

Solutions for Shipbuilding

Setting the course and strategy for digital shipbuilding





“Brilliance of the Seas” is the second unit in Royal Caribbean’s Radiance-class of luxury cruise ships.

Built by renowned Meyer Werft, Papenburg, Germany, employing IBM PLM computer aided design solutions. Solutions from the CATIA portfolio include hull design, compartment/access, steel detailing, machinery design/layout, piping, drafting, cable trays, electrical design, photo realism, visualisation and configuration and penetration management.

Ship facts:

- *Operator: Royal Caribbean Int.*
- *Shipbuilder: Jos L. Meyer Papenburg, Germany*
- *Length: 962 feet/293 meters*
- *Beam: 105 feet/32 meters*
- *Draught: 26.7 feet / 8.14 meters*
- *Gross Tons: 90,900 tons*
- *Cruising speed: 24 knots*
- *Total passengers 401, 3/4 occupancy cabins*
- *Double occupancy cabins: 2,100*
- *Coast Guard passengers limit: 3,360*
- *Crew: 859*
- *Dining capacity: 1,079 dining (2 dining rooms)*
- *Total rooms: 1,050*
- *Interior rooms: 237*
- *Exterior rooms: 813*

On board amenities include:

- *Rock climbing wall*
- *Indian Raj-themed solarium*
- *Indoor/outdoor country club with golf simulator*
- *Sports court with basketball/volleyball courts*
- *Billiard club with self-levelling tables*
- *Reservation-only restaurants with Italian and steakhouse eateries*
- *Casino Royale*
- *Fitness centre.*

Collaborate

“We find that having the 3D capabilities of CATIA and being able to communicate with the customer and the shipyard in 3D is invaluable.”

Kevin Isham

Manager of Mechanical Design at Brunvoll AS, Norway

Innovate

“Our customers deserve the best and we give them the best. Our prices are very, very competitive against any shipyard in the world and we sell on good quality and delivery. This is only possible if we use the best technology on the market to build our ships and that’s why we chose IBM PLM solutions.”

Brian Chang

Chairman/CEO, Yantai Raffles Shipyard

Dominate

“In addition to the performance superiority of the solutions, we based our investment decision on the excellent relationship we have had with IBM and Dassault Systèmes since 1989. Their long-term engagement in our shipbuilding programs and the reliability of their solutions is a significant plus.”

Joerg Ackermann

Manager IT and Organization, Jos. L. Meyer GmbH

21st century design tool for 21st century ships

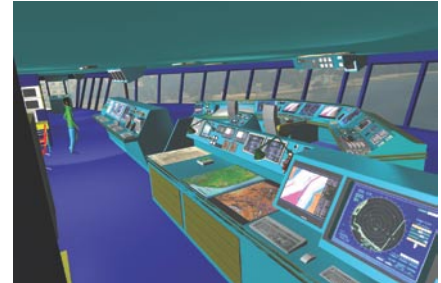


They stand as tall as skyscrapers, floating cities that are the largest, most technologically advanced structures ever created by the hand of man.

Some are pleasure palaces, offering the best of the hotel, restaurant and entertainment industries to thousands of passengers. Some are military marvels, carrying the world's most advanced electronics and weapons systems to trouble spots around the globe. And some are the lifeblood of global commerce, moving cargo to waiting customers and factories.

With as many as 1 million parts, the most advanced of these ships dwarfs in engineering complexity even the modern jet passenger plane, with just 150,000 parts. Some, such as a modern cruise ship, cost up to \$700 million, take three to five years to build and require up to 1.5 million man hours to design. Navy aircraft carriers are even more complex with up to 40 million parts.

The true marvel, however, is that the modern shipbuilding industry has reached this pinnacle with largely manual, cumbersome, paper-based processes. Through the sheer will and skill of its craftsmen, the industry has created one unique masterpiece after another, custom-engineering each design, each system, each part, and then creatively solving the inevitable gaps and conflicts that invariably appear only during construction.



Time and money: The pressure is on



A host of new competitive pressures, however, are combining to make the old ways, no matter how amazing, a luxury the industry can no longer afford. Today, time and money are everything:

- Demand for certain categories of ships has increased sharply, pushing many yards to capacity and beyond despite a global capacity glut. Major new defense programs are underway, affluent consumers are spending more time on cruises, commercial ships are upgrading to meet new environmental standards, and rising oil prices are causing offshore oil production to boom. To maintain margins and guard against future economic slowdowns, however, yards are focused on becoming more efficient rather than adding capacity.
- The amount owners are willing to pay and the time they are willing to wait for new ships has declined. Being able to deliver ships faster and at lower cost has become a deciding factor in the competition for new contracts. Re-using or adapting existing designs and systems, incorporating off-the-shelf components and applying best manufacturing practices cuts both time and costs. That means purchasing, manufacturing and engineering must move in perfect harmony, requiring seamless on demand connections among these disparate functions.

- *Ship designs are being evaluated earlier in the design cycle, which maximises the sections that can be fabricated in existing robotic workcells, but significantly shortens available design time.*
- *Working with subcontractors allows yards to leverage specialists who can produce the most advanced systems quickly and at the lowest possible cost, while balancing demand in a fluctuating market. But outsourcing requires unprecedented levels of collaboration, communication and on demand integration to keep everyone working in sync. Even the US Navy is accelerating the need for collaborative tools by splitting its contracts among multiple yards, forcing 'coopetition'. Analysts estimate that 40 – 70 per cent of design and construction is now outsourced.*
- *Owners are increasingly emphasizing total lifecycle costs – not just the cost to build the initial vessel. Today, the cost of construction is just 10 per cent of total lifecycle costs, but 80 per cent of lifecycle costs are locked in at the design stage. This puts additional pressure on designers to find innovative solutions that improve maintainability and cut operating costs, even as the time available for the design phase is compressed.*
- *Allowing design problems to go unnoticed until they are uncovered during construction is no longer an option. There simply is no margin for the time lost and costs incurred by such oversights. Modular construction methods cut man hours 30 – 60 per cent but increase coordination complexity exponentially, requiring multiple enterprises to act as one digital enterprise.*
- *Drawing production is one of the most labor-intensive, costly and error-prone activities during design and engineering. Relying on paper printouts to keep everyone – from owners and classification societies to purchasing and subcontractors – aware of changes has become too cumbersome. Designers need better ways to communicate design intent, redirecting the 80 percent of their time spent producing drawings into better designs.*

Information: The shipbuilding success quotient



Tying all of these trends together is a simple thread: the need for quick, timely access to information. Information that allows yards, subcontractors, suppliers, owners, classification societies, insurers, underwriters and markets to work together seamlessly and in perfect synchronisation. Information that allows designers to leverage best practices and designs from past projects in future ones, optimizing designs for cost-effective manufacturing that uses existing resources and eases maintenance. Information that updates

itself effortlessly and automatically each time a change occurs and alerts everyone who needs to know – immediately and without fail.

Information is exactly what you get with IBM shipbuilding solutions – rich, intelligent data so sophisticated it automates most of the manual, purely mechanical processes and so accessible that you can collaborate with virtually anyone, anywhere with just a basic Web browser. Best of all, IBM's comprehensive on demand framework allows you to

pull information from legacy systems throughout your organisation and across your supply chain, leveraging it as if it existed in a single, centralised database. Our extensive on demand integration experience and clearly defined architecture, unmatched in the industry, make it possible.

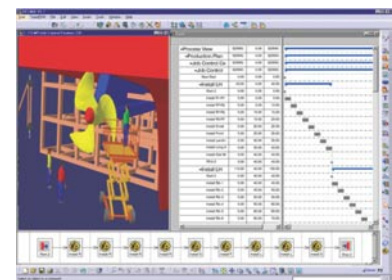
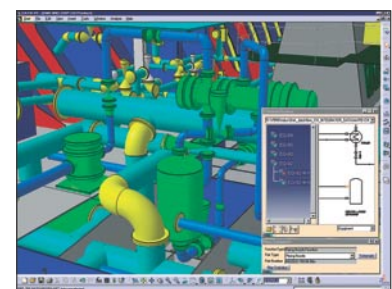
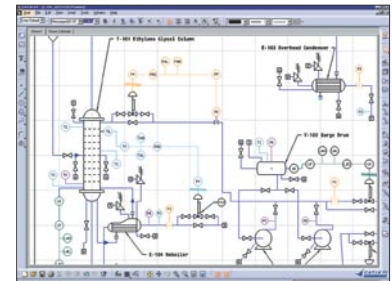
IBM shipbuilding solutions are built on the CATIA, ENOVIA LCA, SMARTEAM and DELMIA brand infrastructure from Dassault Systèmes. Developed by Dassault in cooperation with leading shipbuilders and naval designers including Deltamarin, General Dynamics Marine/Electric Boat, Bath Iron Works, Northrop Grumman Ship Systems, Meyer Werft and Northrop Grumman Newport News, they are quickly becoming the industry standard.

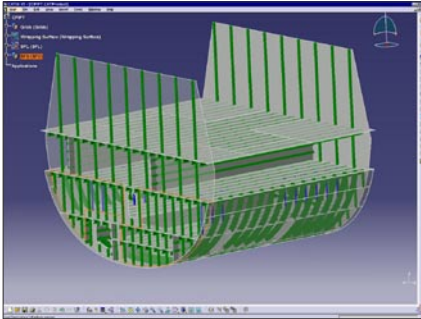
Leveraging the same digital manufacturing skills widely used in the automotive and aircraft industries, IBM shipbuilding solutions allow you to significantly reduce time to market, product cost, lifecycle costs and delays during new product launches. These solutions perform many digital assembly, manufacturing and maintenance processes early in the design cycle, allow you to de-bug the manufacturing and maintenance process in the digital world, which avoids expensive change orders in the physical world.

IBM shipbuilding solutions incorporate the best thinking in the business to solve the very real challenges you have today. With IBM Global Services to pull it all together, mix and match modules to suit your needs and customise the software to your way of doing business, IBM shipbuilding solutions are the most complete, comprehensive, customizable and collaborative on demand solution available today. The main technologies behind the solution include:

Advanced Applications

- *Design, Engineering, Planning, Manufacturing and Collaboration Tools*
- *Functionality for design, analysis, simulation, planning and production*
- *Based on proven, industry-leading CATIA, ENOVIA LCA, SMARTEAM and DELMIA brand infrastructure from Dassault Systèmes*
- *Multi-CAD compatibility*
- *Browser technology*
- *3D design visualisation*
- *Production planning*
- *Digital manufacturing*
- *B2B procurement interface*
- *Design change/document management*
- *Workflow*
- *Robotic simulation*
- *Knowledge capture and reuse.*



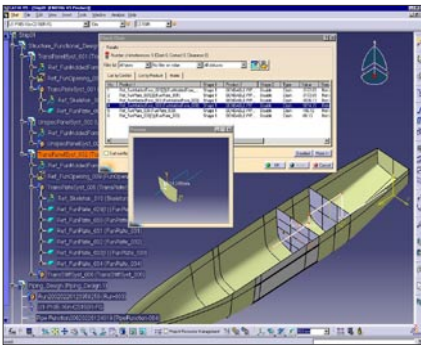


Systems & Networks to Interconnect Owners/Yards/Suppliers

- Legacy system integration
- Interfaces to production and ERP
- Browser access.

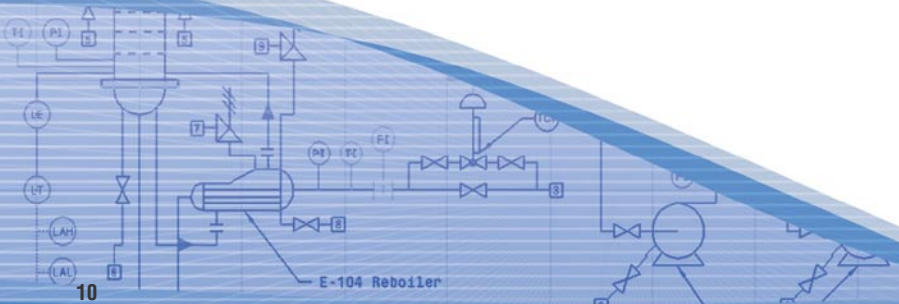
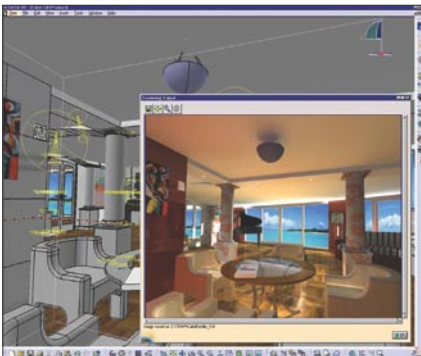
Systems Management

- Managing the network and access
- Secure environment
- Centralised product, process and resource database
- Customizable user view
- Multi-CAD Support.

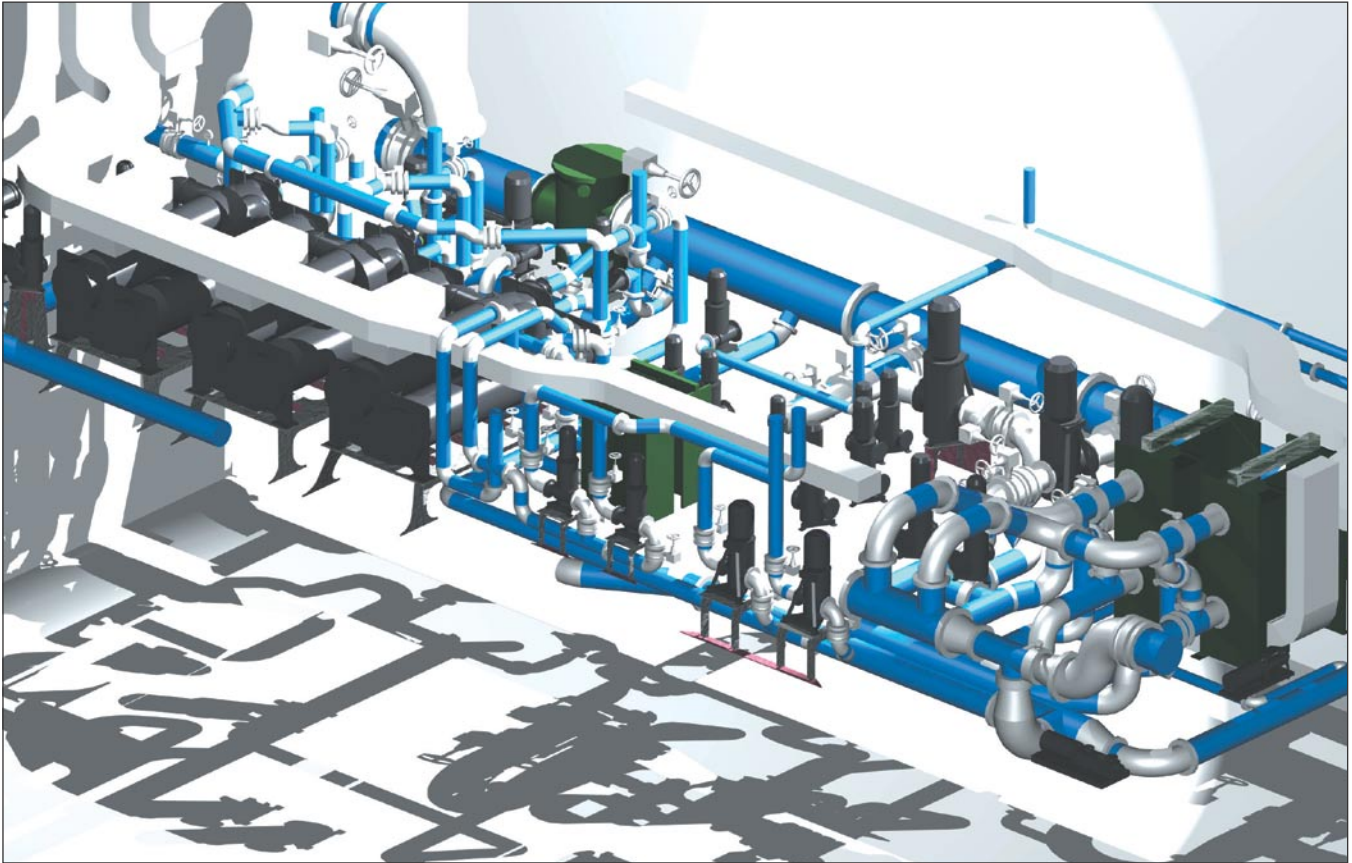


Consulting & Services

- Skills transfer
- Modelling and simulation
- Best practices
- Installation and performance tuning
- Systems integration
- Outsourcing
- Customization.



The complete, smart, collaborative shipbuilding solution



With IBM shipbuilding solutions, it is now possible to design a complete 3D product model even before contracts are signed and the first steel is ordered, and to use that model as the basis for detail design, purchasing, build strategy, production planning, workshop documentation, installation and even maintenance. The system supports online collaboration through the ENOVIA LCA and Portal, which gives everyone on the team, from owners to purchasing, the means to view and markup 3D models using a simple Web browser.

IBM shipbuilding solutions stores individual ship parts, process templates and manufacturing resources as intelligent and interconnected components that know about themselves and their relationship to one another by attaching information about their real-work industrial characteristics and behavior. The system actually uses the design context to pick the most appropriate part from the project catalogue. Designers only resolve conflicts – when no part is available or when multiple parts fulfil

the requirements. And when the time comes to order parts, integration of the design solution with the corporate ERP and procurement systems through IBM's on demand framework ensures your buyers know exactly what they are purchasing and why.

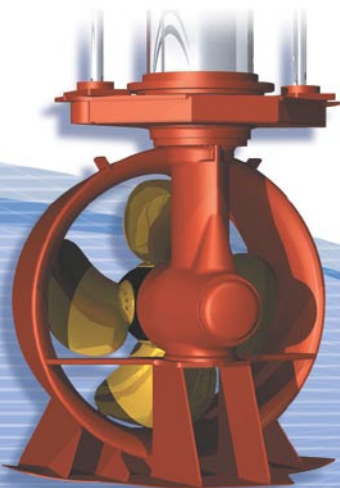
With CATIA, every 3D model is continually associated with every 2D extraction made from it. Deleting an object in 3D removes it from each 2D drawing, and vice versa. Every change automatically updates every drawing, eliminating many sources of error.



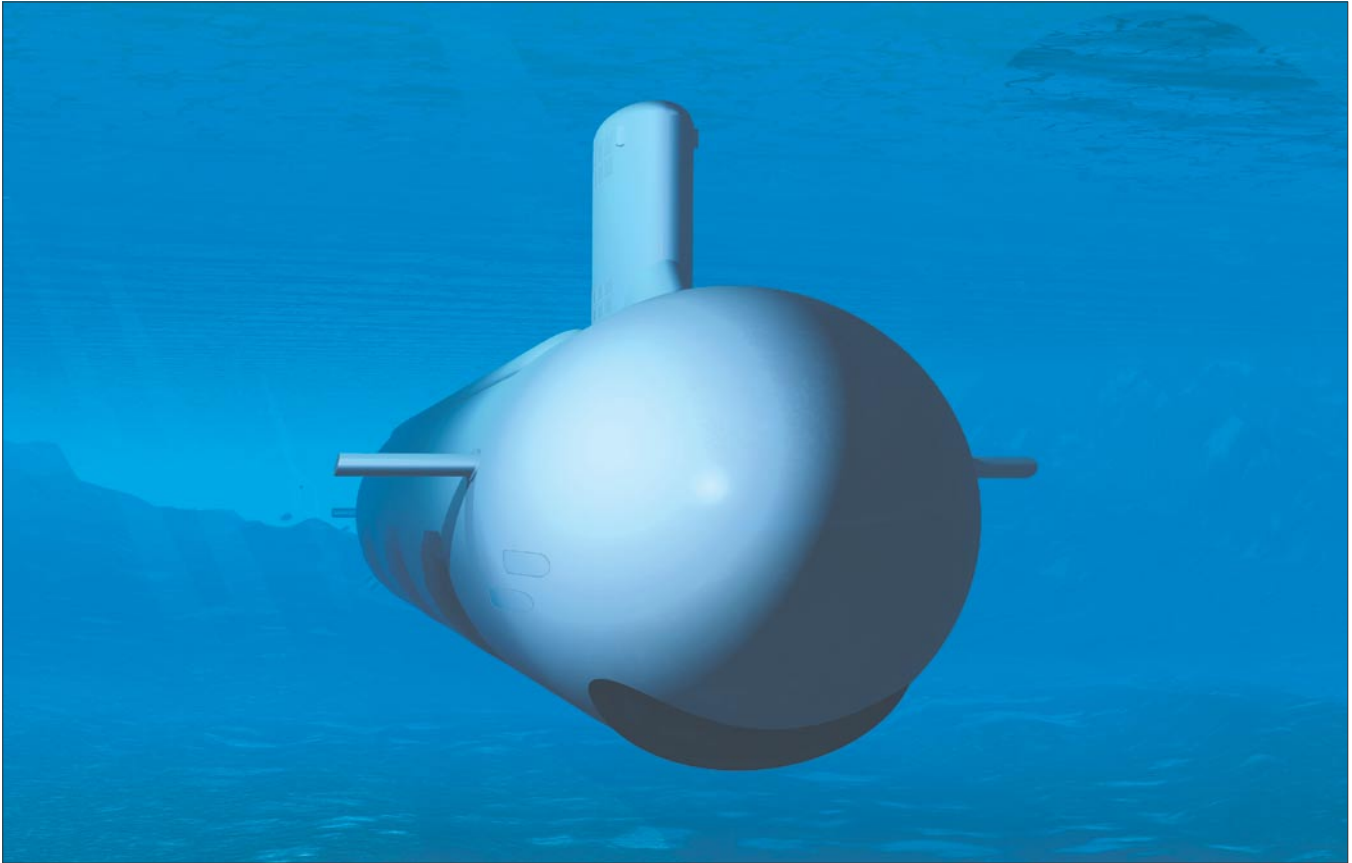
Knowledge engineering rules analyze design intent. For example, in a piping diagram, the distance between pipes and heat sources is automatically calculated, and the software assigns the proper level of insulation to the pipes and neighbouring structural elements based on an analysis of the fluids to be transported.

As an IBM on demand solution, IBM shipbuilding solutions empowers team members to interact with one another, suggesting changes or communicating new requirements. Participants can hold markup and discussion sessions in real-time online, or use subscription capabilities and instant messaging to track changes as they occur.

System intelligence also provides interference clash detection. But unlike most systems, which only model hard interferences, IBM shipbuilding solutions can distinguish between true penetrations and subtle contacts, eliminating the false positives that burn designers' time. It also analyses soft interferences – modules that don't touch or bump but interfere with each other when maintenance or operation is required, from leaving enough room for worker access to providing clearance around light fixtures to ensure their illumination is not blocked by nearby objects.



The proven, real-world solution...



Best of all, IBM shipbuilding solutions has been developed and proven in actual yard operations by some of the world's leading shipbuilders and naval architects.

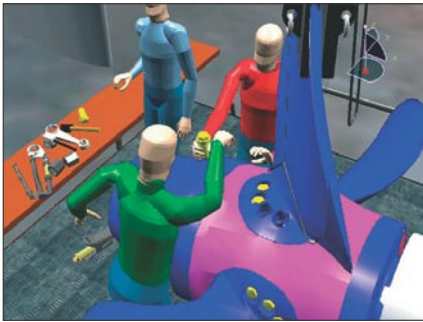
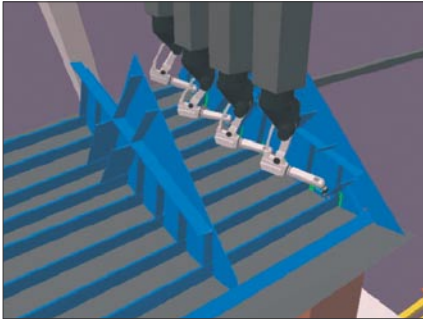
Deltamarin, for example, has documented lead time savings of two to six months during the design phase by creating a complete 3D model at the first stage of a project. Having a good, well-coordinated model available at the signing of a newbuilding contract saves coordination time later and remarkably

reduces the discussions of contents and the actual meaning of contracts and design as work progresses.

The same model can be used for calculating essential design parameters and for extracting subcontractor and supplier inquiry models. Deltamarin notes that having such models 'reduces the risk of modifications, saving both man-hours and, particularly, lead time'. When fleshed out with piping, ducting, cable tray, main components, equipment and systems, the same model serves as

the basis for turnkey contracting, detail production, planning and workshop drawings. Owners, meanwhile, have used Deltamarin's models for marketing, training, safety and even for bank financing and insurance purposes.

At Meyer Werft, 3D models have been used to eliminate costly, traditional scale models of complex areas and to analyse and review construction in a virtual environment, allowing the development of building and erection sequences.



General Dynamics Electric Boat, meanwhile, believes that its decision to electronically mock up the entire attack class submarine while simulating assembly and outfitting has shortened design cycle time, improved quality and contributed significantly to a 25 per cent decline in costs compared to the Seawolf class. Electric Boat has used its mockups and assembly simulations to allow design/build teams of designers, production workers, lifecycle support personnel and customers to work concurrently on finding the optimum locations for equipment, the optimum modular build and test units, and the optimum sequence of assembly. Physical mockups have been reduced by 75 percent.

Collaborative work tools have also allowed EB and Northrop Grumman Newport News, which are co-building the submarines, to divide the construction of key modules, avoid duplicating the learning curve and save US taxpayers an estimated \$700 million. NGNN, meanwhile, has fully integrated its ERP and CATIA systems, using ENOVIA software as the product data handler in between.

...From your proven, real-world partner: IBM

Designing and building a modern ship is one of the largest, most complex undertakings in the modern world. Not just any company can build one – and not just anyone can support the companies that build them. Just as no one else can match the skill and know-how that you bring to a project, no one else can match the skill and know-how that IBM puts at your disposal. We have more experience with large and complex projects than anyone else in the business, and our track record of success speaks for itself. We have the people, experience and resources to ensure your success, because we understand both the complexity of building collaborative systems for design and production and the complexity of the global marketplace in which you compete.

That's why CATIA and DELMIA use a common object technology paradigm that supports multiple views of the product, giving you simultaneous access to system, space and build strategies. It's why our solution is scalable, allowing you to easily

accommodate multiple, complex ship development projects. Our IBM on demand framework is the most comprehensive in the business, giving you a broad-based, complete and fully integrated solution for sharing information across your enterprise and throughout your supply chain.

We also realise that technology must constantly evolve to meet your needs, so IBM is committed to continuous improvement of its Shipbuilding Solutions. IBM and Dassault have joined with Seoul National University in South Korea, for example, to create and equip the Digital Shipbuilding Innovation Center, accelerating research into shipbuilding innovation. And we provide global support for customers through our IBM Shipbuilding Competency Center, which is staffed with experts in hull design, structures and other aspects of shipbuilding. The centre provides consulting services on the business, best practices and management of electronic shipbuilding solutions – all so that the best shipbuilding solution in the business today will still be the best for years to come.

“A major source of additional competitiveness for shipbuilders is improving collaboration between engineering and manufacturing. We are convinced that the combination of CATIA and DELMIA provides the unique opportunity to connect these two domains.”

Dr. Jong Gye Shin

Department of Naval Architecture & Ocean Engineering, Seoul National University



For more information contact your IBM Marketing Representative, IBM Business Partner, or call one of the numbers below:

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