SEAMLESS

SAFE, EFFICIENT AND AUTONOMOUS:
MULTIMODAL LIBRARY OF EUROPEAN SHORTSEA
AND INLAND SOLUTIONS

Second year project results

The SEAMLESS Project is about to embark on its third year of implementation, and many are the progress achieved across all Work Package in the frame of the first 24 months of implementation. Dive into this newsletter to explore the strides made by the consortium and gain insights into the upcoming milestones. Stay in the know by following SEAMLESS on LinkedIn and Twitter!

Redesigning Logistics

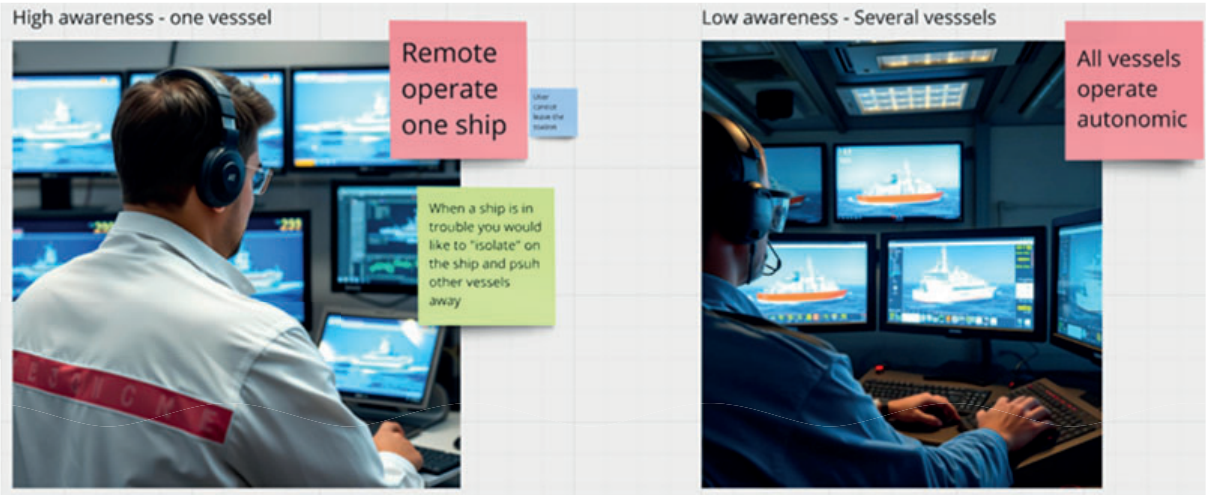
The activities within the second year of the project focussed on providing the conceptual basis for the realization of the SEAMLESS building blocks and logistics redesign efforts. In line with this, we have continued our collaborative and integrative work approach. Apart from progress on the regulatory gap analysis the work culminated in two publicly available reports that were published this year. The D2.2 report presents the SEAMLESS reference logistics system architecture and highlights opportunities for simplifying complex administrative procedures in the planning and execution processes of multimodal transport chains using autonomous vessels. Based on an analysis of current practices in short sea shipping (SSS) and inland waterway transport (IWT), it describes and visualizes processes and organizational changes within the respective logistics systems that are induced by the technological innovations. Further insights on the technological concepts to be implemented later in the project is given in our D2.3 report. It defines the SEAMLESS Building Blocks by their subsystems and explains how those are intended to work as part of the overall SEAMLESS concept. Also, functional and non-functional requirements assessed in relation to autonomous systems in the context of the demonstration use cases are presented in the report.

Enabling Autonomous port operations

For autonomous mooring, our task is to enhance autonomous onboard technology without any need for changes at the quayside. MacGregor has progressed well on defining and securing the components to be used in the forthcoming demonstration. Also important to notice that the exact berth for the demonstration has been agreed with Port of Antwerp-Bruges. For the development of the triple joint crane, MacGregor has studied and developed the first draft of the headblock. That is the device/connection between the crane structure and the spreader. Along with the development of the new headblock, development of a new control software for path planning and anti-pendulation control has been started. This is needed as the new crane structure is completely different from the traditional one. For the VCOP, an application that is able to perform stowage planning of containers, MacGregor has started to draft the improved ROC user interface. Also we have identified the key stakeholders that are needed to achieve machine to machine integration with vessel and port operating systems. AWAKE.AI has defined the required communication messages and protocols for the autonomous vessel smart port manager (AVSPM). AVSPM is a software that handles the port call bookings, traffic control and monitoring, environmental sensors, and traffic situational awareness, as well as adherence to traffic rules and notices for the autonomous vessel. VFP has been defining the concepts for automated port interfaces and intermodal cargo forwarding to the hinterland. And as a result , the connected deliverable will be released within a month. Furthermore NTUA has started to draft the Operational safety and security assessment based on the development done for the autonomous mooring and autonomous cargo handling.

Activating Autonomous fleet operations

The second year of SEAMLESS has marked significant technical progress for WP4, which focuses on enabling autonomous fleet operations. In this context, ESI and NTUA have advanced work on the methodology for identifying optimal powerplant configurations for the SEAMLESS Use Cases. This effort highlighted an unanticipated need: the design of the SEAMLESS vessels, which are essential for WP6 activities aimed at assessing and evaluating the Pan-European impact of the project's technological innovations. As a result, NTUA has spearheaded the development of a methodology for designing concept vessels tailored to the specific requirements of the project's Use Cases. In parallel, TUD has led advancements in the development of the Guidance, Navigation, and Control (GNC) scheme for autonomous vessels. This includes creating a model-based method for diagnosing thruster faults, complemented by a multi-agent diagnosis scheme for detecting and isolating multiple faults in navigational sensors. Additionally, efforts have been made to model the vessels' kinematic and kinetic behaviors within the framework of linear parameter-varying systems. Progress has also been steady in developing the Risk-Based Approval framework. An initial breakdown of the outlined work has been completed, and NTNU has already submitted two papers for publication on this topic.
The cornerstone of WP4's technological efforts, however, lies in the work led by Kongsberg Maritime (KM). KM has been advancing the development of a Remote Operation Centre, enabling maritime operators to monitor and control multiple ships simultaneously—referred to as the "low attention operation mode." During the second year, the focus has been on designing operator interfaces and interactions for managing navigation and operations across multiple vessels. A key challenge has been balancing the operator's cognitive load and defining rules for transitioning between "high attention" and "low attention" modes (see figure below). This work includes tabletop studies and testing various scenarios with real operators at KM's test facilities in Turku, Finland.



Digitalising logistics operations

ModalNET is one of the three building blocks that conform a fully integrated version of the technological ecosystem that is verified and validated through the SEAMLESS for a fully automated and economically viable, cost-effective, and resilient waterborne freight feeder loop service for Short Sea Shipping (SSS) and/or Inland Waterways Transport (IWT). During the second year in the development of the WP5 named "Digitalising logistics operations" of the SEAMLESS project, Fundación Valenciaport jointly with SystemX have achieved the required standards to release the Deliverable 5.1 named "ModalNET Specifications, systems architecture and design of cyber-secure communication". From the point of view of the computational engine for resilient logistics, the initial algorithm conceptualization and design, the analysis of ConOps, specifications and system architectures have been carried out. The testing and validation of algorithms, their integration, and the release of fully operable computational engine to be used as a basis in ModalNET has been partially completed. From the point of view of the ModalNET platform, the architecture approach analysis, the logistics modules overview developments, the design and implementation of the loop services definition about autonomous vessels have been done. The design of the booking system to allow the user to request the intermodal transport has been addressed and the integration of ModalNET with the Computational engine for resilient logistics (CERL) too. The design and implementation of data model to support all BBs involved in ModalNET has also been further developed.

Evaluating impact and developing sustainability driven business models

The second year of SEAMLESS marked a milestone for WP6, as all associated tasks have now officially begun. WP6 aims to provide the SEAMLESS Consortium with robust tools to assess the project's technological innovations and to evaluate their applicability across Europe. During this year, efforts to establish the SEAMLESS Cost Benefit Analysis (CBA) approach have kicked off, with the Task Leaders (PNO/Ciaotech) proposing a comprehensive framework that will guide the project's next steps. This CBA will also incorporate the methodology for evaluating the environmental and social impacts of SEAMLESS innovations. Over the past twelve months, NTUA has identified several promising approaches from the literature, and by 2026, they plan to propose a fully developed evaluation model. In parallel, SEAMLESS is progressing on the development of disruptive business models for autonomous shipping, led by FV. To support this, FV has developed and distributed a detailed questionnaire designed to gather insights on barriers, drivers, and opportunities for autonomous shipping implementation. Additionally, a stakeholder database—including ports, shipping companies, and road hauliers—has been created, and a tailored interview will soon be conducted to delve deeper into stakeholder perspectives. Furthermore, SEAMLESS is investigating the social acceptability of autonomous technologies in Short Sea Shipping and Inland Waterway Transport. Though this task began only a few months ago, VNF, leading this work, has concluded that an observational study is essential. Researchers will shadow practitioners (e.g., seafarers) in their daily work to gain insights into their profession and assess how future autonomous or highly automated technologies might impact their roles. Lastly, WP6 is working to ensure that SEAMLESS technological advancements can be transferred to other European regions beyond the project's demonstration areas. DST, leading this effort, has already designed an approach involving agent-based simulations and operations research to support this goal.

Demonstrator and Validation Campaign

The SEAMLESS concept has been defined as the combination of the SEAMLESS innovations and the operational phases which they are involved in. Furthermore, requirements to the SEAMLESS innovations and a CONOPS for each of the two project demonstration use cases has been developed. This is published in the deliverable D2.3 Concept of operations and requirements for SEAMLESS building blocks. The deliverable also defines and explains the SEAMLESS building blocks and how they are constructed from the individual innovations. This work will be the foundation for development and planning of the full scale demonstrations, as well as for the work targeting simplification of approval for autonomous ships in work package 4 Activating Autonomous fleet operations. A pre-study of the SEAMLESS demonstration use case 1 (Northern Europe – SSS) has been done and used as the example case study in the publication "A novel method for evaluating ship concept performance in transport systems". This paper was presented at ICMASS 2024 and is available as Open Access. The pre-study shows that there is a potential for a battery electric container shuttle to compete with road transport for connecting Bergen to a new container terminal at Ågotnes. The study feeds into SEAMLESS work package 6 (WP6) "Evaluating impact and developing sustainability-driven business models", as well as the SEAMLESS vessel concept design. The case study will continue within WP6, including a CBA by PNO and a societal and environmental impact analysis by NTUA.

High-Impact Dissemination, Communication and Exploitation

In the second year of the project, PNO team has focused on defining and advancing the exploitation strategy to maximize SEAMLESS outcomes. This began with establishing a structured methodology and hosting our first Workshop online, where key partners engaged in identifying and refining the Key Exploitable Results (KERs) that hold the greatest potential for impact. By the end of December, we aim to complete our first deliverable, capturing a detailed list of KERs, as well as a tailored exploitation plan for each partner. This deliverable serves as a foundational tool for the project, enabling clear pathways for individual and collective exploitation efforts. Moving forward, we will conduct an in-depth market analysis to evaluate the market readiness and assess the innovation potential of the most promising KERs, identifying pathways for commercialization, research extensions, or strategic partnerships. This approach provides a robust framework for future impact, positioning the project's innovations to achieve real-world success and setting up partners with actionable insights for entering and competing in relevant markets. All channels, materials, and tools supporting the DC&E strategy have been successfully delivered and are actively utilized to disseminate news and raise awareness about the project. Want to discover more? Take a look at the SEAMLESS website!

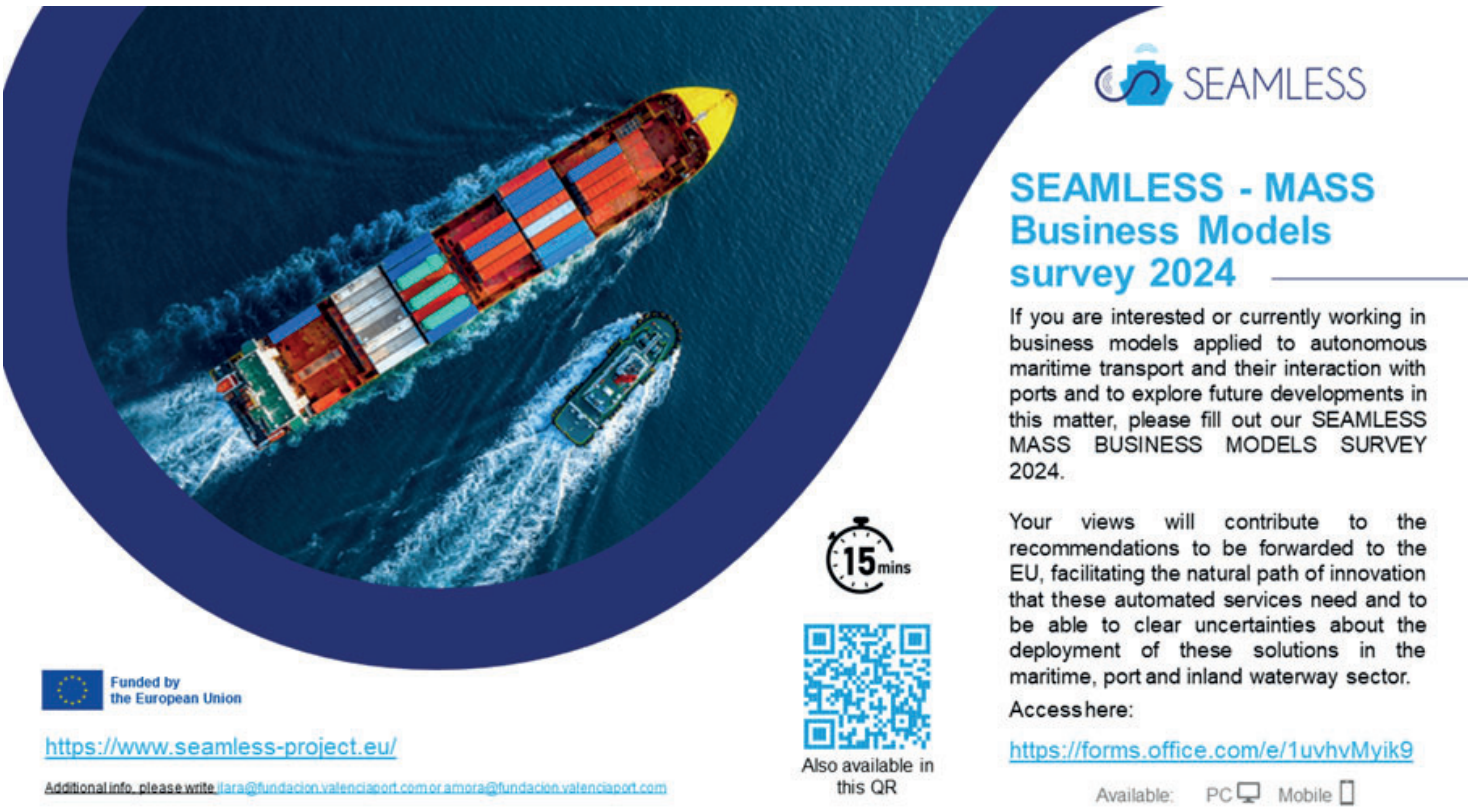
SEAMLESS: MASS business model survey

Ready to dive into the future of autonomous ships and ports and revolutionize the logistics chain, including ports?. Are you working on business models related to this hot topic? SEAMLESS is leading the charge by launching a questionnaire, and we need YOUR input!

Our mission? To develop cutting-edge technology that'll make waterborne freight services fully automated, economically sound, and eco-friendly for Short Sea Shipping (SSS) and Inland Waterway Transport (IWT). With autonomous systems, we're paving the way for safer, greener operations, shifting freight transport from roads to waterways. One of the main objectives of the project is to analyze the state of the art of business models applied to autonomous maritime transport, to identify those business models that could offer real alternatives to the needs of the sector as well as to explore future developments within their organisations, to understand them and to put them in value.

Want to be part of the journey?
Simply scan the QR code or hit this link: https://forms.office.com/e/1uvhvMyik9

Your insights will help us shaping the future recommendations to the EU, guiding the innovation needed for seamless deployment in the maritime, ports, and inland waterway sectors.



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