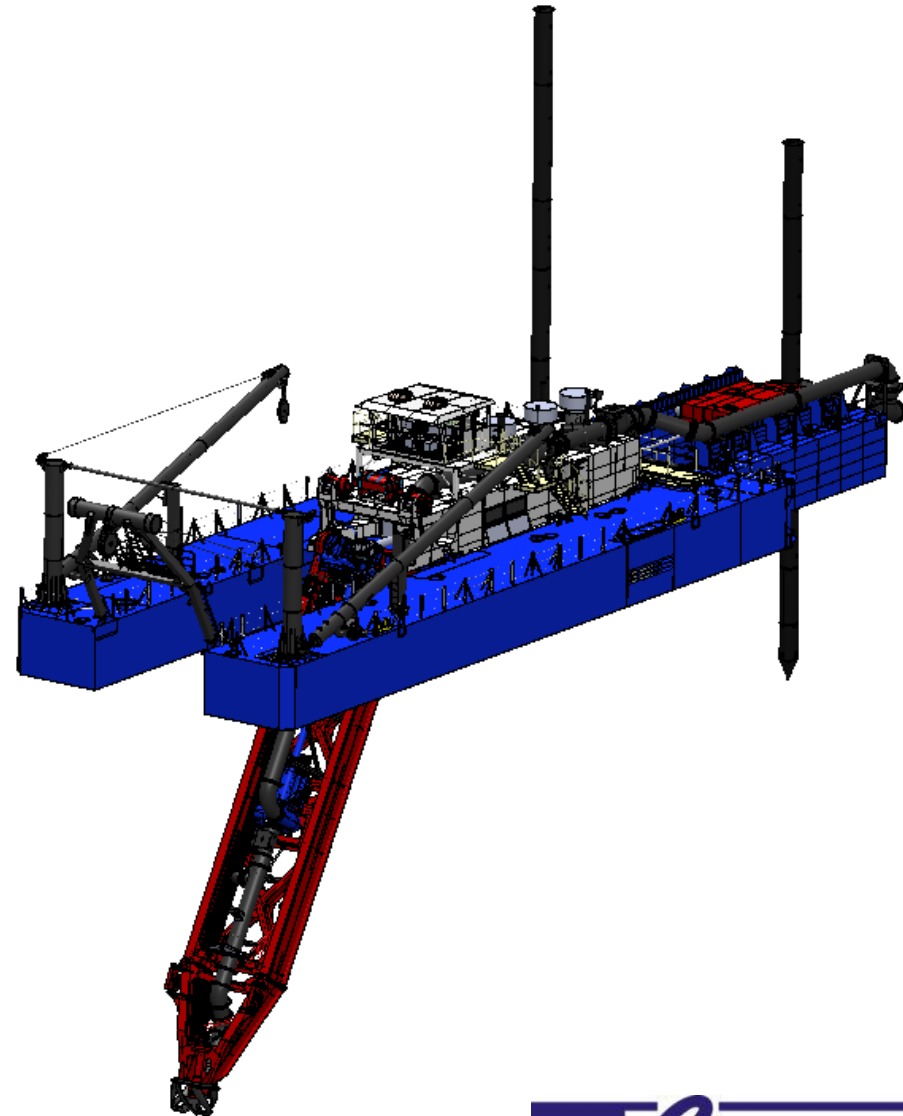


LATEST DEVELOPMENTS IN CUTTER SUCTION DREDGE DESIGNS

**PAUL QUINN
ELLICOTT DREDGES**

OCTOBER 2013

- Key Benefits include
 - Elimination of Genset for Ladder Pump Drive
 - Elimination of Electrical Switchgear,
 - VFD's/MCC's
 - Elimination of exterior-mounted Electric motor
- Features
 - Mechanical drive of dredge pump with Ellicott two-part articulating Gearbox
 - Input portion mounted on the hull and direct connected to the engine or motor; output portion is mounted on the ladder and connected to the pump



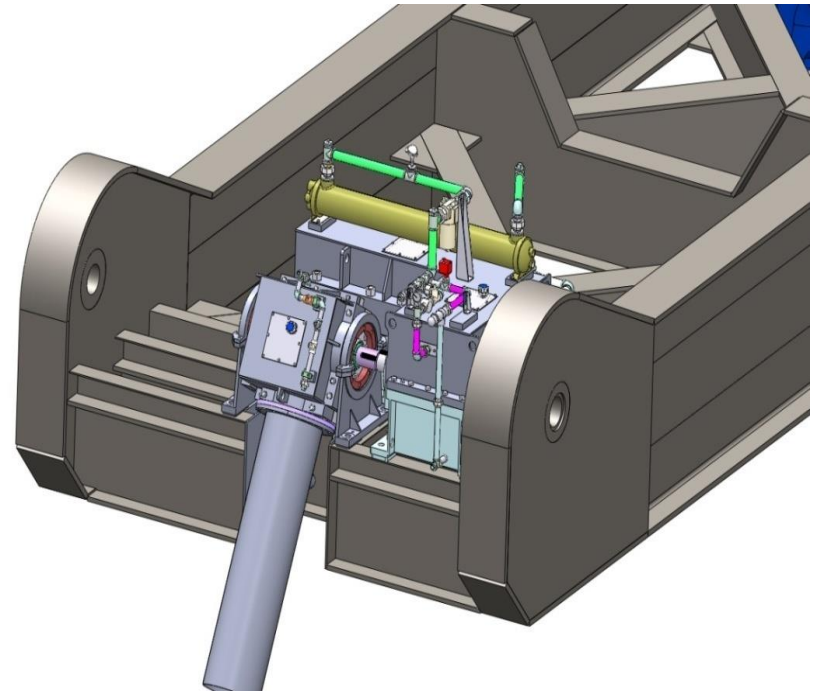
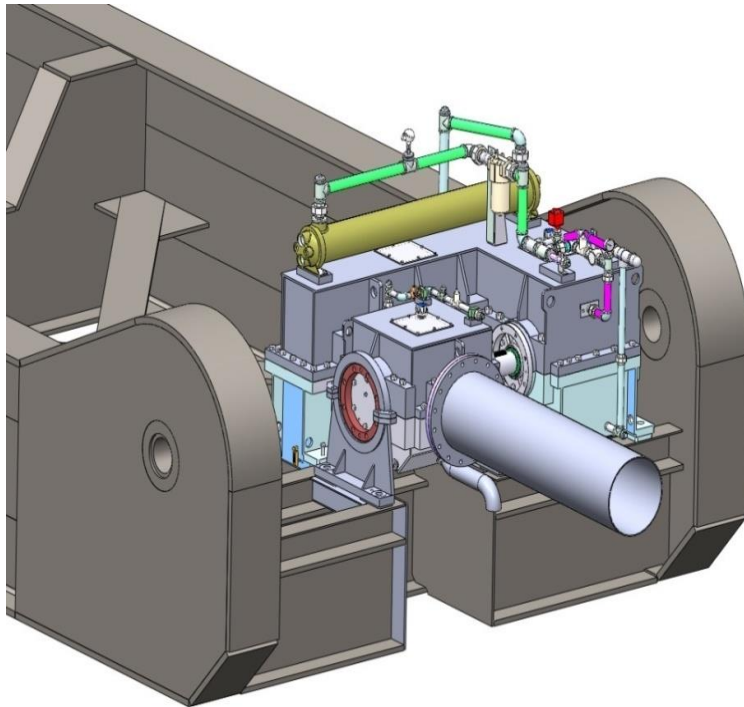
Direct Ladder Pump Drive



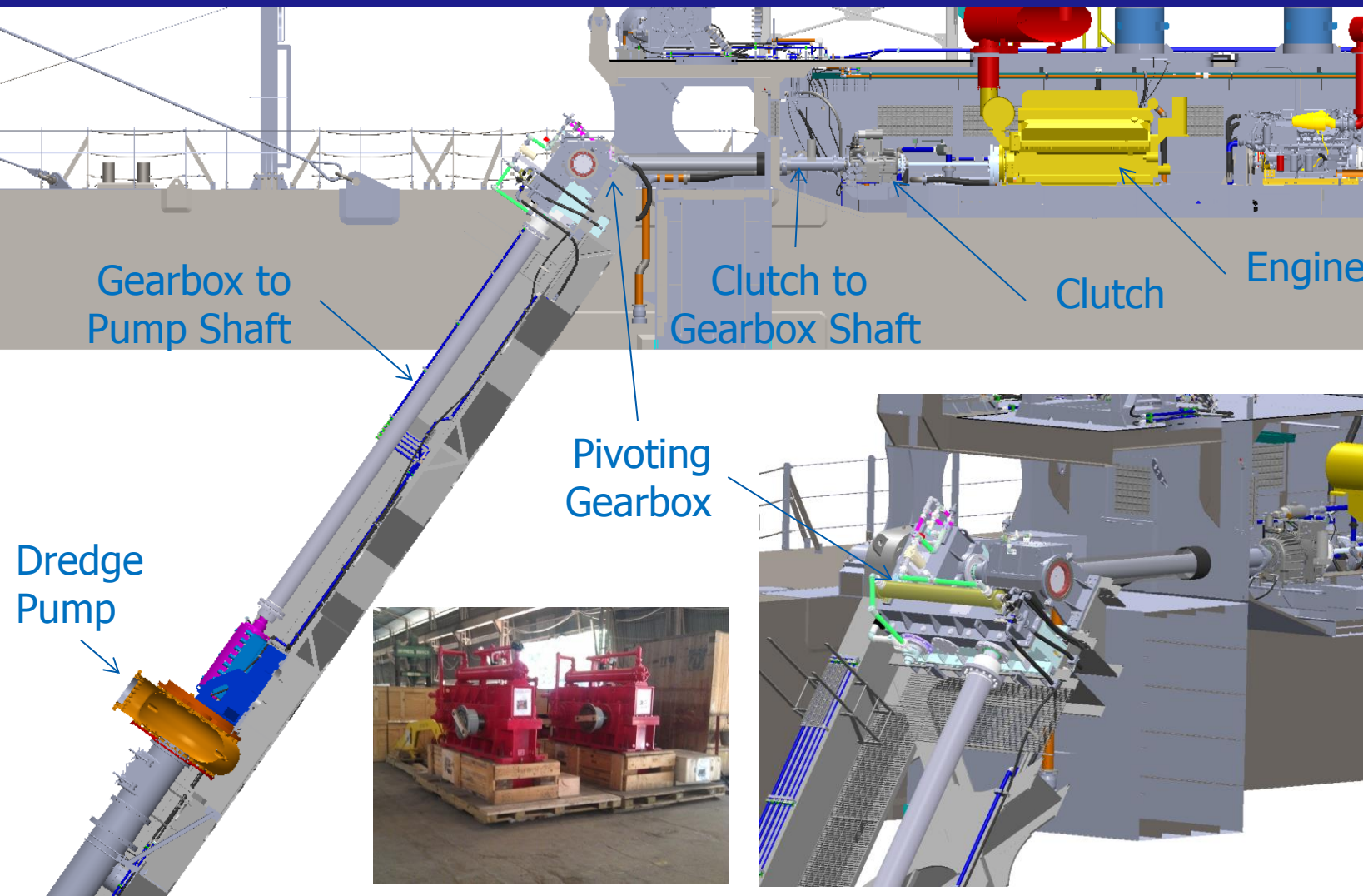
Ladder pump driven by a articulating gear box

Total Power transmitted – 2447HP 1825KW

Ratio – 2.93:1



Direct Drive Dredge Pump Provides High Efficiency Dredging Operations

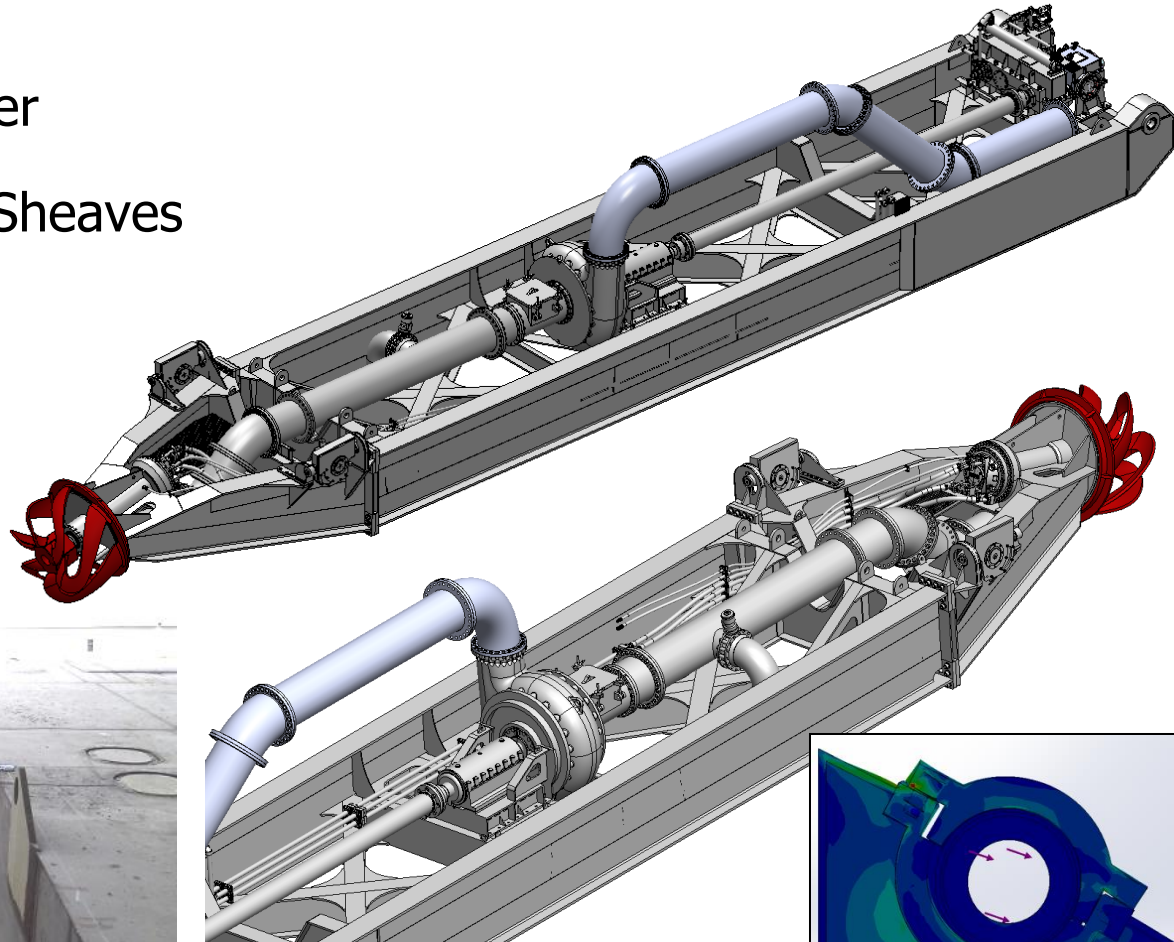


Pivoting Gear Box Provides Efficient Transmission of Dredge Power

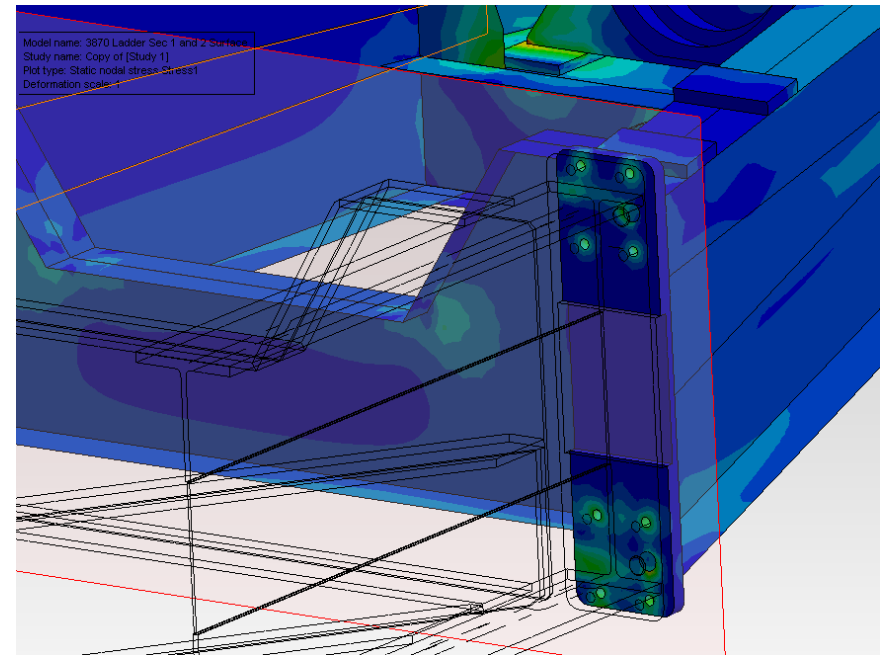
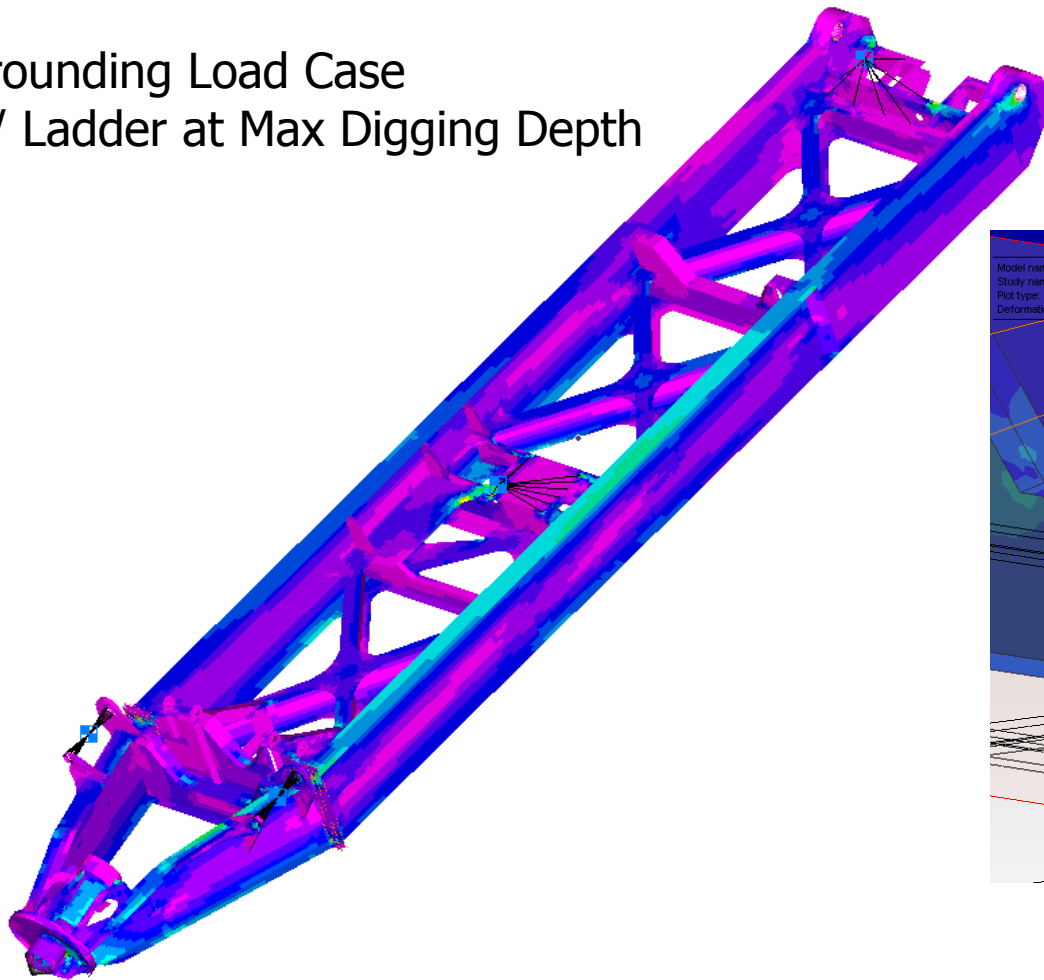
Ladder Pump Provides High Efficiency at Deep Digging Depths



- 600HP Direct Drive Cutter
- Counter Balance Swing Sheaves
- Suction Relief Valve
- Ladder Pump
- Pivoting Gear Box



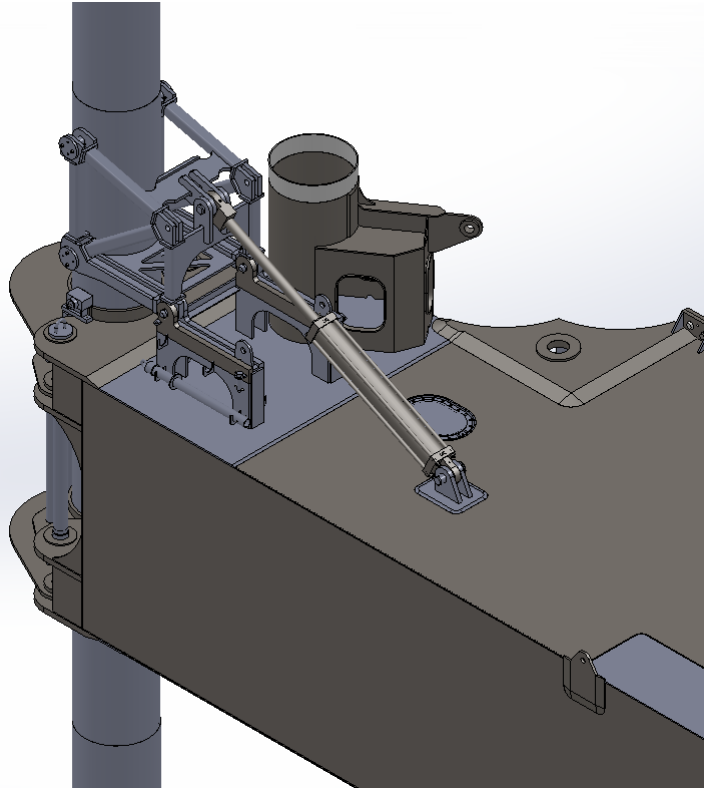
Grounding Load Case
w/ Ladder at Max Digging Depth



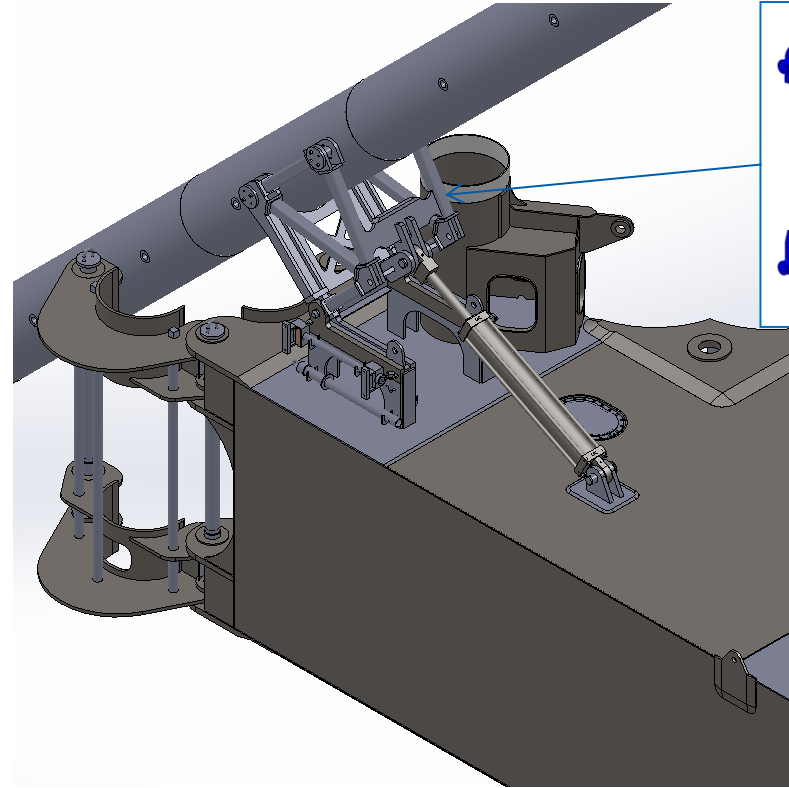
Detailed FEA Model of Bolted Connection

Component Design Digitally Validated Against Worst Case Loads

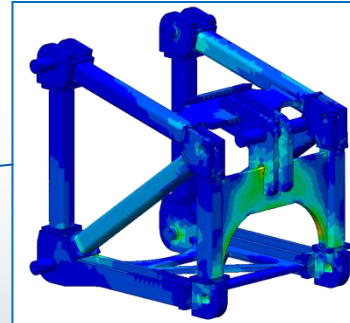
Spud Tilting Capability Allows Dredge to Navigate Shallow Water & Below Bridges



Spud Attached to Tilt Frame
with Locking Pins



Positive Control of Spud
During Entire Tilting Operation

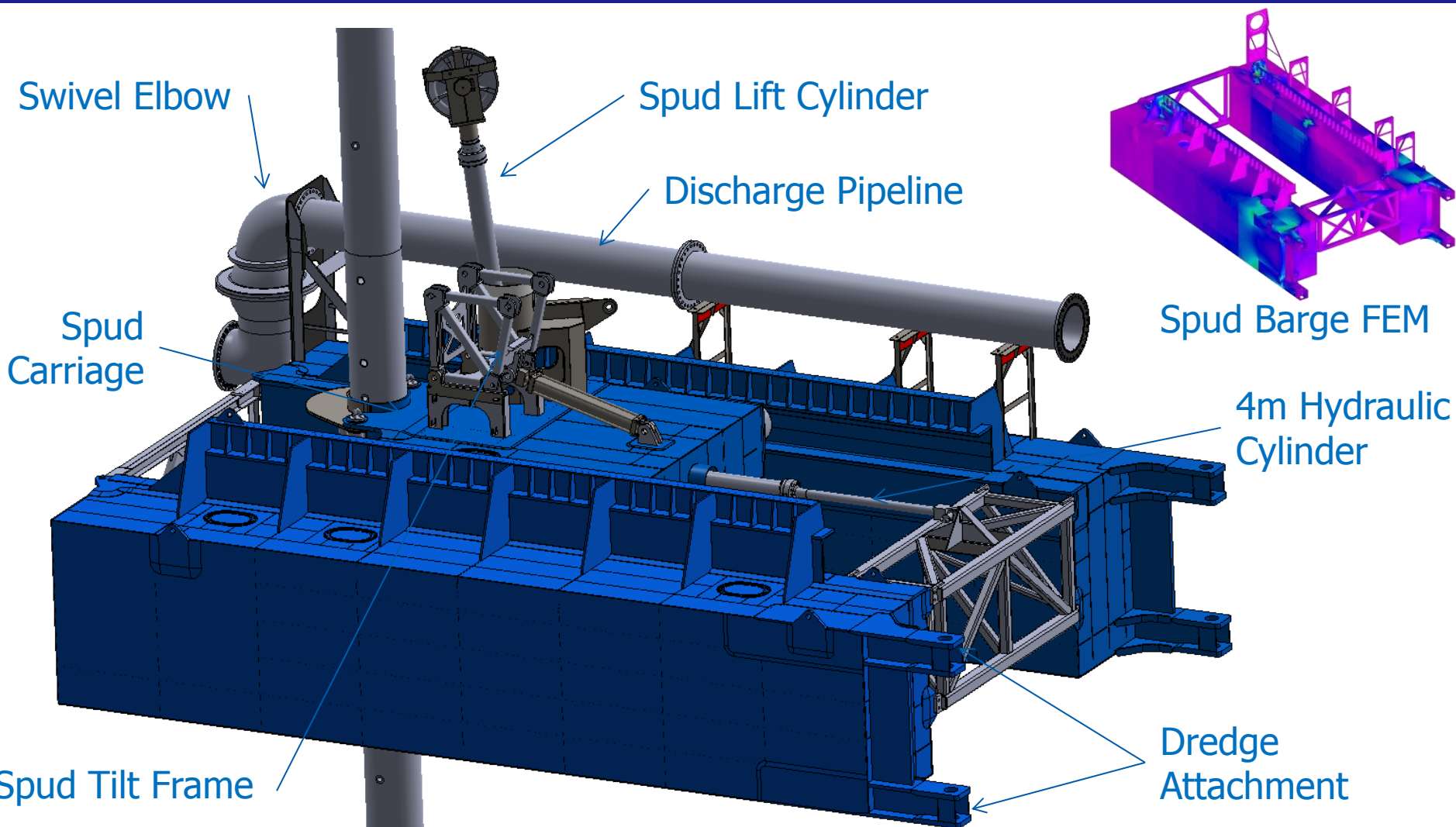


FEM of
Tilt Frame

Spud Tilting Improves Versatility of Dredge



Travelling Spud Barge Improves Efficiency of Dredging Operations



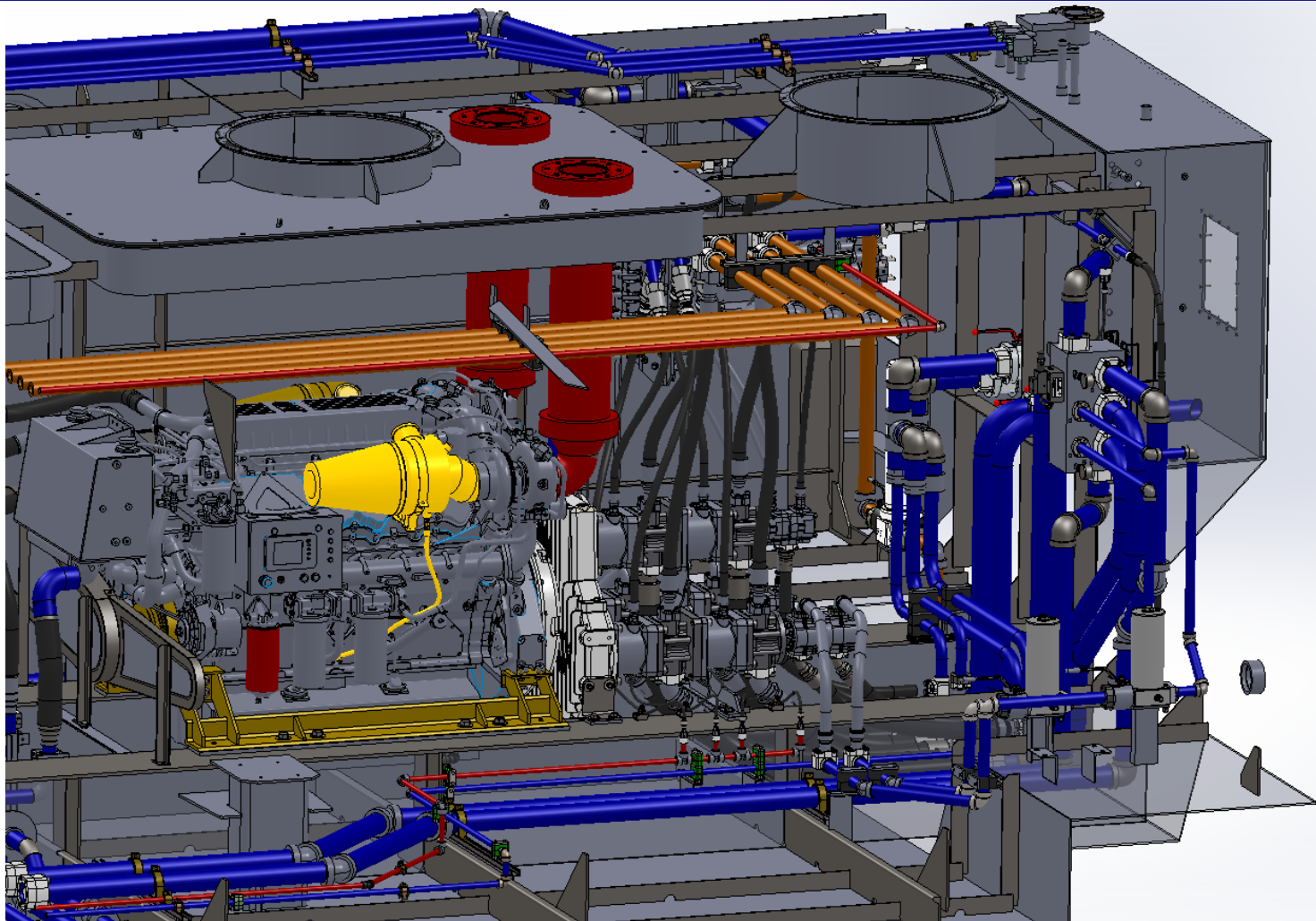
Spud Carriage Designed for Full Coastal Operation

All Dredge Operations Controlled from Operator's Chair



Modern Control System Operator Comfort and Efficiency

Efficient Hydraulic Plant Reduces Fuel Consumption



All Piping Validated via Digital Prototype

- OLD METHOD
 - Open Loop System
 - Uses Gear pumps and motors
 - Always running at full output regardless of load
 - Typically, pumps and motors are only 75% efficient. Net result is 64%.
- NEW METHOD
 - Closed Loop System
 - Uses Variable Displacement Pumps and Axial Piston Motors
 - Typically, pumps and motors are 90% efficient. Net result is 81%.
 - System is Load Sensing; that is, it only draws power from engine/motor when the hydraulic component requires it
- **EXAMPLE**
 - 20" dredge with Open Loop system requires C-15 Engine with 475HP
 - Same dredge with Closed Loop can use C-11 Engine with 385HP

- Remote start, stop, and monitoring of boosters
- Boosters adjust own engine speed by monitoring suction and discharge pressure
- Through a CANBUS connection to the dredge, changes in engine speed on the dredge pump are relayed to the booster, which then adjusts its own speed in anticipation of different operating conditions

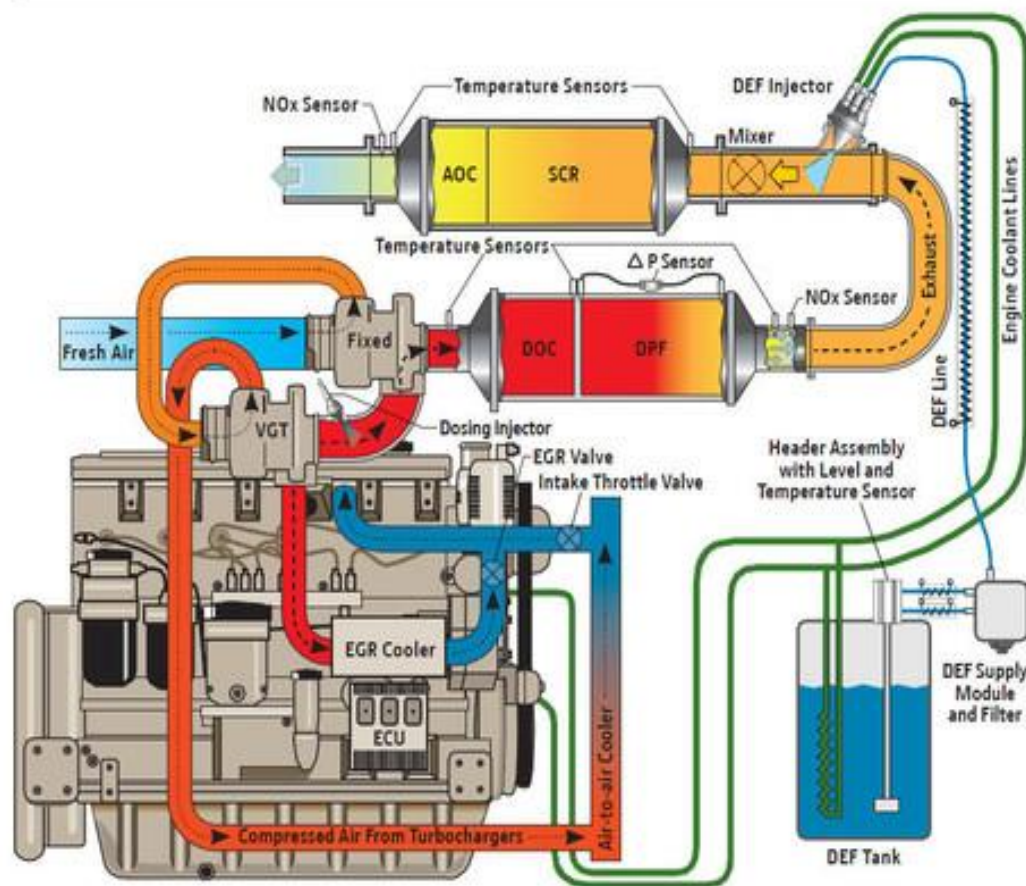


WHATS COMING NEXT?

- Tier 4 Engines

- Depending on HP, will be required as soon as 2016
- Extra space consumed for Urea Tanks, piping and reactors
- Increased operating cost
- Increased capital cost
- .3 Gallons of Urea consumed for ever gallon of Diesel Fuel

Final Tier 4



Thank You

