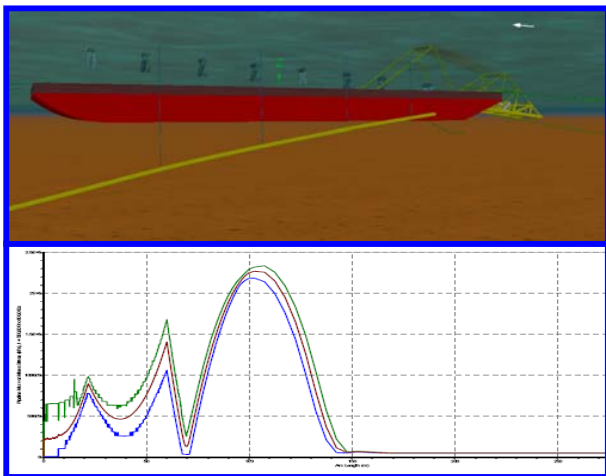
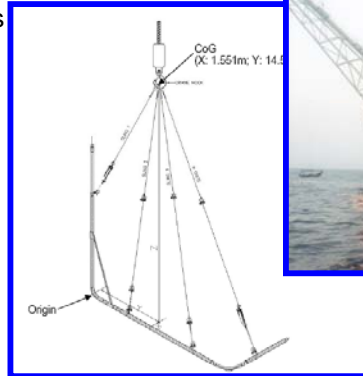


## INSTALLATION ENGINEERING CAPABILITIES

Over the last 5 years, in addition to FEED and DETAILED multidiscipline engineering competencies, ZEE has been enhancing the capabilities of carrying out the installation engineering for fixed structure, rigid & flexible pipelines and marine systems. ZEE has invested in advanced software, and has trained personnel to undertake such projects. ZEE continues to train in-house personnel, and new recruits to improve their technical skills. ZEE Installation engineering capabilities can be summarized as follow;

### FIXED STRUCTURES

- Jacket and Topside Lifting, Load out & Transportation Analysis
- Jacket Floatation and Upending Analysis
- Jacket Launch Analysis
- Jacket On Bottom Stability Analysis
- Pile Stick Up and Pile Driving Analysis
- Grillage and Sea-Fastening Analysis
- Barge Stability (Intact & Damaged) and Longitudinal Strength / Motion Study
- Towing Analysis

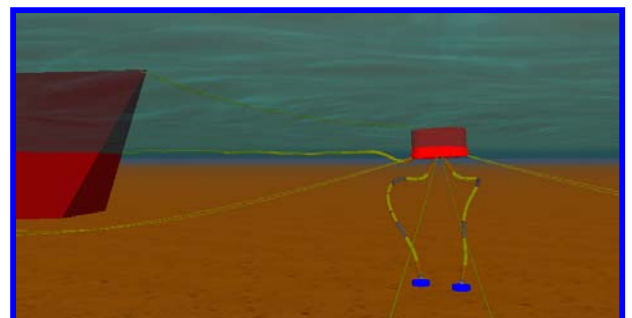


### RIGID PIPELINES

- Static and Dynamic Pipelay Analysis (Start up, Normal Lay, Lay Down, Abandon & Recovery)
- Barge Mooring Analysis during Laying
- Davit Lift Analysis
- Shore Approach and Shore Pull Analysis
- Pipeline Transportation Analysis
- Pipe Stacking Analysis
- Riser Installation Analysis
- Pipeline Crossing Installation Analysis

### MARINE AND FLOATING SYSTEMS:

- Towing Analysis
- Flexible Line Installation Analysis
- Umbilical Installation Analysis
- FPSO/FSO Mooring Analysis (including Fatigue Analysis)
- SPM Mooring Analysis (including Fatigue Analysis)
- SBM & PLEM Installation
- Anchor Design
- Chains & Appurtenances Sizing/design



## RECENTLY COMPLETED MAJOR PROJECTS

### HEERA REDEVELOPMENT PROJECT, India For Oil Natural Gas Corporation (ONGC)

In this project ZEE provided technical assistant to Punj Loyd / SemCorp (EPC Contractors) for the detail design. This project included the design for 4 new Well Head Platforms, modifications to 6 existing platforms, design and installation 8 rigid submarine pipelines, 4 flexible submarine lines and 6 submarine cables. The in-service engineering for the project was successfully completed.



### ENHANCEMENT AND REFURBISHMENT OF FPSO SEAGOOD 1 For Labroy Singapore

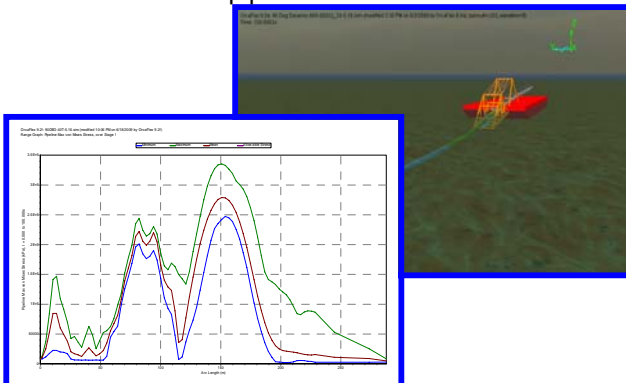
SEAGOOD I was chartered by Santos of Indonesia to be operative in the Oyong field (Indonesia). The enhancements required the FPSO to be jambonized to be made 20 meters longer and the top side facilities to be redesigned for 3 phase processing. The complete engineering was carried out by ZEE. The scope also included deploying an engineering team at Batam (Labroy Shipyard) for construction supervision and assistance.



### SHUQAIQ 2 FUEL IMPORT PIPELINE PROJECT, Saudi Arabia For Leighton Contractors (M) Sdn Bhd

Leighton was the EPC Contractor for "Shuqaiq 2 Fuel Import Pipeline" project. Leighton requested ZEE to carry out the independent installation engineering. The scopes of works for ZEE were as follows:

- Pipelay re-analysis & tensioner optimization
- Mooring analysis during laying
- Pipeline transportation analysis/Riser installation analysis
- Davit Lift Analysis/PLEM lifting analysis
- Cable reel sea-fastening/engineering verification for pipe hook



### RELOCATION OF EX LOADING DOCK, Saudi Arabia For Khafji Joint Operation (KJO)

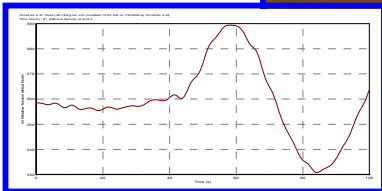
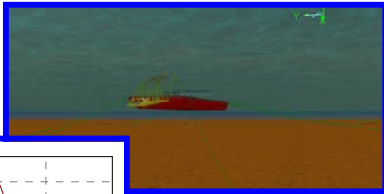
KJO is planning to demolish the loading dock platform due to its deteriorating condition and to rerouting all the related pipelines. ZEE undertook the pipeline rerouting conceptual study and detail engineering design for this relocation project. The prime contractor was AKER Engineering Malaysia (AEM). ZEE scopes included detail engineering design of pipelines up to cost estimation, Specification for Installation contractor's scope of work and preliminary decommissioning plan.



**BEDB SPM SYSTEM, PLEM and PIPELINE, Brunei  
For Leighton Contractors (M) Sdn Bhd**

ZEE scopes are:

- Pipelay analysis
- Mooring analysis during laying
- Pipeline Transportation analysis
- Structural Transportation analysis



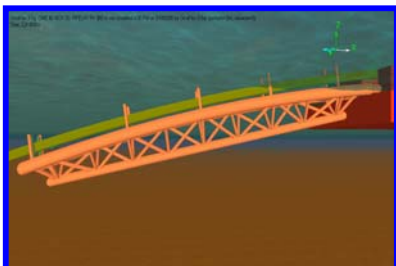
**DLB ENTERPRISE III FIXED STINGER DESIGN  
For TL Offshore, Malaysia**

TL Offshore (Malaysia) contracted ZEE to carry out the design of the 60 Meter “fixed” Stinger for the DLB Enterprise III. The Stinger design and the related deck strengthening on the DLB were included in ZEE scope.

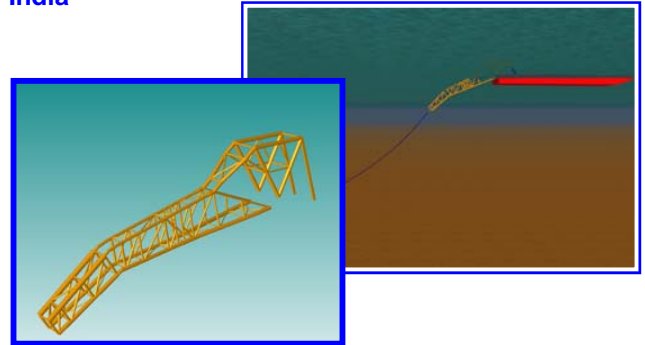


**DLB HAMIZAKU FLOATING STINGER DESIGN  
For OME Synergy, Malaysia**

OME Synergy Sdn Bhd contracted ZEE to carry out the conceptual and detail design of “pontoon” type stinger for Hamizaku DLB. OME are the Project management Consultants for this project. ZEE scope included conceptual and detail design of the self floating stinger.



**KUBER STINGER DESIGN For Punj Lloyd,  
India**



Punj Lloyd has appointed ZEE to carry out the detail design of the Stinger for 120m Accommodation / Pipe Lay Barge (Kuber). The stinger is capable of laying the pipe in the range 4” to 48” at a maximum water depth of 150 meters, and be operational up to Beaufort Scale 5 weather condition.

**DEVELOPMENT OF FLOATING LPG STORAGE  
FACILITIES For PT Bukaka Teknik Utama, Indonesia**

PT Bukaka Teknik Utama (Indonesia) required storage of LPG offshore and transportation to a jetty terminal at their facilities near Cilegon. ZEE contracted to carry conceptual and detail engineering study to meet the most economic way of transporting LPG from FSO to shore with due consideration to OPEX and CAPEX.



**DESIGN / ANALYSIS OF FSO-SPM MOORING  
SYSTEM For Camar Resources Canada Inc Oil  
and Gas, Indonesia**

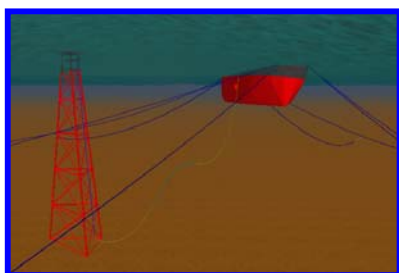
Camar Resources Canada Inc Oil and Gas (Indonesia) retained ZEE to carry out conceptual and detail engineering for the off loading system at Camar CPP platform. The study included the simulation of the full mooring system comprising of PLEM, SPM, FSO and TANKER to carry out an economic design of Hoses PLEM to SPM, and SPM to FSO.



### PAGERUAN UTARA DEVELOPMENT PROJECT For Kangean Energy, Indonesia

Kangean Energy Indonesia contracted ZEE to carry conceptual and detail engineering for the following scopes;

- To carry out engineering for the Power supply and offloading facilities at WHPF platform including mooring analysis of the FSO in order to arrive the most economical way to route cables from offloading hoses at the FSO to the Well Head Platform. In the study various options were considered.
- To carry out engineering for the installation of a flexible hose between a jetty manifold and FPSO. The length of the hose is approximately 300m. The study included a full dynamic simulation of the FPSO mooring system.

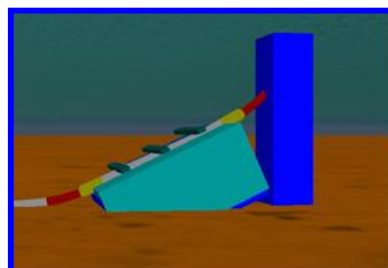


### FEED for NGL PLANT PROJECT For PT E1 Pertagas, Indonesia

ZEE ZEE was commissioned by PT E1-PERTAGAS (Indonesia) consortium to carry out a FEED study for a NGL plant. This involves the construction of cryogenic extraction facilities at Prabumulih Barat, and NGL pipeline to the PERTAMINA Refinery at Palembang, where Fractiobation/storage and product loading facilities will be constructed. The study involves carrying out Preliminary Engineering and the preparation of the Bid document.

### SA-21 SUBSEA WELLHEAD MODIFICATION PROJECT For Premier Oil Natuna Sea B.V, Indonesia

ZEE was requested by Premier Oil to undertake engineering scope related to flowline and umbilical modification and re-termination of SA-21 Subsea Well Head.



### PIPELINE REPLACEMENT PROJECT For BP, Indonesia

BP (Indonesia) required replacing badly corroded pipelines in the Uniform field. The project involved the engineering of 3 lines and modifications to 10 existing platforms. The EPC Contractor was Dewi Satu Mustika Bumi. ZEE carried out the detail engineering for this project.



**ZEE TEAM**

