

CAPABILITIES AND RECENT PROJECTS

1. CAPABILITIES

Exmar Offshore Company is an engineering company dedicated to design and engineering services related to marine vessels, ships and offshore mobile units. It has developed full and complete design packages of semi-submersible production and drilling units, including drawings and shipyard construction specifications. Exmar Offshore has also completed projects related to the upgrade and retrofit of existing vessels, drilling units and unique offshore engineering problems as listed below. Exmar Offshore Company staff has extensive experience with all aspects related to basic design, engineering, and operation of ships, offshore service vessels, and mobile offshore drilling units. Exmar Offshore is registered to provide Defense Services pursuant to ITAR Part 122 and the Arms Export Control Act. A list of main areas of expertise follows.

1.1 Marine Problem Solving – Unique Solutions for Unique Problems

Overall floating structure and rig design from concept to yard drawings

1.2 Naval Architecture

Rig motion studies

Rig operability and Downtime studies

Air gap analysis

Stability analysis and stability enhancements

Mooring analysis

Dynamic positioning studies

Model testing, including test management

1.3 Structural Analysis

Structural analysis - Global Structural analysis and design

Structural analysis - Fatigue

Detail engineering and design of local structures (crane pedestal, lifeboat platform, etc.)

1.4 Electrical Engineering

Conceptual one-lines, Engine/generator sizing, Load prediction, Voltage selection

Equipment Selection/Specification, Power, Lighting

Analysis - Fault (Short Circuit), Load, Harmonic

Breaker Co-ordination

Cabling Diagrams and Schedules

Trouble Shooting

1.5 Electronic Systems

Engine and Generator Control, Telephone Systems, P.A. Systems

Ballast valve and pump Control, Tank Gauging, and Bulk Systems
Drilling Instrumentation
Dynamic Positioning
Vessel Management

1.6 Hull Marine and Mechanical Systems Engineering

Hull marine and mechanical systems evaluation and design
Piping system analysis and design
Drilling systems evaluation and design
Drill Floor layout arrangement
Tubulars and riser handling arrangement and design
Mud and well fluids systems arrangement and design
Drilling systems integration to hull systems
Drilling equipment procurement specifications

1.7 Project Management

Water depth enhancement studies and modification design
Rig and Marine Vessel modifications and repair specifications
Top drive installations project management
Shipyards negotiations
Marine Vessels and Drilling Rigs technical & condition audits and surveys
Interface with Classification Societies

1.8 CAD Design and Drafting

2-D/3-D AutoCAD, Mechanical Desktop, Inventor
3-D Visualization and Animation

1.9 Software Resources

Wamit	Vessel Motions - radiation/diffraction wave interaction
Multi Surf	3-D parametric surface modeller
Sacs	Finite element program
StruCad	Finite element program
NASTRAN	Finite element program
FEMAP	Structural modeling program
MathCAD	Mathematical Modeling
Pilot	DnV - buckling code check
Mars BV	Structural code check
AutoHydro	Stability program - ships and semis
StabCad	Stability program - semis
Ariane 3D	Static and Dynamic Mooring Analysis

DPSIM	DP simulation
EDSA	Electrical engineering circuit analysis
Autocad LT	Drafting tool - 2D
Autocad 2000	Drafting tool - 3D
Mechanical	Drafting tool - 3D modeler
Inventor	Drafting tool - 3D modeler
3D Studio Max	3D Rendering and Animation
Fortran 90	Programming language
Perl 5.4	Programming language

Other in-house developed programs and spreadsheets for:

- Vessel motions evaluation
- Operability (uptime) prediction
- DP capability plots
- Model test data analysis
- Structural panel stiffening checks and sizing
- Weights Control Management Database

2. RECENT PROJECTS

List of projects recently undertaken by Exmar Offshore Company.

2.1 Atwood Seascout Tender Assist Conversion

Scope of work was to develop an engineering design package and shipyard technical contract specification for the conversion of a semi-submersible drilling rig into a self-erecting tender assist drilling unit. Engineering work included full ABS design approval of all drawings and calculations, for Class, Flag, and Regulatory compliance. Scope of work included:

General Arrangements

Naval Architecture and Global Analysis - Motions & Stability Analysis, Global Strength and Fatigue Analyses, Redundancy Analysis

Structural Design, Lower Hull, Deck Structures, and Columns

Structural Design - Equipment, outfitting and foundations: main & emergency engine-generators, switchboard and MCC foundations, crane pedestals, boom rests, man way, etc.

Piping Systems Design - Marine systems, ballast & bilge, vents & sounds

Utility Systems, fuel & lube, engine cooling, compressed air. Drilling systems - LP and HP mud systems, bulk system

Electrical Systems - Equipment and Electrical Load List, Short Circuit Current and Protective Device Coordination Analyses, Power Management and Load Shedding System, AC & DC Power Distribution System, Emergency Power, Lighting and Emergency Lighting Systems

Control Systems, Safety Systems, Fire and Lifesaving Plan, Hazardous Areas Plan, Fire, Gas, Public Address and Alarm Systems, Communications Systems, Navigational Lights and Signals

Accommodations Design

Shipyard Contract Technical Specification
Class Society submittal and approvals
Client: Atwood Oceanics, Inc.

2.2 Shell Dual Gradient Drilling Sub-Sea Pumping System (SSPS) - Installation and Retrofit To Semi-Submersible NAUTILUS

Development of concepts and engineering details for all structural, mechanical and electrical modifications needed to install onboard, interface, support, deploy, operate and recover Shell's Dual Gradient Drilling Prototype system called the Sub Sea Pumping System (SSPS) on Transocean's 5th generation deepwater semi-submersible NAUTILUS. The work produced detailed engineering drawings including:

- General Arrangements
- Safety Plan Arrangements
- Structural Drawings
- Piping Drawings/Diagrams
- Outfitting Drawings
- Electrical Drawings

Drawings were supported with detailed calculations and engineering documentation and including:

- Rig Survey and Photo Documentation Report
- Concept & Feasibility Studies of Equipment Storage Arrangements
- Concept/ Feasibility Studies and Detailed Design for Deployment of Specialized SSPS Equipment
- Vessel Motions and Air-Gap Assessment and Report
- Vessel Stability Assessment and Report
- Structural, Mechanical, and Electrical Calculations for All Systems Designed and/Or Modified
- Fabrication/Construction Specifications for All Structural, Mechanical, and Electrical Work
- Weight Management Documentation
- Decommissioning Manual
- Preparation of Class Approval Documentation and Co-Ordination with Class for Approvals

2.3 ExxonMobil HPHT Deep Draft Caisson Drilling Module

Pre- feed design of the drilling facilities for a High Temperature High Pressure Deep Draft Caisson Vessel. (HTHP-DDCV) to be utilized in 5000 ft water depth in the Gulf of Mexico. Concentration on an integrated design with the production facilities and the host platform to increase efficiency and reduce weight and space. Tasks included among others:

- Design Basis Memorandum
- Structural Design Basis
- Electrical Best Practice Document Review
- Electrical Power Distribution System One Lines and Load List
- General Arrangements Drawings, Interface With Riser and Subsea Handling Systems, Access and Egress and Pfd and P&ID of Key Systems

2.4 GlobalSantaFe SBOP

Develop and evaluate concepts related to certain mechanical and structural aspects of installing an SBOP (Surface BOP) system on the GSF semi-submersible rig ARCTIC III. Developed structural load cases followed by structural evaluation of localized effects due to this basic concept utilizing a global finite element model of the rig. Created new equipment concept development and layout (new SBOP platform, new SBOP deployment system structure, and equipment). Prepared a listing of work items to carry forward into the next project phase involving more detailed design and analysis.

2.5 Japan Drilling Company HAKURYU-3 upgrade

Developed an upgrade concept for the Japan Drilling Company, Ltd. semi-submersible rig HAKURYU-3 providing client specified targeted deck load capacity increases at minimal installed cost and shortest possible installation schedule. EXMAR prepared a menu of upgrade concepts that were evaluated. One was subsequently chosen and investigated in more detail for strength, stability, constructability, weight, and cost. Discussions were held with potential shipyards for construction techniques and costing.

2.6 BOCIMAR Iron Ore Terminal

Developed conceptual drawings of a replacement floating iron ore transfer terminal with throughput capacity of 9MM tones of iron ore per year. The concept selection/presentation effort was aimed at identifying/presenting to the Client, technically feasible, economically viable methods of iron ore transfer to/from a floating terminal. The station receives and unloads ore from 70,000 DWT shuttle ships at 30,000 tonnes per day and offloads/discharges to Cape Size bulk carriers at 60,000 tonnes per day.

2.7 THALES Cursor Launch ROV for GSF GLOMAR GRAND BANKS

Development, evaluation and selection of a concept for cursor guided ROV LARS for installation aboard the GSF Glomar Grand Banks semi-submersible. EXMAR prepared the detail design of a new 7.6m x 16m ROV system platform for the rig plus the detailed design of all of the selected cursor guide system components including cursor guide wires, guide wire tensioning system, upper and lower cursor guide wire terminations, guide wire termination support structure tying back to rig hull structure, ROV LARS A-frame & skid with horizontal slide doors/work/storage deck over launch opening and the ROV cursor guide frame proper. Client: Global-SantaFe

2.8 THALES Non Cursor Launch ROV for GSF GLOMAR GRAND BANKS

Developed the structural solution required to place the THALES ROV LARS on the GSF GGB Starboard wing deck and prepare a drawing for necessary structural modifications. Client: Thales

2.9 EXMAR NV – LNG Systems

Provided personnel to act as “owner’s representative” for various diverse equipment. (Steam generators, heat exchangers, cryogenic pumps, integrated system prototype testing). Verified the construction and quality control methods of machinery and equipment were to purchase specification. Acting as “owners representative,” alerted the owner to potential problems that were not apparent in the test reports and classing society certifications.

2.10 TODCO Rigs 205 and 206

Design and engineering for the conversion of TODCO jack up rigs 205 and 206. Tasks included enlarging the quarters manning, upgrade deep well pump system, deluge system retrofit, water maker upgrade, solids control system upgrade, cold start compressor retrofit, design new crane foundation and installation, install new flare boom, upgrade choke manifold piping, design new wing deck and relocate cement unit. Revised Fire and Safety Plan, Hazardous Area Plan, and Operations Manual. Provided weight control for the upgrading / modification of the entire vessel. Personnel provided on site to implement the project.

2.11 AMFELS

Verify the structural integrity of the Amfels Jackup P186 during launch. Tasks included:

Using channel survey data and other previous launch information, determine the friction and drag coefficients and predict the launch trajectory and clearance between the jackup and the channel bottom. From the trajectory prediction, determine the critical reaction being transferred through the cradle beam to the jackup structure.

Evaluate and design reinforcements for the cradle beams to sustain launch loads.

Build a plated finite element including the cradle beams to simulate the load transfer by using contact elements between the cradle and the jackup structure.

From the finite element stress results and DnV 30.1 buckling capacity calculations, propose structural reinforcements to the jackup structure to support the launch loads.

2.12 DELMAR Subsea 2,500 Kip Connector Design

Redesign effort aimed to improve the entire family of subsea connectors from Delmar, ranging from 1,400 kips to 4,500 kips. The improved connector performance is achieved by increasing the allowable loads and reducing the weight of the 2,500 kips unit and then extending the results to the rest of the connectors. The connector was modeled in 41,000 solid elements (TET) and 91,000 joints. The finite element model used a non-linear static solution as it used a non-linear material in order to capture the elastic and plastic behavior on the connector and also used gap or contact elements to simulate the connection between the two parts of the subsea connector.

2.13 Celtic Sea Anchor Chain Stoppers

Glomar Celtic Sea's mooring system was modified to include a Bodewes chain stopper. Utilized 3-D drafting to position the Bodewes chain stopper. Formulated the solution to install the supporting platform and the Bodewes equipment offshore during rig normal operation.

2.14 Diamond Offshore Ocean Yatzy

Deep Water upgrade conversion package for the Diamond Yatzy Semi submersible. Work included:

- Prepared Design Basis for Upgrade

- Upgraded General Arrangement drawings as per Design Basis requirements

- Prepared pipe deck arrangements and investigate the local reinforcements

- Evaluated new riser handling and storage requirements and develop proposed solutions

Developed solution for adding extra marine riser tensioner and determine substructure strengthening

Reviewed mud system and engineer required changes including bulk and sack storage, mud pump and treatment compartments arrangement and cuttings handling system

Created lightship estimates for the conversion and develop appropriate margins

Developed hull configurations with respect to payload and stability requirements. Prepare 3-D “hull models” of proposed modification

Performed stability analysis of selected configurations

Developed electrical load list and one-line drawings, determine power requirements, recommend new power system, prepare engine arrangements, prepare electrical space arrangements, and prepare description of electrical system modifications required

2.15 BP Rig of the Future

Application of latest and projected future technologies to conceptualize the deepwater drilling Rig of the Future. The study included configuration of experimental drilling and completion methods in ultra-deepwater to achieve break-through well delivery results. Alternative power generation methods were considered to determine potential for reduced emissions. Client BP

2.16 BP Thunderhorse PDQ Semi-Submersible - Electrical System Review

Third party review of electrical system for PDQ (Production, Drilling, Quarters) semi-submersible unit for BP’s Thunderhorse Gulf of Mexico field. Work scope included load analysis, short circuit analysis, verification of power integration schemes and application of codes and regulations. Client BP Thunderhorse Project Team.

2.17 KIZOMBA, HOLSTEIN and MAD-DOG Drilling Packages

Engineering support in the areas of drilling systems design, general arrangements, structural design and analysis, weight management and control, drafting and equipment specifications for the drilling modules to be installed in the production units for Kizomba, Holstein and Mad Dog projects. Client Pride International.

2.18 LPG FSO - Conoco Belanak

Pre-feed studies and analysis of technical alternatives for a LPGFSO in the Belanak field, Indonesia. Studies included:

Definition of functional requirements regarding unit storage size and tanks configuration

Definition of turret system - internal vs. external

Definition of offloading system side-by-side vs. tandem

Sizing of refrigeration plant

Electrical and power generation requirements - gas turbines vs. diesel engines

Side-by-side offloading ship to FSO mooring, maneuvering, and berthing approach, relative motions of the system

Functional specifications

Suitability of existing vessels for conversion.
Life cycle operation costs
New build and conversion costing estimates

2.19 Exxon Mobil Pre-FEED Study Papua New Guinea Gas Project

Pre-feed studies and analysis of technical alternatives for a LPGFSO for Papua New Guinea. Studies included:

Independent review of LPG markets as it relates to shipping, producers, and consumers areas.
Shipping needs as it affects parcel sizes to be exported from the FSO
Determined storage size requirements on the basis of export parcel sizes, production rates, and available shipping for offloading and evaluate considerations regarding trade-offs for combined condensate/LPG storage in the same unit vs. separate units
Determined refrigeration and re-liquefaction requirements for separate (propane/butane) production streams and storage volumes. Estimate plant size for alternate case for incoming stream of propane only
Evaluated power generation strategy vis-à-vis trade-offs between power generation onboard LPG FSO and receiving power from fixed facility
Verified feasibility of LPG tandem offloading based on evaluation of cryogenic hoses, adequacy of equipment onboard offloading vessels, required tug support for operations, handling of hoses, etc.
Identified requirements for tandem offloading of condensate and potential conflicts and interference with LPG offloading
Evaluated trade-offs and create risk matrix scenarios for location of living quarters in alternate positions onboard, either forward or aft
Evaluated capital costs and life cycle costs based on new build and conversion
Evaluated and compare the use of external and internal turrets
Performed the evaluation on the basis of safety and cost implications, the position of accommodations unit and mooring depth at the FSO location
Evaluated use of different types of storage tanks with respect to construction experience, safety, and cost for 30 years life cycle operation
Investigated codes and safe operations practice to determine unit's flaring equipment. Compare same with other gas installations.
Based on considerations developed in previous tasks, costs of equipment, and cost of similar installations and ships, developed a credible and reasonable cost and schedule estimate for PNG LPG FSO.
Developed general arrangements to show accommodations location, compartmentation, and number of tanks, mooring location and offloading.
Created 3D rendering for presentation purposes.

2.20 Diamond Liberator Upgrade

Deep Water upgrade conversion package for the Diamond Liberator Semisubmersible. Work included:
Prepared Design Basis for Upgrade

- Upgraded General Arrangement drawings as per Design Basis requirements
- Prepared Drill Floor arrangements and investigate mast upgrade potential versus a new derrick
- Evaluate new riser handling and storage requirements and develop proposed solutions
- Determined required crane coverage and recommend solutions
- Developed solution for adding extra marine riser tensioner and determine substructure strengthening
- Reviewed mud system and engineer required changes including bulk and sack storage, mud pump and treatment compartments arrangement and cuttings handling system
- Integrated combination winches into new general arrangements and develop new anchor rac
- Created initial lightship estimates for the conversion and develop appropriate margins
- Developed hull configurations with respect to payload and stability and fatigue requirements
- Prepared 3-D “hull models” of proposed modification
- Performed stability analysis of selected configurations
- Developed motion RAOs and significant responses for “Ring” and “Conventional” solutions. Prepare WAMIT runs for strength and fatigue. Develop SACS beam model for existing rig
- Developed structural load condition (Severe storm and operating). Perform structural analysis of modified rig including fatigue studies
- Developed scantling drawings and structural arrangements for increased hull. Provide structural design and strength calculations, develop scantling drawings and structural arrangements for deck
- Developed electrical load list and one-line drawings, determine power requirements, recommend new power system, prepare engine arrangements, prepare electrical space arrangements, and prepare description of electrical system modifications required

2.21 Petrobras P-XIII and P-XVI Conversion Study

Deep Water upgrade conversion package for the Petrobras P-XIII/ XVI semisubmersibles. Work included:

- Developed alternative hull configurations and the selection of one potential design
- General Arrangement drawings based on study
- Prepared four load conditions, lightship weight estimates
- Prepared ballast system schematics
- Prepared mud system schematics to include lower hull mud tanks for riser mud volume
- Developed motion RAO's, Intact stability for selected upgrade alternative, and Prepare DP station keeping rosettes.

2.22 AMFELS B class Jack Up Launch

Cradle design and jack up structure Verification. Work included:

- Verified the ability to launch the rig into the water by verifying the global hydrostatic and hydrodynamic response as the rig is launched
- Verified the ability of the jackup structure to withstand the launch loads and create structural solutions to any members not capable of withstanding the launch forces.

2.23 Pechney Aluminum Study

Perform a study to investigate the benefits and applicability of aluminum in semisubmersible construction. The study included:

- Checking existing industry recommended practices and procedures or Classification Rules covering aluminum design for marine/offshore use
- Developed a set of guidelines to convert steel structures into aluminum
- Redesigned the steel lower hull and deck of the Exmar E-II semisubmersible mobile offshore drilling unit in aluminum
- Redesigned the basic scantlings of the pontoon, columns, and deck structure of the E-II in aluminum
- Estimated the weight of the aluminum structure and revise the lightship characteristics of the E-II
- Assessed the impact of weight savings using aluminum on payload and variable load of E-II

2.24 Sea Sorceress Conversion

Conversion of moored work barge SEA SORCERESS to a DP Class 2 offshore work vessel. Work scope included development of engineering drawings for shipyard bid package. Major aspects of the conversion project considered in this scope of work are:

- Install 8 x 14 tonnes thrust retractable FPP azimuth thrusters
- Install aft thrusters in a new stern section
- Create forward thrusters room within the existing hull
- Install four new diesel generators in two new machinery spaces with all auxiliary support equipment
- Install new switchboards with thruster drives and associated low voltage equipment in new air conditioned compartments within the machinery space
- Install DP control system, power supply units, position and environmental reference units
- Prepare drawings for structural modifications and foundations
- Install new 360 ton crane with all ancillary systems
- Prepare all general arrangement drawings
- Support shipyard detail and construction engineering
- Prepare motion analyses
- Prepare stability analysis, assessment of motion compensation system, and crane operating limits
- Lightship survey and inclining test
- Installation of retractable thrusters
- Creation of new machinery spaces
- Installation of new diesel generators
- Installation of new switchboards with thruster drives,
- Create required new air conditioned compartments within the machinery spaces Structural upgrades where required
- Stability studies and load plans
- Installation of new derrick crane

Client: Caldiv International

2.25 Arctic Class - Enhanced Pacesetter MODU Upgrade

Development of alternatives for hull enlargement and increase in capabilities of existing semi-submersibles of Arctic Class. Work included:

- Upgrade of variable drilling load capabilities to 6,000 and 9,000 tonne.

- Hull Sizing

- Stability

- Structural design for modifications

- Drilling equipment layouts

- Mud system upgrade

- Global Strength Structural Analysis

- Fatigue Life Assessment

- Shipyards bid package

Client: Global Marine Drilling Company.

2.26 Sedco 700 Series Deepwater Upgrade

Deepwater upgrade study for 2,500 meter water depth. Work scope included:

- Hull sizing for new deck load requirements

- Riser storage and handling

- Drill floor layout

- Mud system and tankage layout

- Subsea trees handling and deployment

- Stability analysis

- Structural design

Client: Transocean Sedco Forex.

2.27 Ocean Nomad - Payload Upgrade

Upgrade Aker H3.2 design semi submersible DVL to 3,500 ton deck load upgrade. Development of alternative configurations, structural design, class submittals, and approvals. Client: Diamond Offshore.

2.28 Nymphaea - Upgrade Study For 1,500 Meters Water Depth

Enhanced Pacesetter design semi-submersible. Upgrade evaluation for 1,500 meters water depth operation in mild environment. Alternative hull configurations for additional VDL, increase in deck areas, upgrade to drilling systems: drill floor, mud system, riser storage, etc. Solutions and alternatives presented for evaluation. Client: Pride International

2.29 Elf Matterhorn - Drilling Package Layout and Specification

Work scope included development and layout drilling package for the Spar and TLP field development alternative concepts, including preparing bid package specifications for drilling contractors. Client: ELF USA.

2.30 Atwood Hunter - Water Depth Capabilities Study

Study to evaluate maximum water depth capabilities and required upgrades for operations in three different areas: Brazil, West Africa, and Indonesia. Tubulars storage requirements, sub-sea controls requirements, mooring system requirements, and mud system requirements. Client – Atwood Oceanics

2.31 Peregrine II –Payload And Operational Upgrade. Engineering Design And Class Approvals

Development of engineering of hull sponson for vessel enlargement, related class approvals, rearrangement, and installation of new equipment, redesign and upgrade of mud system, Development of shipyard specifications. Client: Reading & Bates Falcon

2.32 Peregrine III – Crane Change

Development of engineering calculations and structural drawings for shipyard construction package for change of cranes on Peregrine III Drill ship. Client: Reading & Bates Falcon

2.33 MV Uncle John – Engineering Of Full Re-Powering Of Unit.

Development of engineering design and electrical system integration of change out to new diesel engines and generator sets for the DP unit. Client: Cal-Dive International

2.34 Alaskan Star – Stability and Deck Load Upgrade

Design and engineering of stability upgrade for deck load increase
Upgrade engineering and construction oversight
Planning and execution of inclining test at Brazilian shipyard.
Client: Queiroz Galvão Perfurações.

2.35 Exmar 2500 – Design of Semi-Submersible MODU With 10,000 VDL.

Development of design package for shipyard bidding and construction and classification society approval. Development of all naval architecture and structural aspects related to the hull design as well as hull marine systems, drilling systems (tubulars handling and high-pressure well fluids), power generation and instrumentation, and shipyard construction specifications. Clients: EOLP, Drilling Contractor Companies, such as Diamond Offshore, Santa Fe International, Global Marine Drilling, Transocean Offshore, etc..

2.36 Exmar III – Design of Semi-Submersible MODU With 6,000 to 8,000 VDL.

Development of design package for shipyard bidding and construction and classification society approval. Development of all naval architecture and structural aspects related to the hull design as well as hull marine systems, drilling systems (tubulars handling and high-pressure well fluids), power generation and instrumentation, and shipyard construction specifications. Clients: EOLP, Santa Fe International.

2.37 Exmar II – Design Development of Semi-Submersible MODU With 6,000 VDL.

Scope of work same as above. Clients: EOLP, Drilling Contractor Companies, such as Diamond Offshore, Santa Fe International, Global Marine Drilling, Transocean Offshore, etc..

2.38 Sturgeon Drill Ship – Design Development Of Drill Ship For Caspian Sea Operations

Scope of work same as above. Client: EOLP, Drilling Contractors and Conoco.