EFFORTS

Effective
Operation in Ports

CONTENT

WORK PACKAGE 1.1
TUG ASSISTANCE

Work Package 1.1

Tug Assistance aims at improving the realism of the simulation of tug handling in ports and terminals for the benefit of training of pilots and tug masters in safe handling of ever increasing ship sizes, new and more powerful and complex tug types, increased traffic in ports and other challenges to the operators. Furthermore, an increased realism in the simulations will accelerate the training of new mates as a valuable supplement to on-board training.

The Work Package has three main objectives, viz.
- The improvement of the existing FORCE Technology tug simulator in selected critical functionalities
- The validation of these functionalities by experienced tug masters
- Application of the simulator in case studies in one or more of the participating ports, with focus on the cooperation between tug master and pilot.

Furthermore, the results of WP1.2 and 1.3 are integrated into the tug simulator.

Work Package 1.1
The Results

- Implementation of stereo vision system for improved depth perception at close distance from assisted ship, with improved visual effects
- Realistic simulation of the effect of wave action on the bollard pull, taking into account the wave height, period and relative direction
- A realistic model of a Rotor Tug equipped with three individually controllable azimuthing thrusters
- A full 3-D collision and fender module, which detects collisions at arbitrary points of the tug with the assisted ship and calculates the fender forces in three directions
- Implementation of lee zones for wind, current and waves moving with the assisted ship
- Integration with the Portable Pilot Unit and Onboard Display Unit developed in WP1.2.
- Integration with the Port ECDIS developed in WP1.3
- A portable tug simulation system, which may be carried to the involved ports for demonstration

Tug simulation

Advanced tug simulators are being increasingly used for training of tug masters and pilots and for navigational studies of new ports and terminals. The days are gone where the tug effect is just added as a vector force acting on the assisted ship and controlled by the simulator instructor. Modern state-of-the-art tug simulators are sophisticated, fully equipped tug Yet, there is still room for increasing the realism of even the most sophisticated tug simulator, and this is one of the objectives of this Work Package of the EFFORTS project.

Depth perception

The lack of depth perception in simulators implies that it is impossible for the tug master to accurately judge the distance between the tug and the assisted ship when the tug approaches the ship to pick up a line or to push on the side. These


operations are critical for the safety of the tug, so the ability to judge the distance as accurately as in the real situation would be a great asset. Several systems were tested, including projection solutions, monitors and head mounted displays (see photo). The latter system, produced by Cybermind, was judged to be the best, even though it still suffers from a too narrow field of view to be fully acceptable. Other methods to improve the judgement of distance are being tested, including e.g. the use of different textures on the models.

Wave and lee effects

The relatively small tug and the large assisted ship behave very differently in waves. Therefore, the correct simulation and visualisation of wave motion response of the involved ships is very important, including the effect of the larger ships bow wave on the smaller tug. An improved solution of these effects is developed under the project, as well as the effect of the wave action on the tug's bollard pull, which has a direct effect on the tug's ability to assist the larger ship. The presence of the larger ship will influence the action of wind, current and waves on the tug, depending on the relative position of the tug. This effect is also developed under this project.

Indirect escort - 75 deg towing angle
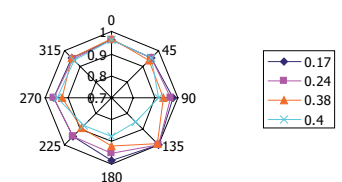
Ship-ship interaction
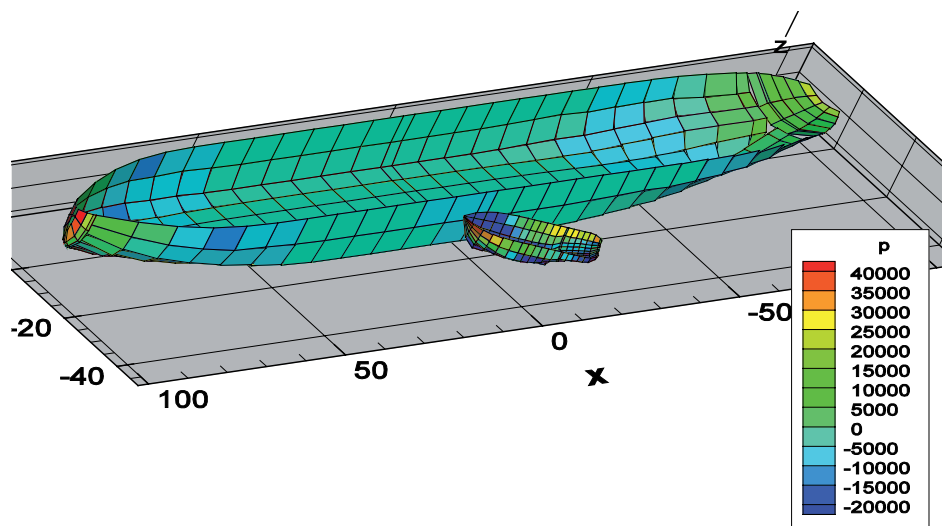
When a tug is operating close to a large assisted ship it is influenced by the pressure and wave field generated around it, so-called hydrodynamic interaction forces. These forces may be large and sometimes cause dangerous situations for the tug. The aim is to implement a real-time calculation of the interaction forces by a potential flow solver linked to the simulator. The code has been developed for deep water and fixed surface and a parametric study has been performed to assess which gridding is necessary to generate sufficiently accurate results. Calculation results have been compared to model measurements of the interaction forces and look good except for some cases, which display the shortcomings of the potential flow and fixed surface assumptions. Further work is being done to try to overcome these.

Collision and fendering

When tugs work in waves and push the side of the large assisted ship, large vertical friction forces may be generated which may destroy the tug's fender. Such forces are not considered in present day's simulators. A fender simulation module is developed, which determines both the push force and the longitudinal and vertical friction force. In addition, the collision module will detect a collision where other parts of the tug than the fender will be in contact with the assisted ship.

A side result of this module is that it may be used to simulate a grounding and a salvage operation.
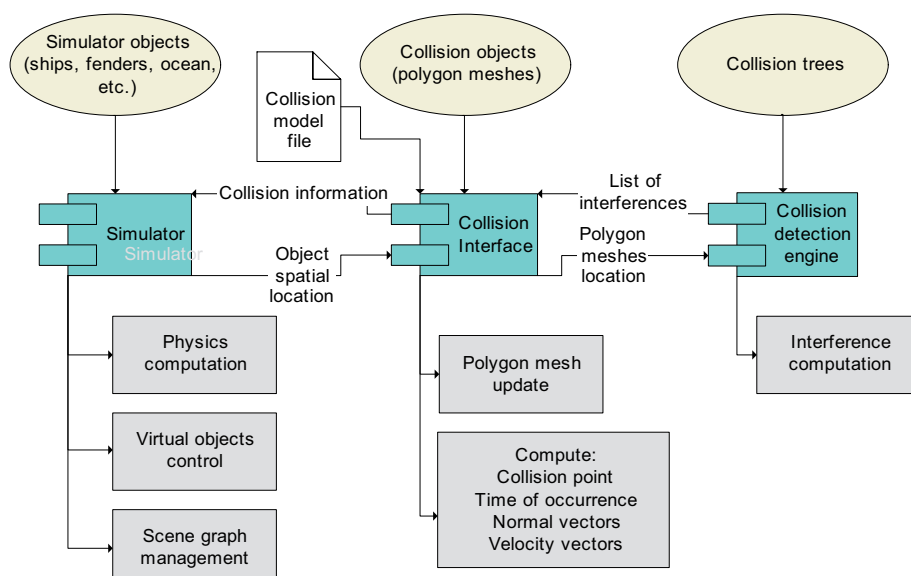
Integration with PPU, ODU and Port ENC

The Portable Pilot Unit is becoming more and more used by pilots worldwide, so it will be a natural element to include in the simulator training of pilots. Therefore, the PPU has been integrated to the FORCE Technology simulators and is being used regularly in training. The Onboard Display Unit, which is also being developed in WP1.2 will assist the tug master in judging the scene of operation and will also assist him in judging the distance between his tug and the assisted ship. Present day's simulators often include a bird's eye view

on the bridge for exactly that purpose and the introduction of the real equipment will make this even more realistic. The Port ENC dataset developed for the Port of Hamburg has been implemented in the simulator.

Demonstration simulator

A portable simulator system comprising two tug bridges (e.g. ASD and Rotor tug) and an assisted ship's bridge has been developed for testing and demonstration of the developments in the EFFORTS project. The system uses the head mounted displays for the tugs and a monitor for the visual display on the assisted ship. The system may be demonstrated at the participating ports. It requires only that a model of the specific port is implemented, either using a standard ENC dataset or a Port ENC dataset if this is available.

WORK PACKAGE 1.2 PRECISE NAVIGATION AND MANOEUVRING IN PORTS

**Work Package 1.2
Precise Navigation and
Manoeuvring in Ports**

The ports need to improve safety and efficiency, on the one hand by introducing new tools in order to lower the human error factor inherent in verbal communication, and on the other hand by providing high - precision positioning providing the pilot with an aid to safe manoeuvring and docking.

Tug operational safety needs to be strengthened to make sure that the tug master follows the pilots' commands.
The tug master/pilot needs better situation awareness. The aim is to develop a portable pilot unit and software tools to improve situation awareness for pilot/tug master/VTS, including visualization of information exchange.

The remaining barriers hindering the widespread usage of PPU systems (Portable Pilot Unit) on board will be removed.

This means in particular reduction in weight and introducing the PPU into the conning infrastructure in the individual harbour by providing an easy-to-use reliable technology, with ease of setup for operation so that the pilot is not distracted from his/her vital conning task. The product will also assist navigation in restricted areas (coastal, fairway and port), during pilotage, or under tug assistance, and while berthing. Therefore an advanced technology is required that is reliable and not dependent on the vessels' equipment, which can vary in quality and performance features. Thus safety as well as efficiency needs to be addressed.

The Portable Pilot Unit (PPU) is not only a tool to assist the pilot in his/her efforts to provide the ships with the best advise and the highest possible security during its navigation, port approach and manoeuvres. The PPU also serves to enhance the efficiency and safety of the port. From an economic point of view, the ports ability to make a profit is dependent on the down time of the plants and the turnaround time of the vessels. An accident resulting in damage to a pier or plant is not just a matter of the loss, it can also be very costly in terms of down time, not to mention the possible environmental consequences. From the ports point- of- view it will always be of the highest of priority to avoid such incidents, resulting in down time, be they big or small.

With the close monitoring of speed, rate- of - turn and tendency the Pilot gets an early indication/warning thus providing him/her with time and room to react in case of a dangerous situation arising. Having the TUG boat performance integrated to the PPU further minimize the need for radio communication and provides all the involved parties (TUG boats, pilots, port Office) with an overall picture of the situation, thus reducing the risk of misunderstandings in a hectic situation. With a PPU's integrated to the port office, the port is not just able to monitor the ongoing ship operations, all operations can be recorded and stored thus having a good record to hand to identify a Vessel having caused a loss, or it case of evidence in a legal claim.

Turnaround time is also essential for the ports profit. The PPU has proven to minimize the manoeuvring time for regular users, due to the pilots having precise position, distance and prediction information displayed. This enables the pilot to optimize his/her manoeuvres radically when a safe distance can be estimated while not relying by "eyeballing' alone.

Having a completely independent back-up solution to the ships instrumentation, with the option of integrating of radar overlay from port VTS, AIS-targets, tide, current, wind and weather provided to the Pilot in real time, via his PPU, moves the limit on which the pilot no longer considers it safe to take a ship in or out of port during difficult conditions.


4

WORK PACKAGE 1.3
PORT ECDIS

WORK PACKAGE 1.3
Port ECDIS

- Masters and pilots approaching a seaport usually use an Electronic Chart Display and Information System (ECDIS) to obtain the required navigational information they need.
- The maritime ECDIS standard supports navigation in the open sea and coastal areas
- The Inland ECDIS standard was developed for navigation on inland waterways.
- The chart requirements for manoeuvring big ships in narrow fairways (harbour access channels) and harbours and for the port maintenance go far beyond the current ECDIS standard in scale, accuracy, chart objects and attributes
- and call for a specific Port ECDIS.
- Managing bigger vessels, increasing traffic, less harbour space, berth organisation, dredging purposes, VTMIS, Marine Simulation, etc. requires accurate and up-to-date high-resolution topographic and bathymetric data to provide all necessary information, in some cases also in real-time.
- As GIS (Geo Information System) the Port ECDIS is able to interact with other port related geo data sources for a more beneficial use and to improve the interoperability of harbour related tasks to support shipping and maintenance work for port authorities.
- The Port ECDIS work package is aligned to improve the maritime ECDIS and the Inland ECDIS standards to fulfil the special user requirements for utilisation in ports and narrow fairways, channels and harbour basins regarding ship navigation, manoeuvring, turning, berthing and docking.
- special requirements exist with respect to vertical and horizontal accuracy for operations in ports. This is achieved by using modern sensor technology. The same accuracy is required in underlying electronic charts (scale, accuracy). The respective source data (topography and hydrographical data) is made available and is normally maintained by the port authorities.

WORK PACKAGE 1.3
The Results

- A very precise / accurate and up- to- date base chart for large scale information
- Including special new port objects and features for the use in ports / narrow channels
- Supplying new 3D possibilities like
- Gridded bathymetry information, as well as
- 3D channel or reference model (designed harbour bottom)
- And a new bathymetric ENC (bENC) - supported by SevenCs

Gradation of the S-57 ENC products
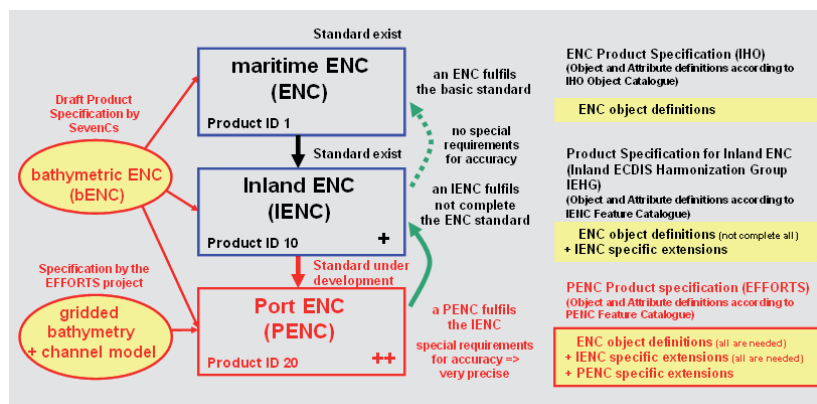
The development of the Port ECDIS concept and the Port ENC (PENC) dataset is based on common standards of the maritime ECDIS and the Inland ECDIS and use these standards as a base for improvements. So the Port ECDIS could be designated as an upgraded standard including the possibility during a downgrading process to reproduce an Inland ENC, but not a real complete maritime ENC.
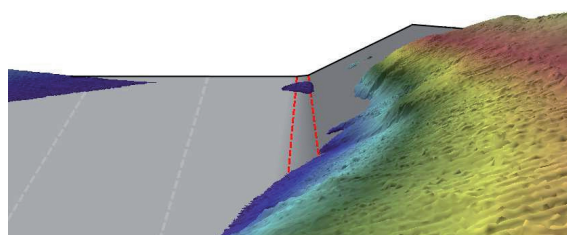
The Port ECDIS / Port ENC fulfils also the requirements that are requested by the EU RIS-Directive (DIRECTIVE 2005/44/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL) on harmonised river information services (RIS) on inland waterways in the Community.

Gradation of the S-57 ENC products
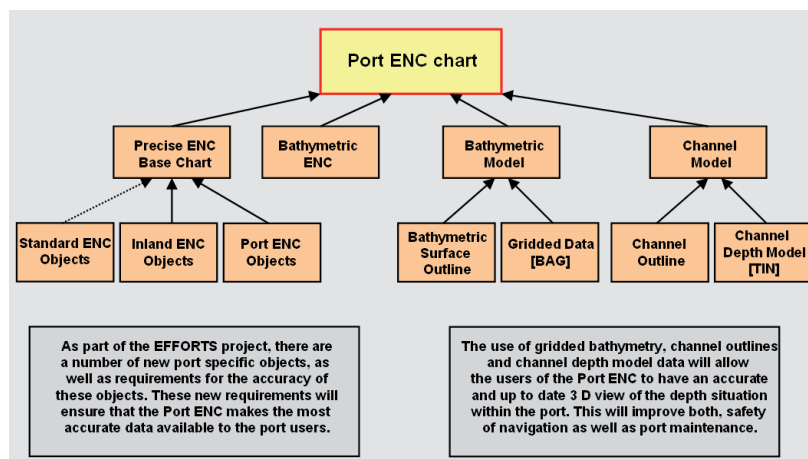
EFFORTS Port ECDIS
information for different groups

Port-ECDIS is not only about producing better electronic charts to be shown in the navigation displays of various applications. Port-ECDIS addresses user groups of other domains as well (maintenance, dredging, planning, river engineering, water police, fire brigade, etc). Often they have the need to look at and use the data not only as a chart but also in 3D.

EFFORTS Port ECDIS scale and accuracy

Large scale information from 1:5000 up to 1:250, accuracy / resolution better than +/- 0,20 m
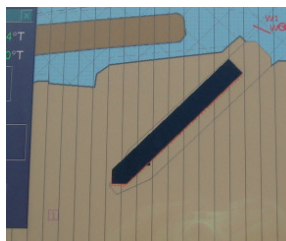
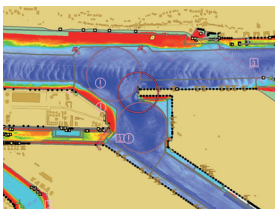*Fig. 4: Onboard ENC*

Fig. 5: Precise Port ENC

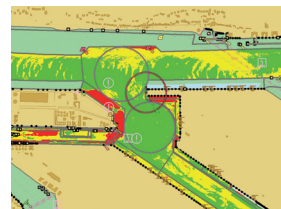*Fig. 6: PENC + Gridded Bathymetry*

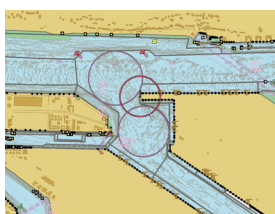*Fig. 7: PENC + Gridded Bathym. versus Channel Model*

Fig. 8: PENC + bENC+ Channel Model

EFFORTS Port ECDIS

A modern ENC as developed in the Port ECDIS work package has to be produced from the related source data to ensure the maximum accuracy for the specified level of detail and ensuring currency! The very special port related requirements must be fulfilled if an ENC can be called a Port ENC! The Port ENC (PENC) stands for up to date and precise information so that the ab

breviation PENC stands also for Precise ENC!! A Port ENC can avoid the misinterpretation that's possible under the current situation. If a PENC (Port ENC or Precise ENC) is used and a vessel is grounded, it will not be the chart that is imprecise, only the navigational information onboard will have to be checked. (see pictures above!)
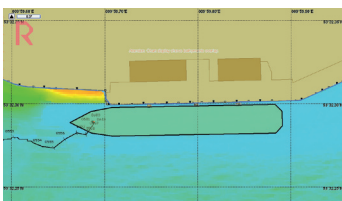

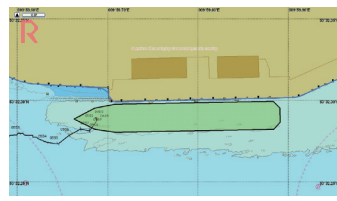*Fig. 9: PENC + Gridded Bathym. for precise berthing*
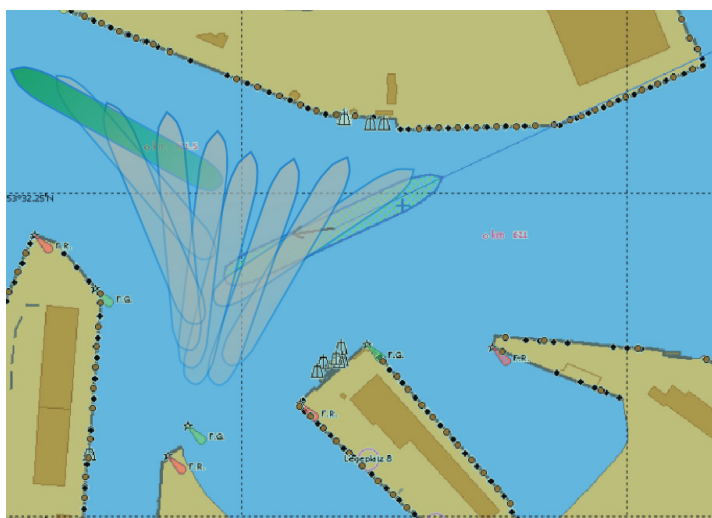

Fig. 10: PENC + bENC for precise berthing

Link to other WP:

WP 1.2, „Precise Navigation and Manoeuvring in Ports" Marimatech (DK)
WP 1.1, „Tug Assistance" Force (DK)
WP 3.1, „Port Processes" Marintek (N)

We informed about the project:

IHO - International Hydrographic Organisation
IMO - International Maritime Organization
Open ECDIS Organisation
Inland ENC Harmonization Group
EC - European Commission -
Directorate-General Energy and Transport
UN/ECE - Economic Commission for Europe of the United Nations
CCNR - Central Commission for Navigation on the Rhine
DC - Danube Commission IAPH - Head Office (Tokyo)
IAPH - Europe Office (Rotterdam)
IHMA - International Harbour Masters' Association
EHMC - European Harbour Masters' Committee
PIANC - International Navigation Association
BMVBS - Federal Ministry of Transport, Building and Urban Affairs, Germany
IALA - International Association of Marine Aids to Navigation and Lighthouse Authorities
IMPA - International Maritime Pilots Association,
EMPA - European Maritime Pilot's Association
EMSA - European Maritime Safety Agency

Fig. 11: Precise turning manoeuvre of a cruise liner in a complex port area. Without a precise Port ENC is such a kind of manoeuvre impossible!

WORK PACKAGE 2.1
CLEAN ENERGY MANAGEMENT

Work Package 2.1 project summary:

„This innovative tool simultaneously simulates energy consumption profiles and the energy mix. It has helped WP 2.1 port partners better understand global energy issues. This energy consumption, being very eratic and linked to ship traffic, has to be studied carefully if one is to modify the existing energy sources present in ports. The approches simulated as part of this project are (1) the auto-production of power by conventional means and from locally available renewables from the sea, (2) the simulation of the effect of local power storage, and (3) the electrification of certain equipments which are currently diesel-powered. This simulation is done in the context of known demand patterns and tariff settings.

## Actual port situation concerning the energy management in ports:

- Ports authorities focus their activities on infrastructure development, ship reception, regulation controls, promotion and land management.
- Ports are not "energy producers", but as land planners have the possibility to integrate energy producers in their domain of management.
- Due to their locations, Ports have a high primary energy potential (wind, current, tide and eventually sun).
- As other companies, Ports have to deal with the greenhouse effect.
- Most ports rely on the national electricity network.
- The classical concept of production and distribution leads to a low efficiency from the raw material to the end-user and to a high environmental impact.
- Ports energy consumption could increase in the coming years if electricity is provided to ships at berth.

The results:

Ports will be able to communicate on how they are integrating energy management into their activities as well as visually representing energy consumptions (electricity, diesel etc.) and resulting CO2 emissions on the port map.

Virtual new energy mix scenarios in the port can be simulated and validated according to their impact on environment and efficiency.

Finally, port managers will be able to model the port's energy consumption and associated environmental impact as a function of time and situation (e.g. traffic)
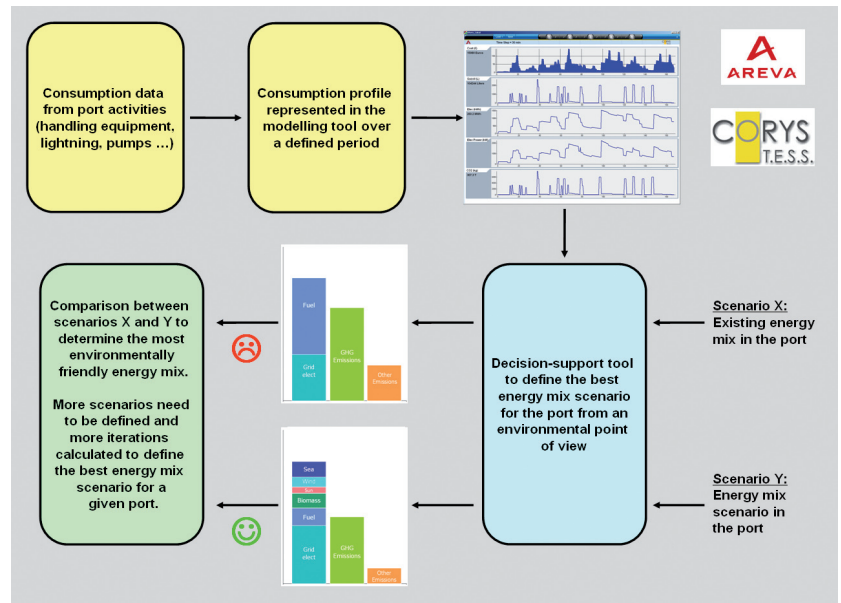

In the light of developing countries' legitimate ambitions and the European Union's commitment to cut greenhouse gas emissions by 20%, the increase of energy efficiency by 20% and an increase of the share of renewable energy sources of the energy mix by 20% by 2020, the industrialised countries have to plan their future accordingly.

The Work Packagee 2.1. Clean Energy Management aims on energy management in European ports by optimising the management of energy consumption and supply based on:

- The utilisation of clean and renewable energy sources as much as possible,
- Waste energy recovery,
- In situ possibilities (weather, geographical, legal constraints).

Predicting short to medium term energy needs on a port is difficult for port managers and the situation made even more difficult by ever increasing environmental regulations. Working on improving all parameters will greatly help towards a greater public acceptance of a port and related activities as well as reducing the environmental impact. This is done as shown on figure 1 (see paragraphs below for explanatory text).

Concerning clean energy management by using consumption data from port equipment and projected traffic it is possible to simulate the energy needs of a port over a defined period of time by done using a dedicated modelling tool. It allows a port to estimate their energy needs (electrical and diesel at the moment) as well as calculating the resulting greenhouse gas emissions of this energy consumption.
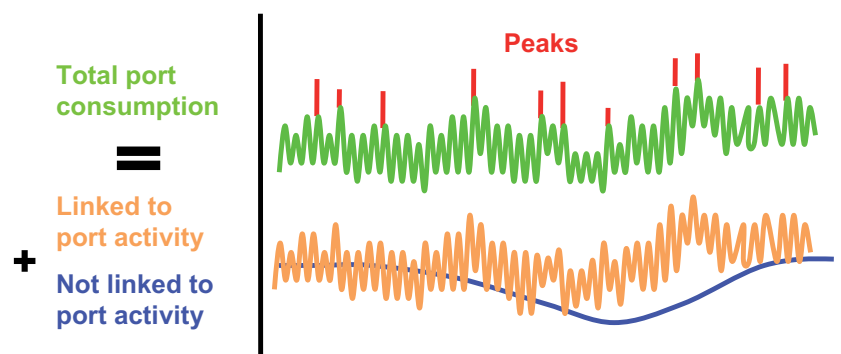
Knowing the port's consumption profile over a defined time period it is then possible to create an energy mix scenario that will provide the necessary energy to the port as well as optimising it in order to reduce the impact on the environment. This scenario can include actual and mature power generation technologies (fossil fuel power plants, electricity from the national power grid, wind turbines etc.) as well as other renewable energy sources nearing maturity.

The best part is that two energy mix scenarios (actual and future) can then be compared with each other to determine which is best suited, from an environmental and efficiency point of view, to answer the energy needs of the port based on the consumption profiles previously simulated.

As shown on figure 2, it is then possible to visualise where and what energy is produced and consumed in addition to the related emissions in the port area. Although the project is centred on port activities, the energy supply solutions considered could be extended to industrial activities located next to the port because they too are energy consumers and sometimes producers. This mutualisation of energy needs could lead to higher efficiency energy consumption as well as promoting the use of distributed production of energy using locally available and, most importantly, renewable energy sources as shown in figure 3.

In parallel to the development of these tools, research and documentation on primary energy sources, energy transformation technologies (conventional, renewable and future evolutions), short, medium and long term storage technologies and finally energy vectors is carried out to determine which technologies are best applicable to a port.
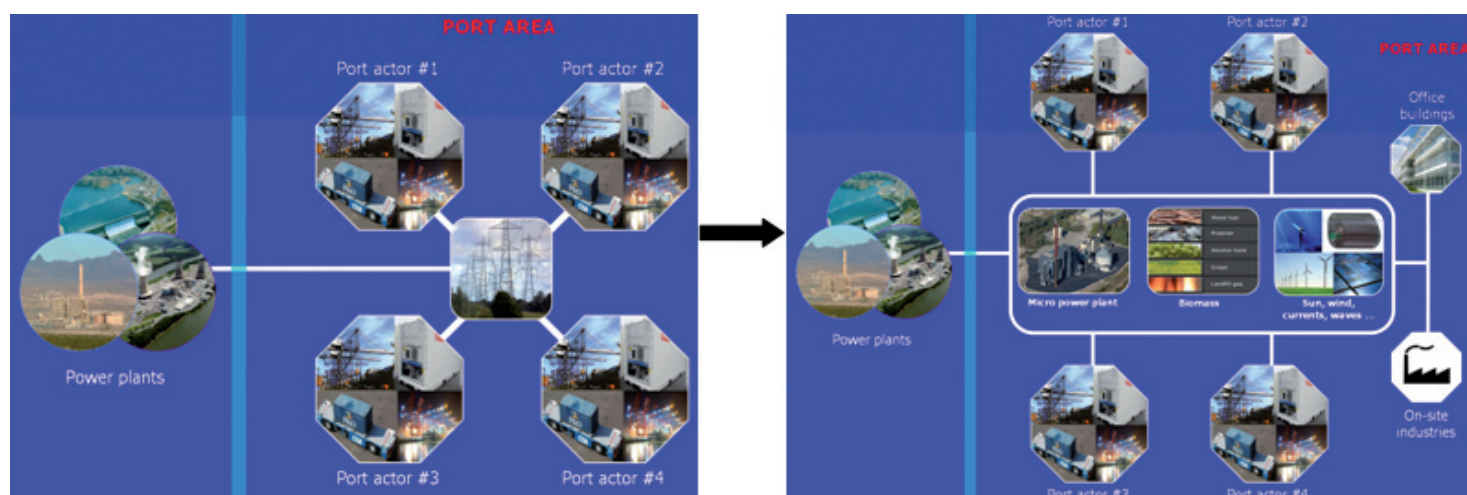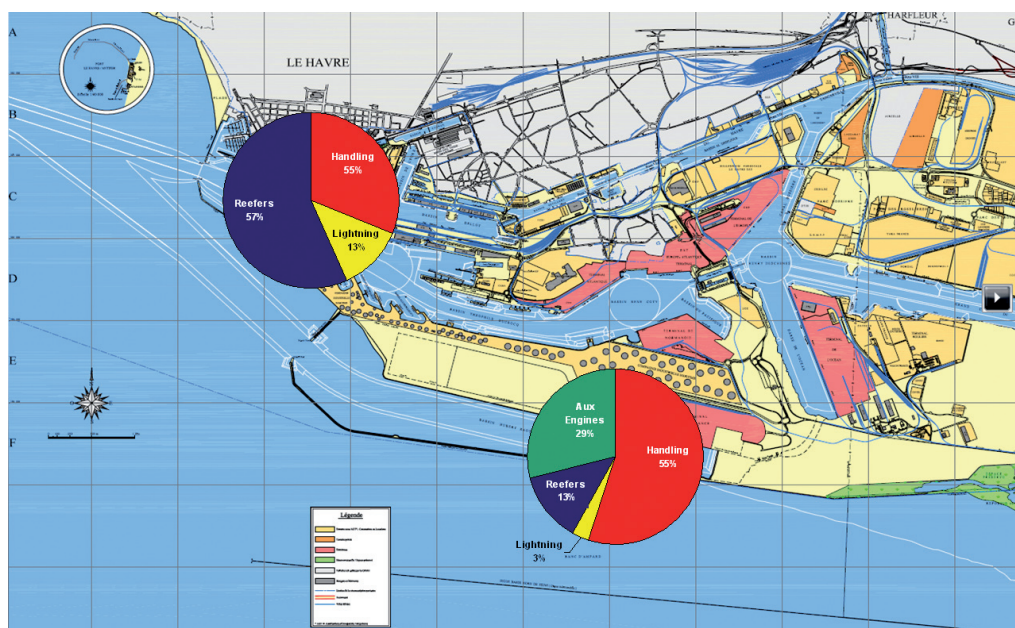
WORK PACKAGE 2.2
WATER QUALITY

Work Packeges 2.2.1 – Ballast water pollution during ship reception

- The selected active substances are industrial products with different chemical bases: peracetic acid, vitamin K3 and alkylamines. The corresponding commercial products are respectively Peraclean® Ocean, SeaKleen® and Mexel®

- Concerning bacteria, peracetic acid and alkylamines seem to be the most effective biocides. regarding their efficiency against phytoplankton (growth inhibition tests), all the products appear to be of a good efficiency when used at the concentration recommended by manufacturers. Finally, to deal with zooplankton (Artemia salina), vitamin K3 was the most efficient

- Ecotoxicological tests highlight that the alkylamine-based product is the only tested biocide which displays no impact on oyster larvae development whatever the concentration

- The alkylamine-based product has been chosen for large scale experiments (in progress) based on its biocide effects, the ecotoxicological tests and the fact that this molecular base has never been used in ballast water treatment.

Work Packeges 2.2.2 – Aluminium pollution related to the protection of port infrastructures

- The Aluminium sacrificial anodes dissolution does not significantly increase the Al concentration in seawater

- A part of the aluminium released from the anodes is accumulated in sediments

- The presence of Al sacrificial anodes is correlated to an increase of the Al mobility in the surface sediments, which can contribute to increase the bioavailability

- Al concentration in living organisms is comparable to values observed for other marine coasts

- Aluminium is mainly accumulated in the digestive gland of mussels (storage compartment), these organisms may develop a specific detoxification process

- The sub-lethal Al concentration defined in water for oyster larvae is higher than the maximal water concentration recorded in the port

EFFORTS WP2.2 – Water Quality

aims are to focus research effort on two complementary topics concerning industrial activity of ports: The invasive species from ship ballasts (WP2.2.1) and the aluminium released from the aluminium sacrificial nodes used for the cathodic protection of metallic infrastructures (WP2.2.2). These approaches involved several analytical and expertise domains: Microbiology, marine biology, physical-chemistry, electrochemistry, material sciences and eco-toxicology.

EFFORTS WP2.2.1 – "Ballast water pollution during ship reception"

aims are to identify the best active substances for the treatment of ballast water, according to their biocide effect, environmental acceptability & on-board usability.

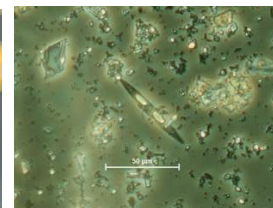*Fig. 1: zooplankton*   *Fig. 2: bacterial colonies*   *Fig. 2: phytoplankton*

Fig. 4: biochemical characterization
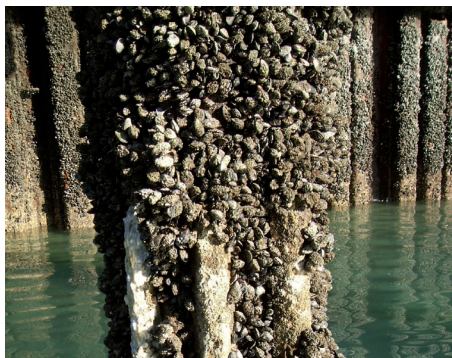
Six steps are defined:

- **Selection of active substances**, regarding different chemical bases available from manufacturers

- **In situ sampling and analyses from ballasts waters**, including the analyse of three groups of organisms: phytoplankton, zooplankton and bacteria (with isolation on culture media).

- **Biocide effects from laboratory scale trials**, using three actives substances against cultivable strains (3 groups) from natural seawater.

- **Environmental acceptability**, using oyster larvae test.

- **Large scale test with a "ballastodrome" device**, using a mix of organisms in an experimental system simulating ballasts conditions.

- **Full / large scale test trials with on-board tests**, regarding the best combination between active substances effect and environmental acceptability.

Final tool for port authorities: recommendations about the risks of the ballast water management using active substances.

EFFORTS WP2.2.2"Aluminium pollution related to the protection of port infrastructures"

aims are to evaluate (1) the aluminium concentration in port water, sediment and living organisms; (2) the aluminium toxicity on marine organisms in order to assess the potential environmental impact of the use of aluminium sacrificial anodes.

Five steps are defined:

- Aluminium concentration in seawater and sediments, from three sampling campaigns carried out between November 2007 and July 2008 in the Port of Le Havre.
- Aluminium concentration in sediments from experimental device, using an experimental reactor in a marine station, including physical-chemical analyses and monitoring of anodes dissolution.
- Aluminium levels in bivalve specie, using quantitative investigations on aluminium concentration in mussel Mytilus edulis sampled in several locations in the Port of Le Havre.
- In vitro bioaccumulation test, conducted from laboratory test implied instrumented bioreactor, including simulation of accelerated sacrificial anodes consumption through an electrochemical device and the stabulation of mussels.
- Ecotoxicological tests, using the embryos and larvae of bivalves (oysters) and echinoids (sea urchins).

Final tool for port authorities: recommendations about the environmental effect of the cathodic protection using sacrificial anodes.

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WORK PACKAGE 2.3
PORT AIR QUALITY

Work Packeges 2.3
Port air quality

The aim of the WP 2.3. Port Air Quality is to reduce the air pollution from the main air polluters in a harbour, i.e. ship machinery, straddle carriers, terminal traffic, petroleum product transfer, pilot and tug operations a auxiliary generators on vessels.

The main pollutants are VOC (Volatile Organic Compounds) sulphur compounds, NOx and ultrafine particles.

Solutions exist, but generally imply cost or efficiency issues and innovative solutions are still required to strongly reduce pollution at low cost.

The technology investigated in this work package is photocatalysis.

It is
• highly efficient
• low cost for set-up
• low energy consumption
• little maintenance
• numerous possibilities of use
• easy to adapt to new situations
• mobile
• acceptable costs

The work package has
• identified the main polluters in the Port du Havre
• Developed a new photocatalytic technology to capture VOCs and sulphur
• Identified the influencing parameters
• Test results show that the process is efficient on VOCs and sulphur

WP 2.3 aims to improve the management of air quality in ports and the environmental-friendliness of different port operations. Within this scope, an innovative system based on photocatalysis is developed for treatment of VOCs, and sulphur compounds generated by ports operations (and concerned ships, handling/transport equipments, petroleum facility…). Further, the approach will concern NOx and soot pollutant as a global innovative solution for treating the pollutants affecting air quality in ports.

Requirements to be followed during the next design and demonstration activities of the WP2.3 have been defined and correspond to both basic and specific knowledge on which the project is elaborated, such as the current situation in European ports, the technical solutions to reduce/control the air pollution, and the European Directive and national transcriptions.

Furthermore:

• Ports operations (and concerned ship, cargo handling, and ground transport source emissions of main pollutants such as VOCs, NOx, fine particles, sulphur) have been more finely estimated in the port of Le Havre;

• The estimation of 80/20 VOC and SOx contributors (identification and meeting with 20% of contributors which create 80% of the pollution) has been performed in port of Le Havre to receive up-to-date fully-useful data and facts, able to be directly and efficiently exploited by ports and users within the project;

• The global impact of the technology has been estimated;

• The key-case of the demonstration barge delivering fuel in the port of Le Havre, with specific operator's requirement (CFT) is notably put forward for updating the knowledge on the real pollutant emissions;

• A comparison has been made with existing non-photocatalytic systems.
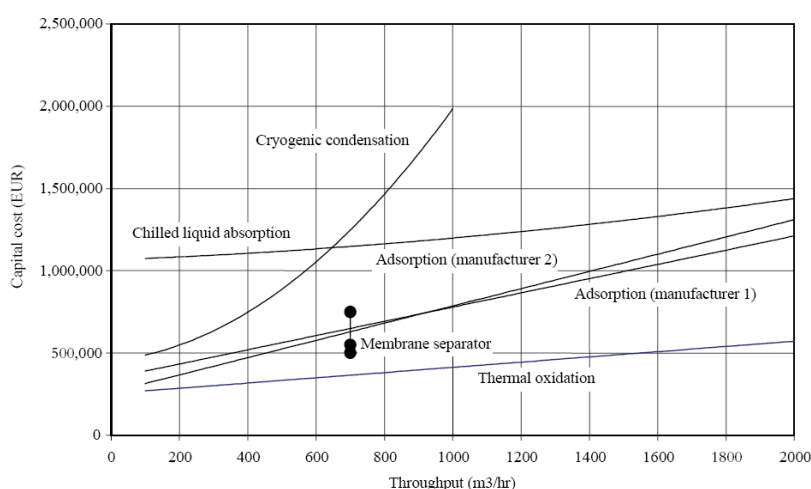
Influencing parameters have been identified for designing and optimizing an air treatment photocatalytic demonstrator. This task has mainly consisted of following activities:

- Design and build-up of laboratory-scale micropilots for the targeted pollutants
- Scientific work at the laboratory scale for the different targeted pollutants (VOCs,sulphur compounds); the experimental research axes of this scientific research project are mainly performed within a PhD Thesis at the Louis Pasteur University of Strasbourg (ULP).
- Bibliography work including technology transfer and scale-up problematic on soot and NOx pollutants
- Scale-up, design and built-up of a pilot for the barge delivering fuel:
  - Technological aspects of the scale-up of the photocatalytic technology
  - Economical aspects of the scale-up
  - Pilot build-up and on-site measurement analytical devices applied to the barge delivering fuel case: tests has currently been realised on the box and UV lamps to guarantee their potential utilisation in ATEX* zone. Based on this approval, the design of the equipment has been finalised in laboratory and tested.
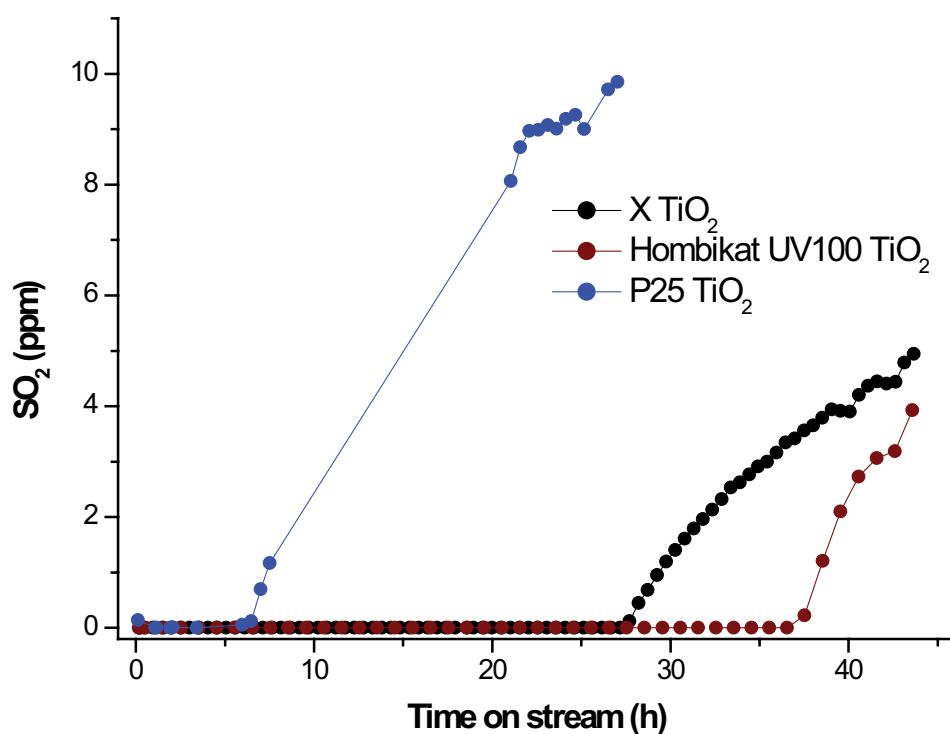

Figure 2 : photocatalysts efficiency for SO2 removal (laboratory tests)

Results of tests show the efficiency of the photocatalysis technology for sulphur and volatile organic compounds removal. If this efficiency is continued in time for VOCs, this is not the case for sulphur compounds where a partial deactivation of the catalyst can be observed. A process of reactivation has been established and its efficiency has been demonstrated in laboratory.

Two pilots are actually being integrated to make tests on site at:
- Vent output of tanks of a barge delivering fuel (to treat VOCs and sulphur compounds in ATEX zone)
- Gas exhaust of a straddle carrier and the chimney of a pusher (to filter soot and NOx in non ATEX zone)

* ATEX gets its name from the French title of the 94/9/EC directive: Appareils destinés à être utilisés en ATmosphères EXplosibles

WORK PACKAGE 2.4
NOISE ANNOYANCE OF PORTS

Work Package 2.4.
Noise Annoyance of Ports

The main objective is to develop methods to evaluate port related noise annoyance by using psychoacoustic descriptors.

The main tasks are:
- Collecting data of sound sources
- Development of sound propagation models
- Refinement of sound source sound samples
- Listening tests for new source specific annoyance indicators
- New concept for utilizing environmental noise monitoring

Results:
- Sound sample database for port sound sources
- New annoyance indicators
- Concept for communicating with the public on noise issues
- Good Practice Guide to evaluate port noise annoyance

Noise Annoyance of Ports

Port areas have numerous sound sources that contribute to the noise emitted to the nearby residents. The sources are located around the area. Therefore their effect is not equal to the residents or receivers. In order to predict the sound percept by the inhabitants, noise prediction software can be used. It is essential to use good quality sound source data for the models. The data can be obtained from the manufacturers of equipment, databases or measured. The data obtained in EFFORTS are both used in noise annoyance studies and as source data in noise propagation prediction software. Frequency bands measured are 1/3-octaves from 20 Hz to 10 000 Hz. The time data of the studied sources have also been recorded for listening tests.

There are several different type of sources from continuous to intermittent and impulsive ones. Therefore further annoyance indicators are being developed in EFFORTS project. Additional annoyance information on the sound source can be given using calculated psychoacoustic descriptors. The descriptors give more information on the frequency and temporal content of the sound signal.
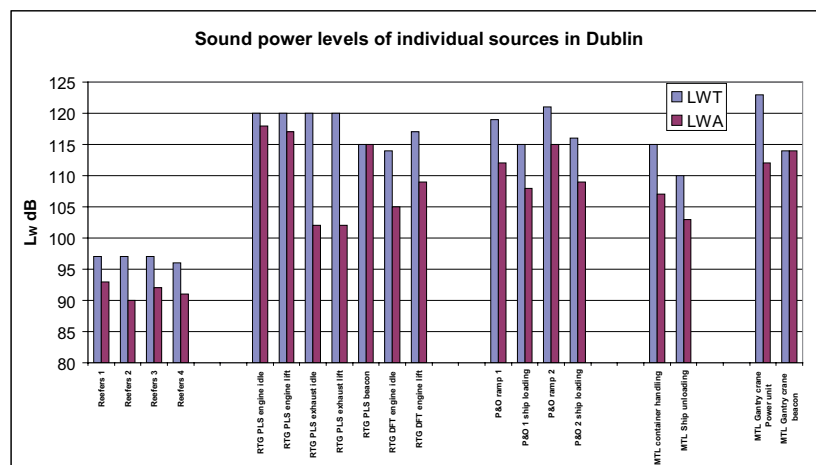

Fig. 3: Typical noise sources of ports

Normally sound that is higher in sound pressure or intensity levels sounds louder, but not always. Perceived sound loudness depends on the frequency content of the sound signal. The A-weighted sound pressure level does not always correspond to the perceived sound loudness. The most significant correlations related to annoyance are loudness, sharpness, and roughness. Psychoacoustic descriptors or metrics have been developed to describe sound properties in relation with human observations. A significant factor related to sound quality is loudness, but also sharpness, fluctuation strength or roughness can determine the sound quality. Mostly the total effect is a combination of many factors. Additional factors are for instance prominence of tonality and prominence of impulsiveness. The above mentioned quite seldom are enough to describe the sound quality well enough on their own, but they are used to create higher order indicators such as annoyance or sensory pleasantness

In order to evaluate the sound sources for annoyance the sound samples will be handled according to sound propagation models and used in listening tests. As a result of the listening tests source specific annoyance indicators will be developed.

Environmental noise monitoring has been used in order to validate the noise maps and to develop a concept to assist port authorities to handle possible complaints concerning noise issues.
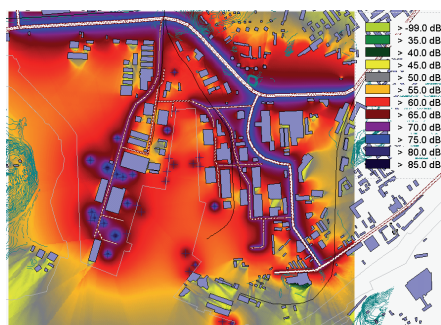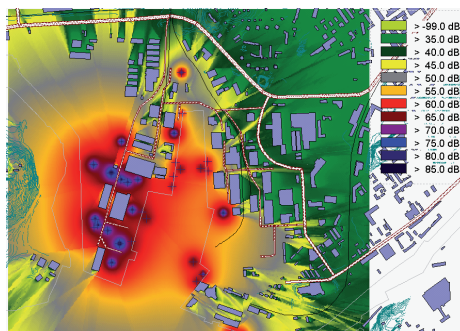
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Fig. 4: Noise maps of ports

Fig. 5: Bildunterschrift

Fig. 4: Listening test GUI.

WORK PACKAGE 3.1
PORT PROCESSES

Effective Operations in Port (EFFORTS)

aims to improve the competitiveness of European port operations and the quality of the ports labour conditions and market, being a prominent one in coastal regions

EFFORTS WP3.1 – Port Processes

aims at providing the methodology and necessary tools to create interoperability solutions between stakeholders in ports

WP3.1 – The Results

- Handbook of process modelling
- Process ontology and process modelling platform
- Port process map
- Procedure model for specification, implementation and quality assurance of interfaces
- Prototype framework for development and testing of interoperability solutions, based on standard business cases
- Prototype system for port process optimisation
- Verification and validation of the pilot installation

Free Tools for Ports

- **A standard high level process map and actors model** that can be used in house to develop own models at a more detailed level and for specific purposes (risk assessments, process improvements, introduction of new ICT systems etc.). This process model is captured in BPMN language with support of Enterprise Process Center (EPC), a process modelling tool of Interfacing Technology Corp.
- The same process model can also be used to **facilitate interoperability solutions** between port actors or even between ports
- A **User Guide** for specification and implementation of interoperable port systems

These tools will be made available in a toolbox based on Enterprise Architect – **(http://www.sparxsystems.com.au).** This will help you to get rapid start on the development process.

EFFORTS Port Process Map
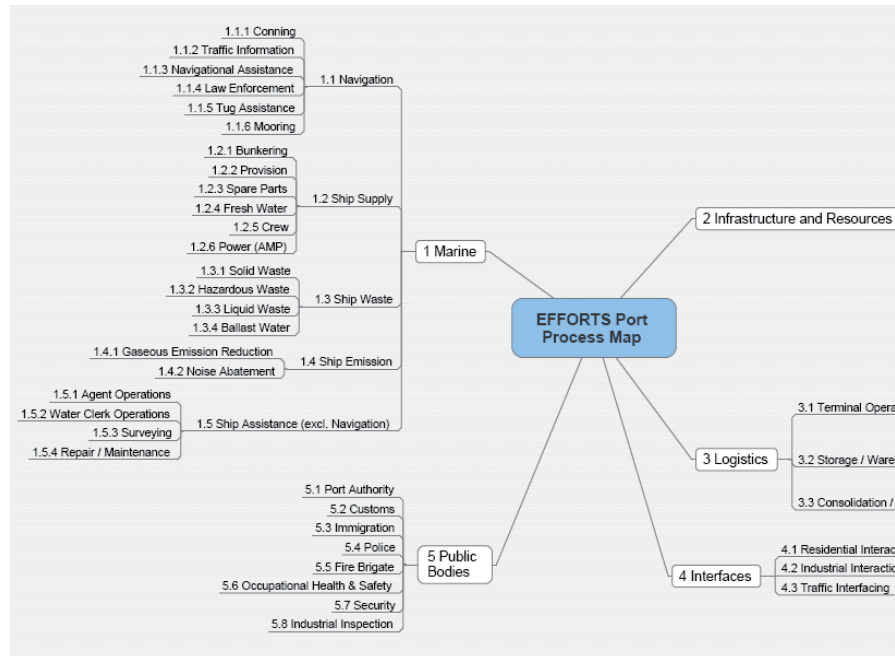
EFFORTS port process map or port process model depicts different operational areas of port irrespective to its cargo types, operational concentration and ownership model. Due to its generalization, port operators therefore are able to retrieve information from this model and customize it to their requirements.

Five areas (process domains) are defined:

- **Marine** includes processes associated with navigation and ship operations in ports
- **Infrastructure and Resources** include processes regarding lland and water infrastructure of ports
- **Logistics** include processes associated with operation among ship, terminal and cargo/passengers
- **Interfaces** include processes not directly linked to the port operation but affected
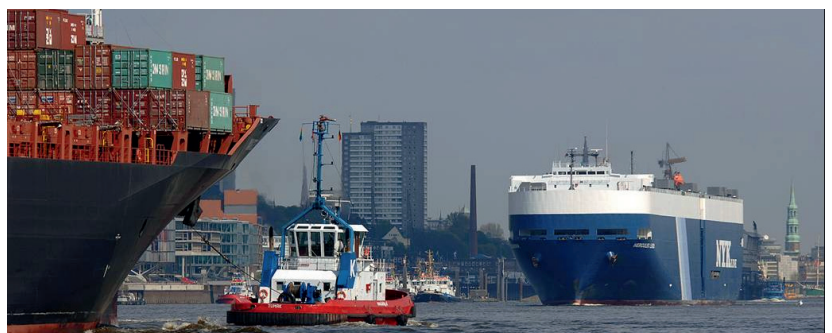
ISSUS / TUHH
www.webadresse.de

NundP
www.webadresse.de

TREDIT
www.webadresse.de

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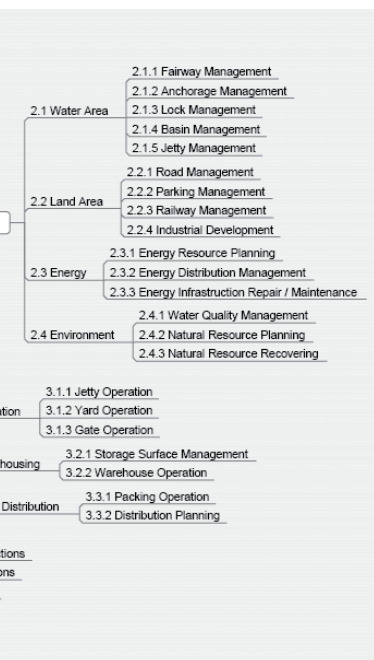www.webadresse.de

Contact:
WP Leader:
e-Maritime MARINTEK
Ørnulf Jan Rødseth
+47 73 59 52 47
Ornulf.j.rodseth@
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www.adresse.de

2.1 Water Area
- 2.1.1 Fairway Management
- 2.1.2 Anchorage Management
- 2.1.3 Lock Management
- 2.1.4 Basin Management
- 2.1.5 Jetty Management

2.2 Land Area
- 2.2.1 Road Management
- 2.2.2 Parking Management
- 2.2.3 Railway Management
- 2.2.4 Industrial Development

2.3 Energy
- 2.3.1 Energy Resource Planning
- 2.3.2 Energy Distribution Management
- 2.3.3 Energy Infrastructure Repair / Maintenance

2.4 Environment
- 2.4.1 Water Quality Management
- 2.4.2 Natural Resource Planning
- 2.4.3 Natural Resource Recovering

- 3.1.1 Jetty Operation
- 3.1.2 Yard Operation
- 3.1.3 Gate Operation

- 3.2.1 Storage Surface Management
- 3.2.2 Warehouse Operation

- 3.3.1 Packing Operation
- 3.3.2 Distribution Planning

The EFFORTS approach is a methodology for specifica-tion, implementation and verification of interoperable port IT systems based on usage of the EFFORTS port process model and the EFFORTS specification model, also called EFFORTS roadmap. By using the EFFORTS approach the basis for all subsequent phases of the IT development lifecycle is formed.

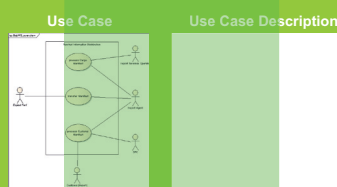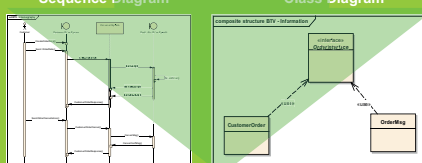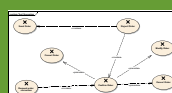**The benefits of using the EFFORTS approach:**

- Focus on business process (and process interoperability), not on the technical interface
- Model based approach
- Supports a component based approach - re-usability of functional units
- Integrates all phases of the development process – specification, implementation and test
- Improved maintainability and extensibility
- Simplify definition of scope; improve communication with business experts; increase acceptability
- Reduction of development, deployment and maintenance costs

Phase 1: Process Model

Business & Technical Process

EFFORTS Process Modelling Framework: E-CIMOSA
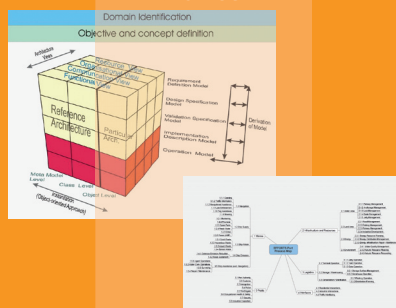
Process Modelling Tool: EPC, Interfacing Inc.
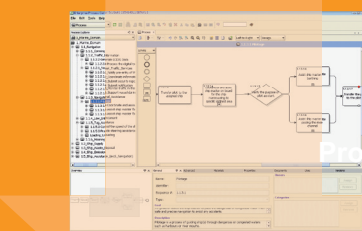
Process Model

Phase 2: Specification Model

Procedure Model

Business Domain View

Use Case   Use Case Description

Business Requirement View

Activity Diagram   Class Diagram   State Diagram
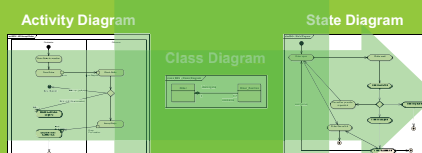
Business Transaction View

Business Choreography View
Sequence Diagram

Business Information View
Class Diagram

Test View (Validation)

Test Scenario Diagram

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WORK PACKAGE 3.2
RISK MANAGEMENT FRAMEWORK

Effective Operations in Port (EFFORTS)

aims to improve the competitiveness of European port operations and the quality of the ports labour conditions and market, being a prominent one in coastal regions

EFFORTS WP3.2 – Risk Management

Framework aims at providing comprehensive risk information enabling port operators

- To formulate the tasks for risk consulting companies leading to a better understanding of risk issues, specific to ports
- To provide a complete data base for ports risk experts or for those consultants engaged for detailed investigation and evaluation
- To be aware of the residual risks and how to incorporate them in contingency plans
- To communicate risk and how it can be managed to the residents, port community (third parties) and to the port staffs

WP3.2 – The Results

- **Structured and categorized information** about risk and hazard related issues
- **RAPORTS – Risk Assessment** for Ports as information supporting web-platform of risk assessment for ports
- **Conceptual model and architecture** when dealing with risk assessment in ports, following Formal Safety Assessment

RAPORT – Guidance for Port Risk Assessment

- **Quick reference** related to port and terminal processes;
- **Easy access** to relevant knowledge to support risk assessment and risk management;
- **Reliable input** to draft contingency plans;
- Clear information on how to achieve best practice.

These tools will be made available at:
http://www.efforts-raport.com
RAPORT – a web-platform to help you perform the first risk assessment exercise in your port

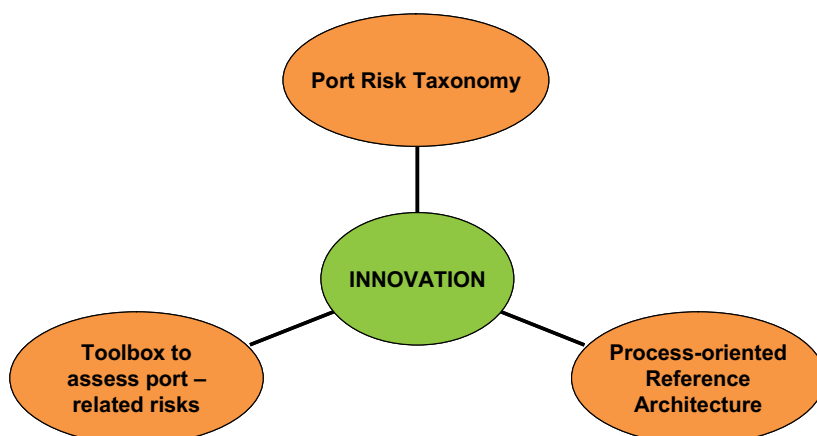## EFFORTS Risk Management Framework – Conceptual Model
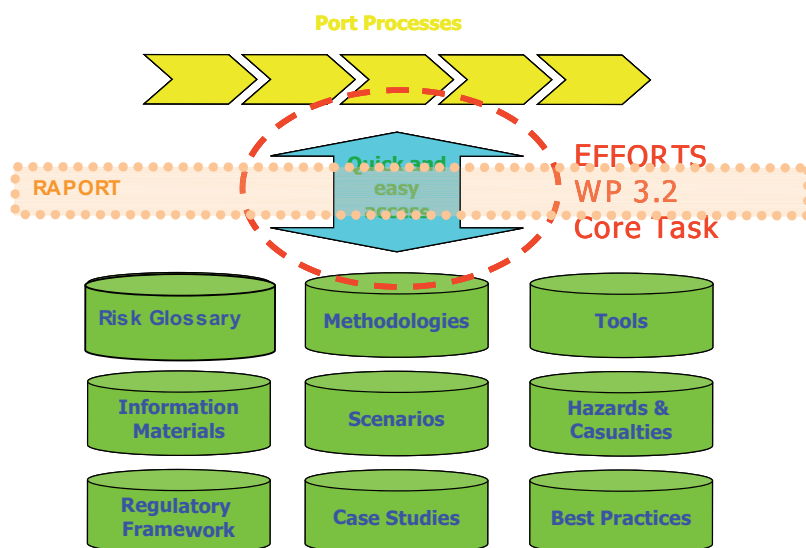
The EFFORTS WP 3.2 innovation is contained in a comprehensively organized EFFORTS Risk Assessment Framework that aims at establishing European standards in order to support operational parties in ports together with regulatory bodies and community interests thus helping all concerned to agree upon accepted residual risks for port operations;

We will define port risk taxonomy - all ports will have a common understanding when referring to port-related risk issues!

- The process-oriented reference architecture for risk assessment allows each port operator to focus on specific hazards that are related to a specific area of port operations in order to assess the risks and prepare preventive actions in the areas of safety and security!
- The toolbox to assess port-related risks will help the port operators to perform risk assessment activities in more convenient and quicker manner!

RAPORT (Risk Assessment for Port) is a web-information platform that supports the port operators (users) in performing their first risk assessment in a specific area of port operations!

This platform will be freely available for the public. In order to use the information repositories of RAPORT, no registration is required. For an individual risk assessment project conducted by each port user, a registration will be required so as to ensure confidentiality of data.

Benefits for Port Operators
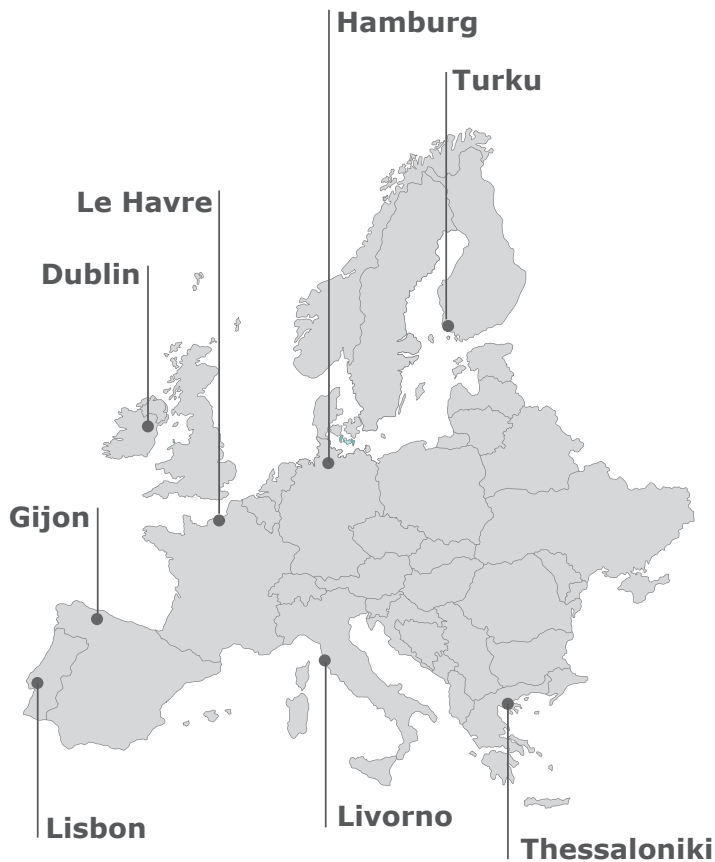
Ability to Identify hazardous operation

Ability to perform the first risk assessment themselves

Ability to apply best practices

Ability to draft risk assessment specification

PARTNER

Ports

APL Administração do Porto de Lisboa/Lisbon Port Authority, Portugal • **DPC** Dublin Port Company, Ireland • **HPA** Hamburg Port Authority AÖR, Germany • **LPA** Livorno Port Authority, Italy • **PAG** Port Authority Gijon, Spain • **PAH** Port Autonome du HAVRE, France • **POTU** Port of Turku, Finland • **THPA** Thessaloniki Port Authority S.A, Greece

Other Partners

ATA Areva TA, France • **BIOWIND** Recyclanet – Biowind, France • **CARIS** Caris, Netherlands • **CETMEF** Centre d'Etudes Techniques maritimes et Fluviales (Institute for Maritime and Waterways studies), France • **CFT** Compagnie Fluviale de Transport, France • **CONSULTRANS** CONSULTRANS S.A., Spain • **CT** Coryss Tess, France • **DAPP** D'Appolonia S.p.A., Italy • **FORCE** FORCE Technology, Denmark • **FIMR** FIMR, Finland • **FMI** FMI, Finland • **ICES** International Consulting Environment Services, France • **IFREMER** Ifremer, France • **IMPERIAL** Imperial College of Science, Technology and Medicine, United Kingdom • **ISDEFE** Ingenieria de Sistemas para la Defensa de España S.A. Istituto Superior Tecnico, Spain • **IST** Instituto Superior Tecnico, Portugal • **JRC** European Commission - Joint Research Centre, Italy • **L&R** Lüttgens&Reimers, Germany • **MARINTEK** Norwegian Marine Technology Research Institute, Norway • **MARIMA** Marimatech A\S, Denmark • **NUNDP** Nielsen + Partner Unternehmensberater GmbH, Germany • **SW** Svitzer Wijsmuller, Netherlands • **TLA** TL & Associés, France • **TREDIT** Transeuropean consultants for transport, development and information technology S.A., Greece • **TUTECH** TuTech Innovation GmbH, Germany • **TUHH** Technische Universität Hamburg-Harburg, Maritime Logistics / ISSUS, Germany • **ULP** Universite Louis Pasteur, France • **UNICAEN** Universite de Caen -Basse Normandie, France • **VTT** VTT Technical Research Centre of Finland, Finland