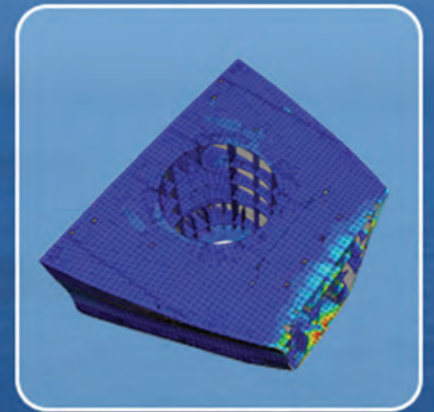


Design & Engineering

Services to **Oil & Gas Industry**



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About Us

Cybermarine is a leading Offshore Design & Engineering Enterprise with global operations. Cybermarine is headquartered in Singapore and delivers projects worldwide through offices at Houston, UAE, Kuala Lumpur and Mumbai.

Cybermarine as a company built from scratch, has developed innovative technology and processes over the years and is in a position to deliver wide ranging design and engineering solutions to the upstream oil & gas industry. Cybermarine, by utilizing its proficiency in engineering & extensive design experience has successfully delivered a range of design and engineering solutions on Jack-up Rigs, Semi-submersibles and FPSOs

Design & Engineering projects are executed using innovative and well-developed technology, which include Work Break-Down, Design-Spirals and 3D Space Arrangements/Models. The execution is augmented by well laid-down processes consisting of work specification spreadsheets and process checklists.



Our technical teams are organized as project teams and operations' teams.

Project teams comprise of project managers and project engineers responsible for project management and client interaction. Project teams are stationed in all our offices in various geographical locations.

Operations' teams comprising of Naval Architects/Engineers/Designers are responsible for project Deliveries and class approvals. They are stationed in Mumbai, India and Singapore.

We also have a Marine Division catering to the Design and Engineering of Multi-purpose support vessels, Cargo Vessels and other special vessels used in dredging and marine construction.

Service Segments

Our services extend to the entire range of assets used in the upstream oil & gas industry and consist of two significant segments as follows:

- FEED studies
- Offshore Engineering

The assets covered are Offshore Drilling Tenders, Jack-up units, Drill-ships, Semi-submersibles and FPSOs.

FEED Studies

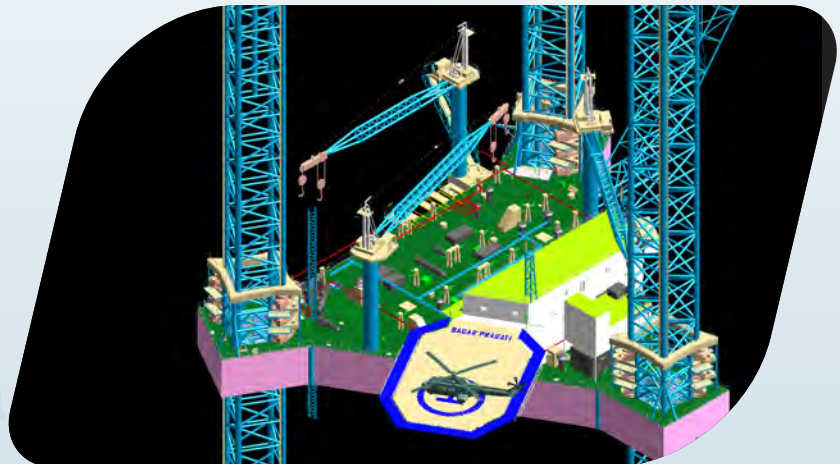
We have carried out FEED studies on

- MODU –MOPU conversions
- MODU –Offshore Installations conversions
- Upgrading a MODU to harsher environments/
higher elevated loads
- Classification / Reclassification of MODU/MOPU
- Increasing Operability of Tender Barges



FEED studies covered establishing the project feasibility considering all the functional requirements of the client and compliance with various industry standards/class regulations.

FEED studies covered all the domains of Naval Architecture, Structural Engineering, Mechanical, Electrical and Instrumentation engineering. These studies also considered all aspects of layout and safety engineering.

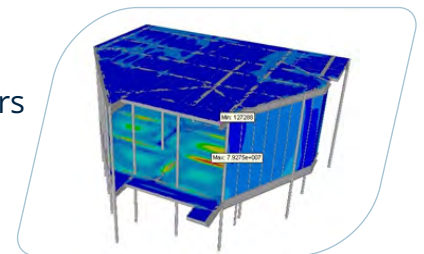
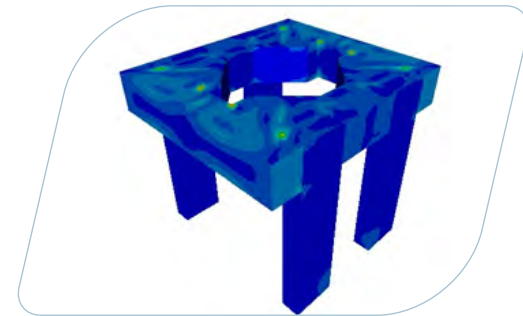


Offshore Engineering

Offshore engineering bouquet of services covers all the disciplines relevant to the project and in order to collect engineering information/data we carry out pre-engineering surveys and also use sophisticated 3-D scanning technologies.

Mentioned below are some of the projects executed by us:

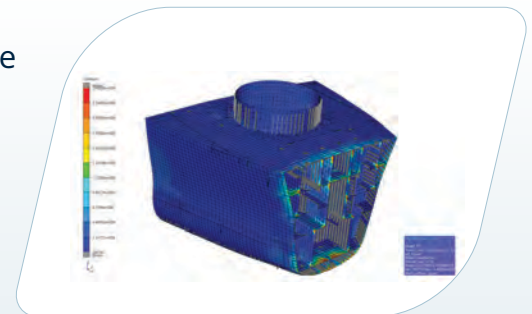
- Offshore Conversion Engineering
- Structural Outfit Engineering
- Up gradation of Electrical Power Systems
- Up gradation/Revamp of utilities
- Safety Systems upgrade/revamp
- Helideck Design /Engineering and outfitting
- Design and Engineering of Raw Water Tower
- Structural Design & Engineering of Burner Booms and Flare Towers
- Helideck Recertification



FPSOs

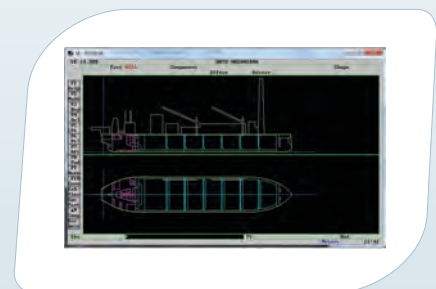
Structural Engineering

- Global FE analysis extending to all longitudinal & transverse members of the vessel
- Cargo Hold Model Analysis to ascertain the transverse strength of the vessel
- Submerged Turret Production Interface Analysis



Stability Analysis

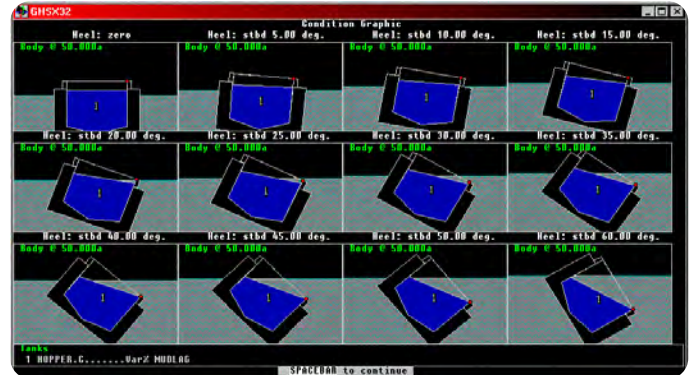
- Developed Inclining Test Procedures and conducted the Inclining Tests
- Developed a FPSO stability booklet for approval including intact and damage stability
- Loading conditions generated for all relevant loading / offloading scenarios, transit and inspection/ repair conditions
- Obtained Owner and Class approvals



Domain Knowledge

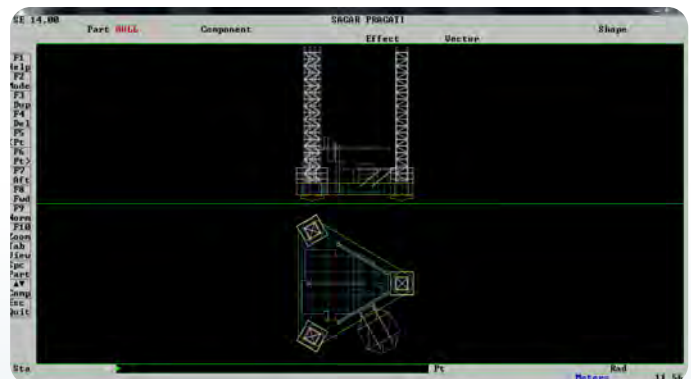
We have strong teams in several disciplines as follows:

- Naval Architecture
- Marine Technology
- Structural Engineering
- Marine/Process Engineering
- Electrical & Instrumentation
- System Integration
- Interface Engineering
- Regulatory Compliance



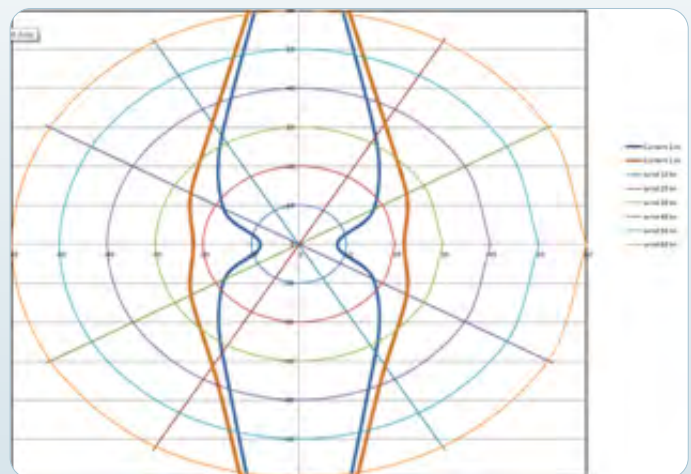
Naval Architecture

- Hull Form
- Space arrangements
- Design for Loadline compliance (Freeboard/Bow Height)
- Design for watertight integrity & subdivision
- Intact & Damage Stability compliance
- Weight & COG determination/Monitoring



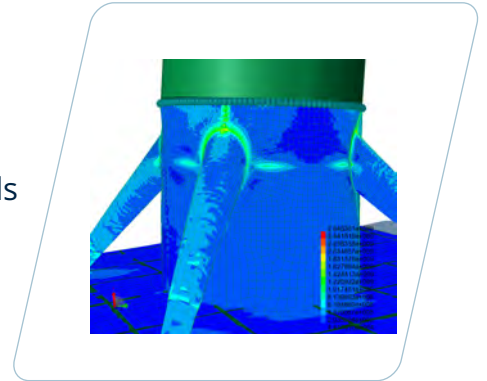
Marine Technology

- Hydrodynamics and Motion Analysis
- Mooring Analysis
- DP Studies



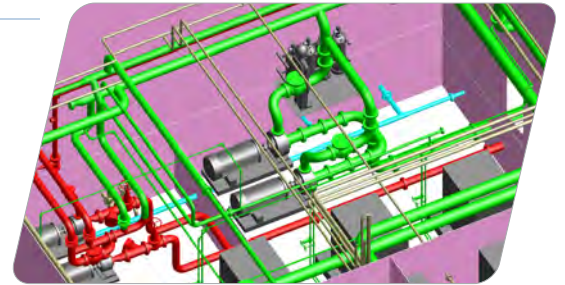
Structural Engineering

- Structural Design & Arrangements
- Finite Element Analysis
- Fatigue Analysis
- Dynamic Analysis
- Buckling and Ultimate Strength Analysis of Panels and Shells
- Joint Strength Analysis of Tubular connections
- VIV screening
- Hydrostatic and Soil Collapse Analysis



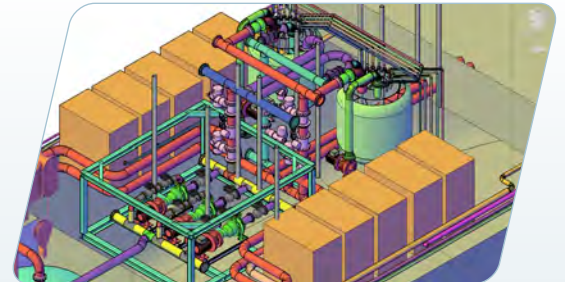
Marine/Process Engineering

- Pipe Flow & Piping System Design
- Pump Sizing
- Procurement Engineering
- Safety Engineering
- Layout Engineering in 2-D & 3-D



Electrical & Instrumentation

- Load Lists & Power Balance
- Cable Tray Routing
- Cable Schedules
- Developing Control Philosophy
- Control Room Design



System Integration/Interface Engineering

- Developing Interface registers
- Interface resolution

Regulatory Compliances

- ABS/DNV Rule compliance
- SOLAS compliance
- MODU compliance
- MARPOL compliance
- API RP2A
- SNAMET & R, 5-5A



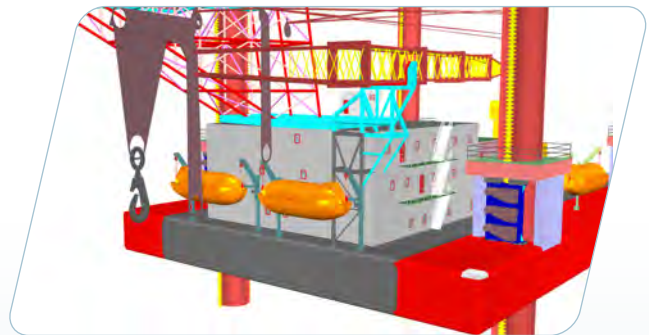
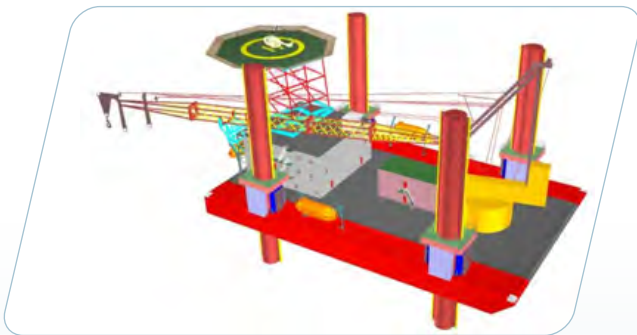
Project Gallery – FEED Studies

● Construction Jack-up Barge

The JUB is of size 64 M length and 41.4 Breadth used in offshore construction in Middle East Asia

Initially a FEED study was conducted to establish the feasibility of conversion and extent of modifications.

The owner required higher elevated loads, replacement of eight legs with 4 cylindrical legs, replacement of pneumatic gripper jacking system with rack and pinion system, Power Upgrade, addition of a CAP 437 compliant Helideck, post conversion design life of 15 years and MODU compliance.



Based on the FEED studies, the following were decided:

1. Breadth Jumboisation by 8 m
2. Circular cylindrical legs with opposed pinions
3. Floating jacking system
4. Repositioning of legs to the newly added sponsons

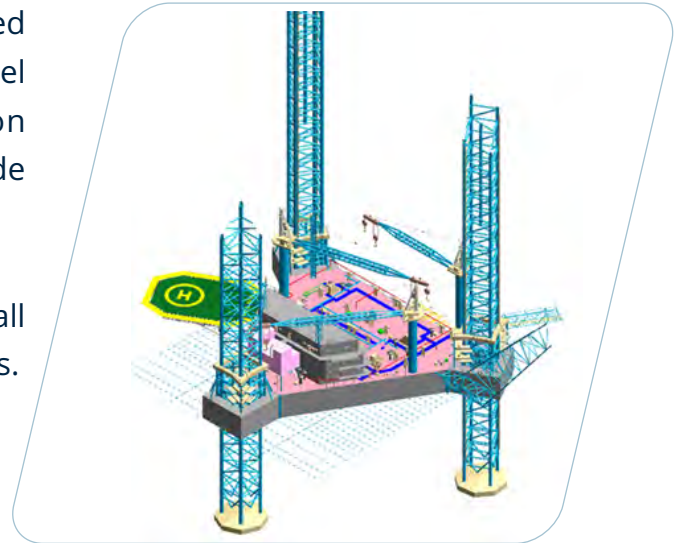


Project Gallery – FEED Studies

● Drilling Jack-up Rig A

JUR an existing Jack-up Drilling Unit is being converted to a Mobile Production Unit. On conversion the vessel will be classed by ABS as Offshore Production Installation, Hydrocarbon Production. The topside production units are engineered by another agency.

This modification also involved the demolition of all drilling, associated power systems and other systems.



FEED Studies

Initially FEED studies were carried out and presented to the owner considering all the modifications including the topside additions and drilling system demolitions. Extensive Naval Architectural and Structural engineering exercises of lightship estimation, stability analysis and leg strength analysis considering the modifications were carried out and changes proposed on layout and tank arrangements.

Based on the FEED studies, the following were decided :

1. Draft Modification by around 0.50 m towards the new displacement
2. Modification to Compartment & Tank arrangements
3. Placing certain restrictions on Variable loads
4. Jacking Capacity Upgrade to suit the new elevated load
5. Restricted Classification for Stability compliance
6. Flag Exemptions on Loadline requirements

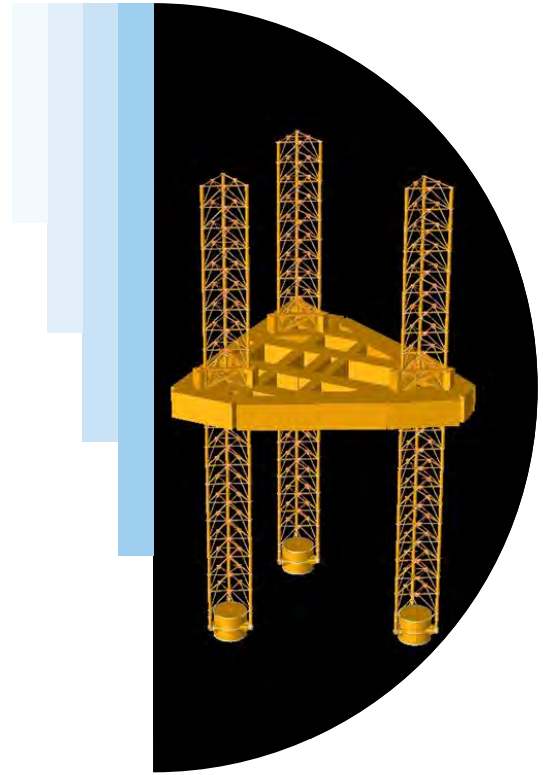


Project Gallery – FEED Studies

● Production Jack-up Rig B (MOPU)

MOPU B an existing Mobile Offshore Production Unit, with an expired classification with ABS is being refurbished and reclassified to deploy at a new location for Production.

On conversion the vessel was to be classed by ABS as Offshore Production Installation, as compared to the previous notation of Self elevating Unit, for Hydrocarbon Production.



FEED Studies

FEED studies were carried out towards establishing the feasibility of the new class notation and presented to the owners considering all the implications due to the applicability of new installation rules and subsequent rule changes to the MODU rules used for the original classification and the study findings were as follows:

1. Leg Strength was found to be not satisfactory
2. Leg storm holding capacity was found to be not satisfactory
3. Preload tank capacity of the unit was also found to be not satisfactory to cater the revised preload requirements

It was concluded and presented to the Owners that the mentioned reclassification is not possible without extensive modification to the units and the Owners decided to refurbish and reinstate the previous classification of MOPU rather than re-classing as Offshore Installation.

Project Gallery – FEED Studies

● Unit 6

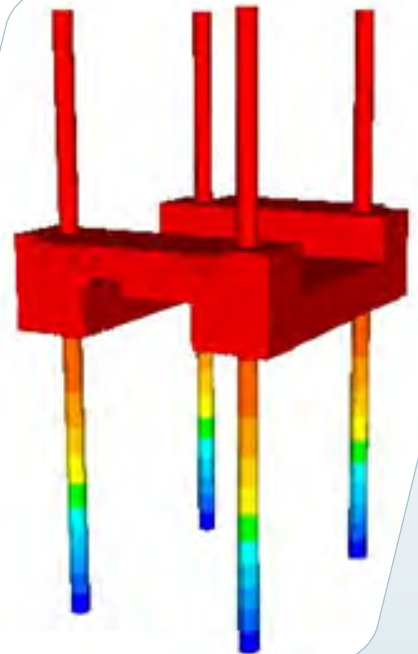
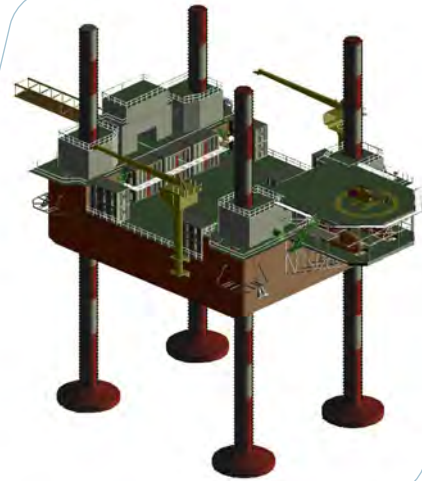
The project was executed in two phases. In the first phase, Unit – 6, an un-classed drilling unit was classified as a MODU with ABD and IMO MODU code complied.

In the second phase, Unit -6 was converted to a MOPU from a MODU and also upgraded to a higher environmental condition. The vessel has been successfully working in the waters off the coast of Thailand for the last five years.

FEED studies were conducted to establish the feasibility of the classification to MODU and subsequent conversion from a MODU to a MOPU.

On completion of the FEED study, the following detailed engineering work was carried out by us:

- Enhanced Leg strength for Increase in leg length and for Higher Operating environment
- Addition of new raw water tower,
- Mooring arrangement
- Global analysis
- Safety Engineering
- Stability Studies and compliances



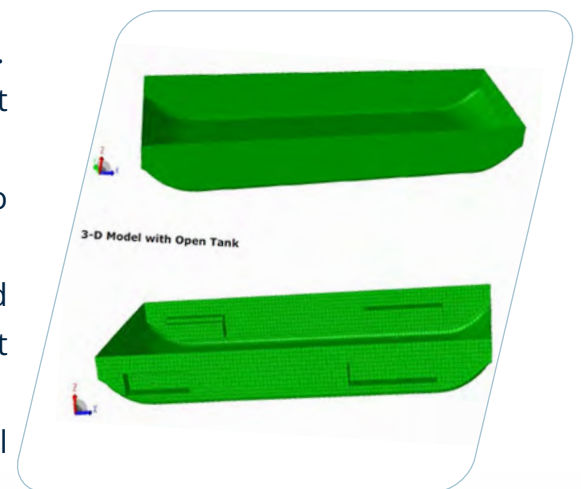
Project Gallery – FEED Studies

● Drilling Tender A

Drilling Tender was experiencing very low operability in calm environment due to uncharacteristically high roll motions which was making the installation of Drilling Equipment extremely difficult. A FEED study was conducted to identify the root cause of the problem and to propose a feasible solution.

Based on the FEED studies, the following were identified.

1. Vessel is resonating with swells of around 10s to 12 s.
2. The Roll Period of the Vessel is more than that predicted by the Motion Analysis (7 s)
3. The underestimation of the Roll period was due to inaccurate estimation of lightship
4. The conventional operational solution of draft and GM variation to alleviate the motions was not favorable
5. The vessel should have additional means to control the resonant roll motions



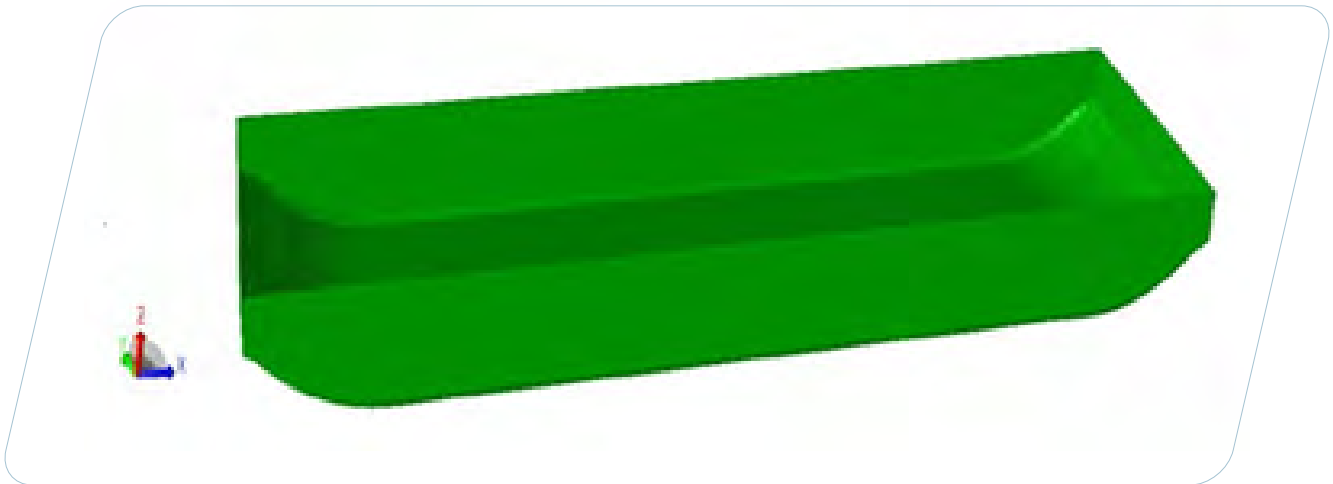
In order to have the simplest solution with minimum bearing on the layout and least implication on vessel's stability the following was proposed.

1. Four pairs of controlled flooding tanks, which can be opened/closed to the sea by means of pneumatically, controlled sea chest/air chest valves
2. The time period of the tanks and thereby the roll damping can be tuned with the fundamental period of the operating sea state by controlling the valves
3. The number and location of the flooding tanks were chosen such that the same has least effect on vessel's stability, trim and capacities

Project Gallery – FEED Studies

● New Built Drilling Tender: B

Motion Analysis Drilling Tender B, a sister vessel to A was about to be launched when the operability problems were noticed for A. The Crane capacity of the vessel was upgraded keeping the same dimensions. The vessel's lightship weight has also unexpectedly gone up by around 1,500t and caused serious apprehensions about the vessels performance.



A different FEED study was necessitated as the lightship weight had gone up and the study became very complicated as there was no leeway on the draft.

The study revealed that similar solutions as on Tender A of providing Controlled flooding tanks offered a solution.

However as the vessel was committed to a charter an alternate quick fix even though less efficient solution was also provided to the Owners.

1. Merging Port and Starboard ballast tanks at either ends of the vessel to convert them to Free Surface Anti Roll Tanks
2. Opening the Center Line Bulkhead partitioning the tanks shall do the modification
3. The roll damping to be induced by means of the internal waves and the tank to be tuned to the sea state's fundamental frequency by varying the filling level

Project Gallery – Offshore Engineering

● Construction Jackup Barge

The JUB is of size 64 M length and 41.4 Breadth used in offshore construction in Middle East Asia

Initially a FEED study was conducted to establish the feasibility of conversion and extent of modifications.

On conclusion of FEED studies detailed engineering as follows was carried out:

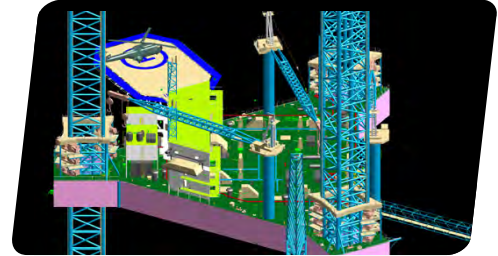
- Increased Variable load
- MODU compliance
- Compliance with ADCO requirements
- Leg design to cater for higher loads
- Replacement of 8 legs by 4 legs
- Elevated Analysis & Leg Analysis
- Global analysis of hull
- Fatigue analysis of legs
- Installation of new Rack & Pinion Jacking system
- Design of leg Well & Jack House
- Redesign of electrical power plant & Electrical systems
- Accommodation Augmentation
- Ship Systems
- Helideck Addition
- CAP 437 Compliance



Project Gallery – Offshore Engineering

● Drilling Jackup Rig A

JUR A an existing Jackup Drilling Unit is being converted to an Offshore Production Installation. On completion of FEED studies and establishing the feasibility, detailed Engineering is being carried out.

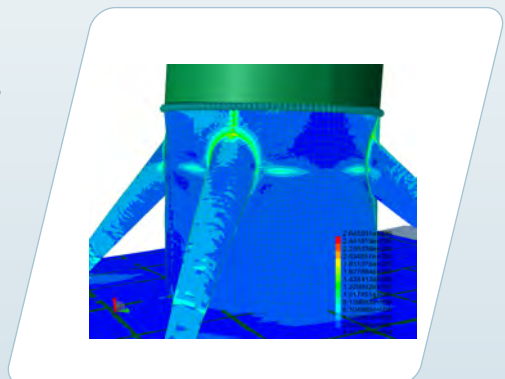


Naval Architecture

- Weight/CG Determination of the lightship
- Extensive Stability Analysis – covering Intact & Damage stability carried out
- 3D Space engineering taking into account MODU Safety Requirements
- Space arrangements complying all loadline requirements, watertight integrity/subdivision requirements and hazardous area requirements

Structural Engineering

- Dynamic Analysis of the Global Elevated Model
- Linear Extreme Wave Time Domain Analysis to calculate the wave loading including dynamic response on the legs
- Elevated Leg Strength Analysis considering soil springs
- Leg Reinforcement iwo the leg guides
- Spud Can / Leg Soil Collapse Analysis
- Global elevated hull analysis
- Buckling and Ultimate Strength Analysis of Hull Panels
- Leg Well & Jack House Analysis for increased interface Loads
- Spectral Fatigue analysis of leg but welds, tubular connections, leg – spud can interface
- Fatigue Analysis of the Hull, Jack House and Leg Well
- Seismic Analysis of the Elevated Unit
- Crane Pedestal Design and Hot Spot Fatigue Analysis
- Raw Water Tower Design and Engineering
- Helideck Upgrade as per CAP 437
- Top Side Structural Outfitting
- Living Quarters Tier Addition and Block Engineering



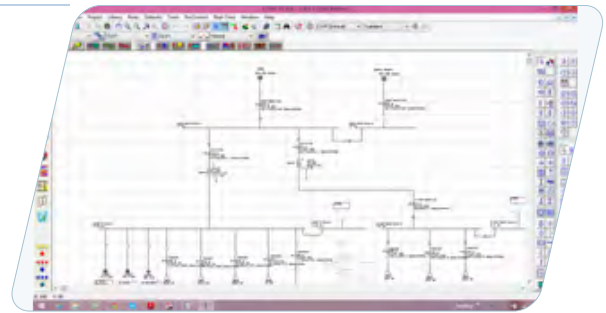
Project Gallery – Offshore Engineering

Marine/Process Engineering

- Developed all Utilities P&IDs
- Pump & Other Equipment sizing
- Flow calculations and pipe sizing
- Extensive studies carried out to establish/utilize the existing pumps and other systems

Electrical & Instrumentation Engineering

- Emergency Generator sizing
- Load lists
- Lighting Arrangements
- Transformer sizing



Safety Engineering

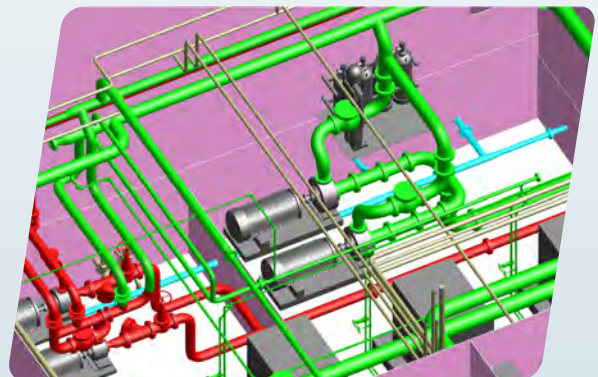
- Compliance with MODU Code safety
- Compliance with ABS rules on Offshore Installations
- Participation/Compliance in HAZOP/HAZID/SIL studies

Interface Engineering

- System design of all utilities to the Top side
- System design for the Emergency Power supply
- System Design for Safety comprising fire water and CO2 systems

Layout Engineering

- 3-D models & Clash Analysis
- Developed layouts for Switch gear rooms and Pump rooms
- Layouts designed for minimizing Hazardous zone requirements
- Layouts also designed for Proper material handling
- Development of material handling facilities

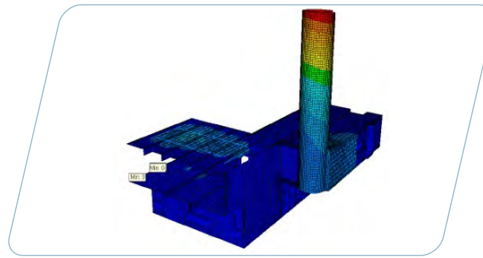
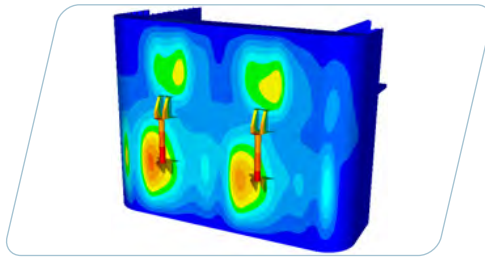


Project Gallery – Offshore Engineering

● Semisubmersible Drilling Tender : New Built

Structural Outfitting Engineering is being carried out for a brand new Semisubmersible Drilling Tender, being designed by a Singapore based leading Submersible designers in compliance with ABS MODU classification.

Structural design and engineering of foundations and supporting structures of various outfits are carried out based on the vendor documents and machinery arrangement drawings provided by the designer.



- | | |
|------------------------------------|--|
| 1. Mooring Fairlead Foundation | 9. Mooring Winch Foundation |
| 2. Anchor Racks and Foundation | 10. Mooring Stowage Winch Foundations |
| 3. Crane Columns and Reinforcement | 11. Helideck Truss and Support Structure |
| 4. Genset Foundations | 12. Crane Boom Rests |
| 5. Mud Pump Foundation | 13. Fender Bumper Reinforcement |
| 6. Cementing Unit Foundations | 14. Towing Bracket Foundations |
| 7. PTB Foundations | 15. Bollard and Chock Foundations |
| 8. Life Boat Platform | |

Structural Engineering

1. Finite Element Analysis of Foundations and Support Structure
2. Panel Buckling and Ultimate Strength Analysis
3. Shell Buckling and Ultimate Strength Analysis for Crane Column
4. Hot Spot Fatigue Analysis of Foundations experiencing cyclic loading (Crane Columns, Mooring Winch Foundations and Fairlead Foundations)
5. Dynamic and Resonance Analysis of Foundations with exciting Machineries (Genset, Mud Pump and Cementing Unit Foundations)
6. Joint Strength Analysis of Tubular Joints
7. ABS MODU Rule compliance

Project Gallery – Offshore Engineering

● FPSO: New Built

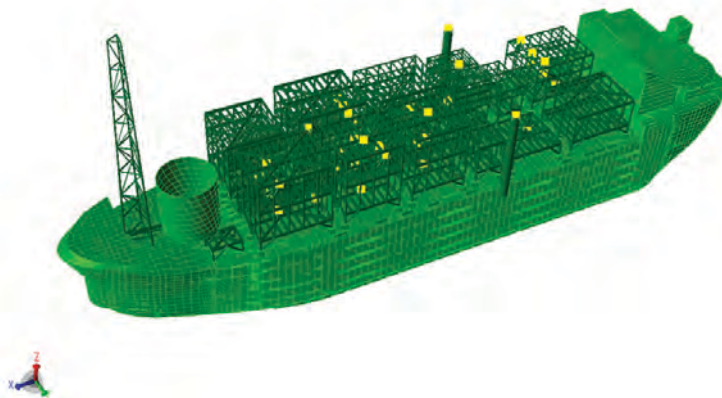
New Built FPSO is being classed with DNV, for unrestricted service to transit worldwide and to withstand the environmental loads during its operation at site located offshore UK Continental Shelf – in 85-95M Water Depth. To assess the vessel structural capacity towards the notation ULS, Global FE analysis is being performed for the operating and sailing conditions, at the maximum and minimum drafts considering the still water shear force and bending moment limit curves. Operating condition is based on Site specific met ocean data, ULS analysis being carried out for both the 100 year & 1,000 year return periods.

Global Finite Element Analysis

A finite element model of the whole ship is generated including all the structural elements contributing to longitudinal and transverse strength the vessel.

The entire mass distribution is modeled as structure self-weight, compartment load, equipment load and concentrated nodal masses as appropriate and a panel model is generated from the outer hull surface of the vessel.

Hydrodynamic analysis is carried out for sufficient number of wave time period to capture the accurate representation of transfer functions and structural responses. Hydrodynamic analysis is carried out using frequency domain approach, including forward speed and nonlinear wave loads, wherever applicable. After load transfer from hydrodynamic model to structure model, structural analysis is carried out for these loads using the structural analysis software (GeniE) and the respective structural transfer functions are calculated.

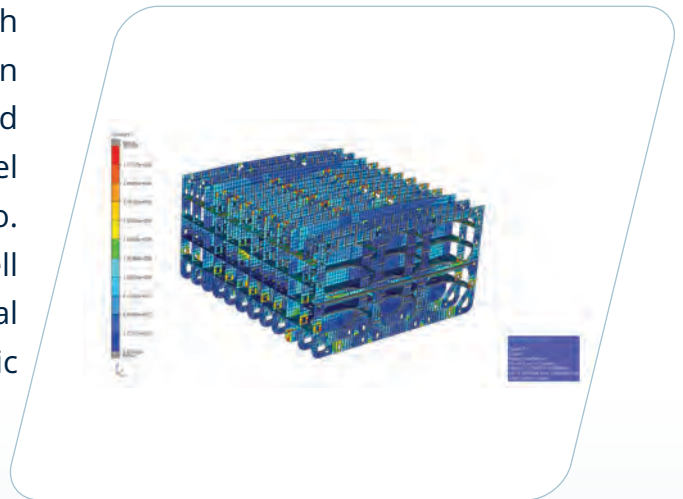


Project Gallery – Offshore Engineering

On account of the weather vaning capability of vessel, 0 deg, 15 deg, 30 deg, -15 deg and -30 deg heading (with respect to centreline of vessel) are considered for the operating conditions. For transit condition, 0 deg to 360 deg direction heading with an interval of 30 deg is considered for the analysis. Global hull analysis is carried out for both the long term distribution of seastate as well as the short term extreme seastates to ensure that geometric tuning effects are not overlooked.

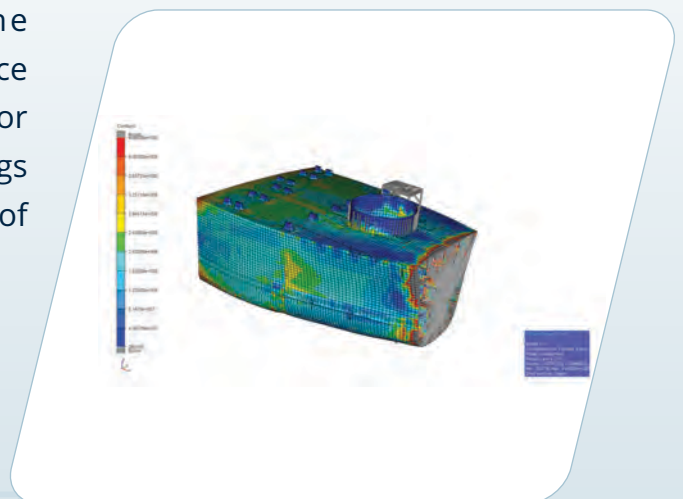
Cargo Hold Model Analysis

The model extent comprises of two tank length model, i.e. one complete tank and two half tank on either side. Dynamic wave pressure is calculated from global analysis and applied over hold model to simulate the site specific wave loading scenario. Dynamic internal tank loads, inertia loads as well as still water loads are all mapped from the global hull model corresponding to various site specific and recommended transverse loading scenarios.



Submerged Turret Production Interface Analysis

Loading conditions corresponding to the maximum mooring/riser loads iwo turret interface is selected as the governing loading conditions for the analysis. Analysis is carried out for the headings consistent with the global analysis at an interval of 15 deg.



Project Gallery – Offshore Engineering

● Reactivation/Modifications of JUR

A. JUR GSF a 300 ft drilling unit

This unit was in cold storage for two years in Malaysia and various Engineering scopes were carried out for reactivating the rig.

- Fast Rescue craft installation
- Helifuel Tank Storage
- Extension of Accommodation deck to install an Accommodation container
- 60T SWL Panama chock on port & stbd side
- Gymnasium
- Choke & Kill line platform
- Crew Baggage iwo Helideck
- Substructure repair plan & FE analysis
- Shaker Deck analysis
- Centrifuge Deck analysis

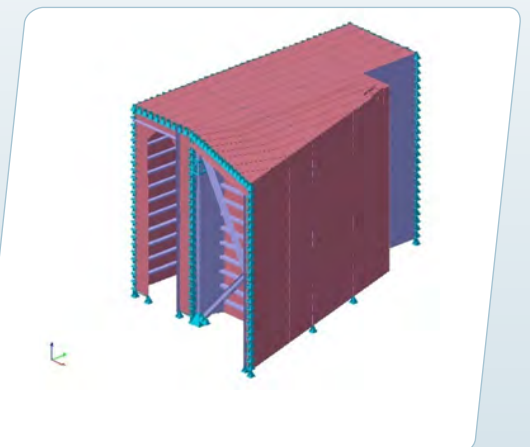


B. JUR GSF a 300 ft drilling unit

JUR CD a Marathon Letourneau 116-C design jack-up drilling unit built in year 1992 required a number of modifications for deployment in the field.

Works carried out

- Strength Calculation of Platform for the loads of OSU-PA unit
- Calculation of SWL of Trolley Beams of BOP
- Trolley Beam in pump room
- Installation of Escape route from derrick
- Installation of a walkway to reach Monkey Board

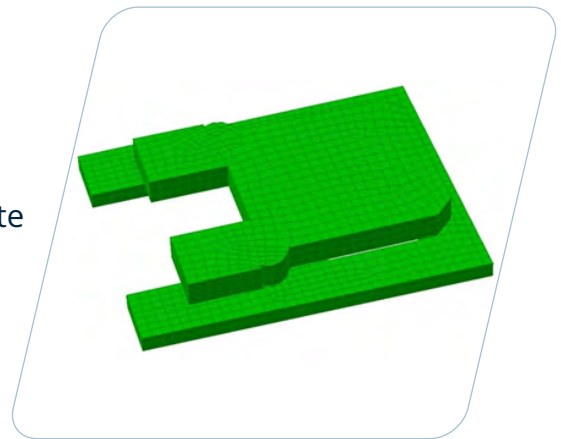


Series 5 & 6

Series 5&6 are Bethlehem type mat supported existing Jack up Drilling Units which are converted to Offshore Production Units for operation in Offshore Malaysia. On conversion the vessels are classed with BV as Offshore Self-Elevating Unit - Production, Offshore Peninsular Malaysia with a design life of 10 years. The detailed Conversion Engineering of the project involved the following.

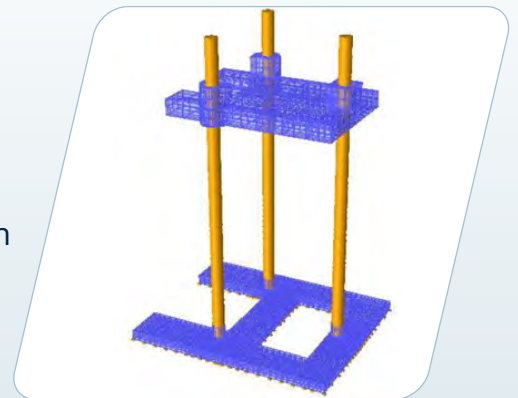
Naval Architecture

- Weight & COG Control
- Lightship Estimation
- Inclining Experiment
- Intact Stability & Damage Stability Analysis
- Motion and Acceleration Analysis for Transit Route
- Accommodation Layout Engineering
- 3D Space Engineering
- Hazardous Zone and Safety Engineering
- Marine Operation Manual



Structural Engineering

- Dynamic Analysis of the Global Elevated Model
- Elevated Leg Strength Analysis
- Leg Reinforcement by flat bar strapping
- Jack House Analysis
- Initial Weibull Fatigue analysis of leg
- Spectral Fatigue analysis of leg and leg-mat connection
- Helideck Hull Interface Analysis
- Structural Outfitting Engineering
- 120' Burner Boom, Kingpost & Heat Shield Analysis



Series 5 & 6

Marine Engineering

- Utilities P & Ids
- Ventilation Plans

Safety Engineering

- Escape Routes and Safety Plans
- Compliance with IMO MODU Code safety
- Compliance with BV Self Elevating Unit Rules

Layout Engineering

- 3D models and clash analysis
- Optimised accommodation and system layouts



Software Tools

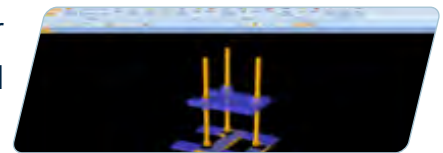
SESAM

A comprehensive structural and hydrodynamic analysis software used by us for all types of floating structures and semi-submersibles.

Genie	is a tool for analyzing offshore and marine structures made of beams and plates	Cutres	is an interactive postprocessor for presenting forces and stress distribution
HydroD	is used for performing hydrodynamic analysis	Submod	is a program for extracting displacements from a global model to sub-model
Mimosa	is a program for analysis of mooring systems of moored vessels	PULS	is a linear nonlinear buckling check for stiffened and un-stiffened panels

SACS - (Structural Analysis Computer System)

SACS is a finite element structural analysis suite of programs for the offshore engineering industry. Software is extensively used by us for Jack-up Rigs.



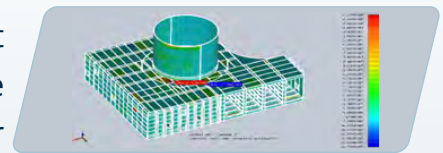
GHS (General HydroStatics)

GHS is used for by us for Intact & Damage Stability analysis of various types of vessels.



NeiNastran

NEi Nastran is a powerful, general purpose Finite Element Analysis (FEA) tool with an integrated graphical user interface and model Editor which is used to analyze linear and nonlinear stress & dynamics, of structures and mechanical components.



Aveva PDMS (Marine)

PDMS is used by us for 3-D visualization of complex machinery spaces on Ships and Offshore floating structures. Space arrangements are refined using this software.



Autodesk Navisworks Simulate

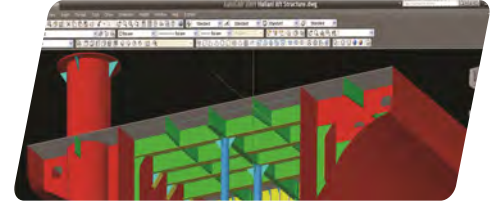
Extensively used for visualization and presentations.



Software Tools

Autocad 2D & 3-D/ ZW cad

AutoCAD/ZW cad are 2D and 3D CAD softwares and used extensively in design & drafting.



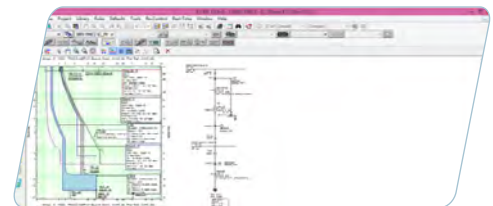
Rhinoceros

Used by us for 3-d modeling of complex hull forms and structures.



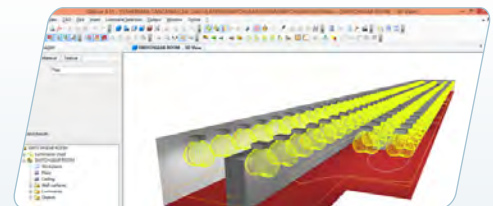
ETAP (Electrical Transient Analyser Program)

ETAP is used to perform system study and analysis for electrical power system which includes load flow, short circuit, relay coordination and motor re-acceleration. All components can be modelled and the program can be run to check the adequacy of equipment selected, to specify the fault levels and to ensure protective relay coordination.



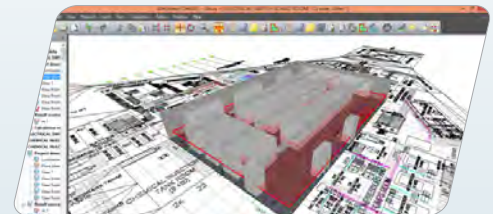
Dialux 4

Dialux is a 3D lighting software widely used to design lighting requirements for any area.



ReluxPro

Relux is 3D lighting software by Relux AG which is used to design lighting requirements for both indoor and outdoor areas. It supports the data of all international lighting system vendors.



Software Tools Licensing Acknowledgements: SESAM - DNV, SACS-Bentley Systems Inc, GTSTRUDLL-Integrgraph, GHS-Creative Systems Inc., NeiNastran-Nei software, Aveva PDMS (Marine)-Aveva Group plc, Navisworks Simulate – Autodesk, AutoCad – Autodesk, ZWCad – ZWSOFT, Rhinoceros-Robert McNeel & Associates, ETAP-ETAP, Dialux 4-Dial GmbH, ReluxPro – Relux AG.



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