Photo: Ulstein

SEUS SMART EUROPEAN SHIPBUILDING 2025 REPORT



SARC MARITIME SOFTWARE AND SERVICES
GONDAN SHIPBUILDERS
CADMATIC ULSTEIN®
CONTACT Software
NHL STENDEN university of applied sciences
UNIVERSITY OF TURKU
NTNU

Partners


NTNU


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SARC
MARITIME SOFTWARE AND SERVICES


YEARS
GONDAN
SHIPBUILDERS


CADMATIC

SEUS
Smart European Shipbuilding

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Funded by the European Union

This project has received funding from the Horizon Europe Framework Programme (HORIZON) EU programme under grant agreement No 101096224. This report reflects only the author's view and the European Commission is not responsible for any use that may be made of the information it contains.

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Our Vision



SEUS Visions

The Smart Europen Shipbuilding Project (SEUS) project is working to establish a digital framework for European shipyards by building an integrated platform that combines CAE, CAD, CAM, and PDM software. This platform will be tested at shipyards and developed using the expertise of academic and industrial consortium participants. The goal is to create new practices for human-centric knowledge management, data-driven AI design elements, intelligent technology, and the Industry 5.0 concept in shipbuilding.

The aim is to reduce engineering time by up to 30% and assembly and construction time by up to 20% in European shipyards. Improving the flow of digital information and streamlining work processes present opportunities for reducing time and costs, resulting in significant economic benefits for the shipbuilding industry.

Objectives

The main objectives of the SEUS project are:

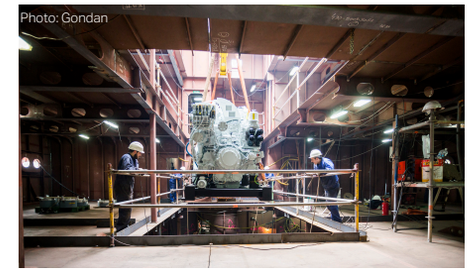
- Computational tool platform solution for PLM approach in shipbuilding
- Facilitation of digital transformation of shipbuilding,
- Increase in traceability and integration of early design impacts on the design process,
- Competitive advantage for EU shipbuilders through time savings in design and production stages,
- Expansion of shipyard's exposure to ship's life cycle: for retrofit, revitalization, use of data from operation and maintenance,
- Management of shipbuilding knowledge with a focus on human needs,
- EU maritime workforce skills and expertise development.

Business Areas

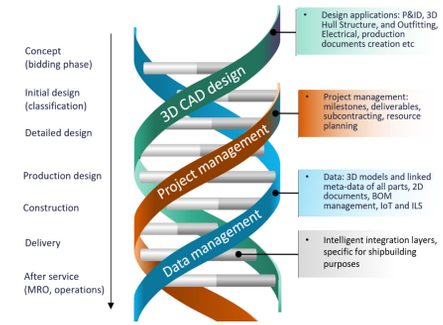
Computational Tools & Data Integration

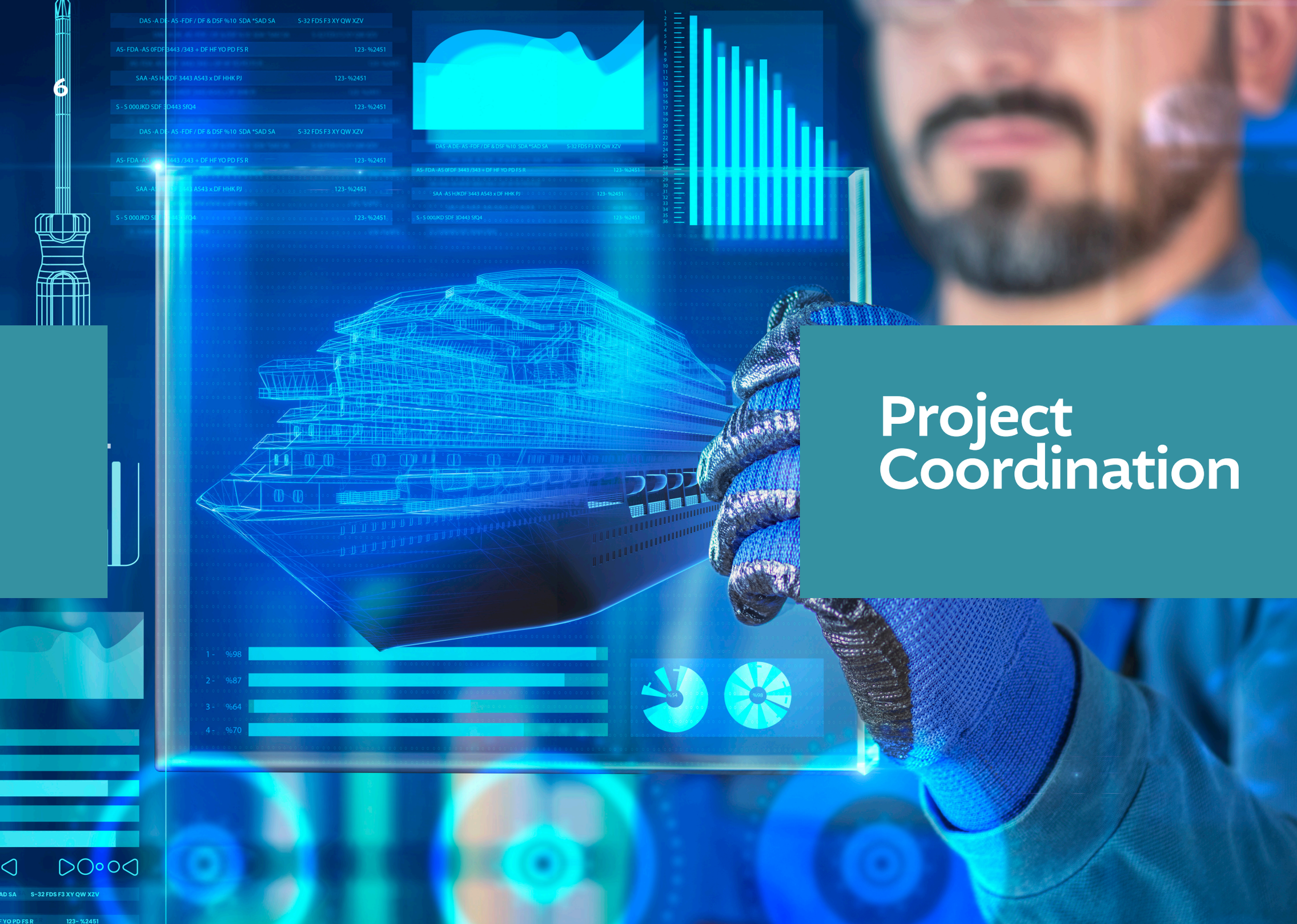


Data Driven Ship Design & Shipbuilding



Knowledge Management




Project
Coordination



Henrique M. Gaspar

Photo: Tony Hall

Horizon Europe - Computational Tools for Shipbuilding

2025 stands out as the year in which the SEUS project advanced from promising foundations to visible and tangible transformation. Across Europe, shipyards, software developers, and research institutions intensified their collaboration, steadily turning SEUS's long-term vision into operational reality. The third project year has been marked by technical breakthroughs, confident progress across all work packages, and a strengthened collaborative environment.

As SEUS has matured, the scope and depth of its activities have increased significantly. Industrial partners are testing an integrated cloud environment that merges advanced PLM capabilities, multi-dimensional taxonomies, and connected CAD/CAE processes. Researchers have contributed a substantial body of scientific work, offering new methods and insights that directly shape platform development. Throughout the year, project results have been presented in seminars, workshops, and conferences across Europe, enhancing the project's visibility and reinforcing its role within the broader maritime digitalization landscape.

A notable achievement is the growth of the SEUS repository ecosystem on Zenodo and GitHub. These repositories are becoming central knowledge hubs where datasets, publications, and software components accumulate to form a lasting digital foundation for shipbuilding research and innovation.

With coordinated progress and no deviations at the objective level, SEUS concludes 2025 on a stable and optimistic trajectory. The project enters its final year with a strong technological base, validated industrial components, and a consortium aligned around the remaining milestones.

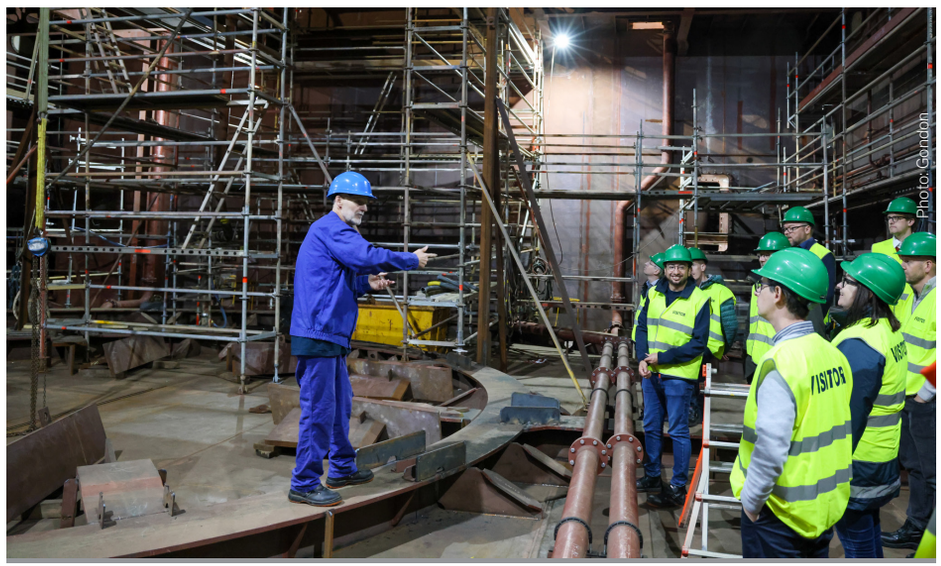
Industrial Developments: Cloud Environment and PLM Capabilities

A major achievement in 2025 is the continued development of the SEUS Cloud environment, based on commercial high TRL tools from the industrial partners, which remains the central space for testing, validation, and collaborative development. The cloud solution integrates existing commercial tools into a unified platform that supports interoperability analysis and efficient iteration across partners.

Within this environment, the Product Lifecycle Management (PLM) system has advanced substantially. Supported by a multi-dimensional taxonomy, the PLM system now unifies equipment and TAG structures, document lifecycles, early-design objects, CAD/CAE models, part libraries, workflow metadata, and planning structures such as PBS and WBS. This cohesive structure maintains consistency across design and production stages, providing shipyards with a reliable digital thread that links engineering models, documentation, and activities.

The system's integrated approach reflects the complexity of shipbuilding processes while improving the transparency and coordination of work between disciplines. Its connections with CADMATIC tools and PIAS continue to mature, with the goal of enabling designers to work from synchronized, up-to-date information throughout the design lifecycle.

Implementation work at the shipyards shows increasing engagement from industrial users. Substantial datasets have been imported into the platform for evaluation, including historical project information, concept-design models, equipment structures, and document repositories. User surveys conducted during 2025 indicate acceptance, with positive feedback on document workflows, data consistency, and the benefits of centralized project management. These results reflect the growing maturity of the SEUS ecosystem and its preparedness for broader pilot applications.



Research Achievements and Academic Collaboration

In 2025, academic partners matured into the topic, and produced numerous peer-reviewed publications, contributed to international conferences, and advanced methodologies essential to the project's technological development. Research efforts addressed topics such as interoperable ship design data structures, multilingual information-retrieval systems, knowledge-management frameworks, lifecycle activity mapping, machine-learning methods for early design, human-centric digital transformation, and emerging Industry 5.0 principles.

A defining strength of SEUS continues to be the close interaction between research and industrial application. Researchers have worked with real shipyard datasets to validate concepts, while developers and industrial partners have benefited from the theoretical and methodological contributions produced within the academic work packages.

Conferences, Workshops, and Industry Engagement

The SEUS consortium maintained high visibility in 2025, participating in major forums dedicated to maritime technology, computational engineering, and digital transformation. Presentations at events such as OMAE, ECMS, COMPIT, HIPER, PRADS, and several thematic workshops provided opportunities to share results, gather feedback, and strengthen ties with the maritime innovation community.

Workshops held at the shipyards in Norway and Spain were particularly valuable, allowing partners to test platform functionalities directly in operational environments. These interactions facilitated knowledge exchange, supported iterative improvements, and helped refine the prioritization of technical developments. Such engagement activities reinforce SEUS's role in the European digitalization landscape and help establish networks that can sustain further innovation beyond the project's completion.



Photo: Gondan

Work-Package Development and Pathways to Impact

SEUS has moved decisively from preliminary research into a fully functional cloud platform. The developments documented in the WP2, WP3, WP4 and WP5 sections of this report show how early activities - such as best-practice analysis, initial data-model structuring, architecture definition, and pilot preparation - have matured into coordinated platform development, industrial testing, and the integration of AI-enabled capabilities.

The project's pathways to impact are now evident. The integrated SEUS platform demonstrates potential for improved efficiency, reduced design rework, streamlined information flows, and enhanced lifecycle traceability. Early industrial data confirms benefits in documentation management and workflow transparency. Scientific outputs continue to expand, training activities support workforce development, and open repositories ensure long-term accessibility and reuse of results. These combined efforts strengthen Europe's competitive position and lay a foundation for sustained digital innovation in shipbuilding.

Outlook for the Final Year

As SEUS enters its final project year, it does so from a position of alignment, technical readiness, and strong collaboration. With the core platform components in place and industrial evaluations underway, the focus for 2026 will be on final integration, comprehensive use-case assessment, consolidation of the business-model framework, and preparation for the concluding demonstration of the SEUS Smart Shipbuilding Framework. The consortium remains committed to delivering an interoperable, human-centric digital platform that will support European shipbuilding competitiveness and long-term innovation.





Innovation Actions (IA)



Photo: Ulstein





Photo: Tony Hall

Hans Petter Hildre

Maritime Innovation

Europe has been a global leader in maritime business for centuries but is facing challenges – globalisation and very tight profit margins. During the last 7-8 years the world fleet has expanded by more than 20%. Europe has historically been dominant when it comes to ownership, and still almost half the world fleet is under European control. On the other hand, operations have increasingly moved away from Europe and today many Asian cities are more important for operations than traditional European centres. We also see that European ownership dominance is falling, as Asian shipowners have taken most of the growth in the last few years.

Energised by changes in technology and mobility, globalisation has greatly changed economies and has made our world more interconnected. The speed of globalisation is relentless. Global trade is growing, and international regulations stimulate mobility of services, capital, and labour.

How can Europe still be a global maritime leader? Innovation is a crucial factor in enabling European maritime industries to handle these challenges. Research, competence development and collaboration are important to support and stimulate such innovation. Cluster collaboration and innovation can be a way for maritime industries to work together to promote sustainability while fulfilling the demands of markets.

Maritime Clusters are geographic concentrations of similar or related companies and organisations - such as offshore, wind services, seafood, shipping, equipment, and port operations - that share common markets. Larger companies use these networks to improve their efficiency and engage a networked economy. At the core of the clusters are companies producing key products, such as vessels built by the shipbuilding industry.



Maritime clusters create competitive advantage by facilitating mutually beneficial relationships between the companies in the cluster. Regions with good maritime education and training combined with surrounding industrial clusters of advanced companies will have a precondition to develop new competencies for the maritime industry. Hence, close links between universities, shipowners, ship builders, and equipment manufacturers are critical for the strength of such a R&D development strategy.

In the long term, the competitiveness of maritime companies is shaped by the cluster dynamics, that is, by relationships between the different players. University industry collaboration refers to the interaction between any parts of the higher educational system and industry aiming mainly to encourage knowledge and technology exchange. The collaboration between universities and the industry is increasingly perceived as a vehicle to enhance innovation through knowledge exchange. The quality and variety of maritime education institutions, as well as industrial clusters with the necessary density of companies, are key to increase competitiveness. Clusters of companies, competing and cooperating, support innovation, entrepreneurship, and access to talents.

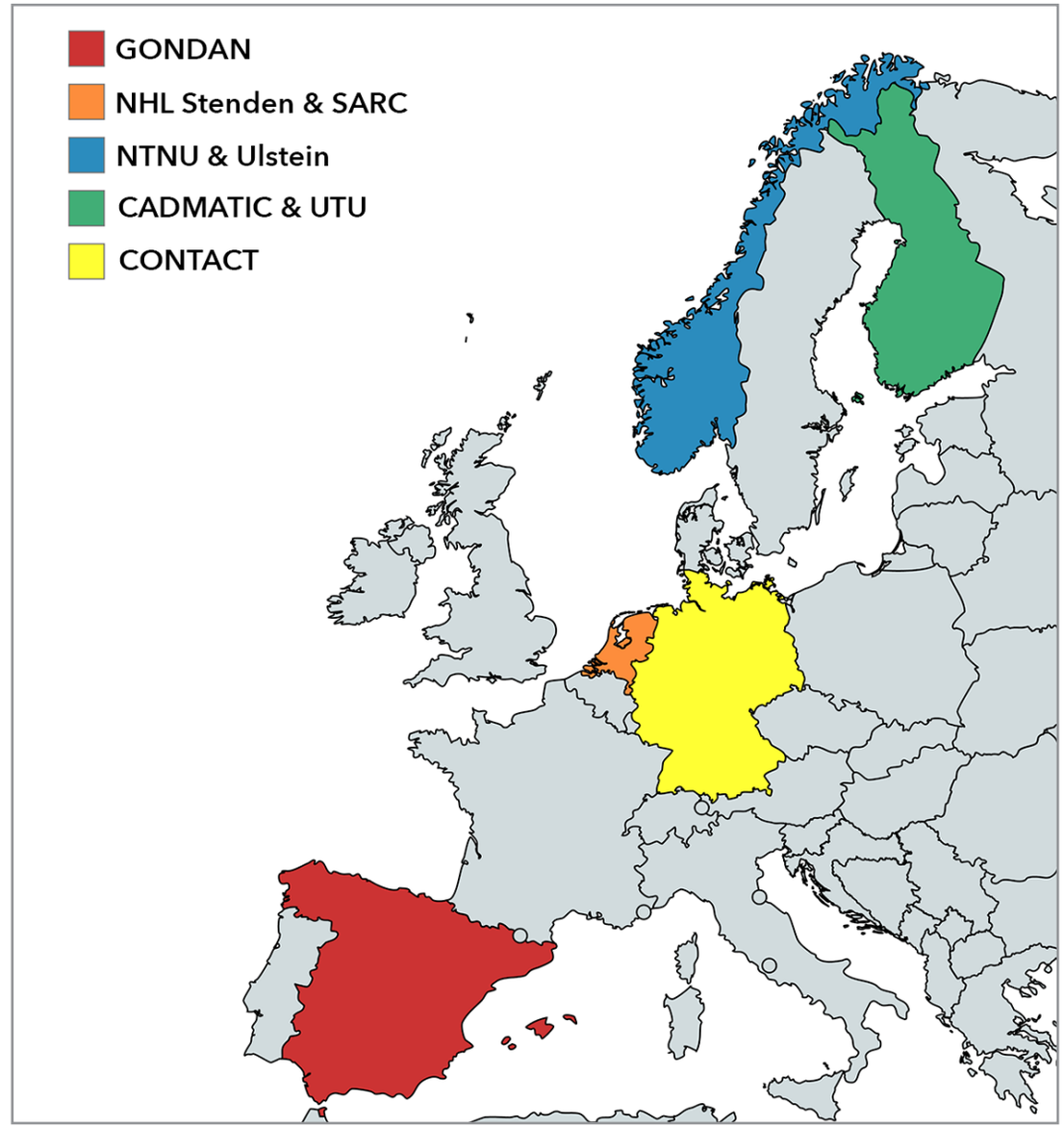
New business and research areas are undergoing strong growth and development. The future maritime activities will integrate people in a way that can digital technology transform how we design, build, and operate ships.

The consortium in the Smart European Shipbuilding (SEUS) do have very strong local and national industrial clusters and universities. If we can cooperate effectively, we will create cluster of clusters with shared mutual interests.

Computational tools have a great potential to generate value for our shipbuilding industry and corresponding maritime clusters. A common smart framework will strengthen all partners. Openness and information-sharing are particularly important, both for reducing transaction costs and more importantly for knowledge flow and innovation.

If the partners in SEUS, together with their maritime clusters, can cooperate together than a significant momentum for improved competitiveness can be achieved.

I would like to take this opportunity to express my gratitude to the partners, CADMATIC, CONTACT, Ulstein, Gondan, SARC, NHL Stenden and University of Turku, and NTNU, who are contributing to our common goal - improving competitiveness in the European shipbuilding industry.





Partners

APPLIED RESEARCH AND INNOVATION

NTNU
NHL STENDEN university of applied sciences
UNIVERSITY OF TURKU

Research
smart technologies, applied use cases, research of implications, knowledge management

metrics from applied research in shipbuilding

SOFTWARE DEVELOPMENT

CADMATIC
CONTACT Software
SARC MARITIME SOFTWARE AND SERVICES

computational tools
development, integration and implementation

new business cases for the software developed

SHIP DESIGNS AND SHIPYARDS

ULSTEIN®
GONDAN SHIPBUILDERS

identification of gaps in processes in shipbuilding and potential to fill these.

short lead time during design, engineering and construction



SEUS
Smart European Shipbuilding

The SEUS project is a collaborative effort between eight international partners from Germany, Finland, Norway, Netherlands, and Spain aimed at improving shipbuilding processes. The partners collaborate to **develop a new computational toolset** that considers the target user groups' needs, new research in industry and technology, integration and interoperability aspects of the platform, the novel human-centric approach, and the required support processes for project management and dissemination.

NTNU leads the project and is responsible for **researching and evaluating a new PLM approach,** while UTU focuses on **human-centricity.** CADMATIC, Sarc, and CONTACT are responsible for **software development**. Ulstein and Gondan shipyards will **implement the platform and provide feedback** on its development. Finally, NHL Stenden ensures that the project is **visible** and that it shares relevant information about its objectives, undertakings, and outcomes with the appropriate stakeholders and scientific communities. This approach promotes the engagement of the target audience in SEUS activities.

In general, the SEUS project aims to develop a unified data exchange standard for shipbuilding, improve stakeholder communication and cooperation, and identify gains from PLM implementation. The project addresses **multiple aspects of the shipbuilding process, from research to software development and implementation.**





NTNU

Photo: Sissel Basso

Knowledge For A Better World

Norwegian University of Science and Technology (NTNU) is a globally focused university with main campuses in Trondheim, Gjøvik, and Ålesund. The university strongly emphasizes science and technology, offering a range of professional study programs and a wide breadth of academic subjects, including the humanities, social sciences, economics, medicine, health sciences, entrepreneurship, and artistic activities.

In 1996, the NTNU was established through the merger of the University of Trondheim with other higher education institutions. These institutions have a rich history that dates back to the 1760s. Since then, NTNU has also included a few former university colleges and grown to become the largest university in Norway.

The Department of Ocean Operation and Civil Engineering (IHB) of NTNU is located in Ålesund. With the close industry ties with the maritime cluster in the region, IHB offers a unique education and experiential learning experience to students and researchers hoping to find synergy between technology, human factors, and business. Providing this unique industrial connection, IHB aims to be a global hub for knowledge and innovation in maritime operations.

Mission

NTNU is a university that conducts primary research and educates outstanding graduates. They offer research-based education at all levels and have expertise in nature, society, people, and technology, which they share with a strong commitment. The university promotes cultural values and innovation in business and public administration and contributes to cultural activities. The university aims to use its knowledge to help people and solve global challenges. The activities of NTNU are to promote human rights, development, and intercultural dialogue.

Link: www.ntnu.edu/ihb


Photo: Geir Mogen/NTNU


Photo: Geir Mogen/NTNU

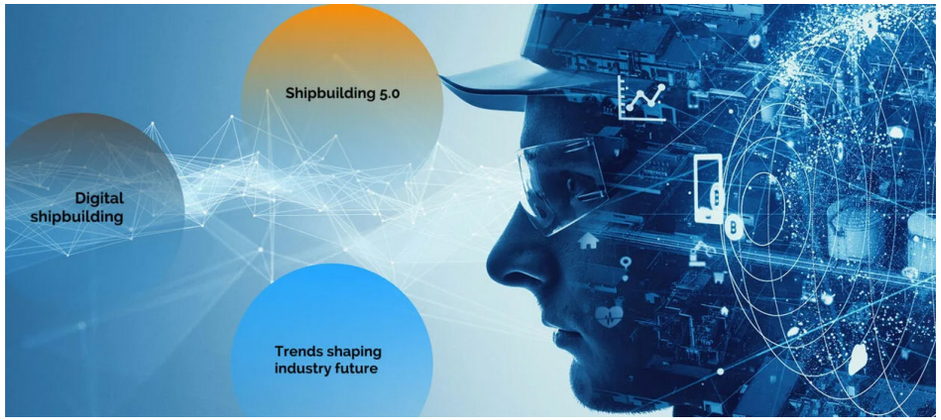


CADMATIC

SEUS Project at Cadmatic :
Bringing the PLM platform closer to shipbuilding realities

Development of the SEUS platform is an active, ongoing effort, executed in close alignment with Cadmatic's product development governance and cybersecurity requirements. The work is carried out using secure-by-design principles and robust cyber security processes that cover the full development lifecycle - from access control and repository management to code review, testing, and release readiness. In parallel, Cadmatic ensures structured coordination across all vendors and technology partners involved in the project, with clear interfaces for requirements, architecture decisions, and integration planning.

A central focus is to ensure that the platform evolves according to best practices in shipbuilding and supports realistic production workflows, information structures, and collaboration patterns between stakeholders. Continuous alignment between partners and vendors enables consistent implementation choices, improves interoperability between components, and reduces integration risk as the solution matures toward customer-grade deliveries.



During 2025, two releases of the PLM platform were delivered (2025H1 and 2025H2). These releases introduced gradual implementation of a new shipbuilding-specific data model and increased integration with other solution components to improve end-to-end workflows. User documentation was added and expanded to support adoption and consistent usage across stakeholders.

The platform has been tested with project partners, and feedback has been systematically collected and reviewed. This input has been used to adjust development priorities, refine usability and integration points, and strengthen the basis for later exploitation of the project results. Continuous collaboration with industry stakeholders has also helped confirm that Cadmatic's targets remain well aligned with market demand.

Link: www.cadmatic.com





CONTACT

Digital Transformation

CONTACT is a leading vendor of open standard software and a pioneer of open source for product engineering and digital transformation. Our products enable project organization, reliable process implementation, and global collaboration based on virtual product models and their digital twins. Our open technology and the low-code platform. Elements are ideal for integrating IT systems and the Internet of Things to create end-to-end business processes.

Agile Collaboration

Shipbuilding deals with complex projects and involves numerous trades. Efficient project management is essential to provide suitable support for shipyards, their engineers, and suppliers. CONTACT Project Office combines systematic planning and control of the entire project with agile collaboration within individual teams. It also intelligently merges complex delivery structures of engineering processes with conventional project elements. The data of a new product, which is contributed by many companies, should be always available in its current version, even beyond organizational and system boundaries. Additionally, CONTACT Collaboration Hub simplifies data flow through intelligent data sharing and supports end-to-end processes. It is particularly suitable for collaborating in engineering projects and integrating suppliers.

Mastering The Entire Product Lifecycle

CONTACTs PLM system CIM Database supports every phase along the entire product lifecycle, from first ideas to customer use. It combines product data management through virtual models and digital twins with functionality for collaboration as well as process and project management. This enables companies to streamline their processes, increase efficiency, automate routine tasks, fulfill regulations more easily, conserve resources, and improve their results.

CONTACT Software Research is well suited to meet these unique requirements. We work with industry partners and the global research community to explore and validate sustainable solutions for the engineering and production of tomorrow in a wide range of fields.

Our focus topics are clustered along the strategic triangle of digital sovereignty, including the development of new



digitalization strategies for various industries to determine and implement different types and degrees of digital transformation, as well as digital maturity.

Our research focuses on improving digital maturity levels by enhancing data availability, process management, employee qualifications, and integration with customers, partners, and suppliers. We also develop and implement process patterns to increase efficiency through standardization and automation across the product lifecycle.

Link: www.contact-software.com



SARC



The Company

SARC BV is a naval architectural software development company founded in 1980. They started with basic software and have since grown to a team of 15 experienced naval architects involved in software engineering and project management. SARC continues to invest in **research and development** to offer state-of-the-art solutions to clients.

Standard Software

SARC offers software called PIAS and LOCOPIAS for ship design and onboard use. The software complies with the latest legislation and classification societies demands. PIAS includes modules for hull design, decks, bulkheads, compartments, and probabilistic damage stability. It is used by over a hundred organizations, while LOCOPIAS has been delivered for more than a thousand vessels.

Project Support

Besides developing new software, SARC also offers project support for design offices, shipyards, ship owners or any other party that lacks time, capacity, knowledge or software. Using our **in-house developed software** as basis for project support, SARC can ensure expert and highly efficient use of software. Over the years, SARC has been involved in over 3500 projects, with tasks such as:

- Calculations for tables of hydrostatic data and tank sounding tables.
- Calculation and optimization of probabilistic damage stability.
- Intact stability booklets.
- Performing inclining tests and light weight surveys.
- Comparative studies on longitudinal strength.
- Determination of engine power requirements, including propeller optimization.
- Preliminary ship design, including preliminary lines plan and all design calculations.
- Hull fairing, and producing shell plate expansions.
- Advise on optimal use of developable shell plates.
- Calculations of stability and motions of heavy transports.
- Ship hull shape measurement.
- Design or computations on non-ship structures, such as a floating swimming pool and a river flood barrier.

Vessel types include tugs, passenger ships, tankers (chemical, gas, crude and product), livestock carriers, heavy lift vessels, heavy cargo vessels, container ships, bulkers, reefers, fishing vessels, sailing vessels, frigates, patrol boats, landing platform docks, pontoons, crane vessels, yachts, submarines, survey vessels, standby vessels, suppliers, ferries, short sea ships and inland waterway vessels.

Software Support

All SARC employees are involved in support, developing software and projects. Therefore, in general questions are answered by experienced users with in-depth knowledge of the software and the applicable **practice and regulations.** SARC highly values this direct contact between end user and developer, as it gives excellent insight in the requirements and opinions of PIAS and LOCOPIAS users.

Link: www.sarc.nl

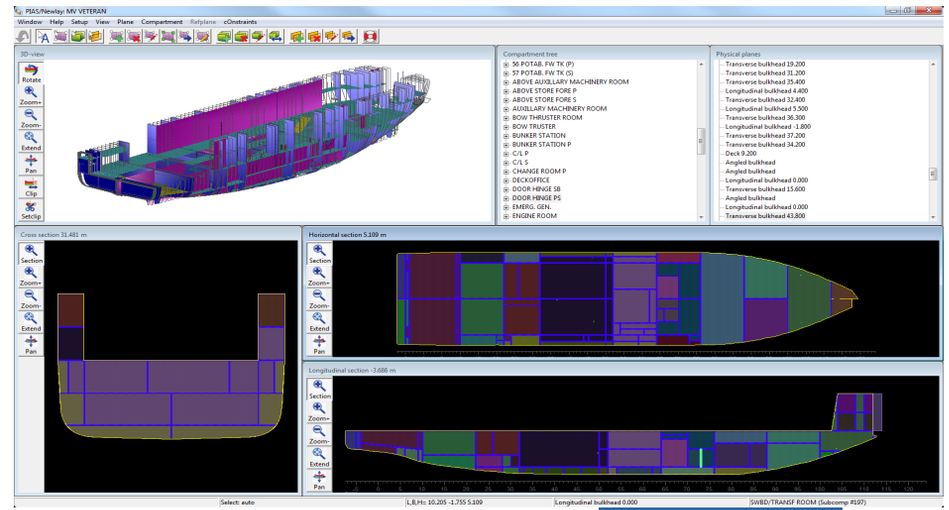


Photo: Ulstein



ULSTEIN

Overview of Ulstein

Ulstein is a third-generation family--owned company and an internationally renowned provider of ship designs, shipbuilding, and system solutions for ships. The company was founded in 1917 and is headquartered in Ulsteinvik, Norway.

Ulstein's vision is to create tomorrow's solutions for sustainable marine operations. For over a century, Ulstein has been able to spot and exploit new opportunities and sustain momentum through changing times in the maritime business. Through hard work and creative enthusiasm, the group keeps renewing and applying its expertise to benefit its customers. Ulstein bases its work on a continuous exchange of knowledge and experience in the maritime cluster between energy companies, contractors, shipowners, designers, suppliers, and shipbuilders.

Ulstein is an international and innovative driving force within marine operations. The group provides cost-effective, safe and reliable products and services to future-oriented players who think holistically and long-term.

Its solutions allow shipowners, operators and contractors to gain long--term competitiveness in their marine operations.

Ulstein's values are Innovate, Engage and Advance. Its employees shall be able, willing and allowed to carry these through.

Innovate

We are bold but disciplined when finding and turning new ideas into reality.

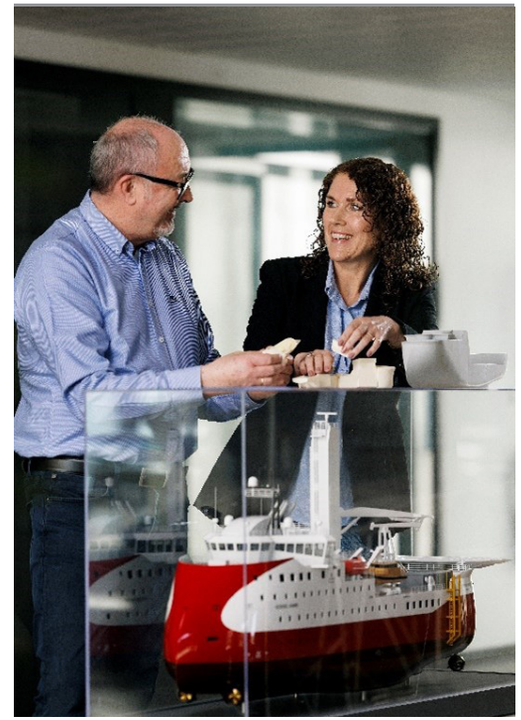
Engage

We say yes to committed employees who help us solve the challenges facing Ulstein and the industry.

Advance

We actively seek possibilities for further development and improvement.

Link: www.ulstein.com







Gondan

Photo: Gondan

GONDAN Shipbuilders

Tailor-made shipbuilding

GONDAN Shipbuilders, founded in 1925, is a centenary shipyard with a proven track record in the construction of specialized vessels for international shipowners. Over the years, it has developed a wide variety of units–from tugboats and offshore vessels to support and passenger ships–with one common denominator: designing and building solutions tailored to each customer's actual mission.


Photo: Gondan

GONDAN's approach is based on combining industrial capacity, applied engineering, and rigorous control of the construction process to ensure that each vessel meets technical, quality, and schedule requirements. The company integrates its accumulated experience with the continuous incorporation of improvements in manufacturing methods, project management, and standardization, enabling it to tackle complex programs with reliability and consistency.

The relationship with the shipowner is a key pillar in this model. GONDAN works closely and transparently with its clients, as well as with designers, suppliers, and classification societies, to transform operational needs into concrete solutions. This collaboration throughout the project cycle–from technical definition to testing and delivery–helps maximize performance, safety, operational availability, and efficiency in service.

Over the last year, GONDAN has strengthened its activity with outstanding results that consolidate its position in highly specialised segments. These include the addition of the Pole Star to the Northern Lighthouse Board fleet, the delivery of the USV Challenger –our first unmanned vessel– and the delivery of the latest CSOV Austri Enabler. At the same time, GONDAN maintains an active portfolio with new units underway, including an offshore tugboat and an OESV for Østenjø Rederi, and the signing of a contract for the construction of two oceanographic vessels for the German Government, demonstrating the shipyard's ability to meet demanding technical standards and tackle projects with a high level of systems integration.

With a long-term vision, GONDAN continues to develop projects that combine performance, reliability, and efficiency, reinforcing its role as a leading industrial partner for shipowners who require specialized vessels, built with technical rigor and a clear focus on operational results.

Link: www.gondan.com


Photo: Gondan



NHL Stenden
University of Applied Sciences

About NHL Stenden & MIWB

NHL Stenden University of Applied Sciences is a dynamic and innovative institution renowned for its commitment to excellence in education and research. With campuses in the Netherlands and internationally, NHL Stenden offers a diverse range of programs tailored to meet the demands of today's global society. Committed to fostering creativity, critical thinking, and practical skills, NHL Stenden equips students with the tools they need to succeed in their chosen fields. Whether in hospitality, business, engineering, or arts and sciences, students benefit from hands-on learning experiences and personalized support from dedicated faculty. Embracing cultural diversity and sustainability, NHL Stenden cultivates a vibrant community where students from around the world come together to collaborate, innovate, and thrive. From cutting-edge facilities to industry partnerships, NHL Stenden prepares graduates to make meaningful contributions to their professions and communities.

The Maritime Institute Willem Barentsz (MIWB) on Terschelling, Netherlands, is a beacon of maritime education and research with over a century of esteemed history. Offering programs in maritime management, engineering, and navigation, MIWB prepares students for the dynamic demands of the global maritime industry. Under the guidance of experienced faculty and industry experts, students at MIWB benefit from practical training and cutting-edge facilities. The institute's strategic location on the UNESCO world heritage Wadden Sea provides a unique learning environment rich in maritime culture and activities. Committed to sustainability and innovation, MIWB collaborates closely with industry partners to explore emerging technologies and best practices. Through its emphasis on leadership, teamwork, and professionalism, MIWB equips graduates to excel in their maritime careers and contribute meaningfully to the industry.

Link: www.nhlstenden.com



Photo: NHL Stenden


Photo: NHL Stenden



University of Turku


Photo: UTU

University Overview

The University of Turku (UTU), Finland's second largest multidisciplinary university, is an internationally competitive research-led university. The UTU is recognized for the quality of research, teaching, and excellent support services. UTU offers study and research opportunities in eight faculties: Humanities, Technology, Science, Medicine, Law, Social Sciences, Education, and Turku School of Economics; and in four independent units. In the international QS ranking, the UTU is among the top 400 universities and is ranked the fifth best university in Finland (QS Ranking 2025).

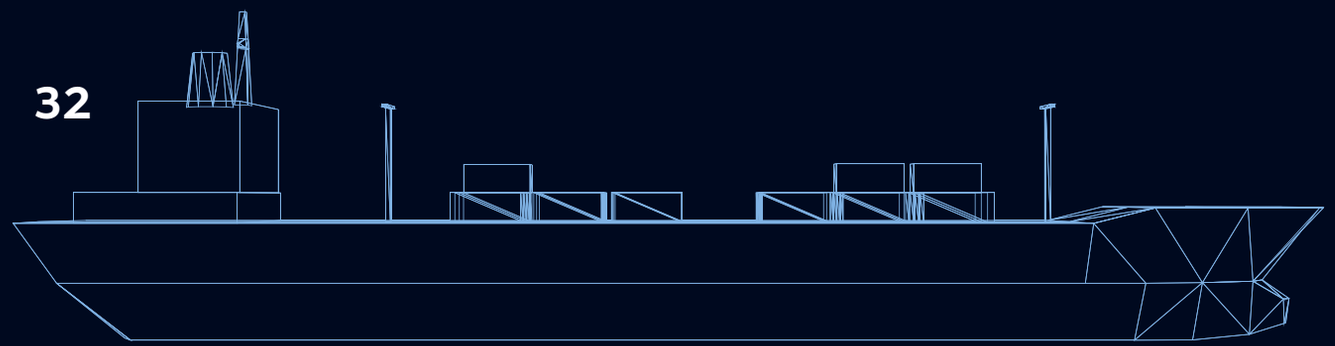
Today, the UTU has about 23,000 students and about 3,600 staff members (16.2% international, 58.6% female). External funding covers 42% of the total funding of 330 million euros. The UTU is active in international cooperation. It is a member of the Coimbra Group, a network of prestigious universities in Europe, and the EC2U European Campus of City-Universities alliance. Over 2,500 international students from over 100 countries study annually in the University of Turku.

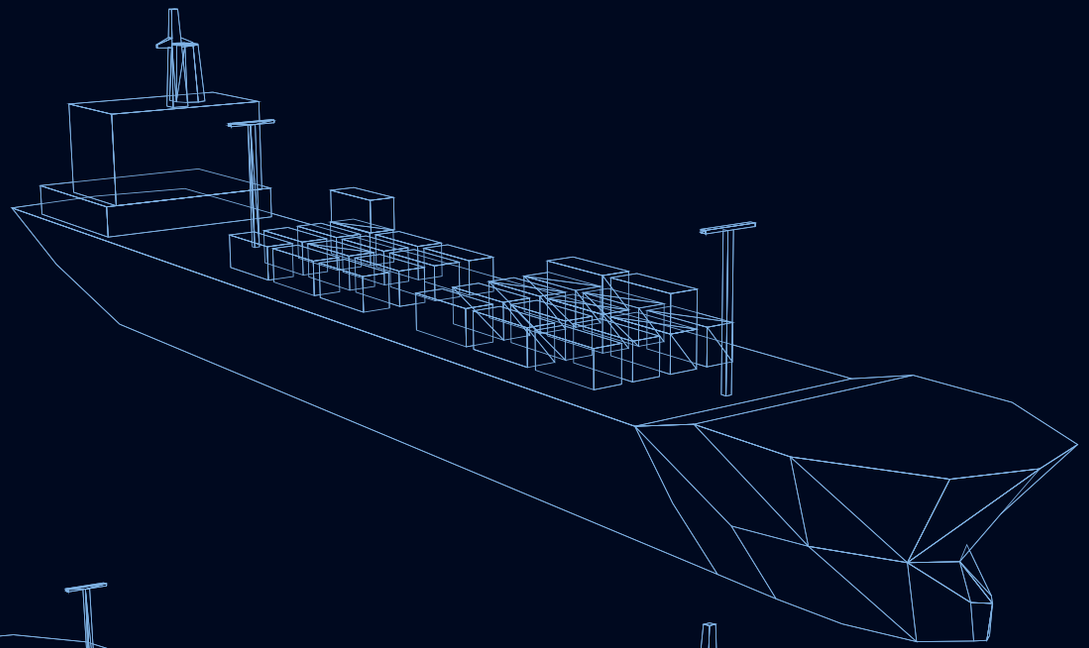
In June 2013, the European Commission awarded the University of Turku the right to use the HR Excellence in Research logo, and this right was continued 2024 onwards. The logo is a token of the University's commitment to continuous development of the position and working conditions of researchers along the guidelines set forth in the European Charter for Researchers.

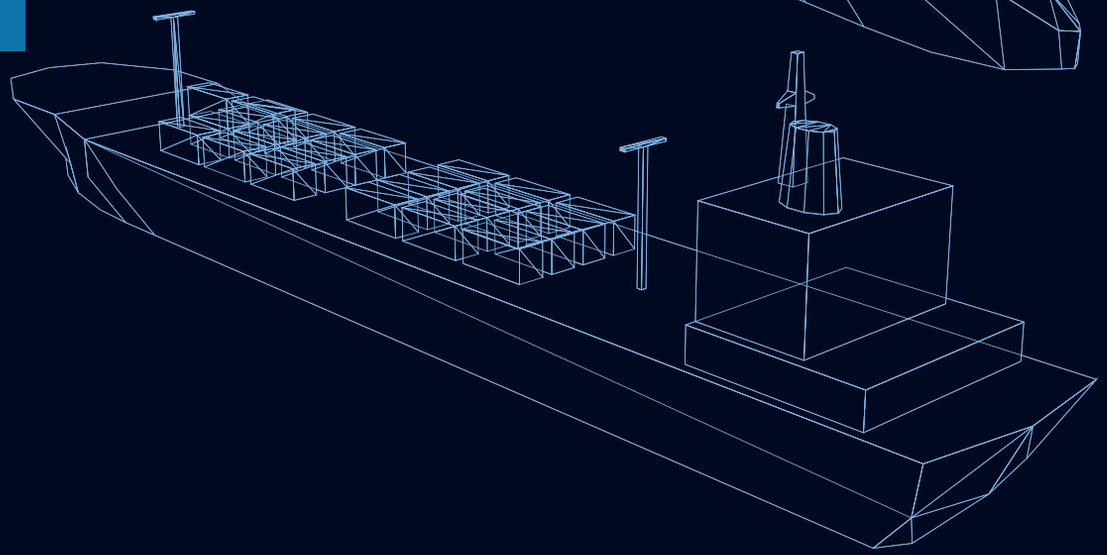
The UTU is an internationally competitive university whose operations are based on high-quality, multidisciplinary research. The UTU promotes education and free science and provides higher education that is based on research. SEUS project belongs to the Maritime and seafaring thematic research area, which is one of the multi-disciplinary strategic profile areas of the UTU till the end of 2024.

The Faculty of Technology that is involved in SEUS project was established 2021, and it is now one of the largest faculties of the UTU. The faculty consists of three departments: Computing, Biotechnology, and Mechanical and Materials Engineering. Emphasis is placed on using the knowledge produced in the field as a basis for solving the complex problems in society. The faculty is an active partner of the businesses in the region of South-Western Finland and internationally.

Link: www.utu.fi/en









WP1:
Best Practice for Smart Shipbuilding




Photo: Tony Hall

Work Package Overview

Work Package 1 (WP1) of the SEUS project addresses research, evaluation and compilation activities to identify the best practices for the smart Product Lifecycle Management (PLM) approach in shipbuilding. It also aims to build a new body of knowledge for the value of shipbuilding can expect to gain from digitalization, a single-source of truth (SSoT) approach with compelling information and data sharing for all stakeholders. The applied nature of such research and interconnection with the computational tool development process (WP2 and WP3) and end-user perspective (WP5) will deliver a practical approach to innovation and implementation of EU shipbuilding industry expertise. As such, the following tasks were identified for this work package:

- **Data Collection of current and best practices** – Collect and analyze available data for current PLM practices in shipbuilding in European and global contexts.
- **Evaluation of bottlenecks and points-of-improvement (POI) for solution development and adoption** – Synthesize the collected data to understand opportunities for improvement and potential risks or bottlenecks related to the development and implementation of the PLM solution.
- **Framework Compilation** - Continuously evaluate and assess the data and relevant elements for SEUS' PLM solution and framework adoption.

Current and Best Practices in European Ship Design and Shipbuilding

European yards face a range of unique challenges. They operate within a highly multi organizational environment that involves extensive offshoring, which increases coordination complexity. Their vessels typically require a high degree of customization, demanding advanced and sophisticated systems integration. Lifecycle management is often fragmented across numerous stakeholders, making it difficult to maintain continuity and transparency throughout the process. In addition, shipyards frequently work within limited physical capacity, requiring very precise and efficient facility planning. Finally, they must respond to increasingly stringent regulatory requirements, particularly in relation to environmental standards.

At the same time, the industry is experiencing rapid regulatory changes and increasing pressure related to sustainability, alongside heightened competition, digitalization, global connectivity, and greater risk aversion. These dynamics create a need for a more up to date understanding of shipbuilding practices, as well as a more accurate representation of shipyards' and firms' expectations for a modern PLM solution. To cover this information, the research was narrowed to the following main themes:

- **EU Place in Shipbuilding Market** – Current trends in European and

global ship design and shipbuilding industries,

- **The Ship Design and Shipbuilding Process** – Current practices and logical stages in ship upstream lifecycle,
- **Multi-domain Taxonomy** – Paradigms in how ship data is presented in ship design and shipbuilding,
- **The Ship Design and Shipbuilding Toolbox** – The state of digital tools used in the industry
- **Distinctions in Ship Design and Shipbuilding** – Unique perspectives and challenges on the application of lifecycle management tools in ship design and shipbuilding,
- **SSoT Concept or Attempt** – Current and latest attempts to develop an SSoT Solution thus far.

	Deliverable Name	Lead	Dissemination Level	Due Date	M6	M12	M18	M24	M30	M36	M42	M46	M48
WP1 - Best practices for smart shipbuilding / NTNU													
D1.1	Results and analysis of the best practices research	NTNU	PU - Public	18	☑		☑						
D1.2	Result and analysis of the survey	NTNU	SEN - Sensitive	18	☑		☑						
D1.3	Strategic roadmap for development	CADMATIC	SEN - Sensitive	12	☑	☑							
D1.4	Framework compilation	NTNU	SEN - Sensitive	48									◊

Survey Findings and results / Evaluation of bottlenecks and points-of-improvement (POI) for solution development and adoption

According to the results of the project's survey, advancing the transformation of EU shipbuilding requires improved data management practices, including higher data quality, better compatibility between digital tools, and the development of a SSoT. A desired SSoT solution is characterized by the ability to integrate information across domains while supporting flexibility for different stakeholders and workflows. It should also enable data reuse, facilitate the use of 3D models across value chain phases, ensure that data remains accessible throughout the design process, and integrate intelligently with existing ship design tools. The SEUS project uses these insights to guide development of an intelligent platform leveraging Industry 5.0 technologies to enhance efficiency and collaboration.

WP1 advanced exploratory research related to Industry 5.0 concepts and artificial intelligence (AI) applications in early-stage ship design. The research includes studies on AI-supported General Arrangement (GA) modelling and open-model visualization to investigate future-oriented design approaches relevant to digital shipbuilding. The key results are:

- **Navigating AI in Naval Architecture** contributes to translating current AI "hype" into practical and valuable applications for the naval architecture industry (Bierkowska et.al. 2025).
- **Managing Design Changes in Shipbuilding** includes a unified design simulation model and data format that enables real time tracking of design changes and revisions throughout the ship design and production process (Ha et.al. 2025).
- **A RAG Based LLM Approach for Data Validation and Harmonization in Ship Design** enables the detection of inconsistencies across documents and versions, helping designers maintain data integrity while reducing manual effort (Bronson et.al. 2025).
- **Interoperability in Project Based Industries** highlights the need for clear legal frameworks, adaptable work processes, and supportive organizational cultures and presents a holistic approach addressing human, organizational, and legal dimensions to improve collaboration in both the construction and maritime sectors (Yilmaz et.al. 2025).
- **Application of Neural Networks in Early Stage Ship Design for Stability Evaluation** contributes to more efficient early stage design processes and supports the development of safer, more comfortable vessels for harsh operating conditions (Bierkowska et.al 2025).

The results have been published in diverse conferences, such as IMAM, IFA MIM, PRADS and COMPIT.


Photo: Tony Hall

Inguna Strazdina

Framework Compliation

An evaluation of state-of-the-art and previous SSoT solutions or platforms that was performed to synthesize the data collected from the survey, interviews, and literature review, helped to determine best practices, achievements, bottlenecks, and possible improvements. This compilation is continually updated with data and information gathered from the SEUS platform implementation for broader industry adoption.

WP1 continues to support software development under WP2 and WP3, contribute to industrial implementation under WP4, and enables education and knowledge-transfer activities under WP5. To validate use-case definitions and interoperability requirements, WP1 collaborates closely with software partners while also having industrial engagement through a structured PLM user survey at Ulstein, and academic cooperation with UTU to support the development of digital learning materials.



WP2:
Platform Development





Evgenii Egorov

Overall Project

Work Package 2 (WP2) drives the ongoing development and maturation of the SEUS PLM platform - turning concepts and research outputs into an integrated solution that can be applied in real shipbuilding environments. The work connects multiple disciplines and systems, from early design to detailed design and documentation, and from 3D models to lifecycle-controlled product and equipment data. At Cadmatic, roughly 50 people are involved or partially involved in WP2 activities–spanning software development, productization, documentation, and technical support–to ensure that new capabilities are not only built, but also released in customer-ready form and supported for implementation and daily use.

CAD+PLM Development

Continuous development, secure-by-design, aligned across vendors

WP2 is executed as an active, iterative development program aligned with Cadmatic's product governance and secure software development practices. The work follows a secure-by-design approach across the lifecycle - covering access control and repository management, code review, testing, release readiness, and coordinated delivery practices - so that the platform matures toward customer-grade deployments while meeting cybersecurity expectations. At the same time, WP2 depends on tight cooperation across the consortium and technology partners: aligned architecture decisions, clear integration interfaces, and shared priorities are essential to keep the solution coherent as multiple vendors contribute components and domain expertise.

A key theme throughout WP2 is shipbuilding realism: the platform is continuously shaped around best practices in shipbuilding and the practical needs of shipyards and their engineering ecosystems. This means supporting collaboration patterns, information structures, and workflow governance that reflect how vessels are actually delivered - across hull, outfitting, and electrical domains, and across partners and suppliers.

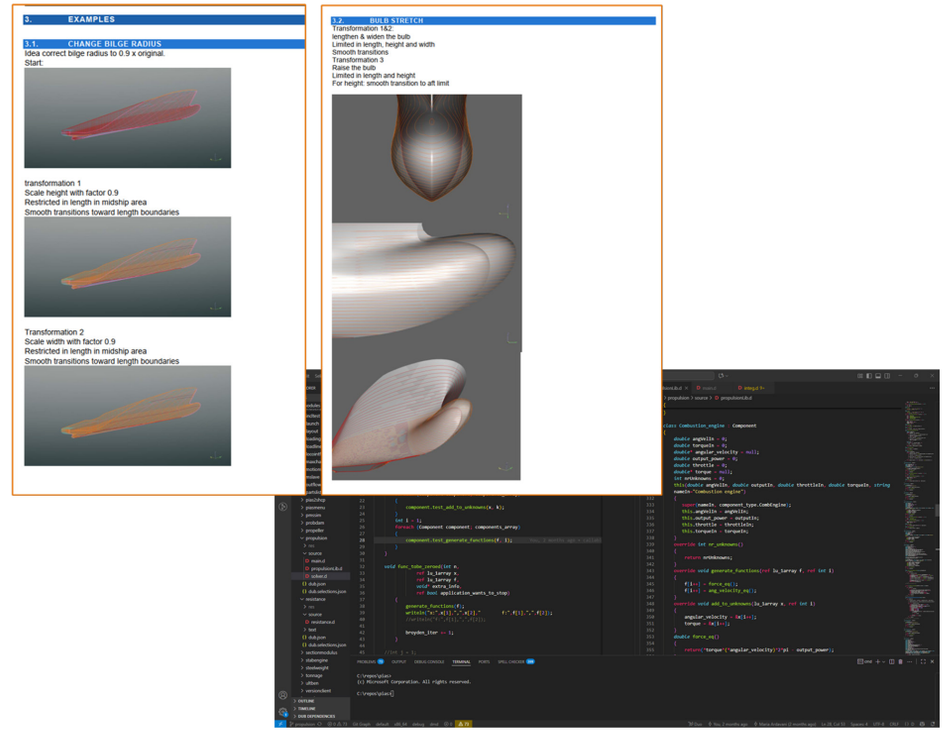
Roadmap, releases, and partner validation

Development is guided by an agile roadmap and backlog that are continuously aligned and refined based on input from project partners and potential users. The roadmap includes both completed work and prioritization for the remaining scope, with development broken down into sprints and issues for implementation. The release cadence was updated from tertial to half-yearly starting 1 January 2025, supporting two platform releases: 2025H1 and 2025H2.

To support collaborative validation, a shared cloud instance enables central access for project participants, while separate local instances have been established for shipyard exploitation. Selected use cases have been executed with each participating shipyard, and the platform has been tested with partners so that feedback can be systematically captured and translated into improved priorities, usability refinements, and strengthened integration points.

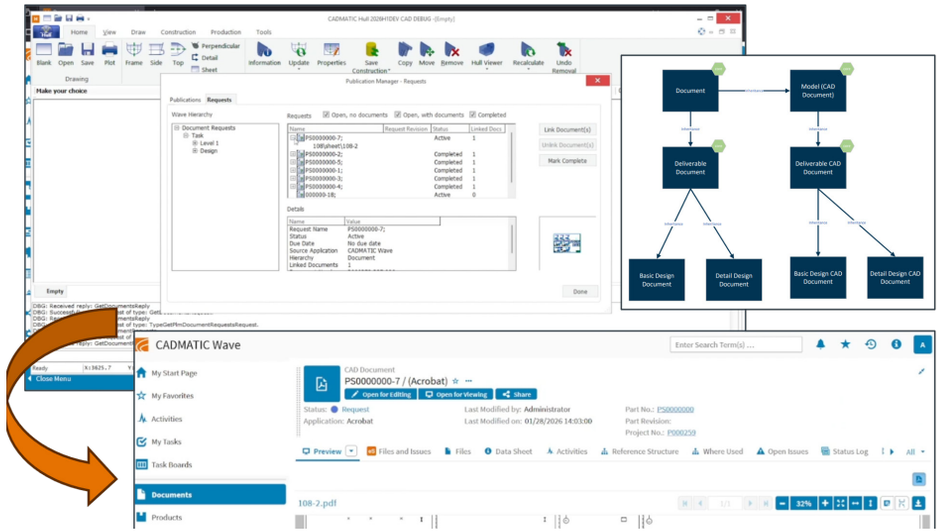
A shared shipbuilding data backbone: product structure and BOMs

A major technical foundation of WP2 is the alignment of the shipbuilding data model, including product structure principles and Bills of Materials (BOMs). Cadmatic and Contact Software specialists have jointly developed and discussed a model that supports the intended use cases and enables consistent mapping and integration across systems. This includes defining core shipbuilding elements and aligning functional and spatial product representations - an essential prerequisite for traceability, change control, and cross-disciplinary collaboration later in the lifecycle.



Integration layer and a digital/virtual ship view

WP2 develops the integrated platform layer that connects tools and information flows across the wider SEUS ecosystem, leveraging inputs from other work packages and linking to downstream work. A key part of this is the evolution of the Digital Mock-Up Unit (DMU) concept as a unified, 3D-based interface for collaboration and review. An early DMU prototype has been expanded with additional use cases such as using 3D models for commenting and 2D documents for redlining, streng-



thening traceability and enabling more effective project communication around a shared visual context.

Early design integration: reducing late redesigns

Shipbuilding benefits significantly when early design decisions remain connected to later engineering phases. In WP2, early-stage design integration is treated as a cornerstone capability, because early design typically focuses on naval architecture and functional intent while later stages focus on geometry, layouts, and detailed production requirements. This transition is one of the most challenging areas from a data organization and integration perspective. Within the project, the early design process is covered by PIAS software from SARC, and investigations have been carried out to identify suitable ways to link early design models with later-stage PLM structures. The aim is a more transparent, interconnected process that can detect issues earlier, reduce expensive redesigns, and shorten both engineering and assembly times.

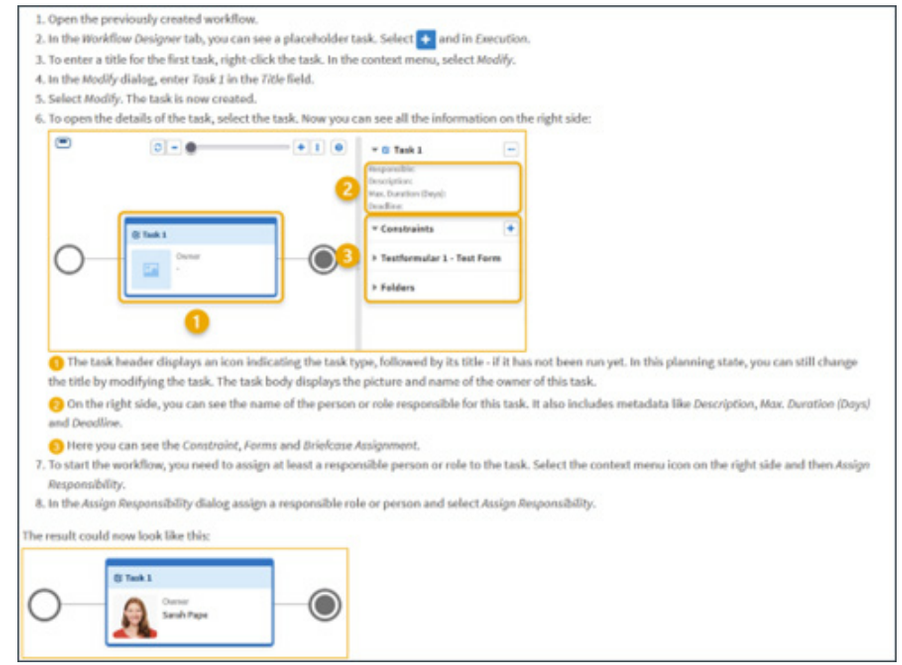
Operations support: documents, workflows, and change management

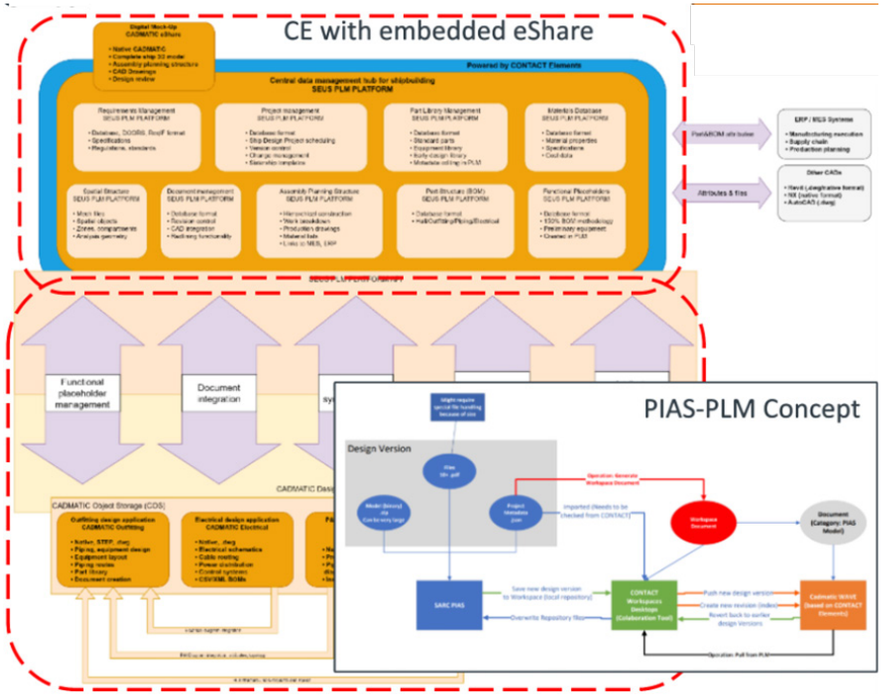
A practical PLM platform must support day-to-day production of controlled deliverables. Document management is often the most requested PLM capability in shipbuilding, and WP2 has therefore prioritized DMS and CAD-document integration early. The solution aims to match how documents are created and managed inside CAD applications - supporting bi-directional links between 3D models and 2D drawings, revision controls, and templates that ensure a consistent appearance of documents in shipbuilding projects. Implemented capabilities include document classes (basic, detail, production), associated attributes, a design document workflow, document requests for Hull DA and Outfitting DA, plus roles and access control for document handling.

Change and workflow management has also been advanced by adapting existing capabilities within the Contact Software platform to match defined shipyard processes and the project's document management needs. Change requests are stored and linked to related tasks, documents, tags, parts, and other objects, improving transparency through ownership, dates, attachments, and comments - while supporting in-system communication among stakeholders.

Managing delivery: project structure and equipment traceability

Shipbuilding projects are commonly driven by contract and document delivery structures, so WP2 also strengthens project management capabilities and their linkage to document deliverables. The toolset supports connecting tasks and deliverables with documents, enabling





visibility into both structure and progress. The approach is based on an EPC (Engineer-Purchase-Construct) pattern, tailorable per vessel, and supports an integrated approach to managing WBS and PBS together, with further enhancement planned to address overlaps by aligning shared deliverables systematically.

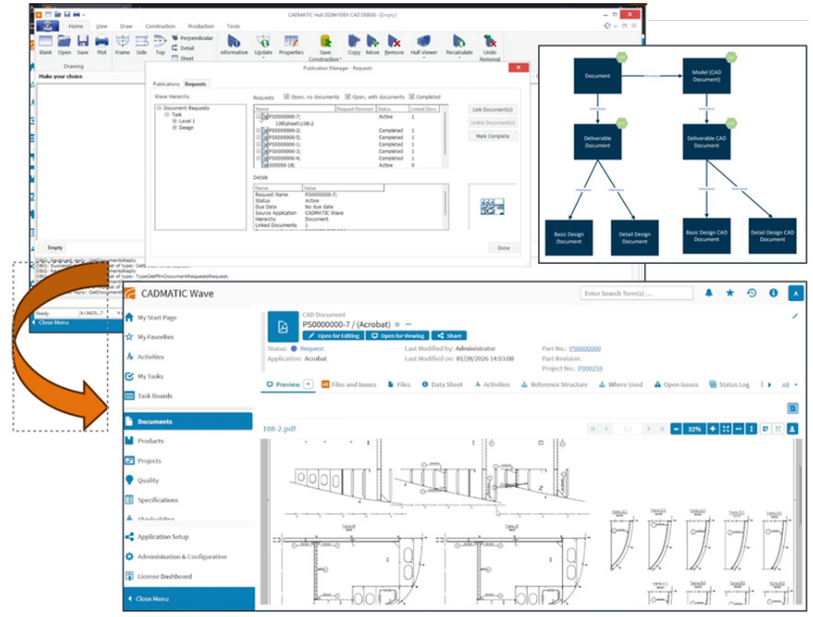
Equipment management has progressed through Item (TAG) management capabilities and traceability of TAG numbers across platform components - including the PLM platform, design applications, and DMU - supported by enriched metadata and attributes and explicit relations between TAGs and part numbers. User documentation has been developed as structured guidance with step-by-step procedures and visual instructions across key functional areas, with the intention to package it in a more standard delivery format.attributes and explicit relations between TAGs and part numbers. User documentation has been developed as structured guidance with step-by-step procedures and visual instructions across key functional areas, with the intention to package it in a more standard delivery format.

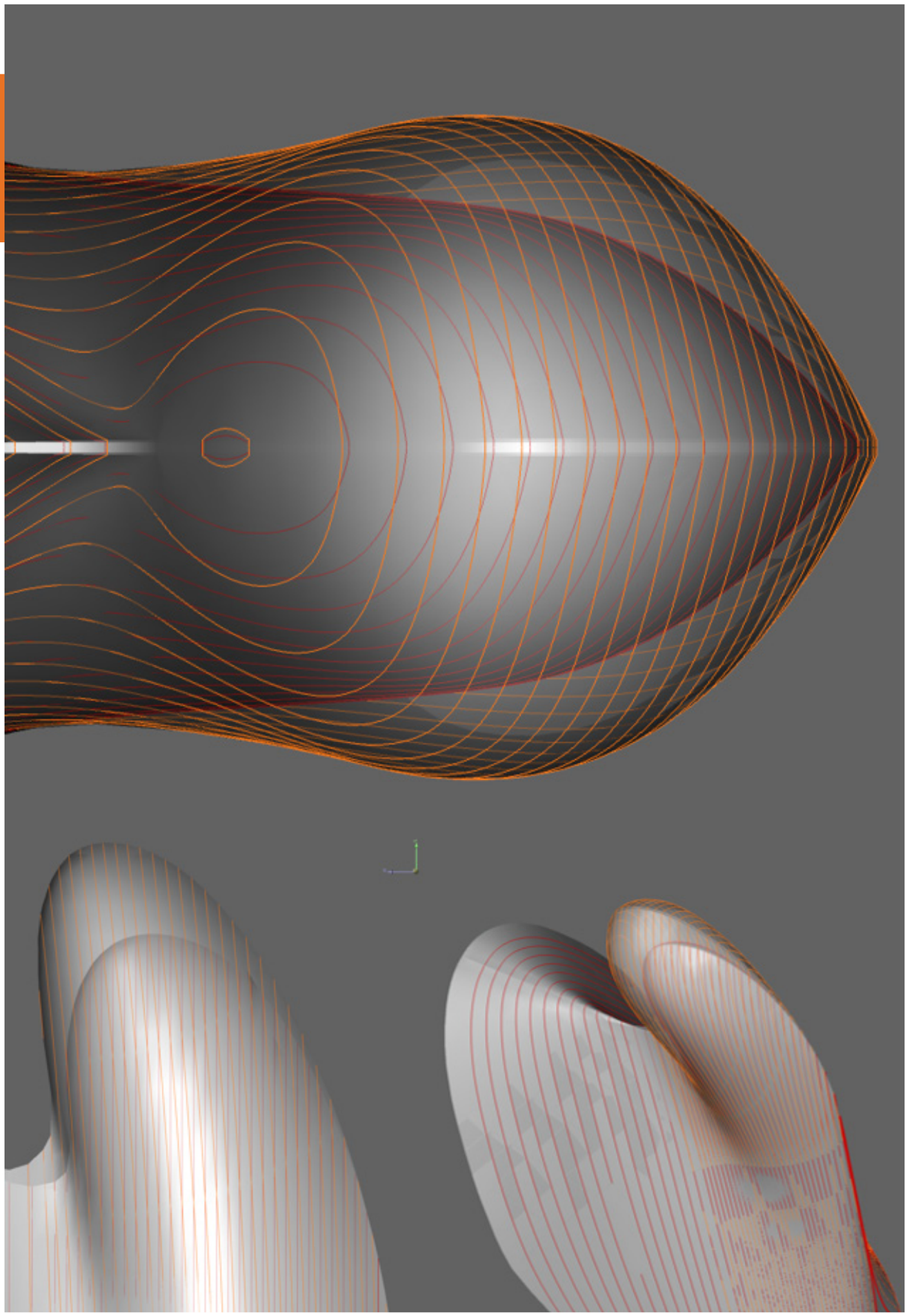
2025H2 release highlights

The 2025H2 version consolidates multiple shipbuilding-specific improvements, including TAG item data model and lifecycle control, CAD–Wave integrations and placeholder management, document handling and templates, part library synchronization, BOM structures, and attribute mappings between systems - iteratively improved based on consortium feedback. It also advances end-to-end vessel delivery support through integrated project and design process capabilities aligned with the EPC pattern and combined WBS/PBS management.

Looking forward

With steady half-yearly releases, partner-based testing, and continuous alignment across vendors and work packages, WP2 is progressively strengthening both the technical foundation and practical usability of the SEUS platform - moving from prototypes toward an integrated, shipbuilding-ready solution that supports real workflows, controlled deliverables, and long-term exploitation.









WP3:
Open Platform Development





Elisabeth Brandenburg

Open Platform Development

This work package ensures the platform's compatibility with major proprietary systems (used in commercial shipbuilding, incorporates possibilities to use of ship operation data via standardized protocols, and supports I5.0 principles. It includes cyber security development tasks and targets to develop the interoperability of the SEUS platform and the existing IT shipbuilding landscape to facilitate the rollout tasks and develop new unified data exchange standards for shipbuilding. To fulfil this goal the proposal offers 7 tasks. The tasks can be summarized into the following subgoals:

- Interoperability: combining CAD authoring tools from CADMATIC and SARC with CONTACT Elements PDM solutions for ship design, connecting MES and ERP with PDM for shipbuilding and provide IoT mechanism with PDM system for ship operation.
- Artificial Intelligence Integration: Giving AI mechanisms access to the platform means, for example, allowing NLP models to process all stored product data to find and analyse the data in relation to a specific user request.
- Cyber Security: Based on best-practice cyber security governance a security management model will be developed and implemented for the platform.

Interoperability

As the progress of SEUS, the following interoperability topics were prioritised: the architecture of the SEUS platform with collaborating databases and their external access points, the description of these connectivity options for other authoring software and ERP integration for specific use cases.

A comprehensive reference for the endpoints used in the PLM Platform-CAD interoperability interface is deveolped. Integration enables bidirectional data synchronization between PLM Platform and CAD systems across five functional categories: Functional Placeholder Management, Document Integration, Part Library Synchronization, BOM Generation, and Attribute Synchronization.

The interface supports real-time synchronization of engineering data, document workflows, part catalogues, and equipment information between the two systems. All endpoints follow RESTful conventions and use JSON for data exchange.

PDM/PLM APL Interface

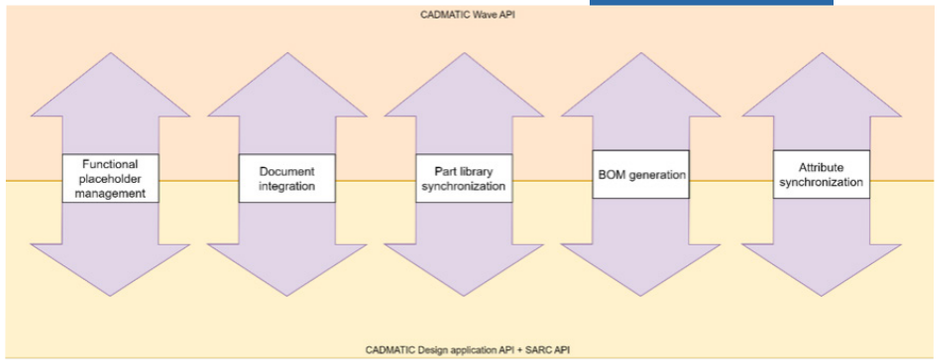
To handle and exchange data with more than one PDM/PLM application, PDM/PLM API interfaces and open documentation of virtual middleware is required. This is where the REST API, the standard data exchange interface, comes into play. The industry-standard REST API serves as the primary backbone for secure and structured data exchange. It allows external services to carry out standard operations (GET, POST, PUT, and DELETE) on important product and project data (e.g., requirements and CAD documents) on the SEUS platform.

A recent development in research has given rise to a novel concept known as the AAS (Asset Administration Shell). The model is characterized by its standardization, which is particularly notable in the context of digital twin data exchange. In this project phase, the opportunity to read and send this information format was also implemented. Therefore, the SEUS platform has the potential to function as an integral component within data ecosystems that employ AAS models.

Platform capabilities for automated and interconnected AI services

The platform revolve around intelligent search of multilingual document collections, with special focus on modern, interactive, chat-based methodology leaning on large language models. Such methods, compared to traditional keyword-based search, bear promise of considerably more efficient access to documents and have a potential of increasing efficiency and decreasing time spent on search, rather than productive work.

The work on this task progressed as follows: (1) An internal review of scientific literature on multilingual neural text embeddings, a component critical for matching user queries to documents was carried out to select a suitable model for initial experiments. (2) An initial prototype literature search system was developed applying these models and subsequently populated with shipbuilding regulatory documents in collaboration between UTU and SARC. The prototype document search system is accessible online for all members of the consortium and is a major step towards the first AI/NLP milestone.



ERP Use Case Implementation

Database synchronisation is achieved by maintaining controlled redundancy in overlapping databases in the respective systems and automatically reconciling them when certain synchronisation points are reached. This principle is known as loose coupling. On the one hand, it enables the controlled management of synchronisation processes – for example, data is not synchronised too early while it is still subject to change processes, but is available in the connected system in good time to ensure the seamless continuation of process execution there. On the other hand, the employees processing the data are freed from monitoring or even manually triggering synchronisation processes. The advantage of loose coupling is that the coupled systems continue to work without any problems even if they cannot communicate with each other, e.g. because the network connection is interrupted or one of the systems is not active. For data whose current live status needs to be queried, such as stock levels, online access to the ERP system can be set up from the ERP platform solution. Such data is then not stored redundantly. The Catalyst 2.0 gateway technology has been implemented to ensure basic interoperability between the PLM/PDM part of the SEUS Platform and any ERP system.

MES/ILS integration

Two important systems are used 11 to enhance how information is shared between different stages of shipbuilding: MES (Manufacturing Execution System) and ILS (Integrated Logistic Support). MES is a system that helps manage and track production processes on the shop floor. It ensures that all production acti-

vities are coordinated and that the right materials and instructions are provided to the workers at the right time. ILS focuses on supporting the entire lifecycle of a product, from design and production to maintenance and support. It helps manage logistics, spare parts, and other support activities that are crucial throughout the life of the ship.

CADMATIC's software provides a comprehensive set of tools for detailed work preparation. These tools offer crucial information like the shapes and sizes of parts, welding details, and material lists. They also create detailed work plans and sketches to guide the production process.

By integrating MES and ILS with these tools, the task aims to streamline the flow of information between engineering, planning, and production teams. This makes the work preparation process faster and more efficient, ultimately reducing the time needed for assembling ships.

IoT and ship operationg data

The platform solution's IoT (Internet of Things) module provides tools for managing assets on a ship in operation by connecting real assets, machines and ship systems with their digital twins – virtual models that represent the physical components. This connection enables the SEUS platform to collect and analyse data from a ship in operation, automatically log events and, if necessary, send commands back to the ship's systems.

For the upcoming project phase, the connection of Ulstein's BlueBox operating data to the IoT platform is planned. This data has already been analysed. This data structure will now be implemented in the IoT platform. Furthermore, it should be possible to apply structural frameworks, such as a system-oriented view according to SFI, to navigate the analysis. The development of the copying process between the PLM and IoT platforms is still pending for the upcoming work. In addition, further structures and views, are to be implemented.

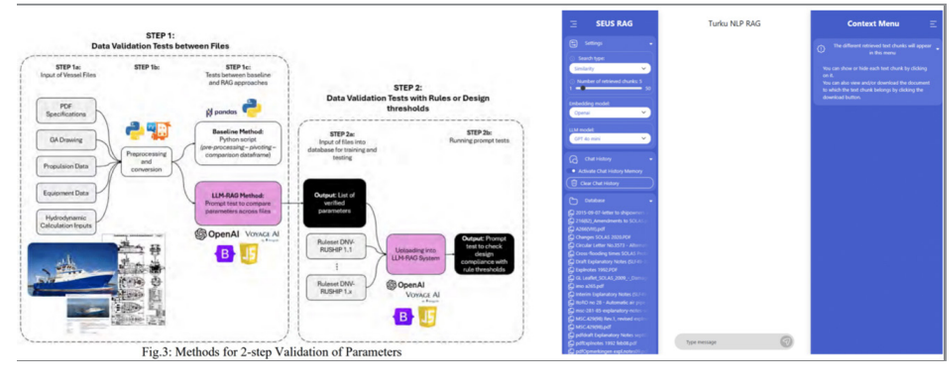
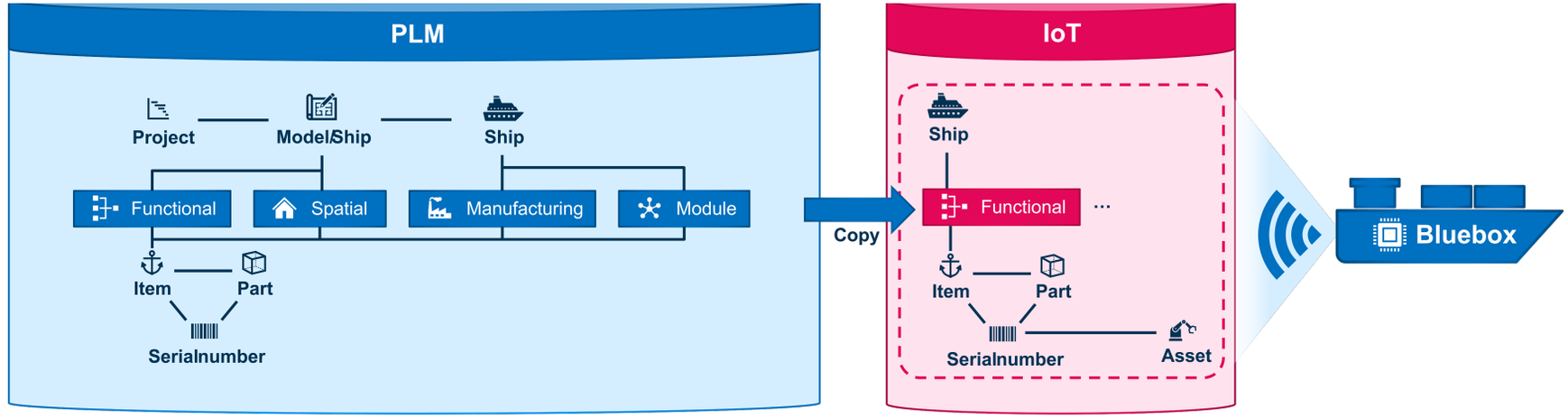


Fig.3: Methods for 2-step Validation of Parameters



Ship Design and Construction

Ship Operation

Cyber Security

In the 2nd year of the project, each consortium partner received a questionnaire to find out who is responsible for cybersecurity, existing cybersecurity, and the need for this topic. In particular, the software vendors SARC and CONTACT were the targeted user groups. After conducting the workshops, similar needs are identified. These needs form the base of the overall platform security management model which will start in the third year of the project. Furthermore, Cyber Security Governance for the platform was delivered.





Cyber Security Workshops



An example of the Cyber Security Governance



WP4:
Implementation at Shipyards



Gaute Gaudestad

Work Package Overview

Shipbuilding projects can be divided into different stages. A normal practice is to divide shipbuilding projects into four stages, named concept & basic design (pre-contract), detail engineering, production, and operation (after delivery). The operational stage might be included outside of the shipbuilding project. However, shipyards do perform activities at this stage, such as guarantee management, handling of spare parts, or other aftermarket services such as repair, maintenance, retrofit, or conversion works.

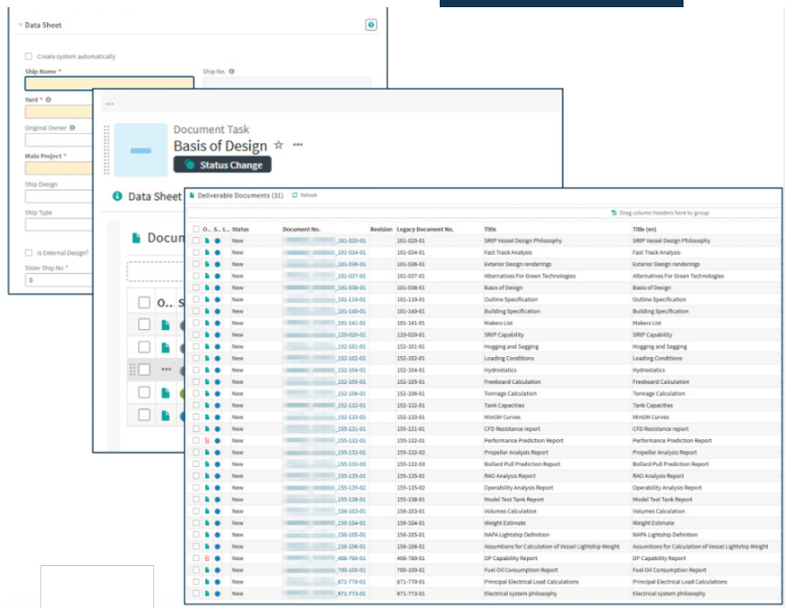
The activities involved in the user case are indirectly connected to this lifecycle since Ulstein shipyard is involved in the four stages, while Gondan focuses primarily on the stages between the shipbuilding contract and vessel delivery.

In Work Package 4, test cases for implementing the developed platform in shipyards are selected, the information flow is analysed, and the benefits of implementation are measured. At the current stage, the platform is being implemented and tested at the design company. The project involved four user cases, which is used for testing of software functionality and for identification of productivity improvements. The four user cases are described below:

- User case I: Concept design development carried out completely in Cadmatic Wave, including documentation, collaboration with external parties, and management of document revisions
- User case II: Establish a newbuilding project including data connections to ERP system, document management, and collaboration with external suppliers
- User case III: Integration PIAS and Cadmatic Hull
- User case IV: Purchase process including management of offers, technical review of documentation, and storage of technical documents. Managing the influx of technical documentation from various suppliers, which often arrive in different formats and classifications.

Deliverables

During 2025 the project has had two deliverables related to work package 4. The first deliverable (D4.3) was coordinated by Cadmatic, and included the training material and training plan for user case participants. It was finalized in December 2025. This deliverable collected information using assessment, training concept, training material and training plan for the SEUS user case participants for the use cases from D4.1 towards training material. The second deliverable (D4.4) was coordinated by ULSTEIN, and related to Implementation data. During 2025 the project focused on compiling data from the design company and the shipyards in order to build the data connections with existing software infrastructure and a database of historical projects. The main focus was on User Case I, and the implementation in the design company at ULSTEIN. GONDAN worked with the integration with the ERP system. AS part of User Case I, 139 historical projects, which relate to 219 individualshipswere registered in the PLM solution database, and a extensive list of functionalities were integrated and tested. This deliverable was finalized in December 2025.



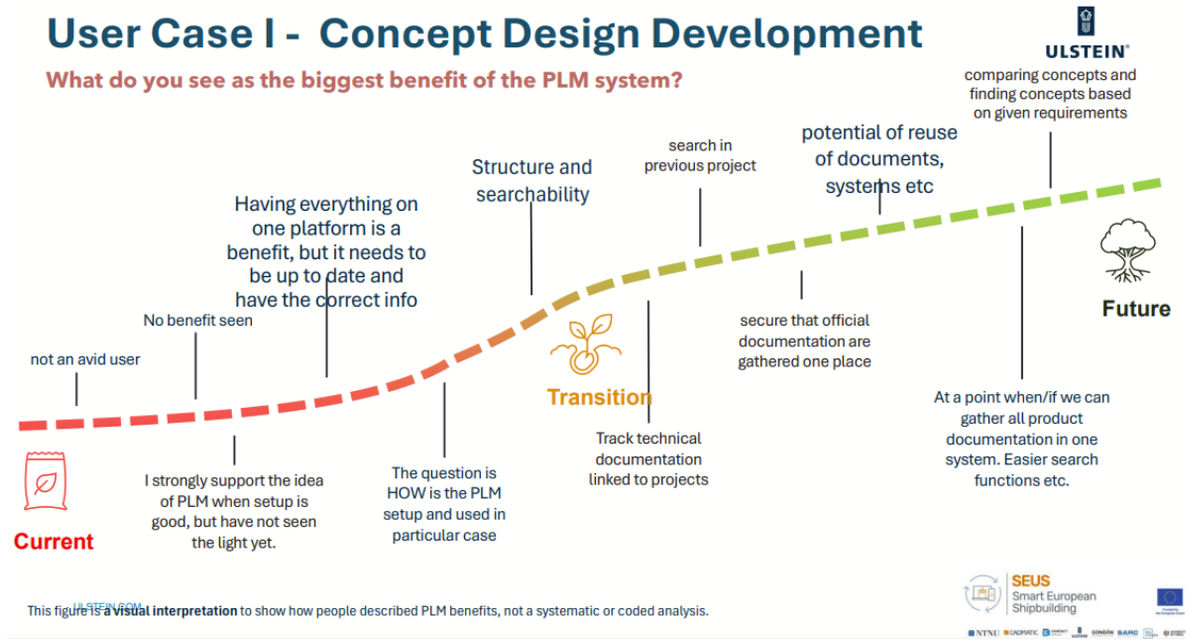


Surveys to users of the SEUS platform

As a part of the implementation process, WP4 has decided to perform periodical surveys to all the end users of the SEUS platform. The purpose of the survey is to identify the degree of utilization of the platform, the strengths and weaknesses of the functionality enabled, and the overall benefits identified by the users. The first survey was carried out during Q3 2025, and a new survey is already planned for Q1 2026.

Analyses of the finding will be performed mostly in Task 4.6 (Evaluation and Feedback). All the case material developed and collected in Tasks 4.2 to 4.5 -inlcuding data, information and knowledge - will be analized. and compared with equivalent projects lacking PLM structures. Based on this work, reports will be prepared, and the resulting learnings will be communicated.

Function Name	PE1	PE2	EE1	EE2
1. Compare product requirements with existing vessel designs	3,30	3,30	2,30	N/A
2. Create a new vessel design in PLM	2,75	2,75	2,25	N/A
3. Create or modify a concept design	3,00	2,63	2,63	N/A
4. Handle and share design documents and master data	2,33	2,56	2,22	N/A
5. Review concept design internally	2,78	2,78	2,44	N/A
6. Develop refined design and documentation	2,75	2,78	2,56	2,89
7. Update equipment-related design documentation	3,89	2,78	2,78	2,22
8. Subscribe users and receive updates on parts, tasks, and responsibilities	3,44	2,56	2,67	N/A
9. Set access rights and user views	3,14	3,14	3,00	N/A
10. Manage document statuses and approvals through workflow	3,44	3,33	3,11	N/A
11. Reuse existing file and assign documents to parts	2,57	2,57	2,43	2,67





WP5:
Knowledge Management and Skills Development







Miia Martinsuo

Work Package Overview

Work package 5 addresses the objective of the SEUS project on human centricity, that is, to enhance the human-centric competitiveness of shipbuilding and reflect diverse values of stakeholders. This WP addresses overall shipbuilding planning and management with human-centric representation and management of shipbuilding activities. In shipbuilding, interaction and collaboration between various stakeholders is necessary, including the shipyard, ship owners, operators, supply chain partners, and service providers as well as users and passengers. The expectations of these stakeholders may differ from each other, which calls for suitable mechanisms for balancing different value priorities and elegant knowledge management systems. WP5 focuses on the knowledge and requirements of shipbuilding actors and their skills development including training. WP5 also includes an AI-based document intelligence development component as well as interfacing with the platform development in WP3.

The core researchers of WP5 are from the Department of Mechanical and Materials Engineering and the Department of Computing of the University of Turku (UTU). Professor Miia Martinsuo and Doctoral Researcher Junsong He are working on human-centric shipbuilding activity mapping, Professor Jussi Kantola and Doctoral Researcher Pengcheng Ni develop the knowledge management system, Professor Filip Ginter and Project Researcher Maryam Teimouri are working on AI-based document intelligence using natural language processing, and Post-doctoral Researcher Dr. Zeynep Tacgin and Professor Miia Martinsuo develop the learning technology solution for training digitalization understanding in shipyards and shipbuilding understanding for software professionals. During the year 2025, WP5 has produced some results that build a solid foundation for further advances in human-centric smart shipbuilding.

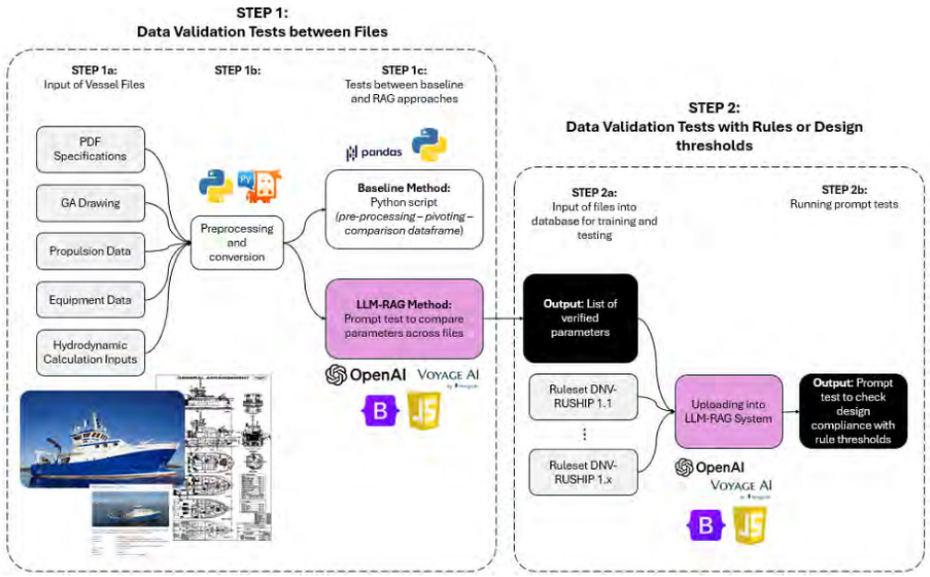
In 2025, WP5 concentrated on finalizing the structure of the Knowledge Management System (KMS) and designed and demonstrated selected AI-based information retrieval tools relevant for shipbuilding. Additionally, the scope and key dimensions for the activity mapping system were delimited as well as data for that purpose was collected and analyzed. WP5 has also completed a comprehensive analysis and design work to create learning technology tools for educating stakeholders on digitalization in shipbuilding.

Main contributions concern:
- the identification and reporting of the key dimensions of the knowledge management system for shipyards
- putting the AI information retrieval tool for test use
- publications on value creation that underlies the upcoming activity mapping system
- the testing and publication of a MOOC (massive open online course) solution for educating general aspects of digital shipbuilding to both general audiences and three different target groups.

The next sections introduce key tasks and achievements in 2025 in detail.

Task 5.1: Knowledge management system:

In this task, UTU completed the KMS architecture. It includes the theoretical model as the foundation for the human-centric KMS, which emphasizes tacit knowledge, stakeholders and their needs, and functional requirements (what-solution). The KMS architecture consists of following three modules: knowledge retrieval, knowledge repository and knowledge presentation. Knowledge retrieval module transfers knowledge (socialization) and creates knowledge (externalization). Knowledge repository module stores knowledge (combination) while knowledge presentation module uses knowledge (internalization) and disposes knowledge (management). The design parameters, such as implementation of KMS, construction of knowledge sharing system and development of knowledge portal, have been proposed. The design matrix has verified the design parameters, and the components of the human-centric KMS have been validated.



Task 5.2: Requirement and shipbuilding knowledge capture, preservation, management, and development using AI:

In this task, conducted by UTU, AI-driven solutions are being explored to handle shipbuilding knowledge efficiently. Using Retrieval-Augmented Generation (RAG), the system enables seamless access to technical documents, design specifications, and regulatory requirements. AI enhances knowledge retention by structuring complex shipbuilding data, automating document classification, and ensuring real-time updates for evolving industry standards. Additionally, natural language processing (NLP) models facilitate intuitive search capabilities, allowing engineers and stakeholders to retrieve critical information effortlessly. The key results are published by Bronson et.al. (2025) and Teimouri et.al. (2025).

The research in exploration of the key factors of knowledge management (KM) in European Shipbuilding to improve its strategic performance shows that the resource factor has the least influence for knowledge management in the SEUS project. The process, environment, and multiple dimensions factors show significant influence for the effectiveness of KM in projects. However, the literature review suggests that there are seven factors which can influence the KM effectively. The survey reflects that the expert pay attention to these three factors (i.e., process, environment, and multiple dimensions). The results are published in Ni and Kantola (2025).

Task 5.3: Shipbuilding Activity Map

Here, UTU aims to deliver a shipbuilding activity mapping system, which supports the representation and management of shipbuilding activities, data, and stakeholder interactions across ship lifecycle phases. The aim is to improve coordination, digital transformation, and value creation in European shipyards. The activity mapping system's practical tasks are to make activities visible, enable coordination and collaboration between actors, reveal value creation and service opportunities, and combine digital resources (e.g., data platforms) and non-digital resources (e.g., human-centricity expertise) to support decision making.

In 2025, the focus was on data gathering through interviews, online discussions, and live workshops. Data analysis has followed concerning which activities add value and on what levels such as network, project and activity, and coordination and collaboration requirements among stakeholders. Also, contextuality has been investigated, exploring the needs of different shipyards and different project types. To reveal value creation and service opportunities, aspects of efficiency, service, and ecological value have been explored in addition to mechanisms for balancing values. Combining digital and non-digital resources required the analysis of mechanisms that purely use data platforms and mechanisms that combine data platforms and human expertise. The key results are published by He & Martinsuo (2025a, 2025b).

Task 5.4: Business model development for implementation and use of the platform:

Development of business model strategy and go-to-market tactics, including evaluation of added value, market size, type of product-service ratio and marketing action planning, will be conducted. This work, conducted primarily by CADMATIC, has now started.

Task 5.5 – 5.6: Learning technology - based training

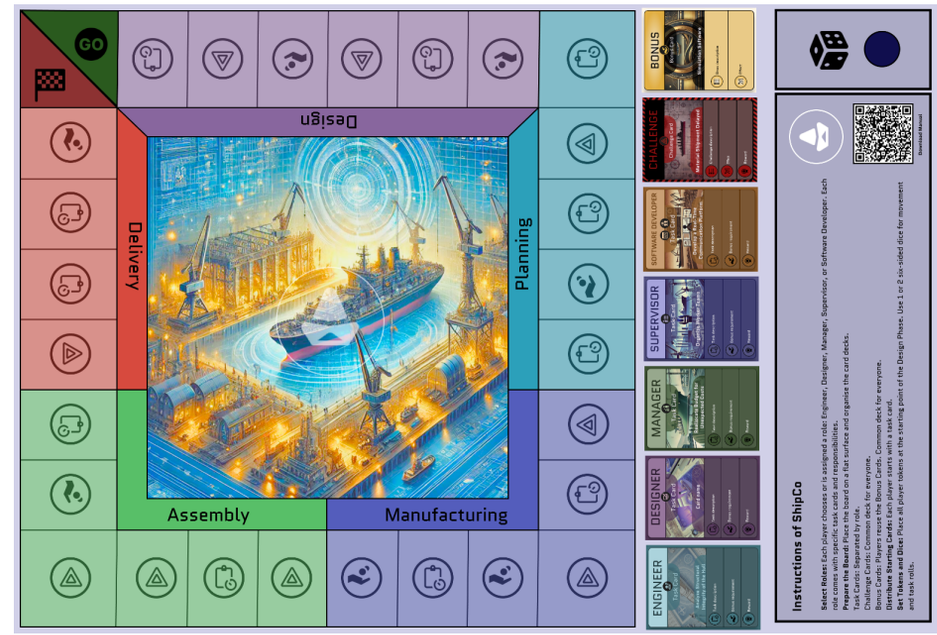
The goal in this task is to raise awareness and motivate different stakeholders to use the new data-driven shipbuilding tools and to tailor content to selected target groups in shipyards. The digital learning solution aims to increase user motivation, foster collaboration, and provide an effective transition to data-driven methodologies (Tacgin & Martinsuo, 2025b). UTU pursued a structured and adaptable learning experience that enhances productivity, optimizes processes, and supports digital transformation in shipbuilding.

A design-based research approach was employed to ensure an iterative development process that refines the learning solution based on user feedback. The research started with a comprehensive educational needs analysis, identifying the primary users of data-driven tools, their expectations, learning patterns, and current challenges (Tacgin & Martinsuo, 2025b). Surveys, interviews, and a detailed assessment of existing workflows provide insights that shape the content and instructional strategies. Validation by subject-matter experts ensures terminological accuracy.

The results are a board game ShipCo with an aim to motivate toward digital solutions and a digital massive open online course (MOOC) to build readiness for data-driven shipbuilding. Separate augmented reality applications have been developed and experimented with for software developers (Tacgin & Martinsuo, 2025a). The ShipCo's goal is for players to recognize potentials of using digital data and collaboratively complete the shipbuilding process by progressing through all phases of the game.

Since learning materials and activities are designed for different stakeholder groups after the needs analysis, considering their distinct roles and responsibilities, the MOOC solution includes four different modules: a common module for all learners, and additional modules for engineers and designers, managers, and supervisors.

The learning modules incorporate interactive elements, simulations, and real-world scenarios to enhance engagement and practical application. To gain access to the MOOC, you can log in to digicampus.fi using your google account, search for SEUS/MOOC and use the enrolment key SEUS-Learning. Enjoy!





WP6:
Dissemination and Communication







Welmoed Van Der Velde

Work Package Overview

The purpose of this work package is to let the world know about SEUS. It is to assure the project's visibility and spread pertinent information on its goals, activities and results to the relevant stakeholders and scientific communities.

This includes:

- Distributing knowledge about SEUS to the wider maritime world.
- Disseminating knowledge that is or can be made publicly available to academics and software developers.
- Distributing user knowledge about SEUS to present and future designers, engineers and their managers.
- Identifying and managing the Intellectual Property Rights as developed in SEUS.
- Training the next generation of ship designers and shipbuilders in the use of digital technologies in the industry.

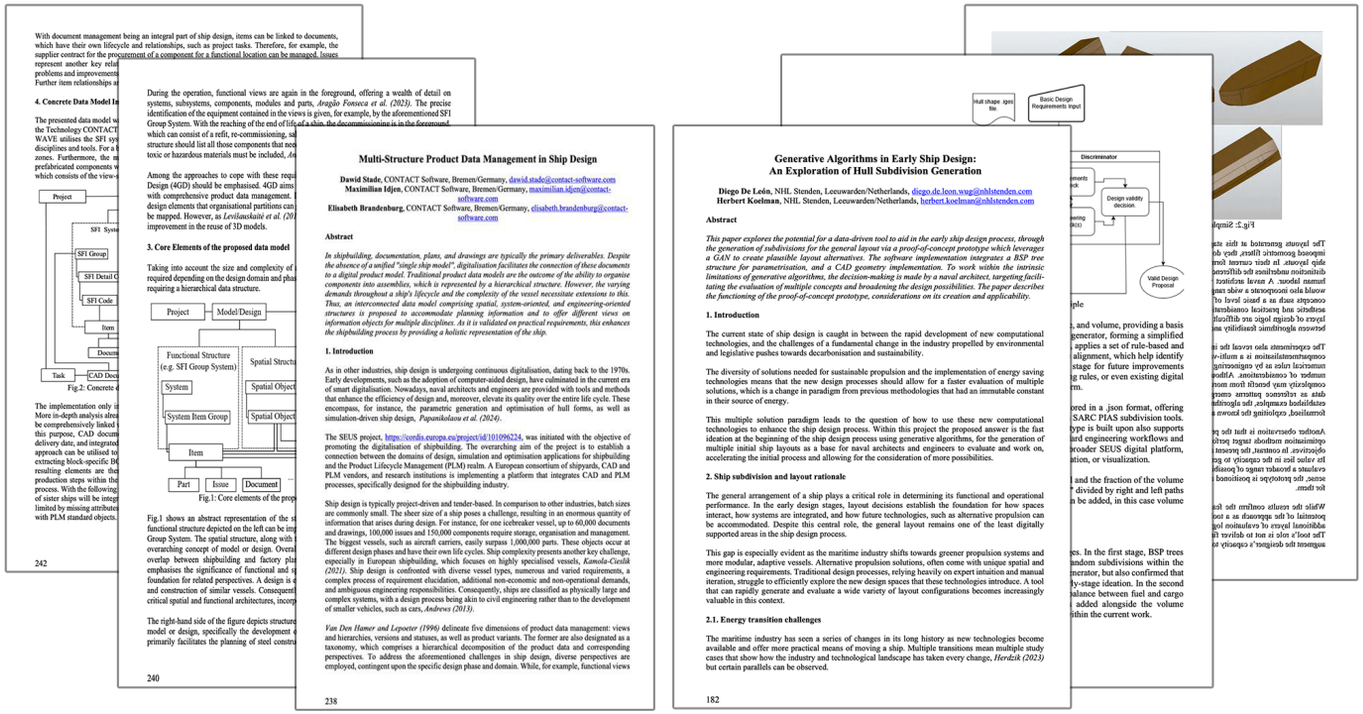
The deliverables of this work package are:

1. SEUS repository of basic commercially useable communication material;
2. Customer-oriented commercial material from software suppliers CADMATIC, Contact and SARC;
3. SEUS website;
4. Set of IP management and exploitation rules and agreements;
5. Training material.

Work package 6 is lead by NHL Stenden in close cooperation with partners CADMATIC and NTNU that lead specific tasks identified in this work package. These tasks are:

1. Communication of results

The purpose of this task is to compile commercially useful material that can be used as basis for the SEUS partners in their commercial communications. The same material will be used for (non-scientific) contributions in professional magazines.
A dedicated SEUS repository of basic commercially useable communication material supports SEUS partners in their communication activities. The SEUS Dissemination and Communication Plan and Visual was updated in 2025. In 2025, communication activities on SEUS were performed during international events



such as COMPIT 2025 in Italy, SSC 2025 in Netherlands, IMAM 2025 in Greece, RANLP 2025 in Bulgaria, INTED 2025 in Spain, a seminar in Norway, several workshops in Finland and during presentations at NHL Stenden and SARC in the Netherlands. Through SEUS partners' company websites and social media such as LinkedIn and blogs SEUS continues gaining attention.

Morover, public information and communication material are maintained and regularly updated in GitHub while all publicly available project data are archived in Zenodo, ensuring FAIR compliance and assigning each release a unique DOI.

2. Reach through customers, partners and prospects networks (lead: CADMATIC)

Software companies CADMATIC, Contact and SARC will use the material as developed by NTNU in their existing channels to reach their customers and prospects.

3. Promotion

In 2023, the public website for the SEUS Project was created by NTNU. The website, which is continuously updated throughout the project's lifetime, includes summaries of deliverables and achieved results from 2023 to 2025, as well as practical outcomes demonstrated on a specimen vessel.

4. Protection of Intellectual Property Rights

In order to protect IP rights outside the consortium, an additional set of rules was developed to complement the SEUS Consortium Agreement. In 2024, a report was delivered summarizing the principles for IP management during the SEUS project and establishing guiding principles for the exploitation of project results.

The IP practices are based on the relevant sections of the Consortium and Grant Agreements, as well as the findings of a survey conducted among project participants in 2023. The agreed practices aim to lay the groundwork for the future business model governing the exploitation of project outcomes.

5. Connecting project outcomes to education

Teaching and training material on the background and usage of the SEUS software are finalized by NHL Stenden, UTU and other project partners to connect project outcomes to university and vocational teaching. These include the minor Hack@Sea, a Massive Open Online Course (MOOC) and a game. In 2025, a report on customer-oriented commercial material from software suppliers was delivered.

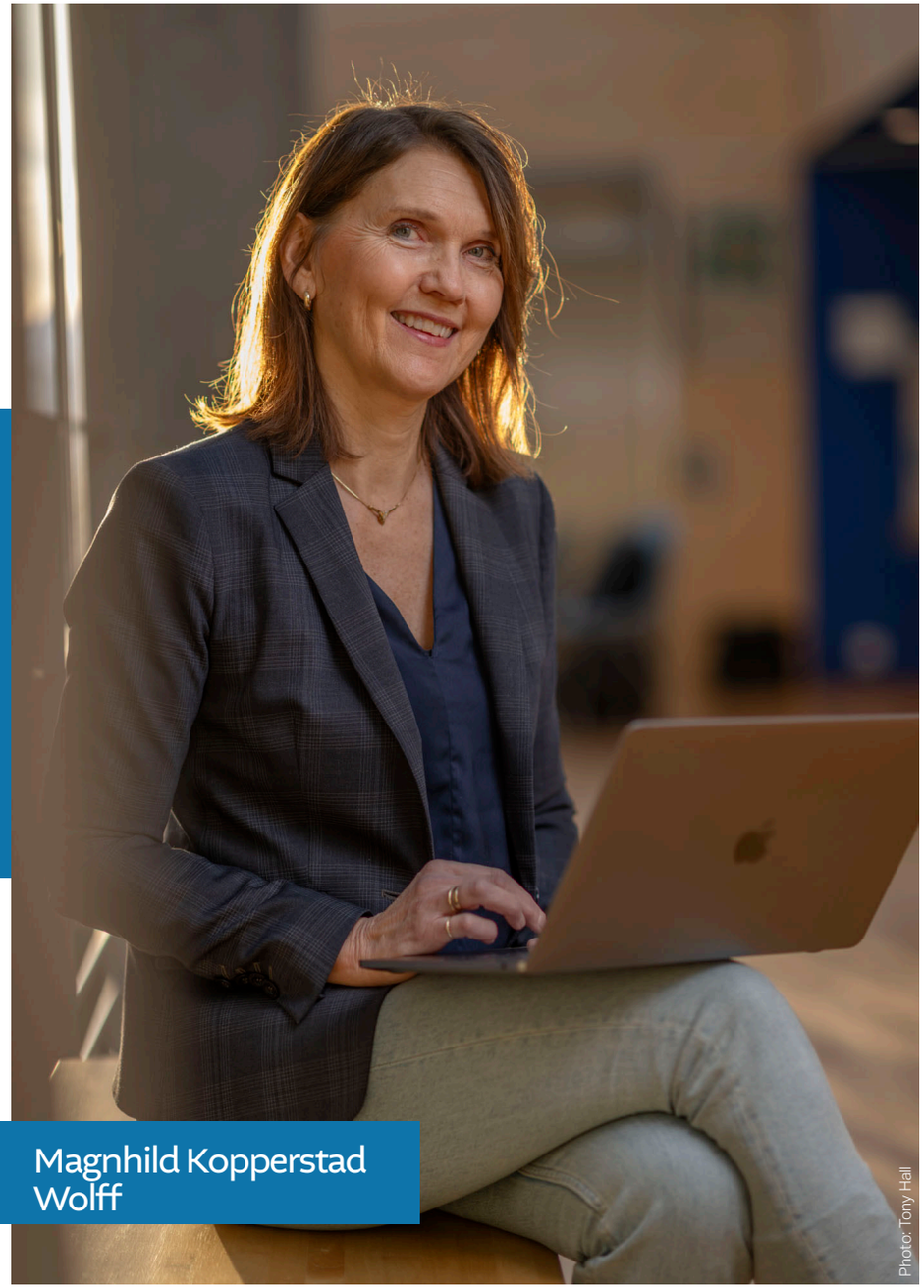






WP7: Project Management





Magnhild Kopperstad Wolff

Photo: Tony Hall

Work Package Overview

Work package 7 (WP7) oversees the overall management of the project. This includes keeping everything on track, coordinating between different teams, and ensuring that risks are properly managed.

To ensure good communication among partners as well as good progress, meet reporting and delivery deadlines and achieve the project's goals, during the first year of the SEUS project, administrative routines were established. If necessary, these routines have been updated based on project needs and feedback from partners. WP7 continues to aim maintaining as dynamic approach to routines to ensure the best possible follow – up and facilitation to meet the goals of SEUS throughout the project period.

The purpose of WP7 can be summarized as:

- Ensuring smooth cooperation among consortium partners
- Leading the consortium towards fulfilling the planned goals of SEUS project
- Efficient financial, technical, and legal management
- Establish efficient coordination and communication between partners and the EC project officer

Communication Among Partners

A structured meeting framework has been established for the project. Online meetings are held on Teams. The project has moved from meetings with all participants every six weeks to have such large meetings less often. Instead there is monthly progress meetings with WP leaders only to ensure a more efficient management and follow up of the project progress.

In the meetings with all participants, each partner is required to have at least one representative present. These meetings serve multiple purposes: they facilitate communication from the Management Team to the partners, provide updates on the status of each work package, enable the presentation of research-related topics, and offer a forum for addressing questions and other issues that may arise. In addition to the online meetings, two physical workshops are scheduled each year. The exception was 2024, when only one workshop took place, held in May in Turku (Finland). In 2025, the workshops were organized in Bremen (Germany) and Ribadeo (Spain). These in person gatherings play an important role in strengthening collaboration and cohesion within the consortium. Furthermore, partners may organize

additional meetings with a more technical focus, guided by the research needs of each work package.

To support continuous communication, a TEAMS chat including all internal participants has been created as an active channel, complemented by dedicated mailing lists. All communication with the Project Officer at the European Commission is handled exclusively by the Project Management Team.

Document Exchange

A data repository for the partners has been established using SharePoint, accessible through the SEUS website with a required personal login. The repository is managed by NTNU, which is responsible for hosting, administering access, and granting permissions to new project participants. All formal project documents are stored in this repository and made available to all partners. In addition, it includes an updated list providing an overview of all participants involved in the project.

Financial Reporting

Internal reporting is carried out every six months. This enables the project management team to assess whether activity within the work packages is progressing as expected and to engage in dialogue with partners if adjustments are required. Payments to partners follow the agreed payment schedule and are released after the submission and review of the internal report. A reporting template is distributed to all partners in advance, and participants are given approximately four weeks to submit their completed reports.

In addition to the internal process, periodic financial reporting to the EU is required at Months 18, 36, and 48. These financial reports are submitted directly by each partner through the EU portal.

Technical Reporting

Routines for reporting Deliverables have been established and communicated to all partners.

An Excel based Roadmap has also been developed and stored in SharePoint. Each work package leader is expected to update the status of their work package on an ongoing basis, using colour coded indicators (green, yellow, red) along with comments providing the necessary contextual information. This ensures continuous monitoring of progress and supports timely follow up when issues arise. Following has been delivered in WP7:

D7.1 – Management and Quality Plan – delivered in June 2023
D7.2 – Risk Management Plan - delivered in June 2023
D7.3 – Initial Data Management Plan - delivered in June 2023
D7.4 – First update to the DMP - delivered in June 2024
D7.5 – Second update to the DMP (December 2025)

Internal administrative procedures may be subject to change depending on needs that may arise throughout the project period.

	Deliverable Name	Lead	Dissemination Level	Due Date	M6	M12	M18	M24	M30	M36	M42	M46	M48
WP7 – Project management / NTNU													
D7.1	Management and Quality Plan	NTNU	SEN - Sensitive	6	☑								
D7.2	Risk Management Plan	NTNU	PU - Public	6	☑								
D7.3	Initial Data management plan	NTNU	PU - Public	6	☑								
D7.4	First update to the DMP	NTNU	PU - Public	18			☑						
D7.5	Second update to the DMP	NTNU	PU - Public	36						☑			
D7.6	Final DMP	NTNU	PU - Public	48									◊

EU Periodic Report

SEUS TECHNICAL REPORT (PART B)

PROJECT	
Project number:	101096224
Project name:	Smart European Shipbuilding
Project acronym:	SEUS

REPORTING PERIOD	
⚠ *Please note that you must report on the entire reporting period.*	
RP number:	2
Duration:	from 01/07/2024 (M19) to 31/12/2025 (M36)

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EXECUTIVE SUMMARY

The purpose of this technical report is to provide an overview of the work completed during the 36 months of the Smart European Shipbuilding (SEUS) Project, focusing on the activities between M19-M36. The report follows the template provided by the EC, presenting an overview of the project, status of the path towards the objectives, the work carried per work package (WP), the pathways to impacts deviations. Additionally, highlights on results beyond the delivered reports are also mentioned.

The previous technical report from M18 reported on the project's progress in establishing current practices and identifying best practices in the shipbuilding sector, in addition to the creation of the platform for the integration of the Software Applications. The project, in the solution implementation phase, continues to conduct platform testing at actual shipyards. Furthermore, a new prototype system capable of multilingual document search had already been built, making it significantly easier to retrieve and analyse information from documents in various languages. This represents a substantial improvement in how information is accessed and utilized within the project. The project is striving to contribute to the efficiency of the design process by leveraging artificial intelligence (AI) to generate innovative design ideas and prototype creation tools, keeping pace with rapid AI technological advancements.

The SEUS Project aims to develop a digital platform that enhances the efficiency of shipyards by integrating design and management software. The platform is intended to be designed with the users' needs in mind, incorporating the latest solutions developed and researched by the partners, ensuring integration with other systems, centring on a user-friendly approach, and providing support for managing and sharing project results. Figure i) presents an overview of the project, with the single digital thread of the upstream lifecycle (concept, engineering, construction, outfitting and trials), and the key innovation in the platform, such as AI and Data-Driven functionalities, collaborative 3D environment, human centric knowledge management, and merging design and planning in the product lifecycle management system. A detailed version of this figure is found at the project's website (www.seus-project.eu).



Figure i) SEUS Project overview.

The platform has been tested in shipyards and has been developed using the expertise of academic and industrial consortium participants. The goal is to improve how shipyards manage information, use coherent and integrated digital technologies, and adopt smarter ways of building ships benefiting from digitalization. By doing this, the project is reducing the time it takes to design ships by up to 30% and the time it takes to build them by up to 20%. Improving the flow of digital information and streamlining work processes present opportunities for reducing time and costs, resulting in significant economic benefits for the shipbuilding industry.

#@PER.REP.HE@#
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1. EXPLANATION OF THE WORK CARRIED OUT AND OVERVIEW OF THE PROGRESS

1.1 Objectives

The Smart European Shipbuilding project (SEUS) aims to create a framework for European shipyards by architecting and developing an integrated and innovative digital platform. The platform combines computer-aided design, engineering, and manufacturing modules (CAD/CAE/CAM) with product lifecycle management (PLM) elements. This framework is intended to increase the overall efficiency of current EU ship design and shipbuilding processes, aiming to save up to 30% of the time in engineering and 20% in assembly and construction. A rich picture can be found at the project website (http://seus-project.eu/), with an excerpt presented in Figure 1.

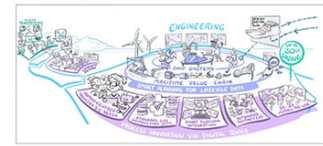


Figure 1 – SEUS innovation points illustrated, a smart planning for lifecycle data, via digital tools

The reduction of gaps in digital data flows and the streamlining of work processes offer opportunities for time and cost savings, leading to significant economic benefits in shipbuilding and competitiveness of the EU maritime industry. The identified impacts include the creation of a computational platform solution, enabling the digital transformation of shipbuilding, ensuring traceability and integration of early design impact on the design process, expanding the shipyard's involvement in the ship's life cycle, promoting human-centric shipbuilding knowledge management, and fostering the development of skills and expertise in the EU workforce.

The platform is intended to be built with shipbuilding and software experience related to digital and industry 5.0 approaches in ship design and construction, and will be developed with the core components, displayed in Figure 1, such as human-centered industry 5.0 needs, open standard for shipbuilding data, CAD/CAE/CAM integration, AI and automated routines and a product lifecycle management (PLM) platform to support 2D and 3D model reuse, as well as planning and project oversight.

The SEUS project is a collaborative effort between eight international partners from Germany, Finland, Norway, The Netherlands, and Spain aiming at improving computational solutions for shipbuilding processes. NTNU (NO) leads the project and is responsible for researching and evaluating a new PLM approach and compiling best practices in shipbuilding, while The University of Turku (UTU - FI) is responsible for ensuring that the project remains focused on the human aspect, making sure that the tools are user-friendly and meet the needs of the people using them. Several consortium partners, such as CADMATIC (FI), SARC (NL), and CONTACT (DE), oversee the development of the new digital platform that integrates various ship design and management tools. Shipyards like ULSTEIN (NO) and GONDAN (ES) will test these tools and provide feedback to help enhance them. Additionally, NHL STENDEN (NL) ensures that the project is visible and that it shares

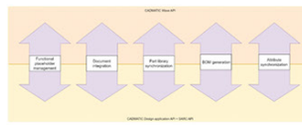


Figure 21 – API interfaces of PLM-platform and CAD applications

D3.2 (M48 – In Progress): Led by CONTACT, Task 3.2 (Interoperability for PDM/PLM solutions) involves the development of PDM/PLM API interfaces and open documentation of virtual middleware. This means that if it is necessary to handle more than one PDM/PLM application, they also have to exchange data. Within this project, however, our partners Ulstein and Gondan are not in this situation. Nevertheless, this situation arises most often when a company changes its PLM system from an old one to a new one. This scenario is also possible in shipbuilding design companies.

This is where the REST API, the standard data exchange interface, comes into play. The industry-standard REST API serves as the primary backbone for secure and structured data exchange. It allows external services to carry out standard operations (GET, POST, PUT, and DELETE) on important product and project data (e.g., requirements and CAD documents) on the SEUS platform.

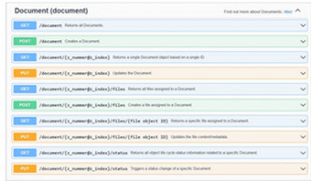


Figure 22 – REST API example overview of the query methods for the "Document" object

A recent development in research has given rise to a novel concept known as the AAS (Asset Administration Shell). The model is characterized by its standardization, which is particularly notable in the context of digital twin data exchange. In this project phase, the opportunity to read and send this information format was also implemented. Therefore, the SEUS platform has the potential to function as an integral component within data ecosystems that employ AAS models.

activities. Figure 43 is from SEUS workshop in Spain (2025), Figure 44 is SEUS team at COMPIT'25 (Computer Applications and Information Technology in the Maritime Industries).



Figure 43 – SEUS workshop in Spain, Nov 2025.





Diego De León
PHD Candidate

Academic Researchers

Data Driven Design - Ship Engineering Application

Project Description

A combination of two factors defines the current evolution of Ship Design. First, the challenges brought by the necessity of tackling the climate impact of shipping with the change in regulations and uncertainty about the solutions to come; and second, the availability of new computational methods based on machine learning and the boom in accessibility of computational power. This leads to a scenario where an opportunity to bridge the gap between the maritime industry's need for a more agile Ship Design process, and the current limitations in software tools and methodologies.

With a goal of contributing to the creation of applicative tools that consider the specific needs and workflow of Ship Design, adapting them to the maritime industry and aiding its transition to newer computational methods, the question itself becomes: How to implement modern computational technologies to enhance the ship design process, in a way that matches the necessities of the maritime industry.

Yet, to ensure applicability and feasibility, a start with the limitations of the available technology and the priorities of the industry is being evaluated as the first step in the creation of such prototypes.

Supervisor Team

1. Herbert J. Koelman, NHL Stenden & SARC BV
2. Henrique M. Gaspar, NTNU
3. José Jorge Garcia Agis, Ulstein International AS
4. Javier García Llaneza, Gondan Shipbuilders



Photo: Tony Hall

Gökce Yılmaz
PHD Candidate

Industry 5.0 in Shipbuilding: Improving Collaboration and Management with Digital Tools

About

Gökce is a PhD candidate who previously participated in the SEUS Project as a technical manager, supporting various work packages, primarily WP7. She holds a bachelor's degree in Architecture from Yeditepe University, Türkiye, and a master's degree in Sustainable Architecture from Politecnico di Milano, Italy After her contributions to supporting project management at SEUS, she began her PhD focusing on Industry 5.0 in project based firms, using the shipbuilding industry as a case context to examine and enhance project management practices.

Project Description

The PhD thesis explores existing solutions and challenges in shipbuilding project delivery models. It examines ways to enhance the adoption and use of digital tools for improved management practices under the goals of Industry 5.0 defined by the EU framework.

Research Questions

1. What defines the transition from Industry 4.0 to Industry 5.0 in project-based firms delivering complex products and systems?
2. How can Industry 5.0 be conceptualized in shipbuilding firms?
3. How can digital tool adoption be strengthened in shipbuilding firms under an Industry 5.0 framework?

Industrial & Academic Goals

- Analyze and validate how digital tools enhance teamwork and collaboration in shipbuilding projects.
- Develop practical guidelines to overcome adoption barriers and improve workflow integration.

Supervisor Team

1. Henrique M. Gaspar, NTNU
2. Miia Martinsuo, University of Turku
3. Maria Jose Legaz Almansa, Polytechnic University of Cartagena
4. José Jorge Garcia Agis, Ulstein International AS



Janica Altea Bronson
PHD Candidate

Data Integration Solutions for the Maritime Industry

About

Janica is a current PhD Candidate for Maritime Computational Tools at NTNU. She completed a Master's in Naval Architecture at the University of British Columbia and a Bachelor of Mechanical Engineering (Mechatronics Specialization) at the University of Calgary in Canada. Before NTNU, she worked in industry at Robert Allan Ltd and Vard Marine Inc., with a focus on ship concept design and the use of programmatic tools to improve decision-making, automate reference data handling, and design simulations. Her prior research involvements include machine learning for fuel consumption with BC Ferries, Queen of Oak Bay.

Project Description

Her current research Ph.D. thesis is focused on assessing the impact value of linking information silos and cross-domain data in ship early design and determining how this can be quantified in terms of time savings. Her current hypothesis is that the use of node-based and open data models can enhance the interoperability and interactions amongst the parameters used in different systems.

Research Questions

- What are the industry's main challenges regarding computational tools or digital infrastructure to manage ship data?
- What are the different ways that one can attain semantic and syntactic interoperability today?
- What data model could address the industry's unique challenges?
- How does this solution increase the overall efficiency and digital competitiveness of a ship design firm and yard?

SEUS, Innovation, and Industrial Goals

For the SEUS project, she is currently providing ancillary support for ongoing deliverables where additional academic and or literature input is needed. Collaboration with class societies, ship design firms, and shipyards is something she hopes to foster to provide software partners with a current and accurate understanding of the needs and information flows in present day ship design and shipbuilding.

Supervisor Team

1. Henrique M. Gaspar, NTNU
2. Icaro Fonseca, NTNU
3. José Jorge Garcia Agis, Ulstein International AS



Junsong He
PHD Candidate

Stakeholder Management for Value Creation in Project-Based Firms

About

Junsong is a doctoral researcher at the University of Turku (UTU). He completed a double master's degree at Tongji University in China and Politecnico di Milano in Italy, majoring in Product-Service System Design. Before UTU, he worked at Accenture and an AI startup.

Project Description

His research focuses on value creation and services from industrial, business, and management perspectives, using specific sectors as the research context. He also supports the development of Work Package 5.3, "Shipbuilding Activity Mapping," which supports and enhances the shipbuilding workflow.

Industrial Goals

The SAS will help project managers, engineers, and stakeholders gain a clear overview of the project, track activities, and optimize resources. By integrating data tools and considering values such as efficiency and service, it enhances decision-making, improves collaboration, and drives productivity–ensuring adaptability across different shipbuilding contexts.

Research Questions

Within the SEUS project, this overarching focus is examined through three key research questions:

- RQ1 (value-creation): How can managers balance service value and efficiency value in customized solutions?
- RQ2 (lifecycle activities): How do data platforms enable smart services through specific lifecycle activities in delivering a complex system?
- RQ3 (stakeholders): How do managers enable the implementation of smart services for business benefits in delivering a complex system?
- In practice, these research questions will guide the implementation of the SAS.

Innovation

Introducing an innovative SAM tool to enhance practical project management in shipbuilding.

Supervisor Team

1. Miia Martinsuo, University of Turku
2. Jussi Kantola, University of Turku



Karolina Bierkowska
PHD Candidate

AI in Ship Design and Construction: Opportunities and Challenges

About

Karolina is a PhD candidate at NTNU Ålesund. She earned her Bachelor's and Master's degrees in Naval Architecture at Gdańsk Tech in Poland. Her master's thesis focused on predicting stability criteria using Deep Neural Networks. Before starting her position at NTNU, she worked at Deltamarin Poland and Seatech Engineering, where she was involved in concept design and R&D projects focusing on stability calculations.

Project Description

The focus of her current research Ph.D. is on using artificial intelligence to make ship design analyses more efficient. She is investigating which tasks could benefit from the use of AI in naval architecture. The subject of her first paper was an extension of her master's thesis, investigating other machine learning models.

Research Questions

- What are the limitations and opportunities to improve digital tools and processes used for analysis in ship design and construction?
- Which analysis-related digital tools and processes in ship design and construction can benefit from the integration of AI?
- How do maritime industry stakeholders evaluate the usefulness of AI-supported analyses in ship design and construction?

Supervisor Team

1. Henrique Murilo Gaspar, NTNU
2. Benjamin Lagemann, NTNU
3. Tomasz Hinz, Gdańsk Tech
4. José Jorge Garcia Agis, Ulstein International AS



Pengcheng Ni
PHD Candidate

Knowledge Management System in a Complex Environment

About

Pengcheng Ni is a doctoral researcher at the University of Turku (UTU), Department of Mechanical and Materials Engineering. He is working in the smart system lab at the University of Turku. His research interest is system architecture in knowledge management of complex environments. He is doing research on knowledge management systems in the European shipbuilding industry.

Description

Knowledge Management System (KMS) is a vital yet abstract concept in the European shipbuilding industry. It is an interdisciplinary research field that combines technology and management research to tackle complex problems in projects. KMS enhances the core competitiveness of projects and contributes to each stage of the project. WP5 in SEUS focuses on the lifecycle of shipbuilding and involves all stakeholders, including shipyard workers, ship owners, operators, and shipbuilders. Finally, the KMS will integrate all the phases to form a Knowledge Network.

Goals

Utilize KMS to maximize the efficiency of managing knowledge assets, ultimately contributing to the core competitiveness of projects and organizations.

Research Questions

1. Is the current KMS suitable for the European shipbuilding industry?
2. How to transfer tacit knowledge in the European shipbuilding industry?

Innovation

The KMS developed for smart European shipbuilding represents the first systematic, organizationally focused study of knowledge management in the industry. This approach clearly differentiates itself from studies centered solely on technological aspects.

Supervisor

1. Jussi Kantola, University of Turku



Photo: Tony Hall

Jisang Ha
Postdoctoral Researcher

Improving Ship Design with Digitalization and Integrated Data Model

About

Jisang is a Postdoctoral Researcher for SEUS at NTNU. He completed a bachelor's and PhD (Naval Architecture and Ocean Engineering) at Seoul National University in Korea. Before NTNU, He mainly conducted research on ship arrangement design, equipment and piping design. He also worked on image-based ship detection and collision avoidance using deep learning techniques.

Project Description

His current research involves exploring the potential applications of Single Source of Truth (SSoT) and data integration solutions within the SEUS project framework. This research extend to performing design elements such as compartments, equipment, and piping during design phases with integrated data model from 2D drawings to 3D models.

Research Questions

- What technologies are required to perform both ship design and production with one integrated data model?
- Can deep learning technology contribute to ship design using an integrated data model?
- How can shipyards take advantage of digitized ship design?
- Can SEUS solutions improve the fragmented models between detailed and early-stage design?

SEUS, Innovation, and Industrial Goals

For the SEUS project, he is working on the development of Work Package 1 (WP1) and supporting other deliverables where additional academic and or literature input is needed. He would like to contribute to the SEUS project by applying SEUS solutions from industrial partners to research cases or by improving solutions.



Maryam Teimouri
Project Researcher

AI-Integrated Solutions for Smart Knowledge Management

About

Maryam is currently working as a Project Researcher at Turku NLP, University of Turku (UTU), Department of Computing. Her work focuses on AI-driven solutions for smart knowledge management. She holds a Master's degree in Data Analytics from the same university and department. Previously, she has conducted research on the role of Mixed Reality in education and analyzed interactions involving Large Language Models (LLMs) and AI. Her research interests span natural language processing, human-AI interaction, and intelligent systems.

Project Description

Maryam is currently exploring the use of Retrieval-Augmented Generation (RAG) technology to develop a flexible and intelligent knowledge management system. The goal is to create a system that is easily updatable while maintaining an interactive and natural communication style, similar to human language.

Industrial goals

The goal is to develop a web-based search engine with configurable settings, including the ability to switch between different language models. This flexibility enables the integration of multilingual models, allowing users to access documents in multiple languages. By supporting diverse language sets, the system aims to enhance accessibility and usability for a global audience.

Research Questions

1. Model Selection: Which language models are best suited for retrieving the most relevant documents while ensuring that all aspects of the user's prompt are considered?
2. Attention Control: How can we effectively control the aspects that models focus on during retrieval and response generation?
3. Specialized Retrieval: How can the system efficiently retrieve specific types of documents, such as tables, images, and formulas?

Supervisor

1. Filip Ginter, University of Turku



Zeynep Tacgin Simsek
Postdoctoral Researcher

Learning technology-based training

About

Zeynep Tacgin has worked in the field of education technologies for more than fifteen years. She is a Postdoctoral Researcher at the University of Turku and an Associate Professor at Marmara University. She graduated from the Computer Education and Instruction Technologies program at Marmara University in 2012. She received a PhD degree in the Computer Education and Instruction Technologies program in 2017. Her fields of interest are education, human-computer interaction, wearable technologies, innovative learning environments, technology integration into education, education management and policies, distance education, augmented reality, virtual reality, simulations, instructional design, and material development.

Project Description

Her current postdoctoral research focuses on designing and developing an orientation tool aimed at motivating individuals in the shipbuilding industry to adopt data-driven shipbuilding tools in their daily work routines.

Research Questions

- What are the most suitable learning models and instructional techniques for training programs aimed at integrating data-driven shipbuilding tools into daily work practices?
- What should be the scope and content of such training programs to effectively support the adoption of data-driven tools in the shipbuilding industry?
- How do learners evaluate the usability of the developed digital learning solution?
- How do learners assess the effectiveness of the developed digital learning solution in supporting their work practices?

Innovation

For the SEUS project, Zeynep is working on Work Package 5 in tasks 5.5 and 5.6 which focus on designing solutions for training shipbuilding and software professionals based on learning technologies. The development of this learning material involves not only an in-depth review of relevant literature but also close collaboration with various project partners to analyze their specific needs for adopting data-driven shipbuilding tools.





Target Group





Collaboration between MTI (Japan) and NTNU (Norway)

Target Audience

SEUS continues to expand its engagement with key target groups across Europe and beyond, reinforcing the project's ambition to support a digitally mature, competitive, and innovation driven shipbuilding sector.

Within Europe, collaboration has intensified through academic partnerships with the University of Firenze, via Industry 5.0 for one of a kind and complex manufacturing. Ship Design and Construction initiatives are also being sketched with the University of Genoa, and the University of Trieste, extending the project's reach into other naval architecture and shipbuilding silos. On the path towards ZEWT, we are part of the board of the Clean Maritime Hub initiative in the United Kingdom, which has further positioned SEUS within a strategic European forum dedicated to sustainable and technologically advanced in maritime operations.

Beyond Europe, SEUS has strengthened ties with internationally recognized research and innovation centres, including the Monohakobi Technology Institute (MTI) and the University of Osaka in Japan. These collaborations enable knowledge exchange on cyber physical ship systems, digital twins and AI, broadening the scientific and technological relevance of the project. In parallel, industrial partners have explored pathways for commercial exploitation in Asia, particularly in Japan and Korea, where interest in integrated PLM based shipbuilding solutions and AI enhanced engineering workflows is growing rapidly.

This combination of European academic partnerships, UK based strategic participation, and non EU scientific and commercial engagement ensures that SEUS results reach a wide and diverse target group. It also strengthens the project's long term impact by positioning its digital tools, methodologies, and knowledge assets within both established and emerging maritime innovation ecosystems.

Communication & Dissemination

SCIENTIFIC ARTICLES (2025)

Dawid Stade, Maximilian Idjen, Elisabeth Brandenburg
Multi-Structure Product Data Management in Ship Design, Computer and IT Applications in the Maritime Industries
CONTACT

Diego De León, Herbert Koelman
Generative Algorithms in Early Ship Design: An Exploration of Hull Subdivision Generation, Computer and IT Applications in the Maritime Industries
NHL Stenden

Gökce Yilmaz, Miia Martinsuo, Henrique Gaspar, Janica Altea Bronson
Interoperability in Project-Based Industries: Learnings and Challenges, IFAC Conference on Manufacturing Modelling, Management and Control MIM
NTNU

Henrique Gaspar
A Single-Source-Of-Truth for Future Ship Life-Cycle Data
NTNU

Janica Altea Bronson, Maryam Teimouri, Henrique Gaspar, Icaro Fonseca, Karolina Bierkoszka, Filip Ginter, Herbert Koelman
A RAG-based LLM Approach for Data Validation and Harmonization in Ship Design, Computer and IT Applications in the Maritime Industries
NTNU

Jisang Ha, Janica Altea Bronson, Henrique Gaspar
Managing Design Changes in Shipbuilding: Proposing a Real-Time Simulation Dashboard, International Symposium on Practical Design of Ships and other Floating Structures
NTNU

Junsong He, Miia Martinsuo
Balancing between efficiency value and service value in delivering customized solutions, World Mass Customization and Personalization Conference
UTU

Junsong He, Miia Martinsuo
Using data platforms for smart service innovation in delivering complex systems, The International Society for Professional Innovation Management Conference
UTU

Junsong He, Miia Martinsuo
Using data platforms for smart services over the lifecycle of a complex system, Spring Servitization Conference
UTU

Karolina Bierkowska, Tomasz Hinz, Grzegorz Mazerski, Przemysław Krata
Application of Neural Networks in Early-Stage Ship Design for Stability Evaluation Using IMO Second Generation Criteria, International Congress of the International Maritime Association of the Mediterranean
NTNU

Karolina Bierkowska, Henrique Gaspar, Tomasz Hinz
Navigating AI in Naval Architecture: A Comparative Effectiveness Study of Machine Learning Models for Ship Stability Computer and IT Applications in the Maritime Industries
NTNU

Maryam Teimouri, Jenna Kanerva, Filip Ginter
A Deep Dive into Multi-Head Attention and Multi-Aspect Embedding, Proceedings of Recent Advances in Natural Language Processing
UTU

Pengcheng Ni, Jussi Kantola
Exploring the factors influencing knowledge management strategy in the European shipbuilding industry: A pilot study. Journal of Knowledge Management Practice, 25(6).
UTU

Zeynep Tacgin, Miia Martinsuo
An augmented reality solution for digitalisation training in shipbuilding: Systematic review and application development, International Technology, Education and Development Conference
UTU

Zeynep Tacgin, Miia Martinsuo
Design-based research for user-centered digital industrial training. Paper submitted to Journal of Technology and Science Education.
UTU

Zeynep Tacgin, Miia Martinsuo
Instructional design to promote data-driven practices and digitalisation in shipbuilding

projects, International Technology, Education and Development Conference
UTU

Zeynep Tacgin, Miia Martinsuo
Promoting digitalization competences in project-based firms: Design and testing of a digital learning solution. Paper submitted to Project Leadership and Society.
UTU

SEMINARS (2025)

Filip Ginter, Madalina Florean, Diego De León
AI Alignment Workshop, Online, 31.01.2025
CADMATIC

Diego De León
Data-Driven maritime implementation for the Introduction to Python class, Leeuwarden, Netherlands 24.02.2025
NHL Stenden

Diego De León, Herbert Koelman
Early Data-Driven Ship Design Prototype update, Bussum, Netherlands, 27.02.2025
NHL Stenden

Janica Bronson, Gökce Yilmaz
Introduction of SEUS for Archimedes student association, Nantes, France, March 2025
NTNU

Junsong He
Industrial Engineering and Management Research Seminar, Turku, 20.03.2025
UTU

Evgenii Egorov
PLM platform Workshop for Japanese shipbuilding, Finland, 15.05.2025
CADMATIC

Evgenii Egorov
PLM platform Workshop for Japanese shipbuilding 2, Finland, 6.06.2025
CADMATIC

Janica Bronson, Gökce Yilmaz, Herbert Koelman, Henrique Gaspar
Maritime data exchange workshop, Norway, 12.06.2025
NTNU

Herbert Koelman
Presentation "Mind the gap", Maritime data exchange workshop, Norway, 12.06.2025
SARC

Madaline Florean, Maximilian Idjen
AI in the PLM Platform Workshop, Online, 27.06.2025
CADMATIC

Herbert Koelman
In-company symposium on applied maritime research, Terschelling, Netherlands, 1.10.2025
SARC

Diego De León, Herbert Koelman
PD-MT, Rotterdam, 16.09.2025
NHL Stenden
Casimir Koelman
Europort, Ahoy Roterdam, 4. – 7.11.2025
SARC

Jisang Ha
Introduction of SEUS for Korean university, South Korea, 12.12.2025
NTNU

Computer Applications and Information Technology in the Maritime Industries (COMPIT'25) (Italy)





SEUS Workshops

SEUS Workshop in Germany

The SEUS EU Project held its third workshop in Germany from March 11 to 12, 2025. During the workshop, partners discussed shipbuilding digital tools, business exploitation, cybersecurity, and research activities.

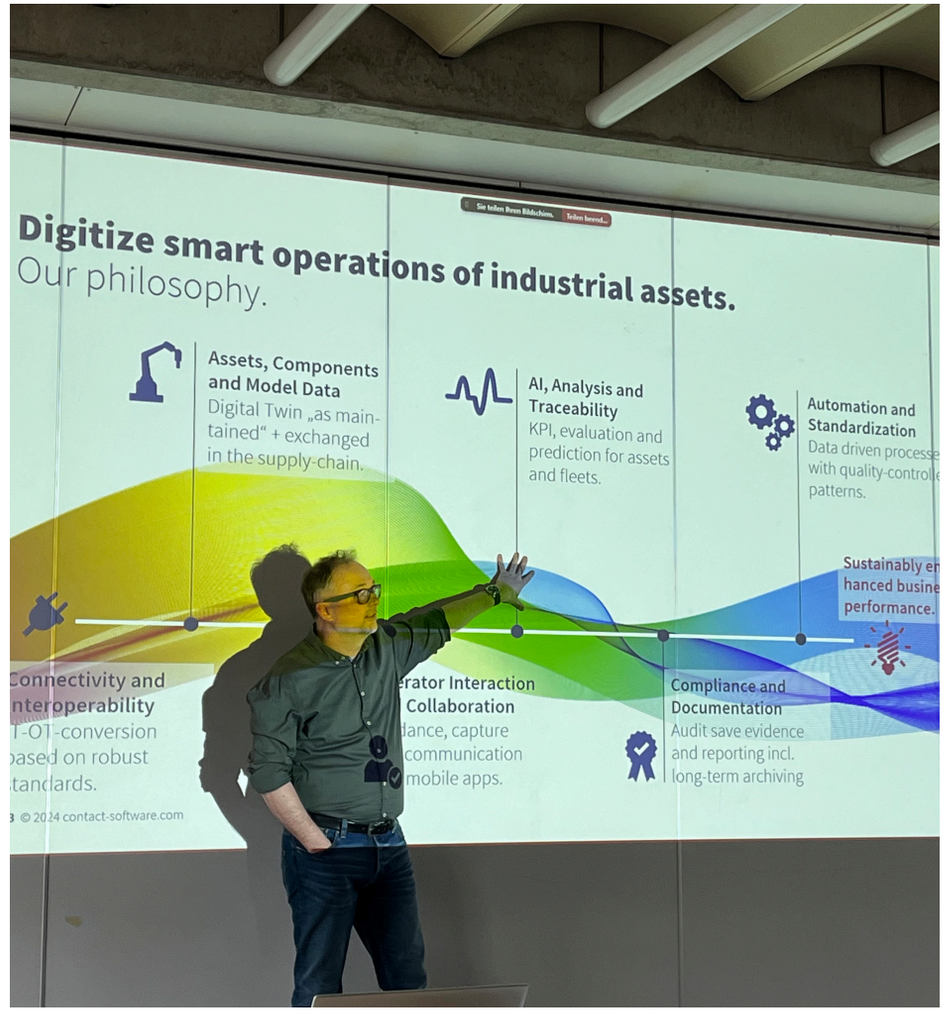
On the first day, the workshop opened with a project summary by NTNU with planning, upcoming tasks, information sharing, and WP highlights of the project. Key sessions included technical presentations on Use cases support and open models annd AI for GA (NTNU) and Wave Platform update (CADMATIC),.

Product Lifecycle Management (PLM) challenges (CONTACT), target use cases, and a document management demo via Wave (Cadmatic). Additionaly, production planning, early--stage design integration (SARC), a live PLM solution demo (ULSTEIN), and implementation insights from shipyard (Ulstein and Gondan) are shared and discussed in sessions.

On the second day, the workshop involved presentations on application of PLM in the initial design phase (SARC), data-driven early ship design (NHL), KMS and AI research (UTU), and PHD updates NTNU, UTU, and NHL Stenden.

The day wrapped up with a summary of action points and a visit to CONTACT for a demo.









SEUS Workshop in Spain

The fourth workshop of the SEUS EU Project was held in Spain from November 5 to 6, 2025. During the workshop, partners discussed project progress and tasks, shipbuilding digital tools, business exploitation, shipyard implementation, and research activities.

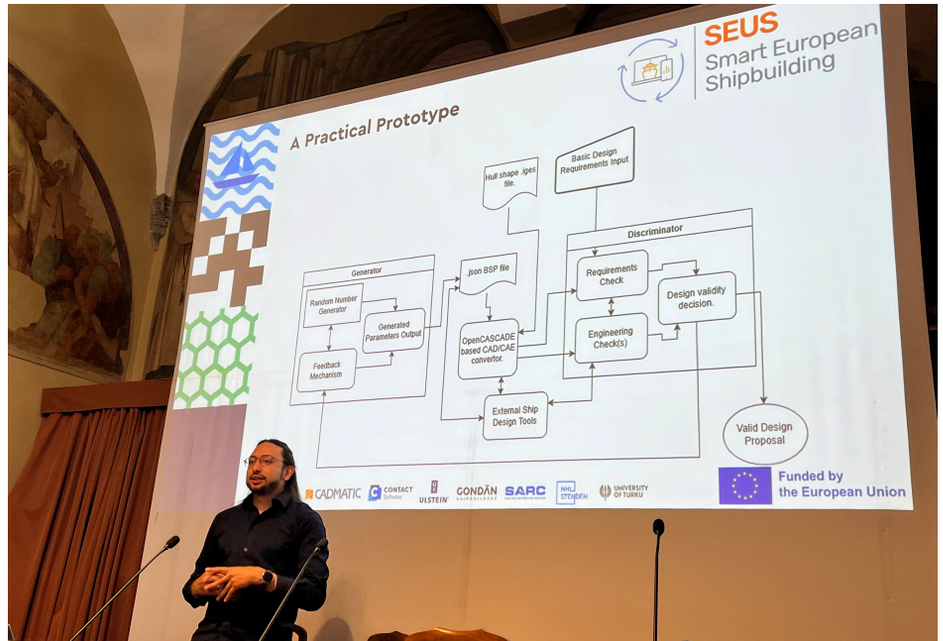
On the first day, the workshop opened with a project summary by NTNU with planning, upcoming tasks, information sharing, and WP highlights of the project. Key sessions included technical presentations on Wave PLM-Platform update (CADMATIC), Interoperability for CAD and Use of AL/NLP technology (CONTACT), survey findings and live demo (Ulstein), and human-centric knowledge management system (UTU).

On the second day, the workshop focused on PhD updates from CADMATIC. PhDs from NTNU, UTU, and NHL Stenden. After the sessions, the workshop concluded with a visit to Gondon's shipyard, where partners experienced the current progress of the shipbuilding industry.





Presentation Highlights



Open Repository

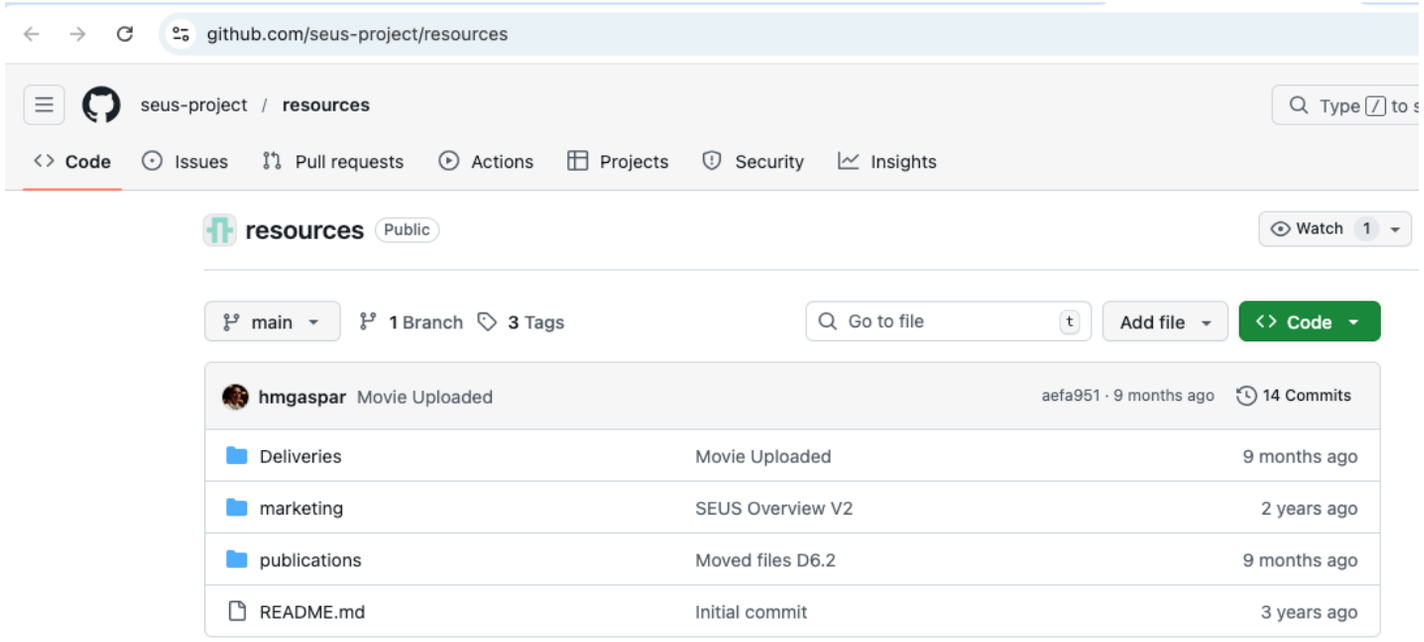
An open-data repository is a place where data, that can be freely shared and reused by anyone, is stored. FAIR data refers to data that adheres to good practices for sharing data while respecting ethical, legal, and contractual restrictions, such as personal information, copyright, patents, and trade secrets. To ensure that open data aligns with FAIR principles, research data are placed in open-data repositories such as GitHub and Zenodo.

GitHub is an effective tool for managing, sharing, and preserving research data. It is a web-based platform that utilizes Git for version control, enabling users to organize, collaborate on, track, and maintain data.

Zenodo is an open-access repository developed and operated by CERN and OpenAIRE. It has the capability to connect with GitHub to preserve datasets and create DOIs (Digital Object Identifiers). Zenodo can automatically archive GitHub releases, ensuring that the data is preserved for the long term.

By assigning DOIs, Zenodo ensures that data can be cited and referenced easily. Zenodo is included in OpenAIRE (Open Access Infrastructure for Research in Europe), an initiative of the European Union that promotes open access to research outputs, making scientific publications, datasets, and other research results freely available to the public.

The research outputs deposited in Zenodo are automatically integrated into the OpenAIRE infrastructure, ensuring that our outputs are part of the broader European open science ecosystem and are searchable through the OpenAIRE portal.



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May 5, 2025 (v1) | Conference paper | Open

A Single-Source-Of-Truth for Future Ship Life-Cycle Data

Gaspar, Henrique

Published and presetned at 17th Symposium on High-Performance Marine Vehicles HIPER'25 Tullamore, 5-7 May 2025.https://zenodo.org/records/15350131

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Uploaded on March 4, 2026

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October 8, 2025 (v1) | Conference paper | Open

Generative Algorithms in Early Ship Design: An Exploration of Hull Subdivision Generation

De León, Diego; Koelman, Herbert

This paper explores the potential for a data-driven tool to aid in the early ship design process, through the generation of subdivisions for the general layout via a proof-of-concept prototype which leverages a GAN to create plausible layout alternatives. The software implementation integrates a BSP tree structure for parametrisation, and a CAD geometry implementation. To work…

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13 15

October 8, 2025 (v1) | Conference paper | Open

A RAG-based LLM Approach for Data Validation and Harmonization in Ship Design

Bronson, Janica Altea; Teimouri, Maryam; Gaspar, Henrique; and 4 others

No description

Part of SEUS - Smart European Shipbuilding

Uploaded on October 31, 2025

31 25

October 8, 2025 (v1) | Conference paper | Open

Navigating AI in Naval Architecture: A Comparative Effectiveness Study of Machine Learning Models for Ship Stability

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Horizon Europe

Project Information

SEUS

Grant agreement ID: 101096224

DOI

10.3030/101096224

EC signature date

28 November 2022

Start date

1 January 2023

End date

31 December 2026

Funded under

Climate, Energy and Mobility

Total cost

€ 8 590 667,50

EU contribution

€ 6 992 201,50



Investment in EU policy priorities

Digital agenda	○	Clean air	◐
Artificial Intelligence	○	Climate action	◐
Biodiversity	○		

Coordinated by

NORGES TEKNISK-NATURVITENSKAPELIGE UNIVERSITET NTNU

Norway

DOI: 10.3030/101096224

NORGES TEKNISK-NATURVITENSKAPELIGE UNIVERSITET NTNU	Net EU contribution	**€ 2 070 875,00**
CONTACT SOFTWARE GROUP GMBH Germany	Net EU contribution	**€ 835 275,00**
STICHTING NHL STENDEN HOGESCHOOL Netherlands	Net EU contribution	**€ 528 285,00**
TURUN YLIOPISTO Finland	Net EU contribution	**€ 663 290,00**
CADMATIC OY Finland	Net EU contribution	**€ 1 184 357,25**
THIRD-PARTY **CADMATIC EAC OY** Finland	Net EU contribution	**€ 78 693,65**
THIRD-PARTY **CADMATIC BV** Netherlands	Net EU contribution	**€ 332 274,10**
ULSTEIN GROUP ASA Norway	Net EU contribution	**€ 624 755,00**
SCHEEPSBOUWKUNDIG ADVIES- EN REKENCENTRUM SARC BV Netherlands	Net EU contribution	**€ 388 709,00**
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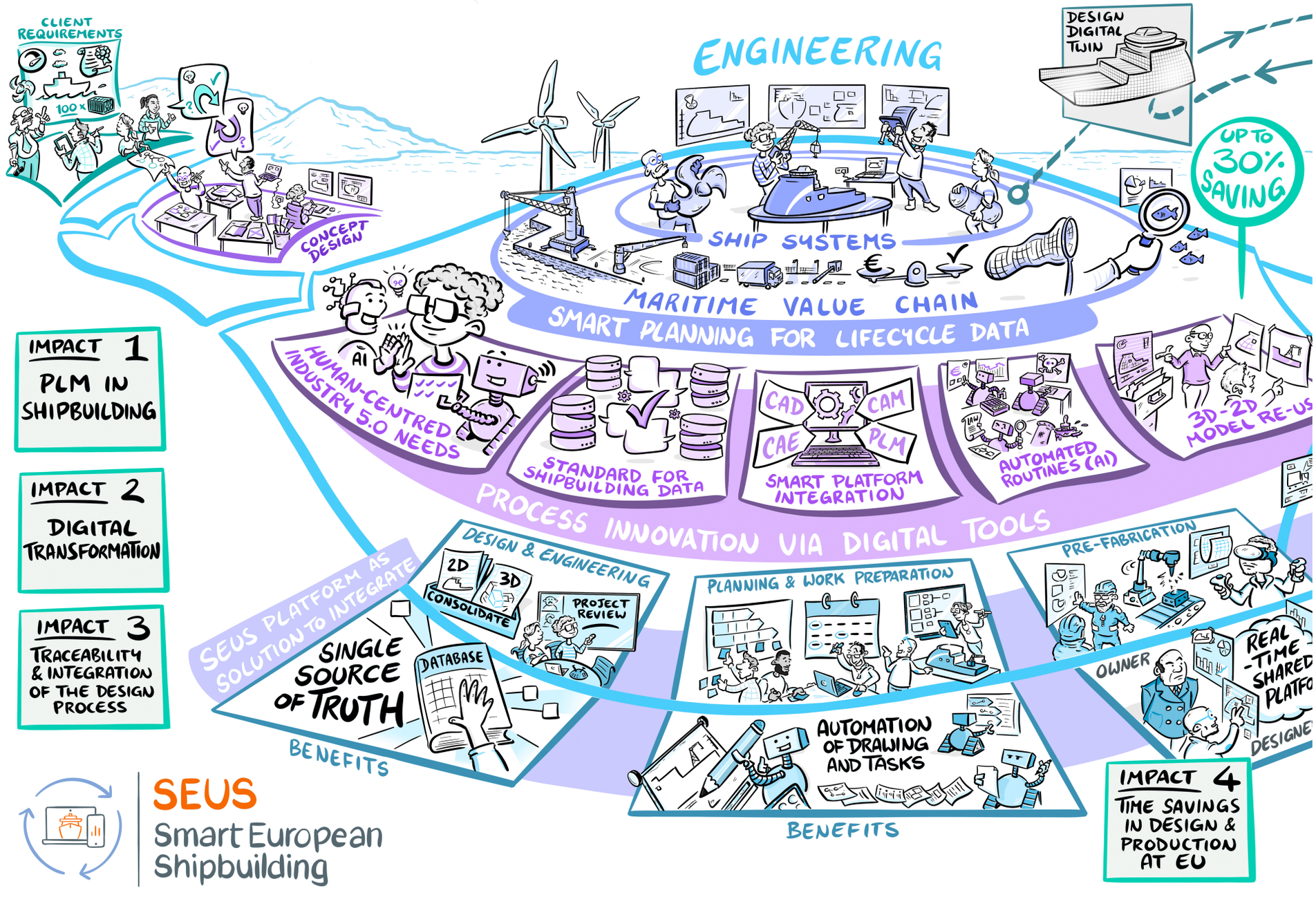
GONDAN INGENIERIA SL Spain	Net EU contribution	**€ 167 562,50**



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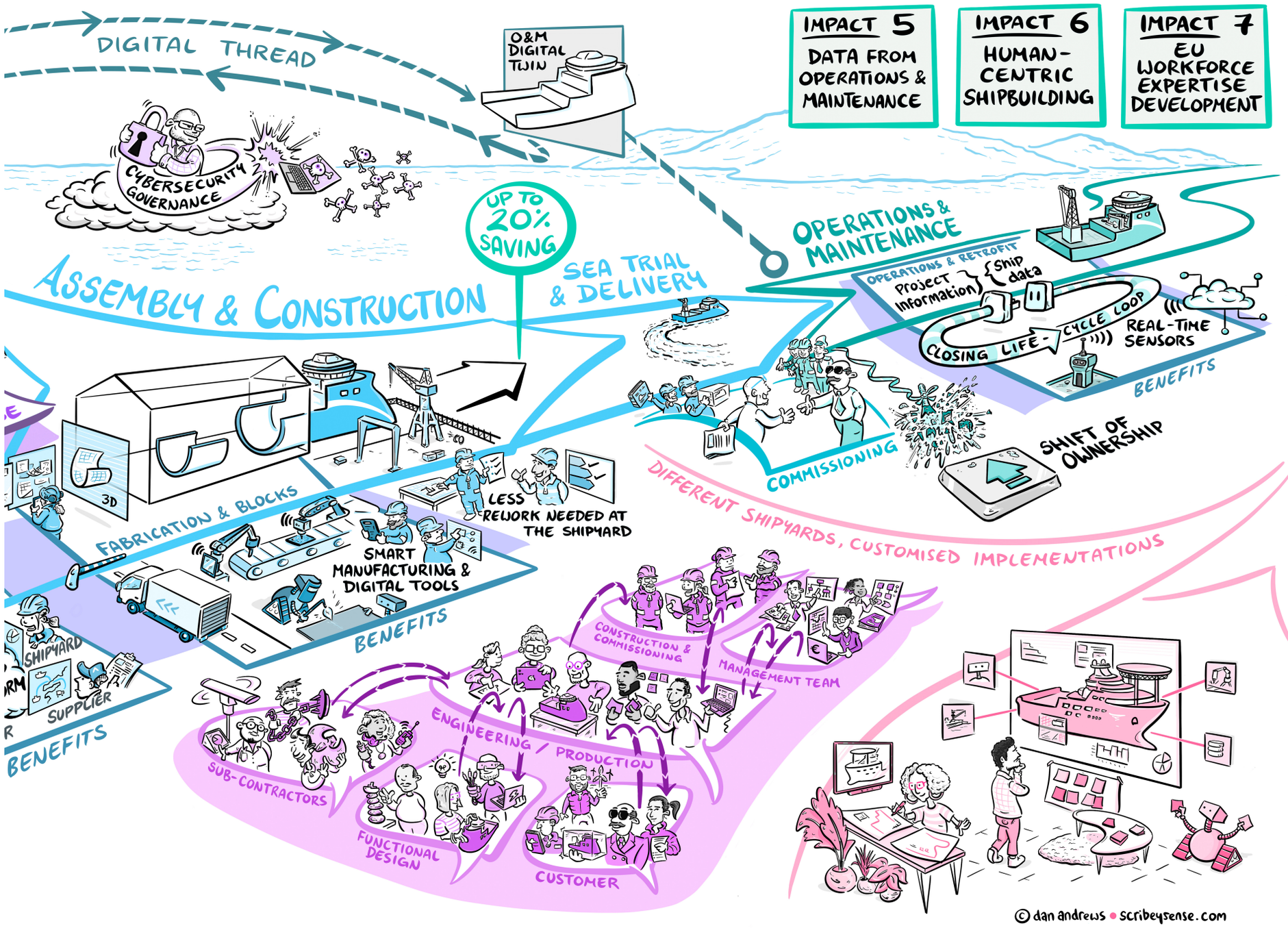
DIGITAL THREAD
O&M DIGITAL TWIN
IMPACT 5
DATA FROM OPERATIONS & MAINTENANCE
IMPACT 6
HUMAN-CENTRIC SHIPBUILDING
IMPACT 7
EU WORKFORCE EXPERTISE DEVELOPMENT
CYBERSECURITY GOVERNANCE
UP TO 20% SAVING
ASSEMBLY & CONSTRUCTION
SEA TRIAL & DELIVERY
OPERATIONS & MAINTENANCE
OPERATIONS & RETROFIT
Project Information
Ship data
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REAL-TIME SENSORS
BENEFITS
SHIFT OF OWNERSHIP
COMMISSIONING
3D
FABRICATION & BLOCKS
LESS REWORK NEEDED AT THE SHIPYARD
SMART MANUFACTURING & DIGITAL TOOLS
BENEFITS
DIFFERENT SHIPYARDS, CUSTOMISED IMPLEMENTATIONS
SHIPYARD
SUPPLIER
BENEFITS
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Funded by
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This project has received funding from the Horizon Europe Framework Programme (HORIZON) EU programme under grant agreement No 101096224. This report reflects only the author's view and the European Commission is not responsible for any use that may be made of the information it contains.

Photo: Gondán

