2024

NSRP
NATIONAL SHIPBUILDING RESEARCH PROGRAM™
Taking Shipbuilding and Repair to the Next Level

Panel Project – Automated Detail Planning and Instant Earned Value Control – Final Report

AGREEMENT #2019-483-012

SHIPCONSTRUCTOR SOFTWARE INC. (SSI)

JUNE 17TH, 2024

Contents

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PANEL PROJECT FINAL REPORT
AUTOMATED DETAIL PLANNING AND INSTANT EARNED VALUE CONTROL – FINAL REPORT
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Project Overview:

Detailed planning and scheduling is a normal activity in shipbuilding; however, the extent of that effort varies among shipyards based on several criteria. Most prevalent are the time and resources available to develop a detailed plan accurately and efficiently to the lowest possible element for the shortest duration of time. To that end, there are thousands of everyday shipbuilding activities which require granular planning levels for sequencing, dependencies, budgets, and resource allocation. To accomplish this daunting task, shipyards use a variety of commercially available scheduling software, spreadsheets, databases, and home-grown legacy systems, many of which require extensive manual data input.

This project provides an integrated solution using a commercially available off the shelf (COTS) detailed planning software system to integrate directly with the engineering data within the 3D detailed design model as well as with other shipyard planning and scheduling systems. This integrated solution using the engineering metadata at the individual part level along with planning data will provide automated scheduling and planning algorithms to support Enterprise Resource Planning (ERP) systems, Earned Value Management Systems (EVMS), and complex planning down to the shop floor.

Project Goals

- Automate the detail planning process coordinated with the project plan through a direct integration with engineering data
- Automated sequencing, budgeting (hours/duration), resource allocation and EVMS control
- Integrate the 3D engineering design model to allow metadata at the part level to drive the automated planning algorithm and interoperability with ERP, EVMS, planning and shop floor control

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Project Steps

Steps taken throughout the project:

- Kickoff meeting
  - Review goals, tasks, responsibilities, deliverables, software, and detailed project schedule with Milestones
- Quarterly Meetings
- Capture business process and data requirements
  - Develop To-Be process use cases and document workflow
  - Develop detail planning output and determine alignment
  - Review and refine project requirements
- Document data exchange requirements
  - Document data exchange protocols
  - Review data exchange protocols
  - Review and refine project requirements
- Execute automated detail planning for selected block construction
- Demo data exchange with COTS solutions
- Final Workshop & Demonstration
- Final Report
- Technology Transfer Events

Project Results

The goal of this Panel Project was to deliver a comprehensive shipyard planning solution by integrating Floorganise's Floor2Plan software with engineering metadata from the 3D model. With that data, Floor2Plan can automate planning and scheduling algorithms which can be customized based on a shipyard's individual problems and needs. The main approach to identifying the shipyards' individual needs was to meet with the appropriate personnel at each shipyard, including representatives of the critical departments involved in planning and scheduling and other subject matter experts to acquire the necessary information needed to tailor the automated custom templates and value streams to each individual shipyard. This report will highlight the work accomplished during the project as well as specific milestones and deliverables critical to the project's success.

Milestone 04 | Capture Business Processes & Data Requirements

In October 2023, the project team traveled to Sturgeon Bay, WI to Fincantieri Bay Shipbuilding's shipyard. This document summarizes a project aiming to improve earned value management in shipbuilding through better data integration between engineering and production processes.

Key takeaways included:

- A shipyard manufacturing execution system (MES) platform will be implemented to capture shipyard-specific value streams and integrate with existing data systems.
- Challenges were identified in data exchange between Fincantieri Marinette Marine (FMM) and Fincantieri Bay Shipbuilding (FBS), including delays and missing information in engineering data.
- FBS production processes were reviewed, including challenges with work package execution, progress tracking, and material availability.
- The project aims to provide shop floor workers with better information to improve progress reporting and give management more timely insights.

Overall, the trip to FBS helped the project team understand how to better improve communication and data flow between engineering and production for better earned value management in shipbuilding going forward.

Milestone 05 | Document Data Exchange

SSI and Floorganise successfully collaborated to define the data to be exported from EnterprisePlatform to Floor2Plan via online sessions. This data exchange aimed to establish a foundation for more robust earned value management reports.

The next steps involved Floorganise processing the available data with SSI's data and mapping it to the Floor2Plan system. This would pave the way for the development of the Floor2Plan solution. The project team anticipated discovering new insights and requirements during development as the participating shipyard team members explored the software and provided initial feedback.

Overall, the visit to Fincantieri Bay Shipbuilding provided valuable insights that would inform how data is leveraged to best serve their needs and add value for shop floor

workers. Capturing these unique value streams is a crucial element to this project as it will help foster a more holistic view of the shipbuilding process.

Software Workshop | February 2024

In February 2024, SSI USA and Floorganise hosted a software workshop with project team members and participating shipyard team members at SSI's office in Mobile, AL. The two-day workshop took place on the 27th and 28th of February 2024. Team members from SSI USA and Floorganise gave an overview of the project and its purpose before diving into the hands-on portion of the workshop. Workshop participants relocated to SSI's training lab to work inside the Floor2Plan software with

Software Workshop hosted by SSI & Floorganise at SSI USA's Mobile, AL office

each shipyard team member using their own data to populate the Floor2Plan templates used in the automated detail planning process. Day 1 of the workshop focused more on the supervisor's workflow with Day 2 focusing on project planning from the planner's perspective. The workshop ended with a roundtable discussion and next steps for the project.

Day 1 | 27 February 2024

Floor2Plan training session from Day 1

The two-day event began in the SSI USA conference room on the 27th of February and the participants were introduced to Floor2Plan and learned how the software can be used with EnterprisePlatform. Later that morning the group moved into the SSI Training Lab to do some hands-on training with the Floor2Plan software. Floorganise led the participants through multiple processes

and workflows in Floor2Plan from a planner's perspective. Each participating shipyard had their cloud environment setup and were able to access their planning data. Several other example projects were also available to use and interact with during the workshop, including the PSV.

Day 2 | 28 February 2024

Jon Torfi Hauksson (Floorganise) leading a training session on Floor2Plan during the workshop

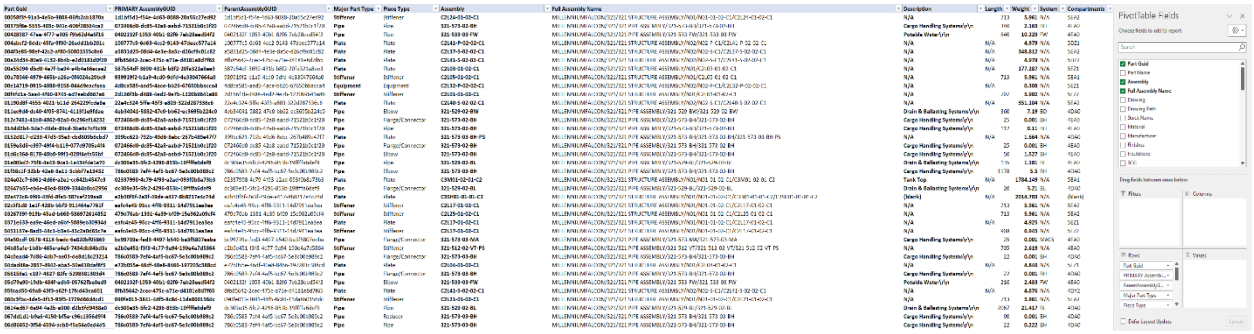
The second day of the workshop began in the SSI USA conference room with a roundtable discussion where the project team and all other workshop participants reflected on the previous day's events, asked questions about Floor2Plan as well as Floorganise, and went over a brief agenda on the activities planned for Day 2. The participants wrapped up the roundtable discussion and then moved over to the training lab where Floorganise picked back up from yesterday. The workshop's second day focused on the Floor2Plan software from the supervisor's perspective. Through the previous workshops, SSI and Floorganise met with subject matter experts from Fincantieri Bay Shipbuilding (FBS) to determine each shipyard's value streams. Those value streams provide the necessary information to create custom, shipyard-specific templates within Floor2Plan.


Roundtable discussion after the training session from Day 1

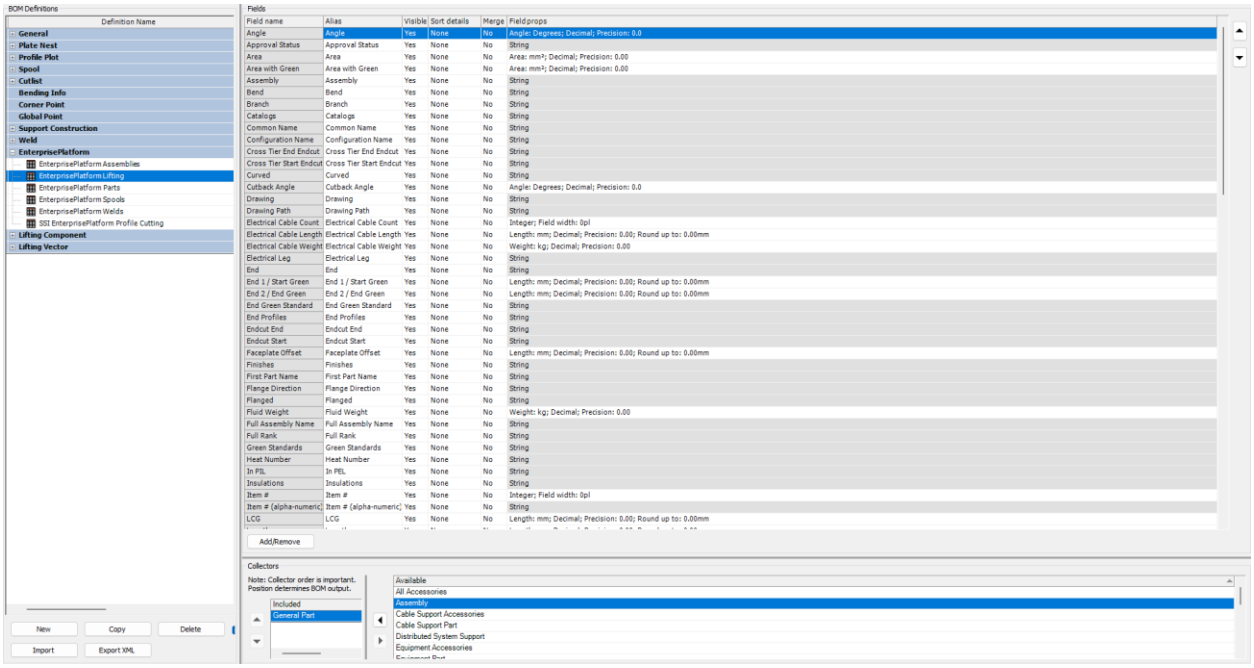
Milestone 07 | Execute Automated Detail Planning for Selected Block

Work was completed on this milestone during this quarter which wrapped up at software workshop in February. In January, SSI conducted an export using BOM data from the PSV to pull the data out which then populates into an Excel spreadsheet. The spreadsheet includes a pivot table to focus on the items the project team wanted

to highlight based on the meetings and conversations had with the participating shipyard team members. At the software workshop in February, all the participating shipyard team members and other participants each successfully executed the automated detail planning for their selected blocks in Floor2Plan.



Screenshot of the Excel spreadsheet containing the export data that will be used in Floor2Plan



BOM settings which pulls the data that populates the Excel file

Milestone 09 | Data Exchange Test & Evaluation

The data retrieved from the engineering model, which was imported from EnterprisePlatform into Floor2Plan, was packaged in a zip file and provided in Excel format. EnterprisePlatform offers users a user-friendly data selection tool which allowed us to choose specific data fields from Table 1. Our goal in selecting these

fields was to enable Floor2Plan to create a product hierarchy based on the drawing hierarchy, and to include information that would allow us to scale our templates for more dynamic project planning in terms of timescales.

ASSEMBLIES	PARTS	SPOOL	DRAWING	UNIT
Assembly GUID	Part GUID	Spool GUID	Drawing GUID	Unit GUID
Part Name	Part Name	Spool Name	Drawing Name	Unit Name
Fill Rank	Major Part Type	Spool Type	Drawing Type	
Part GUID	Parent Assembly GUID	Drawing GUID		
Drawing GUID	Drawing GUID	Parent Assembly GUID		
Total Weight	Length	Weight		
Total Volume	Area	Approval Status		
Total Surface Area	Total Weight	Surface Area		
Total Surface Area	Total Volume			
	Total Surface Area			
	Total Length			
	Total Area			

Upon importing the data into Floor2Plan, we proceeded to assess the correlation between the drawing hierarchy in EnterprisePlatform and the product hierarchy in Floor2Plan. The primary objective of this project is to leverage the Floor2Plan templates in conjunction with the drawing hierarchy from EnterprisePlatform, supplemented with additional metadata, to meticulously outline a project plan. Notably, the demo data provided by SSI for the workshop conducted in February in Alabama indicated that the drawing hierarchy and product hierarchy in Floor2Plan were in perfect alignment. This successful data interchange serves as a testament to the advancements made for this project. Furthermore, the solution's remaining components build on established features currently used in production environments at shipyards across the globe.

Technology Transfer and Implementation

Final Meeting

Virginia Modeling, Analysis & Simulation Center at Old Dominion University | Suffolk, VA

The National Shipbuilding Research Program (NSRP) brought together its Business Technologies and Ship Design & Material Technologies Panels for a joint panel meeting focused on digital shipbuilding and visualization technologies. The event, which took place from 30 April to 02 May 2024 in Suffolk, VA, served as a platform for industry leaders to share explore advancements in these crucial areas. The meeting venue was the Virginia Modeling, Analysis, and Simulation Center (VMASC) at Old Dominion University (ODU). Attendees participated in presentations and tours designed to highlight VMASC's capabilities. The program also included a visit to General Dynamics NASSCO-Norfolk's Ligon Repair Yard in Norfolk, VA, on the final day. This tour provided attendees with firsthand experience of a modern repair yard environment. The presentation on the Automated Detail Planning and Instant Earned Value Control NSRP Panel Project was delivered by Darren Guillory of SSI USA and Jón Torfi Hauksson of Floorganise, LLC.

GD NASSCO-Norfolk's Ligon Repair Yard | Norfolk, VA

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Participants of the NSRP BT/SDMT Joint Panel Meeting sitting in on a presentation on Day 1 of the event

A link to the NSRP website's "Event Page" for the 2024 NSRP BT/SDMT Joint Panel Meeting - Suffolk, VA is provided here.

In July 2023, SSI USA briefed this project at the NSRP Business Technologies (BT) and Ship Design & Materials Technologies (SDMT) Joint Panel Meeting in Seattle, WA. The Panel Meeting included a tour of the NUWC Division Keyport Naval Base.

This project was also presented at the Welding and Planning, Production Processes, and Facilities (PPPF) Joint Panel Meeting in Oak Ridge, TN in August 2023.

Conclusion and Recommendations

Conclusion

The information gathered over the course of this project will equip shop floor workers with enhanced information related to their jobs. This will empower them to generate more precise progress reports, providing management with a clearer and timelier picture of the project's progress. By streamlining communication and ensuring a smooth flow of data between engineering and production teams, this project lays the foundation for a significant improvement in earned value management within the shipbuilding industry. Better communication between engineering and production teams, more accurate progress reporting from the shop floor and clear project insights for management are some of the benefits of implementing this solution.

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The primary conclusion drawn from the February workshop was that a successful connection was established between EnterprisePlatform and the engineering model. The data obtained from EnterprisePlatform is a direct download from the engineering model, meaning the product hierarchy we generated in Floor2Plan during the detailed planning process is linked to the drawing hierarchy in ShipConstructor. This implies the quality of the drawing hierarchy is vital for a good import.

Using weight and surface area improved our automated project plans, making the activities better reflect actual time and budget needs. This will provide a more solid basis for earned value management when this solution gets tested in a production setting, ensuring that project progress aligns with reality.

This project successfully demonstrated the feasibility of integrating a commercially available detailed planning software system with existing shipyard systems to automate detailed planning and scheduling processes. This integrated approach has the potential to streamline earned value management in shipbuilding by:

- Improving communication and data flow between engineering and production teams.
- Equipping shop floor workers with better information for progress reporting.
- Providing management with clearer and timelier project insights.

Recommendations

- Shipyard investment into improving the quality of drawing hierarchies within engineering models to ensure accurate data import during automated planning.
- Further testing is recommended in a production setting to validate the effectiveness of this solution for earned value management.