

Detroit Engineered Products (DEP) is an Engineering Solutions and Product Development company. Since its inception in 1998 in Troy, Michigan, USA, DEP is now a global company with footprints in Europe, China, Korea, Japan and India. DEP uses the accelerated and transformed product development process, accomplished by utilizing our proprietary platform, DEP MeshWorks, which rapidly reduces the development time of products for all segments.

Rapid time to market of new products across several industry sectors such as automotive, defense, aerospace, energy, oil & gas, consumer products and heavy equipment is a unique value proposition delivered to clients via DEP's world class engineers and the DEP MeshWorks platform.



Smarter solutions. Realized.



## MARINE SOLUTIONS

**GLOBAL MODEL**

- Parameterization
- Global modes
- Strength
- Optimization

**POWERTRAIN**

- Performance optimization of complete PT and its components
- Mass efficiency strategies
- In- cylinder sensing technology

**CRITICAL CONNECTIONS**

- Connections
- Openings
- Bracket toes
- Structural knuckle points

**SUPPORTING STRUCTURE**

- Stress
- Deformation & yielding
- Buckling

**CFD BASED HULL SHAPE OPTIMIZATION**

- Global strength
- Longitudinal strength
- Beam strength

**VIBRATION ACOUSTICS**

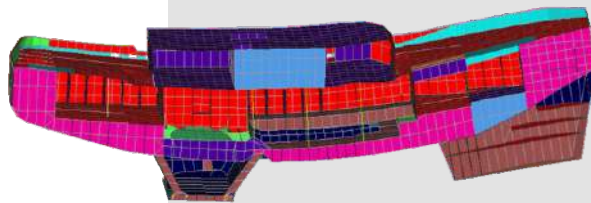
- Stress analysis and optimization
- Vibration analysis
- Torsional
- Axial
- Torsional- Transient & Steady state
- Due to cylinder misfire

Powered by **DEP MeshWorks**

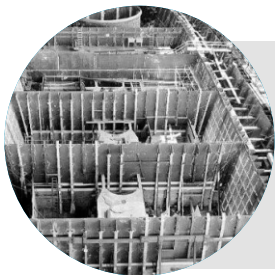
## Aluminum bulkheads converted to composite bulkheads, with performance improvement, and a mass savings of 28%



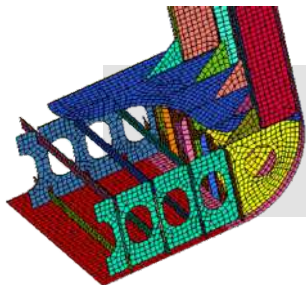
- CAD Modeling
- 3-D Modeling via morphing
  - Ship configurations
    - Tankers
    - Bulk Carriers
    - Container Ships
    - Ocean Liners
  - Modeling of Critical Areas
    - Connections
    - Openings
    - Bracket Toes
    - Structural Knuckle Points



- Primary, Secondary and Tertiary bending on Global FE model
- Stress and Deformation of main supporting members for Yielding and Buckling
- Vibroacoustic Analysis
- Global Bending Modes
- Torsional Modes



- Bulkhead Stress Analysis
- Deformation and Buckling
- Weight Optimization
  - Alternate Configurations
  - Alternate Materials – Composite
- Composite Ply Optimization



- Acoustic Cavity Model Building
- Structure-Acoustic Coupling
- Forced Frequency Response
- Acoustic Response

### The client

The client is a one of the world's largest composite manufacturer

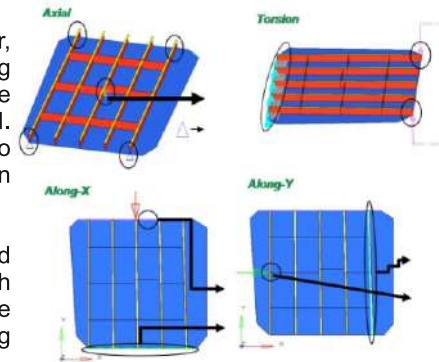
### The challenge

The end customer had been using Aluminum bulk heads, and wanted DEPs help to evaluate other composite materials that could be used without compromising on performance. While aluminium was light, the client was looking for structural integrity and even lighter material at an optimum price point.

### The Solution

DEP worked closely with the partner's materials team and identified two possible options that could be evaluated- a glass fiber composite, and a carbon fiber composite. The proposed material was tested thoroughly against the aluminum bulkhead.

Based on discussion with end customer, DEP Engineers came up with loading scenarios to establish the baseline performance for Aluminium bulkhead. Similar loading scenarios were used to analyze composite bulk head design proposed.



For ease of manufacturability, the rib and base was configured and evaluated, with variable and constant thickness to increase stiffness and overcome manufacturing constraints.

The Depth of the web and number of ply was adjusted to reduce displacement due to torsion.

### The Result

The DEP team was able to reduce the mass by 28 percent, with an improvement in performance, and was able to convert Aluminium bulkheads into a composite bulkhead to gather same level of stiffness.

