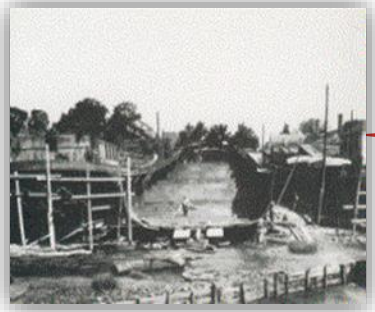
Technology used and engineering skill required in offshore industry

- from the experience of Exmar offshore company -

EXMAR

Exmar Group History



1820

Creation of the Boelwerf Shipyard

1960s

Boelwerf

1980s

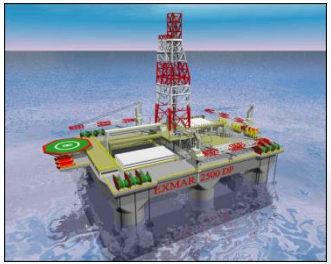
Exmar - LPG

1990s

Arethusa Offshore

2003

Exmar and CMB De-Merge. Exmar Listed on Euronext "EXM"



1997

Exmar Offshore Co.

1991

Merge with CMB

From Ship Builder...

...To Ship Owner

The Exmar Group

LNG

- Shipping
- Floating Storage, Liquefaction, & Regas
- Design & Engineering
- Ship Management

LPG/NH3

- Shipping
- Floating Storage
- Design & Engineering
- Ship Management

Offshore

- Accommodation/Work Barge
- Floating Production & Storage
- Design & Engineering
- Operations & Maintenance

Services

- Shipmanagement
- Design & Engineering
- Brokerage Insurance
- Travel Plus

Offshore Assets and Services

Owned Assets, Management, and Operations:

- **Toscana** – FSRU 3.75 bcm/yr, 37,100m^3, Italy

Accommodation:

- **Kissama** – 350 POB, Cameroon
- **Nunce** – 350/450 POB, Angola
- **Wariboko** – 300 POB, Nigeria

Services:

- Marine and Maintenance Services
- Pre Operations Engineering and Operational Services
- Staffing, Technical, Procurement, and Logistical Services
- ISO Certification and Asset Integrity Management

Engineering Offices

- EOC, Houston
- DVO, Paris
- Exmar Technical, Antwerp

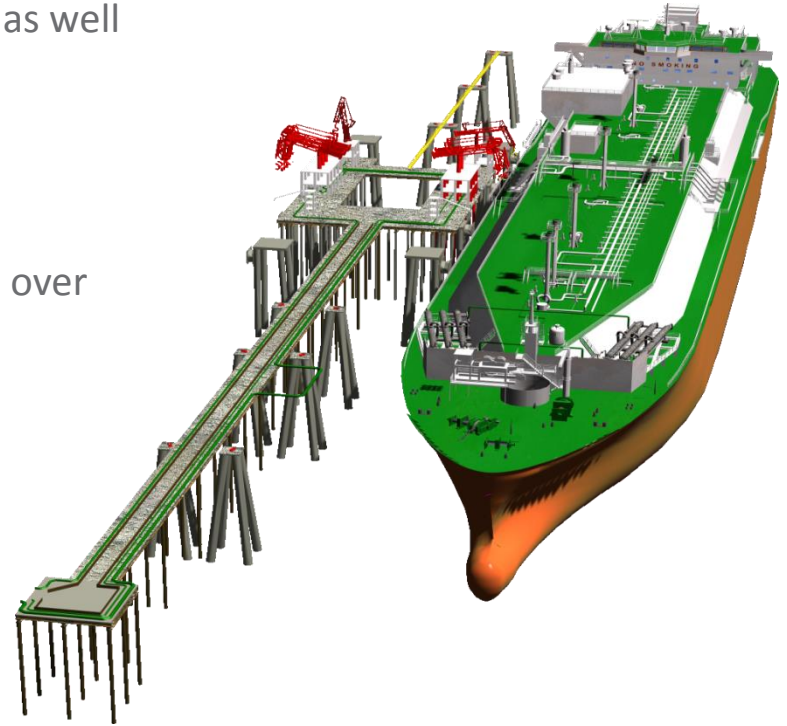
Exmar Offshore Company – Houston, TX

Mission

Provide Engineering Consulting and Design Services to the Offshore Industry of the Highest Quality in the Most Efficient Manner Utilizing the Most Advanced Tools Available.

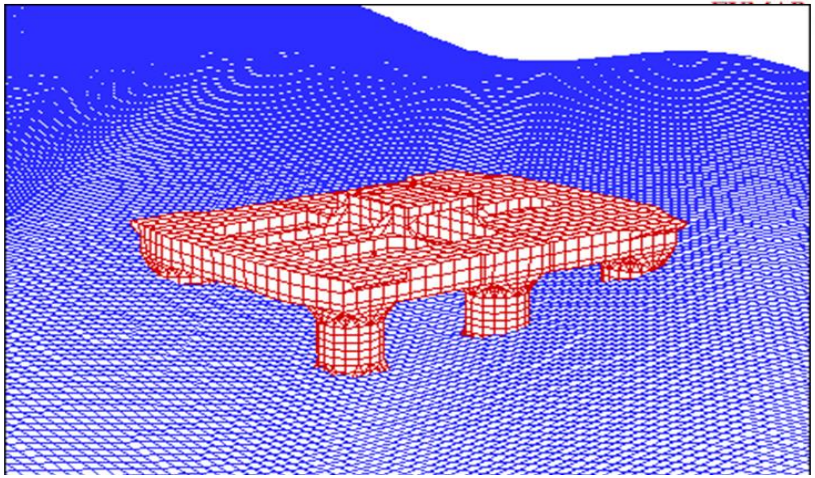
EOC's Design Scope

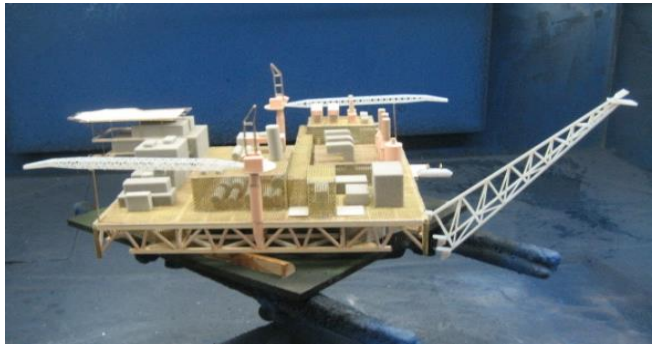
- Production
  - Focus on Semi submersibles, but other concepts as well
  - FPSO or FSO, new or conversion
- MODU
  - Semi submersibles
  - Harsh environments, Well intervention and work over
  - Conversions, upgrades, repairs
- FLNG & FSRU
  - Barge or ship shape
- Modules and Major Modifications
  - Living quarters
  - Sponsons, Fore/aft body replacement
  - Power plants

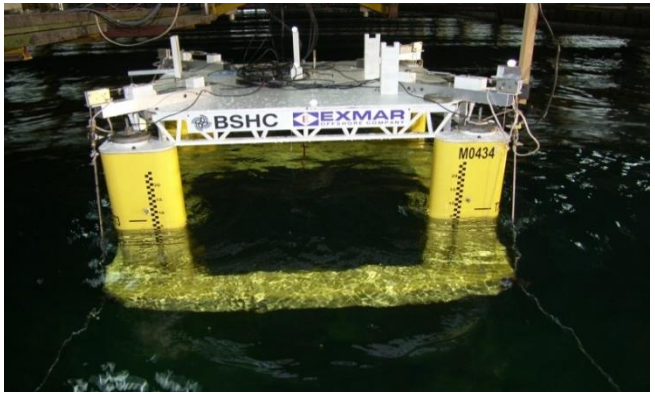


EOC Capabilities – Naval Architecture

- Concepts and layouts
- Seakeeping and Motions
- Hull Design and Stability Analysis
- DP Analysis
- Mooring Design and Analyses
- Inclining Experiments & Deadweight Surveys
- Model Testing – basin and wind tunnel
- Operability and downtime
- Airgap Analysis
- Dry tow and load out

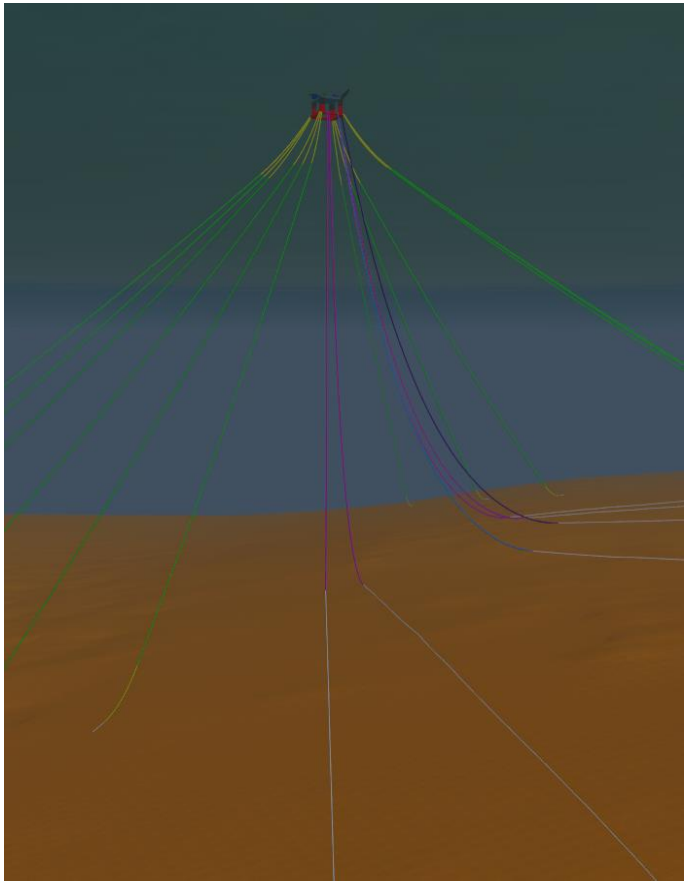






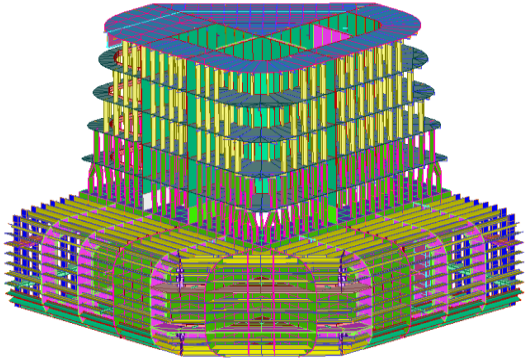
Naval Architecture - Mooring

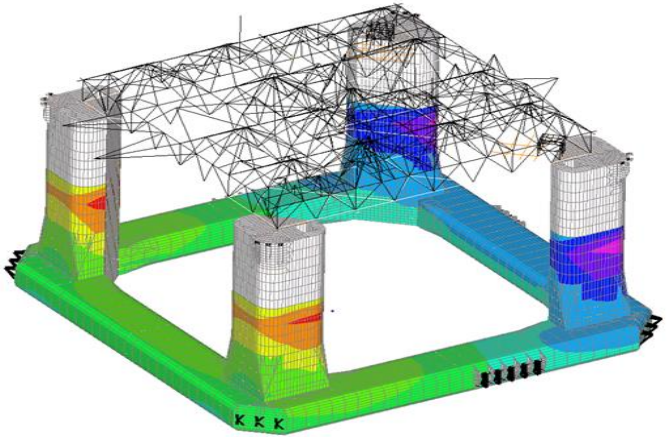
- Basic to Detailed design for Any Type of Mooring System
- Equipment Specification and Installation Procedures
- ARIANE7:
  - Time Domain Quasi-Dynamic
  - Initial and Screening Analysis
- ORCAFLEX:
  - 3-D - Fully Coupled
  - Non-Linear - Large Displacements
  - Risers Bending & Torsion
  - Bottom Topography
  - Air Gap Verification



EOC Capabilities - Structural

- Global/Local Strength
- Fatigue Analyses
- Finite Element Modeling
- Detailed Engineering
- Sea Fastening & Transportation Vessel Interaction



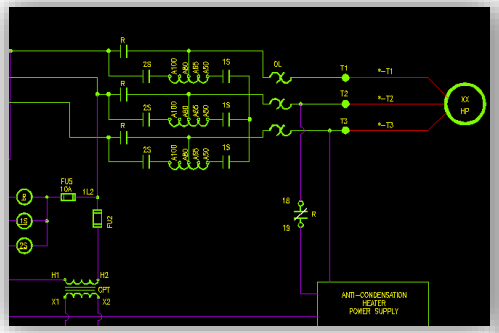


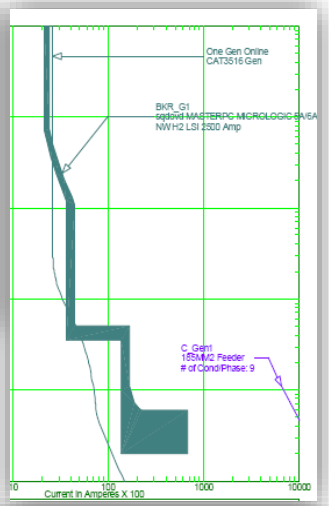
EOC Capabilities – Mechanical

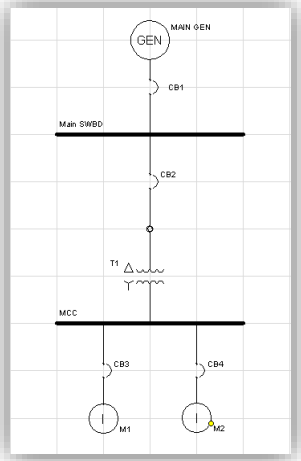
- Equipment Sizing and Selection
- Equipment layouts
- System design and evaluation
- Marine System Design
- Flow analysis
- Pipe Stress Analyses
- Drilling/Material Handling System Layout and Integration
- HVAC design and analysis

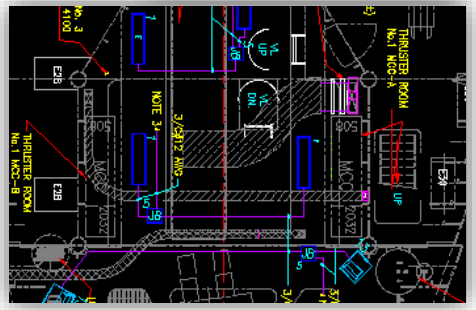
EOC Capabilities – Electrical

- Engine and Generator Sizing
- Circuit Breaker Coordination
- Electrical Load Analyses
- Harmonic Analysis
- Routing Plans
- System Integration
- Routing and arrangements
- Controls and instrumentation
- Safety systems
- Hazardous areas



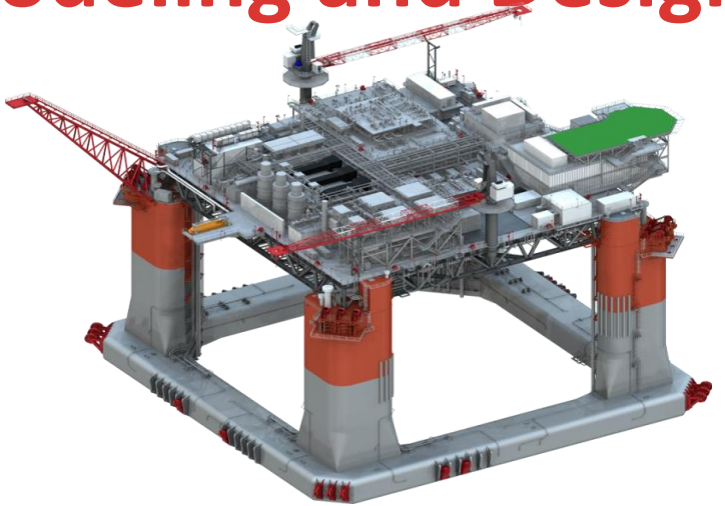


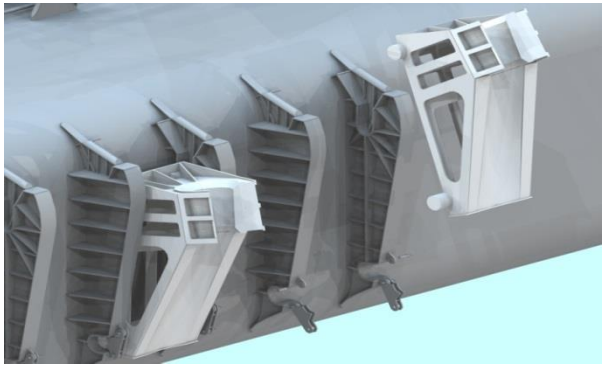


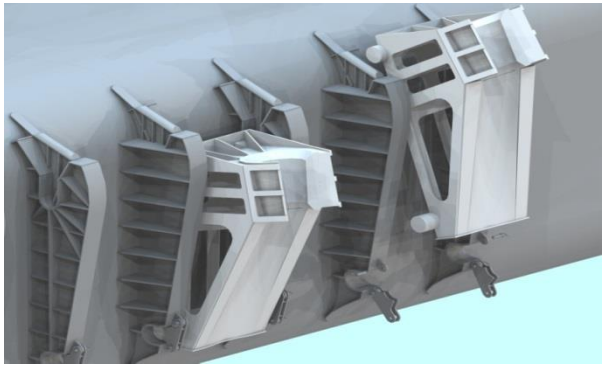


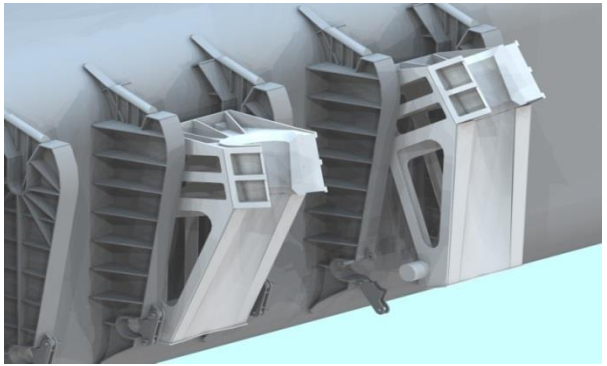
EOC Capabilities - 3D Modeling and Design

- AVEVA Marine 3-D Modeling (PDMS, Tribon)
- 2-D and 3-D AutoCAD
- Inventor, Navisworks, 3-DStudio Max
- Detailed MTO's and Clash Checking
- Fabrication Level drawings









EOC Capabilities – Drilling

- Rig Floor Layout and tubular handling:
  - Single/Multiple Well Centers
  - Simultaneous Ops/Offline Stand Building
  - Range 2 & 3 Pipe-Doubles, Trebles, Quads
  - Vertical & Horizontal DP & Riser
  - Layouts and integration, vendor interface
- BOP/Tree Handling
- Liquid Mud System Design
- Dual Gradient Drilling
- Monobore Drilling
- Expandable Casing

EOC Capabilities – Project Management

Project Management:

- Small projects (retrofit riser porch) to large (hull and topsides lead EPC)
- Engineering only to EPC

Regulatory Services:

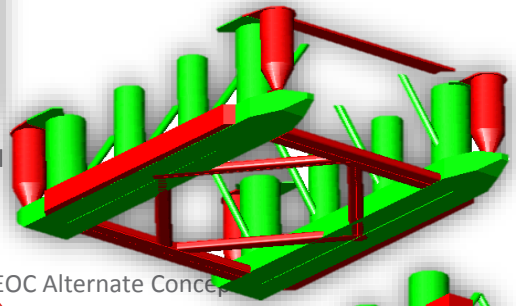
- Plan review process from initial submission to final survey
- Regulatory Body Interface

Exmar Offshore Company - Case Studies

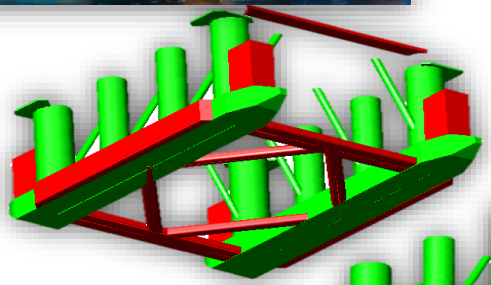
Semisubmersible Deepwater Upgrades

Before Upgrade

Existing Vessel

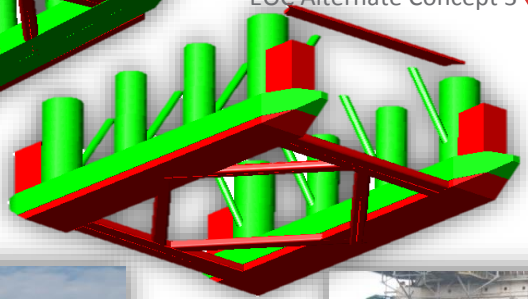


Client's Initial Concept

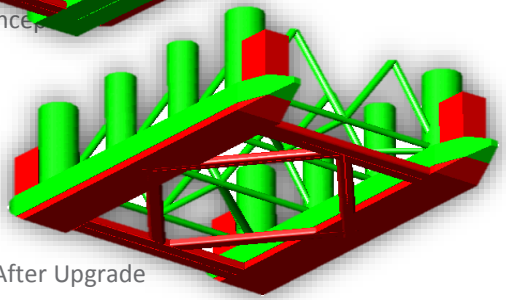


EOC Alternate Concept

EOC Alternate Concept 3

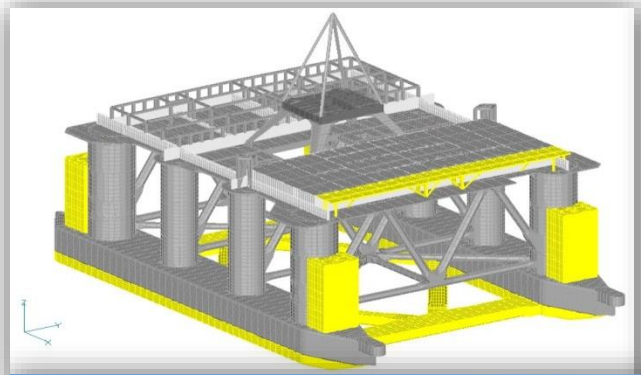


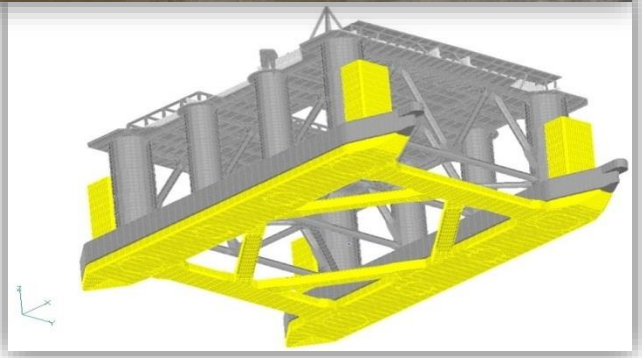
Final Concept



Vessel After Upgrade

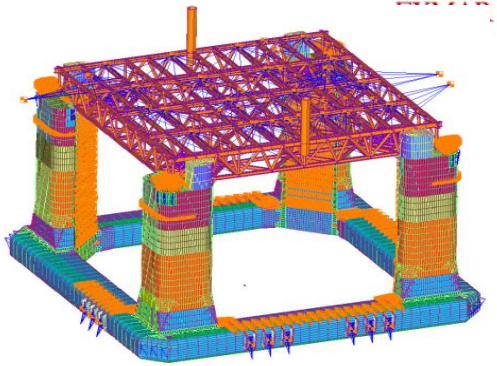
Semisubmersible Deepwater Upgrades



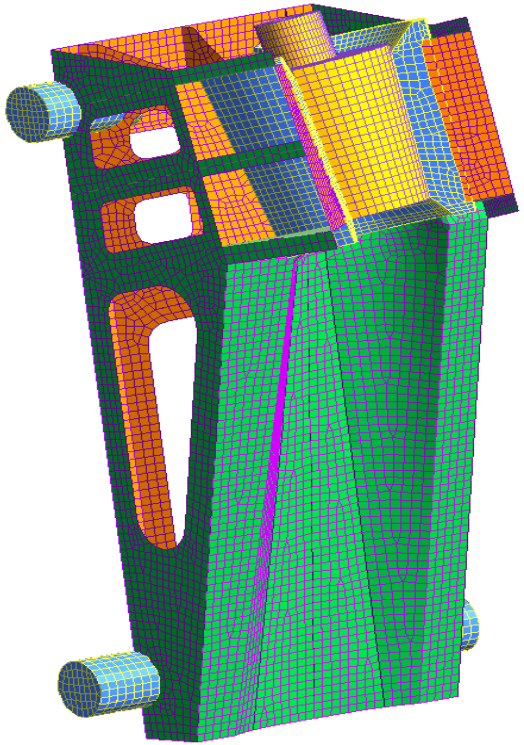


Delta House FPS

- Lead hull and integration EPC
- Scope of work:
  - Hull design and construction supervision
  - Topsides lift and hull integration oversight
  - Riser porch design and adapter procurement
  - Riser installation procedures using FAST pull-in method
  - Weight Control for project
- Key Performance Metrics
  - On location in 34 months from engineering contract and within budget
  - Safety performance 0 LTIs for EOC scope
  - Achieved weight control goal of 900 MT reserve for future expansion



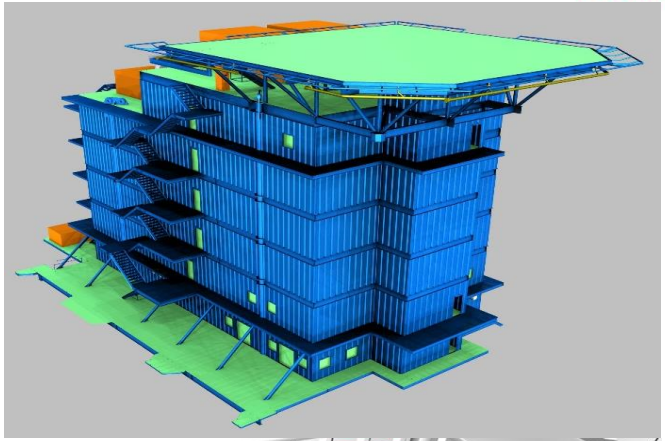
FE Analysis –Riser Adaptor

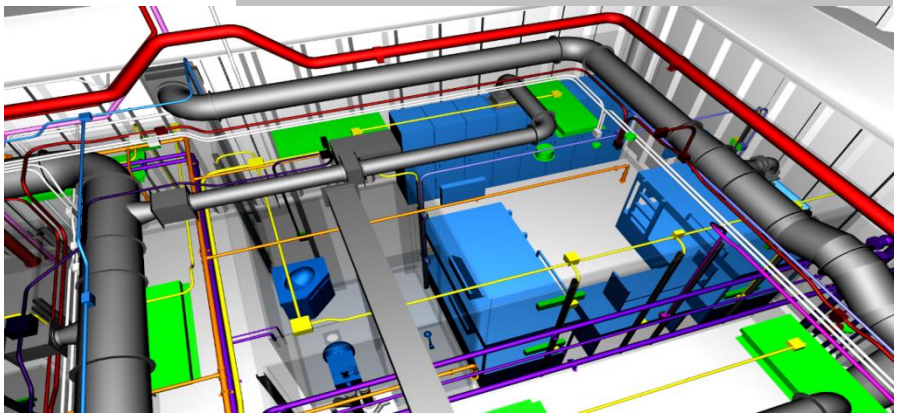


- A key element of novel FAST ™ riser installation system
- Scope of Work
  - Combination of 2D shell and 3D solid elements
  - Contact surfaces Defined Between Bushing (master) and TSJ (slave)
  - Contact Constraints Were Defined at Supporting Pins of Adaptor
  - Loads Were Applied at Lower End of TSJ
- Key Performance Metrics
  - Key contribution to successful riser installations with zero incidents
  - Reduced installation schedule by 2 weeks

148 POB Living Quarters Module:

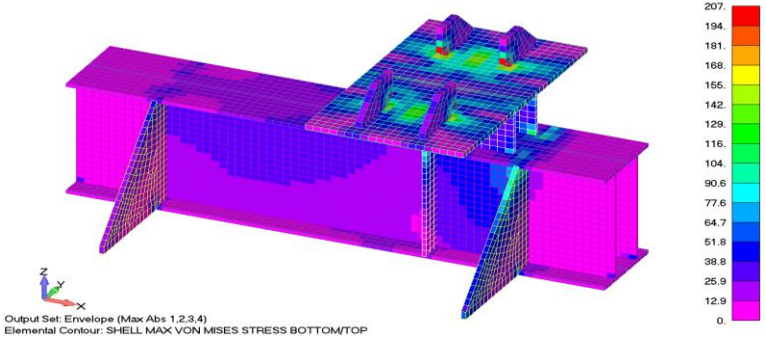
- Engineering and modeling of a living quarters module
- Scope of Work
  - Engineering: Electrical power, utility piping
  - Design: power, safety, telecoms, utility piping
  - Clash check: Structural back modelling and integration of all systems
- Key Performance Metrics
  - Accurately quantified materials
  - Optimized routing for material use
  - Minimized field-routing

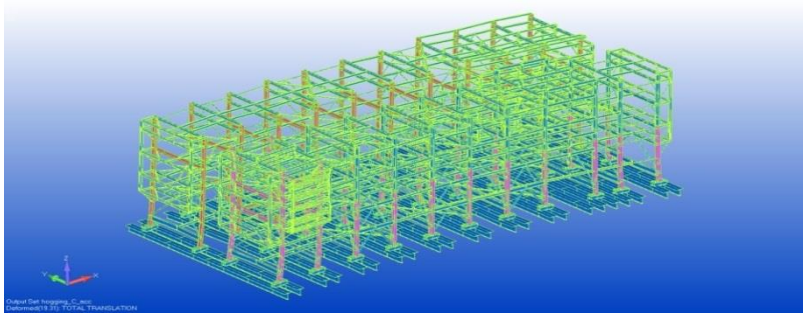




Transportation Loads and Sea Fastening

- Ensured suitable module sea transport plans for major LNG EPC project
- Scope of Work
  - Vessel motions for critical voyages
  - Development and analysis of sea fastening plan
  - Interaction analysis of modules and vessel
  - Third party review of lift company engineering
- Key Performance Metrics
  - Zero incidents during transport related to sea fastening





Facility Weight Tracking and Control

- Full life cycle weight control – tracking and procedures
- Scope of work
  - Design estimates and weight planning
  - Fabrication weight tracking and control
  - Deadweight surveys and inclining tests
  - Post-delivery weight tracking and control service
- Key Performance Metrics
  - Unit delivered within 2% of pre-FEED estimated weight
  - Assisted client in avoidance of in-situ deadweight survey

The OPTI-EX ® Project in Pictures

The OPTI-EX ® Project in Pictures

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The OPTI-EX ® Project in Pictures

The OPTI-EX ® Project in Pictures

The OPTI-EX ® Project in Pictures

The OPTI-EX Project in Pictures

FAST™ Riser Pull In System-1

Do you have any questions? Please contact:

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EXMAR

Thanks for your time!