SEMBCORP MARINE AT A GLANCE

A global company providing innovative engineering solutions, products & services to the offshore, marine & energy industries.

>1300 Design Engineers
>400 Design, Innovations & Solutions
>500 Offshore Engineering Projects
>400 Vessels Serviced Annually

MPA Roundtable: Maritime Sector Strategies to Augment Tsunami Monitoring with Economic, Safety and Environmental Cobenefits, 22nd Aug 2019

Mr. Simon Kuik, VP & Head of R&D, Sembcorp Marine
Our World Class Offshore Engineering Business

- More than **580** Offshore Platforms, Rigs & Floaters Delivered
- Majority are installed in seismically stable zone
- Designs catered for extreme waves conditions

A global map locating historical tsunamis since 1650 and the deep-ocean assessment of tsunamis (DART) stations operated by eight entities as of Jul 2018. Ovals indicate four major regional tsunami warning systems that together comprise the global system Source: Is the World Ready for the Next Big Tsunami?, Oct 4, 2018, Elizabeth Miles, [https://foreignpolicy.com/2018/10/04/is-the-world-ready-for-the-next-big-tsunami/](https://foreignpolicy.com/2018/10/04/is-the-world-ready-for-the-next-big-tsunami/)
Our Solutions Are Designed To Withstand Harsh Environment
Extreme Wave & Seismic Load

- Governing rules and standards
  - API RP 2EQ Seismic Design Procedures and Criteria for Offshore Structures, Nov 2014

- Design criteria
  - Satisfactory capacity during extreme load event (wave with 100 year return period)
  - Satisfactory capacity during abnormal load event (earthquake with 2475 year return period)

- Safety factors
  - Operating environmental conditions: 2.0
  - Design environmental conditions: 1.5
  - ALE earthquake conditions: 1.0

Gravifloat: Redeployable Modularised LNG and LPG Terminals for Installation in Nearshore Waters

Tsunami height comparison
World's Biggest Tsunami | 1720 feet tall - Lituya Bay, Alaska

Gravity Meter
Allows researchers to study large gravity anomalies, which in turn is able to reveal geological features and resources.

Moorings
Put scientific equipment into the ocean to continuously collect data from sensors over a period of one to two years.

Sea Floor Sampling Equipment
Collect core samples up to 24m long, in up to 7,000m of ocean.

Gondola
Contains advanced sonar technology whereby acoustic signals are emitted in a beam 30km wide in water depths to 11.5km.

Weather Radar
- Gather data from clouds towering up to 20km above the tropical ocean to cold ice storms in the Antarctic, in a 150km radius from the ship.
- Collects information about the number, size, shape and movement of rain, hail, ice and snow.

State-of-the-Art
Marine Research Vessel, Supporting Australia’s Atmospheric, Oceanographic, Biological & Geosciences Research from the Tropical North to the Antarctic Ice-edge

Structures
- Ice-strengthened hull
- Ice Breakers
- Double acting ships™
- Harsh environment offshore structures
- Ice accretion

Acoustic Doppler Current Profilers

Product Excellence & Compliance
Safe, Reliable, Superior Products & Solutions
We Repair & Upgrade 400 Vessels Annually
Banyu Urip FSO: Wave Monitoring Systems (with Tsunami Feature)

Semcorp Marine Vision 2025

- 30% of Annual Company Turnover Generated from Sustainable Product Solutions
  - Integrated, Smart and Efficient Operation
  - Low Carbon Footprint Natural Gas Value Chain Solutions
  - Renewable Energy Sources
  - Use of Ozone-compatible Materials
  - E4R: Eliminate • Reduce • Reuse • Recycle • Recover
  - Material Resource Management
  - Water Resource Management
  - Waste Management and Recycling
  - World Ocean Council Commitment
  - Green Wave Environmental Care Competition
  - Chemical-free Ballast Water Management System
  - Responsible Corporate Practices and Policies

Highlights in Using Acoustic Doppler Current Profiler (ADCP) in Wave Monitoring
- An acoustic monitoring system that “looks” out horizontally from its mounting structure to measure near-surface water currents and optional multi-directional waves.
- Collects critical surface current and multi-directional waves data for a real-time understanding of offshore environment.
- Comparative waves data with metocean records can be used to identify the likelihood of a tsunami.