

Ship production efficiency: it all starts with the right planning

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Rough Seas: an industry with more than its share of ups and downs

Maritime business is highly cyclical, continually affected by economic, political and regulatory fluctuations. For years, shipbuilding capacity has exceeded demand forcing prices downward, a trend amplified by the economic crisis of 2008. The slowdown in global trade has delivered a blow to maritime commerce that finds itself “playing it by ear” during its worst crisis in 60 years. Competition rages, not only between Asian players in China, South Korea, and Japan, but with and between European companies as well. In this increasingly competitive context, quality and efficiency are paramount to building a shipyard’s reputation so that it can continue filling its order book. At one time China’s shipyards took large numbers of orders because owners were attracted by their low-cost offers. However, the quality of some of their ships soon prompted these same ship owners to return to ordering ships from South Korea or Japan that have a history of producing higher value vessels.

Manufacturing is widely recognized around the world as a key area for innovation and productivity gains. Next generation manufacturing is a clear focus for shipbuilders and government-sponsored programs alike, such as the “Made in China 2025” initiative. As part of its plan, which highlights shipbuilding as one of the ten priority sectors, China’s immediate priority is to address the issue of inefficient production with a focus on innovation and quality. To survive, shipbuilders must deliver ships faster while lowering their production costs if they expect to turn a profit. They need to boost innovation and productivity of their manufacturing operations with greater automation and digital manufacturing. And it all starts with streamlining production planning. They also need to improve the connectivity between design, production, and operations to ensure continuity for long-term competitiveness.

Challenges abound

Today’s vessels and offshore platforms are massive and complex undertakings that involve millions of parts and operations, the expertise of many disciplines, hundreds of workers, numerous partners and suppliers, multiple sites. The challenge here is to be able to start manufacturing very early in ship design, and validate the manufacturing process before execution starts in order to improve time to market. It is also to reduce the number of work hours required to build a ship. Generally, a ship’s structure is not very complex as there are basically only two types of elements – plates and profiles – and three types of operations – cutting, bending and welding. The difficulty lies in the sheer size of a vessel or platform. Comprising tens of thousands of structural elements and system components, there is clearly an efficient way of bringing everything together and an inefficient way. The trick is to come up with a clear, logical and orderly production process so that the build operation takes a minimum amount of time. The ability to leverage the skills and knowledge of their extended ecosystem is another critical success factor. With 50-80% of a ship’s value provided by partners and suppliers, shipyards significantly depend on external expertise to successfully design and build a vessel. They, therefore, need to boost collaboration between all stakeholders to ensure that the right information goes to the right people at the right time while ensuring proper protection of intellectual property.

Manufacturing planning: a guiding light through manufacturing efficiency

Manufacturing efficiency starts before the production stage. Under the responsibility of production planners, manufacturing planning prepares shipyards for the job that lies ahead. The manufacturing planning defines and validates the sequence of how ships should be built, outlines the tasks involved as well as the order in which they should occur. It also details the human and equipment resources needed to perform each task and the instructions on how to go about each operation. With effective manufacturing planning, shipyards can improve their production efficiency, product quality, and time to market while reducing costs.

Efficient manufacturing planning can only be achieved with the most innovative technology and an early start. Planners gain time and precision if they use solutions that can automatically leverage engineering design data to generate manufacturing information. This seamless integration between engineering and manufacturing improves product quality because it reduces manual operations that can introduce errors and delay delivery to the shipyard. When a change is introduced in engineering, for example, this integration makes it possible to quickly identify the change and then efficiently propagate it to manufacturing. This helps mitigate production bottlenecks due to errors or reworks that can put project schedules at risk.

When designing a ship's structure, manufacturing features such as openings, stiffeners, and marking lines need to be created for tens of thousands of objects. This requires precise preparation. Technology that leverages embedded knowledge rules enables "structural work preparers" to automatically generate the required structure manufacturing features for an assembly, a unit, or an entire block of a ship. This highly automated rule-driven approach results in fewer errors and improves production quality.

Digitally simulating all aspects of the manufacturing planning before delivering it to the shipyard helps ensure that products are built right the first time. With the right technology, manufacturing planners can validate each step of the process plan by simulating the assembly sequence, the required cutting, bending, welding and lifting operations and the resources needed to perform each operation before delivering it to the yard. Simulation can also help optimize the manufacturing execution parameters such as duration, start time, dependencies, and total manufacturing time for each operation. All these capabilities help ensure a smooth execution at the shipyard and on-time delivery to market.

Delivering clear and comprehensive work instructions helps eliminate rework, avoid human error, improve product quality, and ensure worker safety. Planners need technology that allows them to create 3D work instructions with images, videos, and 3D slides with markups to describe the best and safest installation sequence. Shipyard workers are proven to be more productive when they use 3D work instructions as opposed to 2D drawings to perform assembly operations. Moreover, since there are many similar processes and operations in ship manufacturing, companies that are able to build and reuse a catalog of 3D work instructions and production best practices gain time on new projects.

Manufacturing automation has emerged as a key efficiency driver for shipbuilders. Technology that allows machine programmers to integrate arc welding, cutting or bending robots on the shop floor with the manufacturing processes is best positioned to improve a shipyard's competitive edge.

With the right manufacturing planning solutions, shipbuilders can perform manufacturing assembly definition, discipline-specific work preparation, process planning, interactive 3D work instructions, as well as 3D simulation and validation of production plans to help optimize production. They can considerably help reduce work hours and costs, while improving time to market, product quality, safety and compliance with international regulations.