Practical Applications of Design for Producibility Project

Final Project Technical Report

Rev. 0

September 30, 2009

Deliverable for Milestone 28
Under
Technology Investment Agreement (TIA) 2008-392:

Submitted by
Bollinger Shipyards Lockport, L.L.C

On behalf of the
Project Team Members

Table of Contents

1 Title

Practical Applications of Design for Producibility Project. Technology Investment Agreement (TIA) 2008-392

2 Executive Overview

Current ship design practice utilizes many different types of what could be considered standard assemblies that are located and used in various places throughout a ship design often unchanged. These are very common components such as hatches, doors, ladders, rails, etc. Currently, designing and using these components during ship design requires that the objects either be created as single block items that can then be inserted into a design when needed, or to build the component from base shipbuilding structural stock every time it is required. The disadvantage to using a block method for inclusion in the model is that the requisite production information is not available from the block in most software packages (what type of stock, how many, and cutting/forming information). The current method used to obtain production information directly from the model is unwieldy and cumbersome, requiring the designer to rebuild the object from scratch.

There are currently limited capabilities in U.S. shipyards to model and create production output for pipe hangers/distributed system supports. The current practice is often to leave the implementation to the production personnel to locate and fit-up distributed system supports in the field during the various stages of production. There is currently very little support in the software systems in use to be able to model support systems, generate bills of material (BOM) for fabrication, and to assign the components to relevant portions of a build sequence. The information is not being incorporated into the ship model for weights and centers, and there is no mechanism for generating appropriate fabrication and/or assembly drawings.

This project addressed the areas of parts commonality, standardization, and incorporation into the ship design process. Two key areas have been addressed according to industry demand and requirements. Due to the existing successful work on the Design for Producibility NSRP project, there is current emphasis and desire on correlating the design practices closely with those of the production capabilities in the shipyard. The straightforward implementation of a distributed systems support method, and integration of standard assemblies should address industry desires.

Leveraging previous work and relationships conducted under NSRP software development projects, the shipyards and design agent were solicited to better define the workflow requirements of designers. This workflow information was then corroborated with shipyard production practices for handling both common sections of ship systems as well as the best practices for fabrication and installation of distributed systems components. The inclusion of Design for Producibility (DFP) results from previous NSRP projects was essential for better understanding the procedures and requirements that was considered when addressing standard assemblies and distributed system supports. The combination of the base design work flow, standard production practices, and the results from DFP analysis drove the specifications forward for implementing these desirable abilities into the design practices and software.

The significant technical issues that were addressed in this project included:

- Consolidation and generalization of standard assembly and distributed system support practices.
- Detailed software specification which defined the proposed additions to the software such that software engineers then translated the desires of the project team correctly.
- Two Beta releases of standard assemblies and distributed system supports in the design software ShipConstructor.
- Then a Final release of standard assemblies and distributed system supports in the design software.

The project team will see an immediate return on investments as better defined component modeling workflow practices exposed further the design process to not only the development team, but also allows the shipyards and designers an opportunity to carefully examine best practices and impact on the design. By addressing the workflow issues carefully, a demonstrable benefit emerged with reduced design output and production time, and allows for a modular approach to component usage in ship design. There were also benefits in realizing that lifecycle costs can further be reduced by having detailed production information available and applicable across many different types of vessels. The ability to effectively manage the fabrication and installation of distributed system supports and hangers will immensely benefit the project team by allowing for more tightly integrated planning. More complete model information can be generated by taking into account the weights, centers, and production planning procedures.

3 Contact Information

The primary point of contact for this project is provided below.

Name	Company	Email	Phone #
Dennis Fanguy (PM)	**Bollinger Shipyards Lockport, LLC P.O. Box 250 Lockport, LA 70374**	**dennisf@bollingershipyards.com**	**(985) 532-2554**

4 Collaborators

The project participants who collaborated on this project are listed below.

Project Participant	Role and Key Contribution	Relative Level of Effort
Error! Not a valid link.	Project lead, project management, steering committee chair and beta test site**Error! Not a valid link.**	**Error! Not a valid link.**
Error! Not a valid link.	Steering Committee and beta test site	**Error! Not a valid link.**
Error! Not a valid link.	Steering Committee and beta test site	**Error! Not a valid link.**
Error! Not a valid link.	Steering Committee and beta test site	**Error! Not a valid link.**
Error! Not a valid link.	Software integrator and developer, domain experts	**Error! Not a valid link.**
Error! Not a valid link.	Software developer, design software implementation and execution	**Error! Not a valid link.**
Error! Not a valid link.	Steering Committee and beta test site	**Error! Not a valid link.**
		Error! Not a valid link.

5 Description of Methodology

The project was primarily a software development project to be performed by ShipConstructor Software Inc. in order to provide the functionality as requested by the project team members.

The project team led the development of a specification for implementing the desired features in such a way as to correspond with shipyard needs and results from DFP analysis generalized for all members. The specification included means of identifying DFP areas and generalized rules as well as the software interface and functionality required by the team.

The integration of these capabilities was released as beta modules to the core ShipConstructor software design suite, and made available to team members to evaluate and provide feedback. The collaborative feedback drove beta development as the tools were refined for the team members. A collaborative website was used to centralize all team member comments and input for software development.

ShipConstructor provided versions of the software suitable for evaluation and testing of the software. The software locks, used to access the ShipConstructor software, was issued to each project team member within the first month under contract. Each team member received at least 3 trial locks (for a total of 18) to use in the evaluation and testing of the software that was developed. The software locks were provided so that the project team members did not have to utilize current purchased / working software locks for testing software under this project scope. SSI provided the software and locks as cost share for the project so there was no financial burden on the project participants to participate in the development work. These locks were issued for operation at an adequate working level (Level 7) for the evaluation and testing the developed software.

The table shown below provides a detailed description of the tasks that was performed over a eighteen month period to accomplish the goals and objectives of this project. The Project Management Task (Task 1) included the administrative and technology transfer activities that occurred throughout the duration of the project. Task 2 addressed the concerns brought forth in the development of standard assemblies to support the shipyards and designers. Task 3 provided functionality to further refine the product data model such that it accounted for distributed system supports, allowing for a more detailed planning and scheduling through shipyard processes.

Task	**Project Element**	**Time Frame**
1	Project Management • Assemble Team Kick-off Meeting • Develop Project Management Plan • Develop Technology Transfer Plan • Develop Software Development Plan • Provide Ongoing Project Management • Hold Quarterly Technology Transfer Meetings	April 2008- March 2009
2	Integration of Standard Assemblies • Consolidate results from DFP and possibly Lean principles to define clearly the generic use cases involving standard assemblies Coordinate and Conduct 1-day DFP training at each participating shipyard • Document these results in a detailed software specification that will clearly define the requirements of the project team such that software engineers can begin to write the code necessary to support this proposal. • Generate Beta code for testing among the project team members, and provide feedback to developers on the state of the results for refinement. • Generate final code for integration into the design software for general use..	May 2008- March 2009
3	Integration of Distributive Systems Supports • Consolidate results from DFP and possibly Lean principles to define clearly the generic use cases involving distributed system supports. • Document these results in a detailed software specification that will clearly define the requirements of the project team such that software engineers can begin to write the code necessary to support this proposal. • Generate Beta code for testing among the project team members, and provide feedback to developers on the state of the results for refinement.	May 2008- March 2009

Task	Project Element	Time Frame
	• Generate final code for integration into the design software for general use.	

6 Resources Needed

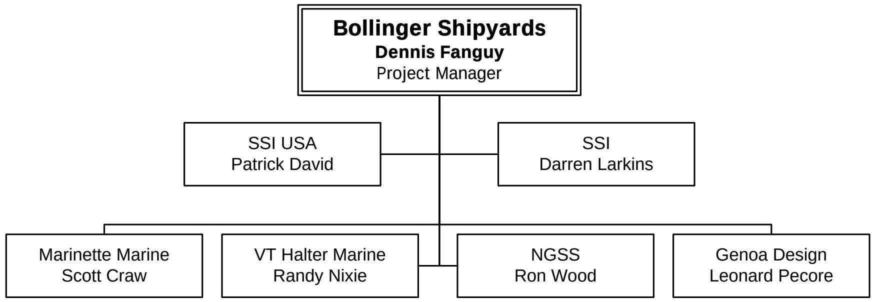
This project maintained management relationships from several mid-tiered shipyards with a strong and capable team that has participated in several previous NSRP projects including Design for Producibility and the Second Tier Design Enhancement Project I-III.

The technical team included experienced software developers who were primary in producing the ShipConstructor design software in use at the shipyards as well. Many of the team project members had previously collaborated on other NSRP projects producing great results. Shipyard members committed very knowledgeable personnel with intimate knowledge of each shipyards internal processes.

The use of a collaborative website allowed interactions between project members as the project progresses. This allowed for seamless communication between the project team members, including the visibility for other project members to see each other's comments and feedback. This visibility allowed the project team to be aware of the current dialog occurring and helped to avoid discussions having to be repeated on previous topics. This also allowed the team members to pool their knowledge on the project topics and greatly increased the effectiveness of this project.

In addition to the collaborative website, the project team conducted regular quarterly meetings, with additional "Go To Meetings" meetings as necessary. These meetings were invaluable to developing and strengthening the professional relationships necessary for a successful project.

The project was organized as a "Lead – Team Member" arrangement. With this structure Bollinger Shipyards signed the Technical Investment Agreement and was responsible for overall project and program management. Each of the team members was issued a Purchase Order/Subcontract Agreement which referred to the scope of work and agreed to costs in the TIA.



Project Organization Chart

7 Evaluation and Analysis Methods

In the training process for users of design software such as ShipConstructor, a common problem has manifested itself for the designers that are most apparent during outfit modeling. The problem we identified was the need to recreate components from scratch every time it is required in order to maintain the production output to assemble and fabricate the components. With the majority of shipyards on the Gulf coast utilizing the ShipConstructor software for design and construction, this indicates a large demand from industry in adding the ability to handle component objects in a well organized fashion that supports production practices. One of the largest drivers for the project has been the successful completion of the Design for Producibility (DFP) project. Acknowledging that there are cost benefits and a solid business case for examination and modification of design practices to better integrate with production capabilities has allowed U.S. shipyards to better compete in a global sense. This project was an extension of those results with a desire to provide a more automated means for realizing those benefits. By providing a framework for defining standard assemblies that are consistently re-used in shipbuilding production, the project team is attempting to address strong needs early and efficiently.

The team then developed a software spec that the final product would be judged against. We did not use any formal assessment tools, however, during the periodic Go To Meetings and the quarterly meetings the team was able to evaluate and provide valuable feedback to ShiipConstructor during the development of the software tools. At the conclusion of the project, the team participated in a beta test session in Victoria in order to provide real time assessment as well as providing a training opportunity for the users. The team does not intend to perform any further evaluation; however, most of the team will in fact implement the software enhancement as soon as it is released.

8 Time Estimate

It took about 15 months to complete the effort, however, now that the software will be readily available in a few weeks, the implementation for future users of these enhancements is literally a few days of training and the users can implement effectively.

9 Limitations or Constraints

The only limitation to a fully implemented solution at other facilities is the use of ShipConstructor 2008 3D modeling tool and the addition of this enhancement to the tool. As mentioned above most of the project participants will be implementing this software soon. This application can work for all types of shipyards, large, small, new construction, repair, etc.

10 Major Impacts on Shipyard

The project team expects to see an immediate return on investments as better defined component modeling workflow practices will expose further the design process to not only the development team, but will allow the shipyards and designers an opportunity to carefully examine best practices and impact on design. By addressing the workflow issues carefully, a demonstrable benefit will emerge with reduced design output and production time, and will allow for a modular approach to component usage in ship design. There are also benefits in realizing that lifecycle costs can further be reduced by having detailed production information available and applicable across many different types of vessels. The ability to effectively manage the fabrication and installation of distributed system supports and hangers will immensely benefit the project team by allowing for more tightly integrated planning. More complete model information can be generated by taking into account the weights, centers, and production planning procedures.

11 Cost Benefit Analysis/ROI

This project has a strong business cased based on the overall shipbuilding design and production practices – improve the efficiency of design engineering by utilizing previous DFP results with the intent to reduce the overall costs of vessel construction, decrease the cycle time for design engineering, and to take advantage of the producibility of components base on production constraints. The results from the Design for Producibility project allowed shipyards to best find design practices that would support production and scheduling constraints, and this project further defined those practices as well as integrated the results directly into the design software automatically.

The largest impacts of this project will likely be felt in the areas of outfitting and distributed systems where there has been considerable feedback from shipyards regarding the topics of this project. A much requested feature of the software from shipyards has been these abilities, and with the recent focus on Design for Producibility the features are even more pertinent. Shipyards are looking for more effective means to integrate production capabilities into their design engineering environment such that the two will seamlessly integrate. This reduces overall costs by allowing planning and scheduling to more accurately represent the current state of the shipyard.

The project team members have already found the value in examining DFP processes, and this project provided extended value by implementing the core DFP ideas at the phase where they have the greatest shipyard impact, the design phase.

12 Lessons Learned

This project maintained management relationships from several mid-tiered shipyards with a strong and capable team that has participated in several previous NSRP projects including Design for Producibility and the Second Tier Design Enhancement Project I-III.

The technical team included experienced software developers who were primary in producing the ShipConstructor design software in use at the shipyards as well. Many of the team project members have previously collaborated on other NSRP projects producing great results. Shipyard members have previously committed very knowledgeable personnel with intimate knowledge of each shipyards internal process.

The use of a collaborative website allowed interactions between project members as the project progressed. This allowed for seamless communication between the project team members, including the visibility for other project members to see each other's comments and feedback. This visibility allowed the project team to be aware of the current dialog occurring and helped to avoid discussions having to be repeated on previous topics. This also allowed the team members to pool their knowledge on the project proposal topics and greatly increased the effectiveness of this project.

In addition to the collaborative website, the project team conducted regular quarterly meetings, with additional Go To Meetings as necessary. These meetings are invaluable to developing and strengthening the professional relationships necessary for a successful project.

All of the aforementioned items were key to the successes of the project and valuable lessons to be implemented in future projects.

13 Technology Transfer

Implementation of this project focused on integration of production processes identified during the DFP project for shipyards that were involved with it, and based research on general practices that were identified as common for other yards relative to DFP. The base implementation plan for the team members was to evaluate the extended functionality available in the software already being used, and feedback to the project team for guidance on implementation. Designers within the participating companies will be evaluating software that they are already using, and that they had a direct feedback loop in specifying.

The results of this project were disseminated among the project participants as well as presentations and papers being delivered at the appropriate symposia and meetings. The results will also be available through the NSRP website for access.