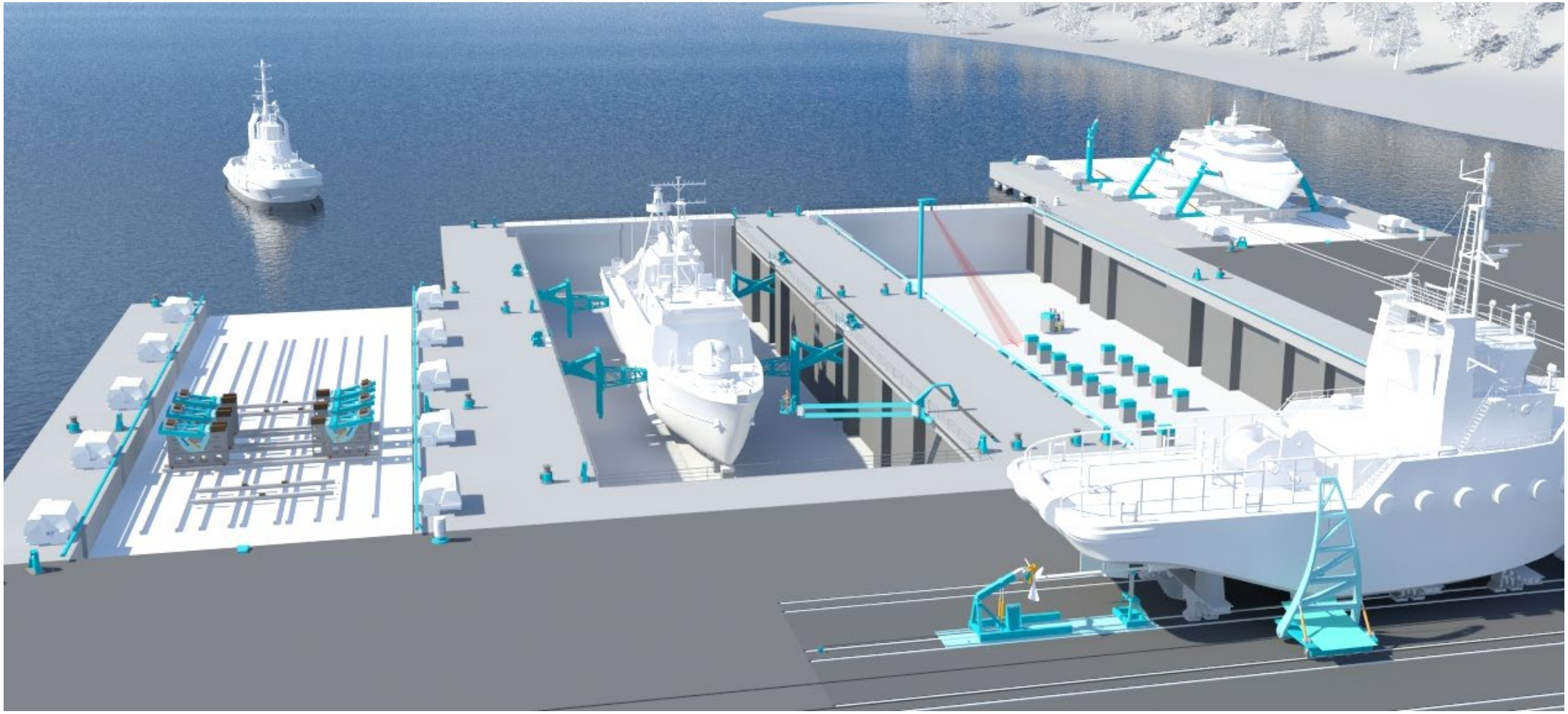
NSRP Panel Project
Fast Docking System Study

DM Consulting

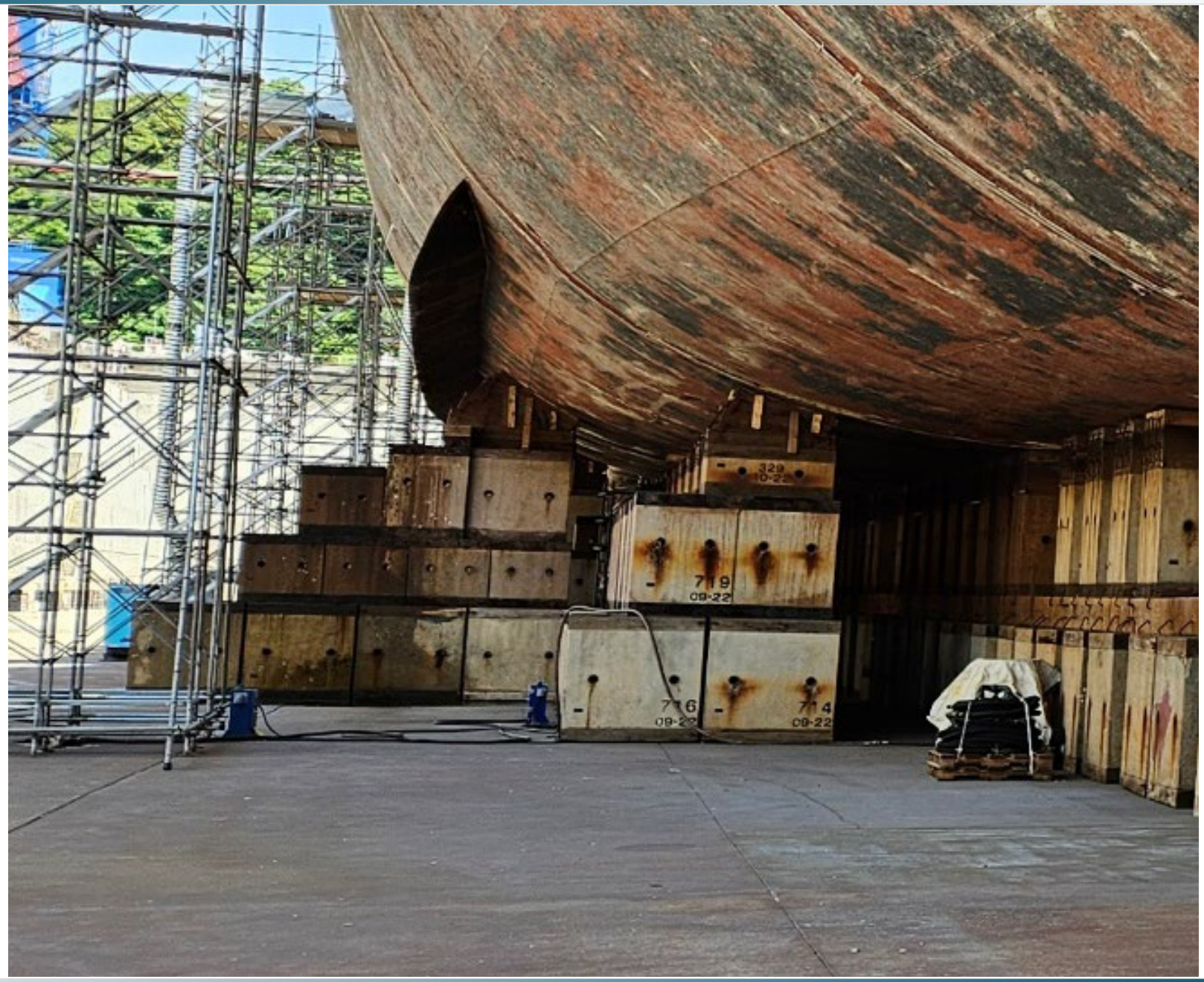
NSRP
NATIONAL SHIPBUILDING RESEARCH PROGRAM™
Taking Shipbuilding and Repair to the Next Level

Fast Docking Systems by Syncrolift

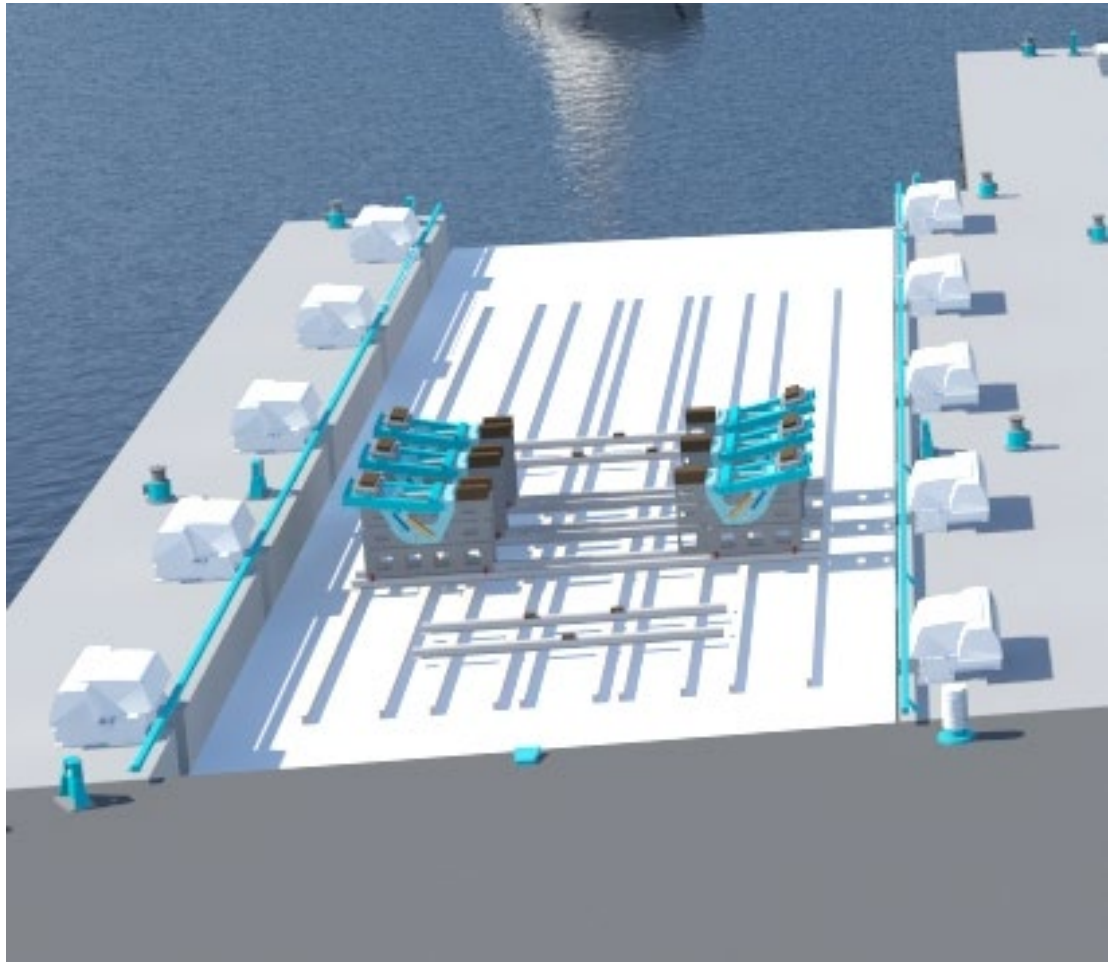
Innovative hydraulic side block support systems



Side Blocks



Bilge Support Arms



Bilge Support Arms

Bilge Support Arms

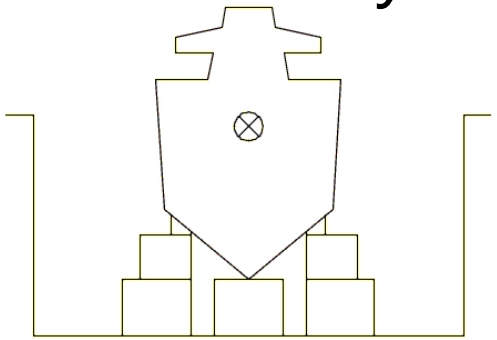
Side Support Arms

Side Support Arms

Side Support Arms

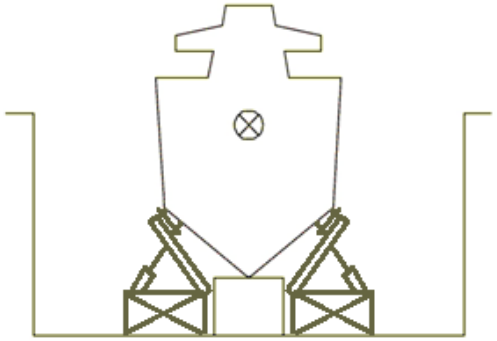
System Comparisons

On site analysis results



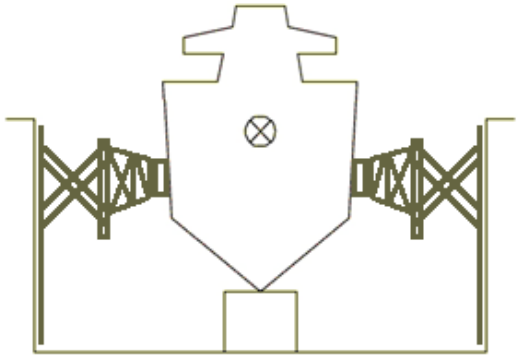
Standard side bocks

- High preparation time
- Material waste
- Low clearance



Bilge support arms

- Minimal preparation time
- Low material waste
- Increased vertical clearance
- Increased maintenance, but easy access



Side support arms

- Minimal preparation time
- Low material waste
- Increased vertical clearance
- Increased hull access
- More difficult maintenance, although systems aren’t fully submerged

System Validation

Industry Standard Calculations

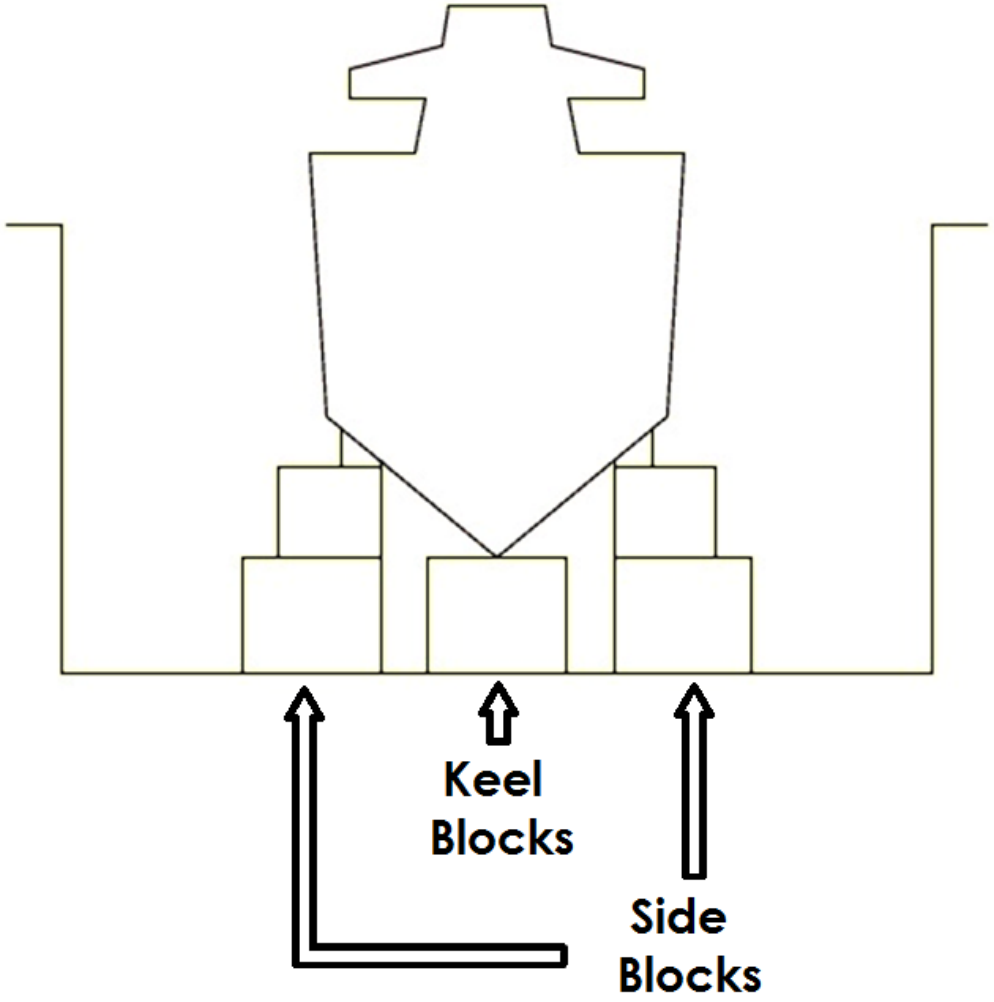
- Worst-case scenario loading situations for side supports in dry dock
- US Coast Guard SFLC Standard Specification 8634
- Equivalent analysis as US Navy NSTM 997 (US restricted)
- Altered for shores

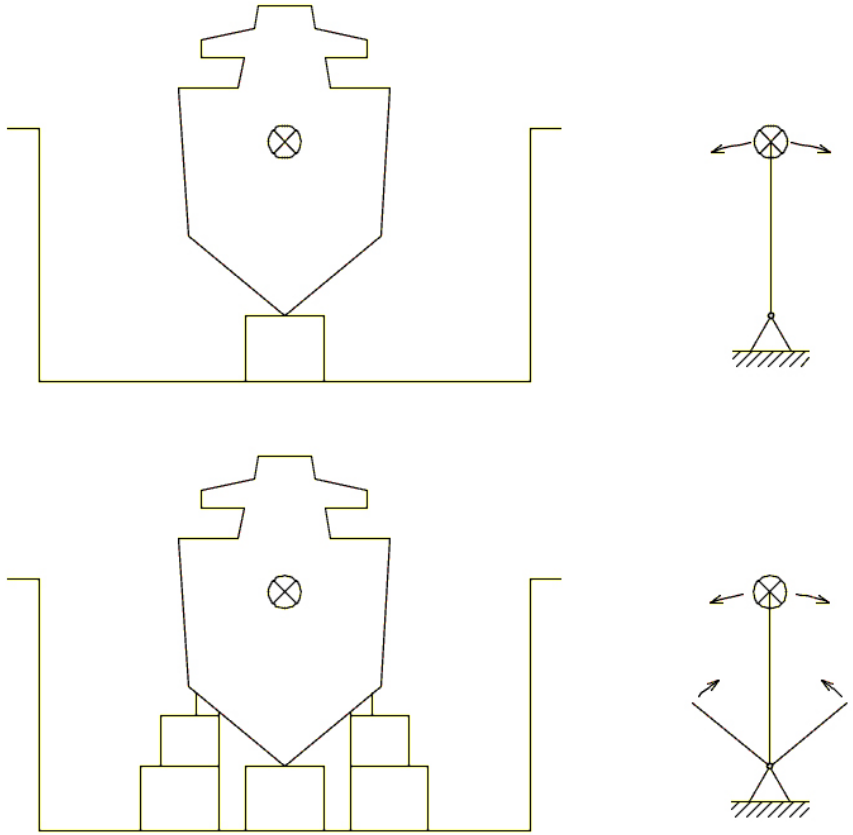
Steel Construction Manual (AISC 325) Confirmation

- Validate the structural design IAW Steel Construction Manual
- Steel Construction Manual is referenced in MIL-STD 1625 (USN standard)
- Engineering calculations for shear, bearing, bending, and axial stress checks
- FEA to verify calculated stresses

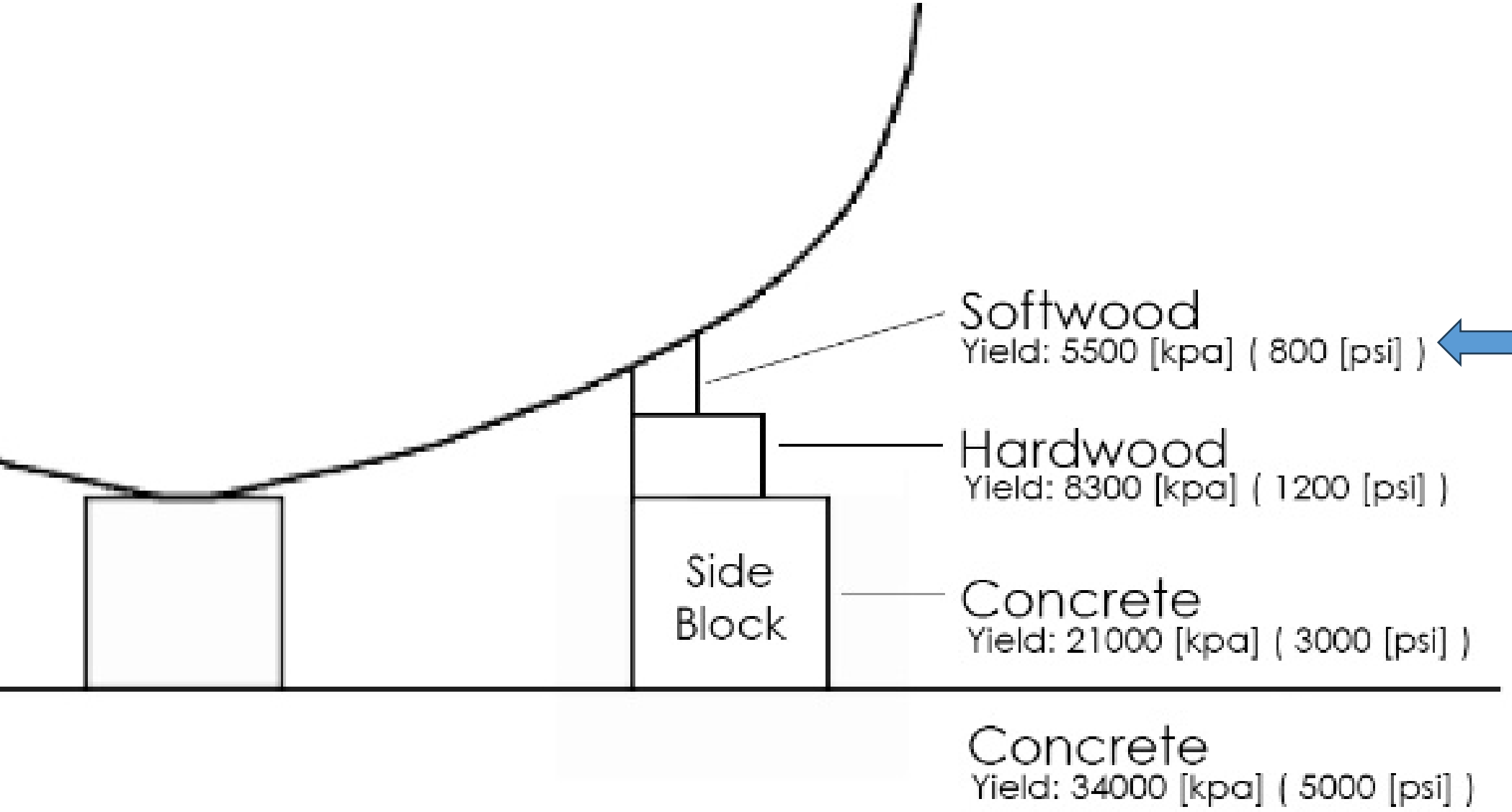
Industry Standard Calculations

Current System





Industry Standard Calculations



Assumption: First point of failure

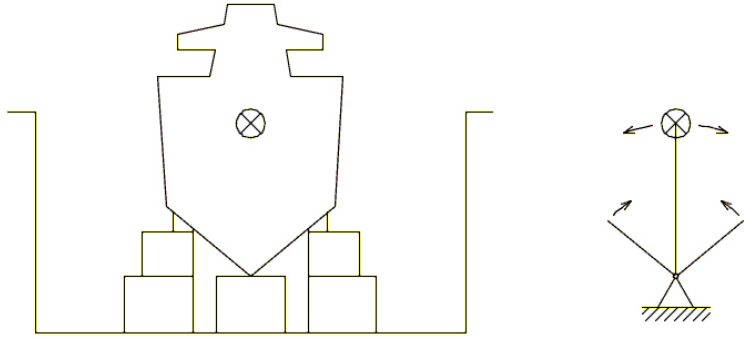
Industry Standard Calculations

Differences with Hydraulics vs Side Blocks

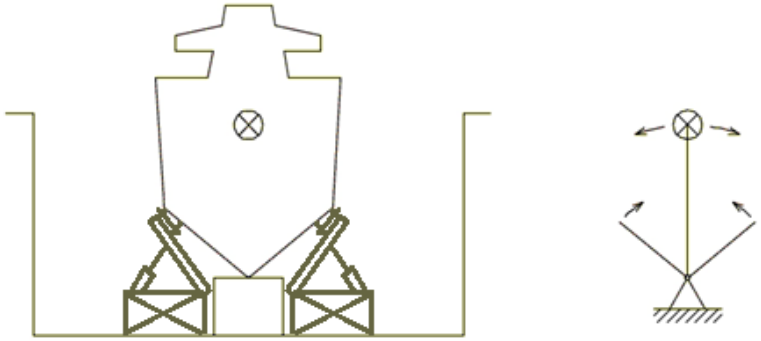
- Analysis using softwood for consistency
  - Rubber could be used, less required crush tolerance with hydraulics
- Analysis using same cap size for consistency
- Bilge support arm has 2 axis-hinged cap rotation
  - Convenient, but not necessary for US Navy with accurate SB offsets

Industry Standard Calculations

System Comparisons

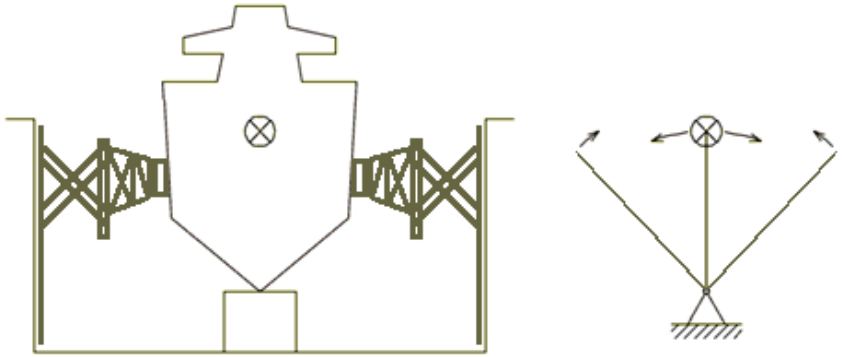


Standard side bocks



Bilge support arms

- Same or longer lever arm than SBs



Side support arms

- Longer level arm = less loads (only limited by dock depth)

Industry Standard Calculations

Differences with Hydraulics vs Side Blocks

- Analysis using softwood for consistency
  - Rubber could be used, less required crush tolerance with hydraulics
- Analysis using same cap size for consistency
- Additional 2 axis-hinged cap rotation
  - Not necessary for US Navy with accurate SB offsets

Industry Standard Calculations

Results – IN PROGRESS

Bilge support arms

- Current standards restrict side supports based on soft cap pressure
  = many supports required

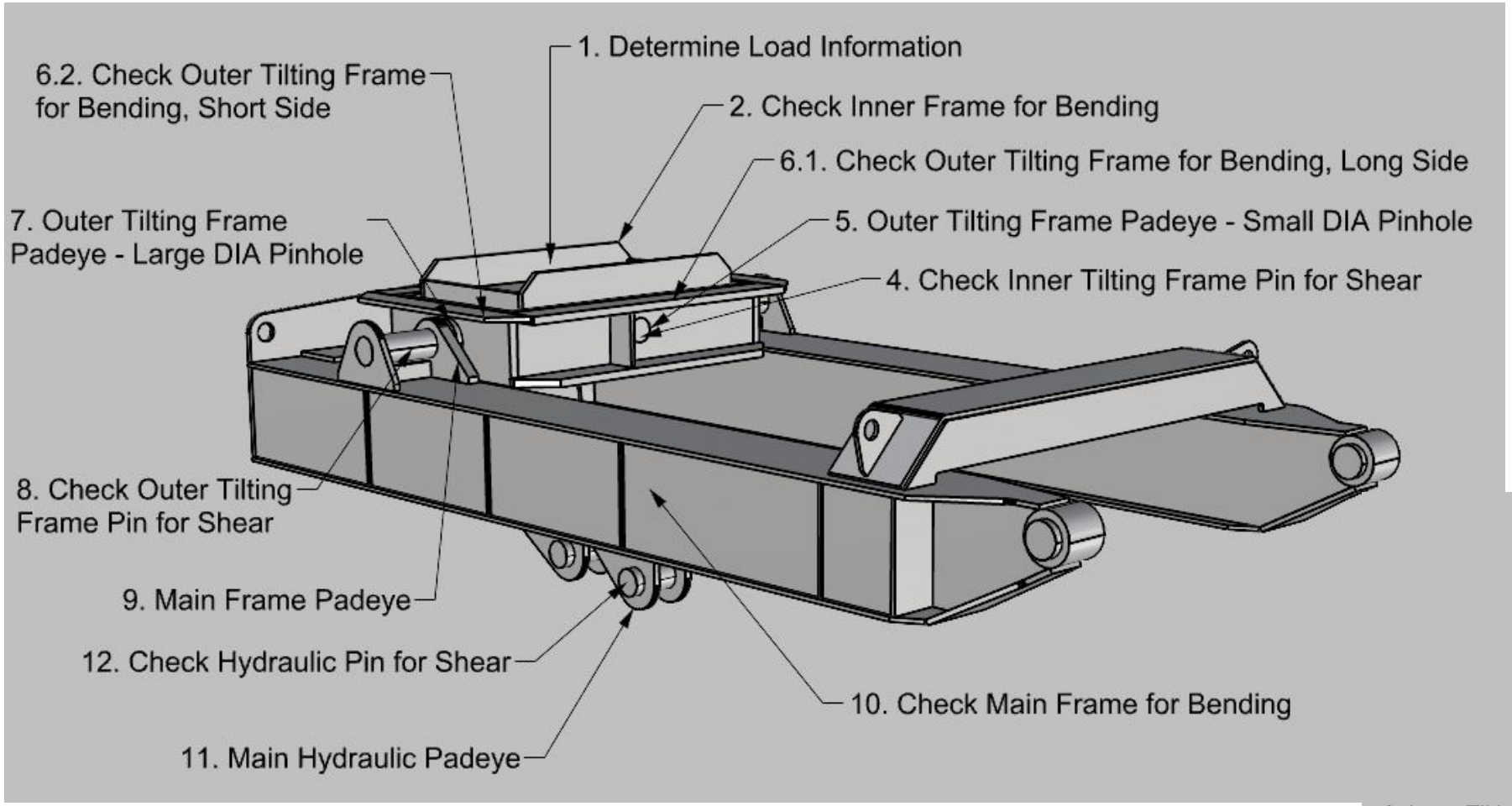
Side support arms

- Requires adjustment of current standards for shores
- Longer lever arm = less loads = less units = more cost effective

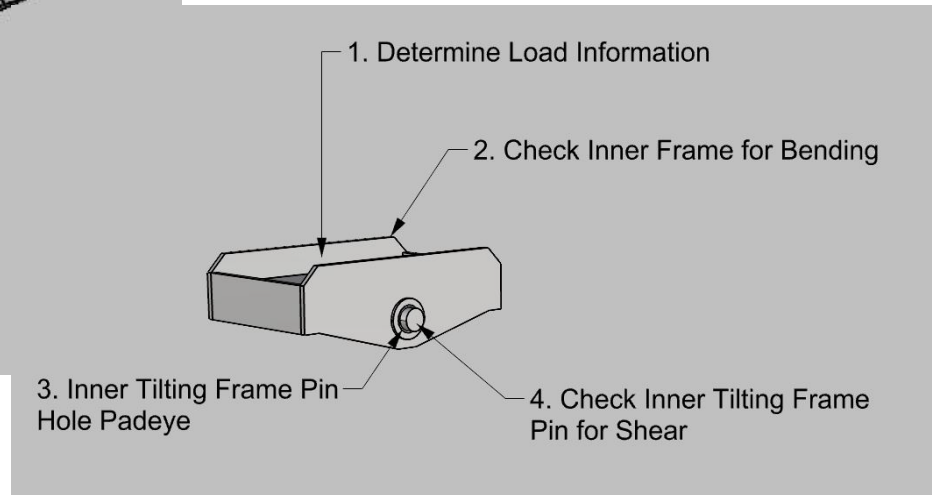
Results will drive the cost comparison – IN PROGRESS

Steel Construction Manual Validation

Bilge Support Arms



Checking the load path



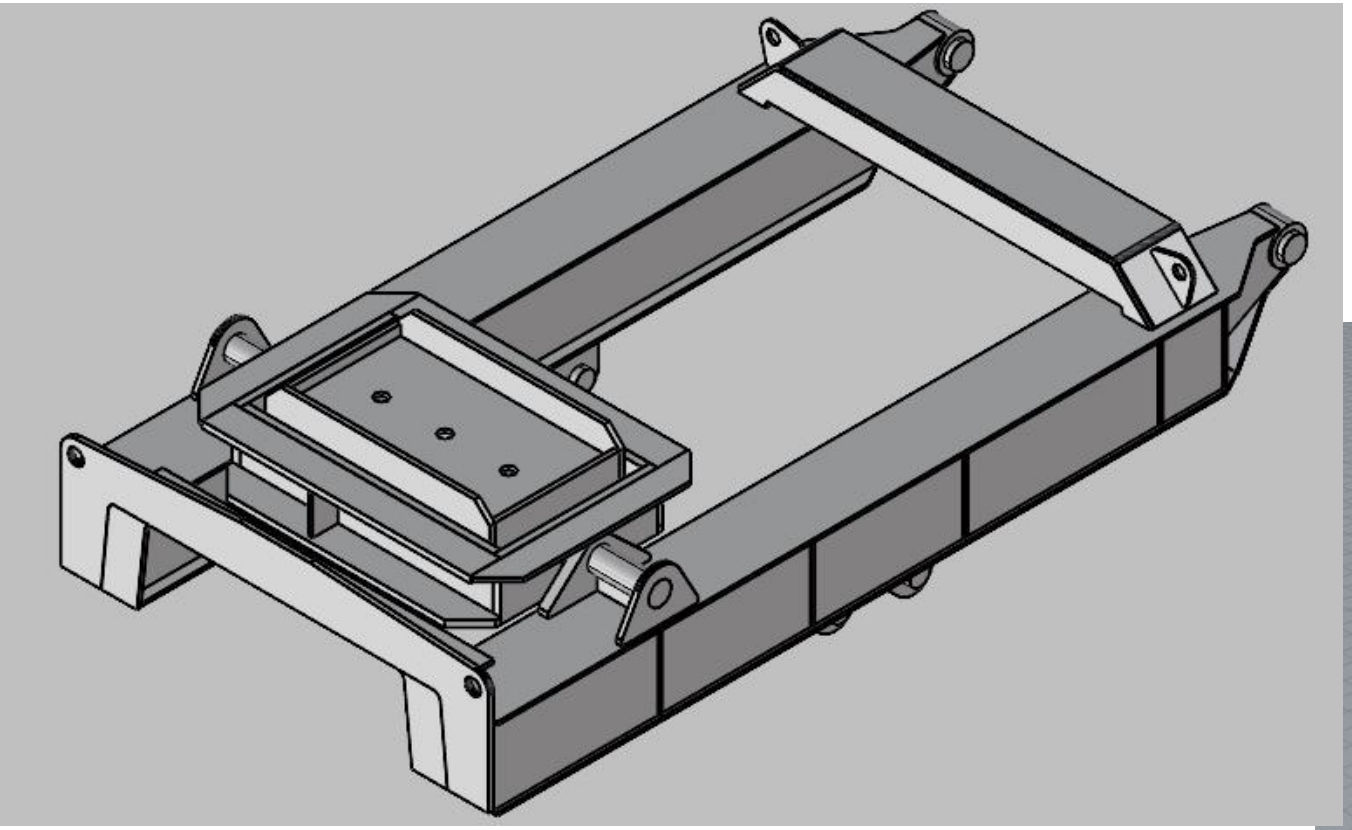
Steel Construction Manual Validation

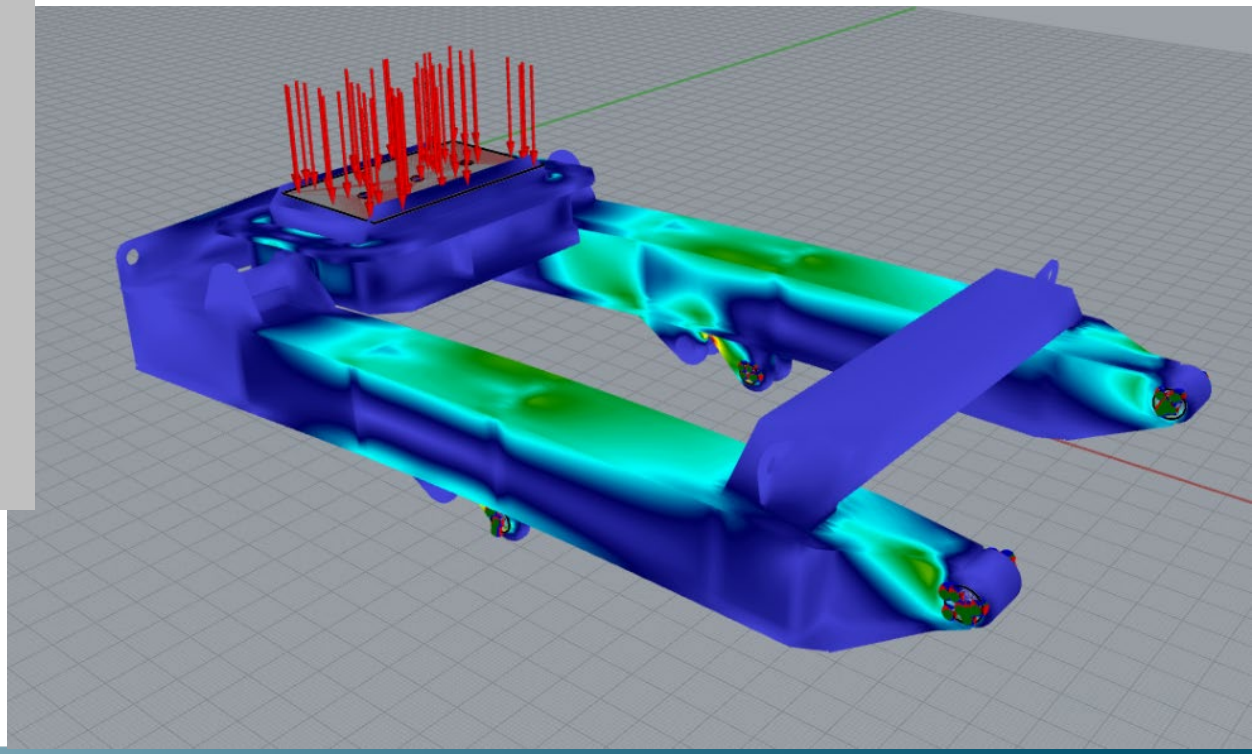
Bilge Support Arms - Results

Spreadsheet Calculation Contents &Summary						
Calc No.	Name	Description	Pass / Fail Results			
			Only Hydraulics		Mechanically Locked	
			Calc	FEA	Calc	FEA
1	Determine Load Information	Calculate applied loads for 300 psi and 800 psi cases, sanity check	Pass	N/A	Pass	N/A
2	Check Inner Frame for Bending	The load is applied to the soft cap and inner tilting frame which wll be checked via FEA software.	N/A	Pass	N/A	In Progress
3	Inner Tilting Frame Pin Hole Padeye	The load is applied to the inner tilting frame pin hole and is checked as a padeye in the "3 FAST Docking Inner Tilting Frame Pin Hole Padeye" spreadsheet.	Pass	Pass	Pass	In Progress
4	Check Inner Tilting Frame Pin for Shear	The load is applied to the pin which connects the inner tilting frame to the outer tilting frame and is checked for shear stress.	Pass	Pass	Pass	In Progress
5	Outer Tilting Frame Padeye - Small DIA pinhole	The load is applied to the smaller diameter pin hole of the outer tilting frame from the pin in No. 4 and is checked as a padeye in the "5 FAST Docking Outer Tilting Frame Paeye - Small DIA pinhole" spreadsheet.	Pass	Pass	Pass	In Progress
6	6.1 Check Outer Tilting Frame for Bending, Long Side 6.2 Check Outer Tilting Frame for Bending, Short Side	The load is applied to the outer tilting frame which is checked as two individual beams for bending and shear stress.	Pass	Pass	Pass	In Progress
7	Outer Tilting Frame Padeye - Large DIA Pinhole	The load is applied to the larger diameter pinhole of the outer tilting frame and is checked as a padeye in the "7 FAST Docking Outer Tilting Frame Paeye - Large DIA pinhole" spreadsheet.	Pass	Pass	Pass	In Progress
8	Check Outer Tilting Frame Pin for Shear	The load is applied to the pin which connects the outer tilting frame padeye to the main frame padeye and is checked for shear stress.	Pass	Pass	Pass	In Progress
9	Main Frame Padeye	The load is applied to the main frame padeye and is checked as a padeye in the "9 FAST Docking Main Hydraulic Paeye" spreadsheet.	Pass	Pass	Pass	In Progress
10	Check Main Frame for Bending	The load is applied to the main frame and is checked as a beam for bending and shear stress.	Pass	Pass	Pass	In Progress
11	Main Hydraulic Padeye	The load is applied to the main hydraulic padeye and is checked in the "11 FAST Docking Main Hydraulic Paeye" spreadsheet.	Pass	Pass	Pass	In Progress
12	Checl Hydraulic Pin for Shear	The load is applied to the pin which connects the main hyraulic padeye to the hydraulic ram and is checked for shear stress.	Pass	Pass	Pass	In Progress

Steel Construction Manual Validation

Bilge Support Arms - FEA





Project Plans

Final presentation at 2025 Dry Dock Conference

www.DryDockConference.com

Thank you