

SSI ShipbuildingPLM: TRANSFORMING Shipbuilding

A proven solution tailored for shipbuilding digital transformation

Takeaways

Shipbuilders face issues that are quite different from other manufacturing companies, they need support for special shipbuilding concepts and capabilities in their PLM and digitalization environments.

Information and process management are both critical to achieving a viable and profitable shipbuilding business.

ShipbuildingPLM is tailored to support the particular requirements of shipbuilders from design through build and post-delivery activities.

ShipbuildingPLM also supports the requirements of vessel owners/operators, in particular navies, to manage program sustainment and MRO activities.

SSI ShipbuildingPLM integrates with other tools required by shipbuilders, such as ERP/MRP, production planning, P&ID, design analysis, and others.

Shipbuilding Business Drivers

Cost reduction demanded by owner/operators, multi-hull and class design, ever-increasing regulations from multiple governments, compliance with classification societies and agencies, speed of delivery and quality demands, massively increasing product complexity, a desire to maintain vessels more easily in operation, long in-service life products, complex manufacturing processes and supply chain relationships, electrification initiatives, design for sustainability, and continuous changes to design and mission profiles drive the shipbuilding industry today.¹

Shipbuilders, throughout history, have not been early and consistent adopters of new digitalization processes and technologies, but have traditionally relied on tried-and-true working methods. Shipbuilding organizations are dominated by poorly integrated, older tools, legacy bespoke systems, lack of up-to-date information technology infrastructures, siloed processes and organizations, and work methods predominately based on documents. All of which are expensive and difficult if not impossible to keep up to date.

¹ Research for this paper was partially supported by SSI.

Shipyards and other production facilities tend to be constricted, spread over long distances, and difficult to access and move around, complicating the production process and requiring extensive planning and logistical support. Transporting and combining large subassemblies are also problematic within the confines of shipyards and constraints of cranes and other equipment. Production planning is a major opportunity for improving shipbuilding productivity and profitability.

Product complexity extends beyond numbers of parts (millions), to physical size of products, numbers of systems in marine products, and number of trades involved in their construction. Ships present a combination of physical mechanical structures, electrical and electronics, software, and human support systems such as HVAC that are all distributed within a constraining overall design package.

Post launch management of in-service ship configurations is difficult and costly due to ongoing and unmanaged change across decades-long lifecycles. Capturing the current configuration of a vessel is, in itself, a major problem.

The cost of doing business in this environment tends to be intractably high. Upgrading facilities and equipment can be exorbitantly expensive. So other paths have to be followed to improve profitability.

This situation has been slowly changing during the past couple of decades as the shipbuilding business has become more global and more competitive. Digitalization technologies have matured and improved to enable solutions to these issues. SSI, with their ShipbuildingPLM solution and related products, is now providing extensive support for highly digital and accessible end-to-end PLM-supported shipbuilding environments streamlining activities from concept to design to production to MRO.

ShipbuildingPLM's Value

ShipbuildingPLM unlocks digital transformation in the design office and shipyard. Its ability to manage shipbuilding programs and work processes from beginning to end, manages projects, and provides access to all the information about ship and vessel projects throughout their lifecycles—in one logical and controlled place. ShipbuildingPLM is where all participants in the shipbuilding process can find the single source of truth needed to make appropriate and accurate decisions, whatever their role in the lifecycle process may be to help design, build, and maintain vessels of all kinds.

Many PLM systems support discreet manufacturing processes such as machinery, automobiles, medical devices, and similar products. While the processes they support can be used for one-off products, they are built around manufacturing concepts that fit factory production line operations. Shipbuilders use a substantially different process, working simultaneously on design, parts procurement, construction, and maintenance.

ShipbuildingPLM is a key enabler of both data and process management. It eliminates issues such as those stated above. As shown in Figure 1, it streamlines and controls the lifecycle of information required to create complex ships and other vessels—from requirements to CAD to manufacturing to commissioning and MRO across multiple ship configurations. ShipbuildingPLM spans all activities in a modern shipbuilding enterprise including project management, design disciplines, analysis and validation, regulatory reporting, classification, production planning, commissioning and handover, maintenance and repair, and many others. CIMdata is impressed with the breadth of SSI's solutions for the marine industries.

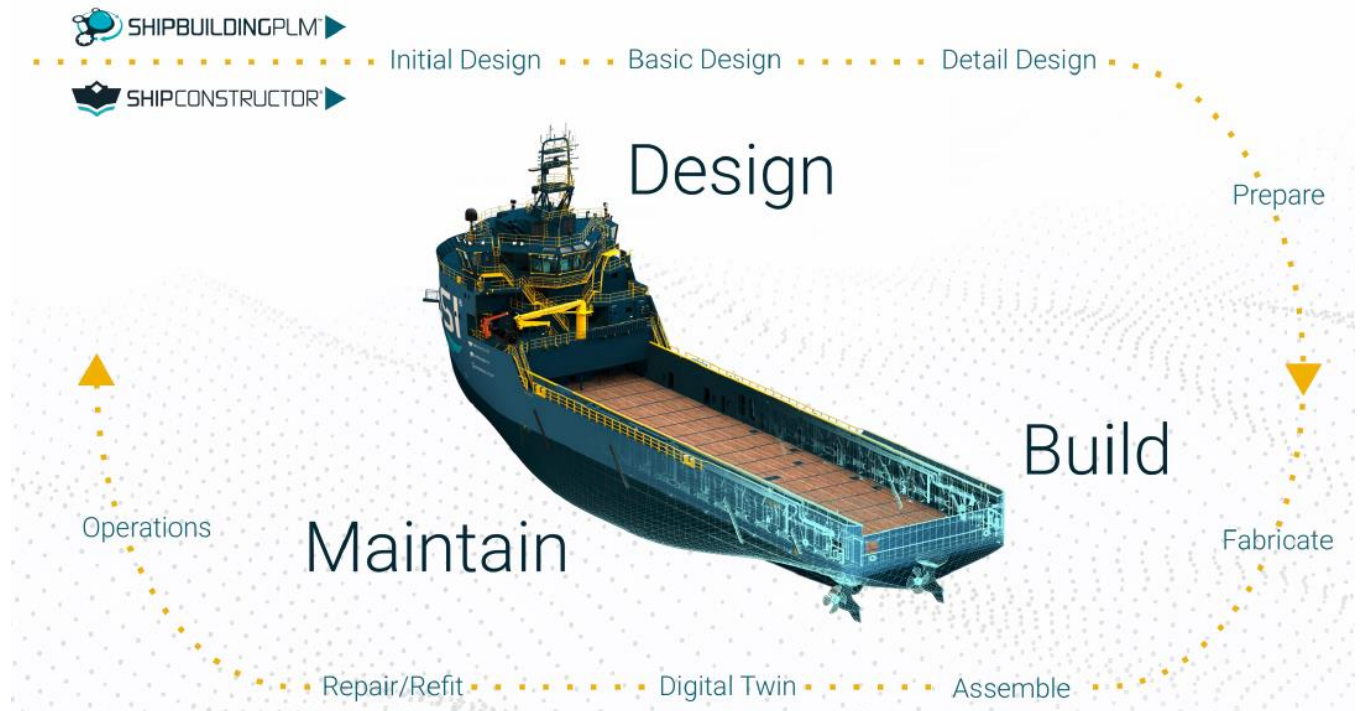


Figure 1—ShipbuildingPLM’s Support for the Ship Lifecycle

Key Features of SSI ShipbuildingPLM

ShipbuildingPLM is not a generalized PLM platform—rather, it has been tailored and extended by SSI experts specifically to support shipbuilders needs. It is built on the Aras Innovator foundation, a market leading enterprise configurable PLM solution. Highly facilitated upgradeability ensures long-term viability with little to no disruption to an organization. This includes underlying security compliance and adoption of new capabilities and technologies. See Figure 2. So, shipbuilders can start using ShipbuildingPLM to support one area of their business, then expand to cover more—SSI calls this “Benefit from day 1.” The system is inherently flexible to be deployed either in whole or a module at a time. Aras’ native low code architecture allows SSI to update the solution on demand while making it scalable, flexible, and extensible.

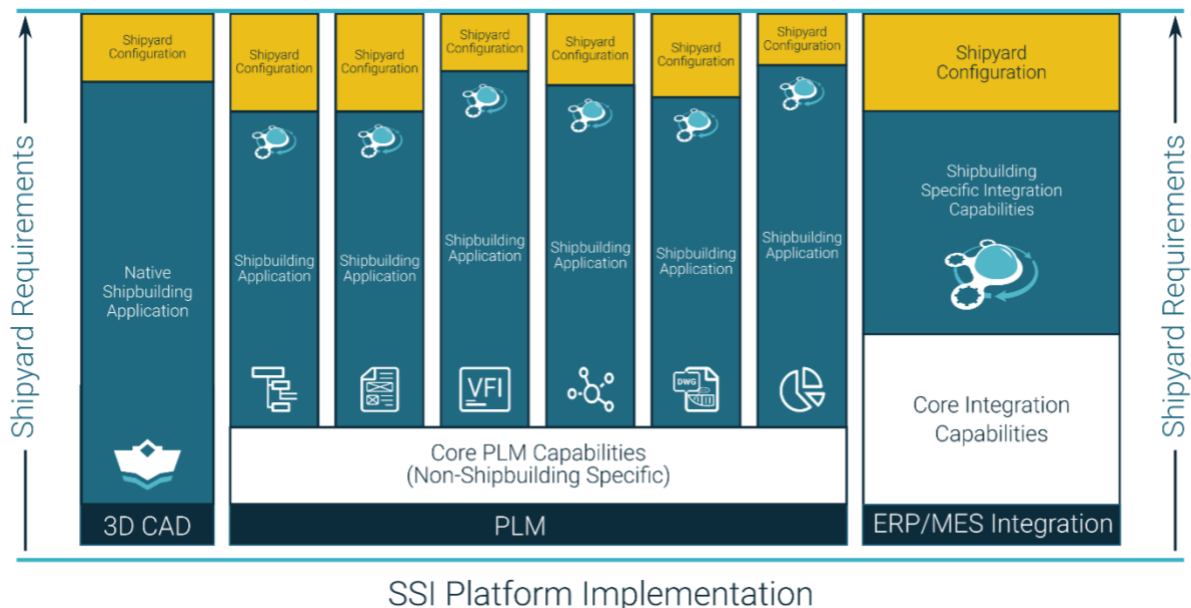


Figure 2—Overview of SSI Platform Implementation and Shipbuilding-Specific Capabilities

Simultaneous and long design and production processes particular to shipbuilding require process workflows and configuration management support during which changes are continuous with configurations that continuously evolve over time. ShipbuildingPLM helps shipbuilders avoid or minimize cost and schedule delays by reducing production rework through visibility to cost of required changes, and improved communication of engineering changes to production.

For multi-vessel programs, a PLM-supported solution manages multiple configurations and part or hull effectivity for each configuration. Thus, changes to follow-on vessels to be applied in a controlled manner, with visibility into each vessel's actual project state. The PLM environment in ShipbuildingPLM also creates a digital thread and digital twin of each vessel providing full examination and traceability of design entity relationships from design through in-service maintenance. A digital twin is key to maintaining the in-service, as-maintained record of each vessel both before and after it enters service. This twin can be deployed onboard to capture as-maintained configuration updates as service and maintenance are performed while at sea or abroad.

Shipbuilding program and project management are built into ShipbuildingPLM with planning activities that flow from design through production. This allows oversight of simple and complex projects including evolving configuration changes of multi-hull class programs.

Relationships and links that make up configurations of designs allow a continuous digital thread across all of the digital twins (as-designed, as-planned, as-built, as-maintained, etc.) to be managed in the ShipbuildingPLM database. The digital thread allows exploration of the full design/build context as it evolves and promises improved MRO activities when the vessel is maintained in-service.

Secure access to ShipbuildingPLM and the data it controls is managed in a number of ways. First, LDAP and SAML2 (Security Assertion Markup Language) support single sign-on. Security is supported through roles (with people- and role-based permissions); attribute-based Mandatory Access Control (MAC) that places access controls on item properties and attributes as well as their lifecycle states; and relationship-based Domain Access Control (DAC) that controls access based on projects. All of the Aras platform security capabilities are also available. SSI provides a suite of tools that can be used to further configure security rules. This provides an extensive set of security controls for both civil and military contexts (including DoD required physical authentication mechanisms such as CAC Card access).

ShipbuildingPLM provides native integration to SSI's ShipConstructor ship design solution and their manufacturing planning and production solutions. It integrates with other solutions to support FEA and other analysis, MES, hydrodynamic and other calculations, manufacturing planning, and support for production machinery such as plate bending and welding as shown in Figure 3. On the production side, ShipbuildingPLM provides procurement and planning capabilities as well as integration to manufacturing support solutions such as ERP/MRP.

Leveraging the underlying low code architecture of Aras Innovator, SSI can efficiently tailor and extend ShipbuildingPLM's processes, data model and applications to meet a shipyard's specific requirements while ensuring upgradeability.

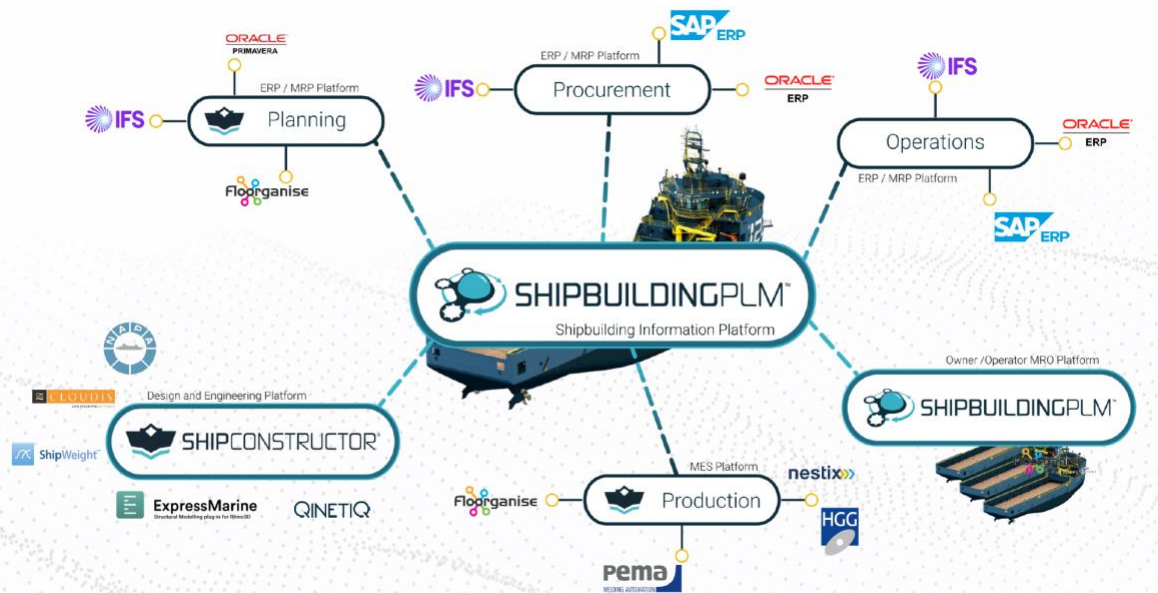


Figure 3—ShipbuildingPLM Platform’s Breadth

All of SSI’s solutions including ShipbuildingPLM are created, developed, maintained, and supported by a team of experienced shipbuilding experts who have implemented these solutions at shipyards. Their team’s shipbuilding backgrounds allow them to optimize workflows, processes, and how product data is shared across the lifecycle. Their implementations at shipbuilders are successful, in part, because the people behind SSI have worked at shipyards and understand the industry and the technology needed to support shipbuilders.

Customer Experiences

HII - Ingalls Shipbuilding

Ingalls Shipbuilding has been driven to seek major efficiencies in operations. One way to do that is to streamline the complete lifecycle of building ships, but that is impossible to do in a process where data and processes are created and managed manually. So, they have been modernizing and expanding their use of PLM—both for design as well as data and process control in support of downstream construction activities. Ultimately, they adopted SSI’s digital shipbuilding platform, Aras Innovator integrated with SSI ShipConstructor.

Ingalls claims that the greatest benefit of their shipbuilding PLM solution is their improved ability to manage change. In shipbuilding, change is constant throughout the long lifecycle. ShipbuildingPLM provides necessary controls centralized to ensure that the right information is sent to the right people and programs at the right time, and that everyone is updated as needed.

Austal Ships

Austal, based in Australia, has a global presence, with shipyards and service centers in several worldwide locations. The company designs and builds a variety of ships for both civil and naval customers. They use digital shipbuilding innovations (including SSI’s ShipbuildingPLM and ShipConstructor) to support a major business transformation underpinned by up-to-date and accurate engineering information.²

Mr. Andrew Malcolm, Chief Digital Officer at Austal commented: *“With SSI, we found a partner who deeply understands why shipbuilding is different and why it’s not production line manufacturing and was able to*

² <https://www.ssi-corporate.com/blog-lighthouse/honoring-over-18-years-of-partnership-between-austal-and-ssi/>

link the CAD tool together with the PLM in a way that we would have to have done ourselves separately if we were bringing in two separate tools together.”

Conclusion

SSI ShipbuildingPLM provides a platform for ship designers, builders, and services organizations in which they can create, manage, and maintain the critical information that is required to support many use cases for this very demanding industry. It supports many forward-looking concepts that are required to help shipbuilders and navies modernize digitalization of their operations. These include creation and tracking of digital threads to embrace requirements, functional designs, product models, production designs, service, and maintenance supported by configuration controlled serialized parts for accurate digital twin delivery. The SSI solution suite manages information across the shipbuilding lifecycle so that configuration and change management can be comprehensively and easily executed. ShipbuildingPLM facilitates and manages hull effectivity and working with sister ships—critical issues in modern shipbuilding.

SSI’s solution suite supports design, engineering, planning, and production team collaboration to support shipbuilding all the way to the waterfront. The overall shipbuilding process is also supported by ShipbuildingPLM’s accurate and on-demand program management oversight.

While the customer experiences provided above are for larger shipbuilders, ShipbuildingPLM can be, and is, used by all sizes of shipbuilding organizations. CIMdata finds its accessibility and the simplicity, extensibility, and upgradeability that it inherits from Aras’ PLM platform to provide a strong base for application across many marine use cases. The Aras platform provides a proven solution built on an extensive PLM innovation platform that is used by global and diverse industries.

SSI has a long track record of working with defense organizations (builders, navies, etc.) and has created security protocols to address the special needs of companies who work with navies around the world. CIMdata recognizes security as a preeminent issue for military shipbuilders and finds SSI’s solutions to have a sufficient level of protection for vital information.

CIMdata believes that SSI’s ShipbuildingPLM solutions are well conceived and built to support both civil and military ship design, construction, and support operations using a suite of tools and processes tailored for the shipbuilding industry.

Any shipbuilding enterprise that is trying to transform their digital capabilities should include SSI when evaluating and selecting shipbuilding solutions.

About CIMdata

CIMdata, a global strategic management consulting firm, provides services designed to maximize an enterprise’s ability to design, deliver, and support innovative products and services. For more than forty years, CIMdata has provided industrial organizations, providers of ³digital technologies and services, and investment firms with world-class insight, expertise, and best-practice methods on a broad set of product lifecycle management (PLM) topics and the digital transformation they enable. CIMdata also offers research, subscription services, publications, and education through certificate programs and international conferences. To learn more, visit www.CIMdata.com or email info@CIMdata.com.

³ Research for this paper was partially supported by SSI