



Offshore Corporate Presentation

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OFFSHORE SUPPORT

OFFSHORE FIELD
DEVELOPMENT & CONSTRUCTION

MOBILE OFFSHORE SOLUTIONS

LNG SOLUTIONS

FLOATING OFFSHORE SOLUTIONS

Leadership



Sophy M. Laughing, Ph.D., MBA
Chief Executive Officer

Sophy Laughing, PhD, MBA, is a distinguished international leader with over 25 years of experience steering multinational corporations through complex and evolving landscapes.

Sophy has successfully expanded the group's operations across 16 critical sectors. Under her leadership, Cobéal has become a respected leader in constructing large-scale commercial and industrial facilities, as well as manufacturing advanced systems in air, energy, power, water, and security applications, thereby strengthening infrastructural capabilities globally.

In 2016, Sophy founded Hollsten Enterprises, Pte. Ltd., headquartered in Singapore. This company carves a niche in marine, renewable, and oil & gas engineering across Europe, Asia, and the Middle East. Serving prestigious clients such as Principia, Dubai Petroleum and Subsea 7, Hollsten Enterprises has positioned itself at the forefront of innovative energy solutions. Sophy's career includes a role as President of a medical device start-up and Board Member of Nitta Corporation, as well as Subdirector for the Campeche State Fund.

Sophy is not only a visionary in business strategy and operations but also an ardent advocate of environmental sustainability and the preservation of our global cultural heritage.



Leadership



Bo Erik Gustav Hollsten
President and Chief Engineer

Bo Erik Gustav Hollsten is a seasoned international executive with over 35 years of experience in industrial mechanical engineering. His expertise spans across environmental systems, indoor air quality (IAQ), air filtration, and dehumidification sciences. Throughout his career, Bo Erik has applied his knowledge to solve complex challenges, focusing on large-scale turnkey construction projects. He has led and executed numerous major projects across industries, demonstrating expertise in operations management, patent development, and supply chain logistics.

His experience includes overseeing large-scale turnkey construction efforts, coordinating complex logistics, and managing multi-disciplinary teams. Bo Erik's contributions extend to the development of filtration technologies, with ongoing efforts in intellectual property, further highlighting his capacity for innovation and technical leadership.

Bo Erik has been an active participant in various technical workgroups and committees, including involvement in ANSI/ASHRAE standards and obtaining security authorizations in Mexico for sensitive installations such as banks, nuclear facilities, and government bunkers. His leadership and technical skills have earned him recognition across industries, solidifying his reputation as an expert in managing large-scale construction projects and delivering innovative solutions that meet both technical and operational demands.

Leadership



Jean Pers
Cobeal Executive Director
PAPE Engineering/Equatoriale

Jean Pers joins Cobeal from Equatoriale, Pape Engineering, and Swiber. Dr. Pers is an international executive with over 40 years of experience in offshore platforms, marine installation operations, and energy projects. His career spans multiple continents, including significant contributions to oil and gas developments in the North Sea, Gulf of Guinea, and Persian Gulf. He is a leader in multi-disciplinary technical areas across the marine, offshore, oil and gas, and renewable energy sectors.

Jean has worked in diverse locations such as Germany, Italy, Scotland, Norway, and countries across Africa, the Middle East, and Asia. He was an active participant in the early development of offshore oil and gas in the North Sea starting in 1974. Known for his ability to conceptualize ideas and bring them to life, Jean has been instrumental in leading major engineering and installation projects, particularly within offshore construction.

Jean has led key projects such as the VEGA PLEYADE Project in Argentina and developed the RENTIS method for pipeline installation. His innovative approaches have streamlined processes and reduced costs across multiple global projects. Jean has also worked extensively in marine operations, managing offshore platforms, Single Point Mooring (SPM) systems, and Floating Production, Storage, and Offloading (FPSO) units. His technical expertise spans engineering design, marine operations, pipeline installations, and dynamic analysis of flexible risers.



Group Profile



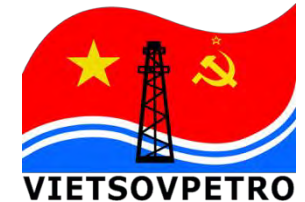
Cobeal Business Units

Offshore Construction	Marine Services	Engineering	Offshore Development
<p>Complete suite of Engineering, Procurement, and On-Site Support and Supervision of Installation & Construction EPIC Services</p> <p>Proven track record of installing pipelines up to 60" OD in varying water depths.</p>	<p>Complementary marine services include:</p> <ul style="list-style-type: none">• Chartering• Brokering• Vessel management services	<p>Specialist engineering (Eng) capabilities in the following areas:</p> <ul style="list-style-type: none">• FEED, Detailed/Design Eng• Offshore Installation Eng. (float-overs, heavy-lift, rigid pipe-lay)• Subsea design and installation Eng.• Vessel design and marine Eng.	<ul style="list-style-type: none">• Design & Eng of Mobile Offshore Structures (i.e., MODU/ MOPU/ FLNG)• Development of innovative projects, renewable marine energies• Single Point Mooring systems• FSO, FPSO mooring systems• Tanker to FSO, FPSO conversions• Offshore Drilling support

Clients



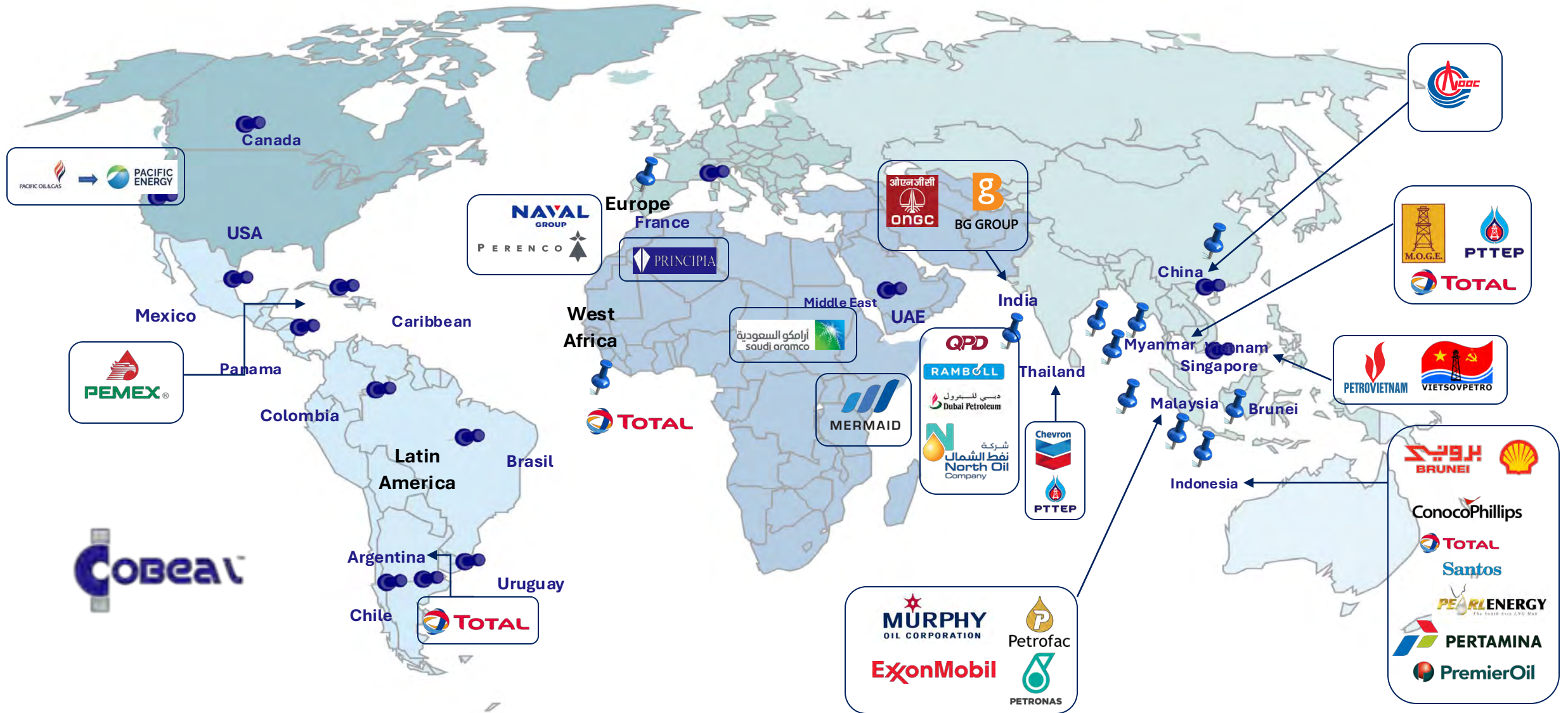
P E R E N C O



Clients



Global Presence



Global Presence

The **Cobeal Group of Companies** has established a presence in the key strategic markets of Asia Pacific, Middle East, and Latin America. We service some of the world's largest operators of oil & gas field developments.



Major Projects

Design, fabrication, and installation of Single Point Mooring Systems

SPM = Single Point Mooring

DP = Design Pressure

WD = Water Depth

RFB = Refurbishment

2003

Murphy SPM Buoy (EPC)

Production SPM Buoy

105,000 DWT FSO

Single Path 8" PSU

DP = 24 bars

WD = 40m

2008

Nucoastal SPM Buoy (EPC)

(EPC)

Production SPM Buoy

35,000 DWT FSO

Single Path 8" PSU

DP = 24 bars

WD = 24m

2011

SOGT SPM Buoy (EPCI)

Offloading SPM Buoys

250,000 DWT FSO

120,000 DWT FSO

Single Path 20" PSU

DP = 21 bars

WD = 29m

Pipeline & PLEM Installation

2015

Nong Yao SPM Buoy (EPCI)

Production SPM Buoy

72,000 DWT FSO

Dual Path 6" PSU

DP = 45 bars

WD = 75m

Pipeline Installation

2015

Murphy SPM Buoy (RFB)

Production SPM Buoy

105,000 DWT FSO

Single Path 8" PSU

DP = 45 bars

WD = 40m



2008

Murphy SPM Buoy (EPC)

Production SPM Buoy

105,000 DWT FSO

Single Path 8" PSU

DP = 24 bars

WD = 40m

2009

Kakap SPM Buoy (EPCI)

Production SPM Buoy

35,000 DWT FSO

Single Path 8" PSU

DP = 19 bars

WD = 24m

2014

Manora SPM Buoy (EPCI)

Production SPM Buoy

96,000 DWT FSO

Dual Path 8" PSU

DP = 46 bars

WD = 46m

2015

Wassana SPM Buoy (EPCI)

Production SPM Buoy

72,000 DWT FSO

Dual Path 6" 1/4" PSU

DP = 20 bars

WD = 45m

Pipeline & MOPU Installation

2016

Sharjah SPM Buoy (EP)

Offloading SPM Buoy

50,000 DWT FSO

Single Path 16" PSU

DP = 20 bars

WD = 20m



Offshore Field Development & Construction

Conceptual Study, Pre-FEED & FEED engineering studies for greenfield & brownfield developments
Full "EPCIC" of fixed & mobile platforms, offshore pipelines (rigid/flexible), subsea structures and offshore mooring systems

*Heavy-Lift
Work Barges*



Fixed Platforms



*Deepwater
Construction Vessel*

Subsea Structures



Rigid / Flexible Pipeline

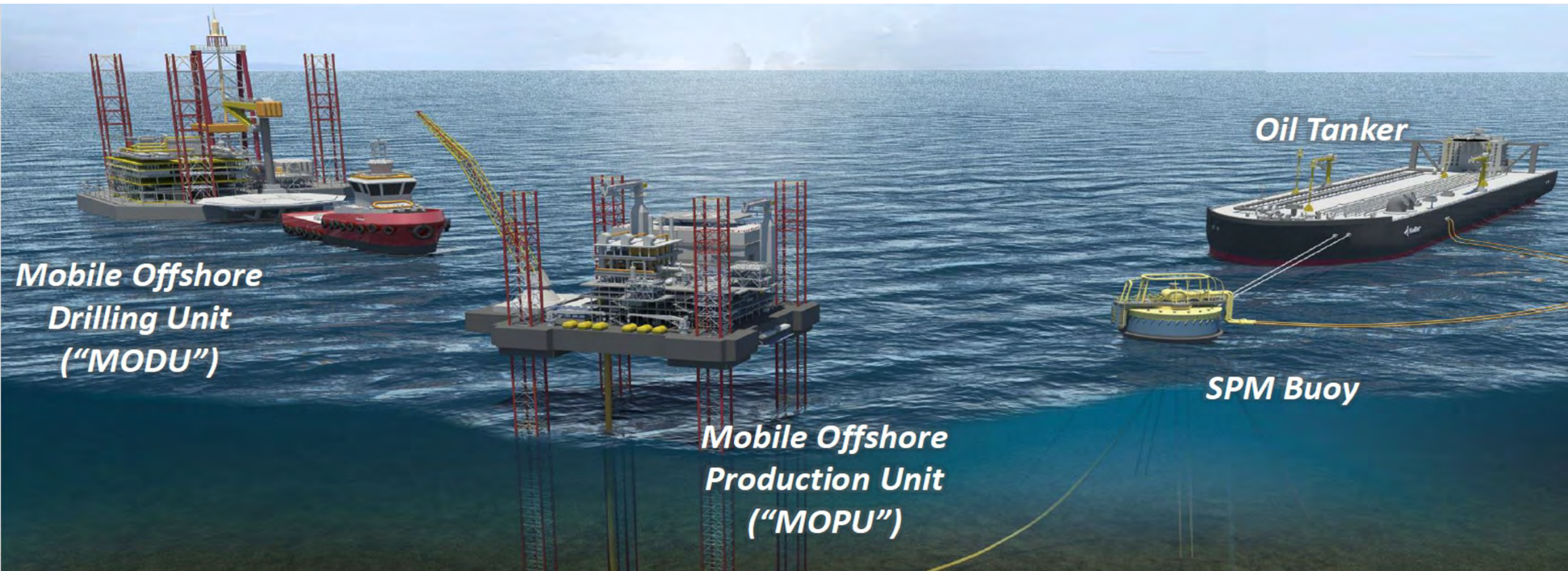




Mobile Offshore Solutions

Focused on the development of the niche areas of shallow water, marginal oil fields

Mobile offshore drilling/production units (“MODU”/”MOPU”) for production in shallow water, marginal oil fields



Oil Tanker

*Mobile Offshore
Drilling Unit
("MODU")*

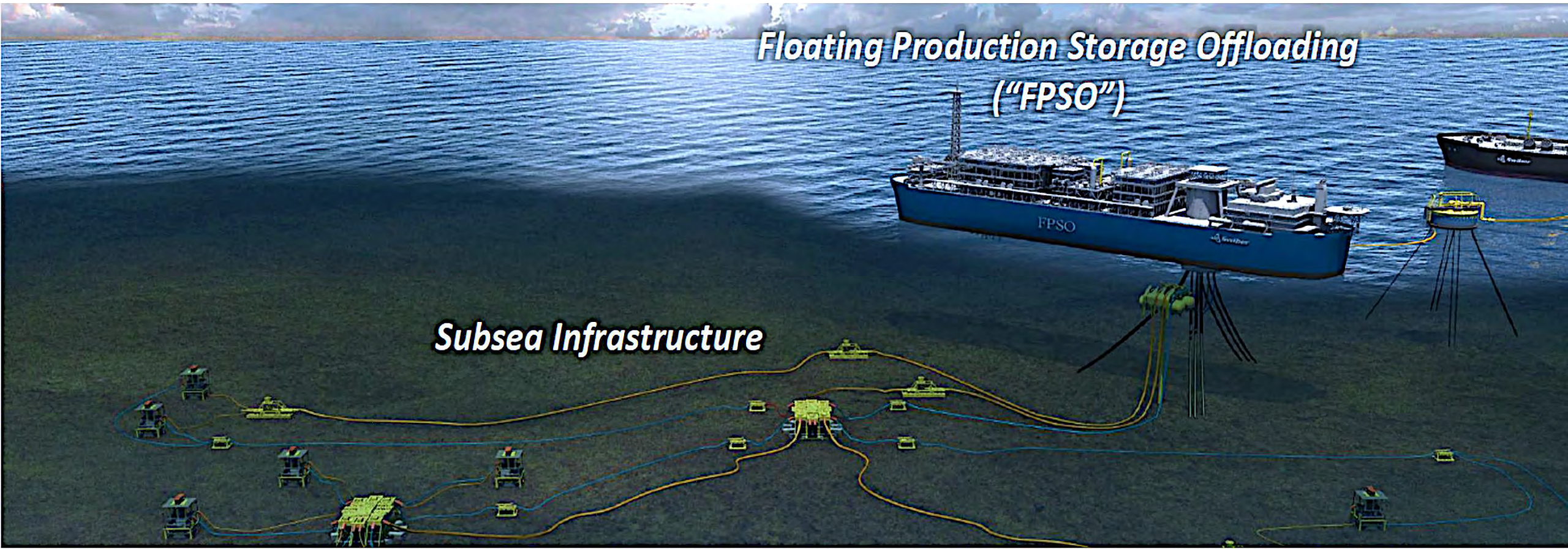
*Mobile Offshore
Production Unit
("MOPU")*

SPM Buoy



Floating Offshore Solutions

Floating vessel used by the offshore oil and gas industry for the production and processing of hydrocarbons, and for the storage of oil
Generally used in remote and/or deepwater where seabed pipelines are not cost effective
Can be a conversion of an oil tanker or can be a vessel built specifically for application



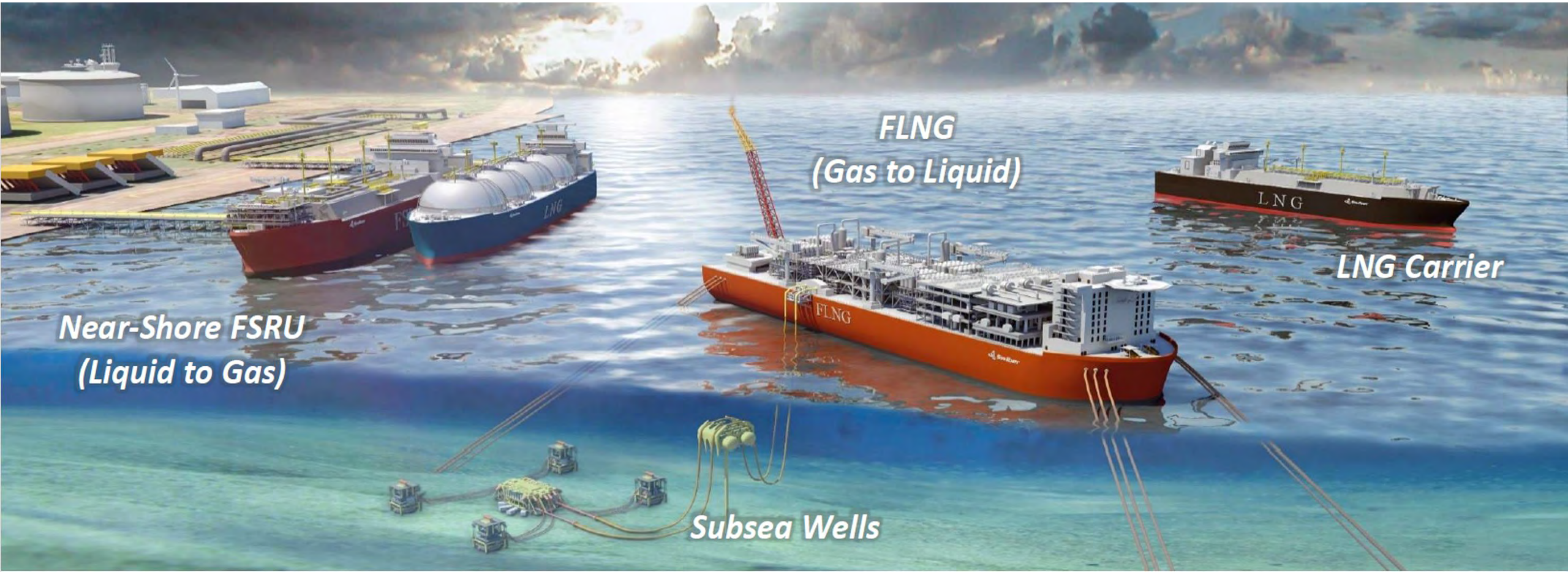
Single Point Mooring Buoys





LNG Solutions

Targeting the monetization of stranded gas fields and associated gas (i.e., flared gas)
Full repertoire of floating LNG solutions to 1) Extract offshore gas, 2) Liquefy to LNG and 3) Re-gas to gas



*FLNG
(Gas to Liquid)*

LNG Carrier

*Near-Shore FSRU
(Liquid to Gas)*

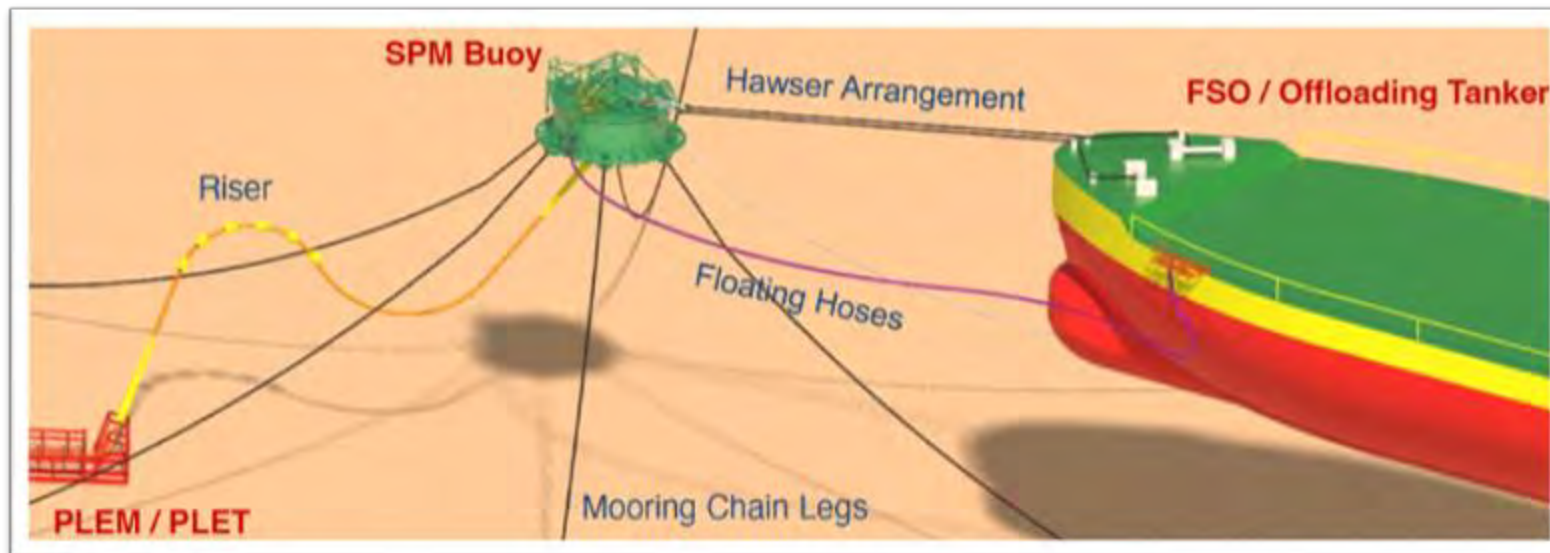
Subsea Wells

SPM Buoy Types & Packages Offered

Tailor-made solutions suitable to the most stringent requirements.

EPCI package includes offshore commissioning and maintenance of the following:

- Floating Storage & Offloading Vessel (FSO)
- Single Point Mooring (SPM) Buoy
- Chain and Anchoring Solution (Drag Anchors, Piles, etc.)
- Pipeline End Manifold (PLEM) / Pipeline End Termination (PLET)
- Floating Hose, Marine Breakaway Coupling & Hawser Arrangement
- Subsea Riser / Under-buoy Flexible Hose
- Subsea Pipeline



Production SPM Buoys



Offloading SPM Buoys





FLOAT-OVER INSTALLATION



Client	ONGC
Project	B193 Process Platform
Location	India
Period	2011 – 2012
WD	75 meters



PLATFORM & PIPELINE INSTALLATION



Client	Brunei Shell Petroleum
Project	Various platform & pipeline installation projects
Location	Brunei
Period	2007 – 2014
WD	40 to 60 meters

PIPELINE & PLATFORM OFFSHORE INSTALLATION



Client	TOTAL EP
Project	Vega Pleyade
Location	Argentina
Period	2014 - 2015
WD	75 meters



EPCI OF 24" PIPELINE FROM SHORE TO 160M (230KM)



Client	PTTEP International Limited
Project	Zawtika Development Project Phase 1A
Location	Myanmar
Period	2012 - 2013
WD	0 – 160 meters



36" PIPELINE EPCI



Client

PEMEX



Project

L5 pipeline EPCI (77km of 36" pipeline, incl. HDD)

Location

Mexico

Period

2014

WD

0– 30 meters

EPCI OF FLEXIBLE PIPELINE; UMBILICAL & POWER CABLE



Client

Brunei Shell Petroleum



Project

Champion Water Floor Project

- 12 Flexible Flowlines *8", 12", 16") – 20km
- 8 Umbilicals
- 4 Composite Cables

Location

Brunei

Period

2012 – 2014

WD

40 meters

Jackup N1 was conceptualized, engineered, fabricated and delivered in response to Petronas Carigali's requirement to drill for and achieve oil production in the shortest time possible.

Jackup N1 in Drilling Mode



- Designed for Petronas Carigali for work in **shallow water (2.5 – 30m WD)**, offshore Indonesia
- Project **fast-tracked** due to client's tight window of opportunity to harvest production
- **Fully engineered and managed by Jean Pers** (design, engineering, fabrication, commissioning & offshore operations)

Development of Wassana field in Thailand for Kris Energy.

Final flexible tie in between FSO SPM and MOPU



- Detailed design, fabrication and installation of **SPM mooring system for Vantage FSO**
- **MOPU** tow and set up on site in 55m of water depth
- Installation, tie in and commissioning of 2 flexible lines between FSO and MOPU
- Fast track project to meet Client target (1st oil achieved in 10 months after contract award)

EPC of CALM Buoy for CASPIAN SEA FSO

Caspian Sea Field, Malaysia

2003



Engineering, Procurement & Construction of SPM Buoy mooring system for Caspian Sea FSO at West Patricia Field for Murphy Oil / Petronas.

Scope of Work:

- Design & Fabrication of an SPM Buoy
- Procurement of all critical components

Specifications:

- 150 MT disconnection criteria
- Diameter: 11m – Overall Height: 8m
- Single-path 8” Product Swivel Unit (PSU)
- Moored by Drag Anchors & 76 mm Stud-less Chain Legs
- Certification by Lloyd’s Register (LR)

The specification of the FSO (Caspian Sea) are as follows:

- 105,000 DWT
- Double chain stopper & Hawser Arrangement

EPC of CALM Buoy for CASPIAN SEA FSO

Caspian Sea Field, Malaysia
2008



Engineering, Procurement & Construction of SPM Buoy mooring system for Caspian Sea FSO at West Patricia Field for Murphy Oil / Petronas.

Scope of Work:

- Design & Fabrication of an SPM Buoy
- Procurement of all critical components

Specifications:

- 150 MT disconnection criteria
- Diameter: 11m – Overall Height: 8m
- Single-path 8” Product Swivel Unit (PSU)
- Moored by Drag Anchors & 76 mm Stud-less Chain Legs
- Certification by Loyd’s Register (LR)

The specification of the FSO (Caspian Sea) are as follows:

- 105,000 DWT
- Double chain stopper & Hawser Arrangement

EPC of CALM Buoy for FSO

Songkhla Field, Gulf of Thailand
2008



Engineering, Procurement & Construction of CALM Buoy for NUCOASTAL FSO in a water depth of 24m including the procurement of mooring system and flexible hoses.

Specifications of the SPM Buoy:

- 150 MT disconnection criteria
- Diameter: 11m – Overall Height: 8m
- Single-path 8” Product Swivel Unit (PSU)
- Moored by Drag Anchors & 76 mm Stud-less Chain Legs
- Certified by American Bureau of Shipping (ABS)

The specification of the FSO (Nucoastal FSO) are as follows:

- 35,000 DWT
- Single chain stopper & Hawser Arrangement

EPC of CALM Buoy for FSO

Kakap Field, Borneo
2009



Engineering, Procurement & Construction of CALM Buoy for EAST FORTUNE FPSO. Replacement of KAKAP NATUNA existing turret mooring system. Installation of new SPM Buoy and hook-up to EAST FORTUNE FPSO.

Specifications:

- Diameter: 11m – Overall Height: 8m
- Moored by Drag Anchors & Stud-less Chain Legs
- Certified by American Bureau of Shipping (ABS)

The specification of the FSO (East Fortune FSO) are as follows:

- 55,000 DWT
- Single chain stopper & Hawser Arrangement



EPCI of 2 CALM Buoys for OFFLOADING TANKERS

Sabah Oil & Gas Terminal (SOGT), Kimanis
Completion 2012



SAMSUNG ENGINEERING



The installation campaign consisted of the following:

- Coordination of logistics and clearances of all installation equipment
- Transportation of all major assets South Kimanis
- Chain prelay & Pull test at design tension using anchored construction barge
- PLEM Installation
- Transportation of SPM Buoys and hookup to mooring chain legs
- Riser tie-in & Floating hose installation
- Pre-Commissioning as per ABS requirements

Simultaneous Engineering, Procurement, Construction & Installation (EPCI) of two CALM Buoys aimed at berthing shuttle tankers at Kimanis Field.

Specifications of SPM Buoy:

- [SPM1] 250,000 DWT export tankers with a flowrate of 50,000 bbl/hour
- [SPM2] 120,000 DWT export tankers with a flowrate of 25,000 bbl/hour
- 29m water depth
- ABS Classification
- 2 x 20" 300m long under-buoy hoses



EPCI of CALM Buoy for MANORA FSO

Manora Field, Gulf of Thailand
Completion 2014

Engineering, Procurement, Construction & Installation of CALM Buoy and associated mooring system and subsea components for Pearl Energy's Mannora Field.

As part of the development of Manora Field offshore Thailand – design and fabricate an ABS-classified SPM Buoy, supply mooring as well as provide services for the installation of the mooring system, 2 (two) NOS flexible risers and floating hose strings.

The SPM Buoy specifications were as follows:

- 200 MT disconnection criteria
- Tropical Environment
- Diam. 11m; Overall Height 8m
- Two-path 8" Product Swivel Unit (PSU) – Piggable
- Moored using Drag Anchors & Stud-less Chains
- Fabrication of SPM Buoy in Batam, Indonesia

The FSO specifications were as follows:

- 96,000 DWT MANORA FSO
- Double chain stopper



Installation executed mid-2014 using a work accommodation barge with air and saturation diving, including the following SOW:

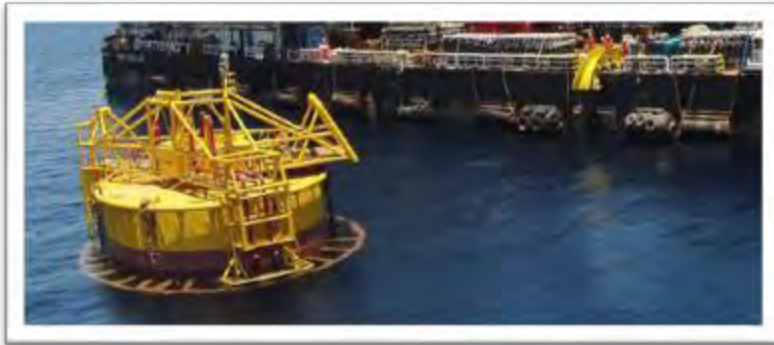
- Transportation & Installation of all assets to Manora Field
- Obtain Marine Warranty Surveying & ABS approval
- Coordination of logistics and clearances of all installation equipment
- Chain pre-lay using construction barge for a pull test up to the required tension of 160 MT
- Wet-tow and positioning of an SPM Buoy
- Subsea riser and floating hoses leak test and installation
- Installation of mooring hawsers and hookup to FSO



No incident reported during the entire installation campaign for a total of more than 200,000 man-hours

EPCI of CALM Buoy for VANTAGE FSO

Wassana Field (Block G10/48), Gulf of Thailand
Completion 2015



EPCI of a BV-classified SPM Buoy, mooring chains legs, drag anchors, floating hoses and installation of all items procured, including 2 x 2km of flexible hoses, stabilizing mattresses and positioning of production jack-up (MOPU Ingenium).

The SPM Buoy specifications were as follows:

- 200 MT disconnection criteria
- Diam. 11m; Overall Height 8m
- Tropical environment with 100-year RP Hs of 4.7m
- Two-path 6”/4” PSU
- Moored by 12-MT Drag Anchors & 76 Stud-less Chains

The FSO (Vantage) specifications were as follows:

- 72,000 DWT
- Single chain stopper



The installation campaign consisted of the following:

- Transportation & Installation of all assets to Wassana Field
- Obtain Marine Warranty Surveying & BV approval
- Coordination of logistics and clearances of all installation equipment
- Anchor prelay carried out with AHT 220 MT BP AHT at a tension of 150 MT
- Dry tow, lifting and hookup of an SPM Buoy
- Transportation of 2 x 2km of flexible hoses, including buoyancy module and 63 concrete mattresses
- SPM Buoy, flexible line and MOPU installation campaign carried out with crane barge with 1.100Mt capacity and 5 AHTs

The installation of all the field assets, including the procurement of all items were completed 5 months after contract award.



No incident reported during the entire installation campaign for a total of more than 135,000 man-hours

Upgrade of CALM Buoy for CASPIAN SEA FSO

Caspian Sea Field, Malaysia
2015

Upgrade piping system of the SPM Buoy used to moor CASPIAN SEA FSO at West Patricia Field for Murphy Oil / Petronas – Supply an upgraded piping system along with installation aids to enable the replacement in-situ of the piping system.

Scope of Work:

- Design & Fabrication of upgraded piping system and in-situ installation aids
- Procurement of all critical components
- Preparation of a method statement and remote technical assistance during the installation campaign



Optimization of the design of the upgraded piping system to facilitate offshore installation. Installation aids provided to avoid the use of an expensive marine spread.

Offshore support during the installation campaign provided to Murphy Oil to enable safe operations offshore using a Diving Support Vessel (DSV).



EPCI of CALM Buoy for AURORA FSO

Nong Yao Field, Gulf of Thailand
2015

Engineering, Procurement, Construction & Installation of CALM Buoy and associated mooring system and subsea components for Mubadala Petroleum's Nong Yao Field.

Design and fabricate an ABS-classed SPM Buoy, supply mooring and services for the installation of the mooring system, 2 (two) NOS flexible risers and floating hose strings.

The SPM Buoy specifications were as follows:

- 200 MT disconnection criteria
- Tropical Environment
- Diam. 11m; Overall Height 8m
- Two-path 6" Product Swivel Units (PSU) – Piggable
- Moored using Drag Anchors & Stud-less Chains
- Fabrication of SPM Buoy in Batam, Indonesia

The FSO specifications were as follows:

- 100,000 DWT AURORA FSO
- Double chain stopper



Transportation & Installation of all major assets to Nong Yao Field, including:

- Obtain Marine Warranty Surveying & ABS Approval
- Coordination of logistics and clearances of all installation equipment
- Anchor prelay carried out with 220 MT BP AHT at a tension of 160 MT
- Wet-tow and positioning of the SPM Buoy
- Installation campaign carried out with Diving Support Vessel (DSV), including chain hookup, laying of a flexible pipe down and tie-in at PLEM using saturation divers, floating hose connection and assistance for FSO hookup.



No incident reported during the entire installation campaign for a total of more than 165,000 man-hours

EPCI of CALM Buoy for OFFLOADING TANKERS

Sharjah Stock, UAE

Completion 2016

Engineering, Procurement, and Supervision of fabrication of an offloading SPM Buoy in Sharjah (UAE).

The generic specifications of the SPM Buoy supplied are as follows:

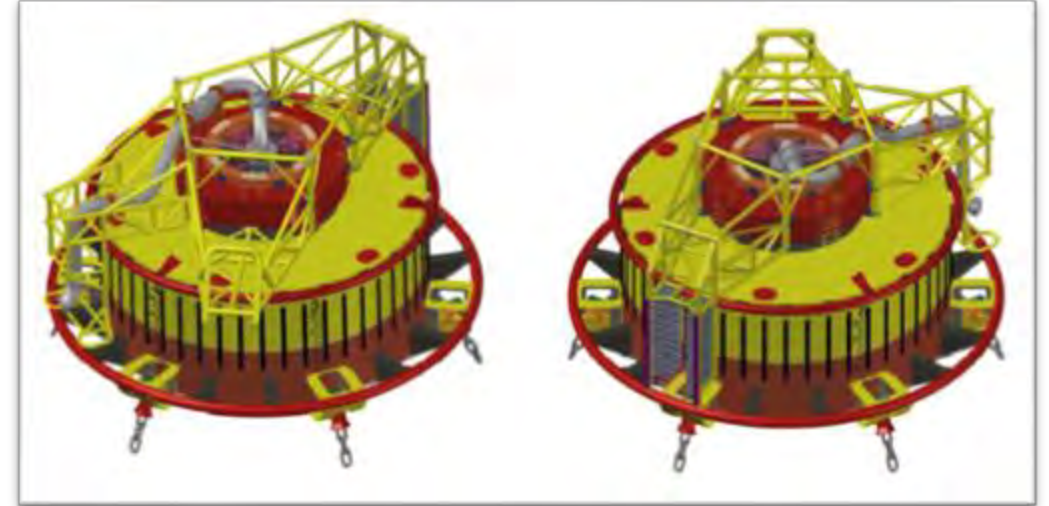
- 100 MT disconnection criteria
- Diam. 9.5m; Overall Height 6m
- Operating environment with Hs of 2.5m
- Single-path 16" PSU
- Moored by 4.5-MT Drag Anchors & 64mm Stud-less Chains

The generic offloading tanker specifications were as follows:

- 40,000 DWT
- Single chain stopper

Scope of Work:

- Design of a BV-certified SPM Buoy
- Procurement of critical items, including main slewing roller bearing, etc.
- Supervision of the fabrication and testing



In-House Engineering

Extensive experience in supplying mooring systems for floating vessels, including FPSOs, FSOs, and offloading tankers. Successfully delivered and installed Single Point Mooring (SPM) units, spread-mooring systems, and turret mooring systems for field operators and refineries.

Our in-house engineering team offers proprietary designs for critical components, including a durable Product Swivel Unit (PSU) and a robust main bearing arrangement, all approved by leading Classification Societies (ABS, BV, and LR). Our mooring systems are recognized for their ease of maintenance and proven operational reliability.





Support for onshore OTEC project

Phase 1

- Provide a description of installation & construction steps (means, aids, required vessels, preliminary prep work) for 3 concepts.
- Pros & Cons of 3 concepts for installation and construction requirements.
- Assessment of key risks and consequences during installation & identification of possible mitigation.
- Confirmation of feasibility of installation supported by calculations.

Phase 2

- Schedule for installation procedures outlined in P1.
- Cost estimation for installation and construction steps.
- Support during the estimation of costs related to the design/procurement.
- Deliverables Technical report summarizing outcomes Phases 1 & 2. Sketches of installation procedures.

Intervention on the NEMO-SPAR TOURET project for DCNS

- Provision of budget and sketches.
- Support Principia for DCNS for NEMO-SPAR TOURET anchored system, including mechanical characteristics, fatigue behavior, operating limits, and EF-driven interface.

SPM Third-Party Design Review

- Engineering contract supporting Principia for DPE in the SPM Third Party Design Review, with upgrade recommendations, including commentary on relevant technical documents.
- Calculation notes for the input data and hypothesis.
- Options Site Survey, Repair Proposal, Repair/up-grades design, and site supervision.



Basic Concept for Jack-Up Barges 38M & 60M

- Basic Concept for JUB 38M & 60M
- Performance of 3D drawings for JUB 38M & 60M concept / basic phase

Detail and Overall Design of Jack-Up Barges 38M & 60M

- Detail and overall design for JUB 38M & 60M
- Performance of 3D drawings for JUB 38M & 60M



SMP BUOY – BLUE WATER Al Shaheen Project for NOC

- “Call for Tender” for the repair/overhauling work, and the offshore operations, including removal from the site, towing to and from the Dry-Docking Yard, and installation.
- Disconnect blue water type, tow to refurbishing yard in Qatar, and reconnect for Al Shaheen project for NOC (North Oil Company).
- NKom Qatar teamed up with MERMAID Subsea Qatar to carry out the onshore-refurbishment of the buoys and MERMAID Subsea took the lead on the project, developing and performing the Offshore operation request, including the Pre-Engineering package.
- In the context of a CCFT, MERMAID prepared the Pre-Engineering and requested Engineering Services Support. MERMAID to prepare and submit relevant work procedures, descriptions, and drawings.

Detail Engineering Review and Analysis for Al Shaheen Project for NOC

Phase 1

- Review of MERMAID Procedures to disconnect floating hoses, the mooring hawser, and the under-buoy flex hoses.
- Review of MERMAID Procedures to install the towing bridle and the SPM Buoy to the Yard.
- Review of MERMAID Procedures to tow and reinstall the SMP on-site.

Phase 2

- P2 Inspection of the SPM.
- P2 Floating hose disconnection, excluding crude oil and cleaning of water return lines.
- P2 Tanker mooring line disconnection.
- P2 Under-buoy, 2 flexible lines disconnection, and recovery, excluding PLEM valves, closing, and saturation diving procedures.
- P2 Step-by-step 9x anchor chains disconnection and the laying/abandonment on the sea bottom.
- Installation of towing gears.
- Towing Tug, main characteristics.
- Buoy tow to refurbishing yard.
- Forecasted mobilization under DeepLines software (static and dynamic simulations).



QPD MOL 10" PIGGING – Procedure for PLEM and Flexible & Rigid Pipe Handling Phase 1

- SPLIT QPD / RAMBOLL Project
- Develop the work procedures, drawings, and related documents for the technical offer.
- All activities performed onsite with high level of coordination between the barge Superintendent/crew, and the diving team through the Diving Superintendent and Diving Supervisor.
- Permanent communication contact was maintained with QPD Representatives and the GIP Platform Production Manager due to the pipeline being in operation.
- Relevant work permit(s) requests submitted to GIP Production Manager and HSE Manager to obtain the necessary authorization(s) to proceed.
- Procedure for handling PLEM, the flexible line and/or rigid pipe that will cover the preparation on the barge of the items to be connected to the PLEM, such as precautions for lifting, lifting from the barge, lowering, and connecting to PLEM, and then leak testing the connections prior to opening valves to start pigging operations.
- Specific devices described in order to avoid oil spillages.
- PLEM subsea preparation, detail description, including diver familiarization with workplace, environment, access to the valves, flanges, etc.
- Detailed diving work procedures, focusing on safe work execution, tools to be used and related contingencies. Diver work observed using the ROV.
- Clean the PLEM prior to starting the work. ROW available on the barge to perform inspection upon barge arrival and onsite setup.
- Procedures to handle the flexible lines, rigid pipes/riser, manifold, filter and other components on barge – to be connected, disconnected, cleaned, stored, etc. = developed with the idea to avoid spillage.
- H2S in Crude Oil addressed for Safety.
- Detailed methods for keeping flexible line steady to avoid excessive motion, kicks, and/or damages.
- Precautions and Recommendations concerning the safety of the people working on the barge, in direct relation, with the work and in consideration of the Crude Oil fluid to be handled, including pressure, temperature, and H2S content.

QPD MOL 10" PIGGING – Barge Specification & General Arrangement Drawings Phase 2

- SPLIT QPD / RAMBOLL Project
- P2 JACK-UP Barge to be used as support for the pigging operation. Eight-point moored barge analyzed given the drawback of being in motion as an effect of waves. Effect may provide detrimental to safety of the operations in consideration of the connection made between the surface and the subsea PLEM.
- P2 Specifications and Requirements specific to the Pigging Work and Location to be established
 - Free work surface area, deck load/sqm.
 - Lifting capacity and crane(s) location
- P2 Barge Specific data
 - Lifesaving equipment
 - Communication equipment
 - Navigation aids
 - Lighting
 - Power requirements for pigging activities
 - Access to/from the barge
 - Helideck
- P2 General and Detailed Arrangement of the deck presented in drawings, indicating the location of the equipment, diving equipment, ROV, control cabins, access, safe muster point, and the areas where equipment sea fastening/lashing is required.
- P2 Multipurpose Self Elevating Platform used as drilling support.



QPD MOL 10" PIGGING – Filter Handling Procedure on Barge

Phase 3

- SPLIT QPD / RAMBOLL Project
- Deliver filter consisting of pressure vessel with two (2) flanged connections fitted with ball valves, pressure gauges, level gauges, vents, and lifting pad-eyes, with support welded into it.
- Access for samplings (located on the bottom).
- Filter in line, positioned after pig receiver. Add a by-pass to isolate the filter.
- Detailed pigging analysis to indicate whether two (2) identical filters are to be provided.
- Every precaution is implemented to avoid spills during connection/disconnection/sampling and handling activities.
- Spill containment tray installed under filter unit.
- Mobilize and install filter and secure on the barge deck prior to moving the barge into location.

QPD MOL 10" PIGGING – Design of Filter System

Phase 4

- SPLIT QPD / RAMBOLL Project
- Design filter unit as a pressure vessel, its internal volume to contain the debris, to be evaluated on the sound assumptions according to the fouling inside the 10" x 40km pipeline. It will be connected in line, after the pig receiver on the barge.
- Basic Design to avoid the need to interrupt the pigging operations, and to avoid the necessity of requiring access to the filter elements during operations.
- Design filtering units to recover the debris once categorization classification is identified.
- Connect to bring the filter inline, performed by flanges with isolating valves. Pressure and level gages and vents added.
- Sampling devices fitted at the top and at the bottom.
- Bypass piping and valves are included as part of the system.



QPD MOL 10" PIGGING – Debris Handling Procedure

Phase 5

- SPLIT QPD / RAMBOLL Project
- Develop procedures to safely extract the debris from the filters.
- Develop storage and disposal procedures.
- Safety precautions were identified considering the Crude Oil and H2S content.
- Debris was handled after the barge returned to port at the quayside.
- Deliver debris samples to a specialized laboratory for analyses, determined by QPD, with corresponding instructions passed along to the Contractor.

QPD MOL 10" PIGGING – Work Pack for ILI Contractor

Phase 6

- SPLIT QPD / RAMBOLL Project
- Prepare 'Work Pack' instructions to Bidders' package based on the engineering studies, approved by QPD, sent to pre-selected Inline Inspection Companies (INI).
- Work Pack Contents:
 - Technical documentation available within the MOL 10" cleaning and inspection engineering study.
 - Terms, conditions, and contractual aspects as standard component for QPD.
 - Technical section of after related engineering work is ready.
 - Manage company performing MOL 10" cleaning and inspection engineering study.
 - Analyze the submitted ILI Contractor bids.



QPD MOL 10" PIGGING – Contingency Plans

Phase 7

- SPLIT QPD / RAMBOLL Project
- Deliver contingency plans considering the following risks:
 - **Oil spillage:** Floating oil boom deployed permanently around the work area; dispersant will be ready to spread, if necessary.
 - **Pig stuck in the pipeline:** Bi-directional pigs will be used. Discussions during engineering study to decide if a pump must be installed on the barge to reverse the flow in the MOL 10: pipeline to free the pig and send it back to the GIP platform. Prepare procedure in the event of platform production shut down.
 - **Filter full of debris:** Installation of a redundancy filtration system – two filters, one in operation, one on standby. Empty and clean the filter vessel.
 - **Flexible lines kicked:** Secure/reroute the flex lines, dependent on site current and waves conditions. Select Jack-Up Barge vs. Moored Barge (preferred).
 - **Bad weather, storms, squalls:** Contract a reliable weather forecast company with suitable scope of services.
 - **Other risks:** Prepare emergency response procedure for all possible risks, with a bridging document that includes the existing emergency procedures for the Field by QPD.
- Interface between QPD, ILL Contractor, and HSE Managers.

QPD MOL 10" PIGGING – Design of Safety and Environmental Equipment on Barge

Phase 8

- SPLIT QPD / RAMBOLL Project
- Risk assessment with mitigation measures to serve as the basis for designing the safety and environmental equipment on the barge.
- Design, specifications, and operating manuals for the safety material and equipment; catering to H2S presence, to prevent/minimize/contain oil spillage, and to avoid incidents.
- “Strong” Recommendations for all personnel training to be set.
- HSE officers to inspect the workplace so that necessary safety rules can be fully implemented.
- Devote specific attention to subsea work performed by the divers.



QPD MOL 10" PIGGING – Fabrication Work Pack and MTO

Phase 9

- SPLIT QPD / RAMBOLL Project
- Detailed drawings with MTOs, specifications, and descriptions for each equipment fabricated:
 - Steel material
 - Welding specifications
 - Valve specification (if not standard)
 - Filter / pressure vessel specifications
 - Piping, riser, flanges (to match PLEM flanges)
 - Pig launcher and receiver
 - Miscellaneous items, to be fabricated for handling
 - QA-QC and Fabrication Acceptance Testing requirements
 - Certificates
 - NOTE: Excluding Marine Warranty Surveyor (MWS) and CLASS.

QPD MOL 10" PIGGING – Kick-Off Meeting, Progress Meetings, Final Presentation and Clarifications (C)

Phases 10, 11, 12, 13

- SPLIT QPD / RAMBOLL Project
- Meetings and final presentation in Doha
- Classifications after final acceptance



Pacific Oil & Gas, Woodfibre LNG Marine Terminal – Jackets-based solution related to berthing, loading & FST Platforms, FST Mooring

P1: Subsidiary of Royal Golden Eagle Group (RGE) planning to develop a Natural Gas Liquefaction plant in Canada, at the WOODFIBRE location where a paper mill was previously operating, at the coastline. The site is close to the city of Squamish, British Columbia, 50km North of Vancouver. Natural gas will be produced and processed onshore and piped to the WOODFIBRE Plant where it will be liquefied, stored, and then exported via a Marine Terminal designed for 175,000 cu m capacity LNG Carriers.

- Note: Standard TFDE carriers of 155,000 – 180,000 cu m are considered directly in the assessment but may be normalized to a 160,000 cu m standard.
- Expected yearly production of LNG is 2,2 million T, over a period of 25 years; meaning an avg. of 25 LNG 175,000 cu m carriers will call the Marine Terminal every year.
- PO&G commissioned engineering company KBR to propose an LNG Marine Terminal overall concept facilities to export LNG, that includes LNG storage on board 2 X 125,000 cu m converted LNG gas carriers type MOSS (RGE group) to be permanently moored at the Terminal, a berthing and mooring system with separate support for the loading arms platform.
- **SOW P1:** Submit an offer to further develop and optimize the concept to permanently moor the two floating storage vessels and temporary mooring of the LNG export carrier, propose sound technical solutions, and evaluate the relevant construction and installation budgets and time schedules.
- The most challenging aspect of this Marine Terminal construction is the steep slope of the sea floor which is almost 45 degrees. Further, the soil consists of rock with an uneven sea bottom and water depth of 80 – 100m at the berthing and loading facilities. The topography is typical of a fjord.
- The environmental conditions to consider for the LNG carrier berthing and mooring are mild: almost no waves, no waves, no current.

Pacific Oil & Gas, Woodfibre LNG Marine Terminal – Jackets based solution related to berthing, loading & FST Platforms, FST Mooring

P2.1: Construction Challenges: The main challenge for the jacket foundations design is the steep slope of the seabed and rock bottom, as the Marine Terminal facilities comprises various structures to be secured to the sea bottom. These structures are designed to:

- Permanently moor 2 LNG floating storage converted 125,000 cu m carriers
- Allow berthing and loading the export LNG 175,000 cu m carrier
- SOW: Design foundations sufficient to resist the vessel impact load and mooring loads, noting berthing and loading “jacket type” fixed steel structures that are pinned to the rocky sloppy sea bottom at a location where water depths vary from 80m to 100m.
- SOW: Topsides/battery limit for each jacket design is at the (assumed welded) connection between the topsides and the jacket structure.
 - Data from POC related to foundation design and topsides are escalated to meet client’s swift engineering concept start requirement.
 - Evaluate berthing impact loads.
 - Design concept.
 - Remote: As the Marine Terminal location is remote, the construction and installation of the marine facilities will have to be brought on-site from far away, which implies high costs for mobilization and demobilization. Provide solutions.
 - The quantity of produced LNG 2,1 million T per annum is relatively low, which calls for the optimization of the marine facilities design to make them cost-effective and at the same time, safe and viable to operate and maintain over the required period of 25 years.



Pacific Oil & Gas, Woodfibre LNG Marine Terminal – Jackets-based solution related to berthing, loading & FST Platforms, FST Mooring

Phase 3: Technical concept/pre-design/misc. Scope of Work

- Evaluations to optimize the overall LNG Marine Terminal (REV 01)
- Berthing, mooring (1 jacket) LNG carrier
- Loading 1 jacket supporting the 3 loading arms to load the expert LNG carrier
- Typical 1 jacket located at the deepest water depth to permanently moor the 2 FSTs.
 - The present design from PO&G is with 4 mooring posts for each FST.
 - Fenders and connections from the jacket to the FSTs are excluded.
- Preliminary design: Intermediate structure to support the loading and offloading arms for the FSTs. (The intermediate jacket and the loading arm jacket are separate structures. In case they are joined, they are still considered as 2.

Pacific Oil & Gas, Woodfibre LNG Marine Terminal – Jackets-based solution related to berthing, loading & FST Platforms, FST Mooring

Phase 4: Detail Scope of Work & Split-PRI Project

- SOW: (LNG 175,000 cu m, carrier berthing impact loads evaluations against the berthing jacket with fender type selection)
 - Structural calculations by expert engineers to confirm the 4 jackets preliminary structural sizing using suitable/recognized FEA software (REV 01)
 - Overall definition of the anchoring/foundation design in the roc
 - Confirmation of foundations sizing by calculations.
 - Related PRELIMINARY drawings, sketches, diagrams, reports.
 - Local coordination in Singapore with PO&G (REV 01)
 - Progress meetings using conference calls, excluding:
 - Seismic analysis, Fatigue analysis, Corrosion protection: only anodes weight estimates
 - Technical Kick-Off Meeting, in La Ciotat (France)

Pacific Oil & Gas, Woodfibre LNG Marine Terminal – Jackets based solution related to berthing, loading & FST Platforms, FST Mooring

P5: Budget evaluation for construction, transportation and site installation of 2 identical berthing jacket structures and 1 loading support jacket: OPTIONAL

- The budget to be evaluated on:
 - Cost of the Project Management Team
 - Cost of Engineering & Detail Design
 - Cost of *Engineering Certification* by CLASS (BV)
 - Jackets Fabrication in suitable yards, such as yards involved in offshore Oil & Gas heavy fabrications, with quality
 - Transportation on a dry tow vessel
 - Installation on site, connect to the seabed anchoring structures assumed preset
 - Cost of Final CLASS (BV) classification
 - Budget Evaluation Excluding:
 - Piping, access, equipment mounted on the jackets structure, anodes and anchoring the structure to the seabed.



Pacific Oil & Gas, Woodfibre LNG Marine Terminal – Jackets-based solution related to berthing, loading & FST Platforms, FST Mooring

Phase 6: Commercial Proposal to Perform Concept/Pre-Design & Cost Evaluations

- Perform the concept/pre-design, for the 4 jackets acc. to P4
- Performed in Singapore. One month in La Ciotat (two-period increments).
- Local coordination meetings with Client in Singapore, included.

Pacific Oil & Gas, Woodfibre LNG Marine Terminal – Jackets-based solution related to berthing, loading & FST Platforms, FST Mooring

Phase 7: Clarifications

- Present Commercial Proposal for CONCEPTUAL/PRE-DESIGN of the 4 jacket structures.
- Mobilize team:
 - 1 Senior Engineer/expert in charge of Project Management & Technical
 - 1 Project Engineer and 2 Draftsmen
 - 1 Structural Engineer
 - 1 Marine Offshore Installation Specialist
 - 1 Advisor for cemented piles foundations for the problems linked with this type of technique to highlights the difficulties to achieve sound results
- Develop preliminary cemented piles foundation concept for the berthing dolphin jacket
- Draw typical cemented pile foundation for 3 other jackets
- Foundations concept subcontracted to specialized company UTEC-Geomarine in Singapore
- One document revision, according to comments
- Software for structural calculations, not included
- Insurance Professional Limited Liability covers up to 500,000 SGD per event.

Haiphong Ding Vu Petroleum Terminal

Alternative Pre-Design Analysis & Fabrication/Transportation/Installation

- First evaluation.

Hexicon-PRI: Engineering Assistance for Turret Pre-Feed (Rotating Systems)

- SOW: Develop the Pre-Feed of 2 types of turret systems which differentiate technically by the way the rotation is organized, using Main Roller Slewing Bearing (MRSB) for one type and Plain Self-Lubricating Bearing (PSLB) for the other type.
- Features to include: (apart from the bearing systems) Turret Parts which are integrated to the weather-vanning main structure and the chain table which is “fixed” in rotation, on which the mooring chains are connected.
- **P1: Rotation Using Main Roller Slewing Bearing**
 - Single heavy-duty MRSB located at the top of the chain table bolted on machined steel structures. Designed to resist the mooring horizontal forces and the weight of chains as well as the moment due to the lever arm length between the chain stoppers at the chain table bottom and the bearing location. Located above the water line. Seals to enclose the bearing to avoid water projection ingress. Bearing lubrication provided.
- **P2: Rotation Using Plain Shelf Lubricating Bearing**
 - Provide a combination of 3 PSLBs, one on top of the chain table to resist the vertical axil downforce, and 2 to resist the horizontal radial forces, one on top of the chain table, the other at the bottom. Design for seawater, 25 years, protected from water ingress, allows for rotation, includes assembly drawings.



Hexicon-PRI: Engineering Assistance for Turret Pre-Feed (Rotating Systems)

P3: Cost Evaluation (REV 01)

- Detail Design & Project Management
- Design approval by CLASS
- Supply of required steel with CLASS certificates
- Fabrication, Supply of mechanical parts:
 - Rotating system with sealing barriers
 - HV Swivel for 2 electrical paths
 - I-tube and J-tube for 2 umbilical cables
 - Chain table with chain stoppers
 - Chain pull-in equipment
- Turret structure fabrication, incl. interface w/main structure
- Corrosion protection/anodes/marine paint
- Rotating system, in situ machining
- Turret assembly & integration into main structure
- Equipment assembly on turret
- Tests
- Pre-Commissioning
- As-built documentation
- CLASS Fabrication Supervision
- Turret System CLASS Certificate
- Spare parts
- Operating Manual
- Inspection and Maintenance Manual



Hexicon-PRI: Engineering Assistance for Turret Pre-Feed (Rotating Systems)

P4: Commercial Proposal

- Sketches/drawings showing two types of turrets (MRSB & PSLB)
- Drawings showing internal and external turret configurations on the main structure
- Preliminary sizing of the turret components
- Description/specification of the turret components & related equipment
- Pre-Feed work in Singapore

COENS HEXICON-TWINWIND

SOW: Completion of the preliminary turret designs.



HEXICON: Offshore Floating Twin Wind Turbines Foundation

SOW: Conceptualize and develop a suitable floating WTG foundation to support two turbines, instead of the standard single turbine design. This is a new technological solution, not successfully commercialized at the time of conception.

- One floating design, 5 MW turbines,
- Second floating design, two 10 MW turbines

BENIN-TOTAL GAS & POWER

SOW: Conceptual studies concerning BENIN LNG REGASIFICATION OFFSHORE TERMINAL PROJECT

- Offshore tie-in procedure guidelines
- Pre-Design of PLEMs, Manifold, Jacket
- Advice for installation procedures and cost estimates

Replacement of a Tanker Unloading Terminal

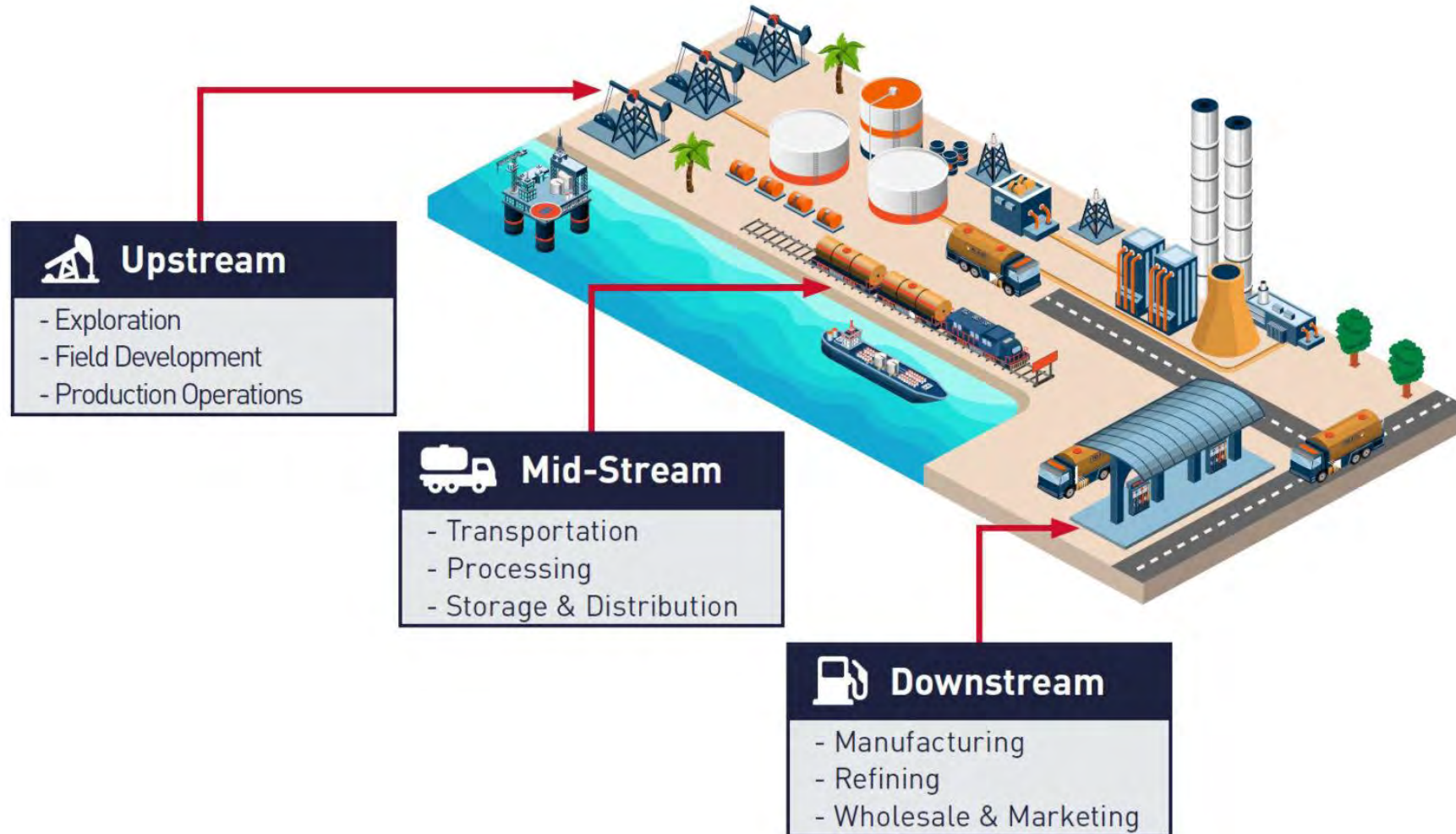
SOW:

- Design for spatial and functional characteristics of seaport, given their role in global logistics and transport networks, seaports interact with other nodes such as overseas and neighboring seaports, intermodal terminals and inland logistics platforms.
- Cooperation between seaports and construction strategies to realize Client / Port Authority goals.
- Identify the most suitable solutions (port demand, environment, health and safety).




Upstream / Midstream / Downstream

Complete Service Provider



 **Upstream**
- Exploration
- Field Development
- Production Operations

 **Mid-Stream**
- Transportation
- Processing
- Storage & Distribution

 **Downstream**
- Manufacturing
- Refining
- Wholesale & Marketing



THANK YOU