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DREDGING RESEARCH AND EDUCATION AT THE CENTER FOR DREDGING STUDIES

Robert E. Randall
Bauer Professor of Dredging
Director, Center for Dredging Studies
Texas A&M University

Presentation Outline

- **INTRODUCTION**
- **HISTORY**
- **DREDGING RESEARCH**
- **ACADEMIC AND CONTINUING EDUCATION**
- **LABORATORY FACILITIES**
- **CONCLUSIONS**

Objective

- Describe the Center's recent 20 years of dredging research, educational programs, and model testing capabilities in the dredge flume in the Haynes Coastal Engineering Laboratory.

ACKNOWLEDGMENTS

- ❖ Graduate students, dredging companies, consulting firms, and the Corps of Engineers for funding research and participating in short courses conducted by the Center for Dredging Studies
- ❖ Model Dredge Carriage
 - ❖ Barrett and Margaret Hindes Foundation contribution for the B.G. Hindes dredge carriage construction
 - ❖ Digital Automation and Control Systems – Peter deJong
 - ❖ Oilfield Electric Marine – Kevin Williams
 - ❖ Dredging Supply Co., GIW Industries, Krohne, Ohmart, CableArm
- ❖ William H. Bauer – Bauer Professorship in Dredging Engineering
- ❖ Barrett and Margaret Hindes education endowment fund provides scholarships to ocean engineering graduate students with dredging interest
- ❖ Larry Patella & WEDA

Brief History

- ❖ The late John Herbich founded the Center for Dredging Studies in 1968
- ❖ Dredging Laboratory built in 1968 in Hydromechanics Laboratory
- ❖ Texas A&M Annual Dredging Seminar (1 day) began in 1970
- ❖ First Dredging Engineering Short Course began in 1969
- ❖ WEDA Technical Conference and Texas A&M Dredging Seminar agreed in 1992 to jointly host a 2 ½ Dredging Conference.
- ❖ Bob Randall became Center Director in 1993.
- ❖ Cutter Suction Dredge Simulator short course began 1999 as a joint effort between Texas A&M and DACS (Peter deJong).
- ❖ Haynes Coastal Engineering Laboratory was dedicated in 2003
- ❖ B.G.Hindes Model Dredge Carriage was christened in 2007
- ❖ Dredging Laboratory in Hydromechanics Lab was demolished in 2012
- ❖ Discussions are underway for the expansion of the Haynes Lab to include a replacement dredging facility in 2015.

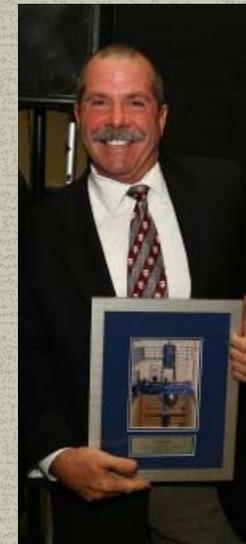
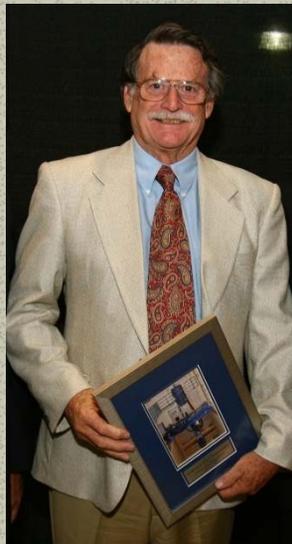
Some Recent and Past DSC Lecturers



History of Dredging Laboratory in Hydromechanics Building at Texas A&M



B. G. Hindes Model Dredge Carriage Christening 2007



Development of Model Dredge Carriage and Modeling Laws

Glover, MS, 2002. Glover, G. J. and Randall, R. E. "Scaling of Model Hydraulic Dredges with Application to Design of a Dredge Modeling Facility", *Journal of Dredging Engineering*, Western Dredging Association (WEDA), Vol. 6, No. 2, September, 2004.

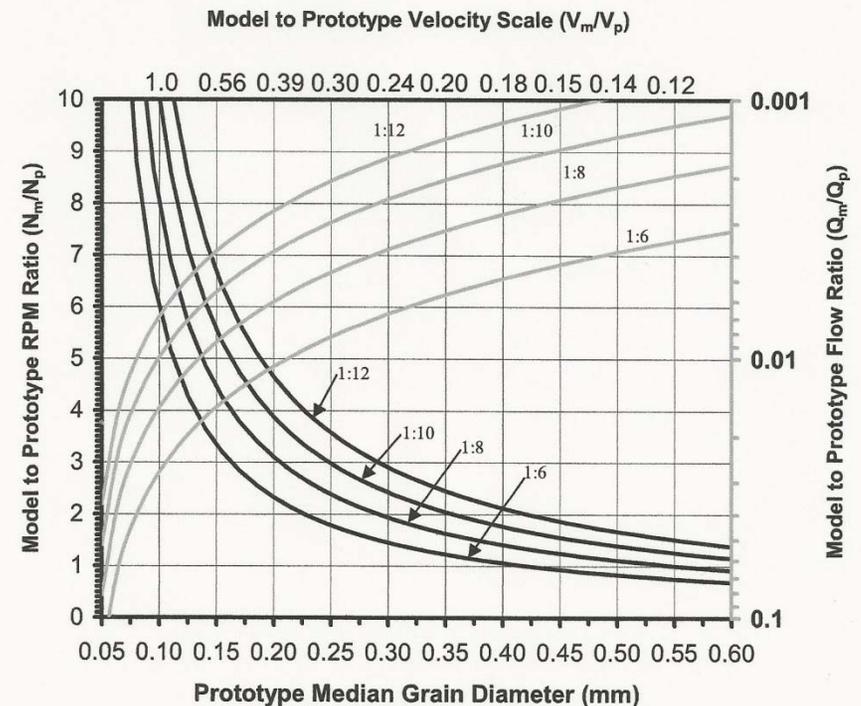
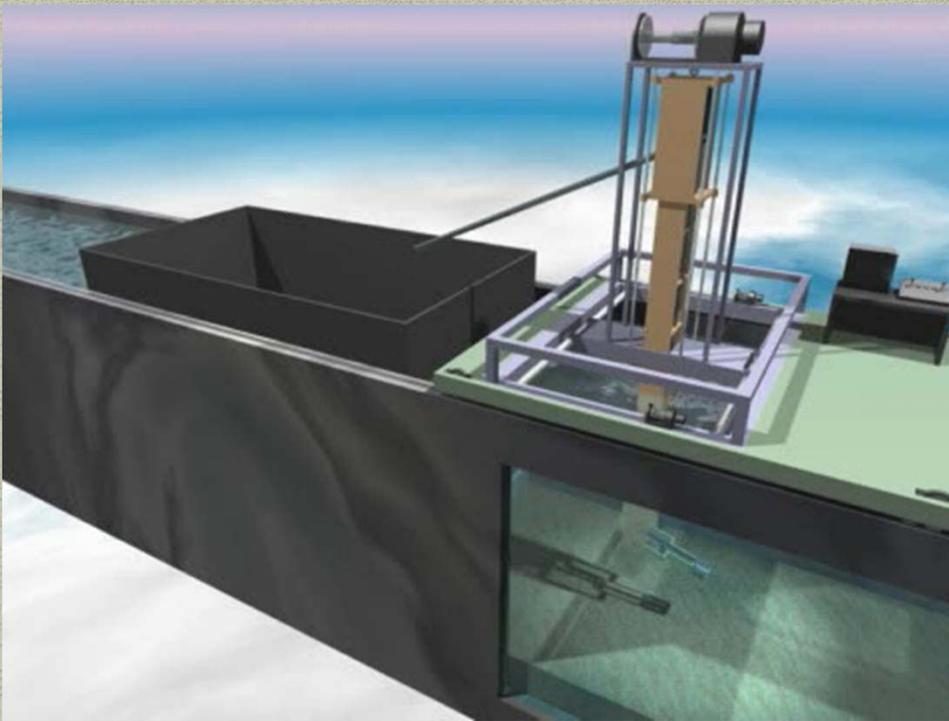
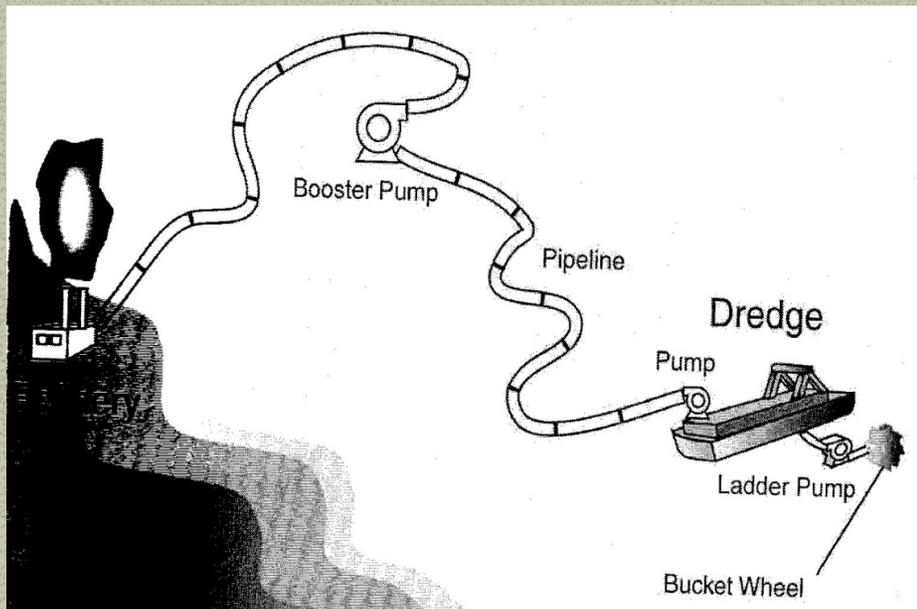


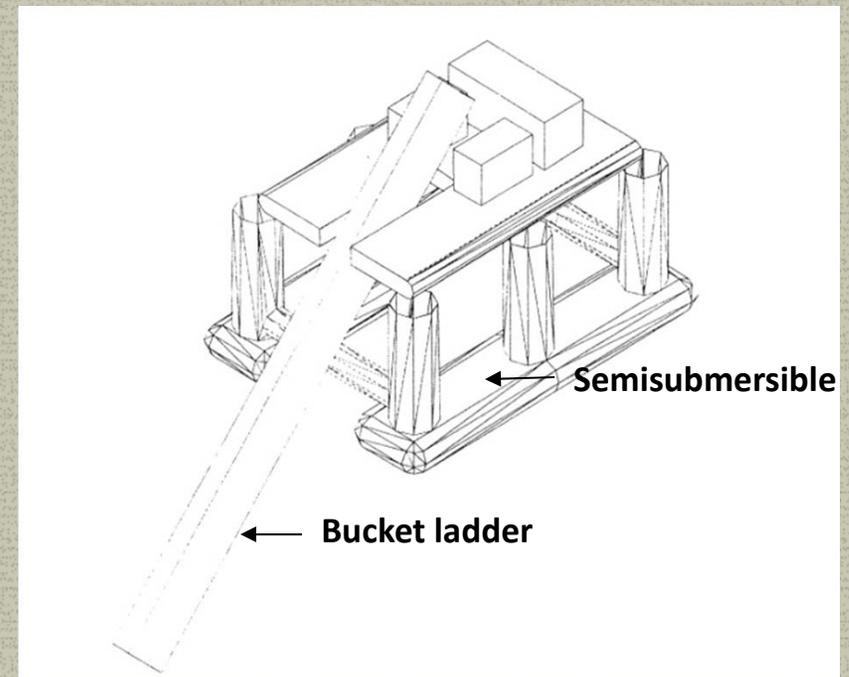
Figure 5: Chart for Selecting Model Dredge Operating Parameters (Model $d_{50} = 0.1$ mm)

Bucket Wheel Dredge Simulation and Semisubmersible Hull for Tin Mining Bucket Ladder Dredge

Albar, PhD Thesis 2001, Albar, A., et al. "A Bucketwheel Dredge System for Offshore Tin Mining Beyond the 50 Meter Water Depth, *International Journal of Ocean Engineering*, 2002.



Arcandra, MS Thesis 1998, Arcandra, et al. "Dynamic Analysis of a Semisubmersible-type Bucket Ladder Dredge," *Marine Technology Journal*, SNAME, 1999.



Resuspension of Sediments

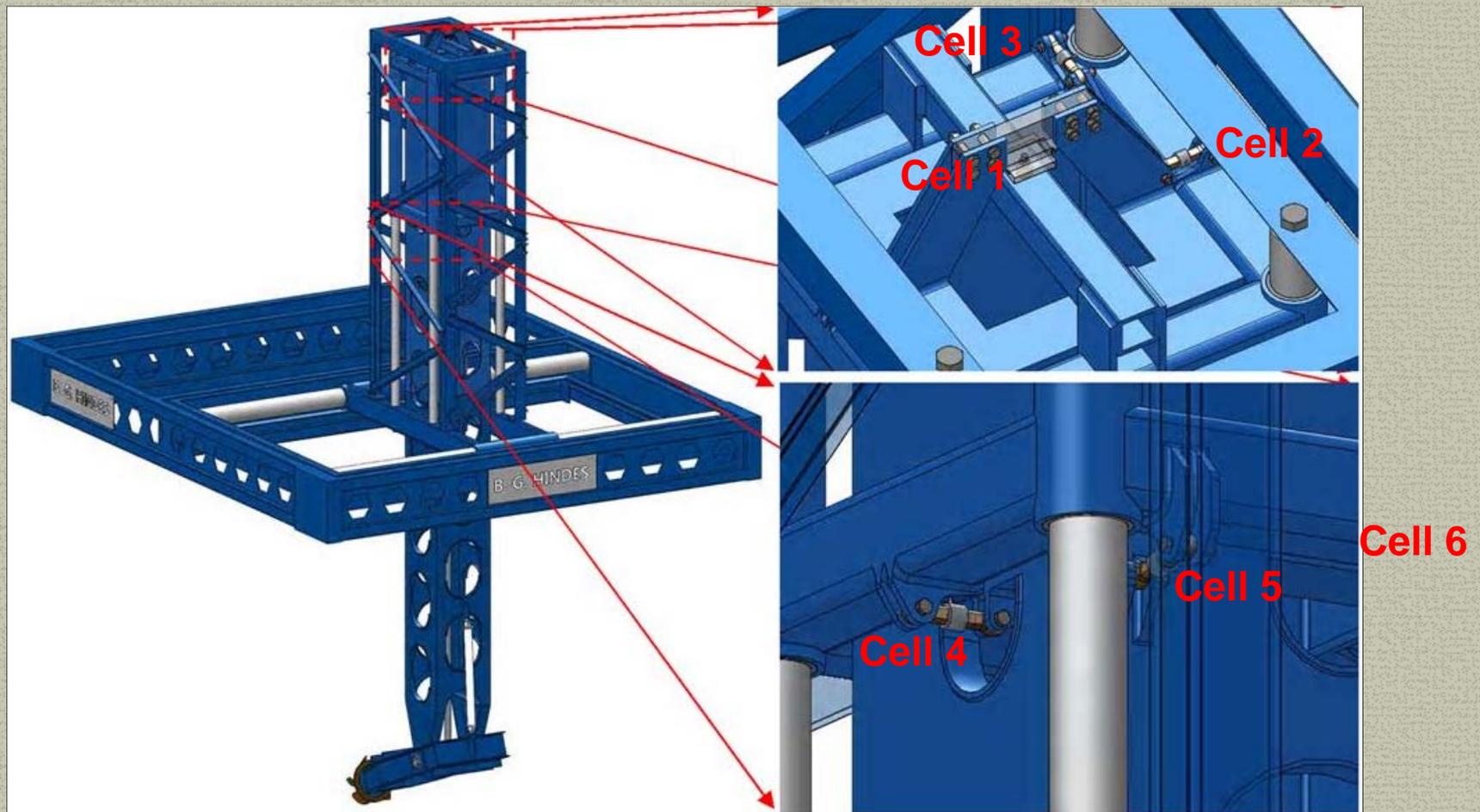


- Near field resuspension model developed based on data.
- Henriksen, PhD Dissertation 2009
- Henriksen et al , Near-Field Resuspension Model for a Cutter Suction Dredge," *Journal of Waterway, Port, Coastal and Ocean Engineering*, ASCE, Vol. 138, No. 3, pp. 181-191, May 2012.



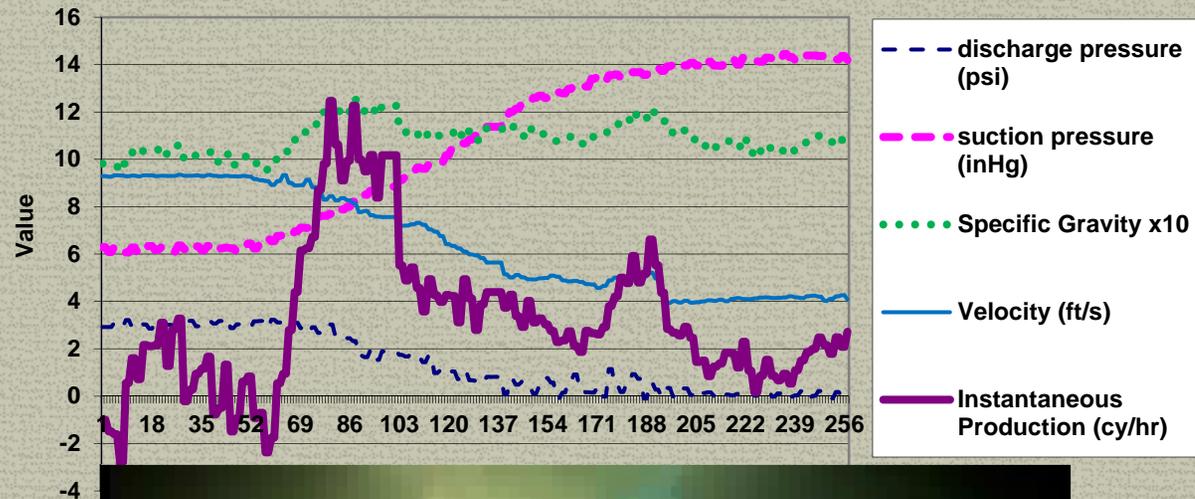
Cutter Force Measurement using the Model Cutter Suction Dredge

(Young, MS Thesis, 2009; Journal of Dredging Engineering, Vol. 11, No. 1, WEDA, April 2011.)



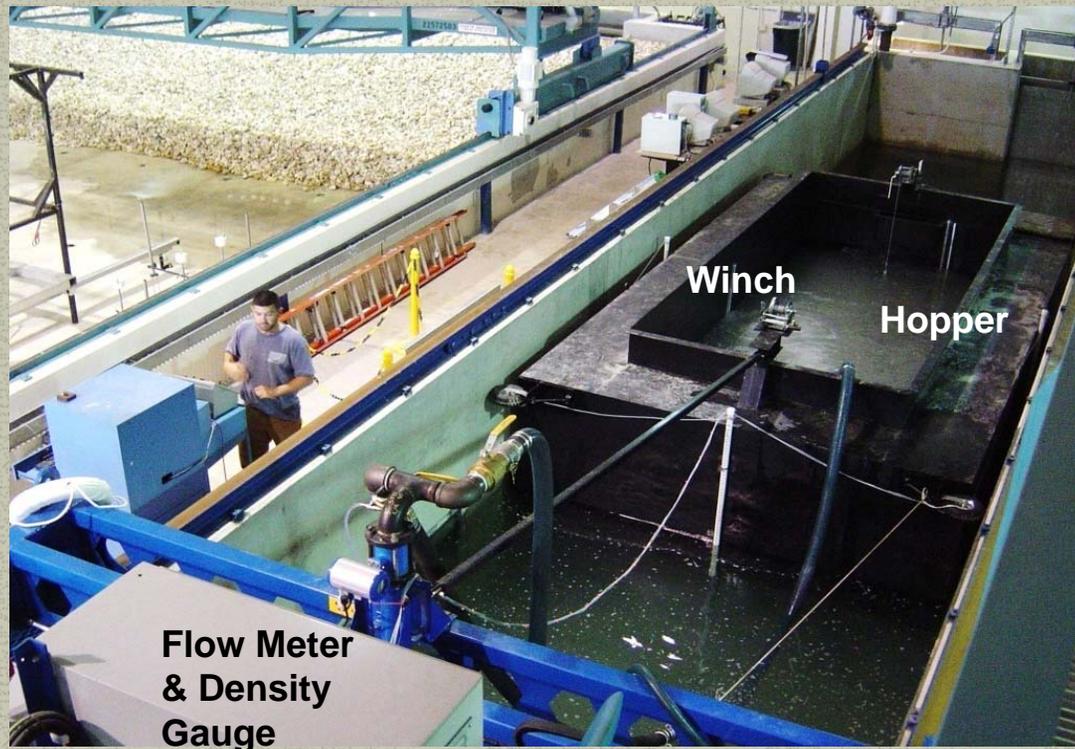
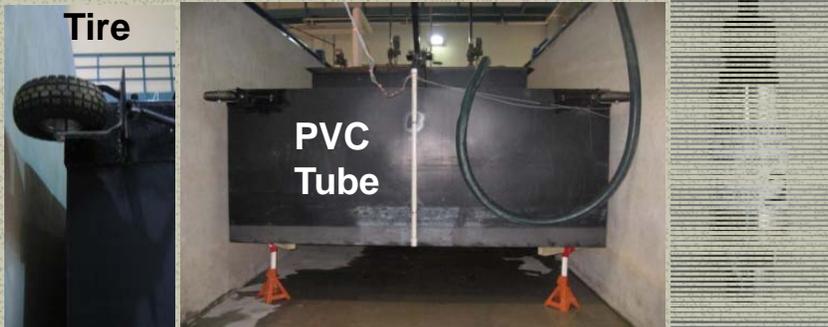
Debris Effect on Model Dredge Production (2008)

Randall, R., et al. WEDA 30/TAMU 41, 2010.



Laboratory Hopper Barge

Pressure Sensor



Clamshell Dredge (Donated by CableArm 2010)



Model Cutter (4 in, 10 cm) Suction Inlet Flow

Dismuke, C. and Randall, R. E. , WEDA32/TAMU 43, 2012.



Dredging Software Development

- ❖ ***Capping Placement (Randall, Clausner, Johnson, 2002)***
- ❖ ***Placement of Dredged Material***
 - ❖ ***Simulating Dredged Material Placement at Open Water Disposal Sites (Moritz and Randall 1995), Forerunner to USACE MDFATE software***
- ❖ ***Slurry Transport***
 - ❖ ***CDS slurry pipeline transport Excel spreadsheet (Koo 1998)***
- ❖ ***Cost Estimating***
 - ❖ ***CDS Combined Cost Estimating Excel spreadsheet***
 - ❖ ***Cutter suction pipeline dredge (Miertschin 1998, Augur 2012)***
 - ❖ ***Hopper dredge (Belesimo 2000, Hollinberger 2010)***
 - ❖ ***Mechanical clamshell dredge (Emmons 2005, Adair 2004)***
- ❖ ***Production and Booster Pump Location***
 - ❖ ***CDS production and ladder and booster pump Excel spreadsheet (Augur, Blackburn, Dearing, Sonne, & Yeh 2013)***

Dredging Engineering Short Courses 1970-Present



42nd Dredging Short Course (2013)



37th Dredging Short Course 2008



33rd Dredging Short Course 2004

Small Slurry Pipe Loop for Demonstrating Critical Velocity for Slurry Flows

(Williams, ME Project, 2010)



Cutter Suction Dredge Simulator Short Courses 1999-Present 2013 – J.F. Brennan



Graduate Marine Dredging Course Topics

- ❖ History, Dredging Equipment
- ❖ Dredge Pumps, Pump Affinity Laws, Pump Characteristic Curves, Dredge Pump Modeling
- ❖ Slurry Effects on Dredge Pumps, Dredge Pump System Curves, Cavitation and Gas Effects
- ❖ Sediment Characteristics & Classification, Settling Velocity
- ❖ Pipeline Transport of Dredged Material, Slurry Composition, Critical Velocity
- ❖ Dredge Production Evaluation, Velocity, Pressure, and Cutter Limitations, Instrumentation
- ❖ Environmental Laws, Framework for Environmental Evaluation of Dredged Material for Disposal, Environmental Impact Statements
- ❖ Dredged Material Placement Alternatives, Confined Disposal Facilities, SETTLE Numerical Model
- ❖ Open Water Placement of Dredged Material, STFATE and MDFATE Numerical Models.
- ❖ Beneficial Uses of Dredged Material
- ❖ Contaminated Sediment, Capping of Contaminated Sediments
- ❖ Dredging Windows, Silt Curtains, Resuspension of Dredged Sediments, Monitoring of Dredging Operations, Dredging Costs
- ❖ Student Design Project Presentations

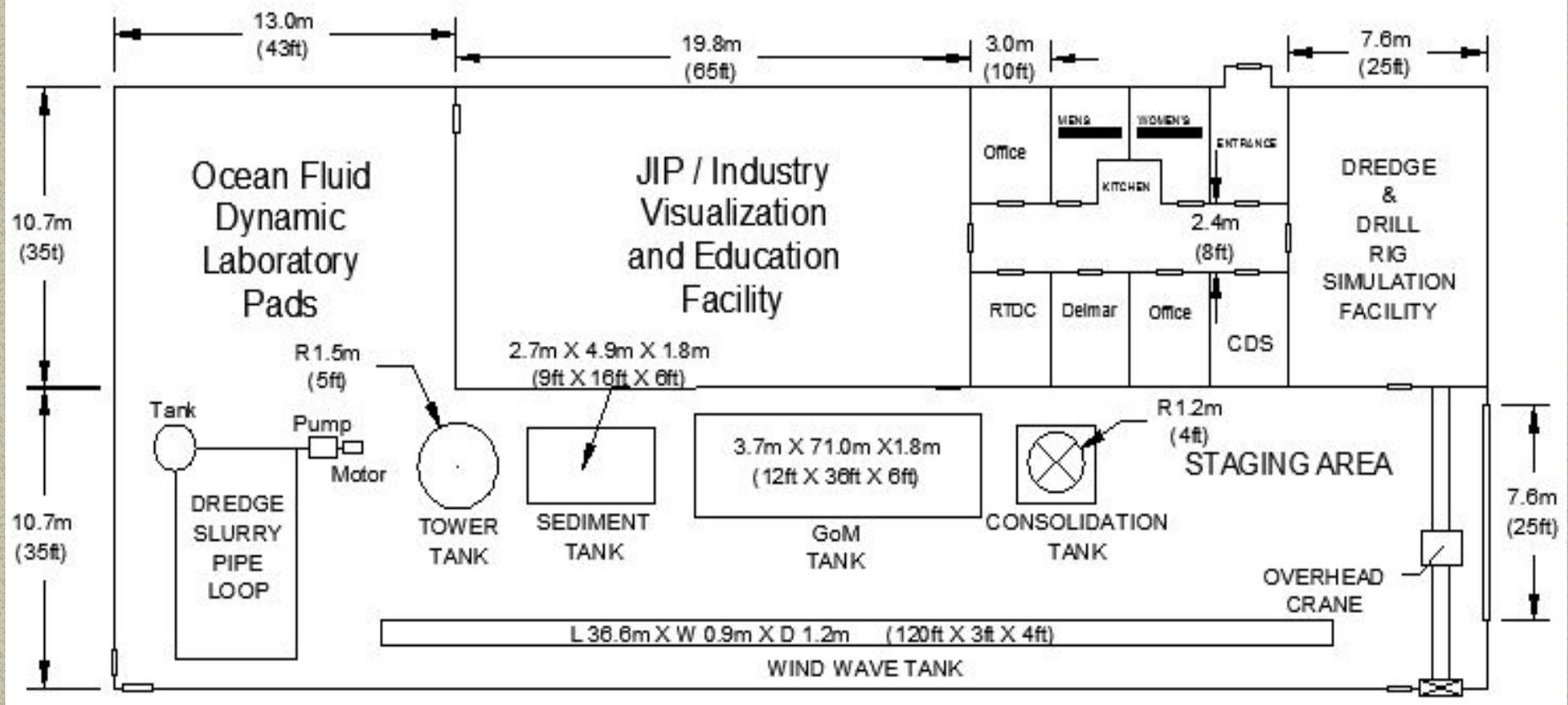
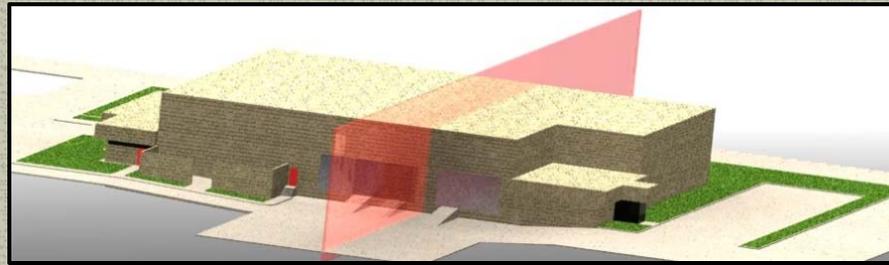
Texas A&M Dredging Seminar

- ❖ 1969- 1993 Texas A&M Dredging Seminar was a one day seminar held in locations such as Houston, New Orleans, Las Vegas, Atlantic City, Virginia Beach, Mobile, Portland, Tacoma, Baltimore, and Toronto
- ❖ First joint WEDA Technical Conference & Texas A&M Dredging Seminar in 1992
- ❖ 1992 WEDA 13 & TAMU 25 in Mobile and 2013 WEDA 33 & TAMU 44 in Honolulu – 22 years of cooperation
- ❖ CEDA and Technical University of Delft have a similar cooperation
- ❖ Texas A&M Dredging Seminar has produced >500 dredging related papers over 44 years

Haynes Coastal Engineering Laboratory Facilities



Expansion Proposal for Haynes Laboratory



Conclusions

- ❖ Dredging Engineering Short Course and Cutter Suction Dredge Simulator Short Course are ongoing for 44 and 14 years, respectively.
- ❖ Texas A&M Dredging Seminar continues to present new knowledge to the dredging industry.
- ❖ Research on the resuspension of sediments resulted in a near field source model for modeling transport of suspended sediments.
- ❖ A model cutter suction dredge working in debris shows the fouling of the suction inlet causes production to decrease by approximately 50%.
- ❖ A new ladder load cell arrangement has been installed to determine the cutting forces on the model cutterhead dredge.
- ❖ A model instrumented hopper barge available for cutter suction or hopper dredge tests.
- ❖ Expansion of the Haynes Laboratory to include additional dredging laboratory facility is being considered and funding is being sought.

Thank You

Mahalo

- Questions

