
Sea Traffic Management in MONALISA 2.0

by

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Development towards increased safety, sustainable environment, and higher profits within shipping cannot be enabled without Sea Traffic Management (STM). Reaching full effects of STM requires engagement from many actors. Important enablers are increased degree of connectivity, increased possibilities of digital collaboration, seamless interoperability between systems, and highly distributed coordination (i.e. each actor taking responsibility for his/her own actions) in sea transportation. This presents an opportunity to move away from a traditional approach to traffic management with a central governance unit. Sea Traffic Management (2.0) will involve and engage multiple actors on multiple levels and will require new procedures for information sharing in a distributed manner within each engaged actor's action scope.

Adopting such a modern approach to traffic management as it is proposed in the STM concept developed in MONALISA 2.0, enables and requires that each involved actor is engaged as *traffic management co-producers*. Consequently sea traffic management will be performed on different actor levels contributing to the overall performance of the transportation system. The co-production of sea traffic management will be designed to enable the involved actors to optimize their operations. Such optimization, both for the individual actor's performance and for the integrated performance of the transportation system as such, requires that involved actors share relevant information that is related to a *shared common object* of interest.

Transportation systems are eco-systems involving different actors performing their different tasks based on their shared common objects of interest. The common object of interest in Sea Traffic Management is the sustainable transport process embedding sea transport. The actors involved will have to arrive at consensus regarding the performance targets that should govern the performance of the different focus *areas*. Within MONALISA 2.0 three areas of performance targets for the future of STM have been identified as critical; *safety*, *environmental sustainability*, and *operational efficiency*. Furthermore, performance targets within one area affect performance targets of other areas, e.g. accurate speed for reaching a destination according to an agreed ETA would enable an optimal consumption of bunker fuel (i.e. operational efficiency) and thereby minimize the effects on the environment (i.e. environmental sustainability). STM shall coordinate and orchestrate the efforts of all actors involved in sea transportation thus leading to improved safety and punctuality with as low impact on the environment as possible. It is of paramount importance that the performance targets, within and between different areas, are well aligned and create synergies in an optimal way.

Various operational (acting) units, i.e. key actors, are engaged in sea transportation, where all

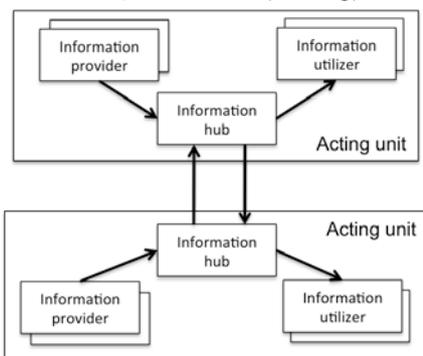


Figure 2: Distribution of information within and between acting units

operations highly influence the performance of the ecosystem as a whole. Each operational unit is to be seen as a “point of interest” collecting several actors acting on behalf of this “point of interest”. Examples of “point of interests” related to sea traffic management are ships, ports, authorities, and ship-owners. These points of interests involve numerous actors that provide and utilize information to perform their tasks. Optimally each operational unit manages information sharing between different actors by collecting information from information providers (through their sources) and

enabling information utilizers to access the information for its operations supported by an information hub. This means that e.g. ships would collect all relevant information from different sources on-board (e.g. the engine, the bridge etc.), refine that, and distribute it to different utilizers on-board the ship as well as to other operational units. The same applies to the other “points of interest” gathering numerous actors, where the collaborative ability including information sharing is one essential key success factor. Ecosystems where the performance relies on integrated performance of different organizational units requires that information is exchanged between these units efficiently and seamlessly (see figure 1). Applied to Sea Transports examples of units (operationalized in ships and ports) and their needs for information sharing are indicated in figure 2. Within MONALISA 2.0 schemas for information collaboration are being developed enabling each unit to act in an optimal way to fulfil the goals of the ecosystem. The distributed nature of sea traffic management requires that each operational unit, and its sub units acts, according to its affordances, act in such

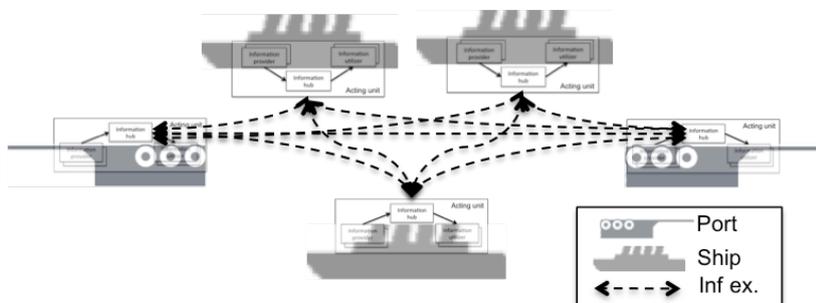


Figure 1: Information exchange in Sea Transports

way that the performance targets of the ecosystem are reached. Schemas of collaboration require the identification of 1) “key” operational units, 2) key information to exchange/share (including standards), as well as conditions for the exchange of information. This reasoning of the use of an information hub has also been applied within MONALISA 2.0 for supporting voyage optimization (c.f. GEOPORTAL).

Consequently Sea Traffic Management, as conceptualized in MONALISA 2.0, explores alternatives to a centralized Sea Traffic Coordination Centre (STCC). Even though that MONALISA 2.0 is highly inspired by Air Traffic Management the ambition with MONALISA is rather to contribute to the establishment of a distributed traffic management than to rely on a “EuroControl” for Sea Operations. The architecture sketched for in this paper also gives

alternatives to a centralized Sea Traffic Coordination Centre (STCC). Even though that MONALISA 2.0 is highly inspired by Air Traffic Management the ambition with MONALISA is rather to contribute to the establishment of a distributed traffic management than to rely on a “EuroControl” for Sea Operations. The architecture sketched for in this paper also gives

room for new actors to enter the scene providing new services building on information that is made available through this network of collaborating actors.

Consequently, inspired by Svallvåg 2013¹, information sharing for STM in Intermodal Sea

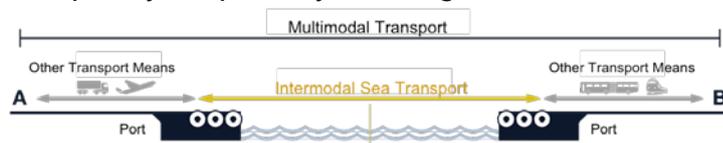


Figure 3: Intermodal Sea Transport as part of Multimodal Transport

Transport could be expanded to also include other transport means and thereby cover multimodal transport processes (c.f. figure 3). This also means that Sea Traffic Management needs to become an integral part of the (distributed) management of the total chain of operations in multimodal transportation processes (c.f. figure 4 for an example).

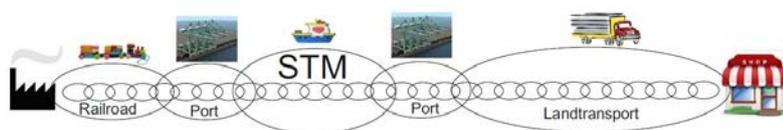


Figure 4: (Example of) chain of operations in multimodal processes covering sea transports

The Sea Traffic Management (STM) concept implemented in the maritime sector is the paradigm shift of information management by introduction of

"Voyage based operations" instead of **"Surface based operations"**, as is the common practice in the maritime world of today. With a combination of the **SWIM Process** (System Wide Information Management) and **Voyage based operations**, the maritime sector is anticipated to solve the obstacles to obtain a complete chain of information, both from a Sea Traffic Management perspective as well as for the long-term strategic and mid-term tactical planning for any of the involved stakeholders. The planning stretches from years to come for shore-based stakeholders up until the critical executive minute operations of involved mariners onboard the sailing vessels. Inspired by the definition of e-Navigation by IALA², the initial STM definition by Swedish Maritime Administration³, and the thoughts of modern traffic management elaborated in this document, the following definition of Sea Traffic Management is proposed:

Sea Traffic Management (STM) is a concept encompassing all actors, actions, and systems (infrastructure) assisting maritime transport from port to port. STM is a part of the multimodal logistics chain, encompassing sea as well as shore based operations. STM is a network-based approach for optimal Intermodal Sea Transport. STM is performed on multiple actor levels, where each engaged actor co-produces traffic management. These actors

¹ Svallvåg 2013: Svensk maritim forsknings- och innovationsagenda

² E-Navigation according to IALA: "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."

³ Sea Traffic Management according to SMA: "The aggregation of the seaborne and shore-based functions (sea traffic services, maritime space management and sea traffic flow management) required to ensure the safe and efficient movement of vessels during all phases of operation" ... further this includes "The dynamic, integrated management of sea traffic and maritime space (including sea traffic services, management of the maritime space and sea traffic flow management) – safely, economically and efficiently – through the provision of facilities and seamless services in collaboration with all parties and involving seaborne and shore-based functions."

contribute to the integrated performance of the realization of the performance targets of intermodal Sea Transport as the shared common object of interest of the ecosystem constituting Sea Transport. STM puts an emphasis on interoperable and harmonized systems allowing a ship to operate in a safe and efficient manner from port to port with a minimal impact on the environment. STM secures sea traffic flow and capacity optimization.

*** This paper describes preliminary findings within the MONALISA 2.0-project. We encourage readers to send feedback and comments on this paper! ***