SNAME MARITIME 2022 CONVENTION

26-29 September | Houston, TX

Streamlining Structural Design Through the Ship Design Spiral

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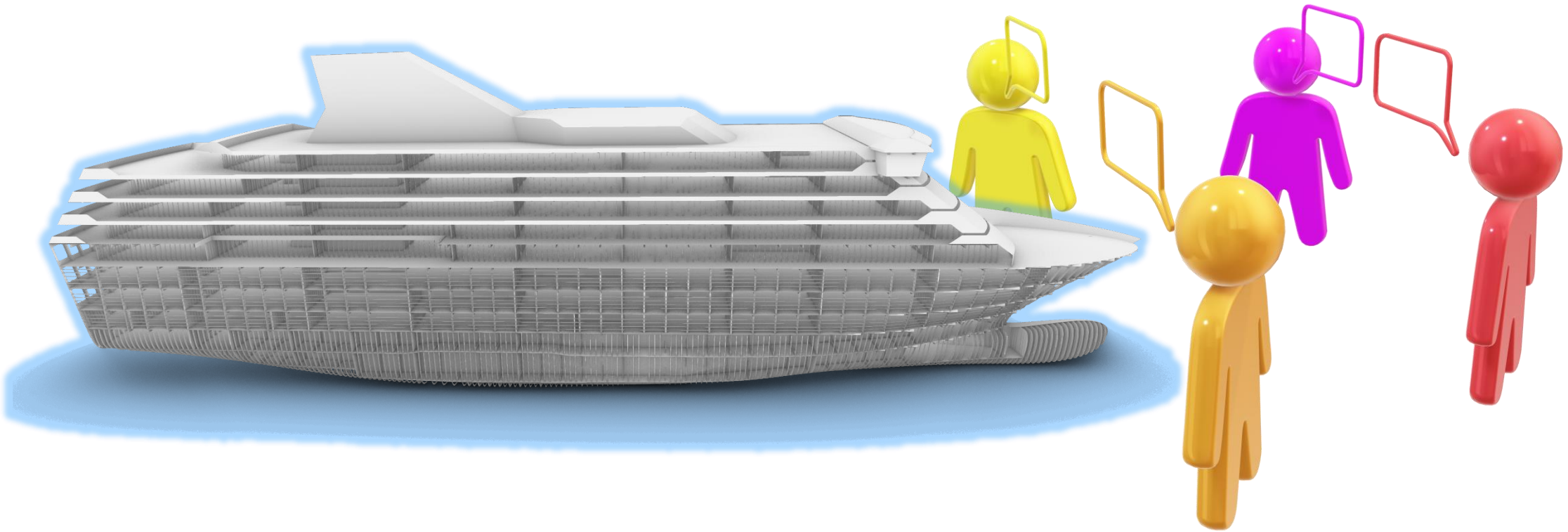
ShipConstructor Software Inc.

ExpressMarine

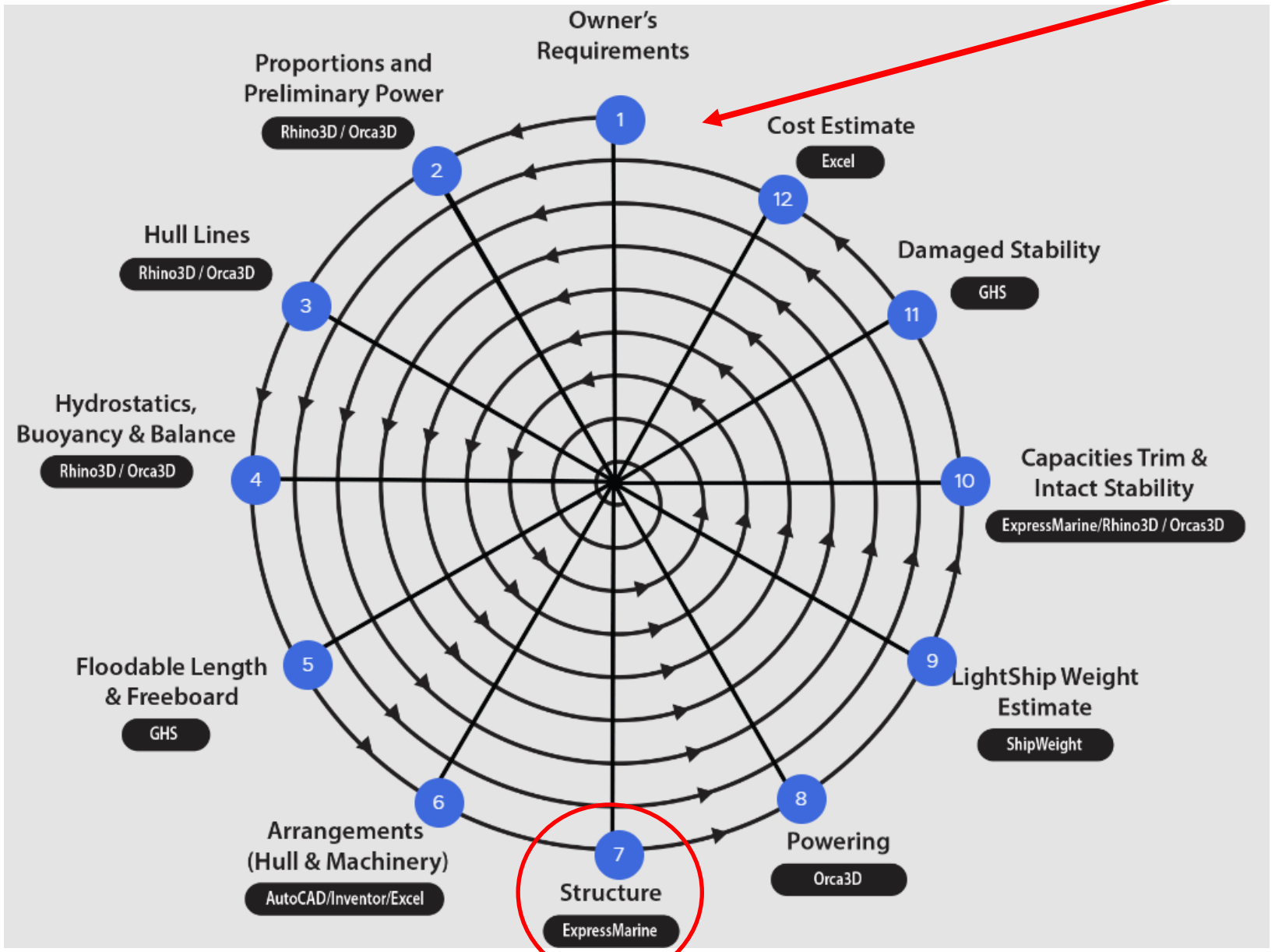
innovmarine
PRODUCTIVITY & TECHNOLOGY PEOPLE THAT CARE

The Problem

With the emergence of the 3D modelling techniques in shipbuilding, Naval Architecture firms and shipbuilders are required to re-create all of the work from the early-stage design in the detail design software manually.



The Problem

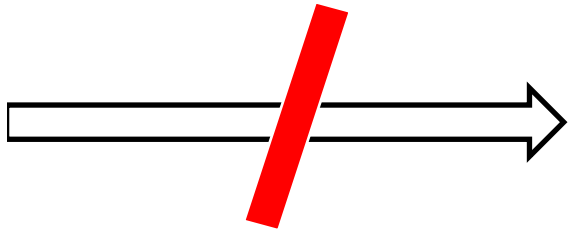


SHIP CONSTRUCTOR

Disconnect in the Design Spiral
If the structure is done in Rhino3D, there is no way that structure can be reused in ShipConstructor. It will need to be remodeled.

The Problem

Early-stage design



Detail Design Software

SHIP CONSTRUCTOR®

Data Translation

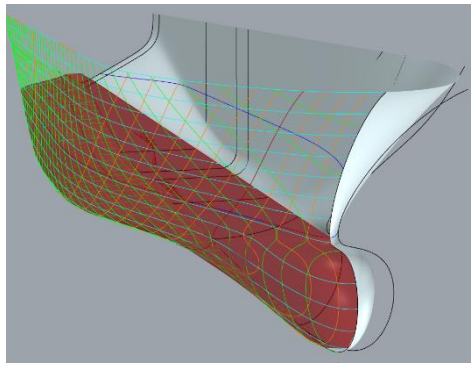
250 man hours !!

ShipConstructor modelling times (detailed design): 250 man hours.

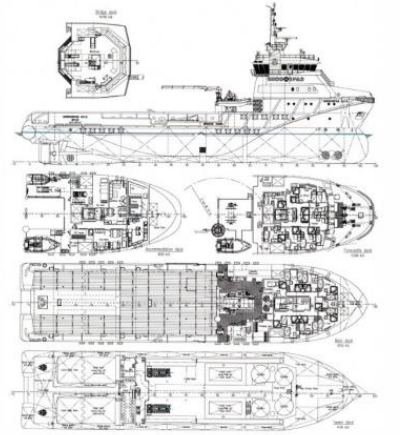
- Unit and planar group creation: 25 man hours
- Hull module curved surface modelling and work: 50 man hours
- Structural detail modelling: 175 man hours

Objective

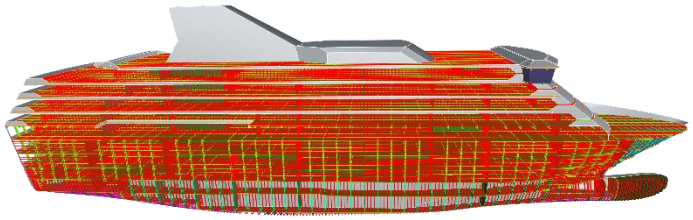
Pass rich, early phase structure model to a detail-engineering production tool without losing properties and metadata.



Rhino 3D model



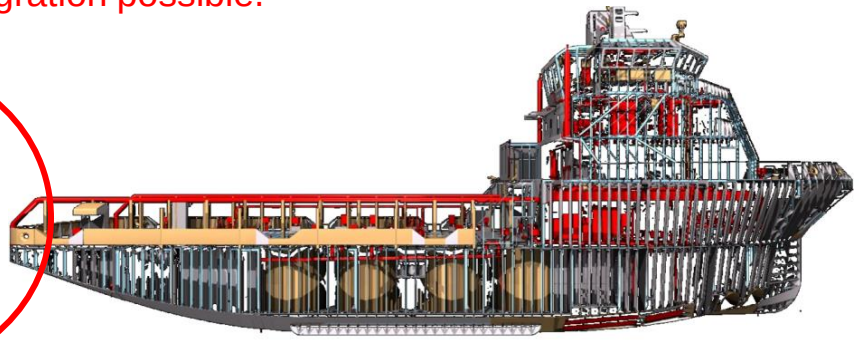
2D General Arrangement



3D ExpressMarine Model

Structure developed in ExpressMarine (fully parametric) using ShipConstructor Stock Library.

Find a way to make the integration possible.



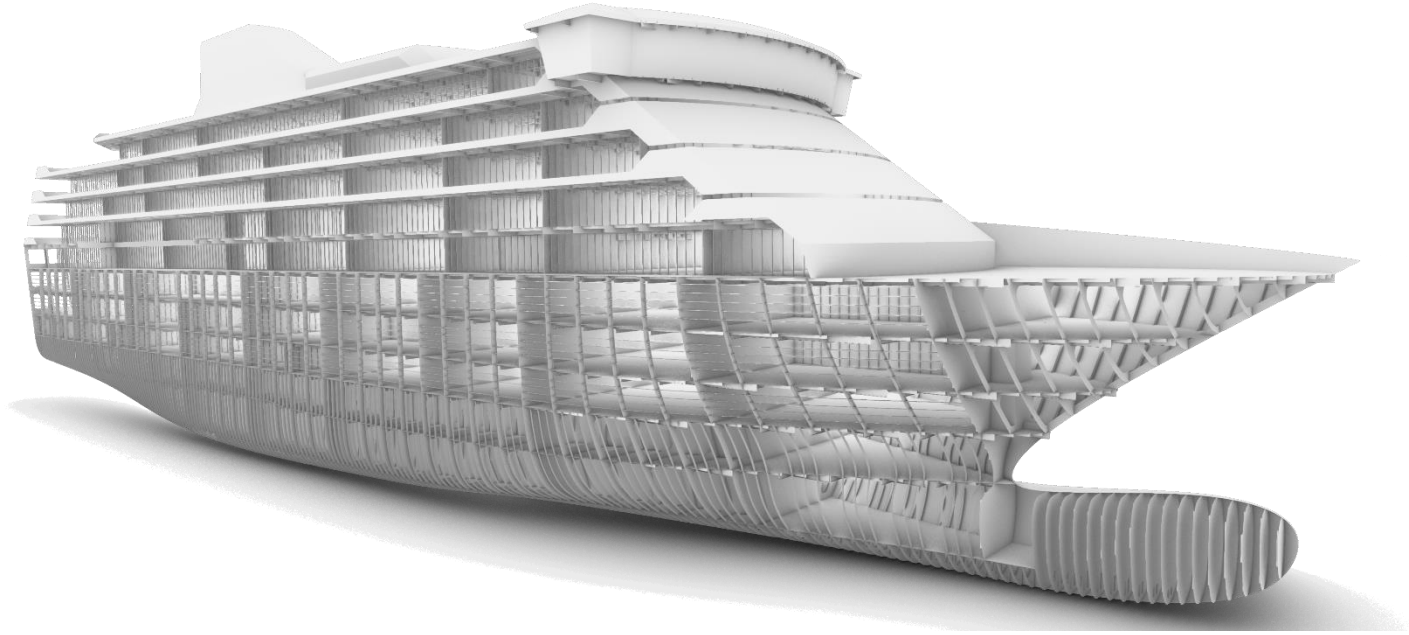
3D ShipConstructor Model

Strategy

In partnership with the NSRP, ExpressMarine, SSI, VT Halter Marine & Austal USA worked together to fully integrate both software & test the workflow in two real Shipyard environments.

Project Used for the study

- Cruise Ship
- LOA: 146.7 m
- LPP: 118.3 m
- Beam: 24.4 m
- Scantling draft: 5.5 m
- Height upper. cont. decks: 10.4 m
- Maximum height: 45 m
- Number of decks: 11
- Material: Steel
- Hull Default thickness: 10 mm



3D ExpressMarine Model of the ship used for the study.

Shipyard Involvement

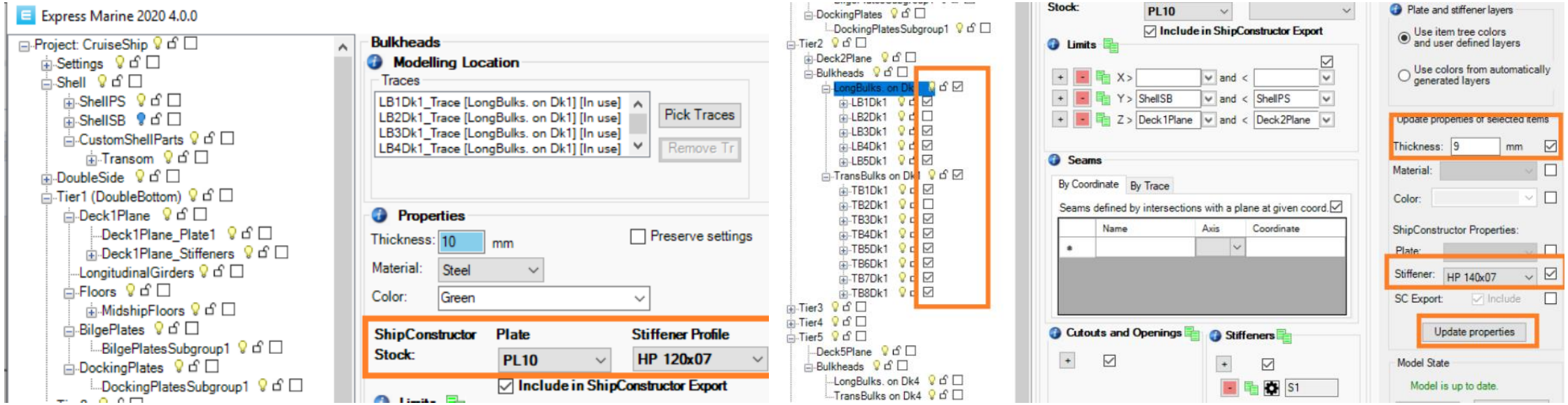
1. Input from the Shipyards to;
    a) Understand how they were using the tools.
    b) Understand their workflows & processes.

2. Workshops:
    a) Demonstrate the functionality of the early design tool.
    b) solicit feedback from Shipyard.

Collaboration

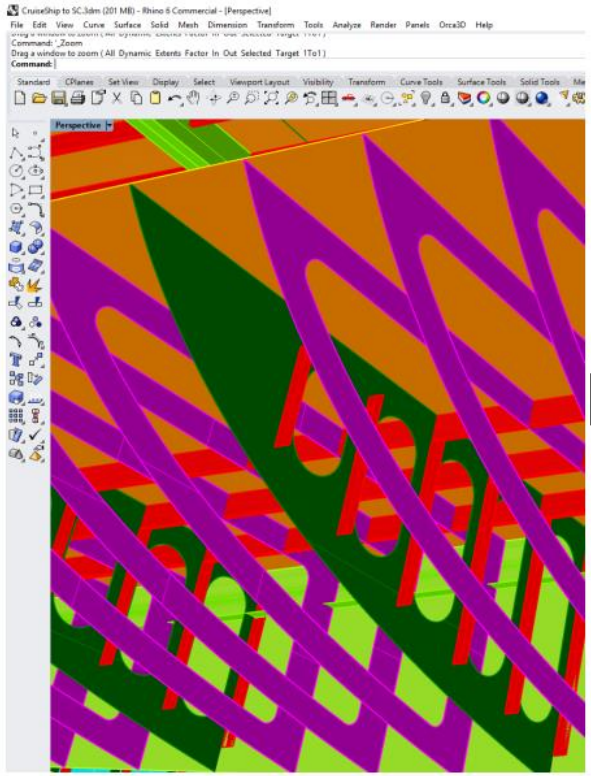
The ExpressMarine team was able to query the ShipConstructor project for stock name information to include in the User Interface (UI) for building components.

- You can choose your ShipConstructor stock while modeling in ExpressMarine.



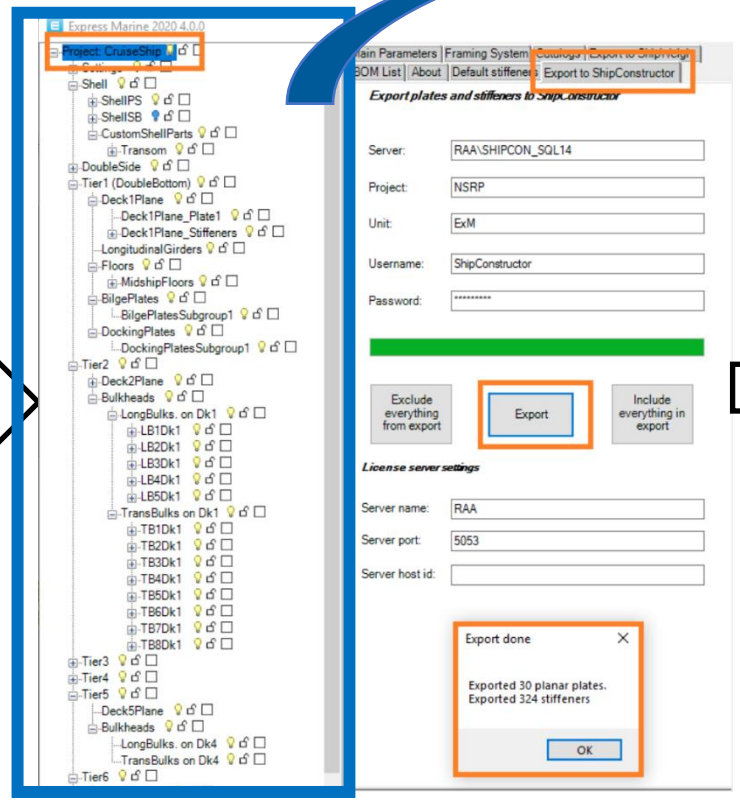
Example of ShipConstructor stock identifications in ExpressMarine.

Data-translation (Creation Framework)

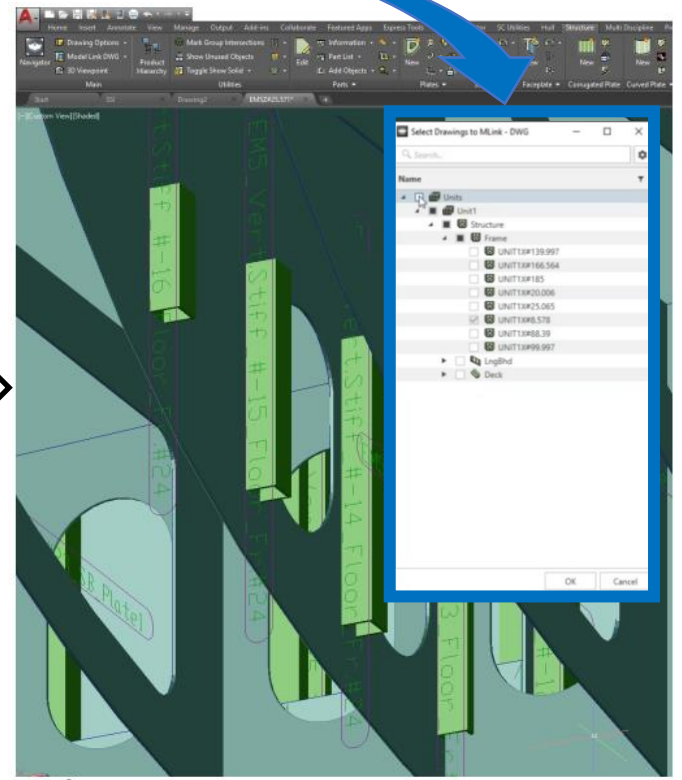


ExpressMarine Structure created using ShipConstructor Stock.

Project Hierarchy Nodetree



ExpressMarine export to ShipConstructor Interface.



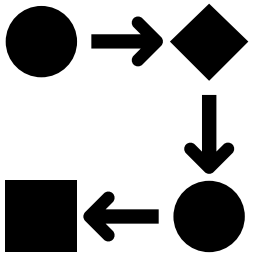
ShipConstructor Model exported from ExpressMarine.

Process in ExpressMarine

NSRP Workshop Workflow Summary

Introduction to ExpressMarine

- The Hierarchy Nodetree
- The Parameter Input and Property Setting Area
- The Global Property Display, Setting and Update Area
- Other Global Settings

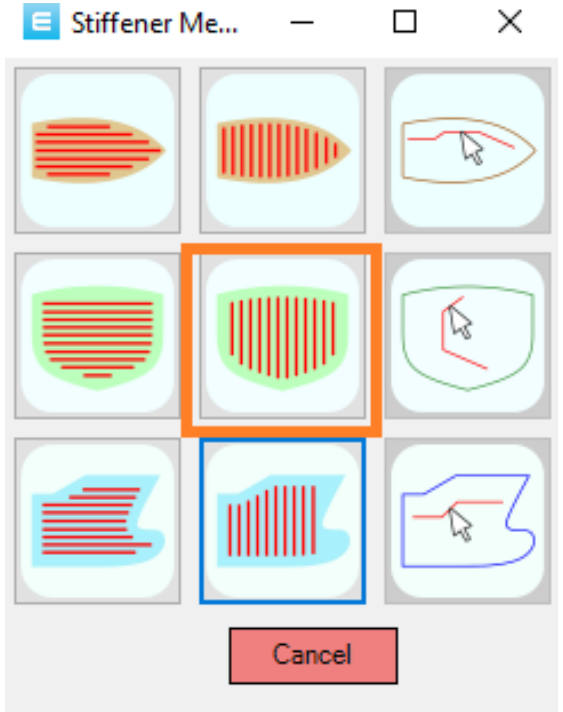


- Main Parameters Tabsheet
- The Framing System Tabsheet
- The Export to ShipConstructor Tabsheet
- Create the Project
- Create a Deckplan
- Creating MidshipFloors
- Create 2nd Deckplan
- Make a Change and Update the Model
- Make Some Watertight Floors

Basic Design

Prepare for Export to ShipConstructor

- Default ShipConstructor Stocks
- Mass-update of ShipConstructor Stock (and other properties)
- Exclude Objects from the Export
- Export to ShipConstructor
- Checking the Import
- Typical Errors
- Stiffeners on the Plate Edge



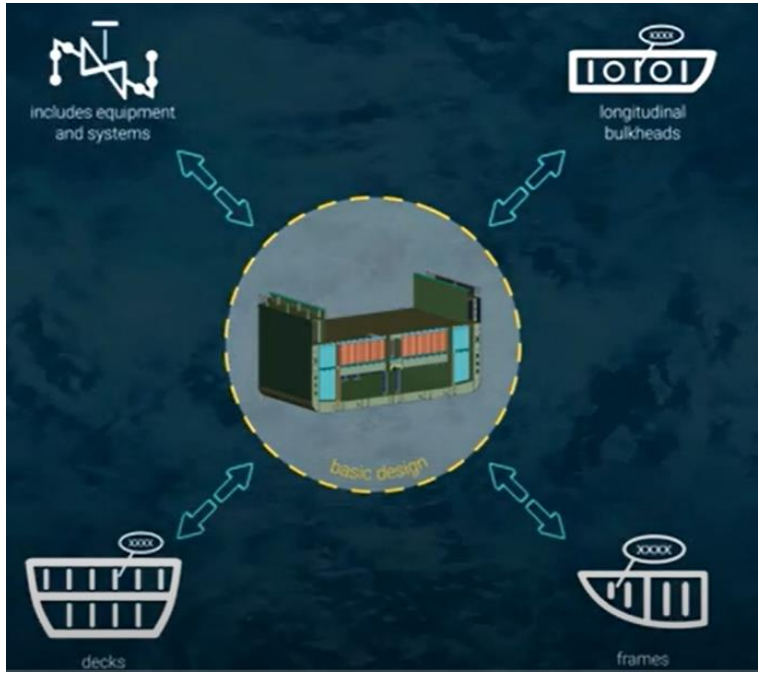
ExpressMarine Stiffeners available layouts.

Process in ShipConstructor

Preparing the model for class approval drawings

- Adding Details to a basic design
  - Add profile cutout
  - Add Corner Treatments
  - Add details to watertight bulkhead
  - Add bracketing
  - Add end treatment to profile
- Generating Class Approval drawings
  - Automatically generate 2D views
  - Assemble the midship section drawing
  - Annotate and add further detail
  - Effectively respond to change or feedback
  - Generate views for all sections
- Placing Major Equipment's
  - Capture information from initial design
  - Add detail required for the 3D product model
- Developing Compartments and Zones
  - Define compartment and functional zones
  - Define volumes for each zone or compartment
  - Review the design in ShipExplorer
  - Generate drawings based on compartments

Basic Design



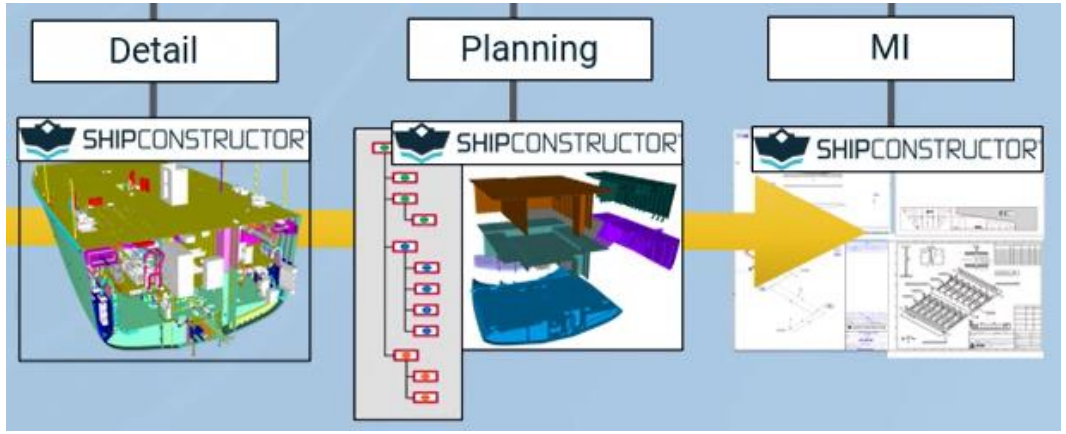
ShipConstructor model with the associated components required for Class Approval Drawings.

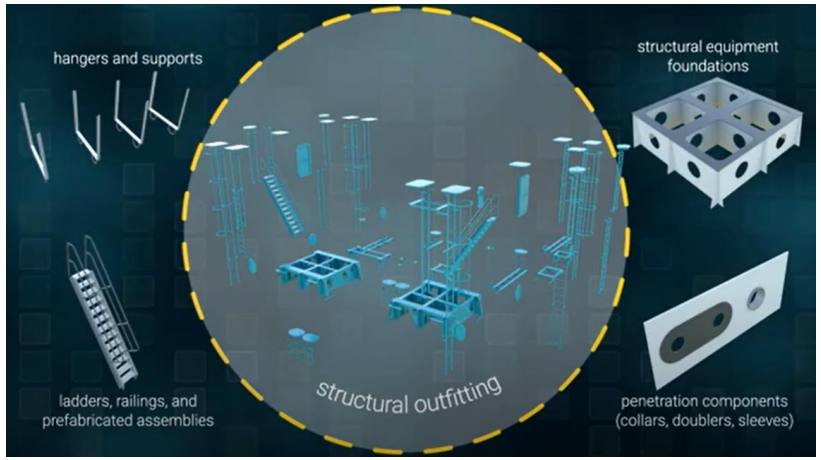
Process in ShipConstructor

Preparing the model for production and planning

- Adding the details in detail design
  - Create structural foundation for equipment
  - Add pipe and HVAC penetrations
  - Review Clashes
  - Add pipe and HVAC supports and hangers
- Create a 3D piping system
  - Model pipe lines and branches
  - Route pipe lines between equipment's
  - Validate the 3D pipe model against the P&ID

Detail Design

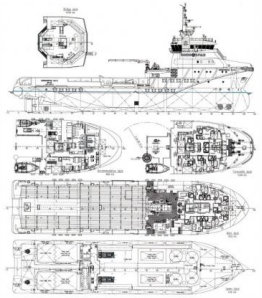




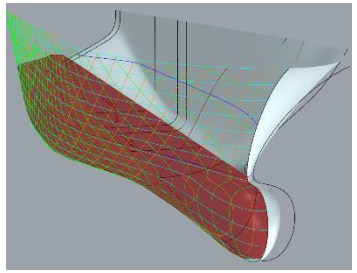
ShipConstructor Structural Outfitting components.

Results

Previous Process

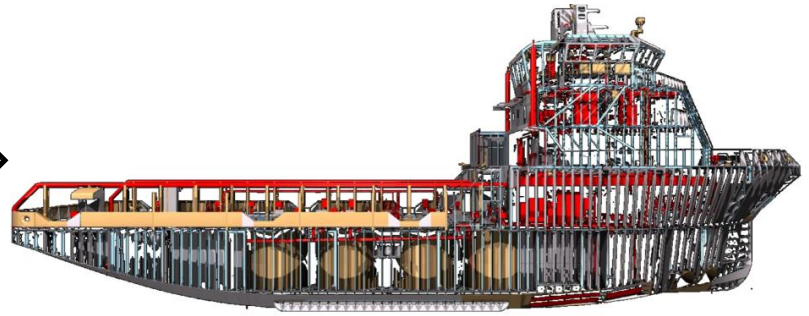


2D General Arrangement



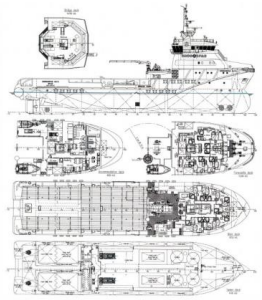
Rhino 3D Model

Modelling time: 250 man hours
(Details on next slide)

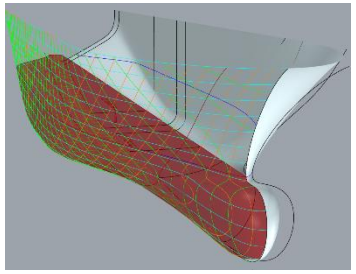


3D ShipConstructor Model

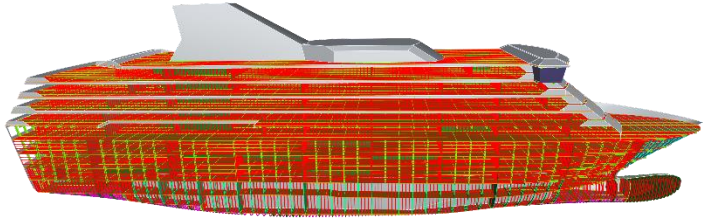
New Process



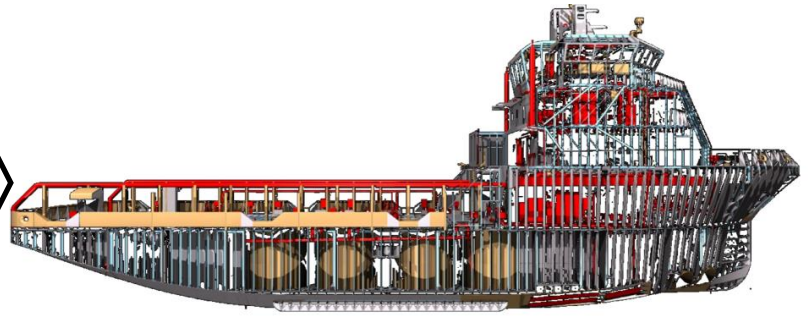
2D General Arrangement



Rhino 3D Model



3D ExpressMarine Model
Modelling time: ~10 man hours
(Details on next slide)



3D ShipConstructor Model

Results

Detail Design tool - Modelling time (detailed design): **250 man hours**

- Unit and planar group creation: 25 man hours
- Hull module curved surface modelling and work: 50 man hours
- Structural detail modelling

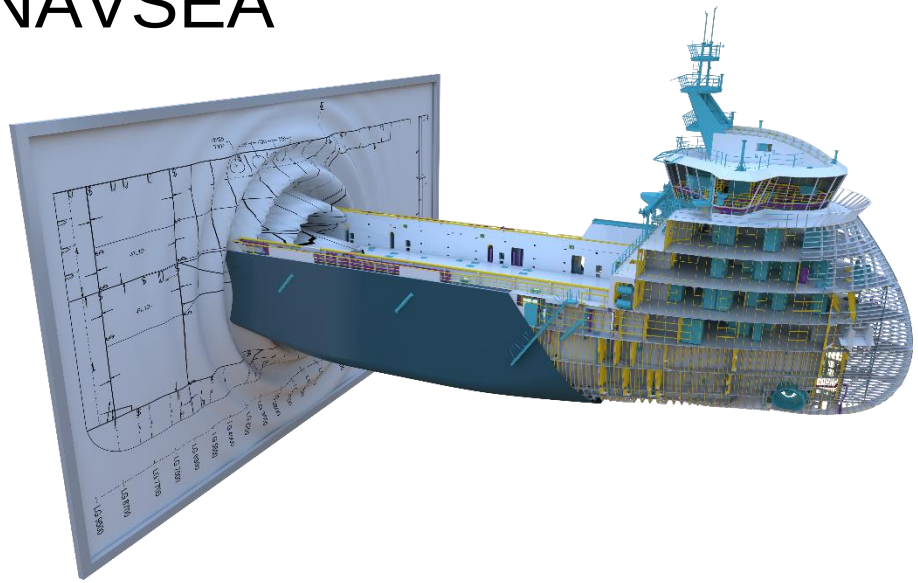
ExpressMarine: **~10 man hours**

*Estimates came from the comparison made by a senior designer when doing the work in both methods.

Source calculation taken from reference:
2019-438-001 MS07 ExpressMarine Final Report

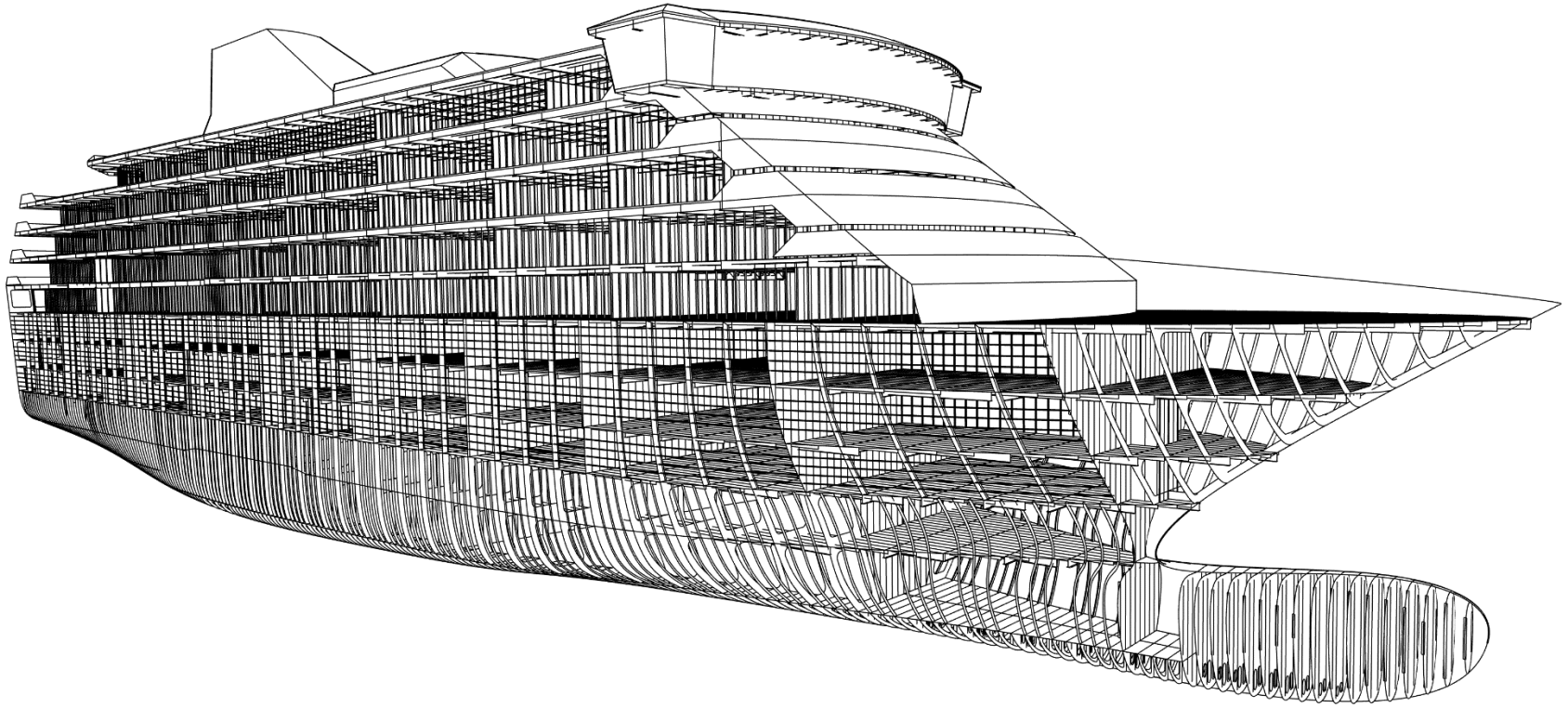
Technology Transfer & Implementation

- July 2019 – NSRP Business Technology Panel Meeting
- October 2019 – NSRP Business Technology Panel Meeting
- October 2019 – SNAME Maritime Expo
- November 2019 – NSRP Day at NAVSEA
- March 2020 – Final Workshops



Conclusions & Recommendations

The maturity of the development for the project means implementation and realization of the benefits are immediate. A time saving of a saving of 25:1.



What’s Next ?

Both Shipyard Halter Marine & Austal USA have a lot of current/ upcoming projects that could leverage this workflow :

- Offshore Patrol Cutter (OPC)

- Navajo-Class T-ATS

- Polar Security Cutter (PSC)

Reference: NSRP Final Report ExpressMarine Integration

Thank you for your attention this concludes the presentation

Questions?

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