

NEW, ADVANCED AND VALUE-ADDED INNOVATIVE SHIPS

This fourth edition of the Newsletter of the NAVAIS project, provides an overview of the activities executed since May 2020. NAVAIS develops a platform-based modular product family approach supported by the **3DEXPERIENCE®** integrated business platform. This concept will increase efficiency in vessel design and flexibility in production networks. NAVAIS focusses on passenger/road ferries and multi-use workboats

integrating sustainability in the design of the ships. NAVAIS supports the transfer from an engineered-to-order business model to an assemble-to-order business model, which allows shorter process lead-times, constant quality, reduced design and production costs and better integration of the SME supply chain, thereby increasing competitiveness of the European shipbuilding industry. Since the newsletter of May this

year, detailing and developing the functional modules for road ferries, the execution of a detailed study of the main systems present in workboats, the execution of a series of model tests related to URN and the implementation of the ferry and workboat concepts in **3DEXPERIENCE®** have been among the core activities of NAVAIS.

AREAS OF INTEREST

NAVAIS works on six areas of attention throughout the lifetime of the project to achieve its goals

1 REQUIREMENTS AND ASSESSMENTS

setting and aligning the detailed requirements, ensuring the different work packages remain aligned, validating and verifying the project results. Cost-benefit, including societal costs, are an important element for defining requirements in NAVAIS.

The innovative approaches to ship design (and building) foreseen by NAVAIS have been agreed upon in the mid-term concept assessment. The focus here was on three key elements:

- ① A design process based on systems engineering and modularity,
- ② An implementation of these processes in the DS software suite;
- ③ and the creation of simulations of the production aspects to validate these approaches.

The mid-term assessment was a very useful event to bring all stakeholders together and hold an in depth discussion on the required tools within and potentially even outside of the **3DEXPERIENCE®** suite.

The next assessment will be on the concept implementation of workboats and ferries as well as simulation of the production, which will validate the implementation chosen by NAVAIS.

2 PLATFORM BASED FERRY PRODUCT FAMILY

creating a platform based modular ferry product family and creating a digital twin to verify simulations of the production process

The previous months of NAVAIS have been spent on further detailing and developing the functional modules for the Road Ferries. The modular blocks for the electrical propulsion

system have been defined and a development plan for the next part of the project has been created. Secondly, the initial study into the different effects of a modular hull

shape have been investigated and will be finalized in the next few months. Subsequently, the definition of the modular construction plan will start after the summer period.

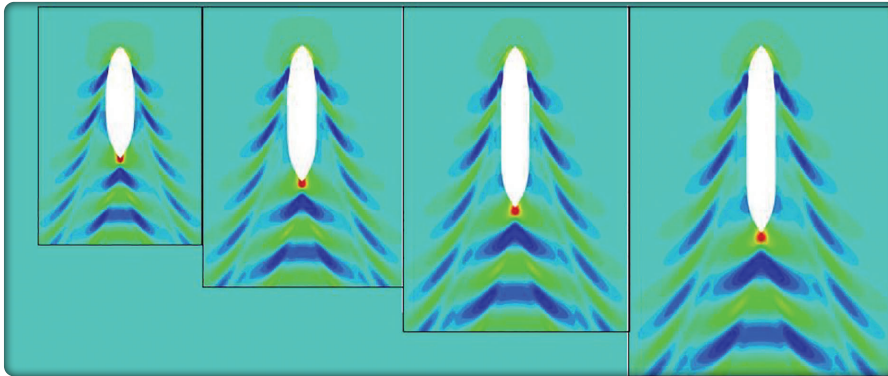


Figure 1: Top view of the wave pattern of 4 hulls with a different length

Starting from this month, other functional modules on board of the vessel will be implemented on the basis of the re-use principle defined under area of attention 5, therewith directly proving the concept of NAVAIS and re-using functional modules over different platforms and ship types.

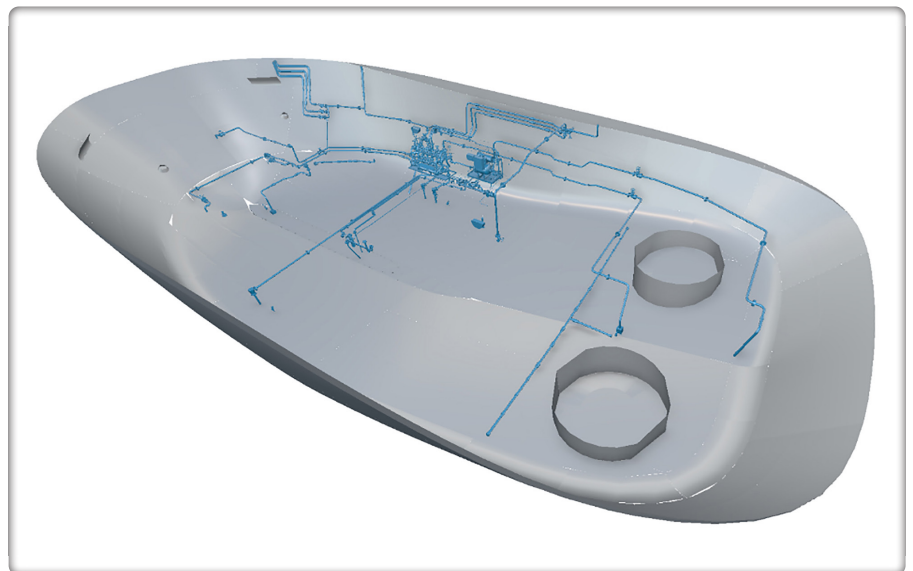
3 PLATFORM-BASED WORKBOAT PRODUCT

to develop a platform-based workboat family for a wide range of customer demands. The concept is based on the analysis and redesign of standards and scalable functional modules often present in the workboat industry.

The activities in this area of attention are in full swing. After an extensive market analysis a solid workboats product family has been defined consisting of 3 vessels.

In parallel, the team carried out a detailed study of the main systems typically present in workboats aiming to create, for each system, a single system architecture built upon the commonly shared components and solutions; the obtained system architectures will be applied to all members of the product family with no, or at least minimum, changes within the Logical and Physical domains.

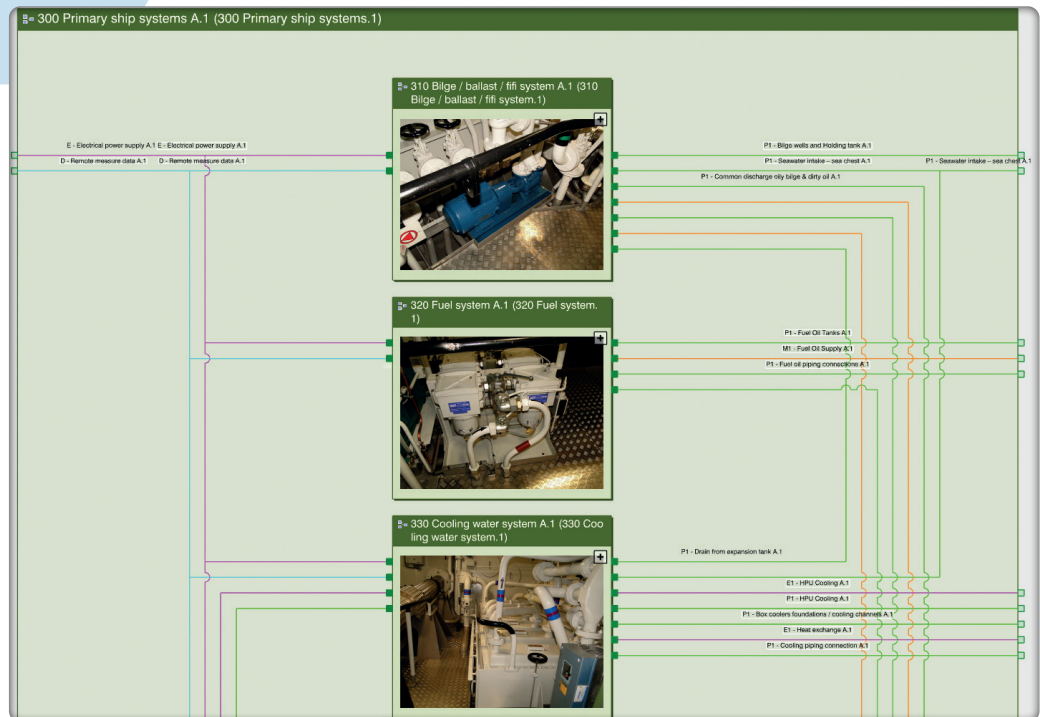
Together with a successful collaboration with area of attention 5, the implementation of the newly developed system architectures, and



all the relevant systems interfaces, in the **3DEXPERIENCE®** platform are well in progress. Each implemented system is completed by its own set

of requirements and functionalities properly stored in the **3DEXPERIENCE®** platform. The implementation mainly consists of the logical system diagrams

made by active elements, e.g. pipes and pumps, which can be properly sized and connected to applicable requirements, functionalities and other relevant systems.

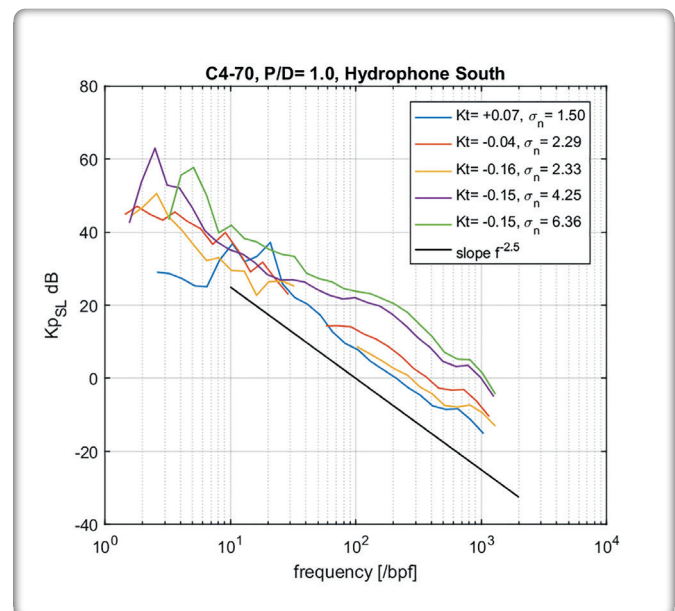


4 LOW-IMPACT DESIGN & OPERATIONAL PRINCIPLES

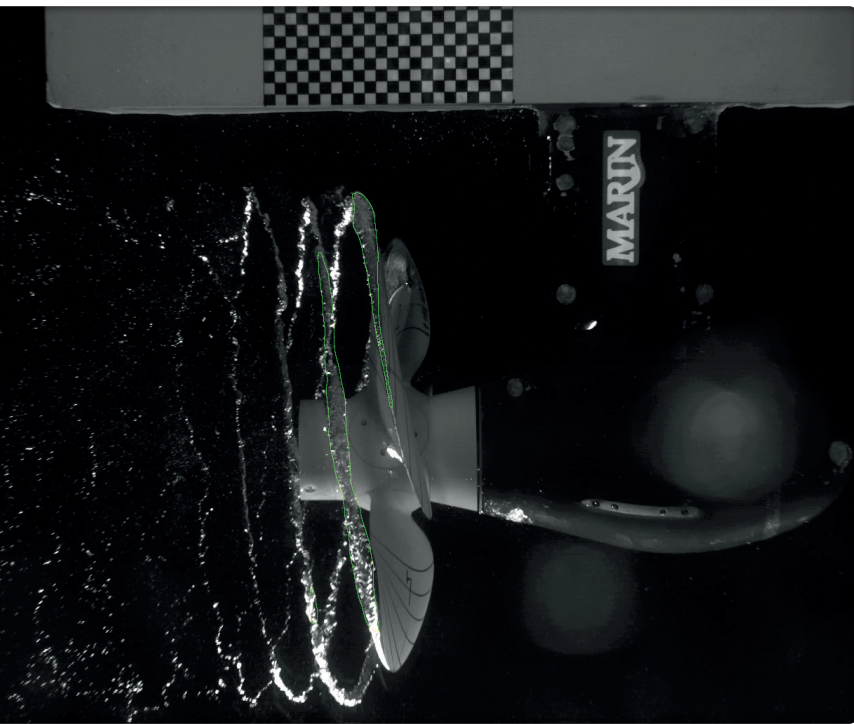
to provide guidelines and goals for low-impact design of vessels.

One of the environmental impacts considered in NAVAIS is underwater radiated noise (URN). Prediction models for URN due to cavitation during deceleration and during dynamic positioning are under consideration since those are operating conditions that occur regularly for road ferries and workboats respectively.

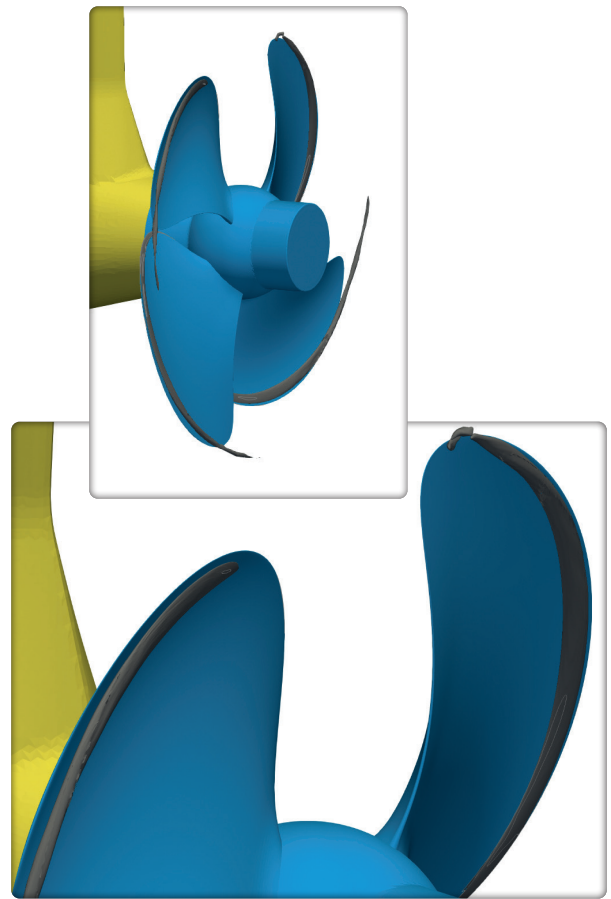
As reported in previous NAVAIS Newsletters, a series of model tests has been performed to provide validation data for the computational models. The noise measurements of these tests have been analysed. Currently, all tests are being compared and used to create computational models. An example of the non-dimensionalised noise levels (Kp_{SL}) of a four-bladed propeller in a low pitch setting is shown in the following figure. The lines show various thrust coefficients (K_t) and cavitation numbers (σ_n). The black line is an approximation of the slope of the spectra as used for creating the models.



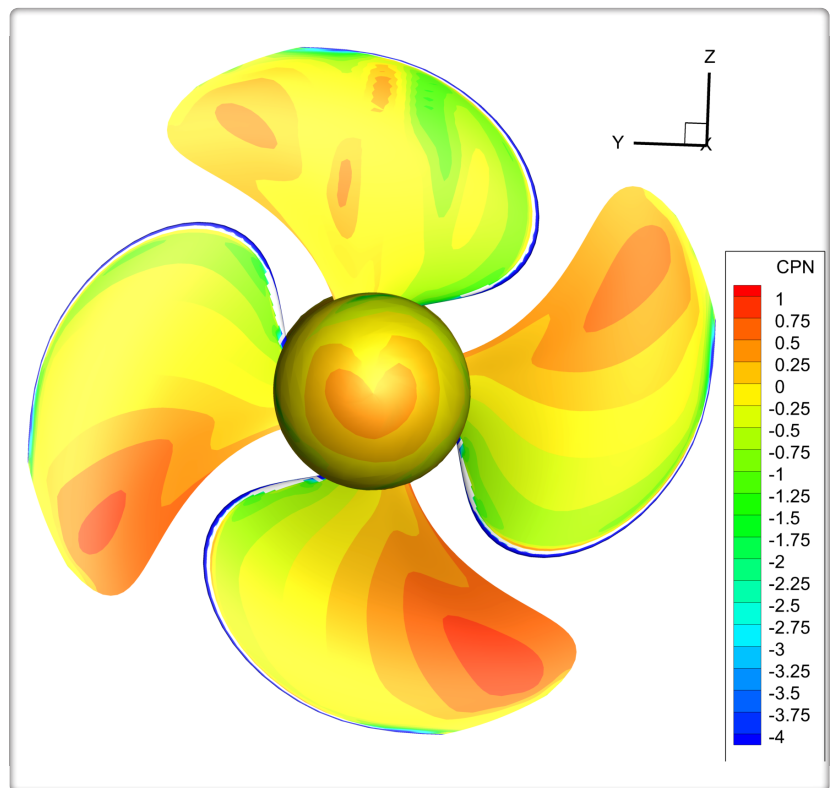
As well as the noise levels, the cavitating tip vortex diameter is also used as an input for the URN prediction models. This is being determined by applying image processing and machine learning techniques on the high-speed video observations. An example thereof is shown in the image below. The green outline shows the automatically determined cavitation outline.



This is also compared to data from time-resolved CFD computations, which also include cavitation. Examples thereof are shown in the two figures beside.



Such CFD computations take about 5 weeks on 360 computational cores and create several TB of data. They are very useful for getting detailed information about the flow but they are not practical in a design process. Therefore, the URN prediction models will make use of Boundary Element Method (BEM) computations - which run in a few minutes - to provide the needed input. The BEM solution for the pressure distribution of the propeller as used for the CFD computations is shown in the right figure.



When the semi-empirical models for URN are ready and have been validated, they will be used to compute the URN of a large collection of automatically generated propeller designs. These propellers will have different numbers of propeller blades, different blade area ratios, and operate at various conditions. Based on the trends obtained from these propellers, a tool to estimate the URN in an early design stage will be developed and coupled to the 3DEXPERIENCE® platform. Additionally, models for URN caused by machinery inside

the ship will also be coupled to the 3DEXPERIENCE® platform allowing the two most important URN sources to be predicted during the ship design process.

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PLATFORM-BASED MODULAR PRODUCT FAMILY DESIGN & PRODUCTION

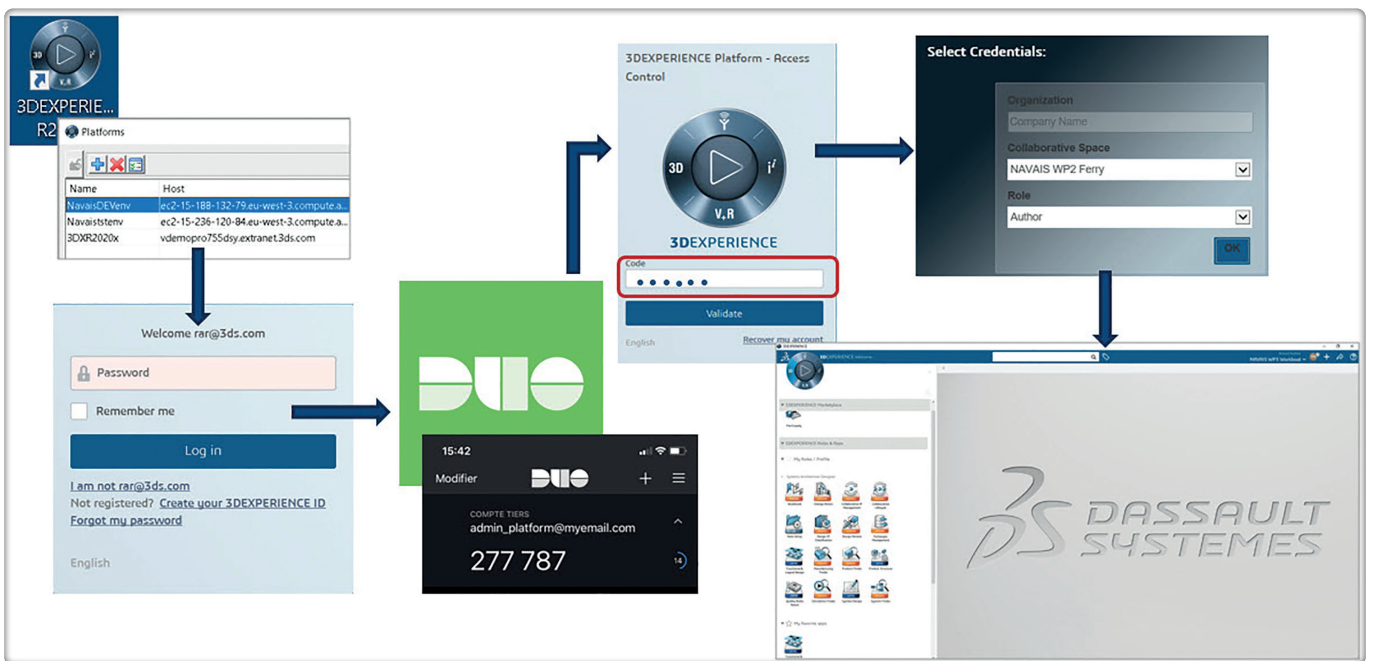
will develop the principles and guidelines for modularization (design process and re-use library), for platform-based product families definition, for modular production concept and simulation and finally for approval thanks to the 3DEXPERIENCE® platform added value.

In line with the actions we initiated previously (please refer to newsletter #3), we made significant progress on the implementation of the e-ferry and workboat demonstrators.

Carrying out of the official R2020xFP2014 3DEXPERIENCE installation.

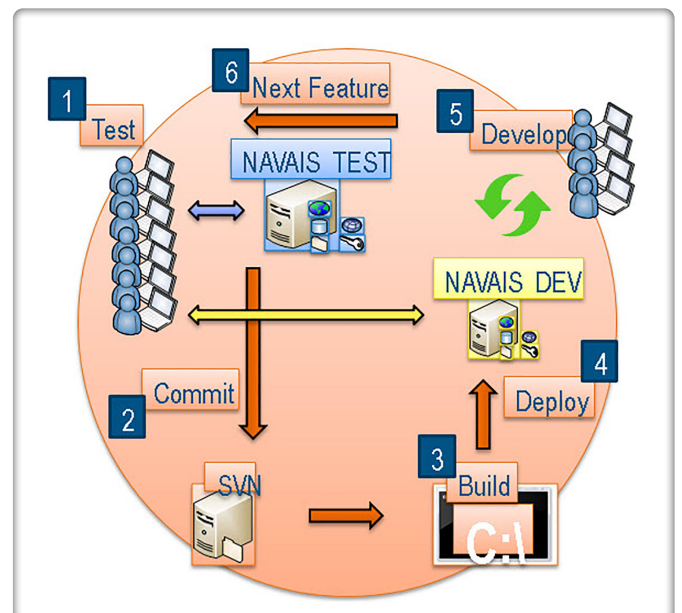
Based on the "D5.2-Working environment" report and with the support of NAVAIS partners DAMEN and Processia, we replaced the 3DEXPERIENCE® "On the Cloud" working environment that was used for users to develop their skills with the official one hosted by DAMEN Gorichem. Thanks to two-factor authentication (see figure below), users are

able to connect to two different NAVAIS environments: the TST upstream environment to test NAVAIS concepts as well as new design and production methods, and the DEV downstream one to validate the methods against the two demonstrators (see figure on following page).



NAVAIS process to login to the 3DEXPERIENCE platform using two-factor authentication

NAVAIS R&D iterative development project from TST to DEV

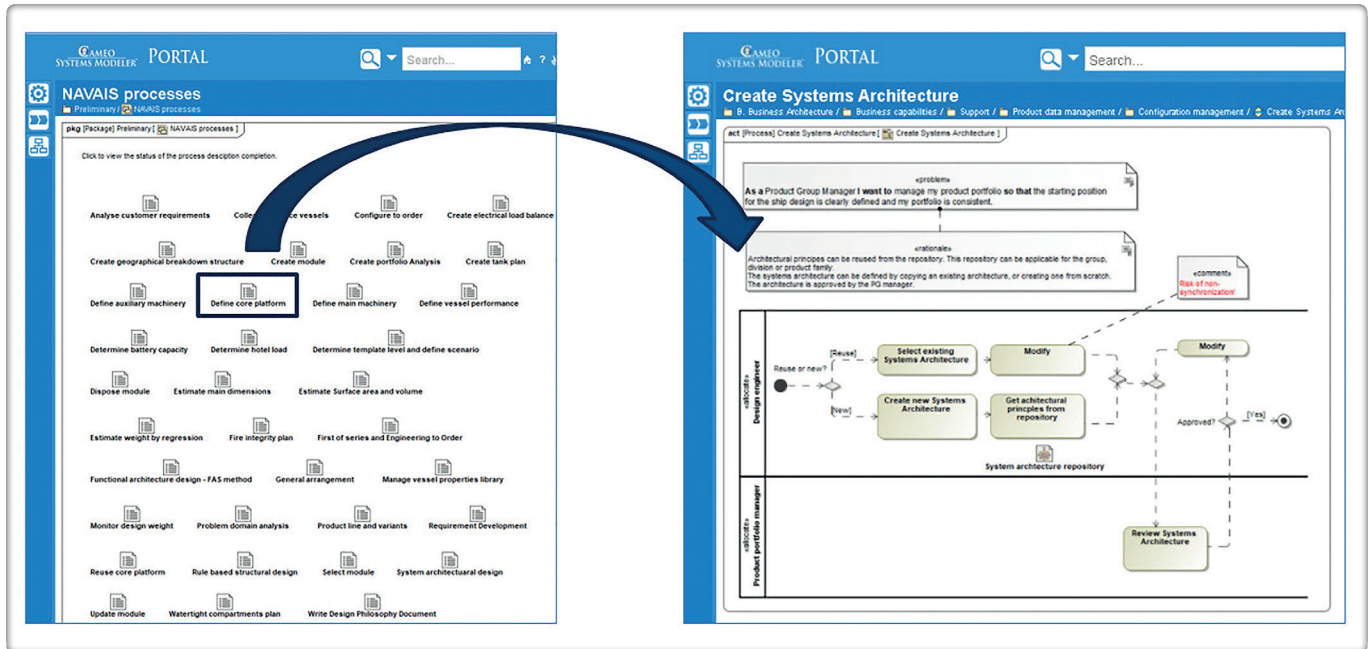


Modular design procedure is underway

Based on the “D5.4-Modular design procedure” report, 66 user stories have been defined to represent all the activities necessary to conduct the modularization and product configuration, based on a product platform. This list will be enriched with additional user stories linked to the Modular production concept (D5.5). These user stories have been created using CATIA Magic to enable

capitalization, traceability and maturity management (see figure below). They have been classified into two groups:

- Must Have: valuable scenarios to achieve NAVAIS R&D new principles
- Nice to have: subsidiary scenarios with no direct impact on NAVAIS R&D new principles



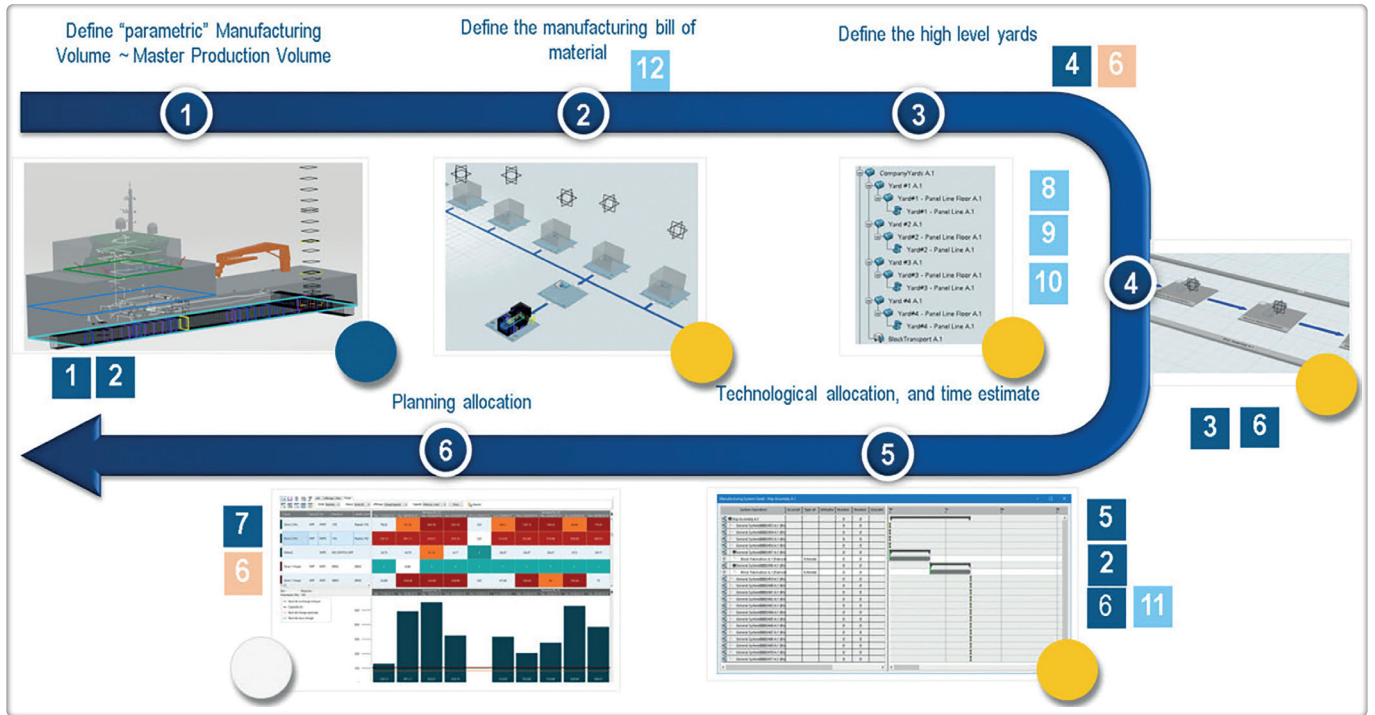
Definition of NAVAIS user stories in CATIA Magic to illustrate NAVAIS modular principles

In terms of methodology, first, we analyze user stories. Based on this analysis, we propose use cases to describe how users should perform tasks to address a given user story. This process is iterative to make sure that the original user stories are properly addressed. This whole process

is monitored through a new task, T5.8. User stories are also used to test (in the TST environment) and verify the implemented solution when comparing the process with the case-ship (in the DEV environment).

Modular production concept is underway too

In addition to D5.4, the D5.5 report on Modular production concept allowed to define the production strategy (see figure below) to support additional user stories dedicated to production.



Production strategy on the 3DEXPERIENCE platform

- > Winning Bid for Sea Industry Solution Experience (initial concept design)
- > Optimize Production For Sea Industry Solution Experience (Production planning)
- > Build For Sea Industry Solution Experience (Manufacturing operations)
- 3 6 > User Story reference number

We are currently prototyping the use cases to address user stories #6, #7, #8, #9 relative to DELMIA Ortems, knowing that user stories #1 to #5 have already been demonstrated during previous workshops (see figure below).





DISSEMINATION AND MARKET-UPTAKE

are key to maximize the impact of the NAVAIS project, to involve the SME supply chain and to pave the way to market uptake of the project results

The activities in the framework of dissemination and market-uptake are executed in four interrelated domains:

- ① The development of a strategy for dissemination and exploitation of the project results, which has been completed in the previous period.
- ② The development of dissemination and communication measures and tools, the organisation of events, and the facilitation of the involvement of the SME supply chain are key to ensure a proper dissemination and exploitation of the project results. In the past couple of weeks, we have started the development of a corporate movie. In addition, the preparations of a NAVAIS online media campaign started.
- ③ Implementation, monitoring and assessment of the implementation of the strategy and tools developed to ensure the strategy and tools meet the expectations of the target audience, thereby ensuring the maximization of the impact of NAVAIS;
- ④ The set-up of the involvement of the (SME) supply chain, to facilitate the adaptation to new business models. An SME forum will be created to ensure the supply chain of shipbuilding companies is aligned during the execution of the project.

Any relevant stakeholder that would like to participate in the SME-forum that will be initiated, please contact the project by sending an e-mail to: info@navais.eu

For next issues of the NAVAIS newsletter, please register by using the link on the NAVAIS website:

<https://www.navais.eu/news>

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