WELCOME

Innovation in mooring solutions and offshore design

London Marine Consultants Ltd (LMC) specialises in the engineering design and provision of mooring systems for FPSOs, FSRUs and FSOs including External Turrets, Internal Turrets, Disconnectable Turrets and Spread Mooring Systems. Alongside this, LMC can supply their own swivel stack systems as part of the EPC supply. LMC also have a fully detailed suite of designs for Conventional, CALM and Deepwater Offloading Buoys.
The external cantilever turret is the simplest form of the turret mooring system. The external turret can be mounted onto the bow or the stern of the vessel, and can be fabricated independently, with very little time required in a dry dock for integration. Whether a bow or stern mounted turret is selected is dependent on a number of parameters such as vessel hull structure and process conditions and hence proximity to the accommodation block.

The external cantilever turret is better suited for shallow water than the internal and column turrets due to the elevated position creating a larger distance between the riser hang off points and the sea bed, facilitating the riser configuration.

Internal turrets are generally used for larger vessels in harsher environments due to the inclusion of the lower bearing. They are also very adaptable to allowing for multiple risers as they are not as limited by bearing size as external turret designs.

If the vessel is a newbuild, then an internal turret can be efficiently integrated into the original design. If, however, an internal turret is to be part of a vessel conversion, then a typical turret configuration is as per the LMC designed LEWEK EMAS turret, where the design is such that the internal turret can be installed with limited dry dock time, hence reducing the cost and schedule.

The LMC external column turret design is an amalgamation of the external cantilever turret and the internal turret design. The external column turret allows for higher loads to be taken by the mooring system, for the same equivalent turret steel weight. This is because the horizontal loads are mainly carried at the lower plane bearings. By essentially creating an internal turret design on the bow of the vessel, LMC has allowed for the tank space that would otherwise have been utilised for the internal turret to be available, therefore increasing the capacity of the vessel.

Another advantage of the external column turret when compared to a cantilever turret is that the swivel stack and turret equipment are closer to the bow of the vessel, reducing the accelerations and hence loadings, and also allowing for easier access for inspection and operations.
<table>
<thead>
<tr>
<th>PROJECT</th>
<th>END CLIENT</th>
<th>LOCATION</th>
<th>INSTALL DATE</th>
<th>WATER DEPTH</th>
<th>DWT</th>
<th>EXTREME SIGNIFICANT WAVEHEIGHT</th>
<th>TURRET TYPE</th>
<th>SCOPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>PIONEIRO DE LIBRA FPSO</td>
<td>PETROBRAS</td>
<td>BRAZIL</td>
<td>2017</td>
<td>2400M</td>
<td>130,596</td>
<td>11.6M</td>
<td>CANTILEVER</td>
<td>EPC</td>
</tr>
<tr>
<td>GAZA FSO</td>
<td>MOG</td>
<td>LIBYA</td>
<td>2016</td>
<td>170M</td>
<td>215,000</td>
<td>8.8M</td>
<td>COLUMN</td>
<td>DETAILED DESIGN GROUP EPC</td>
</tr>
<tr>
<td>FSO SUKSAN SALAMANDER ENERGY</td>
<td>SALAMANDER</td>
<td>THAILAND</td>
<td>2014</td>
<td>60M</td>
<td>80,000</td>
<td>7.5M</td>
<td>CANTILEVER</td>
<td>EPC</td>
</tr>
<tr>
<td>PERISAI KAMELIA FSO</td>
<td>HESS</td>
<td>MALAYSIA</td>
<td>2013</td>
<td>55M</td>
<td>85,000</td>
<td>6.6M</td>
<td>CANTILEVER</td>
<td>DETAILED DESIGN GROUP EPC</td>
</tr>
<tr>
<td>LEWEEK EMAS FPSO</td>
<td>POVO</td>
<td>VIETNAM</td>
<td>2011</td>
<td>95M</td>
<td>100,000</td>
<td>7.9M</td>
<td>INTERNAL</td>
<td>DETAILED DESIGN GROUP EPC</td>
</tr>
<tr>
<td>FSO TOSCANA</td>
<td>OLT</td>
<td>ITALY</td>
<td>2012</td>
<td>120M</td>
<td>60,000</td>
<td>8.8M</td>
<td>COLUMN</td>
<td>DETAILED DESIGN</td>
</tr>
<tr>
<td>FIRENZE FPSO</td>
<td>ENI</td>
<td>ITALY</td>
<td>2011</td>
<td>815M</td>
<td>150,000</td>
<td>8.8M</td>
<td>COLUMN</td>
<td>DETAILED DESIGN</td>
</tr>
<tr>
<td>PTSC BACH HO – FSO-5</td>
<td>PTSC</td>
<td>VIETNAM</td>
<td>2010</td>
<td>45M</td>
<td>150,000</td>
<td>7.8M</td>
<td>CANTILEVER</td>
<td>DETAILED DESIGN</td>
</tr>
<tr>
<td>RATU SONGKHLA FSO</td>
<td>CPOC</td>
<td>MALAYSIA</td>
<td>2009</td>
<td>50M</td>
<td>120,000</td>
<td>5.8M</td>
<td>CANTILEVER</td>
<td>DETAILED DESIGN</td>
</tr>
<tr>
<td>CPTL 1378 FARWAH FPSO</td>
<td>EXMAR/ TOTAL</td>
<td>LIBYA</td>
<td>2003</td>
<td>90M</td>
<td>90,000</td>
<td>9.7M</td>
<td>COLUMN</td>
<td>EPC</td>
</tr>
<tr>
<td>CAKERAWALA FSO</td>
<td>CTOC</td>
<td>MALAYSIA</td>
<td>2002</td>
<td>65M</td>
<td>60,000</td>
<td>5.8M</td>
<td>CANTILEVER</td>
<td>DETAILED DESIGN</td>
</tr>
<tr>
<td>FSU SOORENA</td>
<td>NIDC</td>
<td>IRAN</td>
<td>2002</td>
<td>45M</td>
<td>330,000</td>
<td>5.8M</td>
<td>STERN CANTILEVER</td>
<td>DETAILED DESIGN</td>
</tr>
<tr>
<td>MUBARAKA FSU</td>
<td>CRESCENT</td>
<td>SHARJAH</td>
<td>1992</td>
<td>80M</td>
<td>76,000</td>
<td>5.6M</td>
<td>STERN CANTILEVER</td>
<td>DETAILED DESIGN</td>
</tr>
</tbody>
</table>

ABOVE: PIONEIRO DE LIBRA - EXTERNAL CANTILEVER TURRET
### PIONEIRO DE LIBRA FPSO EXTERNAL CANTILEVER TURRET (EPC)

| **CLIENT** | Petrobras led Consortium (Petrobras, Total, Shell, CNPC, CNOOC) | Odebrecht Oil & Gas - Teekay (OOGTK) |
| **LOCATION** | Santos Basin, 230 km offshore Brazil | **VESSEL** Converted vessel; (257 m (L), 42.5 m (B), 22.4 m (D)) |
| **FABRICATION** | 2015 - 2016; SOFEL (Triyards), Vietnam; Integration: Jurong Shipyard, Singapore | **CLASS SOCIETY** American Bureau of Shipping (ABS) |
| **DESIGN LIFE** | 20 years | **WATER DEPTH** 2400 m |
| **SIG WAVE HEIGHT** | 11.6 m | **MOORING SYSTEM** 3 x 3 cluster, all chain mooring system |
| **ANCHORING SYSTEM** | Torpedo Pins | **RISER SYSTEM** 2 x 8” Oil Production Risers / 2 x 6” Service Risers / 3 x 6” Electro Hydraulic / Umbilicals 2 x 6” Gas Injection Risers |

### FSO SUKSAN SALAMANDER EXTERNAL CANTILEVER TURRET (EPC) AND SWIVEL

| **CLIENT** | Salamander Energy / Teekay Shipping |
| **LOCATION** | Gulf of Thailand |
| **VESSEL** | Converted FSO; (210 m (L) x 38 m (B) x 19.6 m (D)) |
| **FABRICATION** | 2013 - 2014; SOFEL (Triyards), Vietnam; Integration: Yiu Lian, China | **CLASS SOCIETY** American Bureau of Shipping (ABS) |
| **DESIGN LIFE** | 15 years | **WATER DEPTH** 60 m |
| **SIG WAVE HEIGHT** | 7.5 m (Cyclonic) | **MOORING SYSTEM** 3 x 3 cluster, all chain mooring system |
| **ANCHORING SYSTEM** | Drag Anchors | **RISER SYSTEM** Lazy Wave; 2 x 6” Crude Import Riser, 1 x 6” Production Water Riser |
| **SWIVEL SYSTEM** | Two Product Buoy Type Swivel (2 x 6”) Utility Swivel, (3 x ½”) |
### GAZA FSO (SLOUG REPLACEMENT) EXTERNAL COLUMN TURRET AND SWIVEL STACK

<table>
<thead>
<tr>
<th>CLIENT</th>
<th>Mellitah Oil and Gas B.V / STX Offshore and Shipbuilding / EMAS Chiyoda Subsea (EMAS AMC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOCATION</td>
<td>120 km North West of Tripoli, Libya</td>
</tr>
<tr>
<td>VESSEL</td>
<td>New Build; (316 m (L) x 51 m (B) x 30 m (D))</td>
</tr>
<tr>
<td>FABRICATION</td>
<td>2013-2016; Keppel, Singapore; Integration: STX Offshore and Shipbuilding, Korea</td>
</tr>
<tr>
<td>CLASS SOCIETY</td>
<td>Det Norske Veritas (DNV)</td>
</tr>
<tr>
<td>DESIGN LIFE</td>
<td>35 years</td>
</tr>
<tr>
<td>WATER DEPTH</td>
<td>165 m</td>
</tr>
<tr>
<td>SIG WAVE HEIGHT</td>
<td>8.8 m</td>
</tr>
<tr>
<td>MOORING SYSTEM</td>
<td>3 x 3 cluster, all chain mooring system</td>
</tr>
<tr>
<td>RISER SYSTEM</td>
<td>Lazy-S with Mid Water Arch; 2 x 14.75” Production Risers, 1 x 10” Import Riser, 1 x Power / Optical</td>
</tr>
<tr>
<td>SWIVEL SYSTEM</td>
<td>3 x 8” Production / 1 x High Voltage Slip Ring (HVSR) / 1 x Low Voltage Slip Ring (LVSR) / 1 x Utility Swivel / 1 x Power / Optical Joint (FORJ)</td>
</tr>
</tbody>
</table>

### LEWEK EMAS FPSO INTERNAL TURRET

<table>
<thead>
<tr>
<th>CLIENT</th>
<th>Premier Oil Vietnam Offshore (POVO) / EMAS Offshore Construction and Production (EOCP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOCATION</td>
<td>Chim Sao and Dua Field, Vietnam</td>
</tr>
<tr>
<td>VESSEL</td>
<td>Conversion: (278 m (L) x 50 m (B) x 24 m (D))</td>
</tr>
<tr>
<td>FABRICATION</td>
<td>2010 - 2015; Keppel, Singapore; Integration: Keppel, Singapore</td>
</tr>
<tr>
<td>CLASS SOCIETY</td>
<td>American Bureau of Shipping (ABS)</td>
</tr>
<tr>
<td>DESIGN LIFE</td>
<td>25 years</td>
</tr>
<tr>
<td>WATER DEPTH</td>
<td>95 m</td>
</tr>
<tr>
<td>SIG WAVE HEIGHT</td>
<td>7.9 m</td>
</tr>
<tr>
<td>MOORING SYSTEM</td>
<td>3 x 3 cluster, all chain mooring system</td>
</tr>
<tr>
<td>ANCHORING SYSTEM</td>
<td>Driven Piles</td>
</tr>
<tr>
<td>RISER SYSTEM</td>
<td>Lazy-S with Mid Water Arch; 2 x 10” Production, 1 x 10” Gas Export, 1 x 4” Water Lift, 1 x Umbilical, 2 x 10” Future Production, 1 x Future Umbilical</td>
</tr>
</tbody>
</table>

### PERISAI KAMELIA FPSO EXTERNAL CANTILEVER TURRET AND SWIVEL STACK

<table>
<thead>
<tr>
<th>CLIENT</th>
<th>HESS Exploration and Production / EMAS Offshore Construction and Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOCATION</td>
<td>North Malay Basin, Malaysia</td>
</tr>
<tr>
<td>VESSEL</td>
<td>Converted FSO; (250 m (L) x 40 m (B) x 22 m (D))</td>
</tr>
<tr>
<td>FABRICATION</td>
<td>2012 - 2015; SOFEL (Triyards), Vietnam; Integration: Keppel, Singapore</td>
</tr>
<tr>
<td>CLASS SOCIETY</td>
<td>Det Norske Veritas (DNV)</td>
</tr>
<tr>
<td>DESIGN LIFE</td>
<td>15 years</td>
</tr>
<tr>
<td>WATER DEPTH</td>
<td>55 m</td>
</tr>
<tr>
<td>SIG WAVE HEIGHT</td>
<td>6.9 m (Cyclonic)</td>
</tr>
<tr>
<td>MOORING SYSTEM</td>
<td>3 x 3 cluster, all chain mooring system</td>
</tr>
<tr>
<td>ANCHORING SYSTEM</td>
<td>Driven Piles</td>
</tr>
<tr>
<td>RISER SYSTEM</td>
<td>Lazy Wave; 1 x 12” Gas Import, 1 x Export</td>
</tr>
<tr>
<td>SWIVEL SYSTEM</td>
<td>Double Path Toroidal Swivel (2 x 8”) / Utility Swivel (5 x ½”) / Axial Swivel (8”)</td>
</tr>
</tbody>
</table>

### FSRU TOSCANA EXTERNAL COLUMN TURRET

<table>
<thead>
<tr>
<th>CLIENT</th>
<th>Offshore LNG Toscana (OLT) / Saipem S.p.A</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOCATION</td>
<td>12 miles offshore Livorno, Italy</td>
</tr>
<tr>
<td>VESSEL</td>
<td>Converted LNG Carrier (Moss Type); (310 m (L) x 48 m (B) x 26.5 m (D))</td>
</tr>
<tr>
<td>FABRICATION</td>
<td>2009 - 2011; Dubai Dry Docks, UAE; Integration: Dubai Dry Docks, UAE</td>
</tr>
<tr>
<td>CLASS SOCIETY</td>
<td>RINA</td>
</tr>
<tr>
<td>DESIGN LIFE</td>
<td>20 years</td>
</tr>
<tr>
<td>WATER DEPTH</td>
<td>112 m</td>
</tr>
<tr>
<td>SIG WAVE HEIGHT</td>
<td>8.2 m</td>
</tr>
<tr>
<td>MOORING SYSTEM</td>
<td>6 x 1 cluster, all chain mooring system</td>
</tr>
<tr>
<td>ANCHORING SYSTEM</td>
<td>Driv Anchors</td>
</tr>
<tr>
<td>RISER SYSTEM</td>
<td>Lazy-S with Mid Water Arch; 2 x 14” Gas Export Risers, 1 Umbilical</td>
</tr>
</tbody>
</table>

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**Note:** The text includes details about various offshore facilities including their locations, vessels, fabrication details, and mooring systems. The information is structured in a table format for clarity and ease of reading.
**RATU SONGKHLA FPSO**  EXTERNAL CANTILEVER TURRET

**CLIENT**  Carigali-PTTEPI Operations Company Sdn Bhd / M3nergy Bhd

**LOCATION**  Block B-17 and C-19, offshore Thailand

**VESSEL**  Converted FSO; (218 m (L), 32 m (B), 21 m (D))

**FABRICATION**  2008 - 2009; Keppel, Singapore

**CLASS SOCIETY**  American Bureau of Shipping (ABS)

**DESIGN LIFE**  20 years

**WATER DEPTH**  60 m

**SIG WAVE HEIGHT**  5.1 m

**MOORING SYSTEM**  6 x 1 cluster, all chain mooring system

**ANCHORING SYSTEM**  Driven Piles

**RISER SYSTEM**  1 x 8" Condensate Riser

**CPTL 137 B (FARWAH) FPSO**  EXTERNAL COLUMN TURRET (EPC)

**CLIENT**  Compagnie des Petroles Total (Libye) (CPTL) / Exmar Offshore / Doris Engineering

**LOCATION**  Offshore Libya

**VESSEL**  New Build; (210 m (L), 44 m (B), 23 m (D))

**FABRICATION**  2002 - 2003; Burntisland Fabrications (BIFAB), Scotland; Integration: IZAR FENE, Spain

**CLASS SOCIETY**  Bureau Veritas (BV)

**DESIGN LIFE**  20 years

**WATER DEPTH**  83 m

**SIG WAVE HEIGHT**  8.8 m

**MOORING SYSTEM**  3 x 3 cluster, all chain mooring system

**ANCHORING SYSTEM**  Stevpris Drag Anchors

**RISER SYSTEM**  2 x 10" Production Riser

**FIRENZE FPSO**  EXTERNAL COLUMN TURRET

**CLIENT**  ENI SpA / Saipem SpA

**LOCATION**  50 km NE Brindisi, Italy, Adriatic Sea

**VESSEL**  Conversion; (238 m (L) x 42 m (B) x 22 m (D))

**FABRICATION**  2009 - 2011; Dubai Dry Docks, UAE

**CLASS SOCIETY**  RINA

**DESIGN LIFE**  15 years

**WATER DEPTH**  880 m

**SIG WAVE HEIGHT**  8.8 m

**MOORING SYSTEM**  4 x 2 cluster, chain - wire - chain system

**ANCHORING SYSTEM**  Existing Piles

**RISER SYSTEM**  Sleep Wave with Tether; 3 x 2.5" Gas Lift, 3 x 6" Production, 3 x Umbilical

**PTSC BACH HO (FSO-05) EXTERNAL CANTILEVER TURRET**

**CLIENT**  Petroleum Technical Services Company (PTSC) / Monobuoy

**LOCATION**  White Tiger and Dragon Oil Field, 200 miles offshore Vietnam

**VESSEL**  New Build FSO; (218 m (L), 32 m (B), 21 m (D))

**FABRICATION**  2008 - 2010; Vinashin, Vietnam

**CLASS SOCIETY**  American Bureau of Shipping (ABS)

**DESIGN LIFE**  20 years

**WATER DEPTH**  47 m

**SIG WAVE HEIGHT**  7.5 m

**MOORING SYSTEM**  3 x 3 cluster, all chain mooring system

**ANCHORING SYSTEM**  Driven Piles

**RISER SYSTEM**  2 x 8" Production Risers
Cakerawala FSO External Cantilever Turret

- **Client**: Carigali Triton Operating Company (CTOC), Saipem SpA
- **Location**: Gulf of Thailand, Thailand-Malaysia Joint Development Zone
- **Vessel**: Conversion; (166 m (L), 39 m (B), 21.7m (D))
- **Fabrication**: 2000 - 2002; Samsung Heavy Industries, Korea
- **Class Society**: American Bureau of Shipping (ABS)
- **Design Life**: 30 years
- **Water Depth**: 55 m
- **SIG Wave Height**: 5.8 m
- **Mooring System**: 6 x 1 cluster, all chain mooring system
- **Anchoring System**: Driven Piles
- **Riser System**: 1 x 6” Condensate Riser

Fsu Soorena External Stern Cantilever Turret

- **Client**: National Iranian Oil Company (NIOC); Shell Exploration BV
- **Location**: Soroosh Field, Persian Gulf
- **Vessel**: Conversion; (330 m (L), 56 m (B), 28.6 m (D))
- **Fabrication**: 2001; Sembawang, Singapore
- **Class Society**: Lloyd’s
- **Design Life**: 25 years
- **Water Depth**: 45 m
- **SIG Wave Height**: 5.9 m
- **Mooring System**: 4 x 2 cluster, all chain mooring system
- **Anchoring System**: Driven Piles
- **Riser System**: 2 x 15” Export Riser

Mubarakka FSU External Stern Cantilever Turret

- **Client**: Crescent Petroleum Company International of Sharjah
- **Location**: Mubarak Field, Offshore Sharjah, UAE
- **Vessel**: Conversion; 81,000 DWT
- **Fabrication**: 1992; Contech, Sharjah; Integration: Jebel Ali Docks, Dubai
- **Class Society**: Lloyd’s
- **Design Life**: 20 years
- **Water Depth**: 61 m
- **SIG Wave Height**: 6.3 m
- **Mooring System**: 6 x 1 cluster, all chain mooring system
- **Anchoring System**: Driven Piles
- **Riser System**: 2 x 12” Submarine Hoses

Above: Persia Kamelia FPSO external cantilever turret and swivel stack
LMC has the capability and experience to design and supply spread-moored systems, perform the geotechnical assessments, and design and fabricate or procure the piles or anchors, as well as design and supply the chain stoppers and deck reinforcement required. LMC provides installation engineering including procedures and routing layout drawings and can also procure the required winches, sheaves and ancillaries in order to provide a turnkey solution. For riser systems, LMC provides dynamic riser system analysis to assess both strength and global fatigue, Pipe Line End Manifold (PLEM) design, and hang off balcony engineering.

LMC can then either procure and supply the risers, or support the client in all aspects of the procurement on both technical and commercial aspects. LMC has completed the detailed development of a number of spread moored units including FPSOs, FSOs and barges. Involvement has varied from full detailed design (including specification, design, procurement, and installation of key mooring components such as chain stoppers) to third party verification work.
LMC CALM buoy design is adaptable to a range of water depths, offloading tanker capacity and environmental loadings.

- CATENARY ANCHOR LEG
- MOORING (CALM) BUOYS

LMC has developed a detailed design for a standardised CALM buoy for mooring of FSOs at offshore fields or for loading / offloading oil products in near-shore locations at refineries or oil offloading terminals.

The LMC CALM buoy design is adaptable to a range of water depths, offloading tanker capacity and environmental loadings.

**DESIGN PARAMETERS**
- 400 tonnes load from the tanker
- Flexible chain stopper/skirt design to allow for 6 – 12 mooring legs
- Water depths up to approximately 120m
- Environments up to 4.0 – 5.0m Hs, dependent on exact location and configuration

**EXPERTISE & EXPERIENCE**
- Comprehensive detailed design
- Technical specifications
- Operation & Maintenance (O & M)
- Health, Safety & Environment (HSE) manuals
- Feasibility and cost assessments for field development and operator Front End Engineering Design (FEED)
- Owners engineer and third party review
- Engineering upgrades and modifications to existing units
- Preparation of operational documentation
- Offshore attendance during installation
- Expert witness and survey for damage assessment and review

LMC is able to offer full Engineering Procurement and Construction (EPC) services for mooring and offloading buoy systems, including the supply of all associated components, hoses, mooring lines and anchors or piles.

**CATENARY ANCHOR LEG MOORING (CALM) BUOYS**

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As the oil and gas industry moves towards deeper water discoveries, there now exists the requirement for an offloading buoy design suitable for the same water depths.

Accordingly, LMC has extended its range of products to include a deep-water offloading buoy design, suitable for water depths up to 2000m. The deep-water offloading buoy is able to withstand the 100-year met-ocean conditions of West Africa. During offloading, the buoy is designed to be capable of safely mooring a VLCC during a 3.5 m Hs (typical 1-year and squall conditions for West Africa).

The deep water offloading buoy is a complex system of components with strong mechanical coupling between each. LMC has completed a comprehensive design development programme to address the industry lessons learned and ensure that the complex loadings are all accounted for in a fully coupled dynamic system.

The LMC deep water offloading buoy has a number of key features that are considered imperative to the safety and operational uptime of the complete buoy system, attached vessel and surrounding environment.

- Turntable designed to reduce out of plane bending stresses
- Circular hull designed to improve the motions and characteristics
- Skirt system optimised to improve the motions and absorb impact from berthing tanker collisions
- Automatic bearing lubrication system to reduce the risk of bearing failure and reduce maintenance operations
- Bearing triplex redundancy to permit change out of bearing segment in case of damage
- Remotely operated Emergency Shut Down Valves (ESDVs) using portable telemetry units on the nearby FPSO
- Double axis chain stoppers to reduce the out of plane bending stresses on mooring chain connections
- Chain tension monitoring system
- Buoy swivel design similar to turret buoys that have been proven in operation

**Deep Water Offloading Buoy**

- **Buoy Outer Diameter**: 20m
- **Buoy Height**: 10m
- **Compartments**: 13
- **Mass**: 700 – 900MT

**Key Parameters**

The LMC deep water offloading buoy has a number of key features that are considered imperative to the safety and operational uptime of the complete buoy system, attached vessel and surrounding environment.
The LMC toroidal swivel units are designed in a modular fashion, such that they can be stacked in combinations of up to:

- 4 No. 4" swivels rated at 7,500 psi
- 4 No. 8" swivels rated at 5,000 psi
- 4 No. 12" swivels rated at 3,000 psi

Utility swivels and electrical swivels can then be considered in several different configurations, depending on project requirements.

Further research and development is ongoing to progress to the designs allowing for provision of high pressure 8" (6000 psi) and high pressure 4" (7500 psi) LMC swivel designs to the market.

LMC SWIVEL DESIGN

**Toroidal Swivels**
- 12" Toroid (3000psi) – in service
- 8" Toroid (5000psi) – in service
- 4" Toroid (5000psi)

**Inline Swivels**
- 8" Inline Swivel (3000psi) – in service
- 8" Axial Swivel (5000psi)
- 12" Inline Swivel (6000psi)

**Utility Swivels**
- 5 x ¾" Unit (5000psi) – in service
- 2 x 2" Unit (5000psi)
- 10 x 1½" Unit (290psi) – in service
- 3 x ¾" Unit (1500psi) – in service

**CALM Buoy Swivels**
- 2 x 6" Unit (290psi) – in service
- 2 x 24" Unit (435psi)
8" TOROIDAL SWIVEL
Design Pressure 5000psi
Single / Dual Inlet Path Configuration
Triple Seal Configuration
On-unit Spare Seal Storage possible
All Duplex Material (no overlaying required)
Design allows in-situ replacement of seals
ABS & DNV Certified

8" IN-LINE SWIVEL
Design Pressure 3000psi
Triple Seal Configuration
All Duplex Material (no overlaying required)
All forged constituents
Design allows in-situ replacement of seals
ABS Certified

5 PATH UTILITY SWIVEL
Design Pressure 5000psi
Double Seal Configuration
All Duplex Material (no overlaying required)
All forged constituents
ABS and DNV Certified

24" BUOY-TYPE SWIVEL
Design Pressure 435psi
Double Seal Configuration
<table>
<thead>
<tr>
<th>PROJECT</th>
<th>CLIENT / END CLIENT</th>
<th>SWIVEL TYPE</th>
<th>SIZE</th>
<th>NO. OFF</th>
<th>PRESSURE RATING</th>
<th>PROJECT PRESSURES</th>
<th>SERVICE FLUID</th>
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</thead>
<tbody>
<tr>
<td>RATU SONKHALA FSO</td>
<td>M3 ENERGY / CPDC</td>
<td>UTILITY SWIVEL</td>
<td>3 X 3/4&quot;</td>
<td>1</td>
<td>105BARG</td>
<td>DESIGN: 105BARG (MAX)</td>
<td>HYDRAULIC OIL / HC VENT GAS</td>
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<tr>
<td>PERISAI KAMELIA FPSO</td>
<td>EDCP / HESS</td>
<td>IN-LINE SWIVEL</td>
<td>8&quot;</td>
<td>1</td>
<td>30BARG</td>
<td>DESIGN: 30BARG</td>
<td>CONDENSATE OIL</td>
</tr>
<tr>
<td>FSO SUKSAN SALAMANDER</td>
<td>TECKAY / SALAMANDER ENERGY</td>
<td>DOUBLE PATH TOROIDAL SWIVEL</td>
<td>2 X 8&quot;</td>
<td>1</td>
<td>245BARG</td>
<td>DESIGN: 245BARG</td>
<td>PRODUCED HC GAS / WITH CONDENSATE</td>
</tr>
<tr>
<td>TWO PRODUCT BUOY TYPE SWIVEL</td>
<td></td>
<td>UTILITY SWIVEL</td>
<td>5 X 3/4&quot;</td>
<td>1</td>
<td>245BARG</td>
<td>DESIGN: 245BARG</td>
<td>INSTRUMENT AIR / HC VENT GAS</td>
</tr>
<tr>
<td>GAZA FSO (SUB-O/ REPLACEMENT)</td>
<td>EAMC / NOG</td>
<td>IN-LINE SWIVEL</td>
<td>8&quot;</td>
<td>1</td>
<td>207BARG</td>
<td>DESIGN: 207BARG</td>
<td>PROCESSED HC GAS (EXPORT)</td>
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<tr>
<td>DOUBLE PATH TOROIDAL SWIVEL</td>
<td></td>
<td>UTILITY SWIVEL</td>
<td>5 X 3/4&quot;</td>
<td>1</td>
<td>345BARG</td>
<td>DESIGN: 345BARG</td>
<td>CRUDE OIL / PRODUCED WATER</td>
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<tr>
<td>UTILITY SWIVEL</td>
<td></td>
<td>3 X 3/4&quot;</td>
<td>1</td>
<td>20BARG</td>
<td>DESIGN: 10BARG (MAX)</td>
<td>INSTRUMENT AIR / HC VENT GAS</td>
<td></td>
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<tr>
<td>UTILITY SWIVEL</td>
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<td>2 X 8&quot;</td>
<td>1</td>
<td>207BARG</td>
<td>DESIGN: 207BARG</td>
<td>CRUDE OIL / PRODUCED WATER</td>
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<td>UTILITY SWIVEL</td>
<td></td>
<td>5 X 3/4&quot;</td>
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<td>345BARG</td>
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<td>INSTRUMENT AIR / HC VENT GAS</td>
<td></td>
</tr>
</tbody>
</table>
With an extensive knowledge of offshore floating structures and platforms obtained from over 30 years in the oil and gas industry, LMC has a wealth of expertise in the delivery of major turnkey oil and gas projects that is readily transferable to the renewables market. LMC has worked closely with a number of clients to provide technical assistance and expertise. Our experienced design and construction teams are involved from the initial Front-End Engineering Design (FEED) stage and detailed design through to construction, execution and commissioning.

A global operating presence, regional execution knowledge and a wide network of global vendors provides LMC with an opportunity to supply a cost effective solution. LMC has strong engineering capabilities supported by the financial capability to execute large Engineering, Procurement, Construction and Installation (EPCI) projects whilst still priding itself on being adaptable and nimble enough to provide innovative and customized solutions for our clients.

LMC has a considerable track record for the provision of both driven pile, and suction pile anchors, with design of these items usually forming part of LMC’s scopes within its Turret Mooring System projects. LMC has also developed mooring systems for offshore renewable projects including floating wind turbines and marine current turbine systems.

The global renewables sector has been growing steadily over the last 10 years, and alongside this, LMC has undertaken a number of projects for different clients, including wind farms, tidal energy, and wave energy systems.
Typical services that LMC provides to the renewable energy sector include:

- **Feasibility Studies, Capital Expenditure (CAPEX) Studies and due diligence work on potential investment**
- **FEED studies, conceptual design and selection**
- **Functional Specifications and tender documentation**
- **Health, Safety and Environment (HSE) Management**
- **Quality Assurance and Quality Control (QA / QC) Management**
- **Technical and detailed design**
- **Structural Finite Element Analysis (FEA) of mooring components, umbilical hang-offs, foundations, jackets, and piles**
- **Hydrodynamic Assessments**
- **Geotechnical Engineering**
- **Design and dynamic analysis of mooring systems**
- **Fatigue analysis of mooring, umbilical and structural components**
- **Technical assistance for model testing**
- **Component procurement**
- **Transportation, Sea-fastening and Grillage Design**
- **Installation Engineering**

**LMC has a tried and tested in-house design facility to execute complex projects.**

LMC provides a range of analytical services using the latest industry software ANSYS, SACS, Ariane (Bureau Veritas), Orcaflex, Safetrans as well as specific in-house developed programs.

**A key development of the renewable energy industry is the move towards deeper water wind farms, where traditional piled systems cannot be utilised. LMC’s in-depth knowledge of floating structures coupled with mooring systems in extreme offshore environments puts the Company at the forefront of this technological advance.**

LMC provides the market a robust floating wind farm design that brings together all of the technological advances in hydrodynamic and mooring system engineering.
SUSTAINABLE MARINE ENERGY
– PLAT-I

LMC is currently performing the detailed engineering (including hydrodynamic analysis, mooring design, structural design and offshore installation system design) for a floating tidal energy device in collaboration with Sustainable Marine Energy. The device is planned to be tested in Scotland and then relocated to both Singapore and the Philippines.

DOUNREAY TRI PROJECT

The Dounreay Project is a demonstration project for offshore floating wind to be installed offshore Scotland.

LMC SCOPE CONSISTS OF:

- Detailed engineering of turret system

PROCUREMENT AND SUPPLY OF ALL KEY EQUIPMENT FOR TURRET SYSTEM, NAMELY:

- Slewing Bearing System and Lubrication System
- Lower Bearing System
- Sealing System
- Electrical outfitting equipment

PLATFORM PARAMETERS

- Platform length ~180m
- Platform width ~80m
- Draft ~15m
- Hub Height ~100m
- Installed Capacity – 2x5MW turbines
FLOATING LNG & TERMINALS

LMC offer to the LNG market a technical, commercial and engineering expertise which enables the Company to support the Client through all phases of the development.

LMC are able to perform feasibility studies, conceptual development and Front End Engineering Design (FEED) for offshore Floating LNG or nearshore Terminals in order to evaluate cost and technical solutions for the designated location.

LMC can support the client as Owner Engineer throughout the tendering and execution phases by preparing tender packages and specifications and performing a technical and commercial review of the submissions.

Having core engineering capabilities and experience in the oil and gas industry, LMC can provide a complete design for an LNG nearshore terminal. LMC also has extensive knowledge and track record for turret moored and spread moored floating systems, with the FSRU Toscana being the first turret permanently moored FSRU in the world. LMC has also been heavily involved in the FEED stages of the PFLNG2 for Petronas, Mozambique FNLNG for ENI and the Santos Basin FLNG for Petrobras.
LMC offers its clients a wide ranging engineering consultancy and design capability within the offshore oil and gas and renewable sectors.

LMC is often involved at the early phases of Front End Engineering Design (FEED) to support the client during the field development and conceptual stages. LMC has the capability to perform an independent assessment to determine the most suitable mooring and riser system to be deployed at a given site, taking into account such parameters as Met-ocean conditions, soil conditions, existing subsea infrastructure, and vessel and offloading parameters.

LMC can develop conceptual designs and perform feasibility studies for a range of alternative mooring systems, and through our own experience and sub-vendor contacts can provide an expert assessment of the cost and schedule and technical advantage involved with each proposal.

LMC also supports a large number of clients with the detailed design, either by performing full analyses scopes or performing third party verifications.

As well as the technical capabilities available, LMC can support our clients with project, commercial and risk based expertise for life extension studies, HAZOPs and HAZIDs.

LMC’s engineering team consists of Naval Architects, Subsea Engineers, Structural Engineers, Civil Engineers, Mechanical Engineers, Piping Engineers, Electrical and Instrumentation Engineers and Installation Engineers. This enables LMC to offer expert services across the industry. As LMC is also an EPC supplier of long lead and technically complex equipment the company has developed a well-rounded and integrated team that interfaces efficiently across the various disciplines to create a synergy within the project and provide an all-encompassing service.
Inherent in all of LMC’s own turret and mooring EPC and design projects, the company provides extensive Project Management and Owners Engineer services for owners, third party clients and major contractors. This Project Management service is often provided in conjunction with engineering and technical support services, and/or client ‘Owners Engineer’ services on a large number of projects.

LMC’s offices are globally positioned to ensure that our clients have 24-hour a day support from the management team during the course of the project. The company prides itself on maintaining a close relationship with the client throughout the project in order to manage the interfaces efficiently and professionally. LMC can also integrate within the client team by seconding engineers to the client offices.

LMC has proven over its long history that it is very competitive with costs whilst also working flexibly with our clients to accommodate their needs and budgets in the current market. LMC’s mission is to be the company that clients repeatedly trust to deliver projects on time, on budget and with a friendly and collaborative approach to doing business. LMC strives to build a strong everlasting partnership with all our clients.
LMC’s dedicated Project Management Team is responsible for all management, co-ordination and direction including, but not limited to:

- Contract and Sub-Contracts Administration
- Cost Management, CAPEX, OPEX
- Due Diligence
- Management of Health, Safety and Protection of the Environment
- Management of Quality Assurance Policies and Programs
- Perform regular HSE and QA audits of client sub-suppliers and yards
- Engineering Management
- Operations Strategy, Operation and Maintenance Manuals
- Site Supervision and Fabrication Yard Inspection
- Commissioning Support
- Transportation and Installation Management
- Interface Management
- HAZOP and HAZID
- Design Approval and Technical Review
- Classification Society Coordination and Liaison
- Project Controls, Administration and Document Control
- Procurement, Expediting and Inspection
- Technical & Commercial Quotation Reviews
- Planning, Budgeting and Cost Modelling,
- Critical Path Analysis and Progress Reporting
- Front End Engineering Design (FEED) and Field Development and Layout
- Basis of Design, Technical Specifications and Fabrication Specifications
- Invitation to Tender (ITT) Packages

LMC’s track record boasts previous work with all the major oil companies and the company’s capabilities are trusted by some of the world’s largest oil supermajors. LMC has recently completed the US$110 million EPC provision of the Pioneiro de Libra FPSO mooring system for the Libra consortium, comprising Petrobras, Shell, Total, CNOOC and CNPC. When in service, this will be one of the world’s largest external cantilever turrets, operating in water depths of up to 2,400m.

LMC maintains a highly experienced and flexible team in two global offices, and provides engineering solutions and Project Management Services over a complete range of project sizes and scopes. The team includes experts with significant experience in the oil and gas, and offshore marine renewables sector.
With a long-running background in EPC projects, LMC has a global connection to the oil, gas and offshore energy supply chain, supported by an ISO 9001 certified procurement protocol.

As part of the Owners Engineer and Project Management service, LMC’s procurement division can provide support to the client for all procurement and expediting requirements. Listed below are the key services that LMC provides:

- Supply or support in the development of contract & procurement strategy
- Overall project schedule
- Development of Risk Register and supplier critical path analysis
- Responsibility Matrix
- CAPEX/OPEX budgets
- Technical & Commercial Bid Evaluations
- Identification of long lead items & delivery risks
- Material management / material control
- Inspection Services
- Expediting Services
- Perform regular HSE and QA audits of client sub-suppliers and yards
- Integration and Final Acceptance

LMC has a global presence and capability for procurement of equipment, with offices in the UK and Singapore enabling around the clock expediting and inspection. LMC prides itself on its strong relationships with the supply chain to deliver equipment on schedule and within project budgets. LMC work closely with suppliers to ensure that all interfaces are managed efficiently.

LEFT: GAZA FSO - EXTERNAL COLUMN TURRET TRANSPORTATION
TRANSPORTATION & INSTALLATION
ENGINEERING AND MANAGEMENT

LMC provides installation engineering and support for mooring and riser installation campaigns

Projects completed range from conceptual FEED to determine best practice methods, through to detailed engineering and simulations including vessel towing, sea-keeping, pull-in and hook-up operations. LMC also has a wealth of experience during offshore campaigns acting as both turret and mooring designer and as Client Representative.

LMC has demonstrated it is competitive with costs and is willing to work with the clients to accommodate their needs and budgets in the current market.

LMC’s design capabilities and experience extends to transportation analysis of equipment and modules.

LMC has extensive experience in transporting items such as modules, well head platforms, jacket structures, and anchor piles from the quay side to the installation site, having performed such work for some of the biggest names in the industry.

LMC performs detailed lifting and transportation analysis for complete turrets, which are often fabricated in one yard and shipped to another. This involves complex grillage arrangements due to the acceptable loads and deflections on the turret bearing systems whilst in transit. LMC are well versed with a variety of loadout and lifting methodologies including bespoke lifting frames, Self-propelled Modular Transporters (SPMT), rail and skid beam options.

LMC has a proven track record and vast experience in detailed loadout and transportation engineering including:

- Loadout and lifting analysis
- Sea-fastening and grillage design
- Heavy lifting and installation engineering
- On route barge / vessel motion analysis
- Barge stability calculations
- Barge / vessel on-site mooring analysis during installation campaign
- Installation and integration design, methodologies and procedures
- Pile driving analysis
- Design of installation ancillaries, including pile guide frames, offshore overboard infrastructure and chutes
- Provision of and liaison with a Marine Warranty Surveyor / Classification Society approval
- Marine logistics management and support
LMC occupies a unique position in the marketplace due to its considerable experience in the decommissioning of the North Sea Ekofisk complex. As part of the industry’s largest decommissioning project to date and also the removal of the topsides of NW Hutton, the single largest steel platform to be removed, both of which were performed as part of a Frame Agreement with Heerema. For these projects, typical scope included:

- Platform hook-down and removal surveys
- Prepare Make-safe plans (more for very old/long-abandoned platforms)
- Perform weight reconciliation checks (to determine current vs designed weight and CoG data)
- Determination of cut locations and removal sequence planning
- Prepare 3-D models
- Prepare hook down scope and identify locations for splice severance (cables/pipes/offshore structural joints)
- Recommend cut methods (flame/diamond-wire/abrasive jet etc.)
- Design lift-off guides and barge/vessel set-down guides
- Design all rigging, including rigging platforms, spreader bars, etc.
- Perform module global structural integrity checks
- Perform local lift point design checks or new designs where required
- Preparation of detailed offshore work packs / work instructions
- Design grillage/sea fastenings
- Perform barge motions assessments & bollard pull calculations
- Prepare detailed offshore work packs and master equipment lists
- Prepare offshore removal and transportation manual
- Perform load-in/load-off engineering at disposal site

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BROWNFIELD SITES

The tendency in some areas to upgrade older facilities to enhance production or provide flexibility for expansion has led to an increase in “Brownfield” construction. LMC have had detailed involvement in the following types of operation:

- Retrofit of hang-off modules (up to 1000mt in weight)
- Retrofit of caissons (up to 140mt length in one lift)
- Drill Rig change-outs
- Flare tip replacements

For this type of project, the following activities are also often undertaken:

- Initial feasibility studies
- Concept or detailed design of hang-off systems
- Concept or detailed design of bumpers/guides
- Concept or detailed design of any specialised winching/transfer systems
- Anchor clash/interference studies with existing field infrastructure
- Construction vessel mooring analysis

Work is performed under the very rigorous LOLER guidelines or under project-specific client requirements.
<table>
<thead>
<tr>
<th>FIELD</th>
<th>LOCATION</th>
<th>OPERATOR</th>
<th>LMC CLIENT</th>
<th>INSTALL DATE</th>
<th>LMC SCOPE</th>
<th>DESCRIPTION</th>
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<tbody>
<tr>
<td>CLAIRE RIDGE</td>
<td>N. SEA</td>
<td>BP</td>
<td>HMC</td>
<td>2013</td>
<td>T &amp; I ENGINEERING</td>
<td>INSTALLATION OF JACKETS (25,000MT AND 8000MT), DECKS (OVERALL 20,000MT) AND PILES</td>
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<tr>
<td>MUMBAI HIGH NORTH</td>
<td>INDIA</td>
<td>ONGC</td>
<td>HMC</td>
<td>2012</td>
<td>T &amp; I ENGINEERING</td>
<td>INSTALLATION OF DECKS AND BRIDGES (TOTAL APPROX 10,000MT)</td>
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<tr>
<td>NW HUTTON</td>
<td>N. SEA</td>
<td>BP</td>
<td>HMC</td>
<td>2010</td>
<td>T &amp; R ENGINEERING</td>
<td>REMOVAL OF TOPSIDES MODULES (TOTAL-10,000MT)</td>
</tr>
<tr>
<td>EKOFISK</td>
<td>N. SEA</td>
<td>CONOCOPHILLIPS</td>
<td>HMC</td>
<td>2007-2011</td>
<td>T &amp; R ENGINEERING</td>
<td>REMOVAL OF 30,000MT OF STRUCTURES</td>
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<tr>
<td>CLAYMORE</td>
<td>N. SEA</td>
<td>TALISMAN</td>
<td>HMC</td>
<td>2009</td>
<td>T &amp; I ENGINEERING</td>
<td>RETROFIT INSTALLATION OF MOM CAISSON</td>
</tr>
<tr>
<td>JUDY</td>
<td>N. SEA</td>
<td>CONOCOPHILLIPS</td>
<td>HMC</td>
<td>2009</td>
<td>T &amp; I ENGINEERING</td>
<td>INSTALLATION OF 400MT MODULE</td>
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<tr>
<td>GALOC</td>
<td>PHILIPPINES</td>
<td>GPC</td>
<td>EMAS</td>
<td>2008</td>
<td>INSTALLATION ENG</td>
<td>INSTALLATION OF MOORING/RISER/BASE</td>
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<tr>
<td>OKORO-SETU</td>
<td>NIGERIA</td>
<td>AFREN</td>
<td>AFREN</td>
<td>2008</td>
<td>CLIENT ADVISORS/REPS</td>
<td>INSTALLATION OF FPSO AND RISERS</td>
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<td>POLVO</td>
<td>BRAZIL</td>
<td>DEVON</td>
<td>HMC</td>
<td>2005</td>
<td>T &amp; I ENGINEERING</td>
<td>INSTALLATION OF JACKET (5000MT), DECK (6000MT) AND PILES</td>
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<tr>
<td>SHENZI</td>
<td>GOM</td>
<td>BHP</td>
<td>HMC</td>
<td>2003</td>
<td>T &amp; I ENGINEERING</td>
<td>INSTALLATION OF TOPSIDES ON TLP</td>
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<tr>
<td>TAHIKI</td>
<td>GOM</td>
<td>SHELL</td>
<td>HMC</td>
<td>2002</td>
<td>T &amp; I ENGINEERING</td>
<td>INSTALLATION OF STRAKES ON SPAR</td>
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<td>GENE</td>
<td>N. SEA</td>
<td>NORSK HYDRO</td>
<td>HMC</td>
<td>2004</td>
<td>T &amp; I ENGINEERING</td>
<td>INSTALLATION OF JACKET (2500MT), DECK (2000MT) AND PILES (5000MT)</td>
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<tr>
<td>GJOA</td>
<td>VARIOUS</td>
<td>VARIOUS</td>
<td>NORCARGO</td>
<td>2005-2009</td>
<td>SHIPPING MANUALS AND SECURING SYSTEM DESIGN</td>
<td>MODULAR BLOCKS FOR DRILLING SEMI-SUBMERIBLE</td>
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</tbody>
</table>
LMC employs approximately 50 technical staff, comprising Structural, Mechanical and Piping Engineers, Naval Architects and Structural Design Draughtsmen. Responsibility for the management of LMC lies with the following individuals:

**PERSONNEL**

**JON DUNSTAN**
**MANAGING DIRECTOR**

Jon has extensive experience of the design, construction, installation operation, maintenance and decommissioning of large fixed and floating offshore oil and gas facilities including conversions of FPSO, FSRU and FSO production facilities. With commercial, strategic and contractual experience on projects worldwide, Jon has more recently obtained particular expertise in concept selection and studies for LNG terminals utilising FSRU and FSU facilities.

**RICHARD MARTIN**
**FOUNDER DIRECTOR**

As founder of LMC in 1990, Richard has over 35 years industry experience in mooring and turret design. His accomplishments include the conceptual design of mooring systems for twelve floating production systems, detailed design of mooring systems for three floating production vessels, three CALM buoy installations and one fixed loading tower. This work included calculations, project documents and drawings, costings and attendance for installation. He has also specialised in the construction and installation of concrete gravity platforms, marine operations and consultancy to the shipping and insurance industries.

**NICK PALMER**
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With a masters degree in Naval Architecture from Southampton University, Nick’s expertise lies in the subsea, mooring and naval architectural disciplines. He is also experienced in offshore campaigns including FPSO and turret installations, riser installation and hook-up, and anchor pre-installation. Nick was appointed Director in October 2012 and is project managing some major projects for LMC. He is also leading the company’s diversification into the renewable energy market.

**ERIC CROCHET**
**DIRECTOR**

Eric joined from SBM in 2008 where he worked on the Espírito Santo FPSO and the GAP Kikeh project. At LMC he led the structural team to design the CPOC FSO for M3nergy, the DLT FSRU for Skarv and the HOY Chao Sai FFSO internal turret. Eric was appointed Director in October 2012 and has since successfully project managed the Bualuang Turret EPC and been heavily involved in the research and development of the Company’s designs for CALM and Deep Water Buoys and FLNG Turrets.

**VISHNU MUKUNDAN**
**GENERAL MANAGER ASIA**

A chartered Naval Architect with over 10 years of experience in the maritime and offshore industry, Vishnu has led the Naval Architecture team during the design of all of LMC’s mooring systems since 2012 including the recent Pioneiro de Libra FPSO. He has extensive experience of carrying out mooring, riser and hydrodynamic analyses and offshore installation of mooring systems. Since November 2016 he has been managing a multi-disciplinary team of engineers at LMC’s Asia-Pacific office in Singapore whilst promoting LMC’s turret and mooring business in the region. He is a graduate of University College London.

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**VISHNU MUKUNDAN**
**GENERAL MANAGER ASIA**

A chartered Naval Architect with over 10 years of experience in the maritime and offshore industry, Vishnu has led the Naval Architecture team during the design of all of LMC’s mooring systems since 2012 including the recent Pioneiro de Libra FPSO. He has extensive experience of carrying out mooring, riser and hydrodynamic analyses and offshore installation of mooring systems. Since November 2016 he has been managing a multi-disciplinary team of engineers at LMC’s Asia-Pacific office in Singapore whilst promoting LMC’s turret and mooring business in the region. He is a graduate of University College London.
CLIENTS

LMC has carried out work for over 50 clients in the last 27 years and continues to be at the forefront of marine engineering in the global market.

QUALITY ASSURANCE

LMG are accredited ISO 9001:2015 and are regularly audited by DnV in their ongoing accreditation. Part of this system includes procedures for the execution of design work, procurement and compliance with relevant codes and standards. LMG has a documented Health, Safety and Environment (HSE) Management system in accordance with applicable standards and authority requirements.
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