainee to take part of each hands-on exercise.
The HUET simulator has a limitation of 8 trainees, that’s why with a group of 16 delegates must be separated into two groups during the HUET and Sea Survival training sessions.

4.2.3.4 **Trainers’ qualifications**

The instructor in charge should:

- hold a nautical Degree/Master.
- have underway experience as seaman.
- be especially skilled with fire-fighting equipment

4.3 **Competences and training requirements in port operations**

In the port sector, the regulations rely on the International Labour Organization (ILO) guidelines. In 2009, the Sectoral Activities Department of the ILO embarked on work to develop guidelines on training in the port sector with the aim of providing a framework for port worker training to meet the following objectives:

- protecting and promoting health and safety in ports;
- improving the skills of port workers and enhancing their professional status and welfare;
- securing the greatest possible social and economic advantages from advanced methods of cargo handling and other port operations;
- improving cargo handling efficiency and enhancing the quality of service to port clients; and
- protecting the natural environment in and around the port area, and promoting decent work and sustainable jobs in ports.

An informal Working Group of experts was established to assist ILO in the development of an initial draft of the guidelines. The Group was comprised of (port) employer representatives (the International Association of Ports & Harbours, IAPH), (dock) worker representatives (the International Transport Workers’ Federation, ITF) and government representatives, as well as international shipping lines, national and global port operators, port training institutes, the International Maritime Organization (IMO), World Bank, European Commission (EC), the International Safety Panel (ICHCA International Ltd), and several individual experts.

ILO also commissioned an international assessment of training in the port sector to provide a background and overview of ILO instruments and different models of training, and to outline a framework for the implementation of training in ports.

The Tripartite Meeting of Experts for the Review and Adoption of the ILO Guidelines on Training in the Port Sector, held in Geneva from 21–25 November 2011, reviewed and adopted the Guidelines as amended. The Meeting was composed of five

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Government experts (Argentina, Finland, Jordan, Papua New Guinea and Senegal), five Employer experts and five Worker experts nominated by the Employers’ group and Workers’ group of the Governing Body respectively, as well as observers from five other governments and a number of intergovernmental and nongovernmental organizations. The publication of the Guidelines was authorized by the Governing Body at its 313th session.

The ILO Guidelines on training in the port sector present a competency-based framework for portworker training methods and are the first ILO sector specific training guidelines.

At the same time, it is clear that in ports around the world there is now a demand for significant change in skills development. Port work has been transformed in recent years by a combination of the growth in world trade; containerization and other mechanized forms of cargo handling, the introduction of new information and communication technologies (ICT) to direct and track the movement of goods throughout the transport chain; the vertical integration of transport companies offering a “door-to-door” service to clients; and the increasing concentration of port activities under the control of just a handful of global terminal operators (GTOs). Interoperability among the different actors coming to port, i.e., shipping companies, freight forwarders, shipping agents, customs authorities, traders, etc. requires an intensive use of technology. STM project and its Port CDM instrument add the concepts of synchronization and inter-connected ports, so current staff must be prepared for the future changes in the port operations beyond the own port boundaries and where interoperability and synchronization are the key concepts to reach efficiency and optimisation.

The ILO Guidelines are presented in three main sections as follows:

4.3.1 Section 1. Background

The opening paragraphs of this section set out the objectives of training in general, and portworker training in particular, according to fundamental principles and values accepted by the ILO. The section includes the ILO’s preferred approach to competency (see table 1) and introduces a specific model for competency- based training in the port sector (see Figure 2). The model is briefly explained as a prelude to a more detailed exposition in the two subsequent sections that focus on the principles and practice of competency-based training for portworkers.
### Table 1. Dimensions of competence – Source: ILO guidelines on training in the port sector

<table>
<thead>
<tr>
<th>Functional/behavioural approach</th>
<th>Multidimensional approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passive employees (orientated towards the demonstration of prescribed competencies)</td>
<td>Active employees (involved in constructing knowledge)</td>
</tr>
<tr>
<td>Particular skills necessary to perform specific tasks as specified by employers</td>
<td>The ability to deal with complex work situations, drawing on multiple resources that the employee brings to the workplace</td>
</tr>
<tr>
<td>Emphasis on context-bound, practical (tacit) knowledge</td>
<td>Combines practical (tacit) knowledge and context-free, theoretical (explicit) knowledge</td>
</tr>
<tr>
<td>Prescribed outcomes – “competence” is the person’s ability to demonstrate performance to the standards required</td>
<td>“Competence” is a holistic notion, relating to the whole person and including different dimensions such as occupational, personal and interpersonal (“shared understanding”)</td>
</tr>
<tr>
<td>“One best way”</td>
<td>Potentially different ways to perform any given work task</td>
</tr>
<tr>
<td>Binary assessment (competent or not yet competent)</td>
<td>Graded assessment (e.g. exceptional, highly competent, effective, less than effective)</td>
</tr>
<tr>
<td>Individual competence – “possessed” by the individual</td>
<td>Organizational competence – the interaction of individual, group, managerial and technological systems</td>
</tr>
<tr>
<td>Limited transferability (across workplaces in the same industry)</td>
<td>More extensive transferability (across workplaces in the same and cognate industries)</td>
</tr>
<tr>
<td>Employer-led</td>
<td>Consultation, negotiation and agreement of competencies by the social partners</td>
</tr>
<tr>
<td>Workplace/enterprise orientation</td>
<td>Occupational/industry orientation</td>
</tr>
</tbody>
</table>

Source: Based on J. Winterton, F. Delamare-Le Deest and E. Stringfellow: *Typology of knowledge, skills and competencies: Clarification of the concept and prototype*. CEDEFOP Project No. RP/B/BS/Credit Transfer/005/004 (Thessaloniki, SEDEFOP, 2006).
4.3.2 Section 2. Competency-based training

In a supportive environment This section provides an overview of competency-based training and the environment in which port-worker training takes place.

Its purpose is to introduce the reader to the various elements constituting a competency-based training system for port-workers, which can be set within a national qualifications framework that facilitates extension (breadth of acquired competencies) and progression (to higher level skills and qualifications), as well as labour mobility within and between firms. The national qualifications framework is just one element of the wider environment in which port-worker training can be developed within any given country. Another important element, which is integral to the work of the ILO, is social dialogue. Countries that have a greater number of cooperative or consensual systems of industrial relations tend to have more – and a higher quality of dialogue – on training between the social partners than those who do not.

Vocational education and training (VET) requires a cooperative approach among a variety of different stakeholders, including employers, unions, educational authorities, training institutions and the like. Social dialogue provides a solid foundation for such cooperation.

In everyday language, section 2 considers “what to do” when it comes to port-worker training, and “what is needed to do it”.
Competency-based training is evidently not the only approach to port-worker training. In fact, there are several examples around the world of extremely successful port-worker training programmes based on very different approaches, one of the most notable being one in which new recruits to a port labour pool are trained in a broad range of manual and mechanical skills or the handling of different types of cargo. Increasingly, however, ports and other industrial sectors have found that an “output-based” approach (proven and displayed competencies) is more effective than “input-based” (time served) approaches to education and training. Competency standards identify key roles that the worker is expected to perform, which are then broken down into a number of “units of competence”; these are then further subdivided into “elements of competence”. For each element, “performance criteria” are defined which form the basis of assessment, with “range statements” provided for guidance (i.e. the relevant work settings where the defined tasks need to be performed). These are the building blocks of a competency-based training system for port-workers.

4.3.3 Section 3. Port-worker training
The model for port-worker training, which is detailed in this section, follows a sequential process or cycle that starts with competency profiling; identifies any gaps between the competencies required and the competency profile of the workforce; and develops individual learning plans to close the gap through a systematic process of training, subject to appropriate assessment and accreditation (see Figure 3). Details are provided in this section of each step in this process. At the heart of the cycle is the training policy, an explicit statement of intent that may be part of a national (government-inspired) policy on training, either in alignment with cross-sector VET policy in general or ports policy in particular. If no such national policy on training exists, or if it is deemed too general for the port sector, then the industry and/or individual ports/operators are advised to develop their own policy to set out the commitment of different stakeholders to training, with appropriate rules and regulations to facilitate the universal objectives of safe and efficient port operations that provide a timely, cost-effective and high-quality service for all port users.
The emphasis in section 3, in everyday language, is on “how to do it”, with each step in the training cycle clearly described. The training model presented in this section is based on recognized “good practice”, including the ILO’s own PDP. Good practice demands a clear statement of intent. Whereas laws can compel or prohibit certain behaviours, a policy statement merely guides action towards the most desirable outcome – in this instance, towards a safe and healthy work environment; higher level and widely recognized skills; efficient port operations; the effective utilization of new technologies; and the ability to meet the needs of customers, protect the environment and ensure decent work and sustainable employment. In the past, a major problem in the sector was found to be “the lack of specific training policies set by management to improve port services and encourage a more client-oriented approach in port operations”.1 “What to do” starts with the policy cycle – a tool used to analyse the development of a policy item, in this instance port-worker training – but it does not denote what is actually done. As a statement of intent, port training policy merely guides the actions of the relevant parties. These actions are depicted in Figure 3 as a “training cycle”, which is described in some detail in section 3.

The Guidelines conclude with a very brief summary that calls for ports around the world to invest in (competency-based) training that will raise safety and health standards, improve the efficiency of cargo handling operations, enhance customer service, and create sustainable, high-quality jobs for current and future generations of port-workers.
4.3.4 A supportive environment for competency-based training

At the micro level (i.e. enterprise or port level), competency-based training might be viewed as a purely “job-specific” system of training and development, whereby the employer undertakes a detailed job analysis and identifies the necessary (technical) competencies to perform the tasks in hand. However, an effective system of competency-based training involves much more than this. For example, in addition to the technical or “hard skills” required to perform a job in a competent manner – as defined in terms of various performance outcomes, including safety and health – the worker is usually expected to exercise initiative and judgement during any unusual or unexpected operating conditions (e.g. adverse weather, damage to cargo or equipment, early/late arrival of vessels or trucking delays). In many instances, broader employability skills are necessary, such as communications, team working, problem solving, self-management, capacity to learn and the increasing use of (digital) technology. These are skills that can be transferred across jobs, and indeed across industries, especially when they are based on prior learning. As a result, these skills are often provided by the State (via general education) or collectively by employers in a specific sector (e.g. via jointly funded training institutions or the sponsorship of appropriate educational programmes in the general education system). Yet increasingly, these skills also feature in company-specific training programmes, as employers recognize their value in a changing world of work and employees appreciate their contribution to lifelong learning. Tallying cargo, for example, now demands IT skills in many ports. Communication between port-workers is no longer a conversation between gang members in a ship’s hold, or a loud shout to warn of impending danger, but interaction via radio and information displayed on a computer screen.

The full commitment of management and the trainee is an essential condition for the success of skills development programmes. In such programmes, three distinct but interrelated levels can be considered, namely the macro (economy), meso (industry) and micro (company) levels. Competency-based training will be more effective where it is supported at these different levels, as summarized in table 2.
### Table 2. Levels of support for competency-based training – Source: ILO guidelines on training in the port sector

<table>
<thead>
<tr>
<th>Macro (economy) level</th>
<th>Meso (industry) level</th>
<th>Micro (company) level</th>
</tr>
</thead>
<tbody>
<tr>
<td>• tripartite social dialogue</td>
<td></td>
<td></td>
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<tr>
<td>• government commitment to training and development</td>
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<tr>
<td>• a well-established national VET system</td>
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<tr>
<td>• a national qualifications system/framework</td>
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<tr>
<td>• nationally recognized and funded training organizations</td>
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<td></td>
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<tr>
<td>• a recognized system of certification and assessment</td>
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<tr>
<td>• a quality assurance system</td>
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<tr>
<td>• tripartite and/or bipartite social dialogue and engagement with other stakeholders (e.g. port users)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• specialist training schools/organizations jointly funded by employers and/or the State and managed with the participation of the social partners</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• trainers with industry experience and appropriate pedagogic skills</td>
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<td></td>
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<tr>
<td>• opportunities for work-based and work-like training</td>
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<td></td>
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<tr>
<td>• recognized occupational job categories and associated training requirements</td>
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<tr>
<td>• adequate training resources (e.g. training facilities, professionally qualified trainers, detailed training materials, time off for workers to undertake training)</td>
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<td></td>
</tr>
<tr>
<td>• a recognized system of certification and assessment for the port sector and associated (maritime and logistics) industries</td>
<td></td>
<td></td>
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<tr>
<td>• bipartite social dialogue</td>
<td></td>
<td></td>
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<tr>
<td>• a human resource management system in which training plays a specific and clearly defined role</td>
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<td></td>
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<tr>
<td>• human resource planning and development to identify future training requirements for the organization as a whole and individual workers</td>
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<td></td>
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<tr>
<td>• detailed job analysis</td>
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<tr>
<td>• training records that systematically document the employees’ current knowledge, skills and attitudes</td>
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<td></td>
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<tr>
<td>• opportunities for on-the-job training</td>
<td></td>
<td></td>
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<tr>
<td>• paid leave for appropriate training</td>
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<tr>
<td>• well-developed, high-quality training materials, which might be company-based, provided by national/industry training organizations, or international bodies (e.g. the ILO’s PDP)</td>
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<td></td>
</tr>
<tr>
<td>• access to both workplace facilities for practical training and classrooms for theoretical training</td>
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<tr>
<td>• access to advanced training aids (e.g. IT facilities and crane simulators)</td>
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<td></td>
</tr>
<tr>
<td>• mentoring and appraisal to support past, current and future training needs</td>
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</tr>
</tbody>
</table>

### 4.3.5 Competency-based training

The ability to operationalize knowledge and develop skills is a prerequisite for developing competence, along with other social and attitudinal factors. These elements constitute the widely used KSA framework of the training profession derived from Benjamin Bloom’s “taxonomy of learning”. In this taxonomy, there are three domains of learning:

1. The cognitive domain (mental skills) refers to knowledge structures that can be viewed as a sequence of the progressive contextualization of material (knowledge → comprehension → application → analysis → synthesis → evaluation).
2. The psychomotor domain (manual or physical skills) relates to physical movement, coordination and the use of the motor skills area, with progression demanding practice and patience (imitation → manipulation → precision → articulation → naturalization).
3. The affective domain (growth in feelings or emotional areas) includes the manner in which we deal emotionally with situations and people, ranging from mere awareness to the internalization of values (receiving → responding → valuing → organizing → internalizing).
4.3.6 Port training policy
As a statement of intent by the organization, training policies are typically set out in an official document signed by senior managers with executive powers, not only to legitimize the policy but also to signify its central importance to the organization’s success. People are, after all, the organization’s most valuable asset. In general, policy statements tend to follow a standard format as detailed below, often prefaced by the “background” or “motivating factors”:

- purpose – why the organization is issuing the policy, as well as the policy’s desired effect or outcomes;
- applicability and scope – who the policy affects and which actions are impacted by it (e.g. workers who are expressly included/excluded or actions/activities outside the policy);
- effective dates – when the policy comes into force and is due to be renewed; and
- responsibilities, regulations and requirements – which parties and organizations are responsible for carrying out individual policy statements (e.g. identification of any relevant oversight and/or governance structures).

A typical (port) training policy will therefore start by recognizing the contribution of employees to the organization’s success, as well as the need for highly skilled (port) workers.

4.3.7 A generic port training policy
“[Port/company name] recognizes the contribution employees make to its ongoing success and is committed to making the most effective use of the talents, skills and abilities of its workforce. The port/company is committed to delivering high-quality and cost-effective services through its people, who will receive appropriate training in order to undertake their duties safely, efficiently, and without risk to themselves or others.

The purpose of training is to equip all staff with the necessary skills, knowledge and attitudes to meet the objectives of the organization, the needs of the customer, and the employees’ own personal development goals.”

The applicability and scope of the training policy will usually express a commitment to equal opportunities and may therefore include a statement along the following lines:

“[Port/company name] will provide opportunities for training based on operational requirements and employees’ development needs, irrespective of the employee’s gender, age, marital status, disability, race, religion, colour, ethnic or national origin or sexual orientation.”
4.3.8 Certification

Only qualified assessors should be allowed to perform practical assessments. All training providers – both institutions and individuals – should be accredited by the relevant organization or education and training quality assurance body. For qualifications to achieve widespread recognition in the labour market, assessment – and especially accreditation – will normally be performed in accordance with national guidelines.

On completion of the training cycle, port-workers should be issued with a recognized qualification (e.g. certificate of competence), and their personnel files updated accordingly.

4.3.9 Example of information recorded on port sector certificates for port-worker qualification

- name and logo of the accredited provider or authorized body;
- address of accredited provider;
- identification number of provider;
- certificate identification or serial number;
- identification of any relevant acts and regulations;
- surname and initials of operator or staff;
- identification number of operator or staff;
- systems, lifting machine code, code description of equipment, attachments and capacity, etc.;
- restrictions of operation/function;
- registration number of facilitator and assessor;
- UoC (units of competency) number and credit value;
- date of issue and expiry date (if applicable); and
- authorizing signatures.

At organizational and management level, training and certification process of staff depends on the job position, the skills and competence requirements are related to the specific high level education, vocational education or specific graduate programmes for the function to be carried out. The enrolment of staff is part of the contracting policy of the port authority. In this way, the ports sector is diverse, embracing a wide range of activities that are critical to many parts of the economy of a city, region or State. Ports are part of the vital transport networks, which support domestic and international trade. They also embrace fishing, passenger, leisure, car ferry operations and support for the offshore industry as well as the provision of coastal defences, conservation and environmental services. In total, around 90% of the Europe’s international trade by volume moves through them.

Ports and harbours employ a range of specialist people to ensure that they operate efficiently.

For example:

Harbour Masters, marine pilots, operators of vessel traffic services and other marine personnel are employed to ensure the safe navigation of ships in harbour waters and the safety of those engaged in other activities such as fishing, yachting and leisure water sports.
Port operators are engaged to ensure that freight is moved efficiently from a ship moored at the quayside directly to a road vehicle or train for onward transportation, or to a warehouse or holding area for temporary storage. Port operatives are sometimes required to operate large items of mobile and fixed lifting plant and other vehicles, such as forklift trucks and mobile cranes.

People are also employed in passenger operations helping to ensure that customers of ferry services or cruise liners pass through the port in a safe and efficient manner whilst maintaining a high level of customer service. Passenger facilities at ports can be similar to those at airports, providing catering and other recreational services for passengers waiting to board the ship.

Engineers are employed to ensure that plant, vehicles, boats and infrastructure are safe, secure, well maintained, repaired or expanded when necessary. There are mechanical, electrical, systems and civil engineers working in ports on a wide range of specialist equipment and structures.

Other people are employed in ports and harbours in work that is common to other industries. For example, in administration, finance, ICT, port security and personnel related roles.

4.4 Competences and training requirements in sea traffic and vessel traffic services

There is no international IMO instrument for MRCC/VTS training, as the one in force for seafarers (STCW Convention and Code).

Nevertheless, Resolution 10 of STCW-95 deals with the training of maritime pilots, vessel traffic services personnel and maritime personnel employed on mobile offshore units.

In 1993 the International Association of Marine Aids to Navigation & Lighthouse Authorities (IALA) developed the IALA Vessel Traffic Services Manual to provide guidance and assistance to administrations and authorities considering the implementation of new VTS or upgrading existing ones. The Manual remained the primary document on VTS until 1995 when the Conference of Parties to the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers 1978, as amended, (STCW Convention) recognised the important contribution of other professionals towards maintaining the safety of life at sea, safety and efficiency of navigation and the protection of the marine environment. Resolution 10 of the Convention called for international provisions to be drawn up for the training of maritime pilots and VTS personnel. In response, IALA embarked on the development of recommendations for the training and certification of VTS personnel and the associated training courses.
IALA recommendation R0103(V-103) about standards for training and certification of VTS personnel states that, International shipping operations need a common approach and universally agreed professional standards and competence for the delivery of Vessel Traffic Services (VTS). The successful delivery of such services depends upon competent and experienced personnel to discharge the responsibilities of a VTS Authority. Recognising that VTS personnel are members of a profession whose principle interaction is with mariners and maritime pilots for the safe management of maritime traffic, their competence needs to reflect that professional responsibility.

The recruitment, selection and training of suitable personnel is a pre-requisite to the provision of professionally qualified personnel capable of contributing to safe and efficient marine operations. Such personnel will help to ensure that full and due regard is given to the diverse tasks inherent in VTS activities.

This Recommendation sets out the training requirements and certification standards for VTS personnel. These should be implemented by National Members and other appropriate Authorities to ensure that uniform standards of procedures, practices and professional standards are applied by Vessel Traffic Services world-wide.

Competent and / or VTS authorities are encouraged to adopt this Recommendation together with the associated model courses as the basis for mandatory training in a manner consistent with their domestic legal framework.

The objectives of this Recommendation are to provide a basis:

- for Model Courses to establish a training programme on the specific knowledge, skills and attitude requirements necessary to qualify VTS personnel;
- for VTS Authorities when recruiting VTS personnel;
- for Model Courses to establish a training programme on the specific knowledge, skills and attitude requirements necessary to qualify VTS personnel;
- to ensure that VTS personnel are trained and qualified to enable them to perform the tasks required;
- for maintaining a satisfactory level of operational performance through the systematic provision of a revalidation process for VTS personnel;
- to regularly assess the ability of VTS personnel to perform to established and recognised standards and;
- for a structured career progression for VTS Personnel.

The following excerpts from IMO Resolution A.857(20) Guidelines for Vessel Traffic Services are relevant to training:

In planning and establishing a VTS, the Government or the Competent Authority should:
• determine the services and level to which the services are to be provided by the VTS, having regard to the objectives of the VTS;
• ensure that the VTS Authority is provided with sufficient staff, appropriately qualified, suitably trained and capable of performing the tasks required, taking into consideration the type and level of services to be provided;
• establish appropriate qualifications and training requirements for VTS operators, taking into consideration the type and level of services to be provided; and
• ensure that provisions for the training of VTS operators are available.

In operating a VTS the VTS Authority should:

• ensure that the standards set by the Competent Authority for types of service and operator qualifications and equipment are met; and
• ensure that the VTS operations are harmonised with, where appropriate, ship reporting and routeing measures, aids to navigation, pilotage and port operations.

The Centro Jovellanos has the international recognition of IALA (International Association of Marine Aids to Navigation and Lighthouse Authorities) to teach the following courses in the field VTS:

• VTS Operator course
• VTS Supervisor course
• VTS OJT Instructor course

These courses strictly follow the model courses established in the V-103 IALA recommendation. VTS trainings and all relevant training materials shall be delivered in English.

Centro Jovellanos believes that a major factor in the efficient operation of a VTS centre is the standard of competence of its personnel. Recognizing that VTS personnel are members of a profession whose principle interaction is with mariners and maritime pilots for the safe management of maritime traffic, their competence needs to reflect that professional responsibility. All VTS personnel should be appropriately trained before they undertake the duties associated with the type of services provided such as, Information Service (INS), Navigational Assistance Service (NAS) and / or Traffic Organization Service (TOS).
The courses imparted in Centro Jovellanos are composed of modules. This approach facilitates model courses to be developed and:

- reflects the training received, while maintaining common international standards; and
- takes into account the previous training and experience of prospective VTS personnel.
Relating VTS Operator course, the award of a certificate in Centro Jovellanos should be achieved by successfully undertaking the following modules:

- english.
- traffic Management.
- equipment.
- nautical knowledge.
- communication co-ordination.
- VHF-radio.
- personal attributes.
- emergency situations.

![VTS Operator course diagram](image)

**Figure 5. Scheme of VTS operators’ course – Source: own elaboration**

Relating VTS Supervisor course, the award of a certificate in Centro Jovellanos should be obtained by a VTS Operator successfully undertaking the following modules:

- advanced Traffic Management.
- VTS equipment.
- additional personal attributes.
- Responding to emergency situations.
- administrative functions.
- legal knowledge.

Relating VTS OJT Instructor course, the award of a certificate in Centro Jovellanos, should be obtained by successfully undertaking the following modules:

- development of a VTS centre specific training programme.
- preparation of a trainee specific programme.
- delivery of OJT training.
- evaluation/assessment/examination of trainees.
- completion of OJT training leading to authorization to operate.
The detailed teaching syllabus of each module has been written in learning-objective format in which the objective describes what the participant must do to demonstrate that knowledge has been transferred.

Students receive each a manual (on paper and in CD format) with the theoretical content of the course.

A key aspect of the course is the use of a VTS simulator. Working independently or in conjunction with other simulators of Centro Jovellanos, VTS simulator faithfully reproduces any VTS centre contained in IMO Resolution A.857 (20).

The simulator has two well-defined areas.

- the area of the instructor and
- the student area.

![Diagram of VTS simulator configuration](image)

*Figure 6. Simulator configuration for VTS operators training – Source: own elaboration*

In the instructor area exercises are designed and executed. Exercises are conducted in conditions close to real. The difficulty level is gradually increased in order to enable students to acquire the required level in IALA standards.

The trainee area has three operator positions, provided with traffic management screens where students can observe both the radar image and AIS target. It also has a panel of communications whereby trainees can communicate with vessels. All along the simulation the students operate autonomously.
The practical exercises are (Levels 1 to 3)

- Strait of Gibraltar. Information Service Level 3.
- Strait of Gibraltar. Information Service Level 3.
- Finisterre TSS. Navigational Assistance Service. Level 3.

All exercises last 2 hours.

- pre-exercise briefing and preparation: 20 minutes.
- exercise: 1 hour.
- debriefing: 40 minutes.

To obtain the VTS course certificate of success or participation (see attached examples), students must attend ninety percent of the lectures. Absence is not permitted to any practical exercise in the simulator.

4.4.1 Recruitment

As stated by IALA, an accurate recruitment process of VTS staff is vital in order to maintain the quality and capacity of Vessel Traffic Services. To ensure the quality of the trainees it is crucial to use appropriate entry requirements and follow a thorough selection process.

The Competent/VTS Authority should set minimum entry requirements for applicants to become a member of VTS personnel.

When setting the entry requirements, the following points should be considered:

- prior skills and knowledge;
- previous maritime experience and education;
- personal suitability characteristics;
- medical fitness requirements. If applicable, the Competent Authority may consider setting requirements for the VTS Authority to:
  - verify that the applicant meets the entry requirements;
  - assess the applicant’s personal aptitude and suitability;
  - establish a selection process in order to choose the most qualified applicant.

English is the accepted language of international business, trade and diplomacy. Subsequently there is a very high demand for education in the language as well as a high demand for other academic qualifications taught in English. This has led to the establishment of reliable tests to demonstrate that trainees have attained a sufficient level of the language to follow their chosen course or profession.
Candidates should also be fluent in the use of their own native language where their language is primarily used for communications (for example in inland waterways).

4.4.2 Selection Process
The selection process should include aptitude testing, assessment of prior learning, medical/physical requirements and an assessment of the personal attributes of the candidate.

The purpose of the selection process is to provide a mechanism to facilitate selection of applicants for trainee operators. An important part of this is to test and assess the suitability of the applicants to perform the required VTS tasks. The selection process should be established and performed by the VTS Authority in accordance with the requirements set by the Competent Authority.

Personnel may be recruited directly as VTS Supervisors/Manager if they can demonstrate to the VTS Authority that they have the required experience to undertake the responsibilities and duties of a VTS Supervisor/Manager. The VTS Authority should ensure that such personnel have received VTSO training and any additional training as may be necessary to meet the required standards of competence for a VTS Supervisor/Manager.

4.4.3 Aptitude Assessment
Aptitude assessments should be carried out as part of the selection process. All prospective candidates should be assessed, even if they have previous maritime experience. Assessments, which employ simulation of traffic movements, may be used.

Assessments should be designed and conducted in order to determine the ability of candidates to:

- discriminate between relevant and non-relevant information;
- combine auditory and visual information;
- demonstrate spatial and situational awareness;
- demonstrate alertness and decisiveness in all situations;
- carry out several tasks simultaneously (multitasking);
- carry out routine work without losing situational awareness;
- show initiative while working within a framework of standards, regulations and structured procedures;
- recognise and manage work related and personal stress; and
- demonstrate appropriate communication and literacy skills.

Tests which employ simulation of traffic movements, are conducted for this assessment.
4.4.4 Qualification and Certification

Qualification is the education, knowledge, skill, experience or any other attribute which the Competent and/or VTS Authority may have determined desirable for performing the duties of the relevant position.

VTS qualifications should primarily be based on the principle that satisfactory results are obtained during the IALA VTS Model Courses.

The following steps are recommended for attaining qualification:

- the candidate has been selected and the set requirements as regard to prerequisites and medical/physical requirements are fulfilled.
- on successful completion of an approved training course, the VTS trainee receives a course certificate.
- the course certificate may then be submitted to the appropriate authority who, after validation, should issue a VTS Certification Log book.
- the VTS trainee should complete OJT at a specific VTS centre, under the supervision of an OJT Instructor (OJTI).
- on successful completion of OJT the appropriate authority should issue an endorsement and/or a certificate enabling the trainee to operate.
- any additional successful completion of approved VTS training courses, such as Supervisor or OJTI, should also be entered in the VTS Certification Log book.

The VTS certification log book should be revalidated on a periodic basis. Revalidation is the process for the maintenance of a VTS qualification. It ensures that holders of a VTS qualification, develop, increase and retain their competence in order to maintain a satisfactory level of operational performance.

4.5 Competences and training in SAR operations

The importance of thorough training for all personnel employed on SAR missions cannot be overemphasized. Failure of a single link in the often-complex chain of actions that must be required in SAR missions can compromise the success of the operation, resulting in loss of lives that might otherwise have been saved. The purpose of training is to meet SAR system objectives by developing SAR specialists. Since considerable experience and judgement are needed to handle SAR situations, necessary skills require significant time to master. The quality of performance will match the quality of training. Consistency in training and sharing of information relating to search and rescue is promoted through the specific SAR concerned Agencies in each State. Standardisation to the prosecution of SAR Operations is encouraged through specialised international forums in Search and Rescue.
4.5.1 Training, Qualification, Certification and Exercises
Since considerable experience and judgement are needed to handle typical SAR situations, necessary skills require significant time to master. Training can be expensive, but poor training is even more expensive and can result in poor operational effectiveness, which can result in loss of lives of SAR personnel, lives of those in distress and loss of valuable facilities. Quality of performance will match the quality of training. Efforts to ensure professionalism may even extend to career development actions prior to assignment to SAR duties, ensuring SAR assignments of sufficient length to develop expertise and taking advantage of SAR experience in subsequent assignments.

Training is critical to performance and safety. The SAR system should save those in distress when it can, and also use training to reduce risks to its own valuable personnel and facilities. Training personnel in making sound risk assessments will help to ensure that these trained professionals and valuable facilities remain available for future operations.

4.5.2 Qualification
The purpose of qualification is to validate an individual's ability to perform certain duties. It is a minimum level of knowledge and skills which should be required to be correctly demonstrated. This validation activity may take place at a specific position, while maintaining specific equipment or performed as a team member within a unit. Qualification is not designed as a training programme but can result in training. Qualification procedures demonstrate the capability to perform specific tasks.

SASEMAR qualification programme covers fundamental knowledge necessary for the duties of that position and testing of individuals on the systems they will be required to operate or maintain.

4.5.3 Certification
The purpose of certification at SASEMAR is to authorize an individual to serve in a stated capacity. Certificates may be issued to candidates who meet the requirements for service, training and qualification. Certification should be in writing prior to the person assuming watch standing duties.

Training alone can provide only basic knowledge and skills. Qualification and certification processes are used to ensure sufficient experience, maturity and judgement are gained. During a qualification process, the individual must, by demonstration of abilities, show mental and physical competence to perform as part of a team. Certification is official recognition by the organization that it trusts the individual to use those abilities.
Detailed qualification requirements vary with each type of workplace (a vessel, aircraft, or MRCC). The trainee is normally assigned to an instructor or senior operator who observes and can attest to the trainee’s competence to perform each particular task. Thorough knowledge of the geographic area is also expected to be demonstrated.

Training and qualification improve operational effectiveness, reduce accidents, reduce complaints against the organization and helps demonstrate organization’s due diligence.

The MRCC have particularly important duties. Upon completion of training, the prospective MRCC watch stander should undergo qualification procedures.

MRCC staff at SASEMAR are fully qualified in SAR incident analysis, search planning and SAR operations management.

4.6 Training specifics in SASEMAR:

4.6.1 Who We Train

All SAR specialists need some training. Operational facilities which need training include:

- MRCCs operators
- aircrafts
- helicopters
- maritime units
- specialized units (special operations, divers, etc.)

Each person should have had previous training to perform individual tasks. Where the individuals integrate into teams, team training is required so that the individuals can support the team effort. Where teams integrate, multiple team training is required to support the overall effort. An example of multiple team training is aeronautical and maritime SRUs training together.

MRCC operators usually need formal SAR training. If unable to immediately attend formal training, they receive a period of on-the-job training and an interim qualification and certification.

4.6.2 What We Train:

An individual’s training must be based on a needs analysis. This analysis compares actual performance and with required performance. Based on this analysis, training needs and methods to overcome the deficiencies can be identified.

Training of SAR service personnel can include the following:

- study of the application of SAR procedures, techniques and equipment
- assisting in or observing actual operations
- exercises in which personnel are trained to co-ordinate individual procedures and techniques in a simulated operation. MRCC SAR training should include at least the following topics. At SASEMAR search planning expertise gained from formal training is used on a regular basis for real operations or exercises, so periodic refresher training is normally not needed. General categories include:
• aeronautical drift
• SAR Planning tools
• briefing/questioning SRUs
• case studies
• charts
• coastal SAR planning
• computer applications
• COSPAS-SARSAT
• datum marker buoys
• datum determination
• dealing with public and news media
• dealing with families
• documentation of incidents
• electronic sweep width
• environmental factors
• evaluation of flare sightings
• fatigue factors
• inmarsat
• international coordination
• leeway drift
• legal concerns
• look-out skills and limitations
• medical evacuations
• medical advice
• obtain and evaluate data
• on-scene co-ordinator duties
• plotting skills
• registration databases
• SASEMAR procedures
• resource allocation
• risk assessment
• SAR agreements
• SAR communications
• SAR mission co-ordination
• SAR operations conclusion
• SAR phases, stages, and components
• SAR resource capabilities
• SAR system organization
• SAR technology
• search areas
• search patterns
• search planning
• ship reporting systems for SAR
• SRU selection
• visual sweep width
• water currents
4.6.3 When We Train
Training is most beneficial when it is accomplished before a specialist is assigned to duties requiring that training. It matches the duties to be performed and is generally provided at three levels.

- entry level for those specialists just entering SASEMAR
- current level for those specialists who must remain at a certain level of proficiency to continue with their present position. This also includes any updating due to technical and equipment improvements.

4.6.4 Where We Train
Training is accomplished in two locations, from on-the-job site to the Jovellanos training centre. The student can be trained where work is normally accomplished for on-the-job training. Formal training can take place at Jovellanos centre.

The location is determined by cost-effective use of available facilities and training staff or experts.

4.6.5 How We Train
The training of SAR operator and crews to operate and maintain their equipment/systems is a prime factor affecting the operational readiness, search and rescue effectiveness and performance of the system as a whole. At SASEMAR the Director of Operations is responsible for leading the operations department training effort. It is of significant importance to unit readiness that operators and crew obtain relevant qualification and maintain proficiency. Developing and maintaining proficiency is developed through:

4.6.6 MRCC Operator Basic Training.
Individual watch station qualification completed at the fleet unit and facilitated through shore based training.

Systems training for operators/crew teams includes subsystems training (i.e., SARMAP, AAW, FLIR, etc.). While subsystem basic training is normally provided ashore, proficiency training should be accomplished on the job.

Organization-wide training accomplished through exercises. It incorporates the skills achieved in the above categories. Requirements for drills and exercises are set forth in SASEMAR training requirements. Thus, unit training as set includes SAR planning, SAR execution, helicopter winch operation, flight safety, emergency towing, individual watch keeping etc.

Exercises test and improve operational plans, provide learning experience and improve liaison and co-ordination skills. Exercises, conducted on a realistic basis, help to demonstrate and assess the true effectiveness of training and the operational efficiency and competence of the SAR service.
Exercises will reveal deficiencies that may exist in SAR plans and enable them to be improved. It is safer to have shortcomings revealed by exercises rather than during actual operations.

4.6.7 Types of Exercises
Exercises are conducted on three levels:

- the most simple type of exercise, a Communications Exercise, it consists of periodic use of all means of communications between all potential users to ensure capability for actual emergencies.

- a Co-ordination Exercise involves simulated response to a crisis based on a series of scenarios. All levels of the SAR service are involved but do not deploy. This type of exercise requires considerable planning, and usually one to three days to execute.

- the third type, a Full-Scale Exercise or a Field Exercise, differs from the previous types in that actual SAR facilities are deployed. This increases the scope of SAR system-testing and adds realistic constraints due to times involved in launching, transit and activities of the SRUs.
4.6.8 Evaluation and Instruction

The training program requires instruction of personnel and evaluation of their individual progress and ability to function efficiently and safely as a team. The training system must ensure that all operators and crewmembers are knowledgeable and possess the practical skills to clearly demonstrate and communicate the subject matter. The quality of instruction cannot be over emphasized. Effective training is only accomplished when learning occurs. The most effective way for learning to occur is through high-quality instruction.

Analysis and Improvement. The analysis of training effectiveness includes observing performance of groups and individuals, comparing results with standard criteria, implementing lessons learned and recognizing deficiencies and methods for improvement.

At SASEMAR the training plan is the mechanism for detailed planning and scheduling of training. Normally broken down into monthly segments, this promotes effective scheduling of resources and allows the early identification of conflicts where resolution is easier to develop.

Each MRCC in coordination with the SAR base and surface units shall develop a detailed plan for training, which shall include specific dates and type of training. The Head of the MRCC review and approve each Monthly plan.

Training records are kept to a minimum and need only be maintained to show what training has been accomplished. Training records are retained for each operator or crewmember for as long as they are assigned to the unit or MRCC.

4.7 IT tools for Crew Training (Serious Games): safety and advanced SAR methods – Results from PICASSO Project

The scope of this sub-activity is to develop new training tools for safety and advanced SAR missions training, which will greatly decrease SAR response time and reduce misunderstandings during critical SAR situations.

Advanced ship simulators will be used by Chalmers and SMA (partners in EMSN – European Maritime Simulators Network) as platforms and tools for operational analysis and methodology development of SAR missions. The ship simulators are using the recent innovations in ship-to-shore data communication, new innovative IT infrastructural solutions in the maritime domain and new software which has the ability to realize Common Situational Awareness.

Simulations will focus on methodology for the use of the simulator system for operational analysis of SAR missions, measuring parameters as response and search time, and communication efficiency. Operational methods and procedures will be developed based upon these findings. SAR missions will be simulated and extensive tests will be performed.
4.7.1 Expected results
The expected results of this task are an IT Application for iOS and Android for crew training and two educational modules (theoretical/practical training action) to instruct the future SAR officers in using the new procedures.

4.7.2 Executive summary
The scope of the task named “IT tools for Crew Training (Serious Games): safety and advanced SAR methods” is to develop new training tools for safety and advanced SAR missions training, which will greatly decrease SAR response time and reduce misunderstandings during critical SAR situations.

The task is focused on different levels of safety for different persons within the industry. The IT application for handhelds aims at providing more efficient training for on boards crews on passenger vessels. Exploring the serious game idea for this is using new technology in a new context for seafarers.

Establishing a Rescue Coordination Centre (RCC) with its normal technology in a simulated infrastructure is important if you are to train and exercise the whole system from RCC to the individual mobile facility. Such a system was procured, tested and validated and it is now part of the European Maritime Simulator Network (EMSN).

An extensive data collection ranging from interviews, to observation of exercises and a work shop executing a Training Need Analysis (TNA) informed the creating of two educational modules.

The first module was the Mass Rescue Operations Subject Matter expert course that was done in cooperation with the charity organisations International Maritime Rescue Federation and its member organization the Swedish Sea Rescue Society.

The aim of the subject-matter expert course is to help prepare those with responsibilities for complex incident planning and response, particularly at senior command, control & coordination levels.

The second module was an international On Scene Coordinator course for SAR specialists building on a development of the IMO model course.

The IMO recognizes the impossible to cover all aspects of the performance of a search, rescue or on-scene coordinator function within the prescribed hours and recommends an extension of the course specially to train participants dealing with the unpredictable and uncertain nature of search and rescue. The Picasso course answers that need.
4.7.3 Methodology

4.7.3.1 Overview of the project progress
To create training with the objective to decrease response time and reduce misunderstanding during SAR operations one must understand the nature of SAR.

Since it is time consuming and difficult to get firsthand experience and access to real search and mission activities this part of project focused on interviews with international SAR specialists and observations of existing training programs and exercises.

4.7.3.2 Interviews with SAR specialists
Search and mission coordinators in Sweden, Denmark, Spain and Portugal were interviewed using a “semi-structured interview methodology. A set of two questions were prepared and based on the answers the semi-structured approach enabled us to explore and expand issues concerning the uncertain nature of SAR”.

What characterises a search and rescue operation?

What are the success factors for a search and rescue operation?

4.7.4 Observations of SAR exercises/training
Two identical exercises were conducted in Sweden during June 2017. Being able to observe the OSC team during these exercises provided valuable data to the project.

4.7.5 Exercise scenario
A large group (15 persons) of kayakers were due to increasing wind scattered across an area in the archipelago. The group was broken up, a couple of participants turned back, some continued, some capsized and was rescued by other participants to nearby islets and some stayed at the capsize kayaks. The scenario is at start very uncertain and the recue service must act in order to clarify and get more information. An OSC was appointed directly to deal with the complex search and to coordinate with land based rescue services.

4.7.6 Data collection
Audio and video was recorded from the OSC bridge and all VHF communication was recorded and provided together with the tracks from the participating units valuable data to the analysis of understanding SAR.
Figures 8 and 9: Coast Guard and Sea Rescue Unit working together and Coast Guard RIB with two kayaks

Figure 10: Search Tracks from rescue units at exercise end

4.7.7 Workshop
A workshop with 17 delegates, from Denmark, Estonia, Lithuania, Latvia, Poland, Germany, Spain and Sweden, representing rescue services responsible for training was conducted 20-22nd of March 2018.

The workshop was conducted with the following objectives:

- increased efficiency and effectiveness in SAR.
  - contribute to the development of SAR training.
    - focus on SAR OSC
- create a Training Needs Analysis for SAR OSC
  - to inform course development
• base for academic understanding of the topic.
• assist in the development of a new OSC course for Swedish Maritime administration
• compare TNA and evaluation with OSC model course 3.15 and suggest developments to the model course.

4.7.8 Training need analysis (TNA)

The workshop followed a structured way of working and the steps marked in yellow were completed.

![Figure 11: Structure and sequence of the workshop](image-url)
4.7.9 International SAR simulation

During the project the European Maritime Simulators Network (EMSN) workshop conclusions have been used for both developing new scenarios for training. Although created as a test bed for MONALISA 2.0 and Sea Traffic Management (STM) projects it is obvious that the network is highly suitable for training purposes. During the Picasso project the networked was used connecting Chalmers, Swedish Maritime Administration and SASEMAR simulators in joint SAR operations.

![Discussion during the workshop and results after one session.](image1)

Figure 12. Discussion during the workshop and results after one session.

![Tracks from participating units in the EMSN scenario](image2)

Figure 13. Tracks from participating units in the EMSN scenario
4.7.10 Analysis of the data collection
The data collected during the project has been analyzed in different streams leading up to the course deliverable. There is also a paper written on the conclusions of the project data collection. Some conclusions are discussed here:

4.7.10.1 OSC competencies
After analysing interviews, exercises in combination with the workshop the following competencies are necessary for an OSC to harness. This analysis directed the course development of the deliverable in the project.

![Figure 14. OSC unit competences](image)

4.7.10.2 The characteristics of Search and Rescue
Understanding the face of a SAR mission is vital in order to work with the uncertainty and unpredictability that the nature of SAR mission presents, especially during more complex missions. The picture is not intended to be exhaustive and should be viewed as guidance for instructors when establishing training whether it is classroom, simulator or on sea exercise activities.
Figure 15. The characterises of Search and Rescue
4.7.11 Results - Mass Rescue Operations Subject Matter Expert Course

4.7.11.1 Mass Rescue Operations
Mass rescue operations are, by international definition, beyond normal search and rescue (SAR) capability: there are more people in distress than there are SAR units available to save them. How many people this will be depends on the circumstances – location, weather and sea conditions, the availability of rescue craft locally – but mass rescue operations are a concern all around the world, in developed as well as developing States. Emergency response organisations need to “be prepared for the unprepared”, ready to respond to emergencies of a scale they are not resourced for – which may be rare, but are extremely challenging.

4.7.12 The course
The aim of the course was to study in some depth the generic issues identified by the International Maritime Rescue Federation (IMRF) mass rescue operations project as being common in maritime mass rescue operations, thus enabling the participants to develop subject-matter expertise. Focus on the issues enables the review and development of detailed plans to fill the ‘capability gap’ back home – preparing to deal with the unexpected. Attendees will already have extensive SAR / emergency planning expertise.

4.7.12.1 Aim of the course
The aim of the subject-matter expert course is to help prepare those with responsibilities for complex incident planning and response, particularly at senior command, control & coordination levels.

The course will enable them to study maritime MRO issues, challenges and potential solutions in depth, acquiring subject-matter expert skills which can then be applied in their local / regional planning and preparation

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12 The International Maritime Rescue Federation (IMRF) is a charity, and the only organization to represent and unite search and rescue providers around the world, sharing best practice and knowledge and representing this important sector at the UN’s International Maritime Organization.

The IMRF brings the world's maritime search and rescue organisations together in one global and growing family. IMRF's member organisations share their lifesaving ideas, technologies and experiences and freely cooperate with one another to achieve their common humanitarian aim: “Preventing loss of life in the world's waters”.

The IMRF was founded (as the International Lifeboat Federation) in 1924. In 1985, it was granted non-governmental consultative status with the International Maritime Organization (IMO) in recognition of the good work being undertaken and the growing need for an organisation to act as a global focal point for maritime search and rescue. In 2003 it was registered as an independent charity and in 2007 the organisation was renamed the International Maritime Rescue Federation, reflecting the broader scope of modern maritime search and rescue activity.
4.7.12.2 Course format

Self-preparation, before the course, including assessment of the attendee’s local MRO capabilities and challenges

Three full days of interactive study of the maritime MRO issues, guided by expert facilitators.

Post-course application of lessons learned and skills acquired, supported by the material available in the IMRF’s online MRO reference library.

4.7.12.3 Learning objectives

L1 The individual is enabled to consider and discuss MRO challenges and solutions, with a ‘toolbox’ of material to assist him/her in the application of lessons learned during the course

L2 The attendees’ parent organisations gain MRO subject-matter experts.

L3 The international group of people who have considered and discussed the issues in depth is expanded, enabling the IMRF to continue to encourage preparations for MROs by employing subject-matter experts as necessary and as available.

4.7.12.4 Course content

The course will include discussion of the following main subject areas:

- planning for mass rescue operations:
  - responsibilities and roles
  - planning considerations

- filling the ‘capability gap’:
  - identifying additional SAR facilities
  - sharing SAR facilities regionally
  - providing on-board support

- response coordination, command and control communications planning
- search action, including accounting for all those involved
- rescue – retrieval, and support during rescue – and/or support on scene
- effective use of available facilities
identifying ‘places of safety’, and action required there
maritime / shoreside response coordination
public relations
MRO training and testing: the ‘feedback cycle’.

4.7.12.5 Course Schedule

Table 3. Schedule and timetable for the course issue

<table>
<thead>
<tr>
<th>Date/time</th>
<th>Session</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wed 14 June 2017</td>
<td>Introduction</td>
<td>Include contents of IMRF paper 1.1 as appropriate. (The IMRF guidance papers may be found at <a href="http://www.imrfmro.org/categoriesmro">www.imrfmro.org/categoriesmro</a>.) The ‘red line’ will draw the various aspects of MRO planning together during the course.</td>
</tr>
<tr>
<td>0900</td>
<td>o welcomes, introductions, domestics</td>
<td></td>
</tr>
<tr>
<td></td>
<td>o scene-setting film / simulation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>o discussion: what characterises an MRO?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>o the ‘red line’</td>
<td></td>
</tr>
<tr>
<td>1000</td>
<td>Exercise phase 1: setting the scene, and the initial emergency scenario</td>
<td>The idea is that the initial exercise scenario will give rise to a set of questions for discussion. When the subjects arising from the first set of questions have been considered, the exercise will move on to the next stage, prompting the next set of questions, and so on. There will be three such sessions, with a final exercise phase to complete the picture. Four groups of students, with two course team members assigned to each group as facilitators, will break out to discuss each phase.</td>
</tr>
<tr>
<td></td>
<td>Paul Culver, Joel Morgado &amp; Fredrik Forsman to lead the exercise elements</td>
<td></td>
</tr>
<tr>
<td>1100</td>
<td>Coffee</td>
<td></td>
</tr>
<tr>
<td>1115</td>
<td>Planning for MROs (part 1)</td>
<td>IMRF papers 1.2, 1.3, 1.4, 2.1, 2.2, 3.1, 3.2, 3.3 &amp; 3.4 refer</td>
</tr>
<tr>
<td></td>
<td>o risk analysis</td>
<td>Include the international legislative background.</td>
</tr>
<tr>
<td></td>
<td>o ownership of plans</td>
<td>Fredrik Forsmanto lead the discussion of ‘risk’.</td>
</tr>
<tr>
<td></td>
<td>o general planning guidance</td>
<td>Summary presentations raise the questions under each heading, with subsequent discussion in breakout groups followed by plenary discussion and conclusions.</td>
</tr>
<tr>
<td></td>
<td>o filling the ‘capability gap’: identifying additional resources, use of regional resources, providing support on scene</td>
<td></td>
</tr>
<tr>
<td></td>
<td>o general guidance on funding</td>
<td></td>
</tr>
<tr>
<td>1300</td>
<td>Lunch</td>
<td></td>
</tr>
<tr>
<td>1400</td>
<td>Planning for MROs (part 2)</td>
<td>IMRF papers 4.1 &amp; 4.2 refer</td>
</tr>
<tr>
<td></td>
<td>o general guidance on command, control &amp; coordination</td>
<td>As before, questions in plenary; breakout groups; plenary discussion; conclusions.</td>
</tr>
<tr>
<td></td>
<td>o the role of the SAR Coordinator</td>
<td></td>
</tr>
<tr>
<td>1430</td>
<td>Exercise phase 2: operations on-scene</td>
<td>As discussed for phase 1.</td>
</tr>
<tr>
<td>1500</td>
<td>Coffee</td>
<td></td>
</tr>
<tr>
<td>1515</td>
<td>Operations (part 1)</td>
<td>IMRF papers 2.4, 4.6 &amp; 4.7 refer</td>
</tr>
</tbody>
</table>
- use of surface units
- use of aircraft

As before, questions in plenary; breakout groups; plenary discussion; conclusions.
Note: only the first part of ‘rescue’ is considered here, and coordination issues are left until later.

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1650</td>
<td>Summary of day 1</td>
</tr>
<tr>
<td>1700</td>
<td>End of day 1</td>
</tr>
<tr>
<td>Thu 15th 0900</td>
<td>Recap of day 1 &amp; any questions arising overnight</td>
</tr>
<tr>
<td>0930</td>
<td>Exercise phase 3: transfer to place(s) of safety</td>
</tr>
<tr>
<td>1000</td>
<td>Operations (part 2)</td>
</tr>
<tr>
<td></td>
<td>• accounting for people, including searches</td>
</tr>
<tr>
<td></td>
<td>• supporting survivors during rescue</td>
</tr>
<tr>
<td></td>
<td>• places of safety</td>
</tr>
<tr>
<td></td>
<td>• remote areas and other special cases</td>
</tr>
<tr>
<td></td>
<td>IMRF papers 2.5, 2.6, 2.7 &amp; 2.8 refer</td>
</tr>
<tr>
<td></td>
<td>As before, questions in plenary; breakout groups; plenary discussion; conclusions.</td>
</tr>
<tr>
<td>1100</td>
<td>Coffee</td>
</tr>
<tr>
<td>1115</td>
<td>Coordination</td>
</tr>
<tr>
<td></td>
<td>• SAR Mission Coordinator</td>
</tr>
<tr>
<td></td>
<td>• On Scene Coordinator</td>
</tr>
<tr>
<td></td>
<td>• aircraft Coordinator</td>
</tr>
<tr>
<td></td>
<td>• maritime / shoreside coordination, including shoreside authorities’ needs</td>
</tr>
<tr>
<td></td>
<td>IMRF papers 4.3, 4.4, 4.5 &amp; 4.8 refer</td>
</tr>
<tr>
<td></td>
<td>As before, questions in plenary; breakout groups; plenary discussion; conclusions.</td>
</tr>
<tr>
<td></td>
<td>Note that, at least as regards the SMC &amp; OSC roles, the focus will be on the additional work required in an MRO. Refer back to the exercise scenario as necessary.</td>
</tr>
<tr>
<td>1300</td>
<td>Lunch</td>
</tr>
<tr>
<td>1400</td>
<td>Communications</td>
</tr>
<tr>
<td></td>
<td>• priorities, systems, structures</td>
</tr>
<tr>
<td></td>
<td>• public relations, including social comms</td>
</tr>
<tr>
<td></td>
<td>IMRF papers 4.9 &amp; 2.3 refer</td>
</tr>
<tr>
<td></td>
<td>As before, questions in plenary; breakout groups; plenary discussion; conclusions.</td>
</tr>
<tr>
<td></td>
<td>Refer back to the exercise scenario as necessary.</td>
</tr>
<tr>
<td>1500</td>
<td>Coffee</td>
</tr>
<tr>
<td>1515</td>
<td>Exercise phase 4 – review of the full picture</td>
</tr>
<tr>
<td></td>
<td>As discussed for phase 1. The exercise focuses on at-sea operations and transfer to places of safety. The onward operations, ashore, should be referred to here.</td>
</tr>
<tr>
<td>1545</td>
<td>Compiling an MRO plan</td>
</tr>
<tr>
<td></td>
<td>Based on the exercise and discussions, the students, working in small groups (of 3 or 4?), will be asked to compile an MRO plan for the fictional exercise area.</td>
</tr>
<tr>
<td>1650</td>
<td>Summary of day 2</td>
</tr>
<tr>
<td>1700</td>
<td>End of day 2</td>
</tr>
<tr>
<td>Fri 16th 0900</td>
<td>Recap of day 2, any questions arising overnight &amp; review of the MRO plans compiled by the attendees</td>
</tr>
</tbody>
</table>
### 4.8 Maritime SWIM (System Wide Information Management) and Cloud Interaction baseline\(^{13}\)

Sea System Wide Information Management (SeaSWIM) was defined within the MONALISA 2.0 project to realize the potential of the existing data and information in the maritime industry.

The fundamental goal for SeaSWIM is to provide and maintain a harmonized way of communicating within the maritime industry. Current maritime information is often restricted to a certain organization or department because of incompatible standards and technologies. Unifying the way maritime stakeholders communicate enable a common information marketplace and strengthen the ecosystem by providing new interoperable ways of interaction.

By defining a limited set of open industry standards and best practices, SeaSWIM provides an environment where different services can interoperate over organizational boundaries. Furthermore, by providing a standardized environment service developers can focus on value creation to a wider range of customers instead of working on compliance with redundant standards.

Once communication standards are defined, the consecutive goal of SeaSWIM is to facilitate the access and flow of data and information. This means providing solutions to promote trust and lower the barriers of entry for potential data and information providers and consumers. To achieve this, SeaSWIM is envisioned to provide a reference for all common functionality needed by the ecosystem of stakeholders. For example, identity, authentication and service management are recognized as common needs that are provided as SeaSWIM support services.

SeaSWIM consists of specific support services that will ensure interoperability of the STM application services by facilitating data sharing in a common information environment and structure. The specification of SeaSWIM is developed to adhere to some key STM principles:

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\(^{13}\) STM Act2 SeaSWIM Testbed Specification. Date: 2016-11-18
only authenticated identities can provide and consume STM services.
the owner of data is the actor responsible for the original creation and provision. The owner has full control over the access management for this data.
STM strives after a service oriented and highly decentralized architecture.
usage of open and widely accepted industry standards wherever these exist.

SeaSWIM consists of two central services of Maritime Cloud; the Identity Registry and the Service Registry. The Identity Registry enables identity management and authentication mechanisms, while the Service Registry provides functionality to publish and find services, their functionality and endpoints.
After the initial registration and filtering process of the central services (Identity Registry and Service Registry) the communication is primarily between the provider and the consumer.
Currently, the implementation efforts in the Maritime Cloud Platform (MCP) have concentrated on knowledge factors (typically username/password) for human users and ownership factors (certificates) for machine users. The actual authentication of human users will be the responsibility of the organizations that the users belong to using a brokered identity federation approach.
In any case, operational services are required to be compliant with the IALA guidelines.
5 International Regulations and Policies

Training, qualification, certification and competences of seafaring personnel is standardized as minimum requirements in the "International Convention on Standards of Training, Certification and Watch keeping for Seafarers, 1978 (STCW Convention)" and its associated STCW Code. This convention was adopted on 7 July 1978 by all flagstate countries and entered into force on 28 April 1984. The main purpose of the Convention is to promote safety of life and property at sea and the protection of the marine environment by establishing in common agreement international standards of training, certification and watch keeping for seafarers.14

5.1 International standardization of training

Concerning the international standardization of training the main reference is the Convention on Standards of Training, Certification and Watch keeping for Seafarers (STCW) established by IMO, International Maritime Organization. The Convention includes models of training courses so that the programs ensure the construction of standards of competence and knowledge defined for seafarers.

The latest amendments to the STCW Code were adopted on 25th of June 2010, called the Manila amendments to the STCW Convention and Code, marking a major revision of the STCW Convention and Code. The 2010 amendments are set to enter into force on 1 January 2012 under the tacit acceptance procedure and are aimed at bringing the Convention and Code up to date with developments. “The 2010 Manila included changes, namely the growing relevance of technology in maritime activity”.

The regulations contained in the Convention are supported by sections in the STCW Code:

The minimum standards of competence required for seagoing personnel are given in detail in a series of tables. Part B of the Code contains recommended guidance which is intended to help Parties implement the Convention.

The key to maintaining a safe shipping environment and keeping our oceans clean lies in all seafarers across the world observing high standards of competence and professionalism in the duties they perform on-board. The STCW Code sets those standards, governs the award of certificates and controls watch keeping arrangements. Its provisions not only apply to seafarers, but also to ship-owners, training establishments and national maritime administrations. The 2010 Manila amendments was intended to include all agreed changes since 1995, address new technology, inconsistencies, interpretations and outdated provisions. There was particular emphasis on improving control and communication provisions of certification in Chapter 1 and addressing the specific requirements of offshore and short sea shipping. There was also an overall commitment to harmonise the amended STCW Convention, where practical, with the provisions of the 2006 ILO Maritime Labour Convention. Whereas the STCW-78 Convention focused almost entirely on knowledge, the emphasis of STCW-95 has been shifted to practical skills and competence underpinned by theoretical knowledge. The 2010 amendments continued to emphasise competence rather than sea service or period of training.

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The standard set by the convention applies to seafarers of all ranks serving on seagoing merchant ships registered under the flag of a country party to the convention. The term “seagoing ships” includes all commercial vessels engaged on domestic or international voyages. The STCW Convention has already been accepted by all major labour suppliers and shipping registries. This is more than 98 per cent of the world’s merchant fleet.\(^\text{15}\)

Other organisations produce recommendations and guidelines for training in the sector, although with a narrower professional scope, namely ILO (International Labour Organization), IALA (International Association of Marine Aids to Navigation and Lighthouse Authorities) and IHO (International Hydrographic Organization).

Port worker Development Programme (PDP) and Guidelines on Training in the Port Sector was established in the late 1980s by ILO. The PDP and the guidelines set out the general approach and key processes for competency-based training and provides training unit’s material covering different issues (e.g. Safety, Cargo Handling Operations, and Management).

IALA Standards for Training and Certification of Vessel Traffic Service (VTS) Personnel defines general principles of the recruitment, training and qualification of VTS operators. The training standards were issued in 1998 and approved as IALA Recommendation V-103. The main point that justifies the Recommendation is a necessity for staff to get necessary qualifications, proved by certificate, before they can be work as VTS operator or supervisor.

Finally, the IHO International Board on Standards of Competence for Hydrographic Surveyors and Nautical Cartographers are an essential reference for training programs recognition in these jobs. In the last years, the standards were revised in regard to their structure, coverage, and contents.

### 5.2 Certificates and requirements

All shipboard personnel and functions are classified in terms of qualification requirements and training needs. The levels of responsibility are: management level (applies to senior officers); operational level (applies to junior officers); and support level (applies to ratings forming part of a navigational or engine watch). The following table lists the different functions and levels of responsibility at which the functions can be carried out.\(^\text{16}\)

The term ‘certificates’ covers all official documents required under STCW. It includes certificates of competence, endorsements, certificates of proficiency, and any documentary evidence showing that a requirement of the convention has been met. Certificates prove that the level of maritime education and training, your length of service at sea, professional competence, medical fitness and age all comply with STCW standards. Every party to the convention has to ensure that certificates are only issued to those seafarers who meet STCW standards.

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The certificates of competences are issued to masters, officers, radio operators and ratings forming part of a watch who meet the standards of competence relevant to their particular functions and level of responsibility on-board. The tables below indicate the title of the certificates under STCW and the various limitations and tonnage thresholds that apply.

### Function and Level of Responsibility

<table>
<thead>
<tr>
<th>Function</th>
<th>Level of Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deck</td>
<td>Management</td>
</tr>
<tr>
<td>Navigation</td>
<td>•</td>
</tr>
<tr>
<td>Cargo handling and storage</td>
<td>•</td>
</tr>
<tr>
<td>Deck &amp; Engine</td>
<td>Controlling the operation of a ship and care for persons on board</td>
</tr>
<tr>
<td>Engine</td>
<td>Marine engineering</td>
</tr>
<tr>
<td>Maintenance and repair</td>
<td>•</td>
</tr>
<tr>
<td>Electrical, electronics and control engineering</td>
<td>•</td>
</tr>
<tr>
<td>Radio</td>
<td>Radio communication</td>
</tr>
</tbody>
</table>

**Figure 16. STCW functions and responsibilities – Source: STCW A Guide for Seafarers, International Transport Worker’s Federation**

### Certificate of Competences Deck and Engine Departments

<table>
<thead>
<tr>
<th>Capacity</th>
<th>Area Limitation</th>
<th>Tonnage Limitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Master</td>
<td>Near Coastal</td>
<td>Less than 500gt</td>
</tr>
<tr>
<td></td>
<td>None</td>
<td>Less than 3,000gt</td>
</tr>
<tr>
<td></td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Chief Mate</td>
<td>None</td>
<td>Less than 3,000gt</td>
</tr>
<tr>
<td></td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Officer in charge of navigational watch (OW)</td>
<td>Near coastal</td>
<td>Less than 500gt</td>
</tr>
<tr>
<td></td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Rating forming part of a navigational watch</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Radio operator</td>
<td>GMDSS (GOC/ROC)</td>
<td>None</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Capacity</th>
<th>Area Limitation</th>
<th>Propulsion Power Limitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chief engineer</td>
<td>None</td>
<td>750 kw to 3,000 kw</td>
</tr>
<tr>
<td></td>
<td>None</td>
<td>3,000 kw or more</td>
</tr>
<tr>
<td></td>
<td>Near Coastal</td>
<td>750 kw to 3,000 kw</td>
</tr>
<tr>
<td></td>
<td>Near Coastal</td>
<td>3,000 kw or more</td>
</tr>
<tr>
<td>Second engineer</td>
<td>None</td>
<td>750 kw to 3,000 kw</td>
</tr>
<tr>
<td></td>
<td>None</td>
<td>3,000 kw or more</td>
</tr>
<tr>
<td></td>
<td>Near coastal</td>
<td>750 kw to 3,000 kw</td>
</tr>
<tr>
<td></td>
<td>Near Coastal</td>
<td>3,000 kw or more</td>
</tr>
<tr>
<td>Officer in charge of engineering watch (OW)</td>
<td>None</td>
<td>750 kw or more</td>
</tr>
<tr>
<td>Rating forming part of an engineering watch</td>
<td>None</td>
<td>Less than 3,000kw</td>
</tr>
</tbody>
</table>

**Figure 17. Certificates of competences deck and engine departments - Source: STCW A Guide for Seafarers, International Transport Worker’s Federation**
5.2.1 STCW Convention on Standards of Training, Certification and Watchkeeping for Seafarers/IMO

The official documents associated are the certificates of competence and the certificates of proficiency.

The “Certificate of competence” is issued and endorsed by the administration for masters, chief mates, other deck officers and also officers on the engine room. These kind of certificate entitles the lawful holder thereof to serve in the capacity and perform the functions involved at the level of responsibility specified.

The “Certificate of proficiency” attests that the relevant requirements of training, competencies or seagoing service defined in the Convention have been met.

Following are the main contents related to certificates of competences and proficiency of navigation staff. *(the table will be completed after validation)*

*Table 4. Navigation staff/ Certificates of competences and requirements related to education and training*

<table>
<thead>
<tr>
<th>Certificate of competences</th>
<th>Standards of competence</th>
<th>Requirements related to training/ Certificates of proficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Captain/ Master</strong></td>
<td>Standards of competence specified in section A-II/2 and A-II/3 of the STCW Code.</td>
<td>✓ plan a voyage and conduct navigation ✓ determine position and the accuracy of resultant position fix by any means ✓ determine and allow for compass errors ✓ coordinate search and rescue operations ✓ establish watchkeeping arrangements and procedures ✓ ... ✓ leadership and Managerial Skills ✓ ECDIS (Electronic Chart Display and Information Systems) <em>Safety and Security:</em> ✓ GMDSS certificate <em>(Global Maritime Distress and Safety System)</em> ✓ basic safety training ; Medical first aid; Survival craft and rescue boats; Advanced fire fighting</td>
</tr>
<tr>
<td><strong>Chief Mate</strong></td>
<td>Standards of competence specified in section A-II/3 of the STCW Code.</td>
<td>✓ ... ✓ leadership and Managerial Skills ✓ ECDIS (Electronic Chart Display and Information Systems) <em>Safety and Security:</em> ✓ GMDSS certificate <em>(Global Maritime Distress and Safety System)</em> ✓ basic safety training ; Survival craft and rescue boats; advanced fire fighting</td>
</tr>
<tr>
<td><strong>Officer in Charge of a Navigational</strong></td>
<td>Standards of competence specified in section A-II/1 of</td>
<td>✓ ... ✓ leadership and Managerial Skills ✓ Bridge Resource Management Course (BRM)</td>
</tr>
<tr>
<td>Certificate of competences</td>
<td>Standards of competence</td>
<td>Requirements related to training/ Certificates of proficiency</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>--------------------------------------------------</td>
<td>---------------------------------------------------------------</td>
</tr>
<tr>
<td>Watch – OICNW</td>
<td>the STCW Code.</td>
<td>✓ ECDIS (Electronic Chart Display and Information Systems)</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Safety and Security:</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ GMDSS certificate <em>(Global Maritime Distress and Safety System)</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ basic safety training; Survival craft and rescue boats; advanced fire fighting</td>
</tr>
<tr>
<td>Electro-technical officer (1)</td>
<td>Standards of competence specified in section A-III/6 of the STCW Code.</td>
<td></td>
</tr>
</tbody>
</table>

### 5.2.2 IALA Standards for Training and Certification of Vessel Traffic

The VTSO Certificate is a certificate of competence awarded by a Competent Authority after the candidate VTSO has successfully completed the training programme, as well as meeting specific requirements of the Competent Authority. The VTSO Certificate entitles the authorized holder to serve as VTS Operator, VTS Supervisor or VTS Manager.


*Qualifications and certification*

VTS qualifications should primarily be based on the principle that satisfactory results are obtained during the IALA VTS Model Courses.

The following steps are recommended for attaining qualification:

1. The candidate has been selected and the set requirements as regard to prerequisites and medical/physical requirements are fulfilled. On successful completion of an approved training course, the VTS trainee receives a course certificate.
2. The course certificate may then be submitted to the appropriate authority who, after validation, should issue a VTS Certification Log book.
3. The VTS trainee should complete OJT (on-the-job training) at a specific VTS centre, under the supervision of an OJT Instructor (OJTI).
4. On successful completion of OJT the appropriate authority should issue an endorsement and/or a certificate enabling the trainee to operate.
5. Any additional successful completion of approved VTS training courses, such as Supervisor or OJTI, should also be entered in the VTS Certification Log book. The VTS certification log book should be revalidated on a periodic basis. Revalidation is the process for the maintenance of a VTS qualification. It ensures that holders of a VTS qualification, develop, increase and retain their competence in order to maintain a satisfactory level of operational performance.
**Entry requirements:**
The Competent/VTS Authority should set minimum entry requirements for applicants to become a member of VTS personnel. The selection process should include aptitude testing, assessment of prior learning, medical/physical requirements and an assessment of the personal attributes of the candidate.
Personnel may be recruited directly as VTS Supervisors/Manager if they can demonstrate to the VTS Authority that they have the required experience to undertake the responsibilities and duties of a VTS Supervisor/Manager.
Depending on the recruitment level and background of candidates, some elements of the Model Course could be addressed through an Assessment of Prior Learning (APL) and experience.


### 5.2.3 IHO International Board on Standards of Competence for Hydrographic Surveyors and Nautical Cartographers
Standards indicate the minimum degree of knowledge considered necessary for hydrographic surveyors and nautical cartographers to meet national and international hydrographic and charting requirements and the diverse needs of industry.

The standards developed are known as:

- S-5 describing the competencies for hydrographic surveyors and
- S-8 describing the competencies for nautical cartographers.

**Two levels of programme/ two levels of qualification:**

- Category “A” programmes introduce content and learning outcomes primarily from the underlying principles level. Category “A” qualified individual, with appropriate experience, would be a senior professional in their chosen area of activity (government, industry, academia).
- Category “B” programmes introduce them primarily from a practical level. Category “B” qualified individuals, with appropriate experience, would be technical professionals preparing and delivering products and services to meet specifications and outcomes.

Professional certification of individual recognition should be based on completion of a training programme (Category A or B), experience, documentary proof and continuing professional education and training.
5.3 ILO instruments for the port sector

1. Sector-specific Conventions and Recommendations are:
   - the Dock Work Convention, 1973 (No. 137);
   - the Dock Work Recommendation, 1973 (No. 145);
   - the Occupational Safety and Health (Dock Work) Convention, 1979 (No. 152); and
   - the Occupational Safety and Health (Dock Work) Recommendation, 1979 (No. 160).

2. Convention No. 137 deals with new methods of work in docks and their impact on employment and the organization of the profession. It has two main objectives: first, to afford protection to dockworkers in their professional life through measures relating to the conditions of their access to and performance of work; and second, to foresee and manage in the best possible manner, through appropriate measures, fluctuations in the work and the workforce required.

3. Article 6 of Convention 137 requires member States to “ensure that appropriate safety, health, welfare and vocational training provisions apply to dockworkers”, while the accompanying Recommendation No. 145 calls for comprehensive vocational training schemes to enable dockworkers to carry out several related tasks, to ensure workplace safety, and to help dockworkers to find employment elsewhere through the provision of retraining facilities and the assistance of the public employment services.

4. As might be expected, training features prominently in Convention No. 152 and its accompanying Recommendation No. 160 to ensure the protection of dockworkers against the risk of accident or injury to health arising out of or in the course of their employment. Article 38 of Convention No. 152 states that “No worker shall be employed in dock work unless he has been given adequate instruction or training as to the potential risks attaching to his work and the main precautions to be taken.” In case of an accident, Article 35 states that “adequate facilities, including trained personnel, shall be readily available for the rescue of any person in danger, for the provision of first aid and for the removal of injured persons in so far as is reasonably practicable without further endangering them.”

5. Other ILO instruments for the port sector include:
   - code of practice on security in ports (ILO–IMO, 2004);
   - code of practice on safety and health in ports (2005);
   - port safety and health audit manual (2005); and
   - social dialogue in the process of structural adjustment and

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17 ILO guidelines on training in the port sector / International Labour Office, Sectoral Activities Department. – Geneva: ILO, 2012
6. These instruments are supported and supplemented by research studies and extensive training materials, including:

- Portworker Development Programme (PDP);
- training materials on the implementation of the ILO–IMO code of practice on security in ports;
- training materials on the ILO code of practice on safety and health in ports (including the audit manual); and
- training materials for the implementation of the guidance manual on social dialogue in ports.

7. The ILO code of practice on safety and health in ports (2005) highlights the need for all portworkers to be trained to develop the knowledge, psychomotor and attitude skills which they need to enable them to do their work safely and efficiently, as well as to develop general safety awareness (section 2.6.2.1). In addition, general induction training should be given to all persons who are to work in ports. This training should cover the general hazards associated with ports, which are often quite different from those encountered in other industries (section 2.6.3.1).

8. All this information is available at: [www.ilo.org](http://www.ilo.org).

### 5.4 The next requirements – updating and new certificates?

E-Navigation concept is not limited to the equipment and technologies on board ships it also includes the officer as an integral part of the system, because based on all the information available to him, he is expected to make decisions that could make the difference between safe navigation and maritime disasters. But officers do not forget that every equipment has its limitations and its inherent flaws, and could fail to perform, the officer may misunderstand information or take wrong decisions due to the huge amount of data on screens or other electronic means. Thus, it is a very dangerous trend that in modern days an OOW should rely only on the information provided by the GPS or RADAR or the ECDIS. Indeed, many masters consider for a good reason that on board their ships the most important equipment are the eyes, ears, and the mind of the OOW, and that the most important consoles are the windows of the ships.\(^\text{18}\)

E-Navigation improves situational awareness and decision making at sea and ashore. When used in conjunction with other communications and display systems it enables shore organizations to deliver more timely and relevant information to the mariner. And through its many levels of sophistication and scalability it can embrace all levels of system users from recreational craft to the largest and most modern commercial vessels.

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A drawback is that its use requires that there be a new level of sophistication and equipage on the part of the system users. This in turn requires new levels of user training and certification. Fortunately the new generation of waterway users is more technologically astute or more used to technological advances than past generations. They will learn fast but systems and procedures cannot be imposed overnight, they will have to transition gradually.

In the not too distant past, aids to navigation were placed to enable a mariner to determine his or her position, determine a safe course to steer or to avoid unseen dangers. A few visual aids and the COLREGS were all that anyone needed. Not anymore. The aid mix of the future will be asked to do much more. It will define sea lanes and exclusion areas. It will support security as well as waterway efficiency. It will not only serve the navigator, but its benefits will be extended to a host of shore based users in government and commerce19. For the moment, the work must be driven to the combination of COLREGS supported by current training skills covered by STCW, IALA and IHO training and certification. In the short term, new certificates and training courses are not required, an optimal guidance on how to operate new functions and decision making processes together with team bridge and leadership strategies, will improve common sense to improve safety and security on board ships and ashore.

As it has been discussed through this report, shipping is facing several new technology modification challenges including their training and qualification requirements in the next decades. One of the most common and dominating change in the maritime business will be digitalization which is capturing all sectors of shipping: ashore and on-board. As mentioned before, this technology trend was defined and articulated more concrete by the International Maritime Organization (IMO) as the e-navigation concept in 2006. The initiative was launched to make ocean shipping more efficient and safer in all its aspects. To this end, the technical infrastructure on ships and on land should be harmonized, means of communication and routes should be further developed, and navigation systems and processes should be integrated in order to ensure safe shipping traffic and the protection of the maritime environment in the future.

E-Navigation was defined as “the harmonized collection, integration, exchange, presentation and analysis of marine information on board and ashore by electronic means to enhance berth to berth navigation and related services for safety and security at sea and protection of the marine environment”.

So that the further realization of the e-navigation concept can proceed systematically, the E-Navigation Strategy Implementation Plan (SIP) was drafted and ratified in 2014. The SIP is intended to be the framework for the gradual implementation of e-navigation. To this end, five out of nine solutions were identified that were prioritized, to be implemented from 2015 to 2019, and represent the first phase of deployment. The main component of the SIP is the tabular breakdown of the solutions and their measures to achieve the goals in a set timeframe.

The e-Navigation SIP presents the following solutions:

- solution 1: Improved, harmonized and user-friendly design
- solution 2: Means for standardized and automated reporting
- solution 3: Improved reliability, resilience and integrity of bridge equipment and navigation information
- solution 4: Integration and presentation of available information in graphical displays received via communications equipment
- solution 9: Improved communication of VTS Service Portfolio (not limited to VTS stations)

Solutions 2, 4 and 9 focus on efficient transfer of marine information and data between all appropriate users (ship-ship, ship-shore, shore-ship and shore-shore). Solutions 1 and 3 promote the workable and practical use of the information and data on board. These solutions have been addressed by the STM project in particular. Considering this training and competence needs for shipboard crew have to be analysed and defined.

2011 to 2018 ECDIS was introduced to shipping as a carriage requirement. This new bridge equipment was a fundamental change of navigation practice in relation to traditional paper chart procedures. Therefore meanwhile ECDIS trainings become mandatory by the STCW Manila Amendments 2010 too. Considering the e-Navigation concept and ideas concerning digitalization, integration, resilience and harmonized design of new bridges seafarers will be faced with another new major change of bridge environment and software. Although this step will not be as radical as implementation of ECDIS in terms of time scale. Anyway it will require continuous familiarization, qualification and competence improvements by ship’s crew. This has to be achieved and followed up by new training requirements and subsequently new training certificates. There is not a need of a complete restructuring of existing competence and training regulations, it is recommended to revise existing training.

5.5 The need for a common maritime certification system

According to EU roadmap on minimum level of seafarers' training and recognition of their certificates\(^{20}\), the seafarers' training and certification systems in the EU are regulated by Directive 2008/106/EC on minimum level of training of seafarers, and the Directive 2005/45/EC on mutual recognition of seafarers' certificates issued by Member States.

The minimum level of training requirements is based on the international convention on the "Standards of Training, Certification and Watchkeeping for Seafarers" (STCW) developed under the umbrella of the International Maritime Organization (IMO). A centralised system has been put in place at EU level for the recognition of seafarers' certificates issued by third countries, and a reassessment of the third countries' certificates.

\(^{20}\) Minimum level of seafarers' training and recognition of their certificates, DG Mobility and transport - UNIT D2-Maritime Safety; Proposal for a Directive of the European Parliament and of the Council. Q2 2018
compliance with the STCW Convention is carried out every five years. The main objective of the legislation is to enhance the training of seafarers working on board EU vessels, ultimately minimizing the risk of maritime accidents and thus contributing to the general safety and protection of the marine environment. The mutual recognition scheme today in place is aimed at fostering the mobility of EU seafarers among the EU flagged vessels.

The Commission undertook an evaluation of the regulatory framework of EU requirements in this area. The evaluation concluded that both Directives are fit for purpose and have met to a great extent the initial objectives and expectations. However, it also identified elements that have hindered the effectiveness and the efficiency of the common EU mechanism and which would require a legislative intervention.

5.6 Use of Networks in Maritime Transport Industry

Marine operations have traditionally been managed by professional mariners whose years of experience and training have prepared them for all possible emergency scenarios in the open sea regions. Despite all that, human errors are just as likely to occur when dealing with extreme situations and harsh working environment on-board the ships. The development of new computer based systems and programs, used in remotely controlling vessels in many shipping regions of the world, is now a reality, e-navigation and STM project is a proof that maritime industry is now within the ICT era. Autonomous ship definition is another clear prove about the drivers of next generation maritime services and these different scenarios require the design of cooperative networks to support information exchange to reduce maritime accidents, optimise routes and synchronise navigation and port calls, which in many cases, are limited by the human element.

Some authors discussed a new autonomous ship collision free (ASCF) trajectory navigation and control system with a new recursive navigation algorithm based on analytic geometry and convex set theory for ship collision free guidance. Indeed, our current work on STM validation project demonstrate the possibilities to increase the adaptability, availability and autonomy of the waterborne transportation through enhanced autonomy for ship systems and ships by using wireless and network communication technologies for ship-to-ship and ship-to-shore communications. Providing and enhancing the storage and interchange of different information, such as technical, administrative, commercial, environmental and navigational information increases the autonomy of ships as well as their adaptability and availability. Therefore, safety and security, efficiency and quality levels of various transport operations increase as well. On the other hand, developing such system poses significant challenges concerning major ship requirements and scenarios as well as their replicability to a variety of other ships and operations.

Improvement of Marine Transportation Operations is based on the development and implementation of the “Intelligent Ship” concept and addresses the following integration aspects or dimensions:

- physical integration of infrastructure / equipment,
- information integration through the provision of integrated information services to crew and other stakeholders, and
- automated and autonomous tasks within system operation.
One of the major prerequisites for the development of the STM concept has been the task analysis and human factors integration, in the ship ‘system’ landscape. This concepts and prerequisites have been widely explored in STM activity 3 (European Maritime Simulators Network).

Following the EMSN steps concern requirements for integration: the objective is to adapt the operational and business process of the system by integrating these new technologies in order to improve the global system and the quality and autonomy of shipping and ships’ operations. Scenarios are drawn from which a system can be integrated and functional:

**Scenario 1** – Reporting and Port clearance: common standard for reporting and transfer of data from ship to port communication based on XML-tagged information or other efficient and standardized M2M protocol like EDI, with an agreed format for input forms, information routing, reporting procedures, and quality assurance and verification of data;

**Scenario 2** – Environmental concerns and Energy Efficiency: providing tools and solutions for reporting, monitoring and other information for minimising environmental impact and optimising energy efficiency in different operational conditions.

**Scenario 3** - Vessel traffic and navigation: focus on vessel traffic management and information services (VTMIS), including pilotage support and other information concerning safe navigation. This scenario will also cover the possibility of autonomous operations in navigation channels for short-sea shipping;

**Scenario 4** - Crisis Management and abnormal situation management: information system for safety and security and crisis management based on a risk categorisation type of approach.

**Scenario 5** – Search and rescue operations where coordination among ship, rescue units and shore is paramount in order to minimise loss of lives, ships and environmental damage.

At international level\(^2\)\(^1\), globalized production, trade, communication and finance depend on connectivity, that is, the possibilities for people, companies and countries to connect with each other. UNCTAD has led the research on shipping connectivity since the first publication of the liner shipping connectivity index in 2004.

More recently, “connectivity has become a buzz word in development and international economics …” Viewing economic and social ties as isolated point-to-point interactions is losing ground to more comprehensive approaches, in which ‘networks’ are increasingly becoming the unit of analysis” (World Bank, 2013a).

The Group of 20 launched the Global Infrastructure Connectivity Alliance to improve the “linkages of communities, economies and nations through transport, communications, energy and water networks” (Global Infrastructure Connectivity Alliance, 2016). In the same vein, Aid for Trade at a Glance 2017 focuses on promoting trade, inclusiveness and connectivity for sustainable development (World Trade Organization, 2017). In a contribution to the aforementioned report, OECD and UNCTAD (2017) point out that “while digital connectivity can provide new opportunities for developing countries to participate in international trade, traditional trade costs

\(^2\)\(^1\) Review of Maritime Transport 2017 (UNCTAD/RMT/2017)
related to physical connectivity can still represent a significant barrier to the physical delivery of goods”. World Bank (2013b) concludes that “maritime transport connectivity and logistics performance are very important determinants of bilateral trade costs: in some specifications, their combined effect is comparable to that of geographical distance”. Improved liner shipping connectivity can help reduce trade costs and has a direct, positive bearing on trade volumes. This is confirmed by numerous studies on trade, seaports and shipping networks (see Wilmsmeier et al., 2006; Sourdin and Pomfret, 2012; Wilmsmeier, 2014; Ducruet, forthcoming; Fugazza and Hoffmann, 2017; Hoffmann et al., 2017; Wilmsmeier et al., 2017; and Geerlings et al., forthcoming, and the extensive literature referred to therein).

Projects like Monalisa, Monalisa 2.0 and STM validation project have also been defined under the concept of a network based infrastructure for Maritime industry.
6 Trainees, Trainers and the Training Centres

The academies with electronic navigation teaching systems from universities to private training centres, all have an extended experience of students and seafarer training in the subject of navigation. Gradually, there has been an increase in the amount of electronic equipment with sophisticated simulators for bridge, electronic charts, communications, engine rooms and RADAR. The money and investments have a major influence on the amount of equipment as well as the lack of policies regarding hardware and software. Model-courses are considered positive but the development is so fast that these guidelines are soon outdated with respect to the training and the purchase of new equipment. Discussions occur between teachers about training but no simulator cooperation exists. All suggested an urgent call for earlier guide-lines in the direction of e-Navigation and provision of on-going feed-back from authorities. Their suggestions concerned updated information on hardware, software and training.

6.1 Staff profiles analysis

The staff profiles analysis was carried out looking to position the various professions according to the levels of education and training and, by inherent, the level of certification required for the exercise of the professional activity.

For the analysis and positioning of the various professions identified, three international benchmarks were used for the classification and levelling of certifications in the educational and training system, thus giving a global view of the positioning of the professionals according to these references.

The support of the analysis was The European Qualification Framework, the ISCED and the directives 36/2005 / EU and 2012/35 / EU (in Annex more information about these references).

The European Qualification Framework and ISCED are comprehensive insofar as certification levels refer to levels of general education and / or vocational education and professional training. In the case of the 2012/35 / EU directive, it refers only to professional qualifications, without direct equivalence in general education.

The Directive 2012/35/UE establishes rules according to which a Member State which makes access to or pursuit of a regulated profession in its territory contingent upon possession of specific professional qualifications shall recognise professional qualifications obtained in one or more other Member States (referred to hereinafter as the home Member State) and which allow the holder of the said qualifications to pursue the same profession there, for access to and pursuit of that profession (Directive 2012/35/UE). Directive 2012/35 defines two types of certification, the certificate of competency and the certificate of proficiency, with specific indications of the requirements of each certificate, depending on the professional for which it is intended.

Besides, an essential and critical part of the education and training of a seafarer is the training received as part of the mandatory sea time requirements for onboard training. In the following table we present the result of the analysis:
Table 5 – Level of certification required for the exercise of the professional activity
(Note: the criteria to define the professional groups is the interaction with STM and Port CDM functions and responsibility levels; doubts about the relevance of certain groups/ references written in blue)

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<thead>
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<tbody>
<tr>
<td><strong>On board:</strong></td>
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</tr>
<tr>
<td>• Navigation</td>
<td></td>
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</tr>
<tr>
<td>• Controlling the</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>operation of the ship</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Marine engineering</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Electrical, electronic</td>
<td>On the deck</td>
<td>Management level: Captain/</td>
<td>7</td>
<td>6 or 7</td>
<td>Level D or E</td>
<td>Certificate of competency</td>
</tr>
<tr>
<td>and control</td>
<td></td>
<td>Master</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>engineering</td>
<td></td>
<td>Management level: Navigation</td>
<td>7</td>
<td>6 or 7</td>
<td>Level D or E</td>
<td>Certificate of competency</td>
</tr>
<tr>
<td>• Radio</td>
<td></td>
<td>Officers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>communications</td>
<td></td>
<td>Operational level: Officer in</td>
<td>7</td>
<td>6 or 7</td>
<td>Level D or E</td>
<td>Certificate of competency</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Charge of an Engineering</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Watch – OICEW</td>
<td>4 or 5</td>
<td>3, 4 or 5</td>
<td>Level B, C or D</td>
<td>Certificate of competency</td>
<td></td>
</tr>
<tr>
<td><strong>On the engine room</strong></td>
<td>Management level: Chief</td>
<td>6 or 7</td>
<td>6 or 7</td>
<td>Level D or E</td>
<td>Certificate of competency</td>
<td></td>
</tr>
<tr>
<td><strong>Management level:</strong></td>
<td>Engineer?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Operational level:</strong></td>
<td>Electro-technical officer</td>
<td>4, 5 or 6</td>
<td>3, 4 or 5</td>
<td>Level B, C or D</td>
<td>Certificate of competency</td>
<td></td>
</tr>
<tr>
<td><strong>Support level:</strong></td>
<td>electro-technical rating</td>
<td>4</td>
<td>3 or 4</td>
<td>Level B or</td>
<td>Certificate of proficiency</td>
<td></td>
</tr>
<tr>
<td><strong>In shore:</strong></td>
<td>Port operators</td>
<td>Management level: Vessel</td>
<td>4, 5 or 6</td>
<td>5 or 6 or 7</td>
<td>Level D or E</td>
<td>Certificate of competency</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Traffic Service (VTS)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Supervisor</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------------------------------------------</td>
<td>-----------------------------------------------</td>
<td>-------------------------------------------</td>
<td>---------</td>
<td>--------------------</td>
<td>-----------------------------------------------------------------</td>
<td>----------------------------------------</td>
</tr>
<tr>
<td>• Cargo handling and stowage</td>
<td>Operational level: VTS Operator</td>
<td>4, 5 or 6</td>
<td>3, 4 or 5</td>
<td>Level B, C or D</td>
<td>Certificate of competency</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Support level: ?</td>
<td>4</td>
<td>3 or 4</td>
<td>Level C</td>
<td>Certificate of proficiency (?)</td>
<td></td>
</tr>
<tr>
<td>Ship operators</td>
<td>Management level: ?</td>
<td>6 or 7</td>
<td>6 or 7</td>
<td>Level D or E</td>
<td>?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Operational level: ?</td>
<td>4 or 5</td>
<td>3, 4 or 5</td>
<td>Level B, C or D</td>
<td>?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Support level: ?</td>
<td>4</td>
<td>3 or 4</td>
<td>Level B or C</td>
<td>Certificate of proficiency (?)</td>
<td></td>
</tr>
<tr>
<td>Ship operators</td>
<td>Management level: Officials from port administrations</td>
<td>6 or 7</td>
<td>6 or 7</td>
<td>Level D or E</td>
<td>?</td>
<td></td>
</tr>
<tr>
<td>Ship operators</td>
<td>Maritime police ?</td>
<td>4 or 5</td>
<td>3, 4 or 5</td>
<td>Level C, D or E</td>
<td>?</td>
<td></td>
</tr>
<tr>
<td>Maritime administrations, port state authorities and port administration</td>
<td>SAR – Search and Rescue</td>
<td>Operational level: rescue staff ?</td>
<td>4, 5 or 6</td>
<td>Level C, D or E</td>
<td>Certificate of competency</td>
<td></td>
</tr>
<tr>
<td>Operational safety + Radio communications (?)</td>
<td>Support level: ?</td>
<td>4</td>
<td>3 or 4</td>
<td>Level B or C</td>
<td>?</td>
<td></td>
</tr>
</tbody>
</table>
6.2 Vocational education

While there are minimum standards for the training and certification of maritime workers in the EU, for the small commercial vessels sector, qualifications are not always recognised by other EU countries. This means that, for example, a German skipper working on a German boat may be barred from working on another vessel of the exact same model operating under a Spanish flag.

The European Credit System for Vocational Education and Training sets out a framework for describing vocational education and training qualifications in terms of their learning outcomes to allow them to be used across national borders. The system relies on voluntary participation of EU countries and relevant stakeholders however.

The general presentation of vocational training courses for selected professional groups contains the same required IMO training and certification scheme high level professionals.

For seagoing ships:
A ship navigating in areas not close to inland or sheltered waters or where port regulations apply. Seafarers must accomplished with the standards of competence which refers to the minimum knowledge, understanding and proficiency that seafarers must demonstrate to gain certification. The STCW Code specify the standards of competence to be achieved by the seafarer. The thinking behind dividing all duties on board into competencies, functions, and levels of responsibility is that certificates should be awarded on the basis of the specific duties the seafarer carries out on-board rather than on ship departmental divisions (deck/engine).

For the complete tables and full details of standards of competence applying to the certificates you hold, refer to the STCW Code (part A) in the 2010-amended STCW Convention.

The 2010 amendments only refer to the following certifications:

Certificate of competence:

A certificate issued and endorsed by the administration, for masters, officer and GMDSS radio operators in accordance with the provisions of chapters II, III, IV or VII and entitles the lawful holder thereof to serve in the capacity and perform the functions involved at the level of responsibility specified.

Certificate of proficiency:

A certificate, other than a certificate of competency issued to a seafarer, stating that the relevant requirements of training, competencies or seagoing service in the convention have been met.

Documentary evidence:

Documentation, other than a certification of competency or certificate of proficiency used to establish that the relevant requirements of the convention have been met.
### Table 6. STCW Code Training Courses and 2010 amendments

<table>
<thead>
<tr>
<th>NAME OF CERTIFICATE</th>
<th>REVALIDATION</th>
<th>STCW REG.</th>
<th>KEY: C/R certificate required. D/P Documentary proof. T/O Training onboard. E/R Endorsement required</th>
</tr>
</thead>
<tbody>
<tr>
<td>National certificate of competence and endorsement</td>
<td>Yes</td>
<td>I/2, II/2,</td>
<td>C/R</td>
</tr>
<tr>
<td>Flag state endorsement of recognition</td>
<td>Yes</td>
<td>I/10</td>
<td>E/R</td>
</tr>
<tr>
<td>GMDSS endorsement</td>
<td>Yes</td>
<td>IV/2</td>
<td>C/R</td>
</tr>
<tr>
<td>Basic safety training – Personal survival techniques – Fire prevention and fire fighting – Elementary first aid – Personal safety and social responsibility</td>
<td>Achieved within previous five years</td>
<td>VI/1</td>
<td>D/P</td>
</tr>
<tr>
<td>Medical first aid</td>
<td>No</td>
<td>VI/4</td>
<td>D/P</td>
</tr>
<tr>
<td>Survival craft and rescue boats</td>
<td>Yes</td>
<td>VI/2</td>
<td>D/P</td>
</tr>
<tr>
<td>Advanced fire fighting</td>
<td>Yes</td>
<td>VI/3</td>
<td>D/P</td>
</tr>
<tr>
<td>Medical fitness</td>
<td>Yes</td>
<td>I/9</td>
<td>C/R</td>
</tr>
<tr>
<td>Basic safety familiarisation</td>
<td>On assignment</td>
<td>VI/1</td>
<td>T/O</td>
</tr>
<tr>
<td>Ship specific familiarisation</td>
<td>On assignment</td>
<td>I/14</td>
<td>T/O</td>
</tr>
<tr>
<td>Security familiarisation</td>
<td>On assignment</td>
<td>VI/6</td>
<td>T/O</td>
</tr>
</tbody>
</table>

### CHIEF MATE

<table>
<thead>
<tr>
<th>NAME OF CERTIFICATE</th>
<th>REVALIDATION</th>
<th>STCW REG.</th>
<th>KEY: C/R certificate required. D/P Documentary proof. T/O Training onboard. E/R Endorsement required</th>
</tr>
</thead>
<tbody>
<tr>
<td>National certificate of competence and endorsement</td>
<td>Yes</td>
<td>I/2, II/2,</td>
<td>C/R</td>
</tr>
<tr>
<td>Flag state endorsement of recognition</td>
<td>Yes</td>
<td>I/10</td>
<td>E/R</td>
</tr>
<tr>
<td>GMDSS endorsement</td>
<td>Yes</td>
<td>IV/2</td>
<td>C/R</td>
</tr>
<tr>
<td>Basic safety training – Personal survival techniques – Fire prevention and fire fighting – Elementary first aid – Personal safety and social responsibility</td>
<td>Achieved within previous five years</td>
<td>VI/1</td>
<td>D/P</td>
</tr>
<tr>
<td>Medical first aid</td>
<td>No</td>
<td>VI/4</td>
<td>D/P</td>
</tr>
</tbody>
</table>

---

22 STCW GUIDELINE - International Transport Workers' Federation (ITF). 06/06/2017
All navigational officers must now have thorough knowledge of and ability to use ECDIS.

The only mandatory simulator training under STCW has been that relating to the use of radar and ARPA. The 2010-amended STCW also makes use of simulators for training in electronic chart display and information systems (ECDIS) a mandatory requirement during training. In these specific cases, simulators are the only accepted methods of demonstrating competence. In all other instances, approved simulator training and assessment is not mandatory, being just one of the methods accepted by the convention for training and demonstrating competence. (The use of other methods such as in-service experience or training ship experience are equally acceptable.) This category of optional simulator training and assessment covers navigation and ship handling, cargo handling, GMDSS communication, propulsion and auxiliary machinery.

Simulators need to comply with prescribed standards. This does not imply that all simulators need to be highly expensive and complex electronic artefacts. Although certain simulators, such as radar or ARPA, do fall under this category, other tasks can
be taught and assessed using more basic simulators. For example, ship models are widely used for providing training in ship stability and for assessment purposes, and even an orange, when used for teaching injection techniques in first aid training, can be considered as a simulator. Instructors and assessors engaged in simulator-based training need to be properly qualified in the use of such equipment.

Table 7. IALA model courses

<table>
<thead>
<tr>
<th>Courses</th>
<th>Competences certification</th>
<th>Modules/Themes</th>
</tr>
</thead>
<tbody>
<tr>
<td>V-103/1 VTS Operator Training</td>
<td>The award of a VTSO Certificate and endorsement to act as a VTSO should be achieved by successfully undertaking the following modules:</td>
<td>1 Language</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 Traffic Management</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 Equipment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4 Nautical knowledge</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 Communication co-ordination</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6 VHF-radio</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7 Personal attributes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8 Emergency situations</td>
</tr>
<tr>
<td>V-103/2 VTS Supervisor Training</td>
<td>The award of an endorsement in the VTS Certification Log as a VTS Supervisor should be obtained by a VTSO successfully undertaking the following modules:</td>
<td>1 Advanced Traffic Management.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 VTS equipment.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 Additional personal attributes.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4 Responding to emergency situations.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 Administrative functions.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6 Legal knowledge.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Following successful completion</td>
</tr>
</tbody>
</table>

6.3 High-level education

The education and training of seafarers is an important issue for the EU, in order to maintain and develop the level of knowledge and skills in the maritime sector in the EU as well as in the interest of maritime safety. It is therefore essential to define and maintain a minimum level of training for seafarers in the EU.

The fundamental task of Maritime Education and Training (MET) is seafarers’ education in a way that they acquire applicable knowledge, skills and competences in accordance with the techniques and technologies required for the modern on board ship management but also to be prepared for the development of global shipping as a whole.

The basis of MET was defined in the STCW Convention. In addition, the IMO Model Courses provided guides for the application of specific training programmes. The content of the model courses, over the years, has continuously been harmonised by following the new standards of competences required by the STCW Convention, most notably in terms of standards related to safety at sea, marine environment protection, and the English language with maritime terminology. An important influential factor on the MET system is the accelerated technological advancement in the maritime sector.
industry, which necessarily requires better educated, trained and competitive seafarers that can deal with increasingly demanding and complex ship management. Therefore, it is necessary to continuously update and upgrade the MET educational contents, but more effective and proactive affirmation of educated and experienced lecturers as well.

In the last decades, the EU fleet has faced with the shortage of seafarers, especially the officers. The lack of interest for maritime professions and the influx of more competitive labour force from the Far East countries have been identified as the main reasons. This cognition urged the EU to adopt a strategy to promote but also to sponsor numerous regional and international researches in the area of MET through multiannual funding programmes in order to mitigate the negative trends and ultimately terminate it. Likewise, European and global MET institutions are pooled into different platforms and associations so that they could, with support of concentrated intellectual, experimental and other resources through a variety of researches, studies, analysis and with support of the mentioned EU funding programmes, be able to offer with some insights to increase MET standards and thus achieve the ultimate goals, more accessible MET and a high quality, modern and at global level competitive European merchant fleet as well as an increased attractiveness of the maritime profession among young people in the EU.

The existing system of higher education at the maritime higher education institutions (MHEI) has been launched in 2005. It is harmonized with the provisions of the Bologna Declaration, which resulted in the division of university studies into three levels: undergraduate, graduate and postgraduate studies. This is a precondition for the inclusion of European university studies into the European higher education system, which is mostly reflected in the ability of undergraduate students to continue studying on EU universities with similar curricula.

Undergraduate study at MHEI lasts for three years and by graduation credits students are awarded with 180 ECTS and a bachelor degree in marine engineering or nautical sciences. In addition to those who have completed maritime secondary school, undergraduate studies can be enrolled by students who completed other secondary schools, subjected to passing additional programmes meeting the STCW requirement for STCW content. Until recently, undergraduate study was specific because it was divided into 2 + 1 year. Namely, all content programmes subjected to the STCW Convention for obtaining qualification were deployed within the first two years of study. Thus, after the second year of study, students could terminate the study and request a confirmation that they have completed first two years of undergraduate study meeting all STCW requirements for obtaining highest qualifications, namely Second Engine Officer (SEO)/Chief Engineer (CE) and Chief Officer (CO)/Master Mariner (MM).
6.4 The training and education centres

Table 8. Reference training centres certified by IMO/IALA

<table>
<thead>
<tr>
<th>IMO</th>
<th>IALA</th>
</tr>
</thead>
<tbody>
<tr>
<td>The World Maritime University</td>
<td>L’Ecole Supérieure Navale de Tamentfoust - Algeria</td>
</tr>
<tr>
<td>The IMO International Maritime Law Institute</td>
<td>AMC Search Ltd – Australia</td>
</tr>
<tr>
<td>Academy (IMSSEA)</td>
<td></td>
</tr>
<tr>
<td>The International Maritime Safety, Security</td>
<td>Pivot Maritime – Australia</td>
</tr>
<tr>
<td>Academy (IMSSEA)</td>
<td>website: <a href="http://www.pivotmaritime.com">www.pivotmaritime.com</a></td>
</tr>
<tr>
<td>The IMO International Maritime Law Institute</td>
<td>SCHEEPVAARTBEGELEIDING Maritiem Plein 3 8400</td>
</tr>
<tr>
<td></td>
<td>Oostende, Belgium</td>
</tr>
<tr>
<td>The IMO International Maritime Law Institute</td>
<td>SHELTER Cursos em Proteção e Segurança Marítima Ltd (technical</td>
</tr>
<tr>
<td></td>
<td>support of AFS Consultants, UK)</td>
</tr>
<tr>
<td>Canadian Coast Guard College, Canada</td>
<td>FHM – Fundação Homem do Mar, Rio de Janeiro, Brasil</td>
</tr>
<tr>
<td>Maritime Training Centre of Shanghai, China</td>
<td>Canadian Coast Guard College, Canada</td>
</tr>
<tr>
<td>Svendborg International Maritime Academy</td>
<td>Maritime Training Centre of Shanghai, China</td>
</tr>
<tr>
<td>Graaesvej 27 5700 Svendborg, Denmark</td>
<td></td>
</tr>
<tr>
<td>IMO</td>
<td>IALA</td>
</tr>
<tr>
<td>-----</td>
<td>------</td>
</tr>
<tr>
<td></td>
<td>Aboa Mare Academy and Training Centre, Turku, Finland</td>
</tr>
<tr>
<td></td>
<td>L’Ecole Nationale de la sécurité de la mer, NANTES</td>
</tr>
<tr>
<td></td>
<td>Marine Department Training Centre, Hong Kong</td>
</tr>
<tr>
<td></td>
<td>Kongsberg VTS Training Academy, India</td>
</tr>
<tr>
<td></td>
<td>Japanese Aids to Navigation, Japan</td>
</tr>
<tr>
<td></td>
<td>VTMIS Centre, Italy</td>
</tr>
<tr>
<td></td>
<td>Moji Branch School of Japan Coast Guard, Japan</td>
</tr>
<tr>
<td></td>
<td>Korea Institute of Maritime and Fisheries Technology (KIMFT), Korea</td>
</tr>
<tr>
<td></td>
<td>STC B.V, Malasya</td>
</tr>
<tr>
<td></td>
<td>KASI (Malaysia) Sdn Bhd</td>
</tr>
<tr>
<td></td>
<td>National Nautical VTS Training Organisation Adm., Netherlands</td>
</tr>
<tr>
<td></td>
<td>Singapore Maritime Academy, Singapore</td>
</tr>
<tr>
<td></td>
<td>MPA Academy, Singapore</td>
</tr>
<tr>
<td></td>
<td>School of Ports Transnet National Ports Authority, South Africa</td>
</tr>
<tr>
<td></td>
<td>Centro de Seguridad Marítima Integral Jovellanos, Asturias, Spain</td>
</tr>
<tr>
<td></td>
<td>Directorate General of Coastal Safety, Turkey</td>
</tr>
<tr>
<td></td>
<td>ADPorts Maritime Training Centre, United Arab Emirates</td>
</tr>
<tr>
<td></td>
<td>South Tyneside College, UK</td>
</tr>
<tr>
<td></td>
<td>Fleetwood Nautical College, UK</td>
</tr>
<tr>
<td></td>
<td>Port of London Authority, UK</td>
</tr>
<tr>
<td></td>
<td>The Maritime Institute of Technology and Graduate Studies (MITAGS), USA</td>
</tr>
</tbody>
</table>

**European Maritime Safety Agency (EMSA) is** also an important training centre. The training activities are organized on a regular basis and participants are namely officials from national administration’s policy and enforcement officials, maritime administrations and port state authorities.

The most important training fields: Maritime safety, Maritime security, Marine environment, Human Element, Accident investigation, Port State Control, Maritime legislation, Vessel Traffic Monitoring and Reporting, Maritime surveillance

### 6.5 Technical requirements for training and certification

The industry has been reducing the onboard training requirements over the last three decades. This, combined with the faster turnaround of ships and reduced manning,
has led to the situation that learning from mentors on board has gotten severely restricted. No amount of classroom and simulator-based training can be a substitute for what is learned on board. The shipboard-structured training program developed for granting remission of sea time is often not given the importance it deserves because the senior officers on board are themselves very busy with other shipboard work.

Shipowners often complain that the crew is not trained well and is not fully competent despite having certificates. One of the reasons is the lack of interaction between training institutions and ship operators.

Teachers in general are people who like to learn continuously, but the industry does not give them opportunities to upgrade their skills. Teachers need to occasionally sail on ships to refresh their knowledge about the application of latest regulations and the latest equipment and machinery fitted on board. The teachers also need feedback on the accidents and near misses that are happening on board.

The industry associations need to work more closely together to achieve standardization in training.

The school system in different countries differs substantially. This has an effect on how much can be achieved in the maritime school. Mathematics, physics and chemistry or even verbal and written skills that were not properly taught in the 12 years of school attendance cannot be taught in the maritime schools or universities. This is a very difficult issue to address on an international scale, but the industry has been working on it and some solutions are available in the market. E-navigation applications like e.g. enhanced anti-collision displays, dynamic tidal and current information integrated into ECDIS but also completely new services as e.g. route broadcast and route suggestion services for enhanced traffic management and coordination are about to be developed, demonstrated and tested. However, “it is well recognized that training requirements will also rise”. From on-going research it is concluded that there is a need to pay attention not only to the potentials of the new systems and their options to display and highlight safety related objects but moreover and particularly also to the constraints and the corresponding consequences for sophisticated presentations including processed and linked information and even warnings and alarms. The operators must be much more aware and must know about the details of the limits of any system used for navigation.

Finally, at technical level, the industry stakeholders, especially the end-users, shipowners, managers and training institutions need to work more closely together. The industry trade associations need to support training wholeheartedly. Waiting for governments to take the initiative will not work in most countries.
7 Data Collection

The main objective of the Sea Traffic Management (STM) Validation Project is to prove the target concept of STM, which has been defined and elaborated within MONALISA and MONALISA 2.0 projects, previously supported by TEN-T. STM project aims to overcome many of the challenges of communication and information sharing among stakeholders in the maritime transport, ports and logistics industries and create significant added value as a result, in particular for ship, cargo owners and for shipping in the transport chain and improved/optimised port services linked to the supply chain. In the STM Validation Project, the theoretical definition work, carried out in MONALISA 2.0, has been taken into practice by establishing large-scale test beds for sea traffic management in the Nordic region and in the Mediterranean Sea. In these test beds, Voyage Management, Information Flow Management and Port Collaborative Decision Making (CDM) services have been tested, consulted and validated in practice. An infrastructure for the information exchange in the test beds has been set up. This Action has also refined and develop the existing analyses on the effects on charter parties, the legal and liability aspects, operational aspects such as usability and cyber security, as well as provide a cost benefit analysis with compelling business cases for affected parties.

Different actions on data collection have used direct consultations to international authorities, IALA, IMO, ILO, BIMCO, stakeholders at maritime and port levels and finally, end users from shipping industry. Several surveys, living labs, multilateral meetings, workshops and conferences have provided a huge amount of data and valuable information to make STM the flag ship of e-navigation deployment worldwide.

In the chapter of competence and training, this survey on “new competences related to the stakeholders involved in STM in shore, on board and for operational safety”, is part of the analysis in order to collect the next competence requirements regarding the new scenarios coming from the implementation of STM services, with the resulting variations in operational techniques and procedures. The internal and external project stakeholders, the clusters and the international forums have been consulted in order to provide suitable answers promoting the engagement of skilled and qualified professionals and staff into the maritime and port industries in the coming years when STM will be deployed.

7.1 Methods

The method employed to evaluate the future training and competence needs has been a survey. The survey is a research method for collecting information from a selected group of people by using standardized questionnaires or interviews. While many people think of a questionnaire as the “survey”, the questionnaire is just one part of the survey process. Surveys also require selecting populations for inclusion, pre-testing instruments, determining delivery methods, ensuring validity, and analysing results.
Structure of the survey

The survey is divided in five blocks. The survey directs each of these blocks to a specific group of professionals (target groups). Target groups will only respond to the block(s) they are interested in.

The blocks are:

- new technologies and connectivity
- ship navigation
- communications
- European Maritime Simulator Network
- Port CDM

Target groups: watch keeping and crew members, bridge officers and ship owners, port and terminal service providers and other external maritime/port services providers.

They have been called to be the main actors within the Sea Traffic Management services. Within this context, the main services and functions covered in this survey are:

- port call synchronization
- port call optimization
- port call improvement
- port call monitoring
- route exchange ship to ship
- route optimisation
- route cross check
- enhanced monitoring
- flow management
- area management
- winter navigation
- SAR services
- en route navigational assistance
- SeaSwim

STM ACTORS: SEA TRAFFIC MANAGEMENT OPERATORS, NAVIGATION STAFF, TRAINERS AND PORT OPERATORS

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23 Sea System Wide Information Management (SeaSWIM) was defined within the MONALISA 2.0 project to realize the potential of the existing data and information in the maritime industry. The fundamental goal for SeaSWIM is to provide and maintain a harmonized way of communicating within the maritime industry. Current maritime information is often restricted to a certain organization or department because of incompatible standards and technologies. Unifying the way maritime stakeholders communicate enable a common information marketplace and strengthen the ecosystem by providing new interoperable ways of interaction.
Disclaimer on data provided: All personal data acquired by this survey shall strictly be used for the purposes of the STM Project and shall not be further processed or disclosed without the consent of the Company or Person surveyed. The data is collected confidentially and the information provided will be kept in a secure environment to guarantee the participants’ anonymity. Anonymous data collection guaranties that data will be analysed at the STM group level in order to de-identify participants. Identifying details will not be presented in the results of the analyses and will be kept anonymous.

Please complete this online form according to your expertise or professional field.

7.2 Survey

STM sub-activity 5.7 needs to know the industry’s training needs for navigating and Non-navigating staff previously to the future implementation and deployment of the concepts contained in STM validation project. The following maritime industry training requirements and needs survey is the tool that best enables us to help Activity 5 to explore this project area.

The stakeholders’ participation has been essential and will allow us to identify the current and future training topics to better meet the needs of port and marine sector in terms of both land and sea staff referred to the roles required in STM concepts. The survey also allowed STM Project promoters, to draw up a plan for the next deployment of assets, equipment, facilities, procedures and information exchange protocols and contents between the port and maritime industry impacted by the Sea Traffic Management implementation.

The survey has been designed to be answered online through Google services. The survey access is: https://docs.google.com/forms/d/e/1FAIpQLSfQjIT4o0XZsk-2Fo3f6yFHIpOnDuJjq051qA47zUmKWb7g/viewform?c=0&w=1
7.3 Answers and data analysis

Google sheets as a tool for the survey uses the Simple descriptive statistics such as frequency counts and percentage distributions to provide the basic information the sub-activity 7.5 team need to be answered in terms of the questions for which they initially started the survey process.

Frequency counts provide the number of respondents who selected each category in a question. In our case as shown in Figure 20, 111 persons were participated in the survey. The counts for all other response categories also appear in the tables.

In addition to the frequencies, percentage distributions are useful, and should be calculated in a manner that reflects the data appropriately. The percentage distribution is the number of responses in each category divided by the total number of responses. The team should decide whether the percentage distributions based on the total number of responses is sufficient or whether the distribution should be based on the number of valid responses.

Once the frequency tables and percentage distributions are available, our team members began to analyse the data. One way to do this was to look for patterns within the data.

Some specific areas include:

Comparison within a survey – Response patterns for certain questions may stand out from the others and may indicate an area with more relevance within the aspects of STM project covered.

Comparison across subgroups - Breaking out questionnaire responses by specific characteristics helped our team to determine whether certain groups have different interest or competence according to their expertise/knowledge/experience fields.

Analysis of group differences depends on the types of attributes captured in the survey and this will be discussed further.

Figure 20. Online survey answers – Source: own elaboration
Our team conducted the online survey with mostly local trainers, OOW, VTS operators taking the advantage of the opportunity that our trainees offer when they perform their training courses in Integral Maritime Safety Jovellanos Centre. Nearly half of the participants in the survey are partners in the STM project and cover a wide range of specialties in the fields of navigation, maritime affairs, maritime legislation, navigation monitoring and control, training and port operations and logistics. Finally, about 20% of the participants have been contacted through different actions of direct call through the network of stakeholders built throughout the STM project. In Figure 21, the age distribution of the survey participants is shown. The survey did not consider gender issues but it would be taken into account in further consultations.

The range of age among the participants is not significant (44.3% over 45 years vs 55.7% less than 45 years).

The different kind of maritime professionals that respond to the questionnaire, cover a large variety of activities, VTS providers (31.2%) and Coast Guard Services (24.8%) are in the lead.
Figure 22. Distribution of professional profiles participated in the survey – Source: own elaboration

Around one hundred and eleven responses have been collected until the moment of writing the present report.

The distribution per country is also included. The purpose of the survey was originally to collect information from the different stakeholders and project partners but many questionnaires and surveys have been developed under other project activities. Our original objective was to obtain answers from a wide spectrum of profiles and Member States. To get the participation of the project partners, we had to apply different strategies in Spain, workshops performance and asking to our training centres attendants to help us to answer the survey. This is the reason for the large amount of answers from Spain as it is shown in Figure 23.
Figure 23. Distribution of countries participated in the survey – Source: own elaboration
8 Results on new technologies and connectivity survey

The aim of “New technologies and connectivity” survey is to collect the current perspective regarding technology and connectivity from the point of view of crewmembers. By its nature, the technology evolves quickly to solve issues and problems created by previous technologies (axiom), so even young users with advanced technological skills, may be left behind once they met the job position. Updating and recurrent training is the best solution to reach and maintain optimal skills. Adaptation is another critical aspect in the impact of new technologies. Success in the implantation of new technology will be indicated by the degree of usefulness and friendliness perception. One of the new technology and connectivity aspects is the introduction of the SeaSWIM concept as a future set of instruments and services that will Enabling Digitization of the Maritime Industry, SeaSWIM.

The evaluation of this survey chapter is organized as follows:
In a 0 to 5 scale is graded the impact of the following questions, where 0 means not answer, 1 is a minor impact and 5 a great impact.
Questions number 1 and 2 of the survey explore the rate of receptivity in the participants.
A significant proportion of those respondents, expressed the opinion that they were clearly in favour of new technology and that it was received in a positive way in their workplace.
According to questions number 3, 4 and 5, it is not so clear stated that neither quality or quantity of training programs are sufficient when talking about implementing new technology.

TC2: Do your co-workers receive in a positive way, the new technology aids, tools and gadgets acquire in your workplace?

TC3: Do you receive a training program when a new equipment, device or system is installed in your workplace?

TC4: In those cases, what is the quality of the training program?
Level of satisfaction with internet access is not the desirable according to answers in question number 6.

ECDIS equipment is analysed in questions 7, 8 and 9. The respondents showed that not only ECDIS leaves room for improvement in terms of satisfaction but also in terms of training.
Responds to questions number 10, 11 and 12, clearly reflect that also GMDSS in terms of tools usefulness and training, leaves room for improvement in order to face maritime accidents/incidents.
Concerning to AIS, in questions number 13 and 14, most of respondents are satisfied with the usefulness of AIS as collision avoiding, route planning, and traffic information and identification system. However, room is left concerning the use given.
It is clearly stated, in question number 15, that participants need to be supplied with more training related to the AIS.

TC15: What is your opinion about the training supplied related to the AIS?

TC16: In order to avoid vessel collisions, do you consider a sufficient measure to try a previous VHF communication (call) to the ship on collision course?
One of the most intricate debates when analysing the behaviour of bridge officers in collision avoidance is the VHF communications. In this sense, we find two positions:

1. Those who consider that the ships must govern according to COLREGs not to the VHF, in the sense that they understand that the rules are precise and therefore any radio-communication between people of different cultures and languages can be ambiguous.

2. Those who consider that knowing the intentions of the other vessel in advance is very positive in collision avoidance.

While it is true that on many occasions the courts have criticized the excessive time that bridge officers lose contacting the other ship instead of taking effective measures. We think that if the radio-communication is made in due time we can consider it as a good practice. We must not forget that COLREGs, in its Rule 7, obliges the officer on duty to use all available means on the navigating bridge to assess the risk of collision.

In any case, it is important to note that the use of VHF is one more measure, never the only one that the duty officer should use in collision avoidance.

The results of the survey confirm the usual practice on board about the use of VHF as a tool to prevent collisions. The question specifies whether the person considers "a sufficient measure to try a previous VHF communication", to which 12% expressly opposes and 9.8% considers it sufficient, moving the highest values in the intermediate answers.

TC16: In order to avoid vessel collisions, do you consider a sufficient measure to try a previous VHF communication (call) to the ship on collision course?

92 responses

TC17: ¿IS the COLREG (Collision Regulation) still up to date and applied as it was originally intended?. i.e. in what extent are navigators “ignoring” the COLREGS due to new technology

The results of the survey confirm the usual practice on board about the use of VHF as a tool to prevent collisions. The question specifies whether the person considers "a sufficient measure to try a previous VHF communication", to which 12% expressly opposes and 9.8% considers it sufficient, moving the highest values in the intermediate answers.
As we can see in the graph, a high number of respondents think in the way indicated in the previous paragraph. Specifically, 37% opted for the option that COLREGs is outdated and leads to non-compliance. A very delicate situation from the legal point of view, because in the event that a collision produces material or personal damage, the officer on watch (OOW) must demonstrate whether he fulfilled the COLREGs, regardless of their degree of adaptation of COLREGs to the new scenario of navigation.

**TC17: IS the COLREG (Collision Regulation) still up to date and applied as it was originally intended? i.e. in what extent are navigators “ignoring” the COLREGS due to new technology?**

![Graph showing responses to TC17](image)

In question number 18, a considerable proportion of those surveyed said that cyber-attacks are a risk factor for safety in maritime navigation.

**TC18: Do you consider cyber-attacks a risk factor for safety in maritime navigation?**

![Graph showing responses to TC18](image)

In question number 19, most of the informants clearly state the compelling need of the role of an Electro-Technical Officer with specific skills on new technologies on board.
TC19: Do you consider necessary the role of the Electro-technical Officer with specific skills on new technologies on board?

94 responses

In question number 20, regarding SeaSWIM (1) (System-Wide Information Management) that will be the information exchange infrastructure for STM services. It is considered by a significant majority that to a certain extent, SeaSWIM would be a reliable, user friendly and optimal way to integrate maritime data.

TC20: SeaSWIM (1) (System-Wide Information Management) will be the information exchange infrastructure for STM services, do you consider that this would be a reliable, user friendly and optimal way to integrate maritime data?

91 responses
9 Results on ship navigation survey

The aim of “Ship navigation” survey is to collect the current crew member’s navigation needs regarding the impact of the adoption of Sea Traffic Management concepts. The key words of these blocks are: COLREGs, VTS, AIS, ECDIS, etc. This part of the survey also measures the seafarer’s degree of acceptance of STM concepts and services proposed including connection with shore services. It should be noted that, in recent years, navigation has undergone a revolution introduced, first by the satellite positioning systems, and later on by advances in communications and digital cartography.

In a 0 to 5 scale is graded the impact of the following questions, where 0 means not answer, 1 is a minor impact and 5 a great impact.

Question number 1 explores to what extent it is considered that some principles of Air Traffic Control (ATC) could be implemented in vessel traffic services (VTS). Most of those interviewed (37.5%) express the opinion that ATC could be implemented in VTS, but just to a certain point.

Question number 2, the respondents expressed the opinion that Sea Traffic Management (STM) will have a direct impact in the number of crew members but do not agree to what extent.
SN2: To what extent would Sea Traffic Management (STM) have a direct impact in the number of crew members?

97 responses

Question number 3, acceptance of the new concepts implemented by STM among the crewmembers is rated to a great extent but not to the maximum.

SN3: To what extent do you consider that crew members would accept the new concepts implemented by STM?

95 responses

Question number 4, the vast majority of those surveyed responded that they consider to the maximum extent to be relevant that the operational personnel that operate STM at shore centres would have a maritime background.
SN4: To what extent do you consider it is relevant that the operational personnel that operate STM at shore centres would have a maritime background?

In question number 5, 6 and 7 a large proportion of respondents consider that the number of accidents would be reduced due to the implementation of STM concepts and also be relevant in coastal areas but not to the same extent in open waters.

SN5: To what extent do you consider that the number of accidents would be reduced due to STM concepts?

SN6: To what extent do you consider that STM concepts would be relevant at coastal areas?
Question number 8, most of the respondents express the opinion that information and advice provided from shore centres restrict the discretion in decision making of the ship's master to a great and medium extent but not to the maximum.

SN8: To what extent can information and advice provided from shore centres restrict the discretion in decision making of the ship's master?

Question number 9, it is shown the tendency, to an “alarming” extent, in the use of course over ground (COG) instead of course through the water (CTW) in collision avoidance.

New technologies often clash head-on with good seamanship. The case of the use of the course over ground (COG) instead of course through water (CTW) is a clear example.

Satellite positioning systems provide ship’s move over the bottom of the sea. Moreover, for these equipment it is indifferent that the vessel is floating on any fluid or moving with wheels on the seabed. For the navigators, the COG (course over ground) and SOG (speed over ground) are valuable data, which greatly facilitates the dead reckoning navigation (DR).

However, at sea this criterion is not universal. Indeed, when a body is moving through water, its route is altered by the effect of wind or sea currents. For example, a car-
carrier, with wind on her beam, will do a very different course over the bottom than the one through the surface of the sea.

In addition, this is particularly relevant we talk about collision avoidance. According to COLREGs, two vessels are in a crossing, head-on or overtaking situation, depending on the visual aspect which they see each other. This visual aspect is closer to the course through the water (CTW) than to the course over ground (COG). In many cases, the differences are so significant that they can confuse the navigator.

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SN9: To what extent there is a tendency in the use of course over ground (COG) instead of course through the water (CTW) in collision avoidance?

![Graph showing responses]

Question number 10, most of respondents said that they check (or used to check) the GPS position by other means of positioning.
SN10: To what extent do you check (or used to check) the GPS position by other means of positioning?

92 responses

Question number 12, effectiveness of AIS is rated positively in order to manage the anchorage areas from the ship’s perspective, but it leaves room for improvement.

SN12: Give a value to the effectiveness of AIS in order to manage the anchorage areas from the ship’s perspective.

94 responses

Question number 13, exactness (precision) of visual position fixing is valued positively to a great extent of quality.

SN13: Give a value to the exactness (precision) of visual position fixing.

98 responses

Question number 14, respondent’s rate the level of confidence in the design of modern bridges in terms of the equipment/systems installed to a good degree but not to the top one.
Question number 15, it is considered to a great and maximum extent that the integrated information on a multifunction screen (ECDIS/ RADAR/ AIS/ CONNING) benefit the situational awareness of the officer on watch.

SN15: Do you consider that the integrated information on a multifunction screen (ECDIS/ RADAR/ AIS/ CONNING) benefit the situational awareness of the officer on watch?

Question number 16, respondents said that ECDIS/RADAR/AIS information can reduce to a great and maximum extent the reaction time to a potentially dangerous situation.

SN16: To what extent can ECDIS/RADAR/AIS information reduce the reaction time to a potentially dangerous situation?
Question number 17, respondents express very diverse opinions whether the confidence in new technologies decreases the use or necessity of the navigational watch.

SN17: To what extent confidence in new technologies decreases the use or necessity of the navigational watch?

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<td>24 (23%)</td>
<td>20 (20.8%)</td>
<td>25 (27.1%)</td>
<td>7 (7.3%)</td>
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Question number 18, respondents consider that navigational equipment checklists are almost equally useful to a great and maximum extent.

SN18: To what extent do you consider that navigational equipment checklists are useful?

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<td>15 (15.8%)</td>
<td>32 (31.7%)</td>
<td>29 (30.5%)</td>
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Question number 19, informants consider safe the substitution of the traditional fix of the position of the vessel in a paper chart by the positioning on an ECDIS screen, basically to a secondary level extent.
SN19: To what extend do you consider safe the substitution of the traditional fix of the position of the vessel in a paper chart by the positioning on an ECDIS screen?

Question number 20, informants consider that the same nautical equipment provided by different manufactures are standardized only to a medium degree. Therefore, huge room is left for an improvement.

SN20: To what extent do you consider that the same nautical equipment providing by different manufactures are standardized?

Question number 21, respondents do “not” consider to the maximum degree that the new technology on board is easy to use.
Question 22, informants consider that new technology impacts leadership, teamwork and bridge resource management to an important degree but not the maximum one.

Question 23, respondents consider cyber-attacks a real threat to ships in a maximum degree.

SN23: To what extent do you consider cyber-attacks a real threat to ships?
Question 24, the vast majority of informants agreed that fatigue affects the performance of the officer on watch.

SN24: To what extent do you consider that fatigue affects the performance of the officer on watch?
97 responses

Question 25, the vast majority of informants considered younger seamen to be losing good traditional seamanship.

SN25: To what extent do you consider that younger seamen are losing good traditional seamanship?
93 responses

Additional comments for 8 survey answers:

- in SN 8 issues and consequences from passing responsibility from Master to VTS is much deeper than an operational or technical question. It means liability and legal questions to be solved.
- all the aids are good, but the new generations of sailors should complement their security with common sense and not just based on new systems.
- I consider that routine tasks are not properly attended due to overconfidence in technology and should be more careful
- new integrated information systems (ECDIS/AIS/RADAR) should be always understood as "Aids to Navigation" and/or "extra - information provided by technologies in the decision-making at risk situations" by the Duty Officer, as
long with his/her knowledge of traditional navigations skills. If not, new techs can be an added stress factor.

- MLC 2006 is Very important
- the usage of AIS, VHF and other aids to navigation are increasing by poorly trained ‘white paper’ officers who should not have a white paper certificate.
10 Results on Communications Survey

Radio telecommunication at sea had undergone a sea change in the last century. After the days of semaphores and flags (which is still relevant today in some cases), radio brought about a drastic change in marine communication at sea.

From the early years of the last century, ships started fitting radio for communicating distress signals among themselves and with the shore. Radio telegraphy using Morse code was used in the early part of the twentieth century for marine communication.

In the seventies, after considering the studies of the International Telecommunication Union, IMO brought about a system where ship-to-ship or ship-to-shore communication was put into action with some degree of automation, wherein a skilled radio officer keeping 24×7 watch was not required.

Marine communication between ships or with the shore was carried with the help of on board systems through shore stations and even satellites. While ship-to-ship communication was brought about by VHF radio, Digital Selective Calling (DSC) came up with digitally remote control commands to transmit or receive distress alert, urgent or safety calls, or routine priority messages. DSC controllers can now be integrated with the VHF radio as per SOLAS (Safety Of Life at Sea) convention.

Satellite services, as opposed to terrestrial communication systems, need the help of geo-stationary satellites for transmitting and receiving signals, where the range of shore stations cannot reach. These marine communication services are provided by INMARSAT (a commercial company) and COSPAS – SARSAT (a multi-national government funded agency).

While INMARSAT gives the scope of two way communications, the COSPAS SARSAT has a system that is limited to reception of signals from emergency position and places with no facilities of two way marine communications, indicating radio beacons (EPIRB).

For international operational requirements, the Global Maritime Distress Safety System (GMDSS) has divided the world in four sub areas. These are four geographical divisions named as A1, A2, A3 and A4.

Different radio communication systems are required by the vessel to be carried on board ships, depending on the area of operation of that particular vessel.

The impact of STM services and tools on marine communications is analysed.

In a 0 to 5 scale is graded the impact of the following questions, where 0 means not answer, 1 is a minor impact and 5 a great impact.

Question number 1, respondents consider that is not a good idea to replace VHF voice communications by chat or written text messages to a maximum extent.
Question number 2, informants consider that the drawn-out advantage from AIS information to improve safe navigation (0 same, 5 underused) is underused to nearly the maximum degree.

Question number 3, the knowledge command of the AIS system is explored among the participants with the majority result of 4 out of 5.

Question number 4, the knowledge command of the VDES (VHF Data Exchange) system among the participants is mainly rated to a medium level.
CM4: What is your level of knowledge of the VDES (VHF Data Exchange) system?

90 responses

Question number 5, the use of Digital Selective Call (DSC) is tested among participant, with a very diverse result.

CM5: Do you often use the Digital Selective Call (DSC)?

91 responses

Question number 6, the vast majority of participants consider absolutely necessary to keep mandatory listening at least on VHF / Ch. 16 in the maximum extent.

CM6: To what extent do you consider necessary to keep mandatory listening at least on VHF / Ch. 16?

93 responses
Question number 7, respondents consider that automatic ship-to-shore route data reporting would reduce the workload of traffic control centers in a relevant level.

**CM7: To what extent do you consider that automatic ship-to-shore route data reporting would reduce the workload of traffic control centres?**

92 responses

![Bar chart showing responses to CM7 question]

Question number 8, respondents consider that graphical routes exchange between ships would reduce the number of dangerous situations at sea in a relevant level.

**CM8: To what extent graphical routes exchange between ships would reduce the number of dangerous situations at sea?**

92 responses

![Bar chart showing responses to CM8 question]

Question number 9, respondents consider in a relevant extent the necessity of simplifying procedural requirements for safety communications of GMDSS when routes are exchanged among ships and shore centres.
CM9: To what extent do you consider simplify procedural requirements for safety communications of GMDSS when routes are exchanged among ships and shore centers?

89 responses

Question number 10, respondents consider in a relevant degree but not the maximum, the satellite networks reliable.

CM10: To what extent do you consider satellite networks reliable?

91 responses

Question number 11, respondents consider GMDSS alarms displayed on the ECDIS screen useful, but just to a certain extent, 3 and 4 are the prevailing levels.
Question number 12, respondents consider the necessity of more satellite operators than INMARSAT in the GMDSS, up to a relevant extent, but not the maximum.

Additional comments to this block were expressed in 7 responses:

- CM2 question is not clearly posed. AIS provide a lot of information and means a safety improvement; however, COLREG rule 5 obliges to a human visual and auditory watch additionally to any kind of electronic aids to navigation.
- Graphical routes exchange between ships will develop new dangerous situations due to slack of updates and delays in the transmit and receptions of info.
- Compulsory report to VTS should be done in writing, not voice.
- As more satellites are available, communications will improve.
- Small crafts can carry a VHF (walkie-talkie or radio system installed) on board and when DSC fault in larger ships it’s good to know that somebody is watching in VHF Ch.16.
- AIS signals displayed on screens are not such reliable about the real situation, especially in congested areas. They provide more info to the OOW and allows...
him/her the decision-making advance, but could be a bit confusing if it is understood as the real situation and not a mere Aid to Navigation.

- Satellite communications are useful at open seas where VHF is out of range. Internet access must be cheaper in order to maintain good communication service during the whole voyage or route.
11 Results on European Maritime Simulator Network Survey

Several simulator centers around Europe have been and are interconnected in what is called an European Maritime Simulator Network (EMSN) which gives a unique possibility in creating scenarios with a large number of participating own ships.

The primary purpose of the EMSN is to gain experience with STM features and to understand how involved persons and institutions deal with its capabilities. This is done in a simulated environment, which saves large amounts of time, costs and environmental impact.

The EMSN network consists of the following elements:

- simulator centers, including ship bridges and control station;
- EMSN infrastructure, including communication protocol;
- M-ECDIS (the MONALISA equipment) integrated at each ship bridge;
- Shore Center (SC) including decision support systems; and
- evaluation test procedures

Scope and Purpose of the EMSN

The primary purpose of the European Simulator Network (EMSN) is to gain experience with STM features and to understand how involved persons and institutions deal with its capabilities. This is done in a simulated environment, which saves large amounts of time, costs and environmental impact.

The scope and purpose of the EMSN simulations are to reflect the STM concept, to validate and evaluate the findings and to give input to various hypotheses and FSA developed by other activities within the project. The following main aspects are tested and evaluated:

- **Route planning**
  A unique and optimized route – based on the captain's requirements, current data regarding the vessel, cargo owner, port capacity, weather, geospatial limitations, actual no-go areas and MSI – can be drawn up by Shore Centers in cooperation with the captain. The route/voyage plan, delivered in a universal data format, can be accessed by the ship’s Integrated Navigational Systems.

- **Monitoring**
  The ability of all participating vessels to stay on course of the pre-planned routes will be automatically and/or manually monitored and assisted from the Shore Center. Any deviations from agreed routes will alarm the Shore Center, resulting in appropriate action by the captain, the owner and/or the authorities.
- **Anti-collision aid**
  The routes of participating vessels will be available for other ships to be downloaded and presented on their INS. This function will be a key additional aid for assisting vessels in order to foresee and pre-plan the maneuvering of vessels.

- **Assistance**
  Ships can be offered special pilot assistance on different service levels in confined, complex or other areas whenever required by the captain. This could be an alternative to Open Sea pilotage in, for example, non-mandatory waters. Flow management Traffic congestion and prediction of high traffic intensity areas will easily be calculated and appropriate information can be distributed to particular vessels to help them prepare to take precautionary actions. In the longer perspective, suggestions for safer flow management can be calculated and provided to vessels.

- **Surveillance**
  The more ships operating under the "Green routes" umbrella the less unknown ships will need to be handled by anomaly programs and surveillance authorities, giving them higher quality in their other duties.

- **Sea traffic management Vision 2020**
  The MONALISA tool, “Sea Traffic Management”, and the impact of the holistic view, will finally integrate the maritime sector into the digital age of tomorrow. With STM, the future framework, we will be built digitalizing the flow of information and securing the seagoing link in the transport-chain. The benefits will be; Enhanced safety, a better environment and improved efficiency.

In a 0 to 5 scale is graded the impact of the following questions, where 0 means not answer, 1 is a minor impact and 5 a great impact.

Question number 1, respondents show that after they have been involved in an “enhanced monitoring” process in EMSN, it is considered its level of usefulness up to a relevant degree.
EMS1: After you have been involved in an enhanced monitoring process, what do you consider is the level of usefulness?

Question number 2 and 3, respondents would you be ready for exchanging routes with other ships and shore centres in a significant degree, but nor maximum. Crew adaptation process should be brief.

EMS2: To what extent would you be ready for exchanging routes with other ships?

Question number 4, respondents find the exchanging processes slightly more complex than easy.
Question number 5, respondents consider route exchange really useful up to a significant level.

**EMSN5: To what extent do you consider route exchange really useful?**

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<td>19 (25.3%)</td>
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<td>10 (13.3%)</td>
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Question number 6, respondents clearly consider traffic management services useful up to the maximum degree.

**EMSN6: To what extent do you consider traffic management services useful?**

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Question number 7, respondents consider staff on Shore Centres and on-board ships enough trained to use area management services up to a relevant degree, but not the maximum.

**EMSN7: To what extent do you consider staff on Shore Centres and on-board ships enough trained to use area management services in a relevant degree, but not the maximum?**

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<td>5</td>
<td>33 (42.3%)</td>
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Question number 8, informants consider scenarios realism level adequate inside EMSN up to a relevant degree of acceptance but not the maximum.

Question number 9, respondents consider that the use of the SAR simulation Service has improved the performance of the SAR operations up to noticeable degree, bearing in mind that it has not been tested yet.
Question number 10, respondents consider, up to significant degree that the use of the Winter Navigation Service has really improved the ice navigation, although few of the informants are affected.

EMSN10: To what extent the use of the Winter Navigation Service has really improved the ice navigation?

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</table>

Question number 11, informants consider that results obtained in EMSN can be really applied to real world, up to a considerable degree, showing its potential.

EMSN11: To what extent do you consider that results obtained in EMSN can be really applied to real world?

<table>
<thead>
<tr>
<th>Score</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9 (12.7%)</td>
<td></td>
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<tr>
<td>2</td>
<td>7 (9.9%)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>23 (32.4%)</td>
<td></td>
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<tr>
<td>4</td>
<td>26 (36.6%)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>9 (12.7%)</td>
<td></td>
</tr>
</tbody>
</table>

Question number 12, even not all of the simulations sessions were completed, the answers reflect the high level of acceptance on the level of training. Around 40% of respondents give a score between 4 and 5 and this results obvious as professionals from the different simulator centres are high qualified and experienced staff.
EMS12: To what extent do you consider the staff involved on EMSN is well trained and this training is enough on the new M-ECDIS functions

69 responses

Additional comments coming from 2 responses:

- EMSN6. The important point is not only to share the routes but also to properly adjust and update any minor changes, the Captains would made on them. This is with the aim to transmit the real information. Capacity of quickly transmit any changes in congested waters is important for safety purposes.

- After participation on some EMSN simulation sessions, this is one of the main successful tools of STM project
12 Results on Port CDM Survey

Port Collaborative Decision Making (Port CDM) services will increase the efficiency of port calls for all stakeholders through improved information sharing, situational awareness, optimised processes, and collaborative decision making during port calls.

Validation of Port Collaborative Decision Making has taken place by expanding the network of ports and Port CDM services, developed in MONALISA 2.0, in the Nordic and Mediterranean regions. The contextual differences between port approaches has been gathered and analysed. The test beds made has been the first step towards involving both commercial and public service developers/distributors in building Port CDM Services.

The main services explored under the umbrella of Port CDM are:

- port2Port (port-2-port information sharing)
- ship to Port integration (ala STM) (ship-2-port information sharing)
- restricted Info Sharing (access management)
- port Specific Info (information that concerns multiple port calls and/or reflecting the conditions in the port)
- resource View (as e.g. the quay view)
- Port Call Synch (Allowing for green steaming)
- Gantt View (complementary view for the port call structure)
- authentication
- route tracker
- multiple Views (looking upon multiple aspects of the port at the same time (as e.g. multiple port calls, multiple quays etc.))
- integration with Ice-breaking
- integration with Terminal operations
- calculations on waiting times
- calculations on duration times
- calculations on predictability
- calculations on berth productivity

The questions made for the Port CDM block are more specific and the format is different from the previous sections of the survey. The results are as follows:
According to 36 justified answers from 79 respondents on question 1, the justification for this tendency covers the following aspects:

- port stakeholders will rely among themselves
- to anticipate more the ships’ movements.
- companies are not interested to give too many information about their freight and routes
- it would avoid unnecessary communication exchanges
- because i think that it’s a possibility of improving the maritime traffic.
- time saving
- maritime sector need change and update new times
- increase the speed, quality and amount of information
- there are small ports in the area where i work
- know the situation of port is very useful in an emergency
- safe information.
- information updated should be given by agents in every port at any time being demanded.
- sharing information would make easier and faster any operation
- high density of traffic in & outbound without any TSS
- it allows to have a new working tool
- reduction costs, reduction pollution
- some of the actors don’t want to lose their privileges
- shared responsibility
- new opportunities
- it’s a new system interesting for reduced time, cost.
- coordination of operation and early-warning indicators can be obtained from it.
- more information given
- more specific employment
- we have a lot of cruises in our traffic area
- it will promote the fuel and time savings reducing the pollution
it could be a really useful tool for a better resources management. moreover, it will allow planning more efficiently our maintenance operations (it is complicated to find the proper time to organize it without knowing the right predictions of potential services demand).

- less bureaucracy
- PCDM can be an enabler for better organisation of port call agents and for just in time operations in the arrival and departures of ships.
- The implementation of the system will engage all the actors related with a port call in order to have a more efficient and safer operation.
- A concurrent situational awareness and the means of getting information from all stakeholders in a Port-call heightens the possibility to JiT operations. In order to be a Professional actor the stakeholders in the port needs to know the "window of opportunity" from the ship (The "latest possible time" and the physical "earliest time" (of ETA and ETD) that the vessel can Accept from the port and its service providers/actors).

- Need better predictability of ETA/ETD
- improve coordination between terminals and Control Towers and Pilot services
- Better utilization of all allied services within the port
- Increase Operational Performance

Question 2 shows a clear limitation at using the functions applied to ports operations from respondents. 28 persons have explained the justification to this tendency as follows:

- need of proper training
- commercial interests would present some obstacles among competitors.
- they are not relevant data for day to day on board
- there always is a possibility of a sudden change of circumstances which cannot be updated enough fast by the system.
- it’s very difficult because of the weather conditions, instructions from the terminals, etc.
- lack of implementation
not possible see all information in really time
too much time wasted must be avoided
implementation could be hard at first
personnel
have internet on board
not sure
it depends on the level of information shared
overload work. crews shouldn't be reduced
I really do not manage with the app
technology is a necessary updating task
each actor requires specific customized data, therefore they do not require the whole amount of data, which may transform the IHM is some too complex to follow.
fishing boats include complications in use
over reliance
improving work is important and necessary. Simplify and collect info to easy understanding what is happening? what to do? Etc.
the concept is not necessary for regular lines operating the ports like those composed by ferries
legal aspects must be considered
The resistance to change certain procedures can be a limitation, also technical constraints that may be found in different ports (different degree of technological evolution)
including all relevant stakeholders and building connectors
Seen as of today there is a lack of a national or international "HUB" that is mature enough to take over after the PortCDM validation ends 31st of December 2018. The Voyage Information Service (VIS) connector has not contributed to any PortCDM port, as of end of November 2018. The ships which have installed the Connector have not started to use them and there are many ships which have gotten this installed who never visit one of the PortCDM ports or terminals. The issue of contingency and maturity of the "STM" environment, will make it as of now very difficult to use the Application. The VIS and PortCDM have not a stable ground to build upon (E.g. House of Lean/Toyota Production System). The Applications will in my view only be implemented where the industry have an infrastructure, which I do not see just now. There is a lack of both the "HUB" and the M2M integrations that is only meaningful if this is introduced in full scale with all actors involved, that are not a part of the validation project, included the goods’ owners.

Too much information. Sharing ETA/ETD is enough
Contractual terms of the charter party and the C/P contractual terms.
data sharing in the sea

Question 3 refers to the capacity of using the Port CDM functions. 78.9% of positive answers on the ability to use these functions is overwhelming yes.
Question 4 ¿Which training needs would your staff have regarding the use of the Port CDM Concept? 15 have answered it from 66 respondents, indicating that training is required. 2 respondents have indicated that it is not necessary and the rest answered in any affirmative way. In general, to the specific question, the respondents agreed that software, information systems training/certification is required due to the volume of information, the system architecture, and the new concepts included suggesting an intensive training programme with a periodic refreshing process. The sample of answers are shown below:

Yes
No
CBT Courses
Due competence in managing huge volumes of information
Software training
Training is required in order to capitalize Port CDM concept and make a proper use of it. I think that training should be provided periodically (every year).
Intensive!
Training about the use of the PCDM platform, training about the apps way of working
None
Traffic monitoring, using of AIS based tools,
They will need more a m2m and better UI/UX and training.
First of all introduction of the STM concept, to be able to See the Big picture
They need a training tailored for terminal operations staff
Basic
Port Control empowering and training in the concept and use of the application
Software training of the new programs

In question 5, 84.6% are in favour of installing the Port CDM functionalities within their IT systems.
PCDM5: Will you like to integrate your IT system with the Port CDM platform?

65 responses

From 24 respondents, the justifications for this answer are:

- it will facilitate situational awareness
- to simplify procedures. single window for port procedures but also the same criteria for safety reasons.
- in this type of vessel every data is important for assistant
- sharing information would make our work more efficient and faster
- I always want to improve
- make it simpler
- it’s new system and interesting mode of job
- there are small ports in my work area
- to be updated is the best option in SAR services
- every aid to navigation is useful
- it would simplify communications
- less opened programs and less amount of work. we also carry out SAR operations.
- we do not have competences to do it
- quicker and more reliable ship-port communication
- not every vessel/company have on board high speed communications
- automatic connections have shown critical to avoid disruption on day-to-day operational tasks, avoid errors and get real time data.
- why not?
- but interfaces are feasible
- If not, we will duplicate the data submission which means extra-work and it will be inefficient.
- The integration could provide some synergies about information managed by the current systems and those obtained by PCDM
- It depends on the providers business case
- If what I said in PCDM2.1 is implemented.
- Some type of electronic data sharing validation.
• We actually do it

In question 6, 93.9% consider that Port CDM can help to better monitor port calls.

PCDM6: Do you consider that Port CDM can help to better monitor port calls?
66 responses

19 respondents provided the justification of these answers as follows:

• By means of overall control of fleets movement
• It has been answered before.
• I think it will minimize the response time
• Because we would have greater certainty about the information exchanger
• Pin down the task
• It’s necessary update and every business need more cooperation
• Nowadays there are many misinformation
• Shorter communications
• With a schedule of arrival and departures with information of the next port of call and courses outbound as well as traffic density prospects like airports.
• They do not have competencies
• Misunderstanding would be reduced
• Knowledge is a powerful tool
• Live time always
• Yes, but it must be customized at each port to reply to each specific actor's information needs.
• Their is a lot of info we do not see or have when disicion are made.
• Written information with no mistakes nor intermediate steps
• Yes because it can improve the level of common awareness of the agents involved in the port call process
• Improve the commitment of all stakeholders in the port.
• because we share information between different agents
Question 7 was conducted to the Living Labs experience. This activity led by Valencia Port Foundation tried to obtain answers from stakeholders and port staff after experiencing PortCDM functions had been explained in near real working conditions.

PCDM7: Do you think the Living Lab would be a good method to drive the get enough insight project forward in terms of learning how Port CDM works?

61 responses

20 specific answers have justified this affirmative tendency of the question as follows:

- It will enhance the port call actors contribution
- Maybe is one of the possible ways to check the concepts.
- IT APPROACHES REALITY
- Of course, a new system should always test in a Living Lab
- You can see the possible errors
- interchange knowledge
- New methods need to be understood by each staff involved
- Training is a good way to get perfection
- Training is always useful
- They do not have competencies
- The quickest feed back
- Training and test are the way
- It has demonstrated that is a good start. However, the main issue stays on how to get actor's commitment to participate in Living Labs.
- Just for now.
- They have been a good method for expressing the agents' needs and allowing a better integration among the agents involved in port call processes.
- Living Labs can be a useful instrument to make a first approach to PortCDM, but then individual meetings are needed to address the specific details
- and how the ecosystem in the specific port works
- The most important outcome is that the actors get to collaborate and see the benefits. Actors who do not "see" each others views get to present them and get new impulses. In the Port of Stavanger this resulted in a "Metro Map" which would not have been possible to create without the Living Labs and the concurrent design which it enables.
• this way, the port stays and operations could be improved
• Living labs is good way to share knowledge between agents

Question 8 is more focused on the potentiality of using Living Labs as collaborative training tool. The respondents mostly agreed that this is a good learning tool, 89.1% affirmative answers demonstrate this argument.

**PCDM8: Do you consider that the Living Lab would be a useful collaboration platform for learning?**

64 responses

89.1% Yes
10.9% No

14 specific answers justify this tendency and are summarised below:

• It will clear doubts and strength knowledge and skills
• Because it means participation among persons in the same commercial area for a common learning.
• Because it is a fast and easy method to find out mistakes
• You can learn many things.
• Same as above
• It’s necessary according to future methods
• More practical information can be delivered to the staff
• Training is a good way to perfection
• It would allow to know different procedures
• Theory + practise: R&D
• It provides to the Port Authority with the different points of view from different actors, therefore it is possible to foresee where the issues are and collect to proposals to tackle them from different perspectives.
• It’s useful since the beginning of introducing PortCDM
• It would allow the exchange of experiences and knowledge among different agents
• The Living Lab teaches us that other stakeholders may sit on information that one need. If this could be communicated early enough this can be used to optimize Port call operations.

Question 9, “PCDM9: What do you think about the usability of Port CDM?” was answered by 51 participants. The specific effective answers were:
• Yes
• No
• Can be improved
• It’s the future
• As a pilot, usability is maybe not the strongest point of PCDM, but when thinking on the development for full deployment, it will be for sure necessary to design a user friendly platform
• It’s highly usable
• The creation of PortCDM, which has led to the S-211 standard, and the PortCDM governing Council has ensured that when the industry is ready, all actors will see the benefits and necessarily of use PortCDM.
• Too much information, and too much incorrect information (vessels at wrong Berth)
• It could be the main management tool.
• Good if all agents use it

Question 10, “PCDM10: What do you think about the functionality of Port CDM?” received 50 responses. From them, the specific effective answers were:

• Yes
• No
• Good idea
• reduce paper work load
• As a pilot, there are many aspects that can be improved, although the basic objectives from the functional perspective are well addressed
• premature, but functional
• We will most certainly discover that the functionality of PortCDM as it is now will not solve all issues. The PortCDM standard, will through the PortCDM Governance Council, need to continuously adopt and improve to this. As for the moment, its functionality is limited to the lack of users and two-way M2M integrations to stakeholder systems.
• if they explain the terminals, where we fit in, then we can use it
• Resources will be used without unnecessary stand-by times
• Still improving
13 Preliminary Catalogue Approach on New Competences

In general, training for the future performance of STM project services under the scope of e-Navigation environment needs to ensure sufficient transfer of skills and knowledge to new staff. European Maritime Simulators Network is a suitable and promising tool which enables to cover the needs beyond on board functions, covering land and port based services. Maritime training and education will need to go along with the legal requirements but needs to be accompanied by taking into account new solutions that are driven by technological developments and their transfer and implementation in the daily business. Lifelong learning with certain kind of obligatory refresher courses can be an approach to ensure a sufficient level of quality of training for the personnel. Reduction of training needs and degrading of jobs seem to be not appropriate to approach the challenges of the future e-Navigation world.

The holistic approach to identifying training needs and providing training support is summarised in Table 9. The catalogue is a summary of the conclusions obtained from the survey performed during 2017 and 2018 and several interviews with the STM Validation Project Partners from activities 1, 2, 3, 4 and 5. It is focused on the main aspects to be covered or solved on the basis of existing training and certification schemes approved internationally. It is expected that new training courses are not needed to be designed and existing models may be updated to solve the current gaps detected.
<table>
<thead>
<tr>
<th>No.</th>
<th>STM / e-Navigation Services/functionalities</th>
<th>Who is expected to become potential (end-)user of the solution/function?</th>
<th>What is the intended ideal operational context of the solution (purpose, aim and reference/standard operational procedure) (to be reviewed by inventor/developer/manufacturer)</th>
<th>What do potential end-users currently know with respect to training needs?</th>
<th>Present state, identified gaps between current and required training (Results gained from interviews, questionnaires, observations and interaction with EMSN - European Maritime Simulator Network partners)</th>
<th>Suggestions for training items derived from analysis performed (derived from outcome of simulation trials, questionnaires, interviews and interaction with EMSN - European Maritime Simulator Network partners)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tactical exchange of intended route</td>
<td>OOW; VTS operators; Operators in company related FOC; Pilots; other interested parties</td>
<td>Application on board: OOW can make use of an enhanced function integrated into an ECDIS-Display, showing the complete planned route or a section of it for all targets or single, specifically selected targets … Application ashore: … VTS operator can visualize intended routes of Operator on board (OOW): standalone equipment (Radar, ECDIS, GMDSS, AIS etc.); IBS; INS; BRM; BTM; relevant training in accordance with the STCW [3] Operator ashore (VTS-Operator): IALA-AISM V-103 [4]</td>
<td>Training required with respect to functionality / solution • principles • calculations • caveats/errors • pros and cons. • familiarisation with functions • familiarisation with display and its customization Training needs identified with</td>
<td>No independent training required. • should be integrated with existing training regimes like ECDIS, Radar • training should include menus and features of solution functionality. • training should include utilization of</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tactical Route Suggestion</td>
<td>VTS operator and OOW, pilots Operators in company related FOC;</td>
<td><strong>Application on-board and ashore:</strong> Similar as described for solution 1, with the modification, that the VTS sends</td>
<td><strong>Operator on board</strong> (OOW): standalone equipment (Radar, ECDIS,</td>
<td>Training required with respect to functionality / solution • principles</td>
<td>intelligent filtering systems. • training should include limitations of functionality. • training should include optimal utilization of functionality. • simulation training recommended for exploring context of use new ways of working and new communications the functionality creates. • training in standardized / harmonized use of terminology</td>
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<tr>
<td>2</td>
<td>Tactical Route Suggestion</td>
<td>VTS operator and OOW, pilots Operators in company related FOC;</td>
<td><strong>Application on-board and ashore:</strong> Similar as described for solution 1, with the modification, that the VTS sends</td>
<td><strong>Operator on board</strong> (OOW): standalone equipment (Radar, ECDIS,</td>
<td>Training required with respect to functionality / solution • principles</td>
<td>intelligent filtering systems. • training should include limitations of functionality. • training should include optimal utilization of functionality. • simulation training recommended for exploring context of use new ways of working and new communications the functionality creates. • training in standardized / harmonized use of terminology</td>
</tr>
<tr>
<td>Role</td>
<td>Task</td>
<td>Equipment and Systems</td>
<td>Training Needs</td>
<td></td>
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</tbody>
</table>
| Pilots                      | a route suggestion to avoid or solve the development of a critical traffic situation. The VTS can send a segment of the route to aid port approaches, pilot embarkation, manage congestion etc. | GMDSS, AIS etc.; IBS; INS; BRM; BTM Operator ashore (VTS-Operator): IALA-AISM V-103 | • calculations  
  • caveats/errors  
  • pros and cons  
  • familiarisation with functions  
  • familiarisation with display and its customisation  
  Training needs identified with simulation trials and interviews |

Regimes like ECDIS, Radar.  
• training should include menus and features of solution functionality.  
• training should include utilisation of intelligent filtering systems.  
• training should include limitations of functionality.  
• training should include optimal utilisation of functionality  
• simulation training recommended for exploring context of use new ways of working and new communications the functionality creates.
<table>
<thead>
<tr>
<th>No</th>
<th>No Go Area</th>
<th>OOW, VTS operators and Operators in company related FOC; Pilots.</th>
<th>Application on-board: Dynamic information related to the changing topography of the sea bed and conducive to safety depending upon the draft and the under keel clearance of the vessel Application ashore: Inform VTS service provision like INS and TOS depending on</th>
<th>Operator on board</th>
<th>Operator ashore (VTS-Operator): IALA-AISM V-103</th>
<th>Training required with respect to functionality / solution • principles • calculations • caveats/errors • pros and cons • familiarisation with functions • familiarisation with display and its customisation Training needs identified with</th>
<th>• training in standardised / harmonised use of terminology • preparation of bridge team for accepting route • training to convey that the tool does not impart any additional powers. • no independent training required. • should be integrated with existing training regimes like ECDIS, Radar. • training should include menus and features of solution functionality. • training should include utilisation of</th>
</tr>
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<tbody>
<tr>
<td>3</td>
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<tr>
<td>4</td>
<td>Real time vessel traffic pattern analysis and warning functionality</td>
<td>VTS operators</td>
<td><strong>Application ashore:</strong> Inform VTS service provision like INS, TOS and NAS, as appropriate</td>
<td><strong>Operator ashore</strong> IALA-AISM V-103</td>
<td>Use for operational tasks of existing and potentially enhanced VTS services needs to</td>
<td>For traffic monitoring, training of warning/alert handling, meaning of warnings and required action to</td>
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</table>

Simulation training recommended for exploring context of use and new ways of working and new communications that the functionality creates.

- Training should include limitations of functionality.
- Training should include optimal utilisation of functionality.
- Training in standardised / harmonised use of terminology.

Simulation trials and debriefing sessions
<table>
<thead>
<tr>
<th></th>
<th>Maritime Cloud</th>
<th>Concerned stakeholders (IT Developers, Port and logistics service providers, systems manufacturers, etc.)</th>
<th><strong>Application</strong>: Data repository to support navigation and decision making on-board and ashore</th>
<th>not completed yet, to be further included with results from activities 1, 2 and 4</th>
<th>not completed yet, to be further included with results from activities 1, 2 and 4</th>
<th>be taken by operators</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Maritime Cloud</td>
<td>OOW</td>
<td><strong>Application on-board and ashore</strong>: Seamless provision and harmonized integration and display of pertinent information.</td>
<td>Operator on board</td>
<td>not considered yet, to be completed with results from EMSN</td>
<td>not considered yet, to be completed with results from EMSN</td>
</tr>
<tr>
<td>6</td>
<td>Maritime Safety Information/ Notice to mariners (MSI/NM)</td>
<td>OOW</td>
<td><strong>Operator on board</strong> Refer to OOW training as point 1 above</td>
<td>Operator ashore IALA-AISM V-103</td>
<td>Not considered yet, to be completed with results from EMSN</td>
<td>Not considered yet, to be completed with results from EMSN</td>
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<tr>
<td>7</td>
<td>Vessel Operation Coordination Tool (VOCT)</td>
<td>VTS operators</td>
<td>Not considered yet, to be completed with results from EMSN</td>
<td>Operator on board</td>
<td>Not considered yet, to be completed with results from EMSN</td>
<td>Not considered yet, to be completed with results from EMSN</td>
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<tr>
<td>8</td>
<td>Automated FAL reporting</td>
<td>OOW, VTS operators Port CDM Service providers</td>
<td>Not considered yet, to be completed with results from EMSN and Port</td>
<td>Operator on board</td>
<td>Not considered yet, to be completed with results from EMSN and Port</td>
<td>Not considered yet, to be completed with results from EMSN and Port</td>
</tr>
<tr>
<td></td>
<td>CDM recommendations</td>
<td>Refer to OOW training as point 1 above Operator ashore IALA-AISM V-103 Port CDM Waiting for recommendations</td>
<td>CDM recommendations</td>
<td>CDM recommendations</td>
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<tr>
<td>9</td>
<td>Harmonized Data Exchange – employing Inter-VTS Exchange methods</td>
<td>VTS Not considered yet, to be completed with results from EMSN</td>
<td>Operator ashore IALA-AISM V-103</td>
<td>Not considered yet, to be completed with results from EMSN</td>
<td>Not considered yet, to be completed with results from EMSN</td>
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</tr>
</tbody>
</table>
14 Results and Discussion

Preliminary findings are that training is needed to get accustomed to the overlay of a dynamic image over the real scenarios outside in the near future as e-Navigation is now a reality and present need. Personal observation learned that focusing on the dynamic virtual image was not very difficult when the real background was kept steady, however, focus was immediately shifted to the background when this background got dynamic e.g. by moving your head in another direction. However, this also requires further research into the impact of such enhanced technologies on human behaviour in general and on the collisions avoidance task as addressed here in particular. These aspects have been hardly studied with the support of the European Maritime Simulators Network (EMSN) in activity 3 and will complement the results on the present report.

Beside the use and handling of the goggles and its calibration and initialization, of course, training also needs to cover services, situations and procedures implemented in the expert systems to trigger a warning or an alarm or to highlight certain areas of concern. End users need to know how to configure the system and to learn about the potentials but also the limits of this kind of a support service. COLREGS is a suitable common sense tool that in combination of electronic aids to navigation, and supported by the services based on maritime cloud validated in STM Validation project, will result on an improved navigation culture firstly demonstrated in Europe.

Whilst IMO legislates and introduces standards such as STCW, it has not and probably would not monitor the implementation of its own minimum standards. IMO has a huge inertia and often has been reactive to shipping industry’s needs. It has passed the responsibility for implementing and monitoring of its standards, rules and conventions to the national governments. Some limitations are that IMO established the STCW after several major accidents and SOLAS and MARPOL and also came about after major accidents. STCW is now starting a process to anticipate e-Navigation elements with the hand of IALA and IHO but not huge changes have adopted for a clear strategy in terms of training and certification. The core of STCW was developed in 1978 and since then there has been several cosmetic changes to these standards, the most significant being the one in 2010, many of the changes forced upon IMO by larger and more progressive companies canvassing through several national government delegation to the IMO committees. Although the number of accidents and incidents at sea are on the decrease, the number of accidents and incidents due to automation failure has been on the increase and those due to communication errors and linguistic problems have remained substantial.

European Maritime Safety Agency (EMSA) was established to ensure safety at sea throughout the Union and further afield. One area of focus for EMSA (2003) has been the enforcement of STCW throughout Europe and in countries providing seafarers to Europe or visiting Europe’s waters or ports. EMSA is involved in the application of EQF standards in the maritime sector and has, as stated earlier, started to inspect and evaluate quality of the MET in member and candidate countries.
EMSA made a detailed study on the MET systems in 2010 and submitted a report to EU countries and ship-owners about the findings of this study. It is clearly stated that some countries are not able to meet STCW standards and seafarers from these countries are not eligible to be employed on board EU ships. For instance, Certificate of Competencies (CoC) issued by Georgia are refused. Another example is the EMSA formal requested for the closure of 12 MET institutions in Philippines which are found to be sub-standard unless they improve their quality. There have also been quality issues with several EU member states.24

In the other hand, e-Navigation could bring all information services that affect shipping, port operations and links to cover the logistics chain into a cohesive package. This includes not only navigation services but all other government and commercial activities that impact shipping, and this should be done globally, without regard to national boundaries. STM Validation Project is on the path to arrive there. As technical solutions and services are on the validation stage, further efforts must be done in terms of training and certification. This report tried to give the first general picture of the problems to be overcome in the short term.

Other critical aspect is cyber security, with the increasing use of systems with embedded software on ships, ports, VTS services and logistics, cyber security is becoming critical not only for data protection, but also for reliable operations. According to Symantec Security Response, “You don’t need as many technical skills to find one person who might be willing, in a moment of weakness, to open up an attachment that contains malicious content.” 97% of attacks actually consist of trying to trick a user using social engineering techniques. Phishing and social engineering, unintentional downloads of malware, etc., are common issues. Crews and shore staff need to raise awareness concerning cyber security, focusing on issues such as what typical cyber-attacks are and how staff can contribute to the organization’s cyber security. Some companies like DNV GL has developed courses on “Maritime Cyber Security Awareness” to raise awareness about threats and countermeasures, addressing the cyber security management system by encouraging the crew's good cyber hygiene. The course explains in simple steps how and where cyber-attacks may target not only your direct IT infrastructure, but also the embedded software in assorted operational technology (OT) systems on board. The connected sea needs to be provided with cyber security culture and for the moment, training and certification is not require. Further investigation need to be done.

Finally, not only e-Navigation, maritime cloud and Port CDM have to be analysed in terms of practical and technical solutions to bring maritime and port industries into the digital era, other aspects like autonomous vessels, post/over Panama and Suezmax vessels, large sized cruise ships and alternative fuels represent challenges to be complemented by digital sea and maritime cloud. Alternative fuels like LNG or Methanol firefighting, mass rescue and SAR operations or large vessels accidents,

24 Harmonising Maritime Education and Training at Sea and Ashore. Reza Ziarati, Martin Ziarati and Ugurcan Acar. TUDEV Institute of Maritime Studies, Tuzla, Istanbul, Turkey and Centre for Factories of the Future, Coventry University Technology Park, Coventry, UK
require a perfect combination of human, technical and information technology resources supported by the cooperation of national, regional and international bodies – private and public. Digital era of shipping will continue requiring the investment of qualified people to understand and apply next generation tools facing a more competitive and sustainable trade industry, which needs of safer transport, port operations and logistics services.
15 Conclusions and recommendations

The first approach to decide how to drive the tasks on the Training Needs Analysis was defined as an instrument to explore and identify the training needs the STM Validation project services and solutions would generate in the on-board environment for the bridge team as well as ashore, for the VTS and port operators and other service providers. The analysis covered some internal interviews within the project partners that were conducted for the training needs analysis during the Work Camps developed in the three years; EMSN simulation exercises were observed; focus group interviews were conducted in the debriefing sessions that followed; a questionnaire study was conducted and workshops with stakeholders were conducted to study the opinion on the new competences and training needs require to face e-Navigation and other cloud services for international transport. Focused groups were composed by multidisciplinary teams of experts on the fields of shipping, maritime education and training, training centres, universities, freight forwarders, VTS and SAR operators, etc.

The analysis performed in the frame of the STM Validation project were based on the assumption that proposed solutions and services will be technically integrated into existing systems. Operational integration will take place in a way that the existing services provided today like Information Services (INS), Navigation Assistance Services (NAS) or Traffic Organization Services (TOS) will continue to exist but extended in their specific content in order to provide additional benefit for end users.

At the present state of technological development and operational validation of the suggested STM Validation Project and Port CDM Services the report concludes that no additional training in terms of an independent separate courses is needed and to be foreseen.

The ambitions and aims of the development of the proposed services include as easy and as simple handling and integration of new or advanced functions/services under new applications development to build human machine interfaces user friendly and adapted to the next generation usability requirements. Functions are developed in a way that the use of it shall be simply and intuitive to handle and as far as possible self explaining. These aims imply that training shall be minimized and can be focused on handling aspects. However, on the other hand so far the studied candidate solutions do not replace or substitute any existing training module of navigators, VTS operator or other end user involved in Port Operations or Logistics Services.

All training with respect to the developed services should ideally be integrated into existing training regimes such as the ECDIS, a direct result from the practice and deployment of the European Maritime Simulators Network (EMSN). Training in STM Validation Project proposed solutions and services is required for the functionality/solution itself and the manner of its integration in on-board systems like the ECDIS. Training needs to include information and practice on how to use the functionality in the interface, navigation in the interface. The limitations and the caveats of the services and functions studied and tested need to be integrated in the existing
Training plans to avoid overreliance. Training in intelligent filtering to avoid clumping and information overload is considered essential. Computer Based Training (CBT) from the manufacturer providing training on the integration of the functionality, its use and limitations would be useful. CBT should be further complemented by in-house training regimes of companies. Simulation training to immerse the trainees in scenarios highlighting the optimal utility of the candidate solutions is considered useful to add value to the training programme and to encourage the uptake of the developed solution.

With respect to the training needs of the VTS, the legal aspect of the proposed services like shore-based route exchange, needed to be watertight. Appropriate terminology pertaining to the proposed services, in line with the legal aspect of the port authority needed to be identified and harmonised and included in the training for VTS operators. The VTS operators should be trained in procedures to incorporate the candidate solutions in their daily work, including the preparation of the bridge team to receive the solution such as the shore based route exchange. The VTS operator training should further include content on considering the functionality as a supplement/additional tool to help them perform their work efficiently without any additional powers.

This report concludes that training should provide a good understanding of the concept and as STM Validation Project proposed solutions, functionalities and enhancements are developed, training should be made to include a variety of these new developments once they have been completed and demonstrated. Results from the EMSN and Port CDM Living Labs is of relevant importance, the conclusions from the reports have to be complementary to this analysis.

We will most certainly discover that the functionality of PortCDM as it is now will not solve all issues. The PortCDM standard, will through the PortCDM Governance Council, need to continuously adopt and improve to this. As for the moment, its functionality is limited to the lack of users and two-way M2M integrations to stakeholder systems. Further work and research on PortCDM functions is expected to include training and certification options under official bodies at European and international levels.

The results have revealed a lack of clarity regarding the concept of e-Navigation and there is no harmonisation in training for e-navigation and its functional applications. Harmonisation in policy, strategy, equipment and training need to be further worked towards to benefit from the new services evaluated under the STM Validation project.

Training needs with respect to the STM Validation Project proposed services are best identified by conducting observations in the simulation environment followed by interviews and the survey performed. A high level of integration of the different proposed services in the simulation environment of EMSN opens the mind of the users to accept the introduction of the new solutions into their working lives on-board and ashore. Identification of training needs requires to move from simple to more complex services and solutions and accordingly the simulation scenarios in a collaborative perspective may be the next generation simulation based training.
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### List of abbreviations

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<tr>
<th>Acronym</th>
<th>Definition</th>
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<tbody>
<tr>
<td>AIS</td>
<td>Automatic Identification System</td>
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<tr>
<td>AR</td>
<td>Augmented Reality</td>
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<td>ARPA</td>
<td>Automatic Radar Plotting Aid</td>
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<td>BRM</td>
<td>Bridge Resource Management</td>
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<td>BTM</td>
<td>Bridge Team Management</td>
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<td>CoG</td>
<td>Course over Ground</td>
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<tr>
<td>CPA</td>
<td>Closest Point of Approach</td>
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<tr>
<td>DGPA</td>
<td>Differential Global Positioning System</td>
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<td>ECDIS</td>
<td>Electronic Chart Display and Information System</td>
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<td>ENC</td>
<td>Electronic Navigational Chart</td>
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<tr>
<td>EPD</td>
<td>e-Navigation Prototype Display</td>
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<tr>
<td>GMDSS</td>
<td>Global Maritime Distress and Safety System</td>
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<td>HDP</td>
<td>Hydrodynamic Predictor</td>
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<td>HCD</td>
<td>Human Centred Design</td>
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<tr>
<td>HUD</td>
<td>Head Up Display</td>
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<tr>
<td>IALA</td>
<td>International Association of Lighthouse Authorities</td>
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<td>IBS</td>
<td>Integrated Bridge Systems</td>
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<tr>
<td>IHO</td>
<td>International Hydrographic Office</td>
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<td>IMO</td>
<td>International Maritime Organization</td>
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<td>ILO</td>
<td>International Labour Organization</td>
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<tr>
<td>INS</td>
<td>Integrated Navigation Systems</td>
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<td>IVEF</td>
<td>Inter VTS Exchange Format</td>
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<td>MET</td>
<td>Maritime Education and Training</td>
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<td>MSI</td>
<td>Maritime Safety Information</td>
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<td>MSP</td>
<td>Maritime Service Portfolio</td>
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<td>NM</td>
<td>Notice to Mariners</td>
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<td>NMEA</td>
<td>National Marine Electronics Association</td>
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<td>NSR</td>
<td>North Sea Region</td>
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<td>OOW</td>
<td>Officer of the Watch</td>
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<tr>
<td>RTM</td>
<td>Route Topology Model</td>
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<tr>
<td>Acronym</td>
<td>Description</td>
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<tr>
<td>SA</td>
<td>Situational Awareness</td>
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<td>SHS</td>
<td>Ship-handling simulator</td>
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<tr>
<td>SIP</td>
<td>Strategy Implementation Plan</td>
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<tr>
<td>SOG</td>
<td>Speed over Ground</td>
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<tr>
<td>SWIM</td>
<td>System Wide Information Management</td>
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<tr>
<td>SWOT</td>
<td>Strengths, Weaknesses, Opportunities, and Threats</td>
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<tr>
<td>UCD</td>
<td>User Centred Design</td>
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<tr>
<td>VOCT</td>
<td>Vessel Operation Coordination Tool</td>
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<tr>
<td>VTS</td>
<td>Vessel Traffic Services</td>
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<tr>
<td>WMU</td>
<td>World Maritime University</td>
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38 partners from 13 countries - 
Creating a safer more efficient and environmentally friendly maritime sector

Demonstrating the function and business value of the Sea Traffic Management concept and its services.

SAFETY - ENVIRONMENT - EFFICIENCY

Swedish Maritime Administration ◦ SSPA ◦ RISE Viktoria ◦ Transas/ Wärtsilä Voyage ◦ Chalmers University of Technology ◦ The Swedish Meteorological and Hydrological Institute ◦ Danish Maritime Authority ◦ Navicon ◦ Novia University of Applied Sciences ◦ Fraunhofer ◦ Carnival Corp. ◦ Italian Ministry of Transport ◦ SASEMAR ◦ Valencia Port Authority ◦ Valencia Port Foundation ◦ CIMNE ◦ University of Catalonia ◦ Norwegian Coastal Administration ◦ GS1 ◦ Cyprus University of Technology ◦ Port of Barcelona ◦ Costa Crociere ◦ Svitzer ◦ OFFIS ◦ Finnish Transport Agency ◦ Southampton Solent University ◦ Frequentis ◦ Wärtsilä SAM Electronics ◦ University of Flensburg ◦ Airbus ◦ Maritiem Instituut Willem Barentsz ◦ SAAB TransponderTech AB ◦ University of Oldenburg ◦ Magellan ◦ Furuno Finland ◦ Rörvik ◦ University of Southampton ◦ HiQ

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