IMO Cares

Promoting green technology for maritime sustainability

Port Call Data Sharing for improved efficiency and reduced emission

"DigiPort"

Marine Fields Holding Ltd.

BM Bergmann Marine GmbH

Latest Date of submission: **6pm (UK) on Sunday 7th January 2024**

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1. Background

The aim of "IMO CARES" is to find market-ready technological solutions that increase the efficiency of ships and ports, reduce operational costs and cut GHG emissions.

Marine Fields Holding Ltd. and BM Bergmann Marine GmbH (Ltd.) want to contribute to improving the maritime sector in three of the target countries of IMO CARES, namely Namibia, St. Kitts & Nevis and Trinidad and Tobago. Based on the mission of IMO Cares it is our goal to increase efficiency and reduce environmental impact of port call activities by enabling digitalization, data sharing and collaborative decision making. In an attempt "to leave no country behind", the proposal is trying to close part of the "digital divide".

The proposed project "DigiPort - Port Call Data Exchange for increased efficiency and reduced emissions in ports" will implement a solution based on the port call data sharing platform PERSEUS in a Software-as-a-Service (SaaS) concept. The "DigiPort" solution will allow all actors in the port to gain direct access to port call data, necessary to implement "Just-In-Time" operations. The PERSEUS system will enable the port to reduce "Total-Turnaround-Time" and with that reduce emissions.

2. Companies presentation

The proposal is prepared by both Marine Fields Holding Ltd. (MF) and BM Bergmann Marine GmbH (BM). The companies are associated partner organizations where MF is the stakeholder of BM, and both companies are managed by the same CEO.

2.1. Marine Fields Holding Ltd.

Inspired by what digitization can bring to the maritime industry, Marine Fields Holding Ltd. (MF) offers solutions for enhanced digital collaboration between shipping companies, ports, their terminals, port infrastructure and administration. MF provides the necessary information technology to allow our clients make educated decisions about their business with Maritime Information Services, which include customized market analysis for specific needs and developing suggestions on how to improve digital infrastructure.

A principal service MF is offering is the PERSEUS data sharing platform, described in detail below. PERSEUS, developed by Marine Fields, used in the ports of Cyprus in EU funded project "STM-Validation-Project", the Cyprus "STEAM" project and is currently utilized in the Cyprus "Adaption" project.

With PERSEUS MF offers a market-ready solution for small and medium ports to support decarbonization by optimizing usage of port infrastructure, avoiding waiting and anchorage times during port calls.

2.2. BM Bergmann Marine GmbH

BM Bergmann Marine GmbH (BM) consists of a team of experienced experts in the maritime sector. With a broad range of expertise in various areas of sea- and multimodal transport organizational development, team building and optimization. We are supporting our clients to improve business success.

BM provides its clients a large variety of consultancy services, executive advice, and Background Information Services mainly in the maritime field, project management, General Management and technology support.

BM has worked and currently works on various national and international projects related in the logistic and maritime sector.

In the project MAREMIS, a bi-national project between Germany and Singapore, the shipping emissions in ports have been calculated using traditional versus AI technology. The project also predicted the effects of shipping emissions - CO2, NOx and SOx – on the host cities Hamburg and Singapore and provided a tool to calculate the effects on the emissions of changing conditions, like the use of LNG or Hydrogen on certain percentage of visiting ships, the use of shore-based power and the introduction of electrified work boats in ports. This project directly supported the goal of reducing shipping emission as envisioned by IMO.

BM also was involved through its Managing Director Michael Bergmann in the EU funded Project STM Validation. Here BM was co-leading the work package for PortCDM, discussed in this proposal.

Other projects are the LEAS project, on autonomous shipping, the PASSport project developing drone systems for port security and safety, the IMO-NAV project where dynamic routing and data integration was developed and proved, supporting the IMO E-Navigation strategy and others. A reference list is available below.

With its CEO, BM is engaged in the International PortCDM Council, developing standards and procedures for JIT (Justin-In-Time) in ports. It is member of the International Association of Ports and Harbors and works actively in their Data Collaboration Committee as well as their "Europe and Africa" working groups.

Supporting Germany on IMO matters, BM is also active participating on meetings of the IMO MTCCs, especially MTCC Africa and MTCC Caribbean.

2.3. Contact person for project implementation

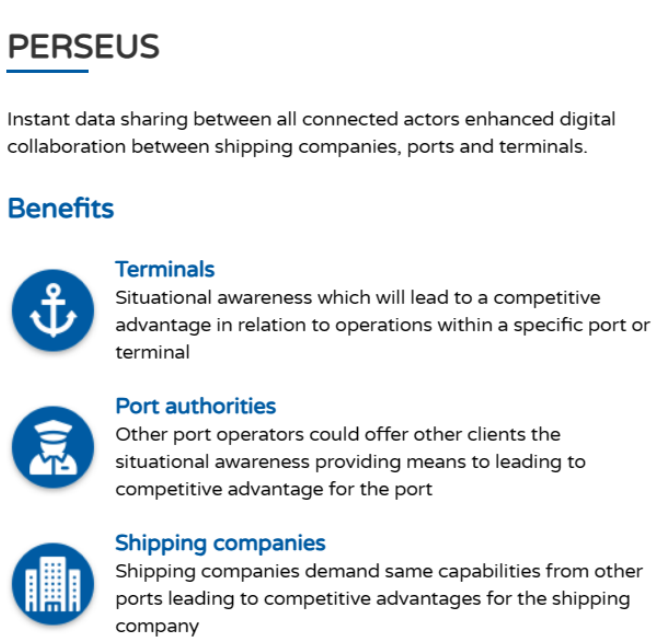
Michael Bergmann

Managing Director – BM Bergmann Marine GmbH
Chief Executive Officer – Marine Fields Holding Ltd.

3. PERSEUS Data Sharing System

3.1. The PERSEUS Base – Data sharing platform

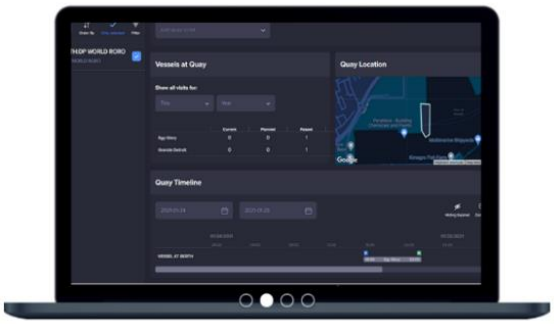
- ***Market-ready technology solution***
- ***Suitable for use in ports and on ships of under 5,000 gt as well as larger vessels***



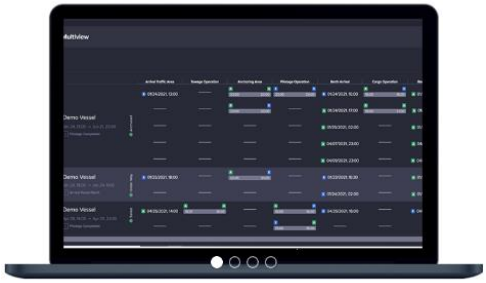
Marine Fields data sharing platform, PERSEUS, is an innovative solution that provides different maritime actors the opportunity to either instantly share information or have complete control over planned and completed port calls all around the world through its real-time connectivity tools.

The PERSEUS system is a solution to interconnect any desired maritime actors to allow data sharing and collaboration, independent of the systems already in use by the individual participant, as it can interface with those. With limited individual adoptions to support local conditions, a port can connect with upstream and downstream ports, individual ships or shipping companies or other actors, within or outside the port.

PERSEUS can be used by the existing infrastructure, e.g. a PCS, to empower its capabilities. The systems of the desired partners which usually needs to be integrated, are not of relevance anymore, same as in the general Internet one user doesn't need to care about the systems one is connecting with.



3.2. PERSEUS SAT (Situational Awareness Tool)



The PERSEUS SAT (Situational Awareness Tool) developed on the top of robust and secure PERSEUS connectivity platform allows users to take control over planned, ongoing and completed port calls. The advanced searching feature helps you find what you are looking for easily by filtering data through various parameters.

Users can also add new or complete missing information about existing port calls using this versatile tool which provides an overall view of all maritime activities at one place in real time with high accuracy rate.

3.3. PERSEUS Partners and possible extensions

MF collaborates with its PERSEUS platform already with various partners to allow seamless integration of associated applications and tools.

PERSEUS collaborates with the Maritime Single Window applications of the Kisters AG company to allow data exchange between the port call platform and national maritime single windows. Partnering with the company Hexagon, PERSEUS integrates the capability of a full Port Community System. And with the integration of APIs of the company STERNULA, PERSEUS can integrate data streams using VDES (VHF Data Exchange System), VDES-SAT and MMS (Maritime Messaging Service). In addition, PERSEUS can provide access to historic and actual maritime data from Kpler, e.g. MarineTraffics and FleetMon data sets.

The extensions for Kisters MSW, Sternula VDES/VDES-SAT/MMS, Hexagon PCS and Kpler Data streams, could be added to the system, if the responsible organizations desire to do so, but they are not part of the initial proposal.

4. Project planning

For the initial phase of the project it is planned, as suggested by IMO CARES, to develop a comprehensive technical proposal for the implementation of PERSEUS and potential associated systems in the target ports and countries.

The project partner BM will conduct most of the work of the first project phase to develop the comprehensive technical proposal. It will focus on user requirements, process analysis, scheduling, and project management. It will work closely with MF, who will provide the technical analysis and technical implementation details for the proposal.

This project phase is suggested in the following way:

4.1. Initial Assessment

- *Kick-off video conference with the IMO CARES Team and target beneficiaries*
  In this online conference the project details, including timeline and expected deliverables are discussed with both the IMO CARES Team as well as the target beneficiaries. The goal is to reach consensus on the project execution and ensure that the input of the participants is appropriately considered.
- *Kick-off video conferences with each individual port*
  As a first step in the initial assessment individual online conferences are conducted with each selected port. The ports will be interviewed to ensure that the project team obtains a first-hand introduction of the port operation and coordination requirements. The ports will be requested to provide any available and sharable documentation of port operations from all involved stakeholders. The project team will introduce the next steps in full evaluation with each port and define the detail timelines.
- *Review and consolidate port and country documentation*
  Based on the results of the kick-off conferences the project team will prepare an initial documentation of port operations for each port as it effects the project execution.

4.2. Definition and analysis

- *Video call with each port*
  To prepare the necessary details for the expected comprehensive technical proposal an online conference will be conducted with each port selected. The result of the video calls will be used to document current port operation in a overview port call process documentation including flow charts, e.g. the Port-

Call Metro Map as developed during STM Validation Project (see Figure 1) or the IPCOTF Port Call Flowchart (see Figure 2)

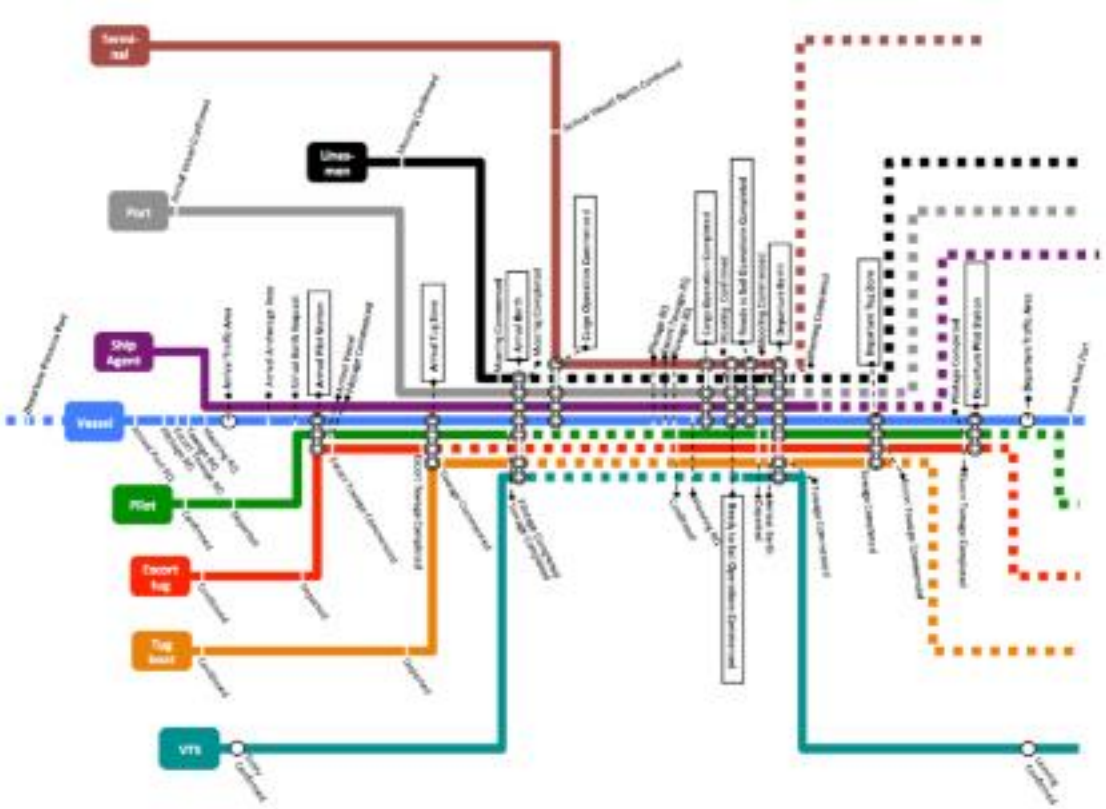


Figure 1 Port Call Metro Map

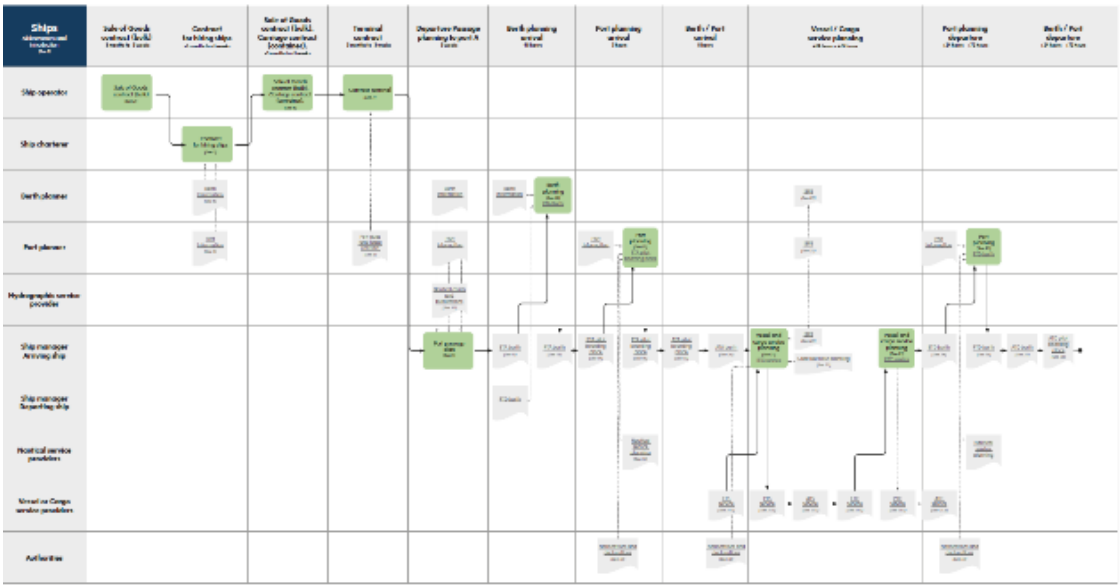


Figure 2 Port Call Flow Chart

- *Status and coordination conference with IMO CARES Team*
  After the port conferences an online meeting with the IMO CARES team will be conducted. In the meeting the project team will inform the IMO CARES team on the results of the conferences and request comments. The next steps in the project will be discussed to ensure that the activities of the project team are aligned with the expectation of the IMO CARES team.
- *Develop a first draft proposal*
  In a next step the project team will analyse the results of the conferences and the input of the IMO CARES team and prepare a first draft technical proposal on implementing PERSEUS platform and associated processes. It will outline how the project team envisions the implementation in each port and with any other stakeholder identified.
- *Review the draft proposal with each individual port and country and collect feedback*
  After the draft proposal has been shared with the ports and countries, the project team will review the proposal with each stakeholder to obtain their relevant input.
- *Update draft proposal*
  Then the project team will update the proposal based on the input provided.
- *Review proposal with IMO CARES Team*
  Once the second proposal draft has been produced, the project team will organize an online conference, with the IMO CARES team to align the proposal with the expectations of the IMO CARES team.
- *Incorporate changes from all stakeholders and prepare final proposal*
  Having available the suggestions from port and countries as well as the IMO CARES team, the project team will update the documents and prepare a final proposal.
- *Final review of proposal*
  In a final review process the finalized proposal will be reviewed with each individual ports, countries and IMO CARES Team and additional comments and remarks are collected, if any.
- *Presentation of final proposal to IMO CARES team*
  After the incorporation of the last remarks the project team will present to the IMO CARES team the final comprehensive technical proposal for the implementation of PERSEUS in the identified ports and with the relevant organizations and stakeholders.

4.3. Project Gant Chart with efforts and costs

IMO CARES Maritime Technology Global Challenge

Project appreviation:	DigiPort
Project description:	Port Call Data Exchange for increased efficiency and reduced emissions in ports
Project start:	1 February 2024
Project duration:	11 Month
Project end	31 December 2024

Hourly rate BM and MF: $ 130,00

Task ID	Task Description	Efforts (hrs)	Start	End	2024 Jan.	Feb.	Mar.	Apr.	May	Jun.	Aug	Sep.	Oct.	Nov.	Dec.
1	***Proposal Development***														
1.1	Initial Assessment		01.02.2024	01.03.2024											
1.1.1	Kick-off with the IMO CARES Team and target beneficiaries	16	01.02.2024	09.02.2024											
1.1.2	Kick-off video conference with each individual port	16	12.02.2024	16.02.2024											
1.1.3	Review and consolidate port and country documentation	40	19.02.2024	01.03.2024											
1.2	Definition and analysis														
1.2.1	Video Call with each port	16	04.03.2024	29.03.2024											
1.2.2	Status and coordination conference with IMO CARES Team	4	18.03.2024	22.03.2024											
1.2.3	Develop a first draft proposal	40	19.02.2024	04.04.2024											
1.2.4	Review the draft proposal	16	08.04.2024	12.04.2023											
1.2.5	Update draft proposal	40	12.04.2024	16.04.2024											
1.2.6	Review proposal with IMO CARES Team	4	17.04.2024	19.04.2024											
1.2.7	Incorporate changes and prepare final proposal	24	19.04.2024	23.04.2024											
1.2.8	Final review of proposal	4	24.04.2024	26.04.2024											
1.2.9	Presentation of final proposal to IMO CARES team	4	29.04.2024	30.04.2024											
	Total Efforts Phase 1 (hrs)	**224**													
	Total Costs Phase 1 (€)	**$ 29.120,00**													
3	**Implementation Phase**														
3.1	Detail assessment in each port	To be defined	To be defined	To be defined											
3.2	PERSEUS customization														
3.3	Implementing, set-up and operation of PERSEUS system														
3.4	System Testing in each location														
3.5	User Training														
3.6	Handover														

It hast to be noted that the timeframes for the implementation phase may be slightly adjusted based on the results of the proposal phase as explained in more details below.

4.4. Technology introduction – PERSEUS

The implementation phase of the project will be executed once the proposal has been submitted and accepted. It will be based on the results of the proposal development phase. The analysis done to prepare the detail technical proposal will be used in the implementation phase.

4.4.1. Installation time

As per the above Gantt chart, the installation time is expected to be two months. Additional customization and system testing is expected to extend the full implementation time to four months.

4.4.2. Feasibility

Given that PRESEUS is in operational use and has been implementation for different stakeholders already, no risks are expected to set up and use the system as described.

4.4.3. Maintenance requirements/maintenance of tech after installation

Once installed a annual licensing fee is applicable. Please see above for current pricing. The licensing fee includes regular maintenance. As pointed out above dedicated hardware is required. Please note that it is expected that the local office computers (PCs, laptops or mobile devises) are expected to be covered by the general office costs and are not part of the PERSEUS maintenance costs. Please also note that specific additional extensions are not covered by the general maintenance.

4.4.4. Ease of application across a larger number of vessels and ports

PERSEUS is easily handling all numbers of vessels and ports. While the system stores data on any of the connected ships and ports, each actor sees only those resources assigned to them. This enables increased situational awareness for own operations while the system is dealing with larger amount of data.

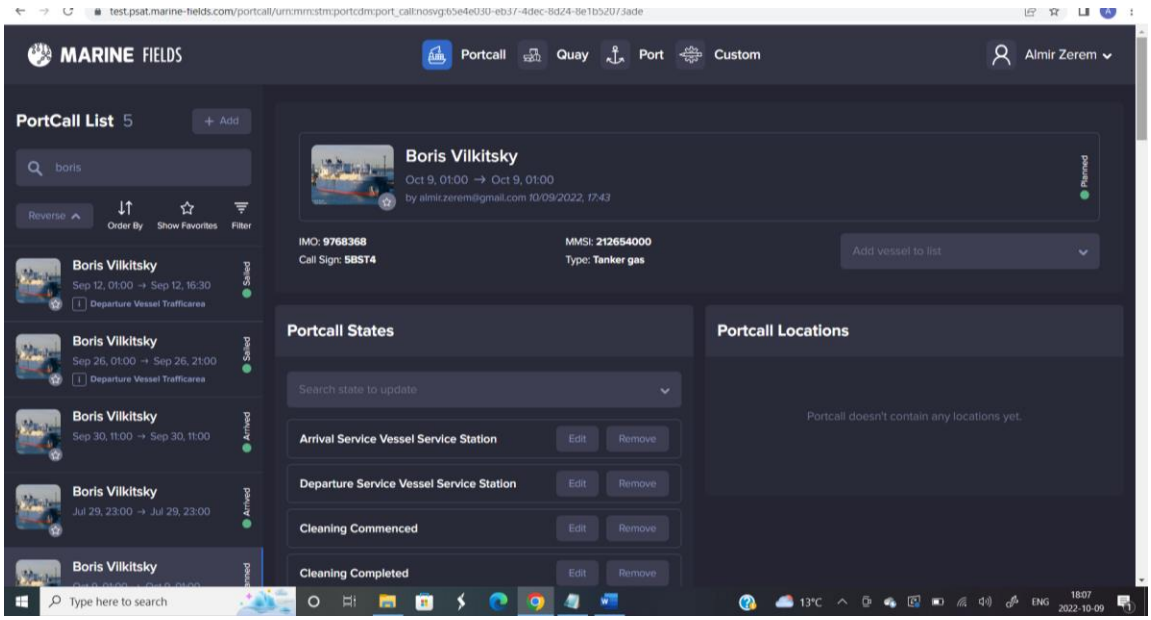


Figure 3 Port Call List

When focusing on a specific port, the authorized actor can see all ships calling with necessary details, while other ports are not distracting the activity but still are handled by the system.

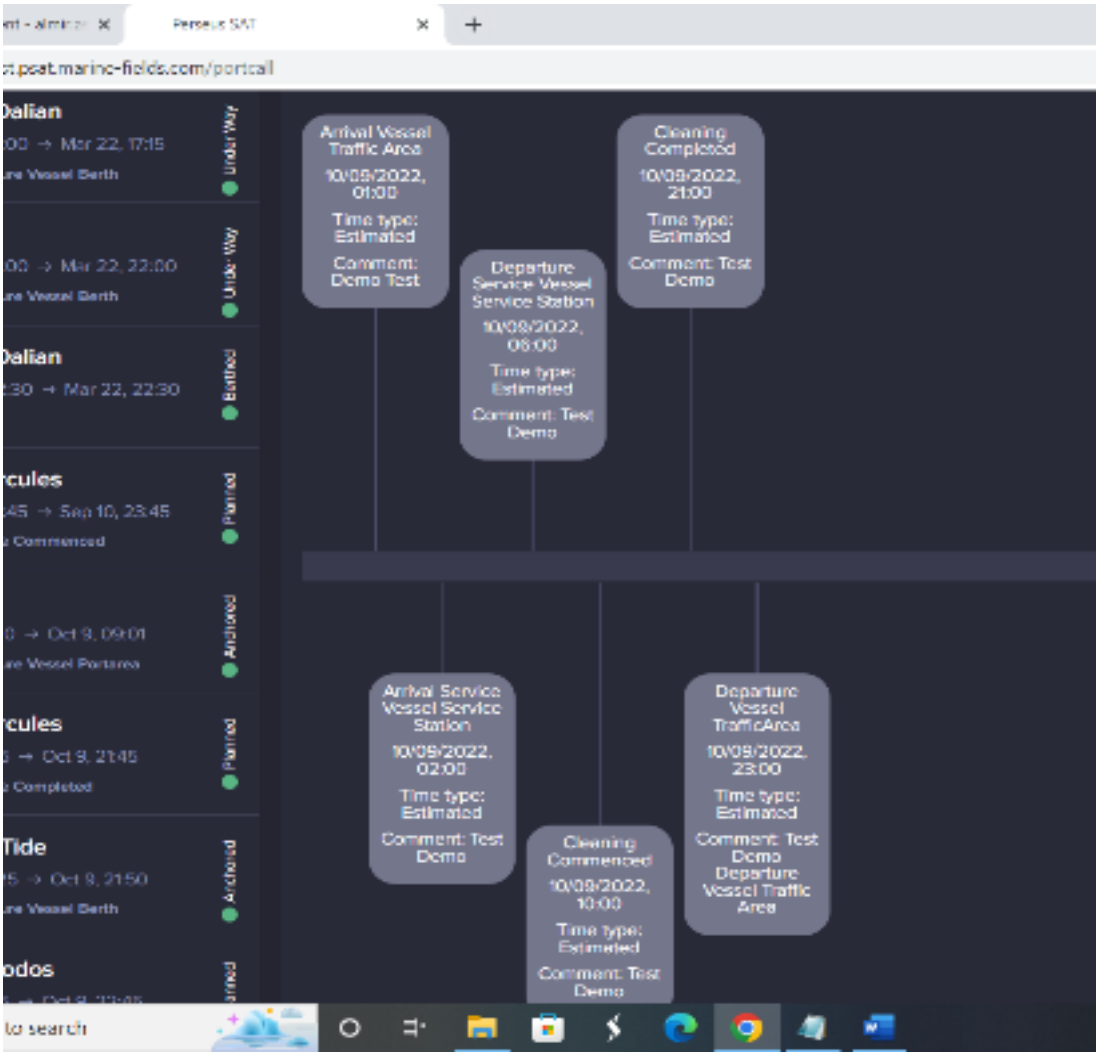


Figure 4 Ship focused view

If focused on a specific ship, only associated activities are visible.

4.4.5. Scalability (could the tech be applied to much larger number of vessels/ports)

The PERSEUS system is fully scalable. Depending on the necessary data volume the capacity of the PERSEUS cloud system can easily adjust to handle large amount of both vessels as well as port data if port call volume exceeds 10.000 calls per year. Scaling up is handled transparent for the users of the system. If the contractually agreed data volume is reached, adjustments of the licensing may be required, but will be handled individually.

During the proposal development phase these aspects will be evaluated as well, and details will be included in the detailed technical proposal.

5. Estimated impact

The effect of data sharing on the ability to reduce GHG emissions as well other environmental impact of shipping is meanwhile well documented.

To better estimate the effects on predictability and with that the ability to estimate emission reduction, figures from the PortCDM validation during the STM Validation Project can be used. The validation has highlighted the challenges for a port operating in the "first-come-first-serve" paradigm to issue and commit to a recommendation of time of arrival to the ship was acknowledged. The port does have lacking knowledge about when the ship can be served due to how resources needed for serving the incoming ship is going to be available. At the core of this is the capability for the port to predict the time of departure from the port (c.f. figure on how predictability is dropping further into the port call).

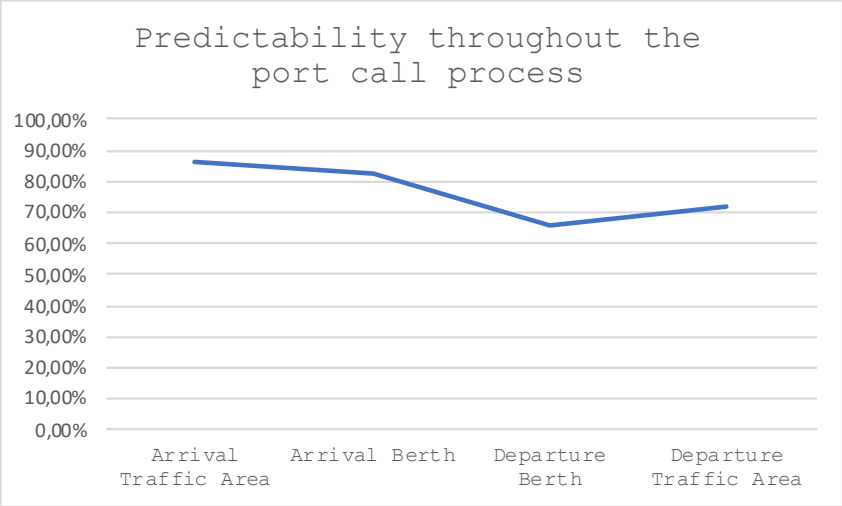


Figure 5 Predictability through the port call process based on the analysis of 43 976 port calls (out of 1 696 115 port call messages)

As it has been proven there are a lot of efficiency and environmental gains that can be drawn from ship operators / ships collaborating and exchanging data with ports on planned and recommended times of arrival. Data sharing in ways like PortCDM, enables the coordination and collaboration between the ship, directly or via ship operation centres, VTS (Vessel Traffic Services) and the port to allow an optimization of the sea voyage. The ship voyage speed can be optimized with focus on efficiency and emission reduction, avoiding the pressure of arriving as early as possible at a port to be first in a "first-come-first-serve" chain but rather arrive on time reducing or even eliminating waiting time at the destination.

Furthermore, data sharing enabled collaboration, reduces waiting time on anchor and eliminates the emissions to contribute to the port environmental footprint. Within the port, ship emissions can be reduced as well. As data collaboration will reduce the ships total turnaround time, less time on hot ironing where no cold ironing is available will be achieved. If a port uses cold ironing, the high predictability of estimates allows for better planning and as such reduces the time the ship still needs to stay on hot ironing.

Besides the ship emission factors mentioned above, the increased situational awareness of port actors and the collaboration in ports with established data sharing tools like PERSEUS enables the port eco system to improve their overall environmental footprint. The resulting optimization of port assets, like tug boats, cargo handling equipment and others will increase reduction of emissions by those assets, supporting ports in their efforts to become a less polluting participant of their wider environment.

But same as ships are actors within ports, the ports are many times also embedded in the port cities and the surrounding community. An increasing number of port cities are actively working to get greener and positively contribute to the reduction of pollution to save our planets environment. Being an integral part, ports are increasingly pushed to reduce their contribution of the city's emissions. With the above-mentioned capabilities of increased predictability of port activities like cargo handling, the port can provide the city with better suggestions on when subsequent transport modes, like trucks, railways are needed. If the ports with this connect with the city, the multimodal traffic systems can be optimized and decrease of pollutions due to traffic congestions can be achieved.

In a recent industry study over the period from August2022 - February 2023, analysing data from 10 ports and 323 vessels it was proven that, If JIT had been implemented across the studied 323 vessels, the cumulative potential savings approximated 24,000 tonnes of CO2 and over $6 million in fuel costs. The most considerable CO2 emissions reductions were feasible at Tanger Med, Los Angeles, and Valencia ports, where estimated savings hovered around 7.000, 4.000, and 3.000 tonnes, respectively.

By having enhanced situational awareness of the ship's arrival and the port's possibilities to meet requirements for the port visit in a just-in-time manner there are a lot of expected benefits for involved actors, such as:

- for shipping companies /vessels
  - saved bunker due to just-in-time arrivals
  - saved bunker due to just-in-time departures avoiding chasing the time window at the next leg
  - fleet optimization and saved bunker due to shorten TTT (Total-Turnaround-Time)
- for shipping agents
  - enhanced basis for planning and easier coordination of port call operations
  - Less time spent on chasing different actors, more time for other services to the vessels
- for terminals operators:
  - Enhanced possibilities for berth management
  - Enhanced capacity utilization (resources and infrastructure)
  - Better planning horizons for approaches to be served
- for VTS (Vessel Traffic Services)
  - Possibilities to digitally log entrance and departures
  - Better coordination of ship movements
  - Increased capability to synchronize the traffic dependent on the status in the port
- for port authorities
  - enhanced basis for planning
  - safe and efficient port approaches

- long- and short-term overview of port visits

• for port control / pilot planning, tug operators, mooring companies, and service providers
  - enhanced basis for planning
  - optimized capacity utilization
  - Enhanced capacity utilization (resources and infrastructure)

Further it should be considered that, as discussed above, the digitalization of ports and shipping as such in the target areas is reducing the so called "digital divide" and enable the ports and actors to actively participate in the digital developments, which is nowadays paramount to stay competitive in the maritime domain. Not only are there increasing requirements of digital data sharing, like the IMO MSW mandate, but also the markets, especially the multi modal supply chain, increasingly put pressure to all actors to increase visibility and accountability by providing solid and reliable digital operational data. This will be increasingly paramount for all ports and shipping actors alike.

The proposed implementation of PERSEUS is a cornerstone to enable all of this and also includes the documentation for digitally enable process improvements, like the implementation of PortCDM.

6. References and Abbreviations

6.1. Reference Projects of MF and BM

IMONAV
"INTEGRATION OF HIGH-RESOLUTION MARINE GEODATES INTO ELECTRONIC NAVIGATION SYSTEMS"
German project to integrate both static and real-time high-resolution data for increased situational awareness and improved safety in the approach to Port of Hamburg through the Elbe River.
The project was successfully completed.

MAGS
"MARITIME ADAPTIVE GNSS SAFETY CONCEPT"
EU Project developing a Maritime Adaptive GNSS Safety Concept, supporting mariners especially within the vicinity of ports.
The project was successfully completed.

STEAM
EU Project building efficient management of sea traffic in the Eastern Mediterranean Sea, while at the same time ensuring safety and environmental sustainability. More specifically, to develop the Port of Limassol to become a world-class transshipment and information hub adopting modern digital technologies brought to the maritime sector, and a driver for short sea shipping in the Eastern Mediterranean through enhanced services based on standardized ship and port connectivity.
The project was successfully completed.

STM Validation Project
Sea Traffic Management (STM) is developed in order to form a common standardized information sharing environment for actors in the maritime domain. Built on these standards, the concepts of Voyage Management, Flow Management, Port Collaborative Decision Making (CDM) and SeaSWIM

have been identified within the MONALISA 2.0 project. The STM Validation Project implements PortCDM and STM in 13 European ports and validates the concept.
The project was successfully completed.

ADAPTION
"M**A**ritime **D**ata Sh**A**ring for **P**ort Conges**T**ion Minimisat**ION**"
The ADAPTATION project aims to reduce waiting times for incoming traffic at ports through intelligent data acquisition processing and decision support tools. The goal is to develop a platform for monitoring and prediction to provide decision support for Smart Ports and optimise just-in-time solutions. This will be achieved through the development of a digital platform for data ingestion, storage, and management of heterogeneous data sources and a demonstrator that will utilise algorithms and machine learning techniques for the prediction of vessel arrivals at any given port.
This project is not yet completed.

MDigi-I
"Maritime Digitalization Research Infrastructure"
The proposed project aims to create a new research infrastructure that will stimulate synergies and provide the means for the development and uptake of maritime digitalization technologies that will improve safety, security, and efficiency for the economic and environmental sustainability of Shipping - Marine Transport activities.
This project is not yet completed.

MAREMIS
"Maritime transport modeling and verification to reduce maritime emissions"
The project will develop and deploy a ship emission model based on real ship movements and sensor-based emission data. The ship emission model will be used to estimate air pollution from maritime traffic in ports. It will reflect spatial-temporal emission dynamics and will track traffic emissions in real time and against scenarios. The impact on regional air quality, i.e. the Northern Germany region as well as Southeast Asia, will be analysed using a chemical transport model, as these areas dominate the air input to urban areas. Models will continue to be developed to enable emission reduction strategies through changes in port operations and maritime traffic management using Big Data analysis, simulation, and optimization.
The project was successfully completed.

PASSport
"Operational Platform managing a fleet of semi-autonomous drones exploiting GNSS high Accuracy and Authentication to improve Security & Safety in port areas"
The purpose of PASSport is to engineer and qualify a solution extending situational awareness to improve safety and security in port areas. PASSport solution complements already operational platforms extending the surveillance perimeter using a fleet of drones to provide innovation and operational support to the safety and security aspects of daily operations with particular attention to Pollution monitoring (safety), Support to e-navigation (safety), Critical buildings/ Infrastructures protection (security), Protection against non-cooperative small craft approaching the port areas (security) and Underwater threats monitoring (security).
This project is not yet completed.

LEAS
"Supporting shipping through land-based decision recommendations to improve the safety and efficiency of coastal sea transport traffic for traffic situations with highly automated or autonomous ships"
The LEAS project focuses on the design, implementation, and demonstration of shore-based support

ser-vices based on AI for conventional to autonomously navigating and possibly unmanned vessels (mixed traffic). The web-based tools developed in the project aims to enable states with limited financial resources and a lot of coastlines that do not yet provide VTS to establish such a facility. This will contribute to increasing safety in international shipping. The development will also consider traffic situations with highly automated ships. The IMO and IALA guidelines will be used as an outline for the development. The areas of layout, cartographic symbology, information, functionality, and decision support play a central role in the requirements.
This project is not yet completed.

AVIS
"Automated Vessels on European Inland Waterways"
The EU project will investigate solutions and perform pilots based on the use of EU Space Data for automated vessels on European inland waterways.
This project is not yet completed.

Optimal-LOADS
"Optimal Logistics Operation & Analysis Data Space"
The project responded to an ITEA4 Call (Eureka RD&I Cluster). A central goal of the Optimal-LOADS project is to equip the Gaia-X/IDS reference architecture (RA) with real SW components in the data space of the multimodal logistics supply chain, to pioneer the emerging Gaia-X/IDS infrastructure services for the data economy (including GXFS) in this data space and to coordinate them with the emerging mobility data space (MDS). When providing suitable AI-based data economy offers for the optimization and further digitization of processes in the logistics industry, international software standards for the sovereign data exchange between the actors of such industry applications are to be promoted and used in a cross-national demonstrator.
This project is not yet completed.

6.2. Abbreviations

Abbreviations	
API	Application Programming Interface
CDM	Collaborative Decision Making
CEO	Chief Executive Officer
EU	European Union
GNSS	Global Navigation Satellite System
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
IMO	International Maritime Organization
JIT	Just In Time
LNG	Liquified Natural Gas
MDS	Mobility Data Space
MSW	Maritime Single Window
MTCC	Maritime Technologies Cooperation Centres
NSW	National Single Window
PCS	Port Community System
PortCDM	Port Collaborative Decision Making
SeaSWIM	System wide information management for Sea Transport
STM	Sea Traffic Management

TTT	Total Turnaround Time (of Port Calls)
VDES	VHF Data Exchange System
VDES-SAT	VDES via Satellite Communication
VHF	Very High Frequency
VTS	Vessel Traffic Service