Universal Shipbuilding Corporation

Streamlining ship outfitting design with CATIA

Overview

Challenge

USC needed to improve the transfer of shipbuilding know-how from its experienced employees to a new generation of young employees

Solution

USC adopted CATIA for all of its outfitting design activities and began implementing a companywide 3D design environment

Benefits

CATIA enabled USC to cut training time of young recruits, as well as reduce the workload at construction sites and improve collaboration with production sites

"We chose CATIA because it's flexible and versatile allowing us to handle design activities such as ship outfitting and engine design, end-to-end flow for 2D functional design, and 3D detailed design."

Hiroshi Tomita
Management Staff, System Team,
Design Department, Tsu Shipyard
Universal Shipbuilding Corporation

Universal Shipbuilding Corporation

Leading manufacturer of tankers, merchant ships and exploration vessels

Japan's Universal Shipbuilding Corporation (USC) manufactures a wide range of ships from merchant ships such as 300,000 ton oil tankers, as well as bulk, ore, and liquified natural gas (LNG) carriers. USC is building the replacement of "Shirase", the Japanese icebreaker used in the Antarctic. It also produces ships for the navy and government agencies.

USC was founded in 2002, the result of a merger of shipbuilding departments at NKK Corporation and Hitachi Zosen Corporation which integrated their shipbuilding operations to create an independent shipbuilding corporation.

USC employs 3,200 people and has inherited NKK and Hitachi-Zosen's more than 100-year history of advanced technology, originality, customer trust and business assets. By leveraging advanced development capabilities, USC delivers new ships that meet both customer needs and expectations.

Knowledge transfer and collaboration challenges

USC's biggest challenge for both its design and manufacturing teams is skill and know-how transfer from experienced employees to new hires. In 1998, USC started evaluating new outfitting design systems as a way for generational change, as well as a means to provide valuable information to the manufacturing team, and to quickly increase the use of 3D models within the company. Previously, knowledge transfer was done using paper or 2D, a very time-consuming task.

In the shipbuilding process, if device-attaching positions are directly marked on steel plates using 3D as a reference, workers can easily attach the devices without drawings. This makes manufacturing work more efficient. In order to achieve this, detailed information must be provided to the manufacturing

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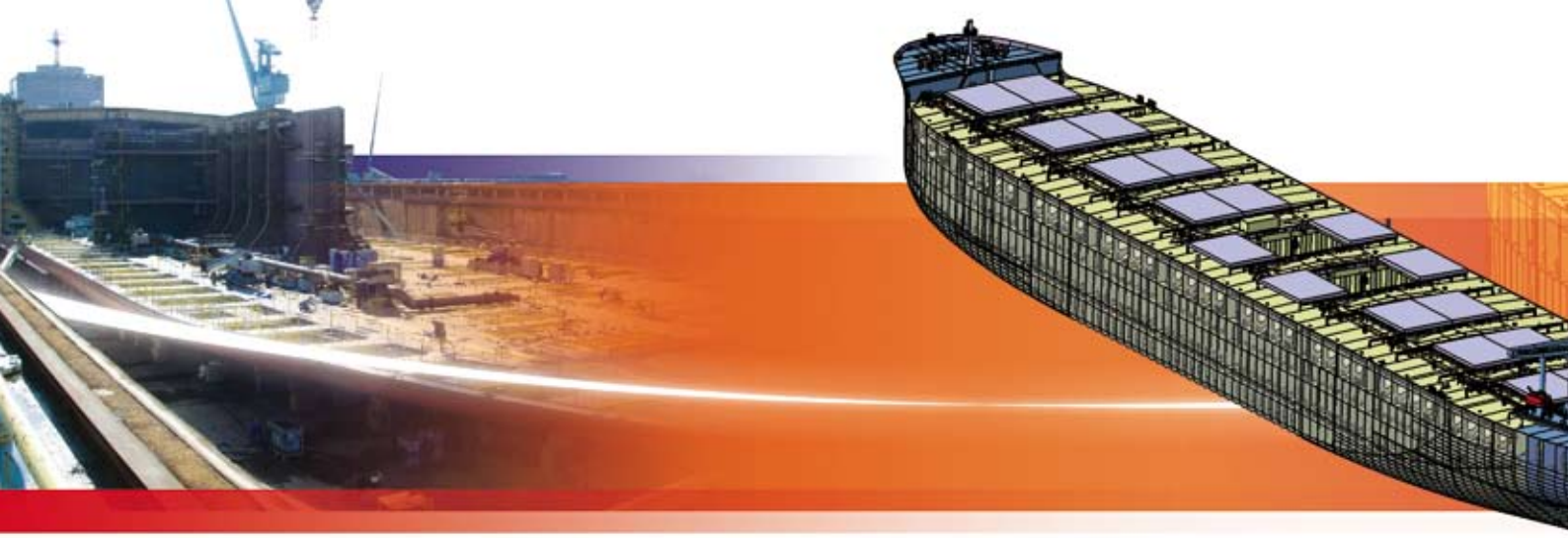

"Previously, it took almost ten years to train an experienced designer. These days with CATIA, a newcomer in his or her early twenties can be up to speed in a year or two."

Nobutaka Umeyama
Manager of Hull Outfitting Design Section,
Design Department, Tsu Shipyard
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site. Providing this information became an important objective for USC, as well as shortening modeling time.

A former CATIA V4 user, USC analyzed various 3D CAD solutions. The new solution had to:

- handle outfitting design activities such as hull outfitting and engine room design, be a 2D-3D immersive CAD system, support end-to-end design flow for 2D functional design (schematic diagrams), 3D detailed design, and manufacturing design such as creating production drawings and interacting with other systems while enabling digital data transfer (attributes or geometry data),
- provide equal or greater functionality than its existing system,
- be able to develop an interface with its hull structure system that defines ship body structure for data exchange,
- be customizable so that it could communicate with other systems e.g. data output to piping fabrication system,
- support the use of current models and customized functions well into the future.

CATIA V5 as new outfitting system

In 1999, USC adopted CATIA V5 for outfitting design and is working on implementing a 3D design environment throughout the company. Implementation at its Tsu shipyard is proceeding smoothly and the CATIA V5 outfitting design system is currently being deployed at USC's Ariake, Maizuru and Keihin sites.

In general, ship outfitting design is closer to plant design than to mechanical design of a car, for example. Inside a ship, there are a multitude of elements to design such as the piping system, equipment, and machines. All have different shapes and each needs to be designed using the same 3D CAD system.

"In the case of commercial CADs, mechanical CADs are usually not good at piping design, and plant CADs are not good at performing mechanical part design. USC looked for a product that would allow both mechanical and plant to be designed on the same platform. Since CATIA started as mechanical CAD, users can easily create 3D models of equipment in their familiar design environment. Moreover, with CATIA V5, piping functions have been largely improved. Due to its flexibility and versatility, we chose CATIA V5," explained Hitoshi

Tomita, management staff, system team, design department, USC Tsu shipyard.

In 2000, USC evaluated CATIA V5 functionality and made plans to develop integration with other systems and to add missing capability. More concretely, USC conducted a fit and gap analysis between its existing system and CATIA V5 on outfitting functions.

USC sent its enhancement requests to the development team of Dassault Systèmes. Requests generally required by the shipbuilding industry were developed by Dassault Systèmes as standard CATIA functionalities. On the other hand, requests that were related to interface or application development and functionalities deemed to be USC-specific, were handled by a DS business partner.

”Even now, when we receive new functional requirements from our users, this is the procedure we choose to follow,” said Nobutaka Umeyama, Manager of hull outfitting design section, Design department, USC Tsu shipyard. “To implement other Dassault Systèmes products such as ENOVIA VPLM and DMU in the future, we will follow this process. We decided to stop in-house system development and minimize customization. So it’s very important for us to be able to leverage the system by keeping a close and continuous relationship with Dassault Systèmes,” he added.

Production drawings and integration with other systems

USC started implementing a piping and electrical schematic diagram system for functional design in 2002, a 3D equipment layout system, a 3D piping system, and a 3D electrical system in 2004 on a real ship project. Today, piping schematics and piping systems, equipment layout systems, other outfitting parts such as duct or traffic equipment as well as electrical systems are handled by CATIA. CATIA feeds data into the existing production system and provides drawings required for manufacturing and fitting.

For example, for piping and pipe outfitting, 2D diagrams with pipe thicknesses or pipe materials are created with the schematic diagram system for functional design. Next, pipe routing, equipment layout, piping fitting parts layout, and pipe supports are designed in 3D for detailed design. Based on the data, piping support production drawings or pipe fitting drawings are output as CATIA drawings. Since piping parts

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are manufactured at USC's site, data is forwarded to the pipe fabrication system. 3D models or schematic diagrams use symbols, equipment, piping parts and other outfitting parts that are stored in a catalog and reused when necessary. The catalog currently contains 1900 schematic diagrams, 500 pieces of equipment, 8000 piping parts, and 600 other outfitting parts.

Reduce workload, educate designers, deploy best practices

USC has a policy of keeping customization to a minimum. It uses CATIA's standard functionality for schematic diagrams, 3D modeling, and drawing creation. Customization is done only to add some design support functions (i.e. adding attributes, counting materials, supporting pipe fitting drawing creation, duct drawings, floors & other outfitting parts drawings) and to develop interfaces to feed data into its existing system (schematic diagrams database, hull structure system, piping fabrication system, distribution system) with the exception of piping support functions, which are treated as exceptions.

The outfitting system has been in operation for more than three years and USC is steadily moving forward. "Drawings become easy to read and that certainly contributes to improvements in fitting performance. A new generation of employees has been integrated into the company and they often have trouble reading 2D drawings. Easy-to-read drawings greatly contribute to enhancing our productivity," said Tomita.

The design department implemented the system with the goal of training young engineers faster. Its efforts are bearing fruit. Previously, it took almost ten years to train an experienced designer. These days, a newcomer in his or her early twenties can be up to speed in a year or two. They can now discuss with skilled engineers and modify designs using CATIA's interference checking while performing 3D modeling. They learn detailed design quickly in an environment we prepared," said Umeyama.

Next steps: data management, 3D viewer and simulation tools for even better performance

USC successfully implemented a new outfitting design system at its Tsu site. Since 2005 USC deployed CATIA to other shipyards such as Ariake, Maizuru and Keihin with the exception of the Innoshima repairing shipyard. USC is planning to implement model management tools such as ENOVIA VPLM and to better utilize 3D models in the production engineering department with the 3D viewer capability. It is also evaluating Dassault Systèmes' simulation tool.

USC's next objectives are to further improve performance in large catalog / model files and enhance drafting functions to create 2D drawings for suppliers or customers. Internally, the company plans to prepare an operation environment and promote education for CATIA engineers for internal system deployment.

> "Thanks to the development support provided by Dassault Systèmes and its business partners, we decided to stop in-house system development and minimize customization."

Nobutaka Umeyama
Manager of Hull Outfitting Design Section,
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