



# WEDA EASTERN CHAPTER MEETING

## GLDD'S ATB ELLIS ISLAND & TUG D.B. MACKIE

Ellis Island      length 433 ft.      Breadth 92 ft  
                         Installed power      11,300 hp

D. B. Mackie      length 158 ft.      Breadth 52 ft.  
                         Installed power      17,300hp

15,000 cubic yard hopper capacity  
(largest hopper dredge in US Market)

Eastern Shipbuilding Group  
Panama City Florida

10 October 2017

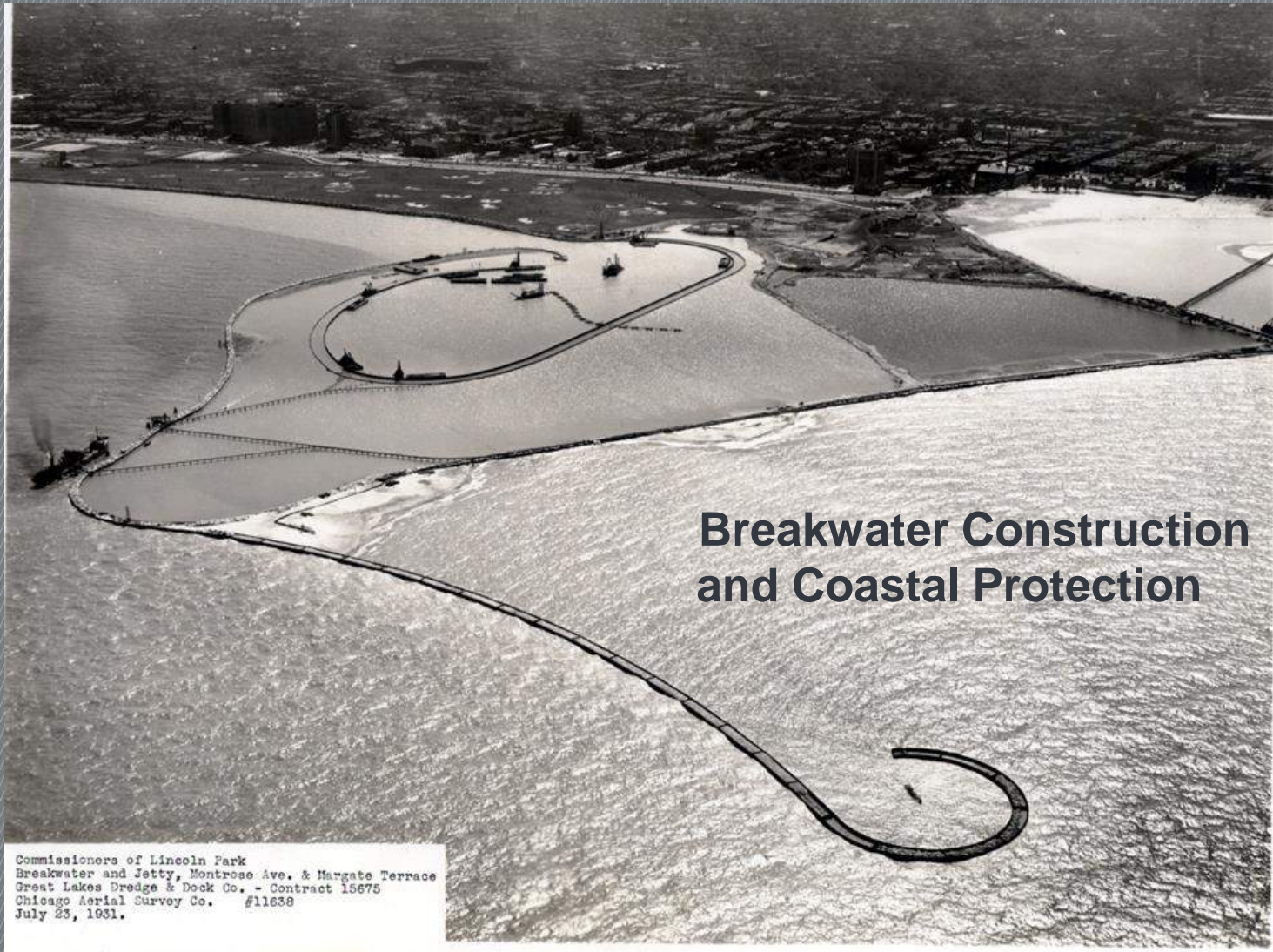
# GREAT LAKES HOPPER DREDGE BEGINNINGS

## 3500 cy Hopper Dredge 'Michigan'



## Lincoln Park Reclamation in Chicago in 1931

# MONTROSE AVENUE CHICAGO 1931



## Breakwater Construction and Coastal Protection

Commissioners of Lincoln Park  
Breakwater and Jetty, Montrose Ave. & Margate Terrace  
Great Lakes Dredge & Dock Co. - Contract 15675  
Chicago Aerial Survey Co. #11638  
July 23, 1931.

# MANHATTAN ISLAND 1<sup>ST</sup> SPLIT HULL HOPPER DREDGE



# GREAT LAKES HOPPER DREDGE BEGINNINGS



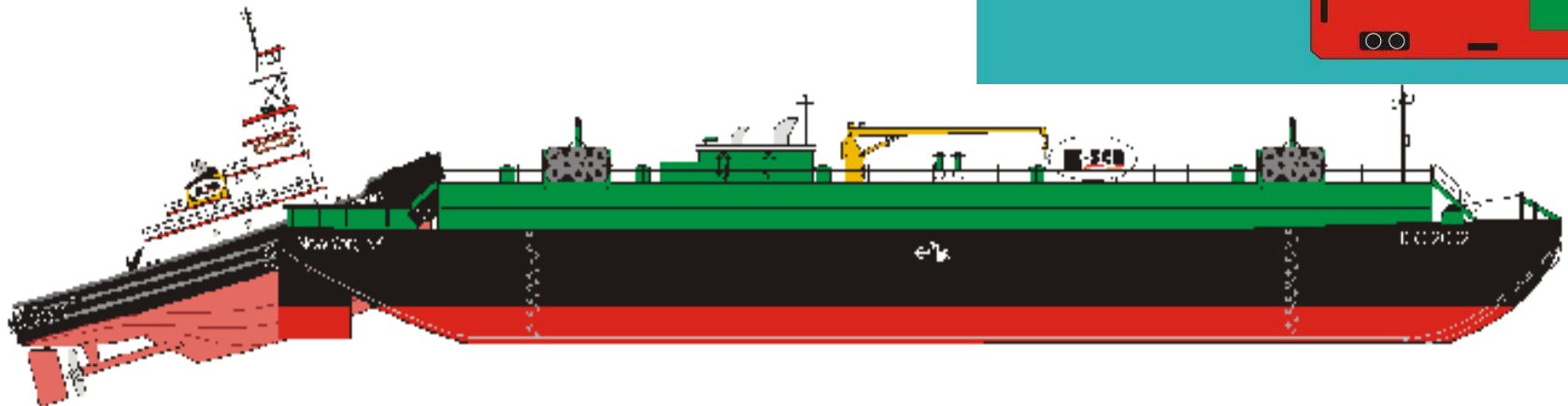
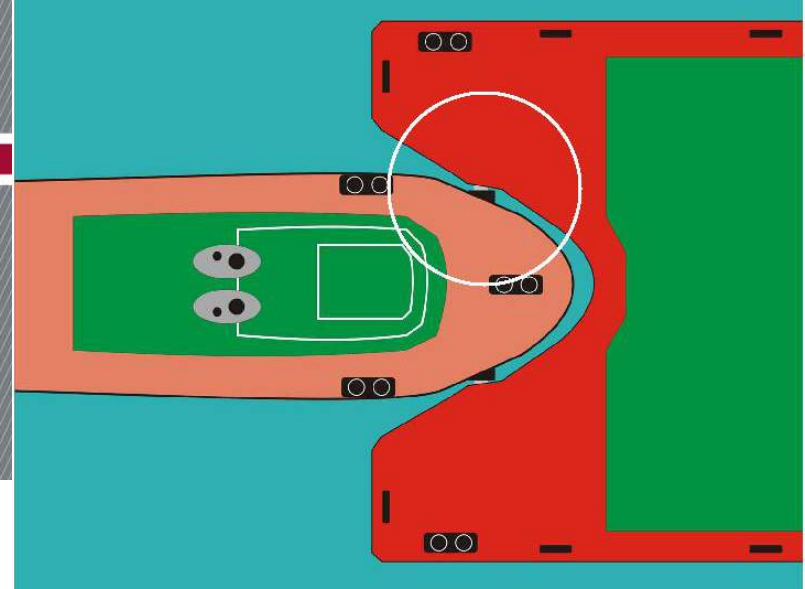
# GREAT LAKES HOPPER FLEET IN 2017



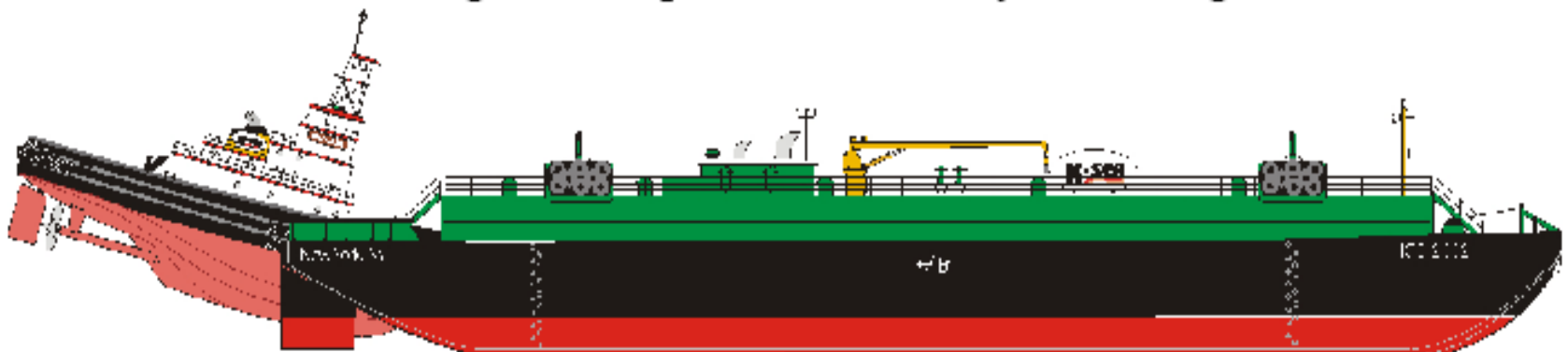
# WHAT IS AN ARTICULATED TUG & BARGE?



# ARTICULATED MOTION

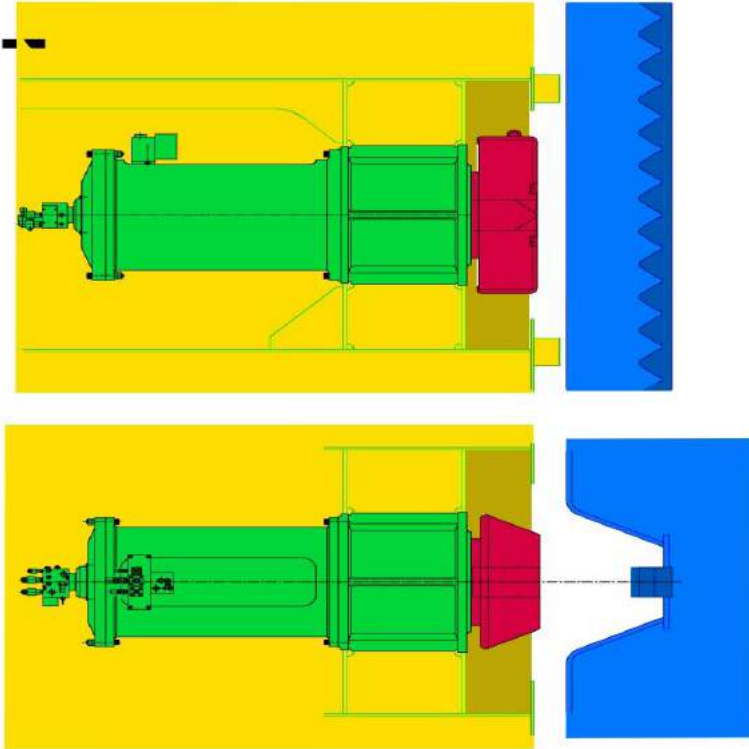


Designed to operate nominally at 15 degrees

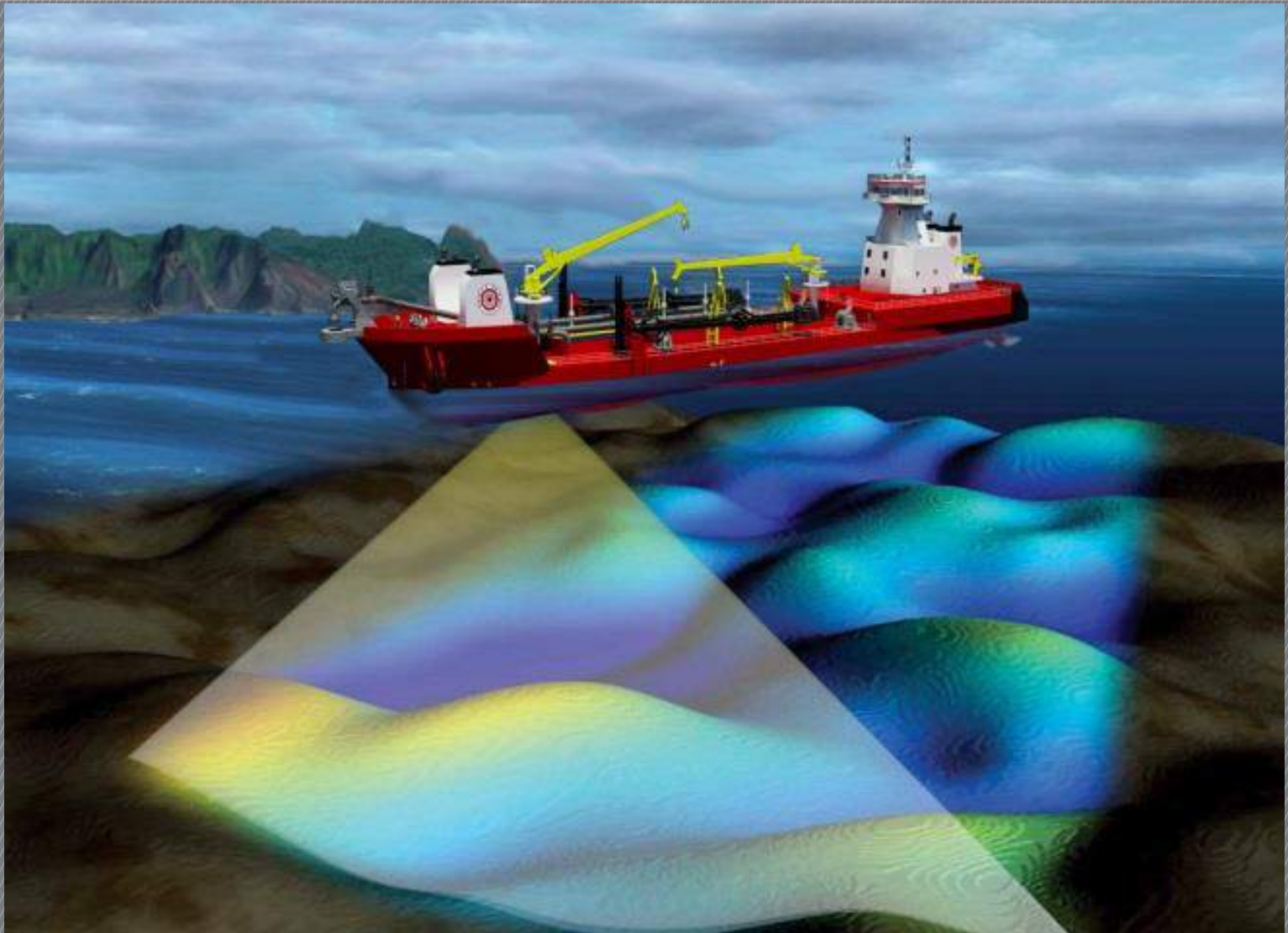




# PIN CONNECTION



# AN ATB IN DREDGING SERVICE???



# CHALLENGES FOR AN ATB IN DREDGING SERVICE

Dual Mode - Connect and disconnect - typically done while in port, in relatively calm waters.

In dredging by contrast, the tug and barge need to stay connected at all times, but the barge draft needs to be able to change as the barge is loaded or unloaded, and all of the foregoing needs to take place in up to moderate seas

- ❑ Can the ATB connection handle offshore wave conditions during loading and unloading
- ❑ ATBs typically 1 to 1.5kt slower speed than a similar sized ship. Can this be overcome?
- ❑ Can the ATB maneuver as easily as a ship?
- ❑ Will the longer length of the ATB compared to a ship prevent its use in certain channels?

## SOME ATB ADVANTAGES

- ✓ Cargo capacity - The cargo capacity of a hopper dredge is based on the vessel's displacement and its lightship weight which includes propulsion engines, generators, accommodations structure, fuel and other ship installations. This weight deducts from the cargo carrying capacity of the dredge.

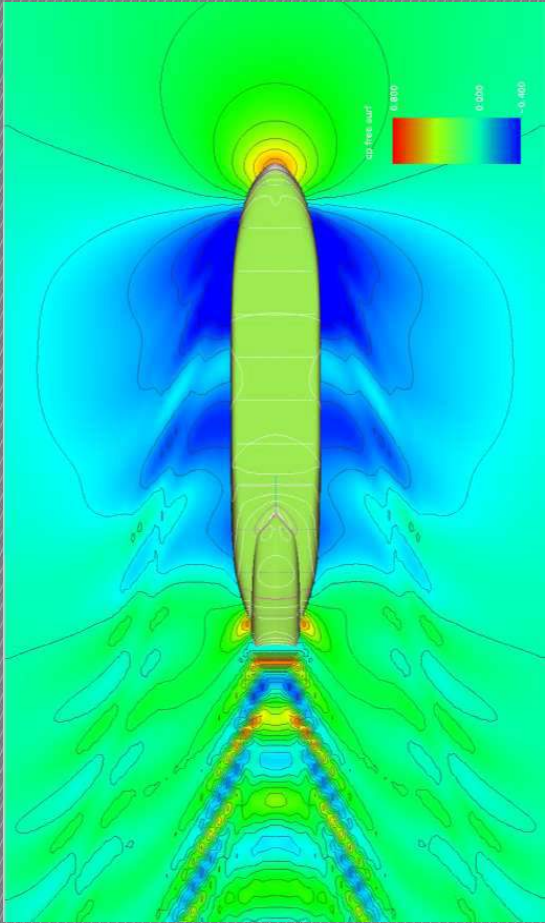
In an ATB hopper dredge, these components and their associated weight are built into the tug and therefore do not deduct from the cargo carrying capacity of the barge. The tug's draft remains constant as the barge increases its load and draft.

- ✓ The manning requirements on this size tug typically result in a crew of 7-10 personnel. The license requirements are lower, i.e. tug license not ship license
- ✓ The manning requirements on the barge are typically zero, since the barge is considered unmanned; the owner crews to meet his *operational requirement*, not an imposed *regulatory requirement*.
- ✓ Today's trend in the U. S. Coastwise-Qualified (Jones Act) trade is to build an ATB instead of a ship for any route where the transit distance is short enough for the positive construction and operating cost economies to offset the negative cycle economies of the somewhat smaller size ATB.

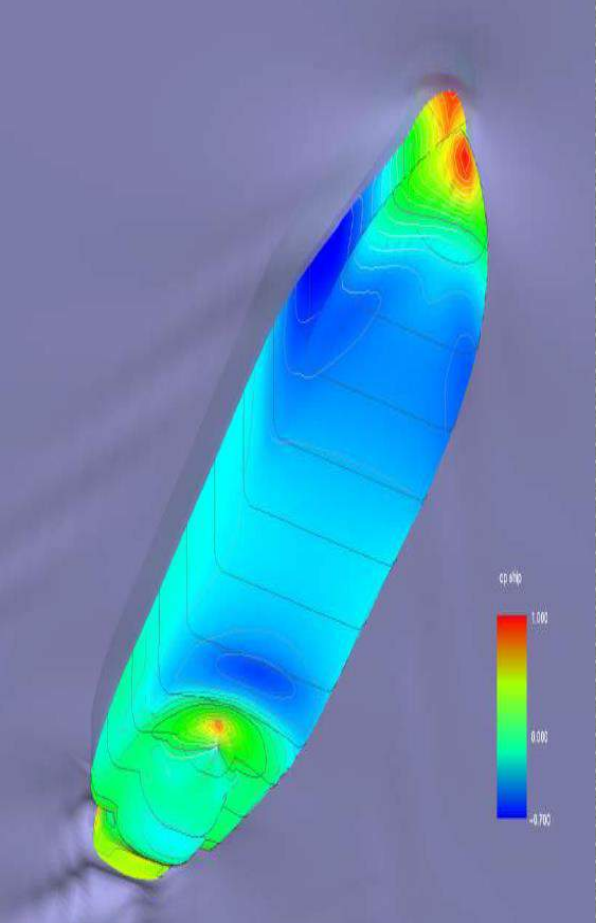
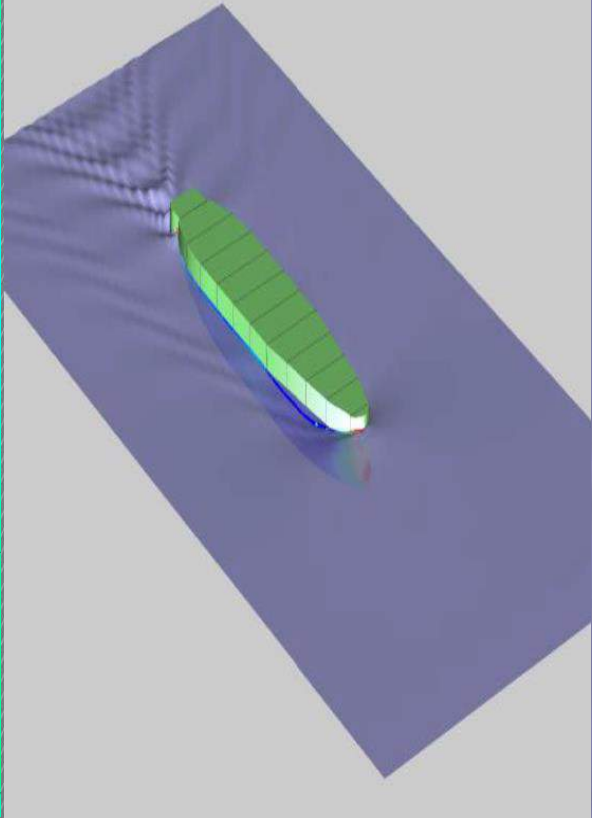
# GREAT LAKES' OBJECTIVES

- The dredge that will carry our Hopper Division to the next generation; the next step in the transition from a fleet of nearly identical dredges to a fleet consisting of different dredges for different purposes – each the low cost producer in its target market
- Meet future market needs with increased O & M demand and funding due to HMTF, Coastal Protection, Gulf Coast Restoration, and the latest channel deepening (Capital Dredging) cycle
- Improve operating margins
- Compete in non-traditional hopper markets
- Make otherwise marginal projects possible due to reduced cost to owner
- Ship-like performance and reliability while retaining the advantages of the ATB

# OVERCOMING THE CHALLENGES – HULL FORM OPTIMIZATION



GET THE BOW RIGHT



Great Lakes hull design, optimized using Computational Fluid Dynamics (CFD)

# TANK TESTS OF LIBERTY VS ELLIS ISLAND



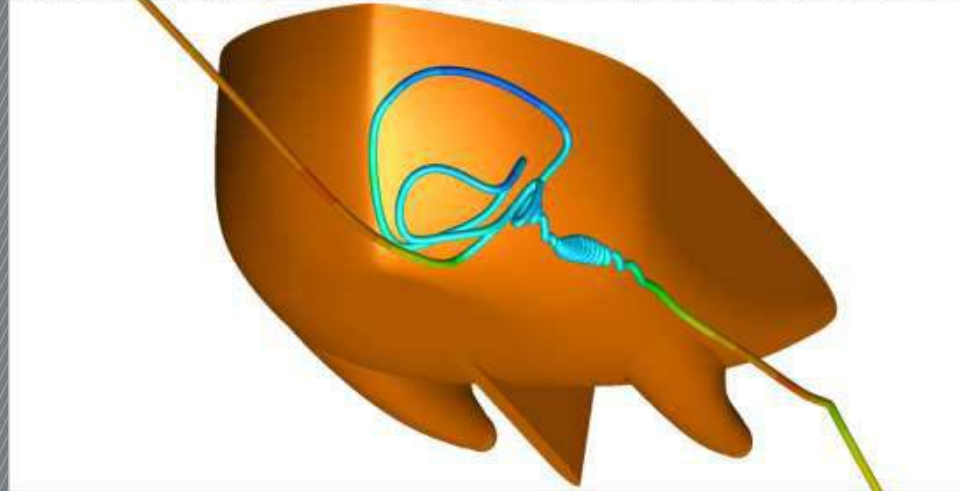
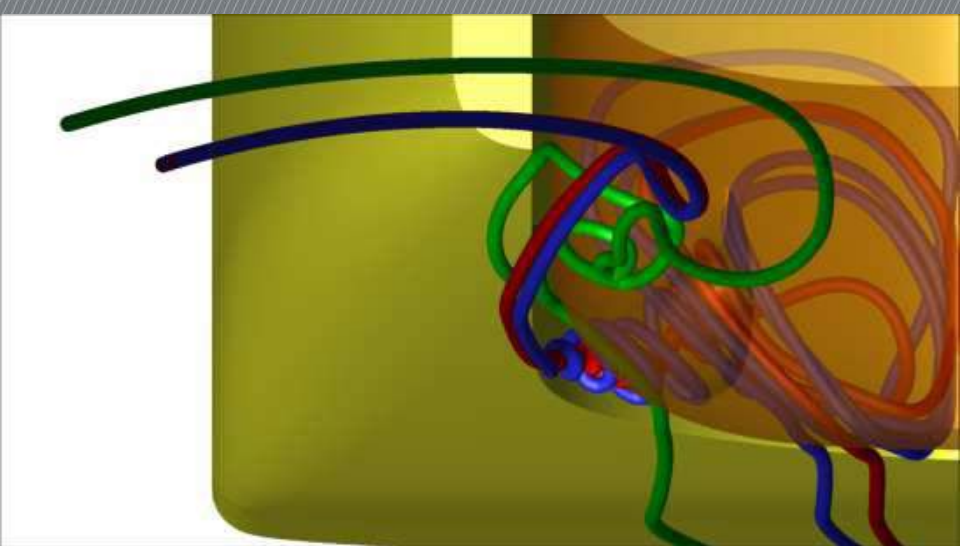
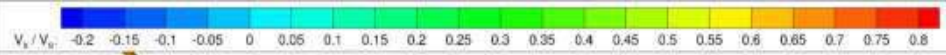
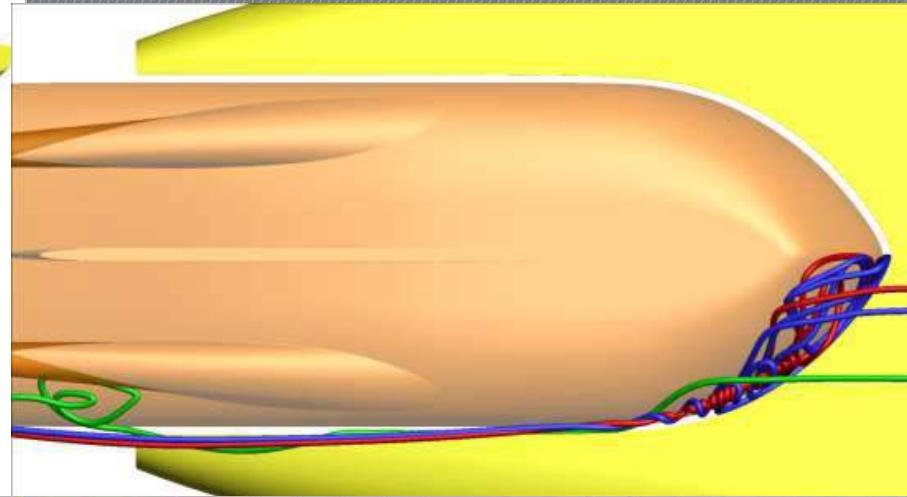
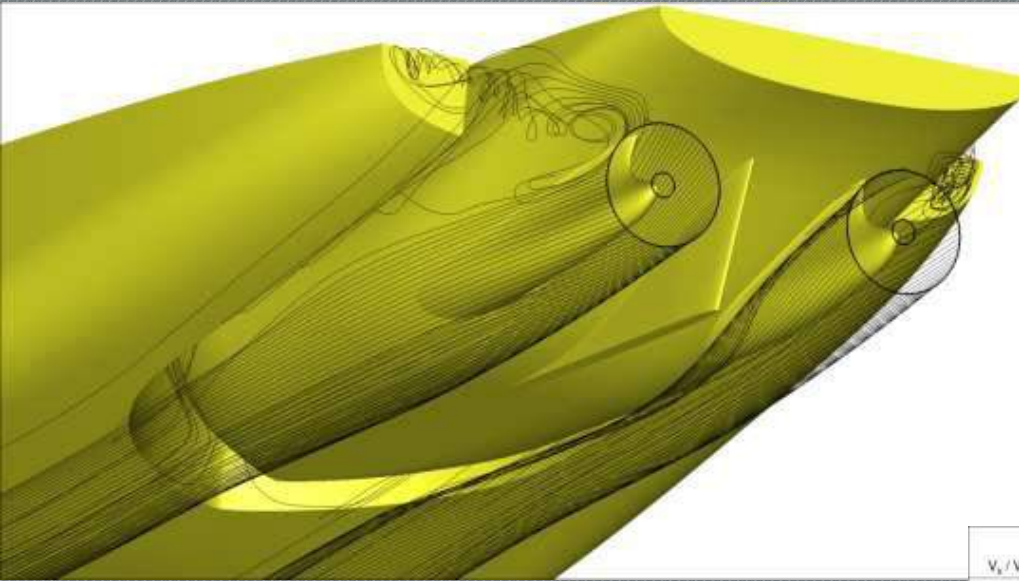
The Liberty with the bulb requires 5,600 kW (7,500 HP) to achieve 13.5 kts in deep water,



The ATB with bulb requires 8,200 kW (11,000 HP) to achieve 13.5 kts in shallow water

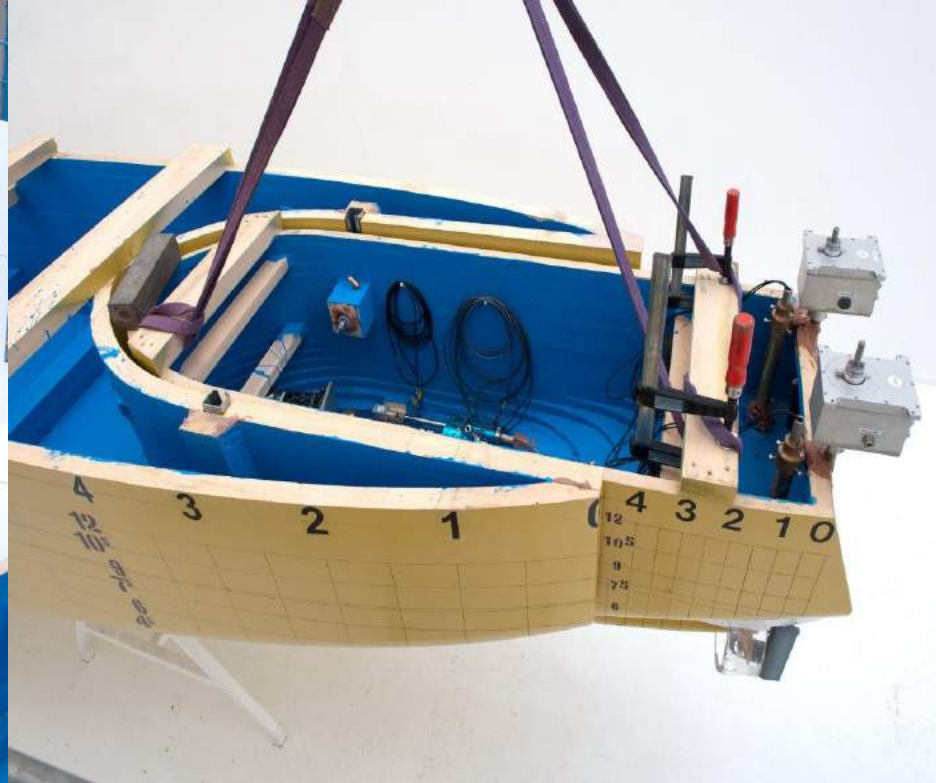
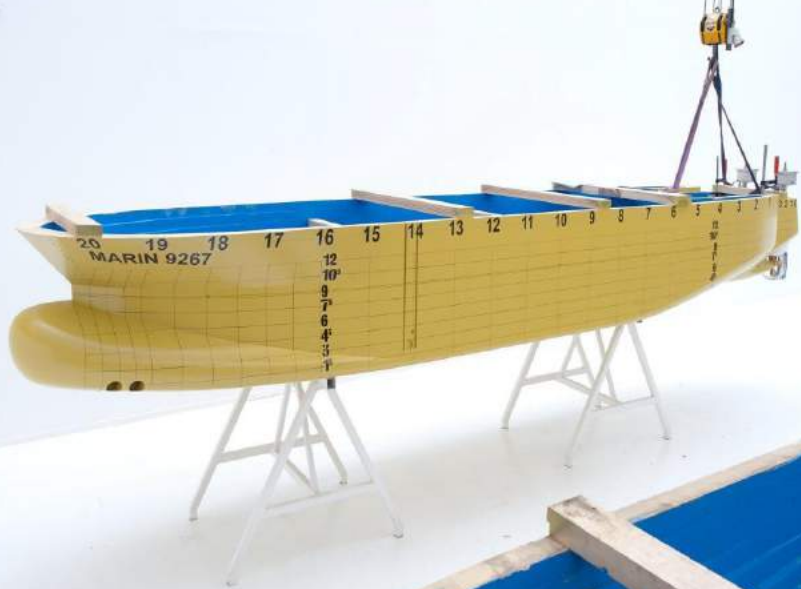
**More than 2x the capacity of the Liberty Island, same speed, 1.5x power, less wake**

# GETTING THE PROPELLER FLOW RIGHT

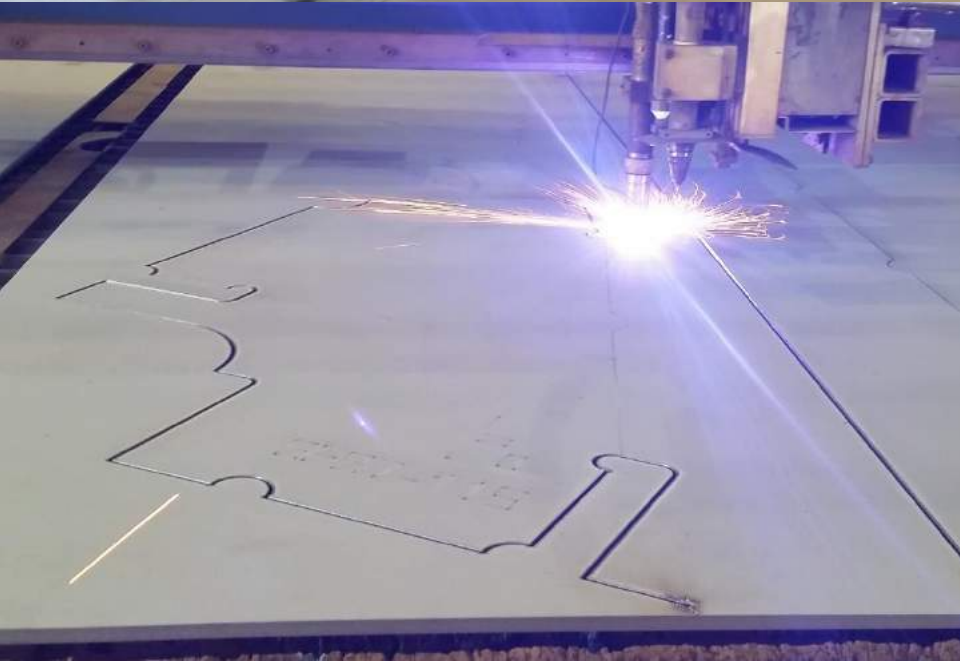




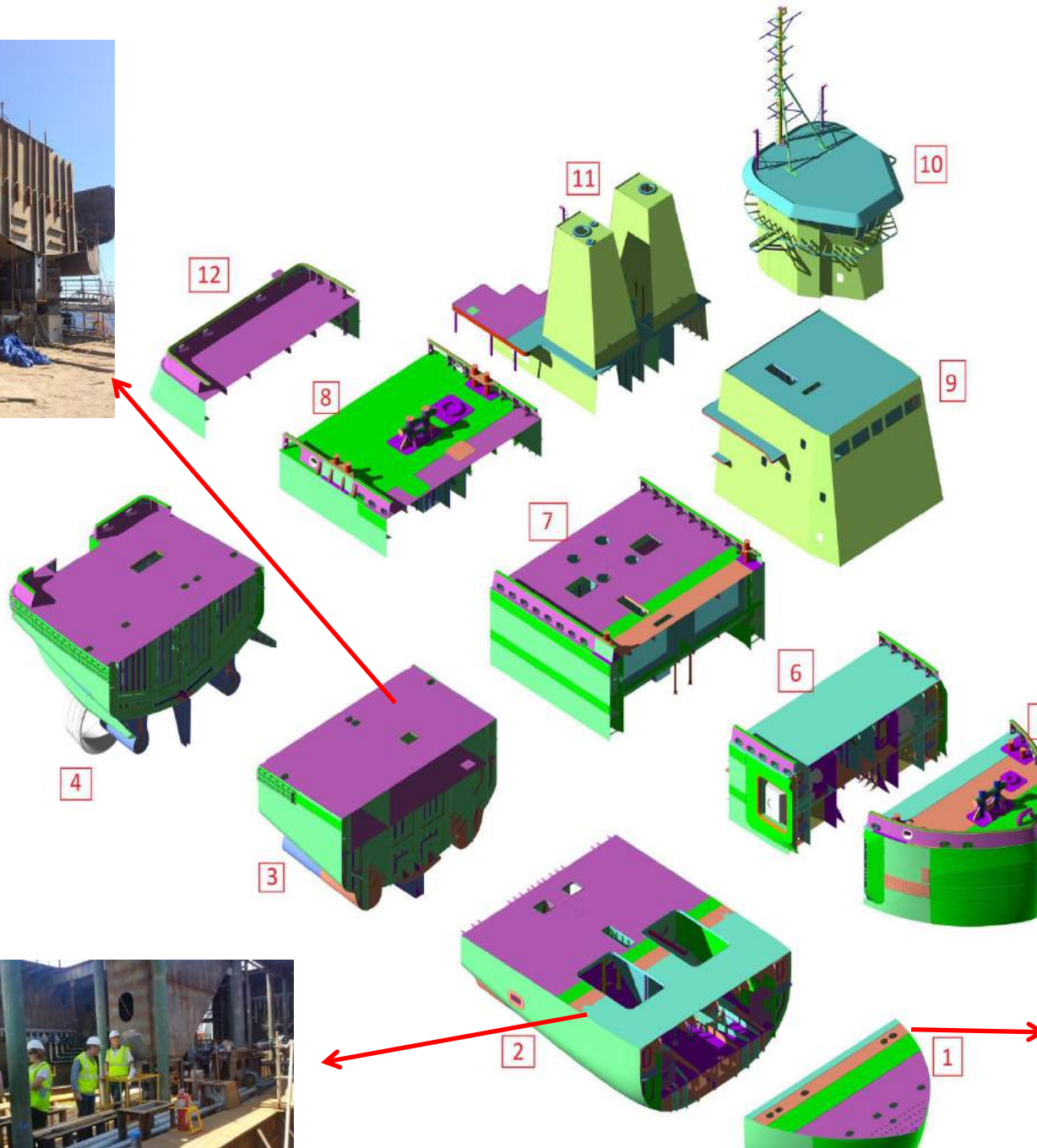
# TUG MODEL TESTS



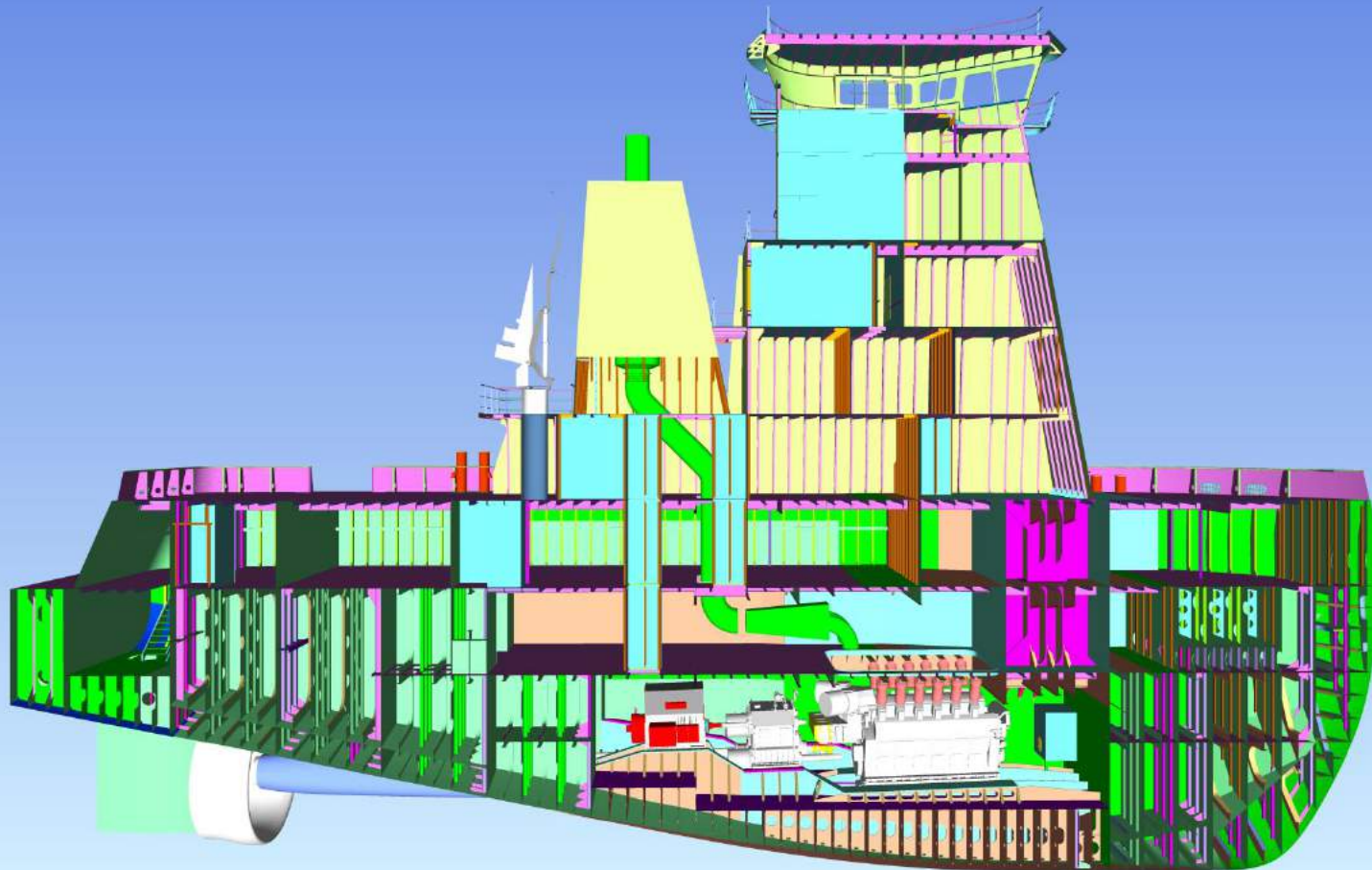
# Steel Cutting 14 September 2014



# Tug Units



# Tug *Douglas B. Mackie* 3D Model



# Final Deck Unit Installation



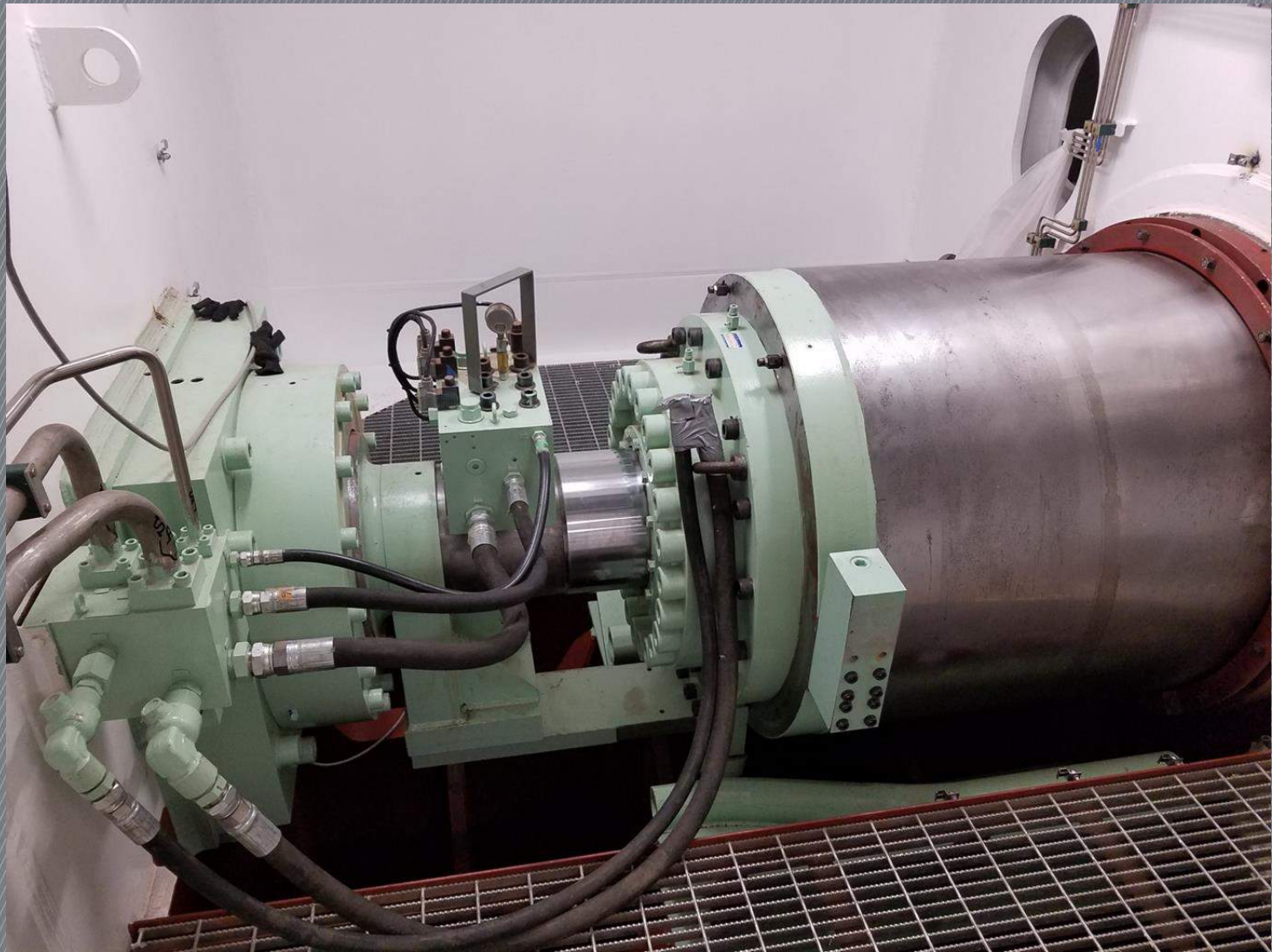
# Main Engine Installation



# Kort Nozzles



# TUG TAISAI PIN CONNECTION





# ARTICOUPLE CONNECTION



# MAK 7,500 Hp Tug Main Engine



# Tug Shaft Generator



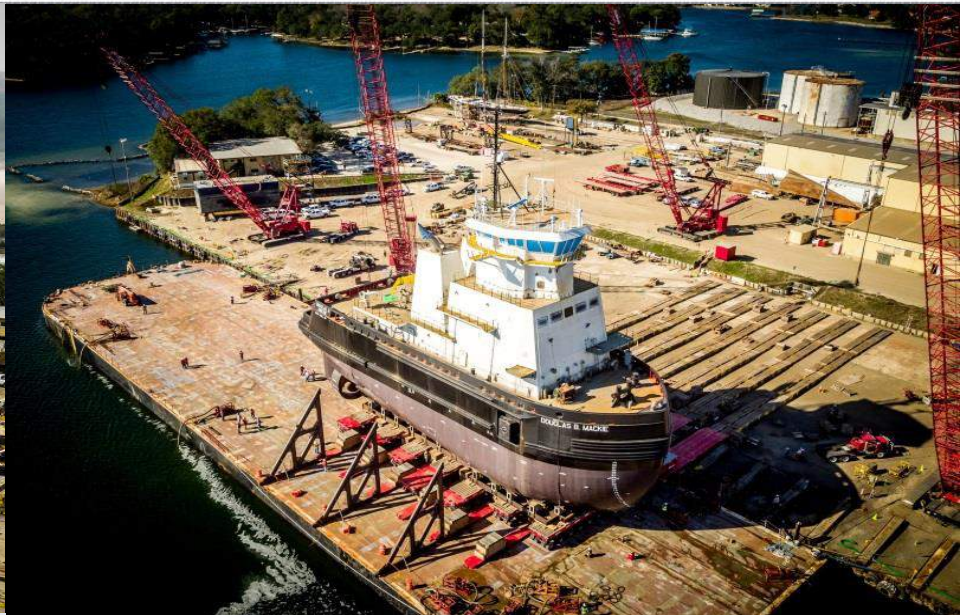
# TUG ARTICOUPLÉ PAD INSTALLATION



# BERARD HEAVYLIFT TRANSLATION ONTO BARGE



# TUG MACKIE TRANSLATION AND LAUNING



# TUG NAVIGATION BRIDGE



GREAT LAKES DREDGE  
& DOCK CORPORATION

SOLUTIONS | [INFO@GLDD.COM](mailto:INFO@GLDD.COM) |  
[GLDD.COM](http://GLDD.COM)

# ENGINEERING DECK

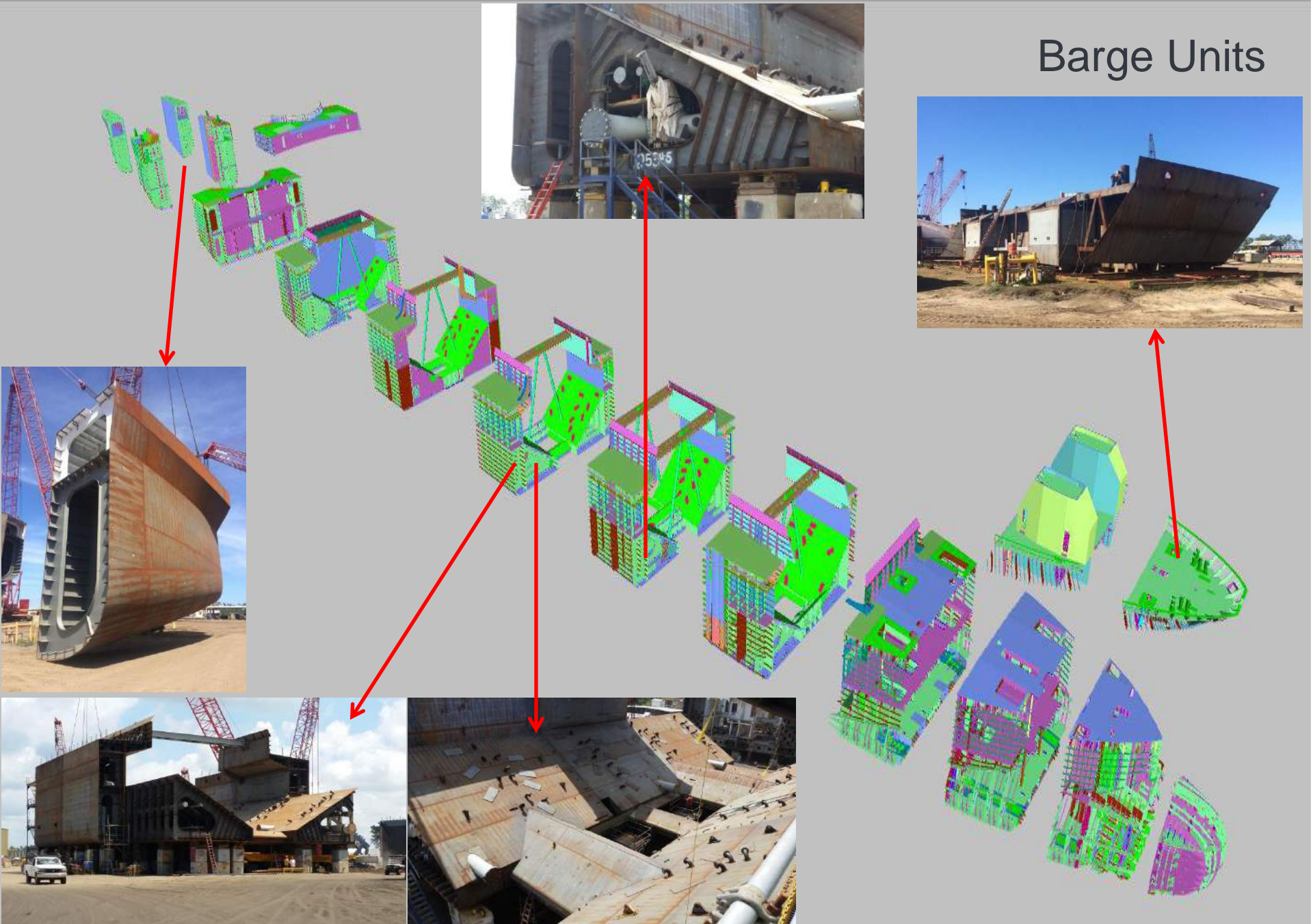




# TUG SEA TRAILS 5 OCTOBER 2017



# Barge Units





# Partially Constructed Hopper

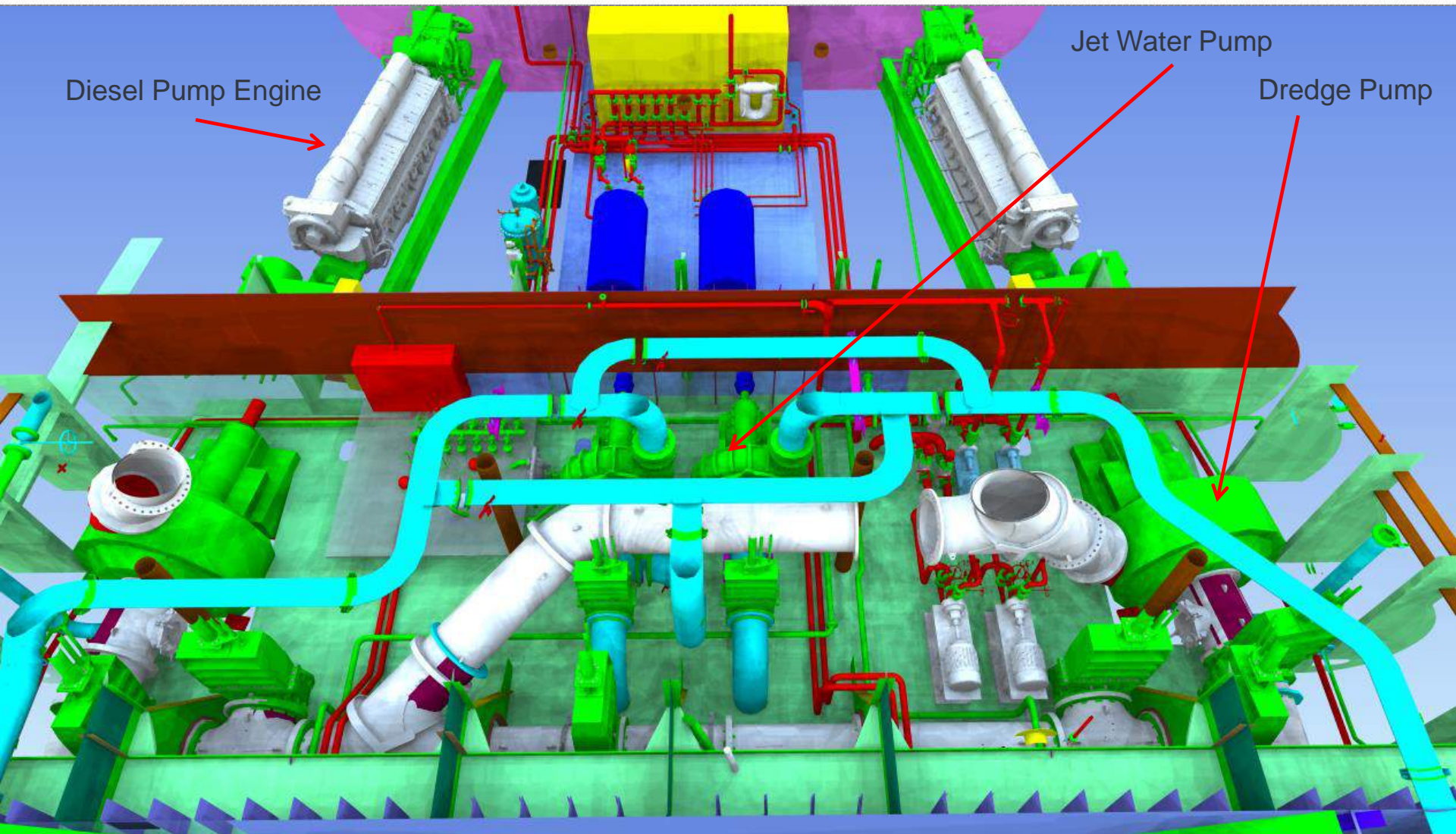


Pump Out Suction Pipe

Bottom Dump Doors

Jet Water System

# 3D Model of Pump Room



Diesel Pump Engine

Jet Water Pump

Dredge Pump

# Pump Engines



Dredge Pump Engines

04/14/2016

# ELLIS JET PUMPS AND 36" GIW DREDGE PUMP



GREAT LAKES DREDGE  
& DOCK CORPORATION



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# Bow Erection Sequence



# BOTTOM DUMP DOORS



# PREP FOR SIDE LAUNCH



LAUNCH 30 SEPTEMBER 2016



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# ELLIS FORE DECK



# Commissioning Starboard Drag Arm



# 6.6kv SYSTEM COMMISSIONING



# ELLIS HOPPER DECK





# ELLIS ISLAND TESTING VOSTA DREDGE CONTROL AUTOMATION



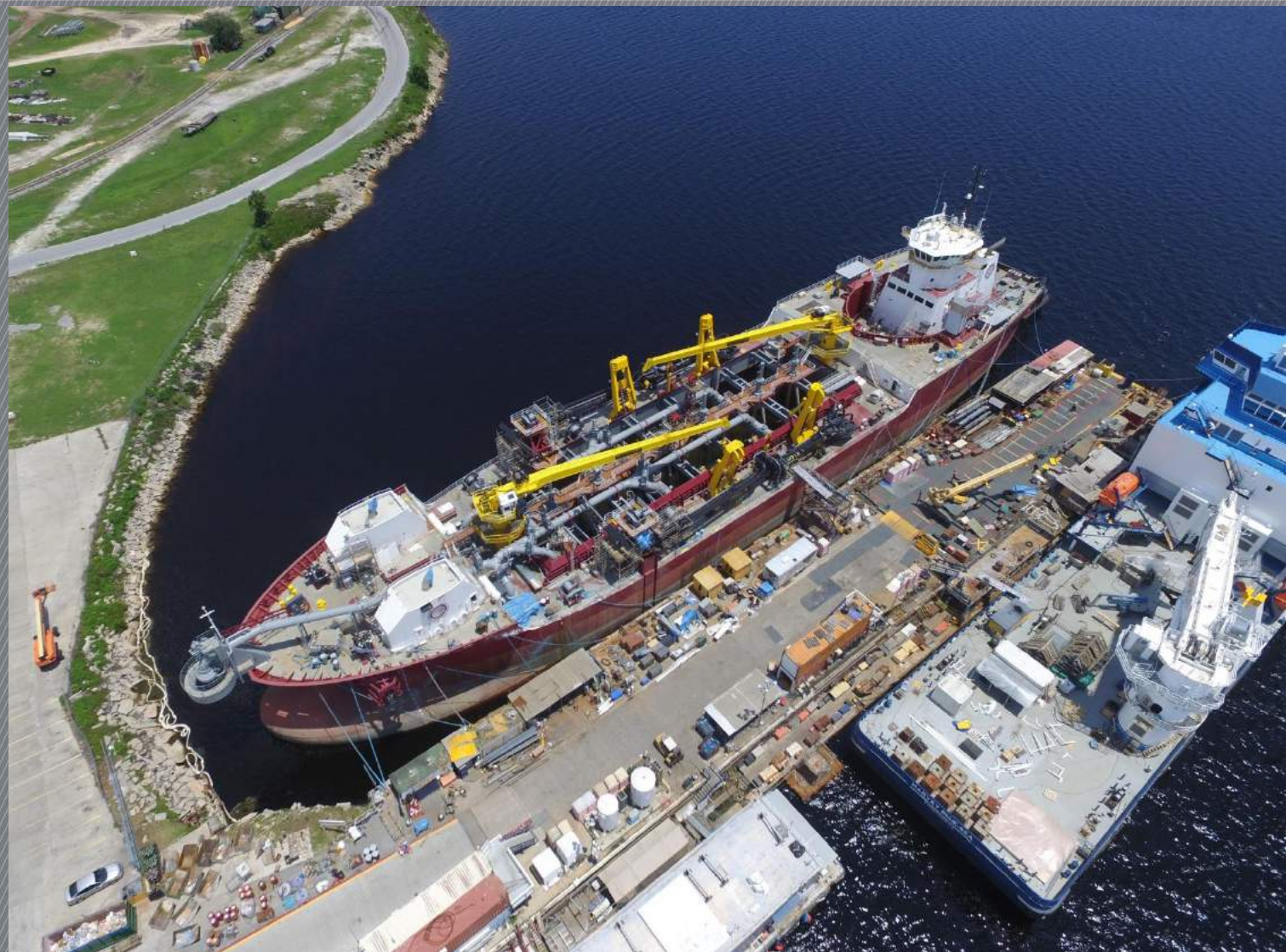
# 3000 HP HOPPER JETTING SYSTEMS TESTS



# VIEW FROM TUG BRIDGE



# TUG MACKIE AND ELLIS ISLAND AT OUTFITTING PIER





# Change in Industry Capacity



Historical Industry Capacity (1997-2015) – 66,340 cy

Industry Capacity with Weeks and GLD&D Newbuilds – 90,040 cy