OCEAN SYSTEM SIMULATION & CONTROL LABORATORY (OSSCL)

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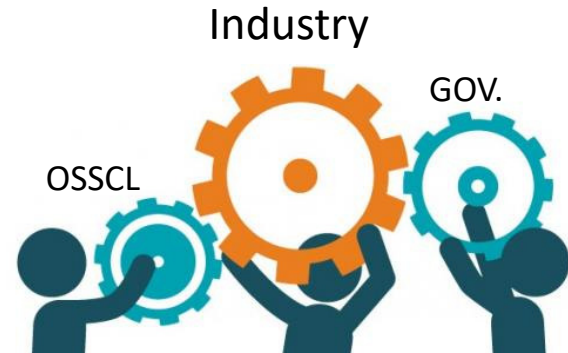hykang@tamu.edu   979-218-0846

Vision

- A research center that practically benefits ocean industry through Ocean System **Simulation** and **Control Consortium.**

Captured from https://youtu.be/JvrB9PMane4

Industry

GOV.

OSSCL

Objectives

- Identify contemporary challenges in Ocean Industry and develop innovative cost effective solutions.

- Develop Integrated Suite of Variable Fidelity Computational Tools including Control for Ocean Systems: the alternative or extended counterpart to physical model testing & the complete package to design various ocean systems.

- Develop Smarter Ocean Systems including advanced materials and controls: cost reduction and safety improvements with less crew.

- Advance Long-term Fundamental Researches.

Integrated Suite of Variable Fidelity Computational Tools including Control

- **Fluid Dynamics**
  Boundary Element Methods (Potential) & Computational Fluid Dynamics (Viscid) & Particle-based Methods

- **Floating Body Dynamics**
  Small motions & Large motions

- **Mooring-Riser Dynamics**
  Small extensible rod dynamics & Large extensible rod dynamic & Beam dynamics

- **Hydroelasticity**
  Modal method & Direct coupling & Full or Local load-mapping

- **Control**
  Semi-active/active control & Linear/nonlinear control

- **Structure Dynamics**
  Small deformation & Large deformation

Smarter Ocean Systems

- **Advanced Material Application:** Magneto-rheological damping tensioner (real-time control of tensioner damping and stiffness to extend operability)

- **Control Application:** High-accuracy dynamic positioning system or Wave feed-forward dynamic positioning system

- **Health Monitoring:** Real-time monitoring with optimum sensor (monitor real-time motion of riser or detect damages to column structures)

To achieve optimum operation with less crew and safety improvement.

Long-term Fundamental Researches

- **Nonlinearities in Fluid and Structure Dynamics:** Nonlinear hydroelasticity, Nonlinear hydrodynamics for forward speed vessels, Particle-based simulation, Advanced CFD simulation, Hydrophobic surface

- **Advanced Controls:** Dynamic positioning within ice impacts, Low motion controls for dry-tree semi submersible.

- **High-performance Computation:** CPU vs. GPU parallel computation, Optimum resolution of CFD, Efficient load-mapping, Fast fluid dynamics solvers

- **System Innovation and Advanced Materials Application**

Operation Plan
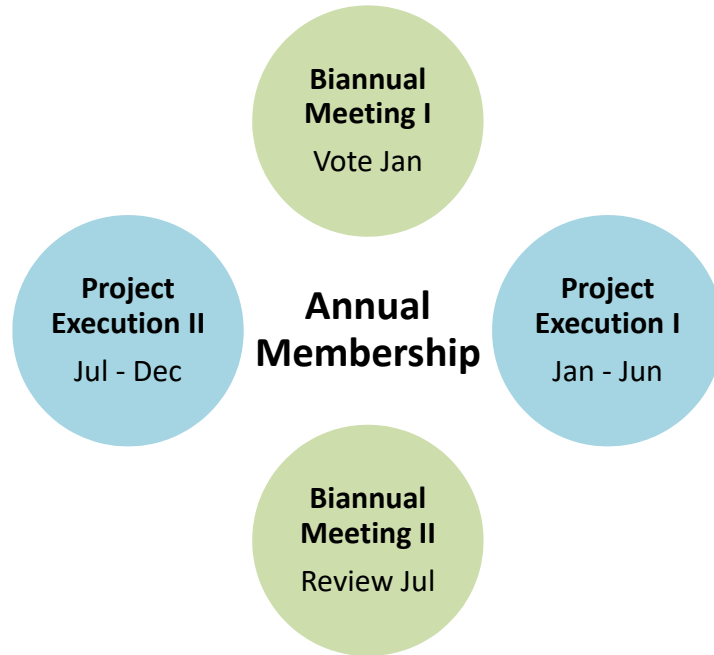
- **Membership:** Diamond $20,000 (1.5 weighting), Gold $14,000, Silver $7,000 (0.5 weighting)

- **Joint Industry Project:** for specific interests, separate projects can be developed.

- **Short Courses:** annual training for industrial professionals.

- **Symposium:** annual international conference.

- **Long-term:** NSF IUCRC 15-year plan

NSF IUCRC

Industry-University Cooperative Research Center

- Contributes to the nation's research enterprise by **developing long-term partnerships** among industry, academe, and government;

- Leverages NSF funds with industry to **support** graduate students performing **industrially relevant pre-competitive research**;

- Expands the innovation capacity of our nation's **competitive workforce through partnerships between industries and universities**; and

- Encourages the nation's research enterprise to **remain competitive through active engagement with academic and industrial leaders** throughout the world.

NSF IUCRC

Industry-University Cooperative Research Center

offshore/coastal/
subsea/renewable

naval defense/
robotics/offshore wind

- Industrial Advisory Board vote research projects annually
- Strict membership requirements in the number and cash contribution

  ($150K +$150, $200K+100K, $250K+50K, 3)
- Annual evaluation measures industry and university interaction (#publication, #hiring, #tech transfer)
- NSF directs centers to achieve objectives.
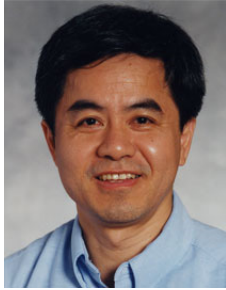
Faculty

OCEAN SYSTEM SIMULATION&
CONTROL LABORATORY
Department of Ocean Engineering

Dr. Joseph M.H. Kim
Professor of OCEN/CVEN
Director of OSSCL

Dr. Hamn-Ching Chen
Professor of OCEN/CVEN
Holder of A.P. & Florence
Wiley Professor I

Dr. Jeffrey M. Falzarano
Professor of OCEN/CVEN
Graduate Program Coordinator

Dr. Sharath S. Girimaji
Professor of OCEN/AERO
Department Head
Holder of Wofford Cain Chair II

Dr. Robert E. Randall
Professor of OCEN
W. H. Bauer Professor in Dredging
Engineering
Director of Dredging Center

Dr. Robert Skelton
TEES Distinguished Research Professor
of OCEN/AERO
Member of NAE

Dr. Robert Gordon
Senior Lecturer of OCEN

Dr. Marc Perlin
Professor of OCEN
Associate Department Head

Dr. Juan J. Horrillo
Associate Professor of OCEN

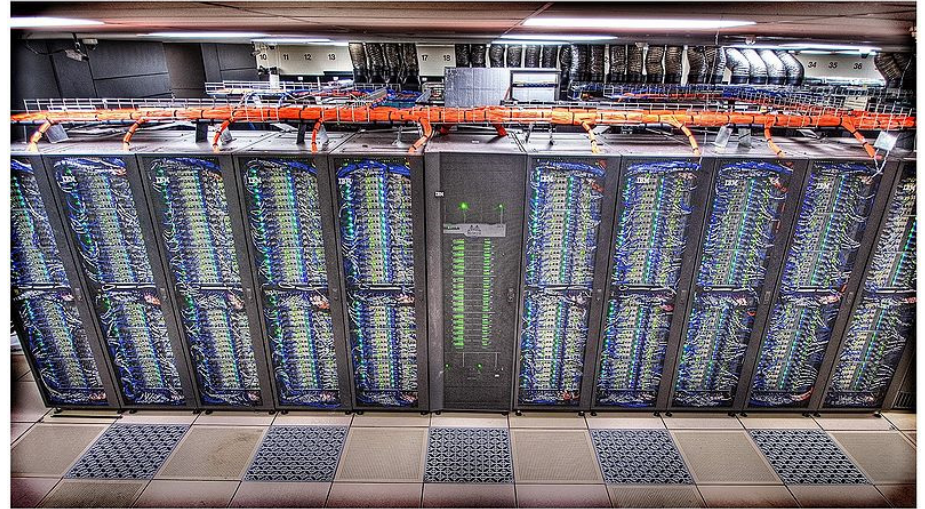Dr. John A. Bert Sweetman
Professor of OCEN

Dr. HeonYong Kang
Research Assistant Professor of OCEN
Assistant Director of OSSCL

Facilities (Supercomputing)

OCEAN SYSTEM SIMULATION&
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Department of Ocean Engineering

- **TERRA (8,512 cores of 304 nodes)**
  CPU 256 nodes & GPU 48 nodes

- **ADA (17,340 cores of 852 nodes)**
  CPU 792 nodes & GPU 30 nodes

Available Program: StarCCM+, Ansys, Abaqus, OpenFOAM, LS-DYNA
External Resource: Stampede UT

Membership Benefits

Selection of Research Topics (about $40K fees in common interests can launch a project)

Exclusive Research Reports

Direct access to TAMU HPC at academic rate

Discount or customize short courses, Discount symposium registration or license fees)

Train graduate students for prospective hiring.

- Diamond Member: The number of vote 1.5, Complementary consulting on commercial program usage

- Gold Member: The number of vote 1

- Silver Member: The number of vote 0.5

Participants

- Agreed to join

Chevron (Chair), ConocoPhillips, DSME, HHI, SHI, NREL, KRISO

- More than 7 companies pending final statement, including BV and DNVGL

- More than 5 companies positively considering, including Glosten, Petronas

- Many others in review.

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