

# **Maritime Institute @ NUS (MI@NUS)**

***Chow Yean Khow***  
***Executive Director, MI@NUS***

# Structure of MI @ NUS

The Maritime Institute @ NUS (MI@NUS) functions as a Maritime and Offshore Cluster Office to drive and coordinate the maritime and offshore education, training and R&D activities within NUS in partnership with the following NUS research institutes/centres:

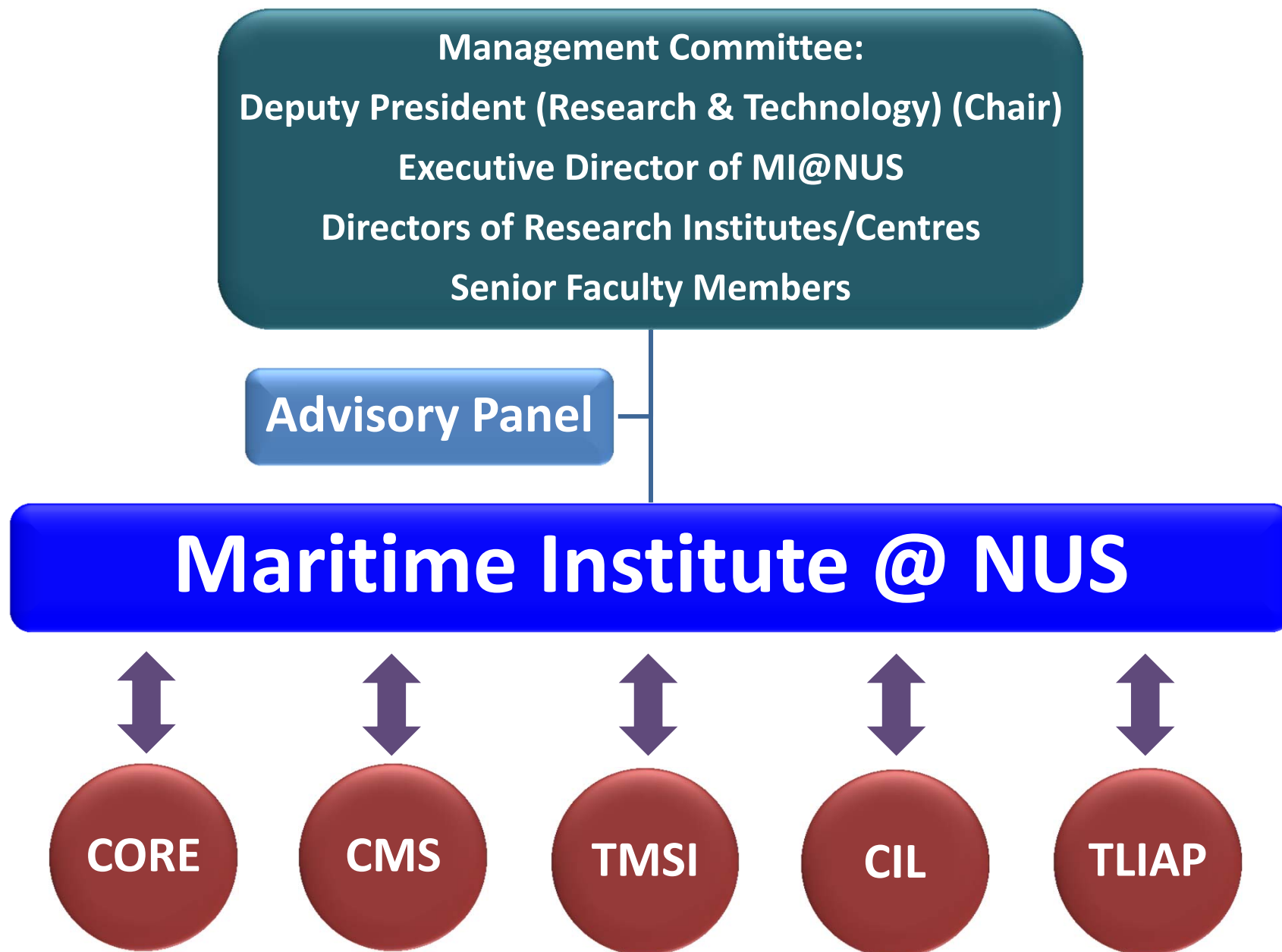
- Centre for Offshore Research and Engineering (CORE)
- Centre for Maritime Studies (CMS)
- Tropical Marine Science Institute (TMSI)
- Centre for International Law (CIL)
- The Logistics Institute - Asia Pacific (TLIAP)

# Structure of MI @ NUS



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## ***Chairman***

- Prof Barry Halliwell, Deputy President (Research & Technology)

## ***Members***

- Prof Chan Eng Soon, Dean, Faculty of Engineering
- Prof Chow Yean Khaw, Executive Director, MI@NUS and CORE
- Prof Bernard Tan, Director, CMS
- Prof Peter Ng, Director, TMSI
- Assoc Prof Robert Beckman, Director, CIL
- Dr Robert de Souza, Executive Director, TLIAP
- Prof Lim Hock, Director, RGE, ODPRT
- Dr Wang Hui, Director, Research Administration, ODPRT

## ***In attendance***

- Prof Choo Yoo Sang, Director (Research), CORE
- Dr Andre Wan, Research Director, ODPRT

# Roles of MI@NUS



NUS  
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- Drive and coordinate the maritime and offshore education, training and R&D programmes and initiatives within NUS by working closely with NUS Research Institutes/Centres
- Promote R&D collaboration with industry, research institutes and tertiary institutions
- Organise conferences, symposia, workshops, seminars and other events for knowledge-sharing and interaction with industry
- Provide oversight and administrative support to the programmes/projects funded by SMI

## ***Keppel Professorship***

- Prof Torgeir Moan, NTNU (Dec 2002 - Dec 2006)
- Prof Andrew Palmer (Apr 2007 – Oct 2012)

## ***Lloyd's Register Educational Trust Professorship***

- Prof Peter Marshall, formerly Shell (Mar 2007 - Mar 2009)
- Prof Choo Yoo Sang

## ***MPA Maritime Technology Professorship***

- Prof Rodney Eatock Taylor, Oxford University
- Prof Paul Taylor, Oxford University
- Prof John Dempsey, Clarkson University
- Dr John Halkyard, formerly Technip

## ***EDB Subsea Engineering Professorships Programme***

- Dr Bil Loth, WD Loth and Company
- Alistair Birnie, Denmore Tech Ltd, formerly CEO Subsea UK and Global Head of Technology, Aker Subsea

## ***MPA Professorship in Maritime Law***

- Professor Steven Hazelwood, Sem 1, 2012/2013
- Assoc Prof Paul Andrew Myburg, Sem 2, 2012/2013

## ***MPA Professorship in Shipping Economics***

- Selection of appointee for 2012/2013 in progress

## *Offshore Technology*

- B.Eng. (Civil) with Specialization in Offshore Engineering (2004)
- B.Eng. (Mech) with Specialization in Offshore Oil & Gas Technology (2005)  
*(with a Track in Subsea Engineering: August 2012)*
- M.Sc. (Civil) with Specialization in Offshore Engineering (2006)
- M.Sc. (Mech) with Specialization in Offshore Oil & Gas Technology (2007)
- M.Sc. in Offshore Technology (Aug 2011) integrating the above 2 M.Sc.  
*(with a Specialization in Subsea Engineering: August 2012)*
- M.Eng. and Ph.D. Research in Offshore Technology
- Joint Ph.D. Programme with University of São Paulo, Brazil in the field of Marine, Ocean and Offshore Engineering (in discussion)



# Education Programmes & Manpower Development

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## *Maritime & Shipping*

- Graduate Diploma in Maritime Law and Arbitration
- Master of Laws (Maritime Law)
- Maritime & Shipping Economics Module
- Port Economics Module
- Dual Master Degree in Logistics and Supply Chain Management - TLIAP
  - *Master of Science (Logistics & SCM) from NUS*
  - *Master of Science (Supply Chain Engineering) from Georgia Tech*
- Master of Science in Supply Chain Management - TLIAP

# Continuing Education Programmes



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- Keppel Offshore & Marine Annual Lecture
- Lloyd's Register Educational Trust (LRET) Annual Lecture
- CORE Seminar Series; CMS Seminar Series
- Joint CORE, SNAMEs, Joint Branch of RINA and IMarEST Technical Talks
- Conferences, Symposia and Workshops (e.g. MTEC (2007, 2011); OSV (2007, 2009); MOSS (2008, 2012); Deepwater Development Workshop (2008); LRET Marine Research Workshop (2010); NSRI-CORE Subsea Symposium (2010); ABS-CORE Offshore Geotechnics Workshop (2012); DNV-NUS Pipelines Open Day (2012))
- Regional conferences/workshops on issues of concern to Asia with the CIL-sponsored participation of government officials/leading researchers from ASEAN countries (e.g. joint development in the South China Sea)

# CORE: Major Research Programmes



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## ***Offshore Technology Research Programme (A\*STAR, MPA)***

15 projects covering smart sensing, re-assessment and retrofitting, and fracture resistance and repair of offshore structures; intelligent deepwater mooring systems; LNG sloshing; subsea processing; AUV; methane hydrates; pipeline-soil interaction; offshore foundation systems (jack-up spudcan foundations; plate anchors, torpedo anchors)

## ***Multiphase Flow Analysis for Downhole Oil & Gas Equipment (A\*STAR)***

7 projects addressing constitutive and numerical modeling of multiphase flow, and multiphase flow processes and issues concerning flow assurance; heavy oil production and downhole equipment design

## ***Materials Innovation for Marine & Offshore Industry (A\*STAR)***

6 projects covering mainly design and analysis of composite risers and joints; fatigue, durability and impact survivability of composite risers; study on novel composite materials for risers

# CORE: Joint Industry Projects (JIPs)



Maritime Institute

## 1. JIP on Static and Fatigue Strength of Grout-Reinforced Tubular Joints

**Sponsors:**       

## 2. JIP on Improved Partial Joint Penetration (PJP-plus) Welded Tubular Joints

**Sponsors:**    

## 3. JIP on Spudcan-Pile Interaction

**Sponsors:**     

## 4. JIP on Spudcan-Footprint Remediation

**Sponsors:**      
   

## 5. InSafe JIP (Jack-up Foundation Assessment Study)

**Project Team:** RPS Energy; NUS; University of Oxford; University of Western Australia

**Sponsors:** ABS; ConocoPhillips; ExxonMobil; Shell UK; Braemar Falconer; Fugro; Geo-Danish Geotechnical Institute, Global Maritime; Noble Drilling; GL Noble Denton; Premier Oil & Gas Services; Premium Drilling/COSL; DONG Energy; HSE UK; ENSCO International; Keppel Offshore & Marine; Maersk Drilling; Matthews Daniel; Transocean (Global Santa Fe)

# InSafe Joint Industry Project



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## ***IMPROVED GUIDELINES FOR THE PREDICTION OF GEOTECHNICAL PERFORMANCE OF SPUDCAN FOUNDATIONS DURING INSTALLATION AND REMOVAL OF JACK-UP UNITS***

### **Work Scope**

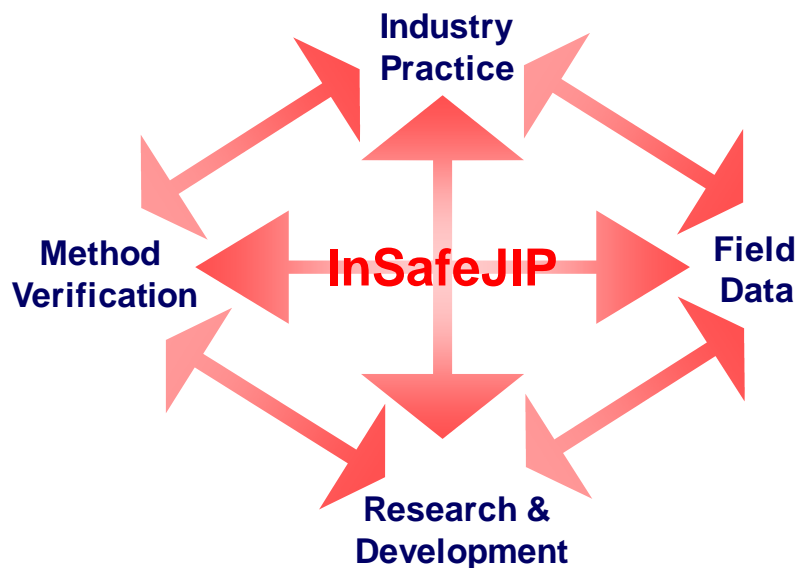
- Site investigation & lab testing
- Spudcan bearing capacity predictions; punch-through
- Spudcan operation related issues

### **Project Team**



### **Project Sponsors**

American Bureau of Shipping	GEO-Danish Geotechnical Institute	Noble Drilling
Braemar Falconer	GL Noble Denton	Premier Oil & Gas Services
ConocoPhillips	Global Maritime	Premium Drilling/COSL
DONG Energy	HSE UK	Shell UK Limited
ENSCO International	Keppel Offshore & Marine	Transocean (Global Santa Fe)
ExxonMobil	Maersk Drilling	
Fugro Singapore	Matthews Daniel	



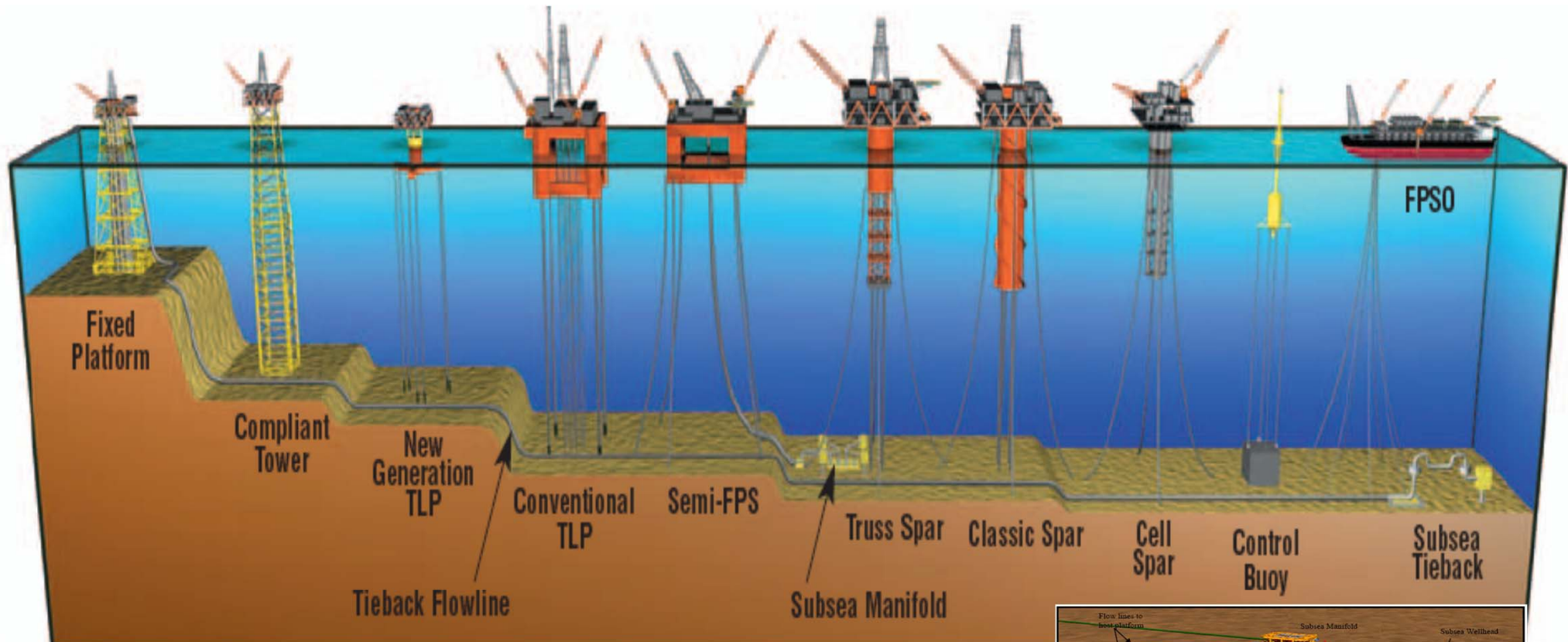


# CORE: Trends in Offshore Oil & Gas Exploration and Production

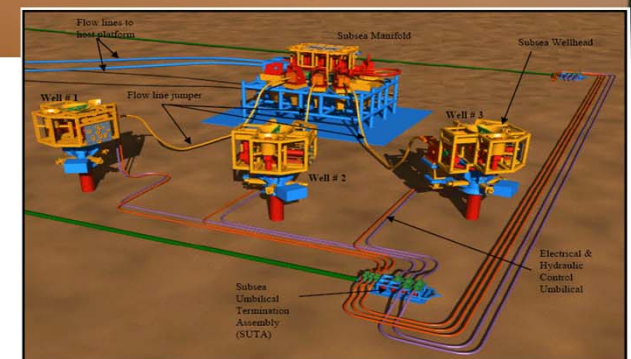


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## Deepwater Development Systems



Subsea systems



# CORE R&D: Major Focus on Deepwater Technology

## Deepwater Structural Systems

- Floating Structures
- Hydrodynamics & Wave-Structure Interaction
- Innovative Structural Systems
- Structural Integrity Management
- Moorings & Risers
- Marine Operations

## Subsea Systems

- Subsea Processing
- Subsea Compression
- Multiphase Flow
- Multiphase Pumping
- Multiphase Metering
- Produced Water Separation

## Seafloor & Subsurface Engineering

- Foundation Systems
- Pipelines
- Geohazards
- Methane Hydrates
- AUVs/Underwater Robotics



# CORE: M.Sc. In Offshore Technology



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## M.Sc. in Offshore Technology Modules

Module Code	Module Title
OT5001	Independent Study Module (8 MCs)
OT5101	Exploration and Production of Petroleum
OT5102	Oil & Gas Technology
OT5201	Marine Statics & Dynamics
OT5202	Analysis & Design of Offshore Structures
OT5203	Design of Floating Structures
OT5204	Moorings & Risers
OT5205	Offshore Pipelines
OT5206	Offshore Foundations
OT5207	Arctic Engineering
OT5208	Fatigue and Fracture for Offshore Structures
OT5301	Subsea Systems Engineering
OT5302	Flow Assurance
OT5303	Subsea Control
OT5304	Subsea Construction & Operational Support
OT5881	Topics in Offshore Engineering
OT5882	Topics in Subsea Engineering
CE5307	Wave Hydrodynamics and Physical Oceanography
ME5301	Flow Systems Analysis
ME5506	Corrosion of Materials



# $f(K)^N$ Consortium for Deepwater Solutions in Brazil



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## **Keppel Offshore & Marine**

The global leader in offshore rig design, construction and repair, ship repair and conversion, and specialized shipbuilding

## **Keppel Offshore & Marine Technology Centre**

Spearheads the R&D of new technologies, processes and competencies, across the spectrum of KOM's businesses



The joint venture between McDermott and KFELS to design, build and deliver deepwater floating production systems



A leading research-intensive university at the cutting edge of knowledge creation. The Centre for Offshore Research and Engineering (CORE) and the Maritime Institute @ NUS represents NUS in this Consortium.

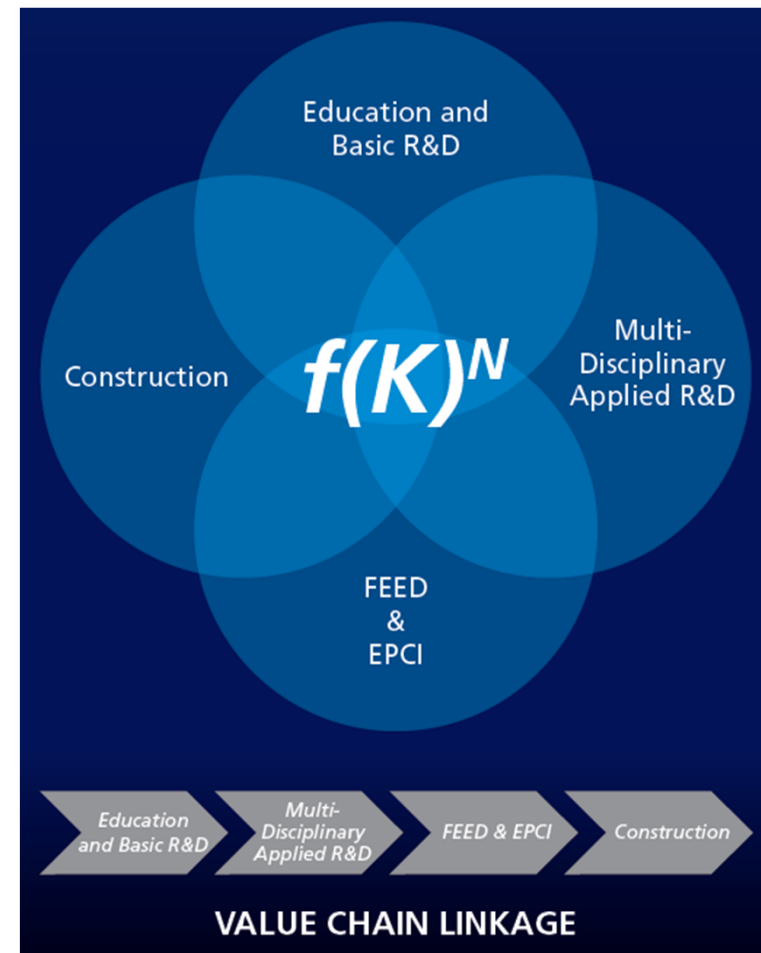
**MOU signed on 9 May 2012**

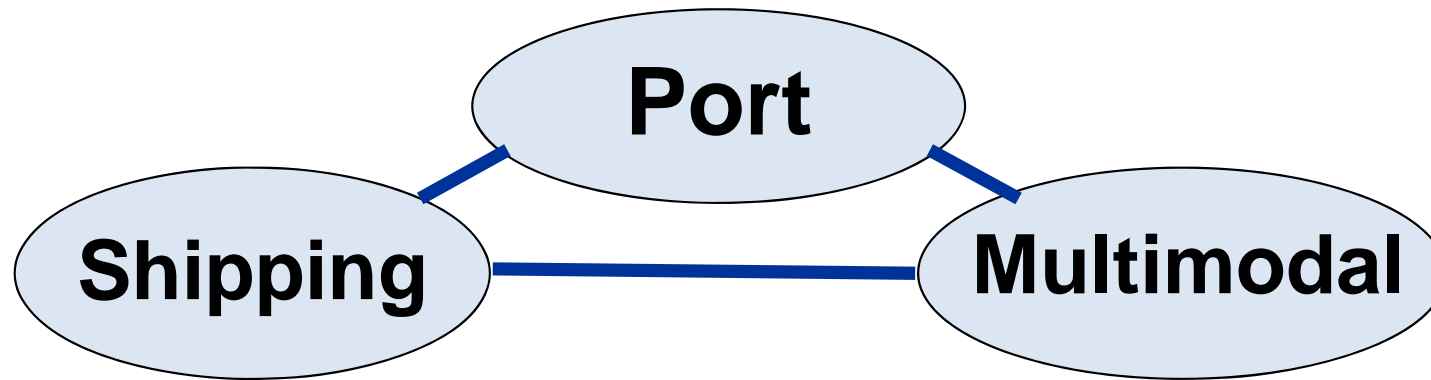


# $f(K)^N$ Consortium for Deepwater Solutions in Brazil

## *Programmes and Scope of Activities*

- Promote relevant workshops and seminars among the universities, research institutes and industry players in Brazil
- Invite outstanding academics for visiting professorships and research fellowships
- Promote engineering postgraduate programmes at NUS and Brazilian Universities to look into the challenges facing the deepwater industry
- Facilitate technology exchange between Brazil's ocean basin, tow tank and numerical laboratories and Singapore's research institutes
- Promote engineering undergraduate exchange programmes between NUS and the Brazilian universities





- Shipping, freight transport & logistics modeling
- Port planning and management
- Maritime strategies and management
- Multimodal freight transportation
- Maritime information technology
- Maritime environmental management

# CMS: Research Focus Areas



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## ***Maritime Policy & Management Cluster***

- Maritime policy & planning
- Maritime economics & finance
- Maritime strategies & management

## ***Maritime Operations & Modeling Cluster***

- Shipping & logistics transportation
- Multimodal freight infrastructure planning & management
- Port operations modeling & analysis
- Port planning & development
- Marine cluster planning & operations management
- General cargo logistics
- Maritime information technology
- Maritime communications technology
- Maritime vessel and navigation simulation
- Maritime environmental management

# CMS: Joint Industry Projects



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## **1. Global Liner Shipping Network Analysis**

**Sponsors:** *NOL Fellowship, APL Co Pte Ltd*

## **2. Port Carbon Footprint Study**

**Sponsors:** *Jurong Port Pte Ltd*

## **3. Development of Ship Sale Form**

**Sponsors:** *Singapore Maritime Foundation*

## **4. East and Southeast Asia Port Database Development**

**Sponsors:** *National Land Planning Association, Japan*

## **5. Quantitative Risk Assessment for Shipping Operations**

**Sponsors:** *MPA MINT Fund, Dalian Maritime University*

## **6. Port and Shipping Hinterland Developments in Asia**

**Sponsors:** *NOL Fellowship, Kainan University, Inha University*

## **7. MicroPort and MicroCity Simulation Model**

**Sponsors:** *Global Centre of Excellence, Kyoto University*



# TMSI: Marine Science Research



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## Sensing & Monitoring

- Real time water monitoring
- Current measurements
- Side scan seabed mapping
- Vertical land movement
- Coastal line retreat/erosion
- Underwater Acoustic Communications
- Ambient Noise Studies
- Cooperative Autonomous Underwater Vehicles



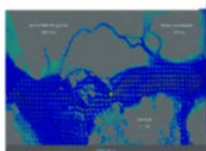
## Climate Change Research

- Rainfall Temperature. Wind. Sea Level Changes, Storm Surges, Ocean current changes and anomalies
- Effects on Environment, Coastal Erosion, Infectious Disease. Impacts on Energy Demand and Emissions



## Modelling

- Coastal Hydrodynamics
- Tsunami and Wave Dynamics
- Ocean currents and ship movement patterns
- Sediment Transport
- Hydrology, Hydro-informatics
- Water Quality
- Oil/pollutant Spills
- GIS, Informatics



## Ecology

- Biodiversity, Invasive Species
- Marine Biosecurity: Antifouling, Ballast Water Management, Harmful Algal Blooms
- Environmental Monitoring, Pollution, Impact Assessment
- Ecological Modelling and Engineering
- Bio-energy, Sustainability
- Shipping impacts on marine mammals
- Underwater Vision



# TMSI Research: Ocean Modelling for Maritime Operations

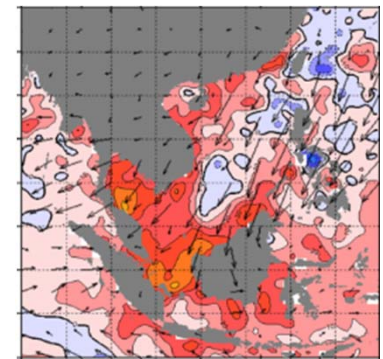
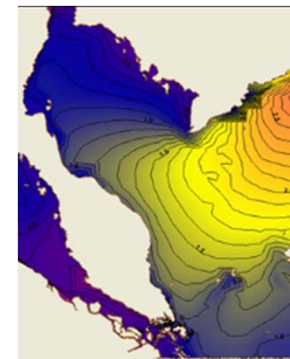
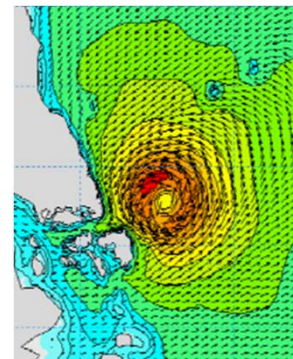
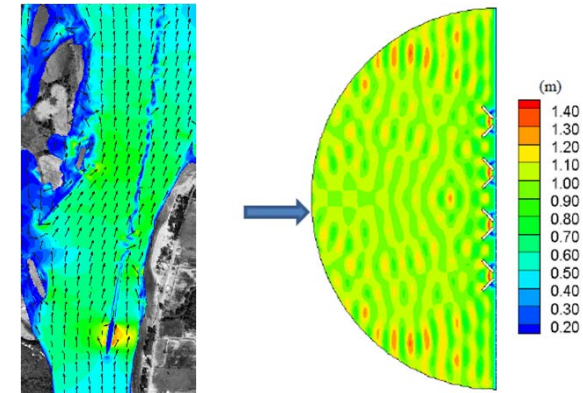


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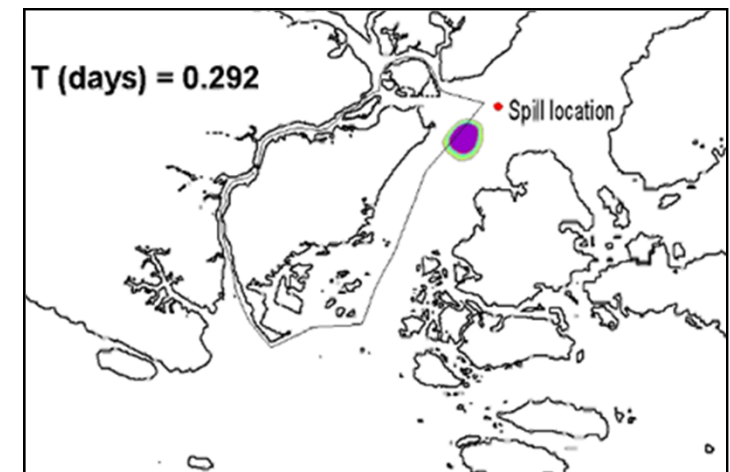
## ***Maritime Operations & Modeling***

- Harbor modeling & design
  - Ship Wakes
  - Wave-Structure Interaction
  - Wave-Current Interaction
- Ocean forecasting
  - Typhoons
  - Currents
  - Wind-Waves
  - Storm Surges
  - Search & Rescue



## ***Maritime Environmental Modeling***

- Oil Spills
- Ballast Water Discharges





# TMSI Research : Marine Biofouling & Antifouling R&D



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## ***Marine Biofouling Research***

- Biofouling surveys, hull inspection
- Fouling management
- Alien invasive species

## ***Antifouling Testing & Performance***

- *ASTM Static Field Immersion Tests*
- *Rapid field tests to screen for novel antifouling coatings*
- *Laboratory bioassays for antifouling activity against microalgae, barnacle, calcareous tubeworms*

## ***Antifouling Technology Development***

- *Novel biocides (NUS-A\*ICES-MPA)*
- *Novel materials - A\*SERC Innovative Marine Antifouling Solutions Research Program (NUS-A\*IMRE-ICES-SIMTECH)*





Law and policy issues relating to:

## ***Offshore Platforms***

- Risks and opportunities arising from abandoned and disused offshore platforms in Southeast Asia, including the feasibility of converting offshore platforms to artificial reefs
- Research on feasibility of global and/or regional regulations and best practices for the prevention of pollution from offshore platforms and installations
- Research on liability and compensation schemes applicable to major oil spills from offshore platforms and installations
- Note: 2012 MOU with Institute of Technology Petronas for collaboration and joint research on offshore activities (including decommissioning) and other ocean policy issues

## ***Submarine Cables and Pipelines***

- *Handbook on Submarine Cables and Law of Sea*, in partnership with the International Cable Protection Committee (industry organization of cable owners and operators) [Co-Editors, publication in process]

## ***South China Sea Disputes***

Study of the international legal issues relating to the South China Sea disputes, including the prospects for joint development arrangements.

## ***South China Sea Marine Biodiversity***

Study of the features in the South China Sea and their surrounding marine habitats for the monitoring of marine biodiversity and its protection from shipping and other offshore activities.

## ***Piracy & International Maritime Crimes***

Examination of the capability of international law to combat piracy, ship-hijacking, hostage-taking and maritime terrorism, as well as problems faced by States in implementing global and regional conventions on international maritime crimes. [Book published in 2012]

## ***Industry Collaboration***

On-going dialogue with industry through seminars and workshops.

## Supply Chain Intelligence:

This area seeks to focus on providing an overarching analysis of the logistics market, the trade flows, and economic barometers of the various countries in Asia as far as it pertains to effective supply chain management for various industries.

## Supply Chain Technology:

This is an emerging area and intends to look at the test bedding of RFID and data capture related technologies, within the context of an independent environment. Policy and implementation issues pertaining to new supply chain technology and the end-to-end supply chain network are undertaken on a contract research basis.

## Supply Chain Optimization:

This, being the traditional and existing strength of the Institute, seeks to deepen expertise in supply chain global network design and optimisation, involving the respective modes of transportation.



## Network Sustainability Modelling

To provide a 'technical reference' for a sustainable supply chain network modelling reference, using commercial optimisation and simulation tools as a basis

## Sustainability Opportunity Assessment

To provide a comprehensive framework of supply chain sustainability best practice, with causal modelling to identify carbon and cost opportunities

# TLIAP: New Areas of Research



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## Master facilitative control tower for risk management of complex supply chains

- Develop advanced Control Tower capabilities for companies to manage their supply chains
- Develop an infrastructure to enable dynamic exchanges between Control Towers to better manage risks from disruptions



## Humanitarian Supply Chain Programme

Serve as a neutral knowledge broker to the sector at large, capturing and disseminating Supply Chain Management (SCM) knowledge and best practices.



## Kühne Foundation – NUS Education Centre for Humanitarian Logistics Asia Pacific



## City Logistics

Multi party coordination for last mile logistics in an urban environment

# TLIAP: Industry Outreach



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THE LOGISTICS INSTITUTE - ASIA PACIFIC

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**DB SCHENKER**



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**MINDEF**  
SINGAPORE

**MOT**  
MINISTRY OF TRANSPORT



**SPRING**  
singapore  
Enabling Enterprise



**WDA**  
singapore  
workforce  
development  
agency

## The THINK Portfolio

THINK  
Executive

THINK  
IT

THINK  
Sustainability

THINK  
Humanitarian

THINK  
Logistics

One Concept –  
Different Target Groups

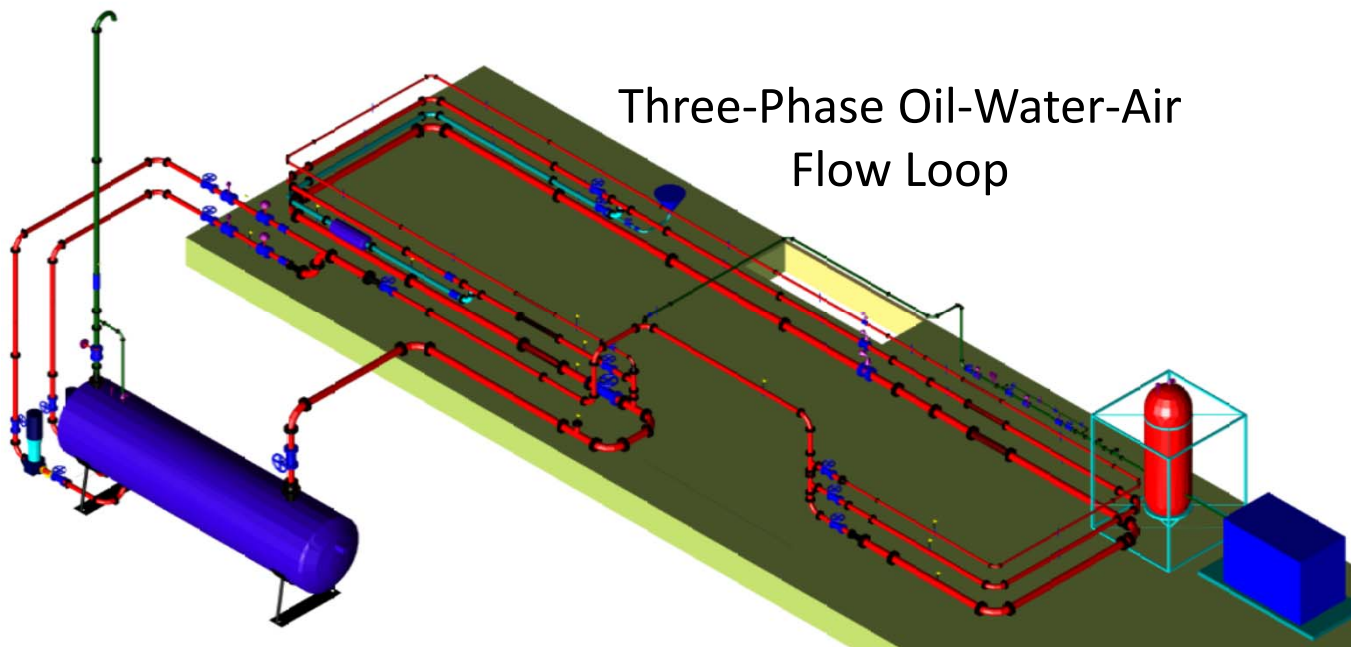
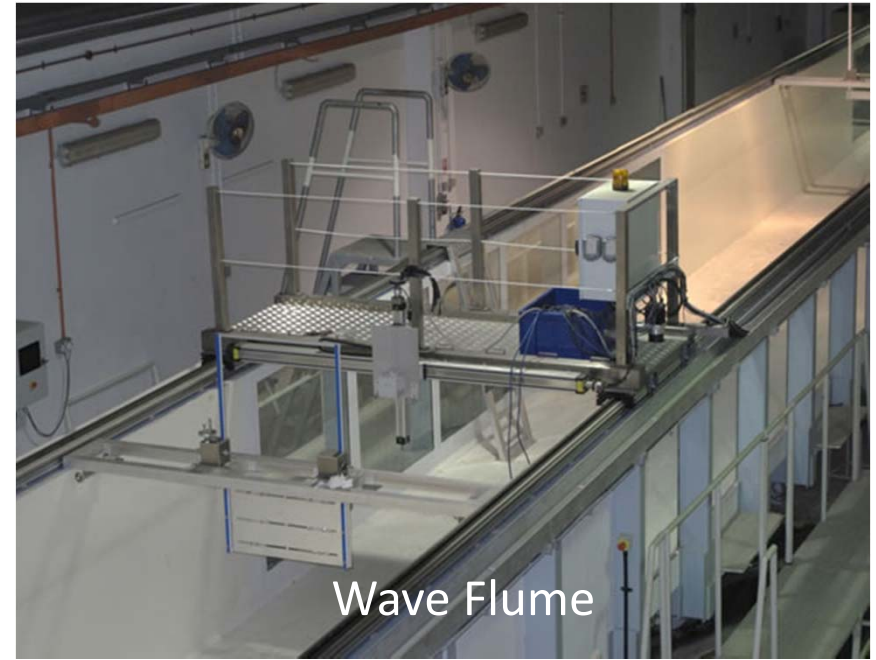
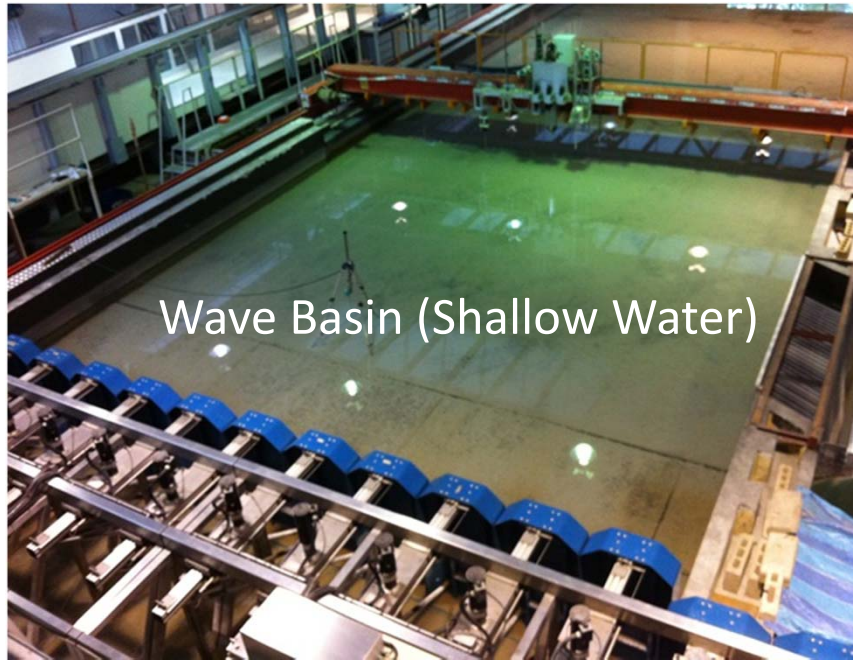


# Research Facilities





# Research Facilities



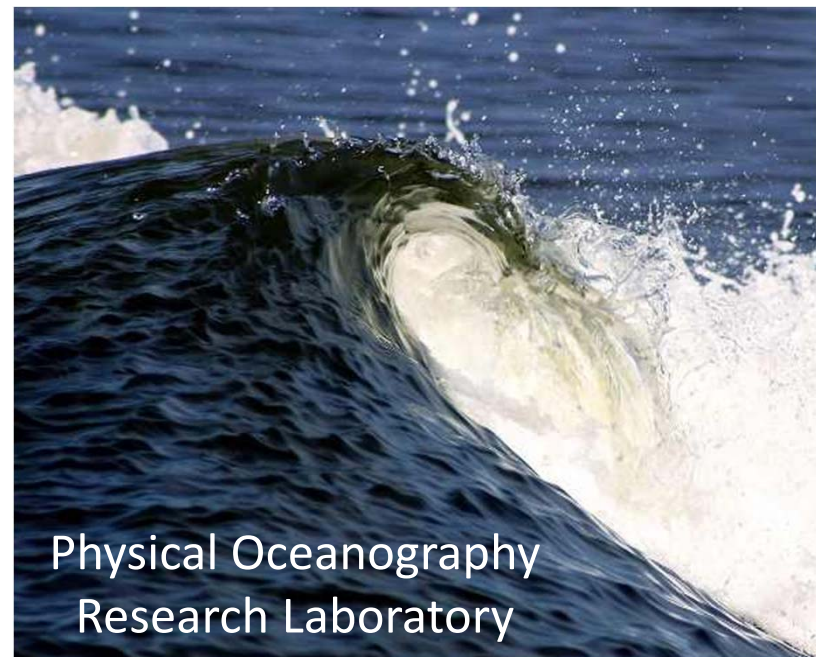
# TMSI Research Laboratories



St. John's Island Marine Laboratory



Acoustic Research Laboratory



Physical Oceanography  
Research Laboratory



# Upcoming Plans



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Goals	Key Action Steps	Resource
<b>Education Programmes:</b> Benchmarking of education programmes with key universities in the field	Identify key universities in the field	Key universities identified and internet
<b>Education and Training:</b> Alignment of maritime and offshore education and training to needs of industry	Consult external stakeholders; conduct needs assessment	SMI, EDB, MPA, A*STAR, maritime and offshore companies
<b>Research &amp; Development:</b> Road mapping exercise on R&D focus areas and needs of industry	Consult internal and external stakeholders	Internal: CORE, CMS, TMSI, CIL, TLIAP External: SMI, A*STAR, MPA, EDB, maritime and offshore companies
<b>R&amp;D Collaboration with Industry:</b> Promote R&D collaboration and partnership with industry as well as research institutes and tertiary institutions	Engage in external and outreach activities	Maritime and offshore companies, research institutes and tertiary institutions