



STM Validation Project results

**The largest
e-navigation
test-bed ever**

**Potential
energy
savings of
20-24%**

**“Let IMO
consider
the global
implementa-
tion of STM”**

INTRO

”The largest e-navigation test-bed ever”

We need large scale test-beds now! The Sea Traffic Management concept has been defined, from a ship and port perspective. We now need to get it off the drawing board and prove that STM can deliver on its promises. Let's get 300 ships capable of sharing voyage plans, stage really big scenarios in the simulator network, and recruit ports in the Mediterranean and Northern Europe.

THIS IS HOW Magnus Sundström (Head of Research and Innovation at the Swedish Maritime Administration) defined the goals of the STM Validation Project back in 2014. Now, the only question was how to make it happen. Luckily, we already had a large network of partners engaged in STM. It was a mix of maritime authorities, research institutes and industry actors, all in accordance with the triple helix model. In fact, the largest group was industry partners – system suppliers, shipping companies, ports and port actors. And they wanted to keep working with STM!

IN PRINCIPLE, we decided to spend the first half of the three-year project period on preparation. This meant that ports and their systems suppliers, navigations system suppliers and shipping companies had to develop their IT solutions to support operational trials with STM. The European simulator network, EMSN, had been established already in previous projects and was fairly well prepared to encompass more simulator centres and larger scenarios. In parallel, the digital infrastructure now had to be detailed down to every single standard component necessary to achieve seamless



Magnus

information exchange among independent systems. Furthermore, we were dependent on our sister project, EfficienSea2, to deliver the Maritime Connectivity Platform. That's where all the digitalized services were going to be registered so they could be found by users on ships and ashore.

YOU MAY WONDER if we really thought we'd pull it all off?

In addition, perhaps not very surprisingly, half way through the project there were still major technical challenges to overcome. The establishment of the live test-bed was delayed; the tests and data gathering started on a small scale and ramped up successively. Luckily, studies in ports and in the simulator network progressed according to plan. The European Commission found it beneficial to grant a six-month extension, which was enough to get us the 300 ships and finalize the studies favourably.

And how did it go?

That's what this brochure is about.



Per

Per Setterberg, Project Manager of the STM Validation Project



Why is there a fax machine on the bridge?

When did you last see a fax machine? The chances are that you'll still be able to find one on the bridge of a ship or in a harbour master's office. Generally, the progress of digitalization in shipping has been slow so far. This may not be due primarily to an unwillingness to change or adopt new technologies. It may well be that when you work amid ever-changing constellations between ports and ships around the globe, you have to stick to what most commonly works in practice. Radio, telephone communication and e-mail have been around for a long time and we know how to utilize them. STM aims to facilitate the digitalization of shipping, in real time, so that actors can exchange information instantly and securely. STM does that in many ways; one crucial way is by identifying the standards necessary for IT systems to speak to each other on the fly. Great things can be achieved by using this approach. Vessel Traffic Services can enhance situational awareness by having access to the voyage plans of passing ships. Ports and ships can exchange estimated times of arrival and departure electronically, and route optimization services can deliver optimized ocean routes directly to the planning system on-board. These are a few examples of enhanced procedures for shipping actors, which have been tested and evaluated in the STM Validation Projects, with the overall goal of increasing safety and efficiency and reducing shipping's environmental impact. On the following pages, we will take you through the highlights among our results. Enjoy!

THIS IS THE SEA TRAFFIC MANAGEMENT CONCEPT

FACTS & FIGURES

A new paradigm for maritime information sharing

STM – Sharing data and benefits

90 % of the world's trade is transported by sea. Every day, all year round, tens of thousands of ships navigate the oceans, sometimes with difficulty due to the lack of updated information, leading to risks of accidents, sub-optimal routes, waiting times in ports and an excessive ecological footprint. Data about positions, routes and times of arrival have always been somewhat confidential. As shipping now enters the digital age, the time is right for change.

Infrastructure, standards and interoperability

Sea Traffic Management is creating a new paradigm for maritime information sharing, offering tomorrow's digital infrastructure for shipping. Sea Traffic Management

is the concept of information sharing in real time, through a secure infrastructure, with standards that create interoperability among various actors such as ships, manufacturers and port actors, allowing information owners to choose with whom they want to share their data.

Services

With common standards, STM offers possibilities for a new service market, such as an app store for the maritime domain. Various service providers can use the infrastructure to offer their services to ships, ports, cargo owners and other maritime actors.

The interoperable services offered include:

- Route optimisation
- Ship-to-ship route exchange
- Navigational warnings
- Enhanced monitoring
- Nordic pilot routes
- Port call coordination
- Port call synchronization

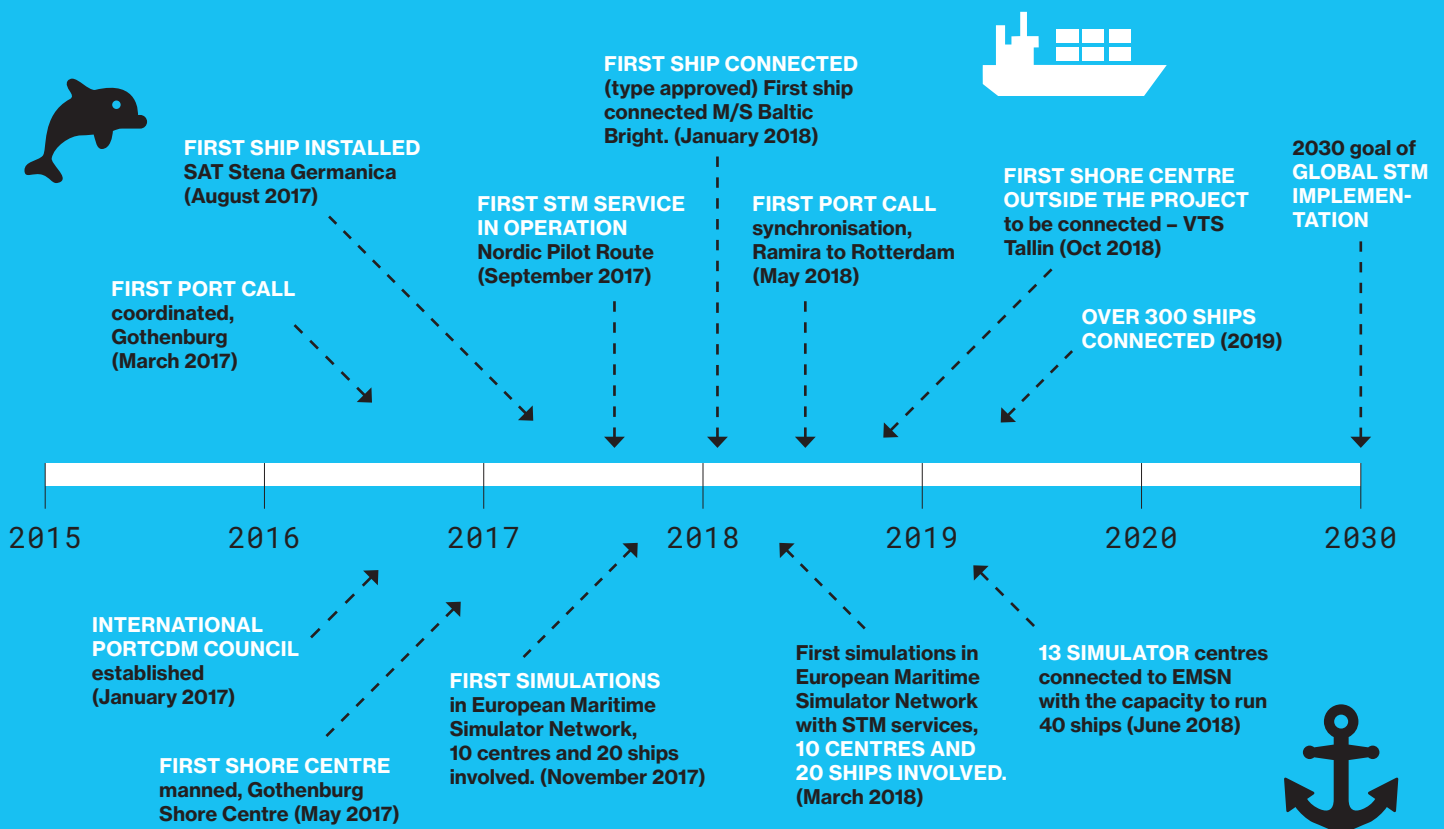
Benefits

STM services allow personnel on-board, and onshore, to make decisions based on real-time information. This enables more just-in-time arrivals, green steaming, reduced administrative burden and decreased risk-related human factors. STM also reduces the ecological footprint of shipping, thereby creating a safer, more efficient and environmentally friendly maritime sector.

Goals

The 2030 goals set for the fully-deployed STM are:

- Safety: 50% reduction in accidents.
- Efficiency: 30% reduction in waiting time for berthing and 10% reduction in voyage costs.
- Environment: 7% lower fuel consumption and 7% lower greenhouse gas emissions.



RESULTS

About the Project

Duration: 2015-2019 (3.5 years)
Budget: €43 million, Co-financed by the Connecting Europe Facility of the European Union
Lead Partner: Swedish Maritime Administration

Connected

- 6 Shore centers connected within the project
- 311 ships STM equipped during the project
- 12 simulator centers connected to the European Maritime Simulator network
- 9 Ports connected; Umeå (Sweden), Vaasa (Finland), Gothenburg (Sweden), Brofjorden (Sweden), Stavanger (Norway), Valencia (Spain), Sagunto (Spain), Barcelona (Spain), Limassol (Cyprus)

“STM goes hand in hand with the IMO objectives. Let IMO consider the global implementation of STM”

KITACK LIM,
IMO Secretary General

Developed

- 3 ECDIS manufacturers developing STM solutions in their products
- 3 VTS manufacturers building in STM-support in their systems
- 3 standards in progress, S-211 Port-Call Message Format, S-421 Route Exchange Format, both compatible with S-100, SECOM - Secure Exchange and Communication of S-100 based products

Delivered

- 10 services; Nordic Pilot Route Service, Baltic Navigational Warning Service, Route Optimisation Service, Winter Navigation Service, Port Call Synchronization, Port Call Coordination, Route Crosscheck, Ship-to-Ship Route Exchange, Enhanced Monitoring and Search and Rescue
- Gothenburg Shore Center will continue to support ships after the project duration
- At least four services will remain operational after the project duration; Winter Navigation, Baltic Navigational Warnings, Nordic Pilot Routes and Search and Resuce
- The previously approved standard format for data exchange RTZ now in operation
- STM clause for Charter Parties adopted by BIMCO in standard contracts
- Industry consortia launched
- Infrastructure in operational environment
- 22 concept notes
- 200 conferences
- 500 articles in trade press

Involved

- 13 countries
- 38 partners from academia, industry and governmental bodies
- 37 associate partners
- 512 mariners participated in the simulator tests
- 87 organisations engaged in port tests

“Sea Traffic Management is a pillar in the European maritime strategy”

JAROSLAW KOTOWSKI,
Senior Project Manager of The Innovation and Networks Executive Agency (INEA)



RESULTS

STMs potential environmental savings

Macro analysis of AIS and STM test-bed data

A MACRO ANALYSIS based on actual AIS data from 50 participating ships, combined with data from the test-bed, was conducted in an effort to obtain estimations of the potential impact of STM implementation on fuel consumption and GHG emissions. The AIS data were collected during the period June 2017 - June 2018 and consist of more than 5.3 million registers. These data were combined with

data from the PortCDM test-bed from nine European ports and more than 43,000 port calls, mainly from 2018.

The macro analysis considered the various potential levels of maturity of STM implementation. Various scenarios that reflect an increasing deployment of STM in the shipping industry and ports were devised.

1. Scenario 1 (SC1) assumed that ports

– thanks to STM – can provide more accurate recommended times of arrival, and communicate more smoothly.

2. Scenario 2 (SC2) assumed that STM is fully deployed in ports and increases efficiency.

3. In scenario 3 (SC 3 Low, SC 3 Med, SC 3 High), the effects on fuel consumption and green-house gas emissions were analysed, based on ships sailing at low, median and high speed.

Energy savings of 20-24%

The figure shows the savings for fuel consumption and emissions in each scenario, as well as comparable variations. Note that for Scenario 3 at low speed, which achieves the best results, the savings – both in fuel consumption and in emissions – are roughly 24% on average. Scenario 1, by eliminating the anchoring times, already provides about 20% savings in fuel and CO2. Scenario 2 introduces some additional savings, due to improved efficiency and reduced times at berth. This improves slightly in Scenario 3 as a result of the enforcement of a lower cruising speed. However, it is interesting to note how the use of the median speed (SC Med) or a higher speed – corresponding to the third quartile of its speed distribution – can nevertheless offer relevant savings in terms of fuel consumption, even though they are considerably lower.

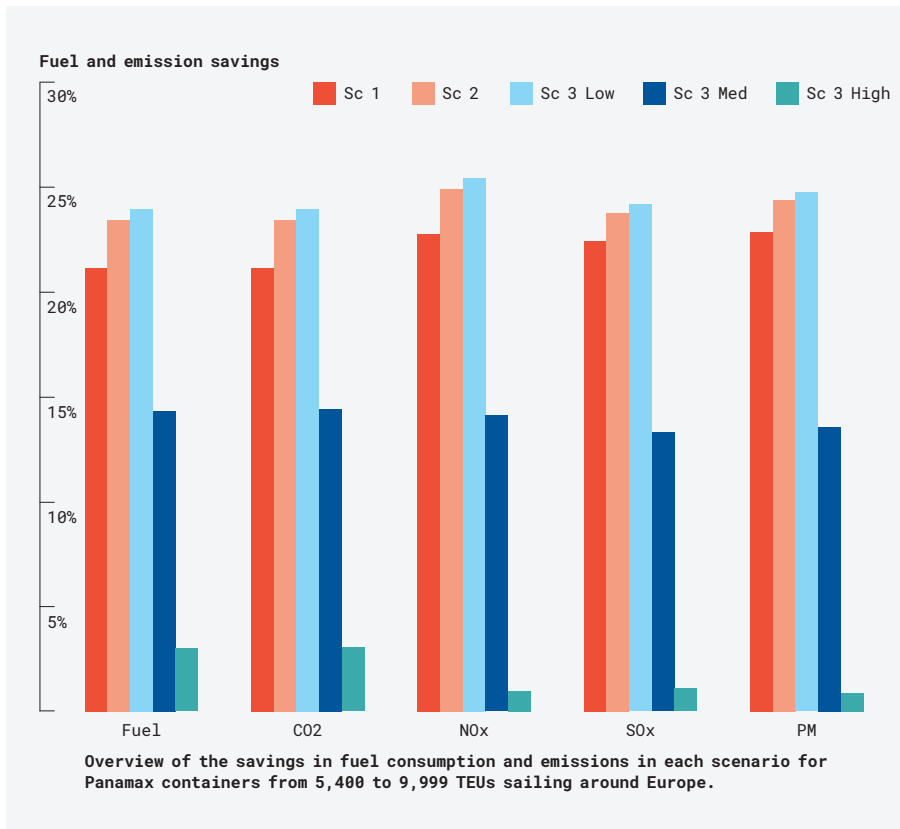
Legal aspects

Sea Traffic Management introduces an entirely new information-exchange paradigm in shipping, optimizing voyages and port calls and providing real-time data to navigators.

The table below describe the legal feasibility of STM service by service. ●

Legal feasibility of STM services

Service	Constraints
Route optimization services	No problem - speed proposals must follow speed limits.
Ship-to-ship route exchange	Some potential for perception problems.
Enhanced Monitoring	No problem
Port Call Synchronization	No problem - port calls predominantly governed by national Law
Winter Navigation	No problem
Importing Pilot Routes	No problem
Navigational Warnings	No problem
SAR - Search and Rescue	No problem - STM positively endorsed



CONCLUSIONS

Enabling datasharing improves operations

Digital information sharing improves operations on-board and ashore

Findings from the navigational part of the STM Validation Project, end-user feedback, indicate that digital information sharing between shore-ship, ship-shore and ship-ship can improve operations on-board, in shore centres, maritime rescue and coordination centres, and VTS centres.

Improved situational awareness and navigational safety on board

Conclusions from the practical end-to-end usage of the various test-bed services prove that services such as the Nordic Pilot Route Service, the Baltic Navigational Warning Service and Enhanced Monitoring from shore centres demonstrated improved situational awareness and operational safety. Specific tests for the Ship-to-Ship Route Exchange service may enhance the officer's situational awareness and shows a tendency to improve navigational safety during strategic navigation.

Improved communication and potential decreased workload

According to the findings in the simulators, the utilized services have the potential to improve communication, decrease bridge-crew workload, while perhaps simultaneously increasing the time to respond, plan and act accordingly in challenging navigational and traffic conditions. Numerical analyses indicate that the STM services are valuable in areas where strategic navigation is applicable, i.e. where there are fewer temporal and spatial constraints. The 512 experienced seafarers participating in the simulations were generally enthusiastic about

and supportive of further development and implementation of STM services

Increased navigational safety, efficiency and pro-activity in VTS

From the VTS operator's perspective, communication and interaction between ship and shore will increase, and it is anticipated that the STM services will promote navigational safety and efficiency through the availability of additional navigational information, monitoring services and communications.

Although it is important to study further the communication and interaction patterns between ship and shore to understand how workload, training, and procedures in the VTS station will be affected by STM, the innovative possibility to review ships' intentions well in advance before entering the VTS surveillance area would allow the VTS to work more proactively than is currently the case.

Increased effectiveness and reduced waiting time in ports means substantial savings

The validation of STM in ports identified considerable potential savings across various aspects of the transportation chain. Improved predictability of operations offers potential economic gains for ports and ship operators.

Just-in-time arrivals, departures, and shorter turnaround times lead to more efficient use of assets and improved predictability of operating and delivery times. Operational productive time can be increased through access to up-to-date status information, leading to better-in-

formed decision-making and, thereby, reduced unnecessary waiting times.

Cross-industry collaboration is key

One of the main successes of the STM project has been the cross-industry collaboration, as leading competitors among providers of ECIDS and VTS-systems have developed the services during the project and, as a result, are currently planning to establish an open non-profit consortium to operate and mature the maritime digital infrastructure established in the STM Validation project. The consortium includes project partners, associate partners, as well as other actors who see the potential of a common basis for delivering e-navigation services and a growing digitali-





On November 13, 2018 BIMCO adopted a specific STM-clause developed to facilitate just-in-time port calls in commercial contracts.

“The new STM clause can assist actors becoming more climate friendly through optimized arrivals.”

Grant Hunter, Head of Contracts & Clauses at BIMCO

sation of the maritime market. Already, the noticeable interest from such a broad industry group is a sign that the maritime digital infrastructure and the STM services have identified a significant need, although it is important that the initiative is supported in parallel by new projects that continue the development of STM in innovative directions. As one of the deliverables of the STM validation project, the International Port CDM Council (IPCDMC) has been established to provide a sustainable international governance body for STM in ports. This paves the way for harmonized collaboration and data-sharing of port-call operations for the maritime community on a global level by supporting regional and local implementations. ●

Recommendations for the future

The overall project recommendation is that the concept and the infrastructure are ready for commercial implementation in the form of new and updated software, services and functions. However, continued support from public funding towards implementation would be advantageous in increasing the adoption rate. Some of the benefits for the entire industry and individual users will be larger as the number of ships using STM reaches a critical mass. A programme, or framework, for Sea Traffic Management within EU's Motorways of the Sea should be established and integrated in the TEN-T Guidelines.

In the coming phases of STM, more and new kinds of operational services based on new message formats and information services/APIs are required. Further focus needs to be directed towards the refinement of operational services as well as components related to the architecture, such as information services and cyber-security precautions and solutions. The ultimate goal is to get STM included in standard operation procedures and make it a natural part of everyday work. By that shaping the digitalisation of the maritime market!

The project also suggests continued work by project partners in international consortia and organizations, such as the Maritime Connectivity Platform Consortium and the non-profit industry group for the maritime digital infrastructure. A new organization has also been formed to develop and operate the European Maritime Simulator Network, for future research, training and testing of new services. ●

Ongoing initiatives

- **Real Time Ferries** will use the on-board awareness of ferry delays to inform passengers, goods handlers and public transportation about the changes.
- **EfficientFlow** will implement STM in two ports and help ships to plan encounters in narrow passages at an earlier stage to save fuel and increase safety.
- **STM BALT SAFE** will increase tanker safety in the Baltic Sea, taking into account the cross-traffic of ferries for the most part.
- **STM in the Eastern Mediterranean, STEAM**, will establish an STM shore centre in Cyprus and implement Port-CDM in the Port of Limassol, exchanging information with ports in neighbouring countries.
- Partners will continue collaboration with the **SMART Navigation** project in Korea and with **SESAME Solution II** in Singapore.

Making STM happen:

Partners:



Associate Partners: Adveto, BIMCO, Carmenta, ChartWorld, Dalex Shipping Co S.A., Estonian Maritime Academy, Fleet Management Limited, Fleetrance, Indra, inPort, Janz Tec AG, KONGSBERG, Latvian Maritime Academy, Marine Institute, MarineFields, Meritaito, MF Shipping Group, NAPA, NAVTOR AS, PortCall.com, Raytheon, Rocket Brother, Rolls-Royce Marine, SEAMLESS, Searoutes.com, Sperry Marine, SSAB, Tototheo Maritime, UK Hydrographic Office, University of Applied Sciences Emden Leer, Urban Hawk, Utkilen AS, VISSIM, VTT Technical Research Centre of Finland Ltd, Wallenius Marine

find out more

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