

Siemens PLM Software

# Ship design and engineering

Using PLM for Shipbuilding solution to develop affordable, durable and flexible vessels for future fleets

## Benefits

- Enables designers and engineers to align with ship requirements and specifications
- Ensures disciplined and timely execution of change and configuration management
- Provides preconfigured process templates to accelerate implementation and shorten time-to-value
- Enhances collaboration between ship-design teams, shipyard operations, key partners and suppliers and fleet-sustainment organizations

## Summary

Making sure that design teams are aligned with ship requirements and specifications is crucial if vessels are going to be delivered on time and on budget as well as satisfy performance requirements. Protracted delays and cost overruns are not compatible with current budgets and can be disruptive to fleet operations.

It is clear that all members of the design and engineering teams as well as key suppliers and shipyard operations planners must be tightly integrated and synchronized so they can work independently, efficiently and in parallel to reduce development cycle time and cost; all while remaining aligned with other members of a multidiscipline, multifunctional team that is responsible for developing a ship.

The complexity and goals of future fleets are further exacerbating the challenges of designing and engineering modern ships as owners and operators are demanding higher levels of performance in addition to greater operating efficiency, durability and adaptability for both initial and through-life

requirements. The latter challenge is forcing designers and engineers to consider the implication of their decisions across a 30-to-40 year period with issues such as: (1) modularity to enable and facilitate mid-life upgrades, (2) expanded service margins to accommodate the growth of electrical power, heating, ventilation and air conditioning (HVAC) and other requirements, and (3) more innovative arrangements such as less densely populated compartments and more space in passageways to allow for the replacement of major equipment and systems in the future.

Never have the harmony and fidelity of the design and engineering teams been more important to the success of future fleet programs.

## **PLM for shipbuilding provides a holistic approach to design and engineering**

PLM for Shipbuilding offers designers and engineers a holistic approach to ship development that ensures alignment with requirements and specifications. Moreover, with its embedded systems engineering capabilities, each subgroup of the overall

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## Benefits *continued*

- Permits designers and engineers to access a specific area of interest, thereby avoiding time-consuming hierarchical searches
- Improves efficiency of engineering teams and production planners

ship-work-breakdown-structure (SWBS) team can also remain aligned with requirements while program management leadership ensures the disciplined and timely execution of change and configuration management.

PLM for Shipbuilding is a modular, open and scalable portfolio of design and engineering solutions with an array of engineering disciplines embedded to enhance multi-physics simulations, including static and dynamic stress analysis, computational fluid dynamics (CFD), finite element analysis (FEA), thermal analysis, system-level dynamic analysis and composites analysis. The modular architecture allows shipyard teams to select the modules that optimize overall team performance. The International Organization of Standardization (ISO) approved standard – the JT™ data format – allows computer-aided design (CAD) modeling to receive inputs from a variety of proprietary codes that are critical for integrating partners and suppliers. In fact, suppliers are often responsible for more than 70 percent of the material and equipment in a ship's bill-of-materials (BOM).

The PLM for Shipbuilding portfolio also has been architected to be more amenable for the individual designer and engineer in a

subgroup so they can readily access just a specific area, compartment and/or system that addresses their specific area of interest, thereby avoiding time-consuming hierarchical searches of massive amounts of data. This feature is crucial to the efficiency of both engineering teams as well as production planners.

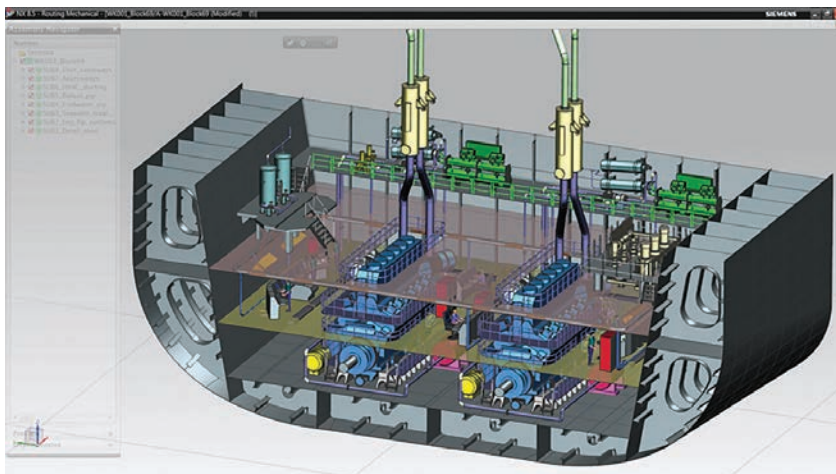
Finally, PLM for Shipbuilding has a set of preconfigured process templates that are embedded in the portfolio to accelerate implementation and shorten the time-to-value for shipyards; for example, automated workflows for drawing release, document management, bulkhead penetration management, weight information management, including center of gravity, import of SWBS sections and automated setup of multiple views.

The digitalization of shipbuilding provides an unprecedented harmony and fidelity across the extended enterprise that is aligning ship-design teams, shipyard operations, key partners and suppliers, and fleet-sustainment organizations at several shipyards; and Siemens PLM Software's PLM for Shipbuilding solution is the lynchpin for this dramatic transformation.

## NX for shipbuilding

NX™ software is built on the latest architecture of Siemens PLM Software, a technology for the design and management of large classes of products having millions of components and spanning a massive volume of space.

This technology allows shipbuilders the flexibility to organize ship data in multiple views, and empowers designers to rapidly search, retrieve and work collaboratively on the end-to-end systems that pass through common ship spaces. NX is fully integrated with Teamcenter® software, a leading product lifecycle management (PLM) system, and seamlessly integrates with Tecnomatix® software digital manufacturing solutions to ensure optimal manufacturing and assembly.



### NX structure

NX Ship Structure Basic Design software is used to implement the concept of a structural system. NX Ship Structure Detail Design provides all of the functionality necessary to define and modify the structural detail parts. NX Ship Structure Manufacturing provides the functionality to create the data necessary for structural fabrication.

### NX routing

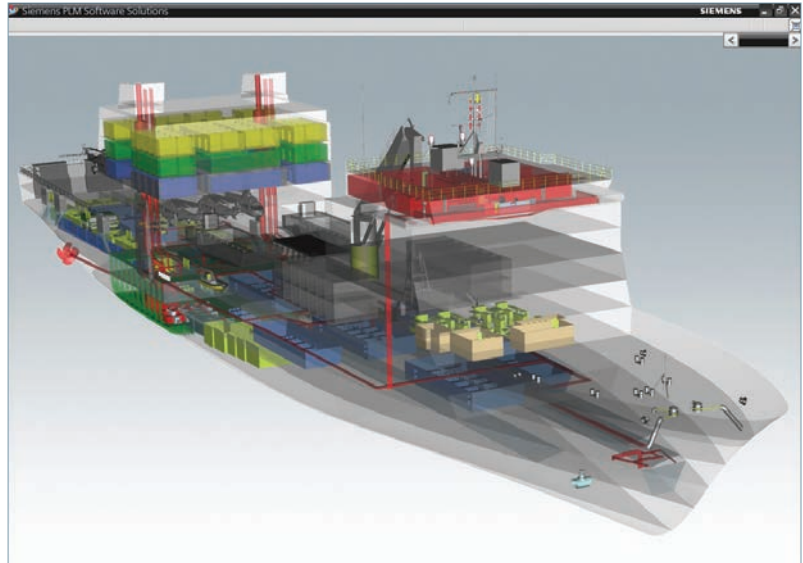
NX Routing Process and Instrumentation Diagram (P&ID) software provides tools for 2D and 3D schematic layout of piping runs. NX Routing Piping and Tubing provides 3D tools to create, modify, validate and document the design of piping and tubing systems.

### NX production

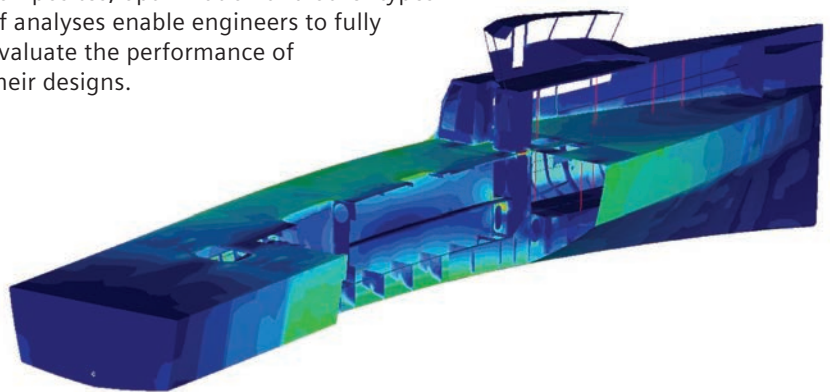
NX Routing HVAC provides 3D tools to create, modify, validate and document heating, ventilation and air conditioning (HVAC) systems design. It enables the optimization of HVAC design workflows through intelligent path creation tools, specifications-driven part selection, smart-part placement, collision detection, weight calculations, duct splits, duct size calculator and knowledge rules that concurrently validate designs against company and industry standards. The product enables the support of both a predefined catalog of HVAC parts and parametric templates that can be modified on-the-fly (smart sizing) to fit any space constraints. Together with other NX capabilities, such as hangers and sheet metal flat patterns, this product provides a complete lifecycle solution for HVAC design.

### NX CAE for shipbuilding

NX provides a comprehensive and integrated suite of engineering applications for the shipbuilding industry, including advanced tools for model preparation and multidiscipline computer-aided engineering (CAE) solutions. NX CAE can be used to



leverage attribute information in the NX CAD model to speed up the process of creating sheet bodies for thin-walled structures, such as hulls and bulkheads, creating beam elements to represent stiffeners, stitching the different models together and creating a mesh for analysis. Recent tests indicate that a model-build process that can typically take weeks can be reduced to just single day with the use of the integrated NX suite. The meshed model can then be solved using NX™ Nastran® software, the premier finite element solver for structural strength and dynamics analysis. Additional solutions for thermal, flow, fatigue, acoustics and vibration, motion, composites, optimization and other types of analyses enable engineers to fully evaluate the performance of their designs.

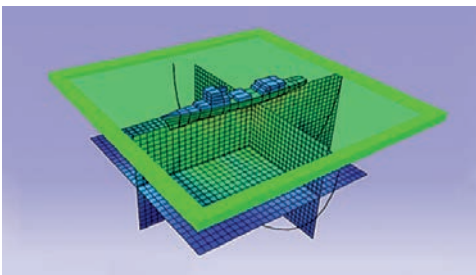


### LMS for shipbuilding

A unique combination of simulation software, mobile and lab-testing systems and engineering services help answer functional performance engineering challenges of shipbuilders and their suppliers. In the early design stage, 1D multi-domain system simulation helps you design and optimize engines, propulsion systems and hydraulic components, with complete solutions for exhaust systems, engine cooling, lubrication, fuel injection, combustion, camshafts, gears, etc. The 3D simulation capability enables you to conduct a more elaborate, real-life performance analysis so you can optimize a component or several key areas of the full vessel:

- Dynamic motion
- Structural integrity and fatigue
- Vibration
- Acoustics (including hull radiation, propeller noise, acoustic scattering for stealth and active and passive sonar design)

The solution allows you to analyze noise and vibration transfer paths and contains an integrated testing environment in support of simulation or for dedicated applications, such as environmental qualification or machine diagnostics. Siemens PLM Software has a team of highly-skilled specialists who can actively support shipbuilders and suppliers in all projects related to any of these functional performance topics.



### Composites engineering and fastener management

Siemens PLM Software provides a portfolio of solutions for addressing the complex challenge of advanced composites engineering and fastener management. The Fibersim™ portfolio of software for composites engineering enables engineers to efficiently develop optimal designs by striking the appropriate balance between lighter weight, cost and performance. Fibersim provides a rapid producibility assessment early in design to alleviate manufacturing issues and rework. The Syncrofit™ portfolio of software enables you to implement a concurrent part and assembly design process by supporting engineering management of fasteners, joints and detail parts. The Fibersim and Syncrofit solutions enable you to reduce weight, tailor structural and multifunctional properties and streamline and consolidate parts and assemblies, all of which has proven to reduce lifecycle costs while improving the performance of vessels.

#### Contact

Siemens PLM Software  
Americas +1 314 264 8499  
Europe +44 (0) 1276 413200  
Asia-Pacific +852 2230 3308

[www.siemens.com/plm](http://www.siemens.com/plm)

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