MONALISA 2.0 – Activity 1.1

Baseline Report

Document No: MONALISA 2.0_D1.1

Co-financed by the European Union
Trans-European Transport Network (TEN-T)
DOCUMENT STATUS

Authors

<table>
<thead>
<tr>
<th>Name</th>
<th>Organisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimitrios V. Lyridis</td>
<td>National Technical University of Athens</td>
</tr>
<tr>
<td>Eirini Stamatopoulou</td>
<td>National Technical University of Athens</td>
</tr>
<tr>
<td>Nikolaos Manos</td>
<td>National Technical University of Athens</td>
</tr>
<tr>
<td>Panayotis Zacharioudakis</td>
<td>National Technical University of Athens</td>
</tr>
</tbody>
</table>

Review

<table>
<thead>
<tr>
<th>Name</th>
<th>Organisation</th>
</tr>
</thead>
</table>

Approval

<table>
<thead>
<tr>
<th>Name</th>
<th>Organisation</th>
<th>Signature</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fabio Ballini</td>
<td>WMU</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ole John</td>
<td>Fraunhofer CML</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fredrik Karlsson</td>
<td>SMA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antonio Lista</td>
<td>SASEMAR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lars Markström</td>
<td>SSPA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Andrew Paul</td>
<td>Carnival</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Per Setterberg</td>
<td>SMA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gunnar Storm</td>
<td>Carmenta</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ulf Svedberg</td>
<td>SMA</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

DocumentHistory

<table>
<thead>
<tr>
<th>Version</th>
<th>Date</th>
<th>Initials</th>
<th>Description</th>
</tr>
</thead>
</table>

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

DISCLAIMER: THIS INFORMATION REFLECTS THE VIEW OF THE AUTHOR(S) AND THE EUROPEAN COMMISSION IS NOT LIABLE FOR ANY USE THAT MAY BE MADE OF THE INFORMATION CONTAINED THEREIN.
Table of content
1. General information .............................................................................................................. 4
2. Executive Summary .............................................................................................................. 5
3. Methodology .......................................................................................................................... 7
4. Results .................................................................................................................................. 35
5. Conclusions and recommendations ...................................................................................... 39
6. Publications .......................................................................................................................... 43
7. Reference material .................................................................................................................. 44
Appendix A ................................................................................................................................... 46
1. General information

MONALISA 2.0 aims at contributing to a continuous improvement and development of efficient, safe and environmentally friendly maritime transport in the European Union by implementation of a series of measures in accordance with the EU's transport policies.

MONALISA 2.0 is a concrete step in the process of further developing the Motorways of the Sea concept by implementing concrete pilot actions and studies that will foster deployment of new maritime services and processes. The following Activities are included in MONALISA 2.0:

Act. 1 – Sea Traffic Management Operations and Tools
Act. 2 – Sea Traffic Management Definition Phase Study
Act. 3 – Safer Ships
Act. 4 – Operational Safety

MONALISA 2.0 takes its point of departure in the results and experiences from the MONALISA 1 project (2010-EU-21109-S), co-financed by TEN-T under the Motorways of the Sea and which has received very positive feedback from both stakeholders, international bodies and the European Commission. MONALISA 2.0 will also make use of relevant results from previously carried out Motorways of the Sea projects, maritime R&D projects and re-use best practises from other areas in society as to bring them further towards deployment in the maritime sector. This will foster innovations and deployment of new technologies and systems to increase efficiency effectiveness and environmental sustainability of Motorways of the Sea and its integration in the Trans-European Transport Network.

In MONALISA 2.0, the demonstrated results of Sea Traffic Management from MONALISA 1, will be taken an important step further towards deployment trough joint actions e.g. by:

• testing of concrete applications and services which would allow rapid commercial deployment;
• integration of route planning tools with additional environmental information and maritime spatial planning for the purpose of improved maritime safety and environmental protection;
• joint private-public action to elaborate better standards for route information exchange through a common interface and common data format allowing equipment from all manufacturers be used for Sea Traffic management;
• demonstrating concrete/hands-on services using new technology to enhance maritime safety, making Search and Rescue and mass-evacuations more efficient than today and by addressing the urgent issue of safety in ports;
• re-using results of previous EU investments in Air Traffic Management as well as from other sectors and their application into the maritime domain.

MONALISA 2.0 will re-use the results and experiences from the development within the aviation sector and its SESAR (Air Traffic Management) programme, which has been strongly supported by the European Union through the Framework Programmes and TEN-T during the past decade. A close cooperation has also been established with the DG MARE CISE-programme (Common Information Sharing Environment) developed to support control of sea areas under Coastal States responsibilities in order to exchange experiences and results.

2. Executive Summary

The baseline, sub-activity 1.1, presents and assesses results from the current MONALISA project, in particular results from Activity 1, and results from previous and parallel projects, such as MarNis, EfficienSea, TrainMoS and ACCSEAS.

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

There are several sub optimal areas for the maritime transport, with a high margin for further efficiency improvement for the global transport system:

• Environmental performance of shipping
• Simplification of administrative procedures
• IT maturity
• Environmental and Maritime Safety
• Response to accidents and incidents
• Chain planning
• Competence and training
• Dynamic and Proactive Route planning
3. Methodology

MONALISA

The main objective of the global project is to contribute to the promotion of the Motorways of the Sea (MoS) concept in the Baltic Sea by implementing a series of measures of wider benefit, which are also included in, or fully in line with, the EU's Strategy for the Baltic Sea Region.

The Activity aims to develop and test a new model in route planning based on existing Electronic Nautical Charts and Automatic Identification System. Each vessel's pre-planned route will be visible for other vessels and monitoring centres ashore. The estimated best route and speed plan will be agreed on between captains and pilot centres which have knowledge about the local sailing conditions such as currents, wind and waves, water depth and sea ice that affect sailing time and bunker consumption but also traffic congestion, availability of berth in the next port of call and cargo handling schedules. Radio communications between vessels will not be needed when preplanned routes clearly describe all navigators intended routes on screens onboard. Monitoring centres and others will immediately see if a vessel is deviating from a pre-planned route and will be able to take action. All vessel routes will be available for other ships for anti-collision purpose.

One of the most important input to Activity 1 is newly produced ENC charts with quality assured depth data sets, to have guarantees that the dynamic green routes can be planned over the sea areas with all the dynamic data inputs effectuated, in order to allow the vessels to avoid squat effects, reduce speed in shallow water areas and to use deep water areas for full speed. It is likely, that more detailed data model, than just ENC, is needed to fully utilize DPR in shallow areas.

MONALISA aims at giving a concrete contribution to the efficient, safe and environmentally friendly maritime transport. This is done through development, demonstration and dissemination of innovative e-navigational services to the shipping industry, which can lay the groundwork for a future international deployment.
Quality assurance of hydrographic data for the major navigational areas in Swedish and Finnish waters in the Baltic Sea contributes to improving safety and optimization of ship routes.

MONALISA addresses a number of priority areas, strategic actions and flagship projects of the EU strategy for Baltic Sea region and thus contributes to the implementation of the Strategy.

MONALISA is also in direct line with the EU concept "Green Transport Corridors", a concept which, inter alia, represents the environmental dimension in the development of the transport system.

Contributions useful for Monalisa 2 coming from Monalisa 1 can be summarized as and fall into the following 4 activities:

- Activity 1 - Dynamic & Proactive Route planning
- Activity 2 - Verification System for Officers Certificate planning
- Activity 3 - Ensuring the Quality of Hydrographic Data on Shipping Routes and Areas
- Activity 4 - Global Sharing of Maritime Information (GSMI)

In this study, we will focus on activity 1.

Activity 1 - Dynamic & Proactive Route planning

Nowadays, there’s no centralized traffic control from shore over open sea areas; Detection and identification of traffic are carried out based on personal judgment by different authorities (Coast Guards) in various countries. Certain regions around the world have launched SRS (ship reporting systems) run by coastal VTS, where-to ships entering the SRS areas shall report ships data and destination.

At TSS areas (Traffic Separation Scheme) traffic movements are subject geospatial constraints marked on maps and even physically with buoys. Those areas are supposed to be monitored by authorities.

Monalisa enhanced existing Electronic Nautical Charts (ENC) and Automatic Identification System (AIS). The rationale behind it was that a ship’s preplanned route will be declared to other vessels and monitoring centers ashore. The
estimated optimal route and speed plan will be set between captains and pilot centers which check local sailing conditions:

Applicable data for the pilot center include:

- Currents
- Wind and waves,
- Water depth
- Ice that affect sailing time
- Bunker consumption
- Traffic congestion
- Availability of berth in the next port of call
- Cargo handling schedules.

**Maritime Single Windows**

**AnNa**

*AnNa, an EU Member States driven project*, focuses on the implementation of the EC Directive 2010/65/EU (Reporting Formalities for Ships arriving in/departing from EU ports). It will promote integration in Maritime Single Window development in order to achieve better data exchange among national systems, including SSN, Customs, Inland.

*What is more, AnNa constitutes an initiative for Administrative simplification in terms of* red tape reduction for users (business), IT languages parsing and data exchange between national (Maritime Single Window) networks.

The projects will process existing and proposed “national” Maritime Single Window platforms and their connections to other systems such as SSN, Customs, Inland, in order to come up with a generic solution, a Master Plan, that could be compatible with Directive 2010/65/EU that dictates “multilateral” harmonisation and standardization in Maritime Single Window systems.

Thus, a “roadmap” will ensue describing the short- (2012-2013), medium- (2013-2015), and long-term (2016-2020) stages to adoption.

What is more, (national) pilot projects will also be developed that will deal with electronic data submission by the reporting entity (the front desk), the national (internal) solution (the mid office), or electronic data exchange between the participating countries that incorporate contemporary exchange systems (the back office).
HR Training

Trainmos

"TrainMoS" promoted the enhancement of knowledge on MOS related topics by contributing, through the human factor, to the development and extension of the EU multimodal transport system, allowing the smart, sustainable and inclusive connection of the regions of Europe, as well as with neighboring countries.

It came up with a MoS knowledge platform, introduced the human element in the Motorways of the Sea by defining the basis for a future EU virtual open MoS University Master Programme and by combining together local MoS related competences and knowledge from different EU universities.

This MoS knowledge base at EU university level (within an ICT infrastructure) was implemented through the preparation of seven EU wide pilot actions in seven EU countries (Spain, Portugal, Sweden, Germany, United Kingdom, Italy, and Greece). The participation of the seven universities and their corresponding aimed at acting as a catalyst which will contribute to the development a European academic training in all MoS related subjects that should meet the needs of the transport industry.

Its Pilot Actions and themes were:

P1: Ports, terminals and hinterland links. (Leader Jacobs University).

P2: Smart cities and intelligent ports (leader UniversitàdegliStudi di Genova).


P4. Multimodality and efficient shipping (leader NTUA).

P5. Multimodal transport economics (leader Edinburgh Napier University).

P6. Safety and security (leader Chalmers University of Technology).

P7. Logistic chains and modal integration (leader Faculdade de CienciasSociais e Humanas, Universidade Nova de Lisboa)
Coastal Zone Management

Blast

BLAST - Bringing Land and Sea Together - was a regional project for the improvement of information integration across the coastal margin in the North Sea region. Over three years, 17 partners from 7 countries, i.e. governmental organizations, universities and private companies, worked on the harmonisation and integration of land and sea data.

BLAST was funded by the European Union as part of the Interreg IVB North Sea Region Programme. The project started in 2009 and was completed in 2012.

From 2009 till 2012, the four technical Work Packages under BLAST focused on:

- Marine spatial planning, environmental protection, socio-economic development, risk management and mitigation, by delivering harmonised land and sea geographic datasets.
- Practical tools, processes, and applications that the North Sea maritime community should adopt for future marine information systems.
- Improving vessel safety and efficiency, and enhancing management of the environment through the design and development of a regional maritime traffic monitoring platform for the North Sea region.
- Homogeneous policy formulation and means to promote coastal zone planning and management (ICZM) under the contemporary global change crisis scenario

Thus, Blast project contributed to the following topics:

- Land and Sea Model
- Navigating the North Sea
- Maritime Traffic Harmonisation
- Climate Change in the Coastal Zone
Maritime Traffic Harmonisation

Within the context of WP5, the project led to the design and development of a regional maritime traffic monitoring platform beneficial for all Member States in the North Sea region. It harmonizes maritime traffic information formats in the North Sea Region and proposes new formats where necessary. It also harmonizes regional maritime traffic information flow with SafeSeaNet and enhances its functionality. Finally, a network and server platform for development and demonstration is developed.

Land and Sea Model

The Land and Sea Model work package led to following results:

- Creation of the Prototype Reference Base for North Sea Marine Map (Specifications for the reference base and complementary data model, picking best practices from participating countries and abroad. A Feature Catalogue and Application Schema were also compiled. The data held in the spatial database was examined and mapped, so that gaps can be detected)
- The development of a new methodology for the realisation of a Chart Datum for the North Sea Area (development and application of a new methodology for the merger of chart data in the North Sea area and the connection to the onshore height systems. The output surfaces are fed into the BLAST Height Transformation Tool so that end users can select desired method when vertically transforming their data)
- Development of the Vertical Reference Framework for North Sea (analysis of existing vertical reference models across the North Sea area. Existing geodetic and tidal models were examined to assess connectivity and these were used as input for a seamless surface data model of the North Sea area)
- Surveys to Support High Resolution Mapping in Use Case Study Areas (a report by the Agency for Maritime and Coastal Services in the form of a comparative study of different LiDAR techniques and platforms in the pilot sites. For each site, three LiDAR techniques on various platforms (airborne, mobile and static) were applied on the intertidal zone. The results, in terms of output data accuracy, point density, cost-benefit analysis, employability and more general benefits are illustrated in the Report)
Land-Sea Interoperability Audit, Methodologies and Tool Creation (toolsets for uploading, processing and integrating the land and sea datasets, as well as a Feature Catalogue and Application Schemas covering land and marine feature types.)

Development of the Prototype Land-Sea Interoperable Reference Base (it combines the land and sea data for the predetermined project pilot sites, in order to come up with the output prototype Interoperable Land-Sea Reference Base)

Navigating the North Sea

The ENC Harmonisation tool compares adjacent ENC cells in order to detect any are inconsistencies between them. The tool can be implemented by the hydrographic offices of neighboring countries in order to address how they could potentially harmonise ENC cells along their borders.

Climate change in the Coastal Zone

State of the art report: Future sea levels

In Europe, adaptation to climate changes will be necessary. The BLAST state of the art report analyses future sea level rise scenarios in North Sea developed by the BLAST project group working on Coastal Zone Climate Change. The scenarios are used as input to BLAST ICZM Decision support system.

State of the art report: Future sea levels

- Integrated Coastal Zone Management in Denmark
- Norwegian policies in ICZM and requirements for data and methods, adapting to climate change

Integrated Coastal Zone Management in the North Sea region

The BLAST project studied the scientific and legal framework for current ICZM practices. The research analyzed how ICZM policies are enforced among the North Sea countries. This report shows how certain policies and legislation give support for ICZM, while others conflict with each other. It also stresses the need for processing ICZM in a European context for improved national ICZM practices.

Climate change adaptation strategies
This report documents how three North Sea nations are dealing with complex climate change adaptation policies. It shows how adaptation measures should be successful and flexible, and the importance of mitigation measures.

**Coastal Zone Management Decision Support System**

For better enforcement of ICZM, BLAST designed a Coastal Indicator System (COINS) destined for planning authorities.

Taking into consideration the 27 climate change indicators developed by the European Expert Group on ICZM, COINS shows how coastal planners must consider potential future impacts of climate change in their studies. COINS is web-based, built on open source components and can be used free of charge from most web browsers under different operation systems.

**Air Traffic Control**

**SESAR**

The SESAR (Single European Sky ATM Research) programme is the technological and operational part of the Single European Sky (SES) initiative to satisfy coming capacity and air safety needs. It was established by the European Union and Eurocontrol, to manage and streamline all related research and development activities in the Community.

One of its major objectives is the 4D trajectory that adds time to classical three dimensional flight trajectory modeling. It seeks to allow for more direct flights with advantages for passengers, airlines and the environment. The 4D trajectory concept dictates that airspace users should agree on the detailed 4D Business/Mission trajectory directly with the service providers involved in facilitating the flight path in the related airspaces.

By the end of 2012, 10,568 commercial flights showed SESAR advantages; these flights were carried out as Demonstration Activities, initially launched in the framework of AIRE (Atlantic Interoperability Initiative to Reduce Emissions) and OPTIMI (Oceanic position tracking improvement and monitoring) and accompanied the Large Scale Demonstration Activities in 2012.
What is more, Live SWIM Demonstration Event linked together 27 different systems and demonstrated realistic scenarios across Airport, Air Traffic Control and Automated Fixed Telecommunications Network domains.

SESAR completed Successful Remote Tower validation exercises, proving the feasibility of providing Air Traffic Service to Angelholm airport from the Malmo ATCC R&D Remote Tower Centre, i.e. remotely nominal and non-nominal operations by capturing the “out of window” traffic situation and operational environment from a single airport and to display this picture in the remote site.

The SESAR Joint connected 8 major European airports (Paris, Vienna, Madrid, Cologne, Dusseldorf, Prague, Brussels and Toulouse, while some 40 partners were involved in Europe and beyond.

SESAR introduced business case methodologies for ANSPs, airspace users and airports. Under the mandate for the SESAR JU to compile a draft Pilot Common Project, with a view to assist the European Commission in setting up the deployment of SESAR, the SJU is now setting up the necessary business cases and their relative models.

SESAR is thus a very successful project that could pave the way for major business process reengineering and overall industry transformations in the shipping sector.

SESAR has thus studied system improvements in:

- Traffic Synchronisation, (Airborne Spacing, Sequencing and Merging, Initial 4D Trajectory (i4D) and Controlled Time of Arrival, Arrival Manager (AMAN) and Extended AMAN Horizon, Point Merge in Complex TMA, AMAN and Point Merge.

- Airport Integration and Throughput. The project developed and assessed a tool for the detection of conflicting ATC clearances for the runway controller.

Furthermore, the project focused on an initial prototype for the provision of Air Traffic Services (ATS) to a single aerodrome from a remote control site located at a distance of approximately 100 kilometres in an operational environment.

In addition, the use of time based separation minima by tower and approach controllers were tested. In particular, new controller procedures and support tools should render refined time-based separation minima in typical operational circumstances, as well as challenging wind conditions and other difficult circumstances feasible.
Simulations and live trials were used for the testing of procedures and technical specifications for planning, assigning and modifying of a route to individual aircraft and vehicles using data link.

Operational simulations in France, Spain, Italy and Germany were developed to ensure human machine interface improvements including safety issues, as well as operating procedures at airports.

- Network Collaborative Management and Dynamic/Capacity Balancing (new procedures to automatically share the static airspace and its use plan or updated use plan data with network managers and flow management positions)
- Conflict Management and Automation (Release exercises in Barcelona and Maastricht evaluated the possibility to improve the match between traffic densities and spare capacity in the network. Supporting tools to balance demand and capacity are being developed.)
- SYSTEM WIDE INFORMATION MANAGEMENT (SWIM): It concerns System Interoperability with Air and Ground Data Sharing. The project includes testing of new coordination procedures for ATS units on various validation platforms in Germany, with a view to boost efficiency in coordination and transfer of flights, the distribution of time constraints supporting the sequencing of arrival flows, as well as downstream and upstream negotiation elements.
- Enhanced Air Traffic Flow and Capacity Management (ATFCM) Processes: The project developed and organizes trials for validating for prototype enabling the reduction of the sector complexity and boosting of air traffic controller performance, operational improvements to Short Term ATFM Measures.

The possible repercussions from the applied research of SESAR concerns all stakeholder with significant societal benefits, while a similar, analogous template for reforms could also be applied to shipping industry through Mona Lisa 2.0: Passengers and society as a whole will benefit from punctuality, minimization of flight duration, lower gas emissions and lower noise pollution due to streamlined procedures even under difficult network or weather circumstances, while airport capacities can be boosted as well. Airlines will be soon able to achieve economies through more sophisticated routing processes, lower operating costs and improved punctuality, while Air Navigation Service Providers (ANSP) will improve quality of service and unit cost indicators
by fine-tuning integration, human/machine interfaces for controller working positions, more sophisticated controller software and refinement of controller working procedures.

**Electronic Maritime Surveillance and VTMS**

**Common Information Sharing Environment (CISE)**

The Common Information Sharing Environment (CISE) is under development jointly by the European Commission and EU/EEA member states. It will merge contemporary surveillance methods and networks and provide all implicated with data relevant for operations at sea.

The Commission has dictated by end 2010 a detailed “roadmap” describing the gradual adoption of the CISE.

This roadmap should lead to a decentralised information exchanging system, connecting civilian and military and counterparties. The CISE architecture is versatile enough to embody various technical innovations and local variations.

**MARSUNO**

This Pilot project on Maritime Surveillance in the Northern Sea Basins (ended) elaborated on the following topics:

**Integrated Border Management – Law Enforcement (IBM-LE)**

The mission of Integrated Border Management and Law Enforcement layer is to study to Eurosuresnforcement issues at sea. This action harmonised and merged several monitoring systems to a degree so that the tactical level surveillance units will be capable of accessing data from peer agencies, which can lead to significant synergies. The action also studied a regional arrangement for joint surveillance operations, principles for safe and lawful exchange of “delicate information” amongst law enforcement agencies.

In addition, the action dealt with single window issues, joint activities, maritime risk analysis, criminal intelligence and criminal investigation.

**Vessel Traffic Monitoring Information Systems (VTMIS)**

This action has to do with the unification of various monitoring systems, e.g. ships reporting systems (SRS) and vessel traffic services (VTS), to a level where the ships’ navigators perceive all the systems as one.
Towards this direction, it examined topics such as:

- Format of the vessel traffic information,
- Barriers (legal, administrative and technical obstacles),
- Operational procedures
- Technical specifications (e.g. XML schemes) needed for the realisation of systems integration

**Maritime Pollution Response (MPR)**

This action concerns response to oil spills, Response to chemical spills, Environmental surveillance and protection of maritime resources

**Search and Rescue (SAR)**

The main topic is the study of “the practicability of fusing Vessel Traffic Management (VTM), Search and Rescue (SAR) and measures to combat marine pollution in littoral waters” and the definition of “requirements for combining SAR, environmental protection and VTM and to develop the set of requirements for Maritime Rescue Coordination Centre (MRCC) to be able to monitor vessel traffic”

**Fisheries Control (FC)**

The fisheries control system according to the IUU-regulation aims at tracking blacklisted vessels and black listed states, i.e. a cross sectoral and cross border mission to enforce the compliance of the regulation. Custom and sea traffic control need a unified information system.

This action aimed at studying ways to enhance the of VMS data exchange, for port, and cross-sectorial and cross-border activities, and via various case studies on technical and legal obstacle to military and VTC access to VMS and on inspections at sea.

**Maritime Situational Awareness (MSA)**

This action concerns interoperability in maritime surveillance and monitoring, tracking and reporting systems in the Northern European Sea basin
BLUMASSMED

This Pilot project on Integration of Maritime Surveillance in the Mediterranean Sea and its Atlantic approaches (2009-2012), dealt with sharing issues on operational information between government departments and agencies responsible for monitoring activities at sea (border control, illegal immigration, maritime security of ships and ports, illicit goods trafficking, customs, drugs trafficking, endangered species trafficking, fisheries and other marine resources exploration control and enforcement, underwater public heritage, maritime safety, search and rescue, pollution response and environmental protection).

The technical working group of the project dealt with data storage, user requirements, national adaptations/interface network and dissemination architecture, data format issues.

Baltic Sea Maritime Functionalities

This is a Flagship Project of the EUSBSR Priority Area on Maritime Safety and Security on data sharing for the maritime sector in the Baltic Sea Region.

MARNIS

Maritime safety, efficiency, security and protection of the environment are inextricably linked. Supported by the European Commission (EC) Green Paper “Towards a future Maritime Policy for the Union”, a requirement has been clearly identified for coherent, transparent, efficient and simplified solutions in support of cooperation, interoperability and consistency between member States, systems and sectors, placing emphasis on and promoting the role of the maritime industry. Figures in the Green Paper state that 90% of the EU’s external trade and over 40% of its internal trade is transported by sea, with Europe having 40% of the world fleet. This emphasizes the importance of the continued efficiency of ports, the effective management of vessel traffic in coastal waters and the facilitation of trade through cooperation and coherence.

Further, the EC is promoting the development of e-Maritime; a meeting of services and systems, in response to the need for a more transparent and harmonized approach within the maritime sector in general in order to secure its position as a leading transport mode.

The EC co-funded 6th Framework project MarNIS (Maritime Navigation and Information Services) is contributing to the development of e-Maritime. The focus is placed on the improved exchange of information and provision of services and
the required infrastructure to meet the requirements placed on both the authority and business level. The stakeholders may include on the one hand the ship itself, together with the ship owner, operator and agent, and on the other hand shore-based entities, including maritime authorities (e.g. Search and Rescue (SAR), coastal and port), related authorities (e.g. customs and immigration) and commercial parties within the port sector.

MarNIS proposes means to put an end to present fragmentation of measures in place through the development of a concept where resources, systems and services are organised and strengthened into one coherent set of measures.

In the lifecycle of the project, the “MarNIS concept” has been developed to enhance safety at sea whilst at the same time improving the efficiency of sea traffic and of course the prevention of the pollution of our marine environment. Whilst providing concrete proposals for the enhancement of the current EU Directive 2002/59/EC and (proposed) amendments, as well as many other Directives dealing with maritime issues, the MarNIS concept is not restricted to a technological solution; it is an integrated organisational, operational and legal concept, using electronic information and communication technology. The concept focuses on an implementation timeframe of 2012 – 2020.

The core concept of MarNIS is three fold:

• Assist the vessel master in communicating with the ports and its myriad authorities in a seamless and effortless way by the introduction of a “one-stop-shop” methodology.

• Coastal vessel traffic management to avoid congestion, fuel savings and port efficiency.

• Enhancing SAR authorities’ capabilities, anti-pollution measures and tracking and monitoring of vessels throughout the EU coastal regions.

Following two successful demonstrators in Genoa and Lisbon, including the enthusiastic response to the MarNIS concept of many different administrations, authorities, service providers and shipmasters, it is to be noted that a number of individual aspects are being carried forward by various member States today.
However, whilst some issues are for the consideration of international bodies such as the International Maritime Organisation, the MarNIS concept as a whole is designed to best meet the needs of the EU member States, taking into full consideration the “Integrated Maritime Policy for the European Union”, or Blue Book, and providing key inputs for developments towards Common Maritime Space and eMaritime. As such the MarNIS concept promotes and relies on coherent, transparent, efficient and simplified solutions in support of cooperation, interoperability and consistency between member States, systems and sectors, placing emphasis on and promoting the role of the maritime industry.

MarNIS has developed the Maritime Information Management (MIM) concept providing the means whereby the Master is only required to report once, all other updates being fed automatically into the information messaging structure and passed on to the relevant authorities. Early reporting leads to improved planning for ports and related nautical services through enhanced traffic organisation services and the integral traffic plan. A messaging structure designed to involve all authorities, not only maritime, has been developed so that the passage of a ship may be as safe, efficient and secure as possible whilst rendering less threat to the environment as a consequence of incidents. The MIM concept also envisages the centralization of all relevant data on a ship, including its cargo, number of passengers, last and next port of call, flag, type, age, Port State Control inspection information, ETA and voyage plan. This centralisation is achieved through the creation of National Single Windows (NSW), through which all the data are funnelled. The NSW is like a hub, to which all authorised maritime stakeholders are connected, sharing the same information. The data are held in an enhanced, pan-European SafeSeaNet (SSN++) electronic database, distributed to stakeholders via the NSW.

Through innovative use of resources and technologies, shore-based operators are able to monitor and provide the appropriate level of assistance wherever the ship may be located in the coastal waters, shifting the emphasis from remedial services towards proactive services. For this the Maritime Operational Services (MOS) concept has been developed.

The MOS concept envisages the integration of several maritime operational services, notably Vessel Traffic Management (VTM), Search and Rescue (SAR) and Oil Pollution Preparedness Response and Co-operation (OPRC) ‘under one roof’, as Maritime Operational Services. In several Member States, these services are separate, with their own staff and resources, and fall under different government departments or Ministries.
The MOS concept does not have to mean physically bringing these services together. They could be coordinated virtually, sharing centralised databases and traffic images, for example. Through the identification of High Risk Ships appropriate measures may be taken in order to relieve the threat to the coastline and oceans. Research in MarNIS into the legal consequences for this more proactive approach has indicated that coastal States have the opportunity to monitor and prevent undesired incidents from developing through the use of appropriate risk-based assessment methods, also developed within MarNIS.

The following notions are used throughout MarNIS: early reporting; buying time; no blame culture; reporting once to authorities; reducing risks; reducing administrative burden; improving safety; improving efficiency of remedial services; they are all common place within the MarNIS project. The MarNIS concept is based on a number of fundamental considerations. The overriding design factor is the respect for the principle of subsidiary of the member States. The member States have elected to co-operate but their sovereignty of their area leads to a sense of immunity of their territory. In short, the analysis of these principles lead to a European authority that makes directives that need to be implemented by the member States according to the agreements but in harmony with the existing legal structures that exist in each member State. The MarNIS concept revolved around three key areas, these being Maritime Information Management (MIM), Maritime Operational Services (MOS) and Traffic Management in Ports. Appropriate consultation has taken place accounting for the e-Navigation and e-Maritime strategies as being developed by IMO and the EU respectively.

The MarNIS initiative seeks innovative global solutions for operations and activities in the maritime industry regarding maritime safety, efficiency, security and protection of the environment. The Port Assessment Tool by MarNIS work package on VTM incorporates the principles of formal safety assessments (IMO) and best practice ideas from IALA and PIANC.

This software simplifies self-assessment for port data gathering procedures, port hazard identification, risk assessment, accident/incident recording and reviewing. The results from the program show the hazards grouped in a prioritized and weighted order, risk control options, accidents/incident records and printable reports. Port authorities and harbour masters can thus set priorities and take more efficient measures on system critical areas.

The rationale of the project is that port assessment constitutes a continuous process with frequent reviews based on real events (accidents/incidents) or due to
changes constituting the assessments and review process part of the port risk management process.

An Accident and Incident Report Module is included, where accidents and incidents are reported. By using this module, risk assessments can be quickly linked to real records of past incidents rendering the assessment of risk more realistic. Thus, as soon as an actual accident or incident enters the system, the user is notified that a similar hazard has already been assessed and should be reviewed or alternatively that such an assessment is not provisioned and therefore should be registered, according to a feedback loop paradigm.

**e-Navigation Technologies**

EfficienSea, has the status of both "strategic project" within the Baltic Sea Region Programme 2007-2013 and "flagship project" in the EU Strategy for the Baltic Sea region.

The project completed an analysis of the supply and demand for higher education and recruitment needs in the maritime sector in the Baltic Sea via mailed questionnaires and a series of interviews. Reports have been compiled and published by project partners.

What is more, the project provided the Baltic Sea countries and the European community with a comprehensive best practice demonstration of the e-Navigation concept in order to facilitate the further development and full scale implementation of the concept. e-Navigation trial zone(s) were established where service providers can deploy and test trial versions of their products and services, and where these can be assessed by real users. This best practice demonstration assists stakeholders towards a faster future full scale deployment of e-Navigation.

In WP5, assessment of current vessel traffic data and new software for streamlining such information are combined with environmental data, simplifying efficient coastal zone management. Thus, databases and prediction tools on maritime traffic (including AIS management, numeric traffic simulation and environmental effects) can be improved, spatial, geographical, biological and coastal zone user data will be gathered. Maritime flow can be optimized while conforming to safety and environmental regulations.

Finally, WP6 focused on maritime traffic control by using modern techniques and introducing Dynamic Risk Management.
ACCSEAS
ACCSEAS deals with the e-Navigation provision in the North Sea with a view to increase safety, security, economic growth and environmental protection, by harmonising shipping information and how it is circulated by offering training provision in order to promote industry implementation.

ACCSEAS identified critical areas of shipping congestion and limitation of access to ports and proposed solutions by prototyping and demonstrating success in an e-Navigation test-bed at North Sea regional level.

The comprehensive open source software suite from the EfficienSea project constitutes a valuable asset that can assist the overall e-Navigation process on its way, if used! So, one recommendation will be to promote the future use and further development of this software suite, either within the framework of new projects, or in other contexts. The software can be utilized in two principal ways: The software can be used as is (or with minor modifications) in order to test the existing services in new regions of the world. The services has been tested in the Baltic sea region in EfficienSea, but it since e-Navigation services should be global, it would be of great value to test the same services in other regions of the world. The software can of course also be used as a starting platform for others to develop new services without having to start from scratch. The extra benefit here is that such new services could then be provided to the existing users of the platform. Thus, everybody using the platform could benefit from what anyone else is developing on it. So, it is recommended to use the software suite in the above mentioned ways, and to promote this. Furthermore, it is recommended that the software suite is being promoted as a possible reference application for e-Navigation. In other areas such as AIS, a need for reference implementation has been identified. Sometimes the existing standards are not sufficiently unambiguous, and therefore the presence of an agreed reference implementation could be of great value.

The project took into consideration the regulatory framework of the EU, the International Maritime Organisation (IMO) and the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA).
IMO e-Nav

The objective of the initiative is to come up with a strategic plan for e-navigation, to integrate existing and new electronic navigational tools for higher navigational safety (with all the positive impacts in environmental preservation) enhancing user friendliness. E-navigation leads to the introduction of new technologies in a coherent manner and streamlines existing communication technologies.

Various technologies related to IMO e-NAV are presented below that all have significant value for MONALISA 2.0:

Table 1 Technologies of IMO e-NAV

<table>
<thead>
<tr>
<th>Test Name</th>
<th>Bed Name</th>
<th>Portrayal Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
<td>NIESS</td>
<td>Navigational Intension Exchange Support System (Passing Pattern): It is displayed on demand, as a Radar Add-On with display arrows of intended routes of vessels in the vicinity. Receive AIS message from target ship on intended passing pattern on demand. (e.g. 3 miles forward) Although it does not necessitate an extra screen, it could flood the Radar display with information, so the concept of data layers on Radar would be necessary.</td>
<td></td>
</tr>
<tr>
<td>Japan</td>
<td>VLSS</td>
<td>Visual Lookout Support System (Tracked target information) It enriches view with electronic data, but moderation and presence of data layers is advisable. What is more, light conditions can deteriorate user experience.</td>
<td></td>
</tr>
<tr>
<td>Japan</td>
<td>INT-NAV</td>
<td>Integrated Navigational System (Tracked Target Information and Video display) By merging visual, radar, ARPA data, AIS data, future maneuver of target and collision danger zone onto a screen, INT-NAV visualizes future tracks and collision danger zone of vessels in the vicinity in a timely manner, so that the Captain can come up with an alternative direction in his maneuvering.</td>
<td></td>
</tr>
<tr>
<td>Japan</td>
<td>Collision Threat</td>
<td>Scheduled route based collision danger area display (Scheduled route and collision danger zone)</td>
<td></td>
</tr>
</tbody>
</table>
The system visualizes ARPA target information, potential collision danger zone on own vessel’s scheduled route, like an ECDIS, while it allows for ship control by changing the scheduled route, via a track ball for ECS by taking into account collision danger zone. However, Coastal cargo ship navigators avoided track control, way point setting via this system is not convenient.

<table>
<thead>
<tr>
<th>Country</th>
<th>System</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
<td>Collision Avoidance</td>
<td>Display for automatic collision avoidance system (recommended collision avoidance route). It calculates collision avoidance route automatically and visualizes information via a display and artificial voice. It also enables ship controls via an action lever for switching from Automatic mode to manual.</td>
</tr>
<tr>
<td>Korea</td>
<td>NAVIYE</td>
<td>This Vessel surveillance equipment (Video image of target ship) incorporates LADAR (laser detection and ranging) technology and video image of the tracked target ship on an ECDIS/GIS display in real time.</td>
</tr>
<tr>
<td>Korea</td>
<td>ECOSOS</td>
<td>Marine engine information display. It visualizes state data and guidance data for optimized engine operation in terms of fuel consumption. It provides a well laid out information arrangement but some further user experience refinement is advisable.</td>
</tr>
</tbody>
</table>

EfficienSea

EfficienSea Maritime Safety Information
It presents MSI to the operator in the form of ECDIS/GIS display.
Minor issues regarding pop-up window that hides parts of the chart area, weak chart presentation of acknowledged MSI messages and missing navigational warning ID number when displayed on chart are reported but overall, the consensus is very positive: MSI/Navigational Warnings are from e-INS via GSM or satellite (Iridium) are up to date, as the Subarea Coordinator for the Baltic Sea in Norrköping and the responsible National Coordinators today distribute the gathered data via NAVTEX, VHF, internet, etc.

EfficienSea

Metrological and Oceanographic Data
It provides an intuitive visual Presentation of forecast metrological and oceanographic data in the Chart
| EfficienSea | Route Suggestion | Route suggestion from Shore to Ship  
A route with up to 15 route segments including start and end time is possible, while AIS capacity determines maximum number of waypoints. On the other hand, the system is unsuitable for monitoring given that turn radius, or XTE are not incorporated within the data package. |
| EfficienSea | Intended Route | Route broadcast from Ship to Ship  
This system broadcasts its intended route (voyage plan waypoints) to all vessels in the vicinity and to the VTS centers. |
| EfficienSea | AIS+ WI | Weather information  
It is used for visualizing ship position in combination with current and historical weather on separate chart display. If used integrated with ECDIS, too much information display could deteriorate user experience. |
| EfficienSea | AIS+ AN | Area Notice  
The system visualizes ships position and nearby geographic; additional information is displayed on demand on a separate chart display. |
| Transas | Tides and Currents ECDIS | Presentation of Tides and Currents in Transas ECDIS  
This is a vector presentation of current and forecast tides and currents, a technology over 20 years old. |
| Transas | NavTex in Transas ECDIS | NAVTEX Message presented in Transas ECDIS.  
The system Highlight NAVTEX warnings without accuracy control or verification. |
| Polish Maritime Administration | MarSSIES | Maritime Safety and Security Exchange Information System  
It provides information on new navigational dangers, temporary changes, elementary geographical details – e.g. ISPS Port Facility areas and PFSO contact details, as well as additional optional layers – wrecks, description database, planned routes, pollution areas, exercise areas, What is more, other data such as |
| Weather forecasts, AIS, VTS, radar, aids to navigation (AtoN), port operations (pilots, tugs) etc. are accessible. It is 100% Shore centralized system not allowing any contribution from ships at the moment. |
The following initiatives have been Test Beds for the technologies:

- ACCSEAS
- EfficienSea
- IONO
- MONALISA (1)
- ARIADNA

Electronic messaging

e-Maritime

The EU e-Maritime initiative seeks to promote the use of advanced information technologies for the maritime transport sector and interoperability. Its resulting guidelines are pivotal for the baseline of MONA LISA 2.0.

The Commission proposed eight measures for processing:

- M1 Guidance, information and support on interoperable e-Maritime systems
- M2 Actions to define e-Maritime standards
- M3 Measures to require the implementation of National Single Windows
- M4 Measures to support stakeholders in implementing the necessary e-Maritime ICT infrastructure
- M5 Actions to support the intelligent use of data
- M6 Actions to optimize traffic inside and around ports
- M7 Actions to support e-services for seafarers
- M8 Measures to support ship-shore broadband communication

A public consultation was initiated where respondents should propose what sort of data could be included to estimate the impacts on the suggested measures. The feedback basically showed that it was necessary to gather information concerning the reduction in waiting time:
• Time saved when executing various duties on-board, within ports or in headquarters

• Waiting time for ship at berthing, arrival and load clearance

• Waiting time for trucks prior to loading or unloading

• Expected Operations reporting time

Feedback from respondents also asked for the following statistics:

• Number of reporting demands per port arrival and number of national authorities

• Number of transmission per ship call of national authorities

• Number of reporting demands and transmission per port arrival in the EU and

• Number of member countries

• Number of ports that have adopted e-Maritime services

• Number of ships utilizing e-Maritime applications

• Number of multimodal links having gains from e-Maritime

• Number of employees involved reporting operations

• Number of inspections (reduction due to coordination or focusing)

• Number of seafarers from the EU

• Fraction of centralised customs clearances of all customs clearance

What is more, the adoption of Key Performance Indicators was suggested, such as World Bank Logistics Performance Index (LPI).

**e-Freight project**

e-Freight initiative seeks to "take the paper out of air cargo" supply chain operations and introduce electronic messaging. Its features could partially shape the specifications of Mona Lisa, given that e-Freight has been very successful.
Priorities for 2012 are making e-freight an industry priority via the Global Air Cargo Advisory Group (GACAG). IATA aims to expand the e-freight network, by targeting the BRIC countries.

IATA estimates $4.9 billion in annual savings for the industry by switching to electronic messages due to reduced shipment times and accurate data due to the electronic exchange of information.

In order to remove paper and use electronic messages, it is necessary to have common and clear business processes and standards.

To support the industry on its move to paperless, IATA dictated the business processes, functional specifications and standards related to e-Cargo projects.

e-Freight dictates the so-called e-freight Operational Procedures (e-FOP) that are obligatory for air cargo, defining a set of 12 core documents:

- invoice,
- packing list
- customs release export
- export goods declaration
- house manifest
- air waybill
- house waybill
- export cargo declaration,
- flight manifest
- import cargo declaration
- import goods declaration
- import cargo declaration
- import goods declaration

The rationale of Cargo Interchange Message Procedures (Cargo-IMP) and Cargo-XML Message Standards could also be adopted for maritime logistics as well.

e-Freight also imposes detailed functional specifications on all aspects of air cargo business, such as e-AWB (Shipment Record), Transit and Transshipment, Direct Shipment, Origin & Destination Freight Forwarders Communication Specifications, Destination Freight Forwarder & Customs Brokers Communication, and Electronic Consignment Security Declaration.
This international standardization also allows for certain Country-specific functional specifications for China, Korea and USA (domestic flows), while the Standard electronic messages, the so-called.

**MIELE**

MIELE projects aims at simplification and harmonisation of administrative burden for shipping companies which are nowadays using a mix of paper and electronic procedures, with different local systems for each port and each authority involved in the process. IMO (FAL Committee), has set common requirements and standards (UN/EDIFACT) for electronic transfer of information, in order to achieve uniformity in procedures. The EC (Directive 65/2010) has ruled on a roadmap towards the establishment in all Member States of a “single window” in order to deal with reporting formalities in electronic form and only once.

MIELE middleware”) has been developed in this project, as a process layer accepting messages from the existing (“legacy”) systems, and pushing them to the appropriate counterparty in such a way that the message can be processed by both competent authorities (single windows or B2A) and related business systems (B2B). Through a unique module to their existing systems (the plug-in to the MIELE middleware) all the implicated operators can tap into a common resource (the MIELE platform) that processes and sends the message to the relevant party.

The expertise in the rest of the world with single windows and interoperable systems shows communications improvement for the operators, economies in equipment, traffic and human resources, boost in competitiveness, and drop in handling errors. The MIELE pilots evaluate the state and restrictions of the existing systems and demonstrate the feasibility and the advantages of a unified interoperable middleware.

**Motorways of the Sea related projects**

**MOS4MOS**

MOS4MOS project proposed a mix of measures for ports to become efficient gateways for SSS freight.

All project worked towards the creation of a European maritime space without borders by:

- Facilitating and simplifying the processes of compliance with EU regulations (Customs, safety and other national and European rules)
• Promoting intermodal sustainable transport solutions, reinforcing the EU Motorways of the Sea (MoS) strategy

• Taking full advantage of existing SSS services and facilities, and promoting a sustainable growth of these solutions

The project focused on Ro-Ro traffic and container traffic in 3 different scenarios with specific customs control requirements.

• Ro-Ro services connecting EU ports to each other, i.e. EU authorised regular services. The conflicts surround the freight transferred between terminals inside the customs area and terminals outside the customs area.

• Container services being within the European Union. Main issues in this scenario were terminals within the customs area, inter-modality, freight concentration, and multimodal corridors.

• Short sea services (SSS) that link EU ports with other intermediate ports outside of the European Community area.

Maritime Spatial Planning

The UNESCO initiative on MSP website has presented an international list of completed MSP projects (Appendix A).

Furthermore, European initiatives in maritime spatial planning are:

• **MASPNOSE**: Preparatory Action on Maritime Spatial Planning in the North Sea (a “sister project” to PLAN BOTHNIA running Dec 2010-June 2012).

• **BaltSeaPlan**: A Baltic Sea Region INTERREG IVB project (2009-2012) on MSP in the Baltic Sea lead by the German Federal Maritime and Hydrographic Agency (BSH).

• **A Flood of Space**: Take a look at this as one example of a nice MSP report -about MSP on the Belgian seas produced by the finalized GAUFRE project

• **MESMA**: An EU-FP7 project on monitoring and evaluation of spatially managed marine areas (2009-2013).

• **KnowSeas**: An EU-FP7 project, the Knowledge-based Sustainable Management for Europe’s Seas (KnowSeas) will run 2009-2013
- **ODEMM**: An EU-FP7 project, Options for Delivering Ecosystem-based Marine Management (ODEMM) will run 2010-2013.


- **CoExist**: An EU-FP7 project analyzing competing actions in European coastal regions (2010-2013).

- **SeaGIS**: on MSP in Kvarken (Northern Bothnian Sea).
4. Results

A testbed from e-Navigation Portal about the MONALISA

Some 80,000 ships passed in and out of the Baltic Sea during 2012 may of them tankers with dangerous cargo. In order to strengthen the safety of shipping in the area tests with dynamic and proactive route planning has been done within the first MONALISA project.

The testbed includes a shore-based Ship Traffic Coordination Centre (STCC) and the ability of ship to exchange voyage plans from testbed ECDIS platforms. The system is intended to be advisory and the process is as follows. A vessel approaching the MONALISA area will send its voyage plan to the STCC. STCC will recheck it for under keel clearance and NoGo areas (and in MONALISA 2 also for separation to other ships). The voyage is then "agreed" and the ship is expected to follow its green corridor (except for obvious deviation due to traffic). Progress is then monitored from shore and route advice may be communicated to the ship. If there are any changes a new route request is made either from ship or from shore.

The intention is that the MONALISA functionality should be integrated in ordinary ECDIS systems based on a new standard and using the proprietary systems own functionality. Until that is possible prototype lab platforms has been used for testing.

The expected innovations into the MONALISA 2.0 should include a large number of tests, and the results to be reported. From the experience of the tests the reliability of the methodology should be tested. The e-Navigation Prototype Display should be involved so the harmonization of the test could be viable.

The category of e-navigation gap/s considered in the test:

- Technical
- Regulatory
- Operational

The category of e-navigation solution/s considered in the test

- Procedure
- Design; and
- Communication

Details of e-navigation solution/s considered in the test (for instance as outlined in NAV 58/WP.6 Rev1):

- S1: Improved, harmonized and user-friendly bridge design
- S2: Means for standardized and automated reporting
S3: Improved reliability, resilience and integrity of bridge equipment and navigation information
S4: Integration and presentation of available information in graphical displays received via communication equipment
S5: Information management
S7: Improved reliability, resilience and integrity of bridge equipment and navigation information for shore-based users
S8: Improved and harmonized shore-based systems and services; and
S9: Improved Communication of VTS Service Portfolio
The type of user group/s involved in the test
   *Shipboard users: Captains and cadets*
   *Shore-based users: VTS operators*

Details of persons involved in testbed
   *Number: 12 bridge officers and 3 VTS operators*
   *Background: professional and fourth year maritime academy cadets*
   *Experience: Mixed*
   *Demographics etc.*

Procedure used in the test
   *Testbed setup*
   *Technical solutions used*
   *Standards*
   *Guidance documents*
   *SOPs; etc.*

Preliminary testbed results
   *Concept level*
   Acceptance from most participants (cadets more positive than captains).
   Positive: Increased safety because the rout is validated once more
   Negative: Possible de-skilling.
   *Procedural level*
   There is very little change in procedures compared with today.
   Positive: Somewhat lessened workload
   Negative: Risk onboard validation will be skipped if relying only on STCC validation
   *Functional level*
   More help with passage distances in prototype planning tool
   Information on waiting times is needed “What is happening?”
   Route validation tool needed in the prototype display
   *HMI level*
   Positive comments on usability (Windows/Google Map standards)
   Negative: WP-list needs to show recommended changes, ships current position, passed WPs and allow locking of fields, etc.

*Details of the findings:*
*Presentation of data: Positive feedback*
*Statistics; No quantitative data was collected*

*User-experiences; positive comments on usability of the prototype displays*
Exchange of voyage plans in the MONALISA way received good acceptance from
the test persons. Even the older captains understood it as “this is the way it is going to be” on condition that it was advisory and that the final decision power was kept onboard.

Future plans: *Tests will be continued in MONALISA 2 including dynamic separation of ships and visualisation of “slit times” using a “safe haven” box. Tests will also include complex traffic environments may ships to test the integrity of the system.*

**ACCSEAS**

A Test BED is also presented here about the ACCSEAS project:

It uses real equipment and infrastructure in the form of e-Navigation prototypes and complementary simulations to test these. The established testbed mainly comprising of a number of vessels equipped to enable the use of the prototype services also constitutes a valuable asset that should be sought reused rather than dismantled. In time of writing, this is actually happening as the EfficienSea test bed is being reused in the North Sea ACCSEAS project and the Monalisa project. In the ACCSEAS project, the test bed will be expanded to include vessels in the North Sea.

**“DATABASE”:**

Baseline information – concerning vessel routes in the North Sea Region and a chart for the e-Navigation services regarding the prototypes. (This data is presented in the template of an ACCSEAS Geographical Information System – GIS);

**“SYSTEMS ENGINEERING DOCUMENTATION”:**

It presents problems and possible solutions for maritime issues in the North Sea Region, how the e-Navigation prototypes and simulations were designed to overcome them, and a best practices analysis for e-Navigation regional measures;

**“ANALYSIS OF THE LESSONS LEARNED, ADVICE on the TRAINING MODULES for PRACTICAL E-NAVIGATION solutions”:**

They support future policy decisions and the formation of any necessary institutional structures and regulatory instruments in order to support future e-Navigation Aids to Navigation services.
5. Conclusions and recommendations

Monalisa 2.0 and Activity 1 in particular, aims to develop and test a new model in route planning based on existing Electronic Nautical Charts and Automatic Identification. Each vessel's pre-planned route will be visible for other vessels and monitoring centres ashore. Radio communications between vessels will not be needed when preplanned routes clearly describe all navigators intended routes on screens onboard. Monitoring centres and others will immediately see if a vessel is deviating from a pre-planned route and will be able to take action. All vessel routes will be available for other ships for anti-collision purposes.

Benefits from optimized route planning

- Reduction of fuel consumption and its related emissions: Complete implementation of Green-Routes could decrease consumption 5-10 % for a normal voyage in the Baltic Sea.
- Nature preservation: Work on spatial planning (MSP) by MonaLisa supports and promotes fish growth and reproduction, areas with good conditions for wind or wave-farms, areas that secure healthy biodiversity, areas where pipes and cables can be placed securely and protected etc.
- Safety upgrade: Radio communication traffic between vessels will be significantly curved as soon as pre-planned routes clearly dictate all intended routes on bridge displays. Monitoring centers instantly check if a vessel is deviating from a pre-planned route and proceed with measures, with a view to anti-collision actions.
- Updated ENC charts: quality assured depth data sets, useful for Green-Routes: avoidance of squat effects, speed reduction in shallow water areas and use of deep water areas for full speed. The concept is under test in the Baltic Sea Region. Parallel studies may also take place in China within an e-Navigation action plan of MoU between Sweden and China.
Consequences by the innovations from Mona Lisa

The Green-Routes idea aims at maximum safety through facilitating sea passage from berth to berth. The Captain is in control and both UNCLOS (United Nations Convention on the Law of the Sea) and COLREG has to be followed in the ships SOP (Standard Operational Procedures).

The ultimate motivation of Green-Routes is to control traffic flow at open sea, VTS (Vessel Traffic Services) for areas not included so far.

Mona Lisa promoted the adoption of the air traffic management concept of sharing voyage plans with all participants in order to improve both the predictability in the system and the situation awareness for everybody involved. Green-Routes also provide Captains with the best available voyage plan for their ships for optimal fuel consumption, minimum distance (shortest way) or other criteria as set by the Captains. All voyage plans are declared as shared and available to other ships in order to improve the understanding between ships approaching conflicting points. In the near future, as soon as the majority of vessels have implemented the Green-Routes system, the present monitoring and detecting procedure will be redundant and replaced by flow management according to the paradigm coming from modern air traffic management system.

The basic functionality of Green-Routes are is route construction, as an optimized, custom-made route, as a function of vessel particulars, cargo owner, port capacity, weather, geospatial limitations and the traffic patterns, can be constructed by a VTMIS (Vessel Traffic Management and Information Service centre) in cooperation with the Captain. The resulting route conforms to a standardized data format, readable by the Navigational Display Units of the vessels.

The input for the route construction will be the initial route which will constitute the fundamental frame, incorporating geospatial coordinate data (waypoints) from point of departure to point of arrival.

STC are continuously updated with real-time data stream from Meteorological organizations, next port of call, pilot stations, soundings, area restrictions, traffic patterns etc.

During the MonaLisa tests, only certain components of these incoming data can be processed in the route construction algorithms. The project identified some of these and came up with partial solutions. This means that the finalization of a mature route construction software module that can process and incorporate all related data is the task for a future initiative for the business world to work on it.
These data will be processed along with the ship’s terms and finally a complete voyage plan can be constructed and uploaded to the ship.

Just like flight plans, the initial route will be sent by the Captain to STC with all necessary conditions set by the ship. Acceptance of the Voyage plan must be signed by the ship Captain (digital handshaking).

Ships abide by the resulting planned routes and be automatically and/or manually controlled and assisted from the VTMIS. Any anomalies will be notified by VTMIS for further action. The routes of vessels, visible to other vessels on their Navigation Display Units also facilitate decision making for maneuvering.

Any conflict locations with other Green-Routes ship are spotted at once by the vessels and STC so that the issue can be resolved according to COLREG. Captains are always in control of vessels and any manoeuvring.

Thus, the minimization of "unknown vessels" in the route planning process will mean lower required resources in coastal surveillance for the rest of the vessels. Authorities will only have to monitor non-participating vessels in order to boost the efficiency in dealing with hazardous or malicious incidents.

The test region for the system was the Baltic Sea and certain ports of the region. Specific ships and a temporary test bed STC, are applied for testing the concept. Prior to real-time tests on board ships, the concept is assessed in simulators in order to ensure the quality of the procedures with officers and VTS operators under realistic conditions.

A general and an analytical view of routes and route information flow have been established. The whole system can run in four operation modes, in analogy with AIS:

Either Ship/ Shore only, as today, or Ship-to-ship/ Ship-to-shore, new mode (as envisaged by the EfficienSea project).

**In Ship only mode, a voyage** is scheduled from berth to berth and its course is monitored by officers, while the Captain can modify the preset route in order to reach weather routing/ETA optimum conditions.

**In Shore only mode, the** STC operators watch the vessels route of within their jurisdiction.

**In Ship-to-ship mode**, route information Exchange among vessels supplement onboard traffic control (together with Radar and AIS data), while scene coordination of SAR and oil response operations is also possible.
**Ship-to-shore mode enhances** traffic control ashore and weather routing/ETA optimization, through the so-called Operational View involving and providing information to all stakeholders, i.e. ship owners, agents, ports, pilots, cargo owner, VTS, and SRS. Thus, accurate and optimized ETA is possible, even for port operations due to better concertation of all parties.

After the compilation of are search paper on Dynamic & Proactive Route planning, the implementation phase for the concept design and system is next; the first simulated transmission between ship and shore with route-updating process took place in early January 2012. The initial standard operational procedure plans have been laid out. The first trials of the concept on board the Swedish working vessel Fyrbyggaren have been run, as well as initial tests with onboard commercial vessels.

There was also emphasis on how to integrate port information in the MONALISA concept study.

Detailed analysis of the regulatory framework i.e. IMO regulations & UNCLOS, and a socio-economic study have also been carried out.

Dissemination to different stakeholders was also an objective, so the Dynamic and Proactive Route planning concept has been promoted in various events since the start of MONALISA. MONALISA was presented at the IMO NAV 58 meeting in July 2012 and at IALA VTS Symposium in Istanbul in September 2012. A second movie presenting the Dynamic and Proactive Route planning concept and the Verification System for Officers Certificates in more detail has been prepared and shown at different relevant conferences. The movie is also available on the website of the MONALISA project.

There is collaboration with WWF (World Wildlife Foundation) that provide the project with maritime spatial planning information. An API (Application Programming Interface) connection has been set up with the HELCOM server over biodiversity areas. In addition, WWF carried out a study on improvements of environmental effects with dynamic & proactive route planning.
6. Publications
7. Reference material

http://www.sjofartsverket.se/en/MonaLisa/
http://www.sjofartsverket.se/en/MonaLisa/Archive/
http://www.annamsw.eu/about.html
http://blast-project.eu/?page=articles&artid=166
http://www.blast-project.eu/
http://www.marsumo.eu/project/ibm
http://www.marsuno.eu/project/vtm/
http://www.marsumo.eu/
http://bluemassmed.net/
https://www.abpmer.net/MarNIS/marnis_overview.aspx
http://www.efficiensea.org/
http://www.accseas.eu/
http://www.accseas.eu/about-accsea
http://ec.europa.eu/transport/modes/maritime/e-maritime_en.htm
http://www.miele-action.org/
## Appendix A

### Table 2 List of international Maritime Spatial Planning projects according to UNESCO

Source: http://www.unesco-ioc-marinesp.be/msp_references?PHPSESSID=4b8d4ad143fd985ce1086c9f2d91a2a0

<table>
<thead>
<tr>
<th>Country</th>
<th>Agency</th>
<th>Project</th>
<th>Website</th>
<th>Project Documents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>Great Barrier Reef Marine Park Authority</td>
<td>GBRMPA zoning</td>
<td><a href="#">click here</a></td>
<td>2009 Outlook Report</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>25-year Strategy Plan</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><a href="#">Adaptive Management</a></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><a href="#">Zoning Lesson</a></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><a href="#">Zoning Plan</a></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><a href="#">Zoning Explanatory Statement</a></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><a href="#">Representative Areas Program</a></td>
</tr>
<tr>
<td></td>
<td>Information for Planners and Managers</td>
<td></td>
<td><a href="#">click here</a></td>
<td><a href="#">Measuring Effectiveness in MPAs: Principles and Practices</a></td>
</tr>
<tr>
<td></td>
<td>Department of the South-west Marine Bioregional Profile</td>
<td>North Marine Bioregional Profile</td>
<td><a href="#">click here</a></td>
<td>Marine Bioregional Information Sheet</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>East Bioregional Profile</td>
</tr>
<tr>
<td>Environment, Water, Heritage and the Arts</td>
<td>North-west Bioregional Profile</td>
<td>South-west Bioregional Profile</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>--------------------------------</td>
<td>--------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>South-east Regional Marine Plan</td>
<td>South-east Regional Marine Plan</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>National Marine Bioregionalisation of Australia</td>
<td>Australia's National Marine Bioregionalisation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MSP Policy Adaptation in Australia</td>
<td>MSP Policy Adaptation in Australia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Guidelines for applying the Ecosystem Approach in the oceans</td>
<td>Guidelines for Applying the Ecosystem approach</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Belgium</th>
<th>Belgian Science Policy Toward Spatial Structure for Sustainable Management of Sea (GAUFRE)</th>
<th><a href="#">click here</a> Belgium Final Report GAUFRE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>A Flood of Space</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Marine Spatial Planning in Belgium</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Biological Valuation in the Marine Environment</td>
</tr>
<tr>
<td>Country</td>
<td>Organization</td>
<td>Programs/Plans</td>
</tr>
<tr>
<td>--------------------------</td>
<td>------------------------------------</td>
<td>-------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Canada</strong></td>
<td>Fisheries &amp; Oceans Canada</td>
<td>Eastern Scotian Shelf Integrated Management (ESSIM) Plan</td>
</tr>
<tr>
<td></td>
<td></td>
<td><a href="#">click here</a> Beaufort Sea Integrated Management Plan</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Beaufort Sea Marine Ecosystem Overview</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PNCIMA Ecosystem Overview</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ESSIM Strategic Plan</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ocean Zoning</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ESSIM Human Use Objectives</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ESSIM Objectives and Indicators Review</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Canada Scotian Shelf Atlas Human Activities</td>
</tr>
<tr>
<td><strong>China</strong></td>
<td>State Oceanic Administration</td>
<td>Territorial Sea zoning</td>
</tr>
<tr>
<td></td>
<td></td>
<td>China Sea Use Management Legislation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>China Framework for Sea Use Management</td>
</tr>
<tr>
<td></td>
<td></td>
<td>China Implications of Sea Use Management</td>
</tr>
<tr>
<td><strong>Denmark, Germany</strong></td>
<td>Wadden Sea Secretariat</td>
<td>Trilateral Wadden Sea Cooperation Area</td>
</tr>
<tr>
<td></td>
<td></td>
<td><a href="#">click here</a> Trilateral Wadden Sea Plan</td>
</tr>
<tr>
<td>Country</td>
<td>Organization/Project</td>
<td>Description</td>
</tr>
<tr>
<td>------------------------------</td>
<td>---------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Ecuador</td>
<td>Galapagos National Park, Ministerio del Ambiente</td>
<td>Galapagos Marine Reserve Zoning</td>
</tr>
<tr>
<td>Europea n Union</td>
<td>European Commission/D G Maritime Affairs</td>
<td>Toward a Future Maritime Policy for the European Ocean and Seas</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Country</td>
<td>Organization/Project</td>
<td>Link</td>
</tr>
<tr>
<td>--------------------------</td>
<td>----------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>DG Environment</td>
<td>Coastal Zone Policy / ICZM</td>
<td>click here</td>
</tr>
<tr>
<td>Finland</td>
<td>Finnish Natural Heritage Service (Metsahallitus)</td>
<td>click here</td>
</tr>
<tr>
<td>Germany</td>
<td>Federal Maritime and Hydrographic Agency</td>
<td>click here</td>
</tr>
<tr>
<td></td>
<td>Spatial Plan for the North Sea</td>
<td>click here</td>
</tr>
<tr>
<td></td>
<td>Spatial Plan for the Baltic Sea</td>
<td>click here</td>
</tr>
<tr>
<td></td>
<td>Federal Land Use Planning Act</td>
<td>click here</td>
</tr>
<tr>
<td></td>
<td>Guidelines for Maritime Development Plan</td>
<td></td>
</tr>
<tr>
<td>Federal Ministry</td>
<td>Nature Conservation Requirements for Spatial Planning</td>
<td>click here</td>
</tr>
<tr>
<td>for the Environment,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nature Conservation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>and Nuclear Safety</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ministry of Transport,</td>
<td>Pilot Initiative on ICZM in the Baltic Sea (Interreg IIIB BaltCoast Project)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Institution</td>
<td>Document Title</td>
<td>Link</td>
</tr>
<tr>
<td>-------------</td>
<td>-------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>Climate Change and Growing Sea Use Pressures: Solutions offered by Marine Spatial Planning</td>
<td><a href="#">Climate Change and Marine Spatial Planning</a></td>
</tr>
<tr>
<td>Institute For Sea Fisheries - Hamburg</td>
<td>Defining Principal Areas for Fisheries in the German Exclusive Economic Zone</td>
<td><a href="#">Fisheries in the Context of Marine Spatial Planning</a></td>
</tr>
<tr>
<td>HELCOM</td>
<td>Baltic Sea Action Plan</td>
<td><a href="#">Baltic Sea Action Plan</a></td>
</tr>
<tr>
<td></td>
<td>Marine Spatial Planning Excercise in the Baltic Sea</td>
<td><a href="#">click here</a></td>
</tr>
<tr>
<td></td>
<td>Integrated Coastal Zone Management and Marine Spatial Planning in the Baltic States</td>
<td><a href="#">State of the Art Report</a></td>
</tr>
<tr>
<td>Mexico</td>
<td>Ecological Ocean Use Planning Process in the Gulf of California</td>
<td><a href="#">click here</a></td>
</tr>
<tr>
<td></td>
<td><a href="#"><em>Presidential Decree</em></a></td>
<td><a href="#">Presidential Decree</a></td>
</tr>
<tr>
<td>Norway</td>
<td>Integrated Management Plan of the Barents Sea</td>
<td><a href="#">click here</a></td>
</tr>
<tr>
<td>Ministry of the Environment</td>
<td>Ecosystem-based Plan Barents Sea (Short Communication; ICES)</td>
<td>EBM Plan Barents Sea</td>
</tr>
<tr>
<td>----------------------------</td>
<td>-------------------------------------------------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>OSPAR</td>
<td>Marine Spatial Management Working Group</td>
<td>click here</td>
</tr>
<tr>
<td></td>
<td>Dutch Fish Product Board</td>
<td>Areas of Ecological Valuation Dutch Continental Shelf</td>
</tr>
<tr>
<td></td>
<td></td>
<td>National Water Plan - Summary</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Draft Policy Document North Sea</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Netherlands Integrated Plan North Sea</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Netherlands Management Plan2015 Summary</td>
</tr>
<tr>
<td>New Zealand</td>
<td>Department of Conservation and Ministry of Fisheries</td>
<td>Fishing on a Square Inch</td>
</tr>
<tr>
<td></td>
<td>Biodiversity Planning</td>
<td>Marine Protected Areas Policy and Implementation Plan</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Marine Protected Areas - A New Approach to Marine Protection</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Classification methodology for marine protection</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>Department of Environment, Food, &amp; Rural Affairs (DEFRA)</td>
<td>Marine and Coastal Access Bill</td>
</tr>
<tr>
<td></td>
<td>Marine and Coastal Access Bill</td>
<td>Marine and Coastal Access Bill</td>
</tr>
<tr>
<td></td>
<td>Irish Sea Pilot</td>
<td>Irish Sea pilot</td>
</tr>
<tr>
<td></td>
<td></td>
<td>click here</td>
</tr>
<tr>
<td></td>
<td></td>
<td>click here</td>
</tr>
<tr>
<td>Natural England and other UK Statutory country Agencies</td>
<td>Click here</td>
<td>Review of Land Use Planning</td>
</tr>
<tr>
<td>--------------------------------------------------------</td>
<td>-----------</td>
<td>-----------------------------</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>UK NGOs</th>
<th>Marine Protected Areas in the context of marine spatial planning (WWF)</th>
<th>Marine Protected Areas in the Context of Marine Spatial Planning</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A Future for our Seas (Wildlife and Countryside Link)</td>
<td>UK Link Planning System</td>
</tr>
<tr>
<td></td>
<td>Potential Benefits of Marine Spatial Planning to Economic Activity in the UK (Birdlife International)</td>
<td>Potential Benefits of Marine Spatial Planning to UK Economic Activity</td>
</tr>
<tr>
<td></td>
<td>Making the Case for Marine Spatial Planning in Scotland (Birdlife)</td>
<td>UK Scotland MSP</td>
</tr>
<tr>
<td>United States of America</td>
<td>International and Royal Town Planning Institute</td>
<td>US Task Force for Marine Spatial Planning</td>
</tr>
<tr>
<td>-------------------------</td>
<td>-----------------------------------------------</td>
<td>----------------------------------------</td>
</tr>
<tr>
<td></td>
<td>Coastal Service Center</td>
<td>click here</td>
</tr>
<tr>
<td>Commonwealth of Massachussets</td>
<td>Executive Office of Energy and Environmental Affairs</td>
<td>click here</td>
</tr>
<tr>
<td></td>
<td>Office of Coastal Zone Management: Massachusetts Ocean Management Initiative</td>
<td>click here</td>
</tr>
<tr>
<td>State of California</td>
<td>California Department of Fish and Game</td>
<td>click here</td>
</tr>
<tr>
<td></td>
<td>Special Area Management Plan</td>
<td>click here</td>
</tr>
<tr>
<td>State of Rhode Island</td>
<td>Oregon Coastal Management Program</td>
<td>click here</td>
</tr>
<tr>
<td></td>
<td></td>
<td>click here</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organization</td>
<td>Title</td>
<td>Resources</td>
</tr>
<tr>
<td>---------------------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>National Center for Ecological Analysis and Synthesis</td>
<td>Ecosystem-based Management for the Oceans: The Role of Zoning</td>
<td>click here: <a href="#">Resolving Mismatches in US Governance</a></td>
</tr>
<tr>
<td>(University of California, Santa Barbara)</td>
<td></td>
<td><a href="#">Place-based management of marine ecosystems</a></td>
</tr>
<tr>
<td></td>
<td></td>
<td><a href="#">New Discourses on Ocean Governance</a></td>
</tr>
<tr>
<td></td>
<td></td>
<td><a href="#">In the Zone: Comprehensive Ocean Protection</a></td>
</tr>
<tr>
<td>Stanford Law School</td>
<td>A New Vision For California Ocean Governance: Comprehensive Ecosystem-based Marine Zoning</td>
<td><a href="#">Comprehensive Ecosystem-based Zoning</a></td>
</tr>
<tr>
<td>University of Arizona Law School</td>
<td>To Ocean Zoning and Beyond</td>
<td><a href="#">Ocean Zoning and Beyond</a></td>
</tr>
<tr>
<td>Conservation International</td>
<td>Marine Portal</td>
<td>click here: <a href="#">Seascapes: Globally Important Marine Ecosystems</a></td>
</tr>
<tr>
<td>Marine Conservation Biology Institute</td>
<td>Protecting Marine Ecosystems through Ocean Zoning</td>
<td><a href="#">Spatial Management and Protecting Biodiversity</a></td>
</tr>
<tr>
<td></td>
<td></td>
<td><a href="#">Ending the Range Wars</a></td>
</tr>
<tr>
<td></td>
<td></td>
<td><a href="#">Place-based Management</a></td>
</tr>
<tr>
<td>Gordon and Betty Moore Foundation</td>
<td>Marine Conservation Initiative</td>
<td>click here: <a href="#">MSP in US Waters: The Path Forward</a></td>
</tr>
<tr>
<td></td>
<td></td>
<td>[Planning our Ocean's Future (M. Gopnik)]</td>
</tr>
<tr>
<td>The Nature Conservancy</td>
<td>Global Marine Initiative</td>
<td>click here</td>
</tr>
<tr>
<td>------------------------</td>
<td>--------------------------</td>
<td>------------</td>
</tr>
<tr>
<td></td>
<td>Practitioners Guide to Planning for Biodiversity</td>
<td>Sea Around Conservation Planning in Marine Areas</td>
</tr>
<tr>
<td></td>
<td>Advancing Ecosystem-based Management: A Decision-Support Toolkit for Marine Managers</td>
<td>click here</td>
</tr>
</tbody>
</table>
39 partners from 10 countries taking maritime transport into the digital age

By designing and demonstrating innovative use of ICT solutions MONALISA 2.0 will provide the route to improved

SAFETY - ENVIRONMENT - EFFICIENCY

Swedish Maritime Administration ◦ Air Navigation Services of Sweden ◦ SSPA ◦ Viktoria Swedish ICT ◦ Transas ◦ Carmenta ◦ Chalmers University of Technology ◦ World Maritime University ◦ The Swedish Meteorological and Hydrological Institute ◦ Danish Maritime Authority ◦ Danish Meteorological Institute ◦ GateHouse ◦ Navicon ◦ Novia University of Applied Sciences ◦ DLR ◦ Fraunhofer ◦ Jeppesen ◦ Rheinmetall ◦ Carnival Corp. ◦ Italian Ministry of Transport ◦ RINA Services ◦ D’Appolonia ◦ Port of Livorno ◦ IB SRL ◦ Martec SPA ◦ Ergoproject ◦ University of Genua ◦ VEMARS ◦ SASEMAR ◦ Ferri Industries ◦ Valencia Port Authority ◦ Valencia Port Foundation ◦ CIMNE ◦ CorporacionMaritima ◦ Technical University of Madrid ◦ University of Catalonia ◦ Technical University of Athens ◦ MARSEC-XL ◦ Norwegian Coastal Administration

www.monalisaproject.eu

Co-financed by the European Union
Trans-European Transport Network (TEN-T)