

# HAYNES COASTAL ENGINEERING LABORATORY

&

# DREDGE CARRIAGE

R. E. Randall

Director, Center for Dredging  
Studies

# Reta & Bill Haynes '46 Coastal Engineering Laboratory Facility

Texas A&M University

Initial Proposal 1994, NSF Grant 1995

Design Completed January 2000

Ground Breaking August 2001

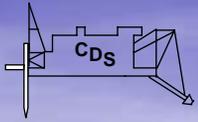
Completed: October 2002

Dedicated: June 4, 2003

Barrett G. Hindes Dredging Engineering Education Fund: 2003

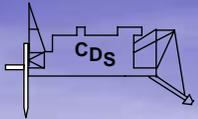
Directional Wave Maker, NSF Grant & Haynes Donation 2003





# SHALLOW WATER BASIN

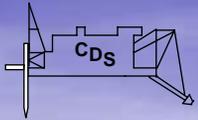




# Waves in Shallow Water Basin

- L=120 ft, W=75 ft, D=4 ft
- Directional Wave Generator
  - Period 0.5-5 s
  - Wave height
    - 0.4 m (1.3 ft) @ 1.5 s
    - 0.6 m (2.0 ft) @ 2.4 s
    - 0.4 m (1.3 ft) @ 5 s
- 35,000 GPM flow rate through wave basin from under wave paddles
- Weirs control water level
- View windows

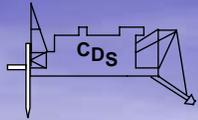




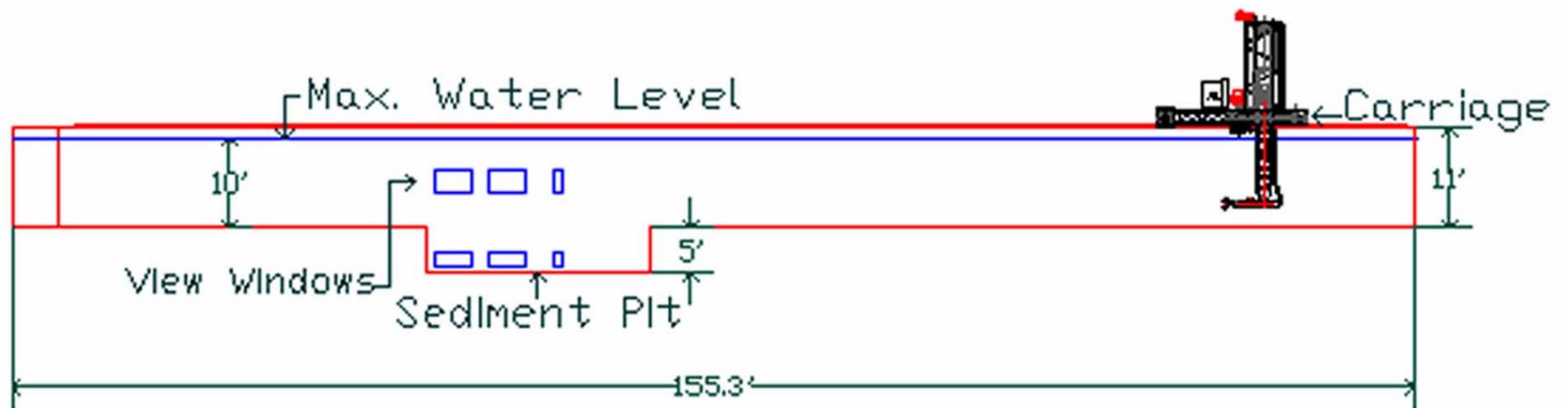
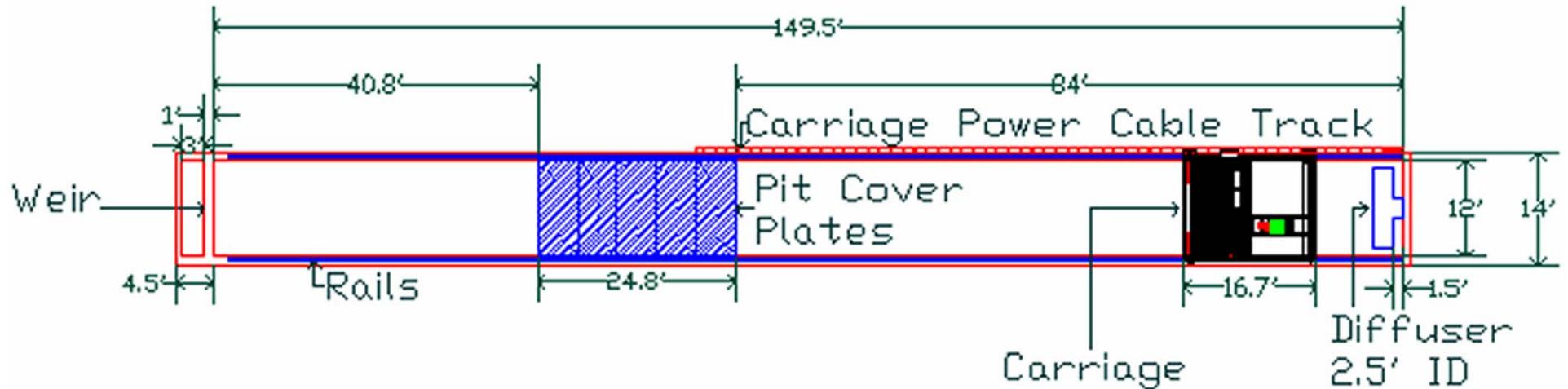
# TOW/DREDGE TANK

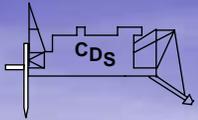


- $L=150$  ft,  $W=12$  ft,  $D=10$  ft
- Sediment Pit  $L=25$  ft,  $W=12$  ft,  $D=5$  ft
- 35,000 GPM flow rate through tank
- Dredge/Tow Carriage, max speed= 6.6 ft/s
- View Windows

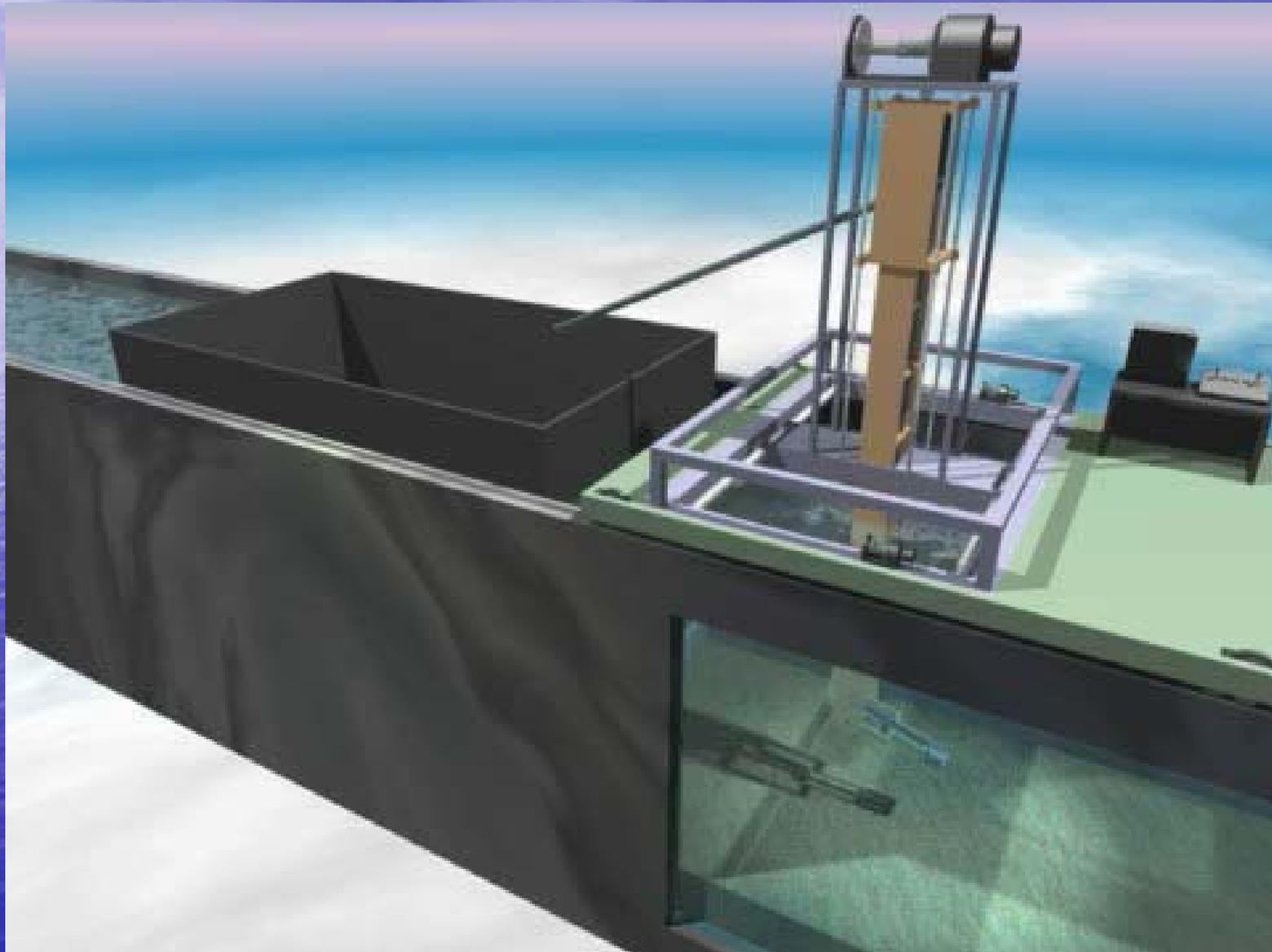


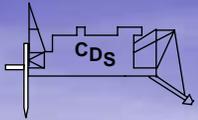
# Dredge/Tow Flume





# DREDGING OPERATION

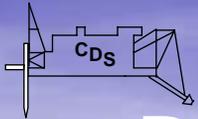




# Dredge Carriage

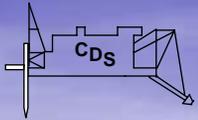
- Approximately 10,000 lb
- Incorporates an upper vertical ladder
- Cradle moves the ladder side-to-side
- Simulates the swinging motion of a cutterhead dredge
- Guide wheels on the starboard rail





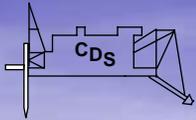
# Dredge Pump Working (August 2005)





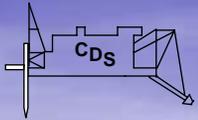
# Wireless Control and Data Acquisition System (August 2005)





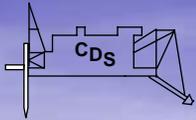
# Dredge/Tow Carriage Characteristics

| Category                                 | Characteristic                                      |
|--|---|
| Maximum Carriage Speed                   | 2 m/s (6.6 ft/s)                                    |
| Distance to reach constant speed         | 3.1 m (10 ft)                                       |
| Total Dredge/Tow Carriage Weight         | 4545 kg (10,000 lb)                                 |
| Cradle Weight                            | 1364 kg (3,000 lb)                                  |
| Ladder Weight                            | 909 kg (2,000 lb)                                   |
| Carriage Power                           | Two 3.8 kW (5 hp) motors                            |
| Cutter Power                             | 7.5 kW (10 hp)                                      |
| Pump Power                               | 14.9 kW (20 hp)                                     |
| Side to Side Cradle Motor Power          | 1.1 kW (1.5 hp)                                     |
| Vertical Ladder Motor Power              | 1.1 kW (1.5 hp)                                     |
| Articulating Ladder Position Motor Power | 0.5 kW (0.8 hp)                                     |
| Dredge Pump Flow Rate                    | Maximum 1893 LPM (500 GPM)                          |
| Dredge Pump Size                         | 10.4 cm ( 4 in), suction; 7.62 cm (3 in), discharge |
| Control System                           | Wireless LPC Automated and manual operation         |
| Data Acquisition                         | Real-time display & data storage (MS Entivity)      |
| Swing Travel                             | 1.6 m (5.3 ft) on either side of flume centerline   |
| Ladder Angle                             | 0 to 50 degrees from horizontal                     |



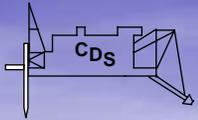
# How Can Dredge Carriage Be Used

- Suction inlet optimization
- Turbidity and resuspension of sediments during dredging
- Cutter evaluation and design optimization
- Draghead design
- Cutter comparisons
- Draghead and cutterhead production measurements
- Dredged material placement from hopper barges
- Erosion of dredged material mounds and islands
- Development of cutterhead and draghead vision systems
- Draghead and cutterhead modifications to protect marine life
- Capping of contaminated sediments
- Model dredges at 1:10 scale or larger



# Completed Projects

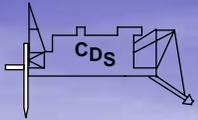
- Oil Spill Modeling, Dredge Tow Tank, Nov 2002
- River Meander and Erosion, Shallow Water Wave Basin, Aug 2003-Aug 2004
- Installation of Directional Random Wave Maker, Shallow Water Wave Basin, Dec 2004 – June 2005
- Tidal Inlet Study for Sea Grant, July 2005
- Installation of Dredge/Tow Carriage, Dredge/Tow Tank, Apr 2005 – Oct 2005.
- River Scour Studies, Dredge/Tow Tank, Aug 2005 - Present



# Summary

- Designed to model dredges from full to 1:10 scale
- Vertical ladder has load cells to measure loads
- Instruments measure cutter torque, pump suction and discharge pressure, pump rpm & torque, flow rate, density, carriage and ladder position
- Power for all dredge carriage systems is electrical
- Wireless technology used for data acquisition and control
- Max carriage speed ~ 2 m/s





# HAYNES COASTAL ENGINEERING LABORATORY VIRTUAL TOUR

- <http://oceaneng.civil.tamu.edu/>

The background is a vertical gradient of blue. The top portion shows a sky with wispy, light-colored clouds. A thin, bright white line representing a horizon separates the sky from the water below. The bottom portion of the image shows a deep blue sea with subtle ripples on its surface.

THANKS FOR LISTENING