ENGINEERING IN **NOV PORTUGAL**

Technical Groups Presentation

MARTECH 2016, Lisbon

Agenda

- NOV Presentation
- NOV Rig Systems Presentation
- NOV Portugal Presentation
  - Structural Engineering Group
  - Mechanical Engineering Group
  - Electro & Systems Engineering Group

NOV
Presentation

We power the industry that powers the world

National Oilwell Varco (NOV) is a worldwide leader in the design, manufacture and sale of equipment and components used in oil and gas drilling and production operations.

NOV Presentation

Global Presence

Major NOV manufacturing facilities

Brazil	Mexicali
California	Norway
China	Russia
Dubai	South Africa
Edmonton	South Korea
Houston	

NOV Presentation

Segments

Rig Systems

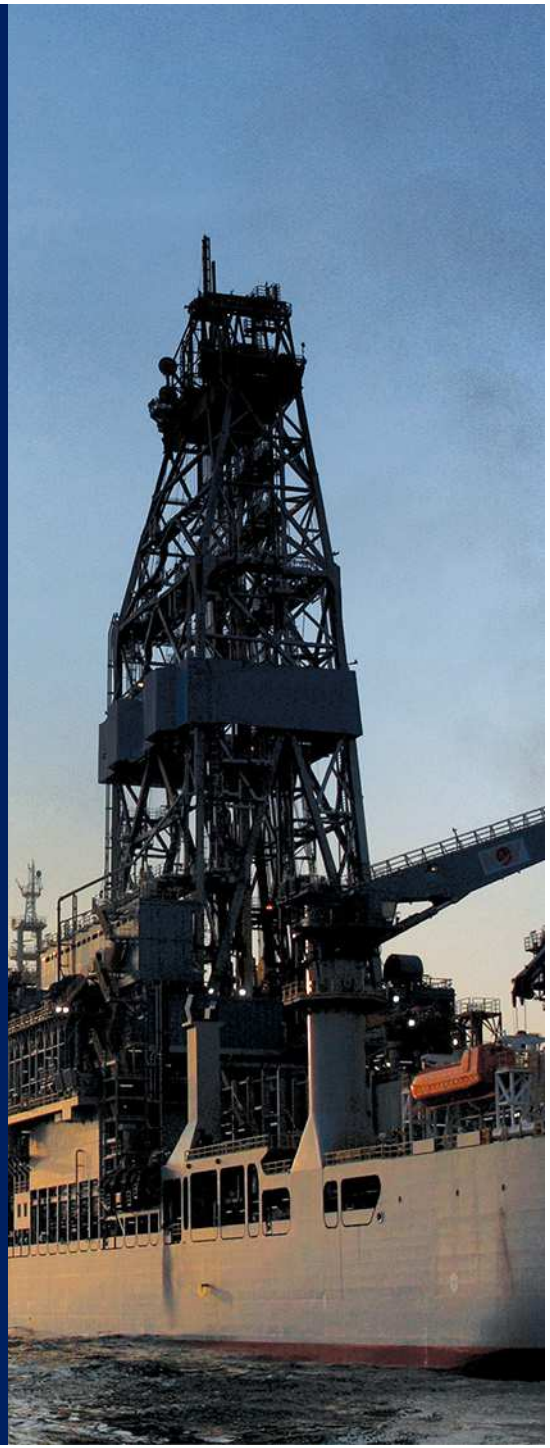
Aftermarket
Land
Offshore

Wellbore Technologies

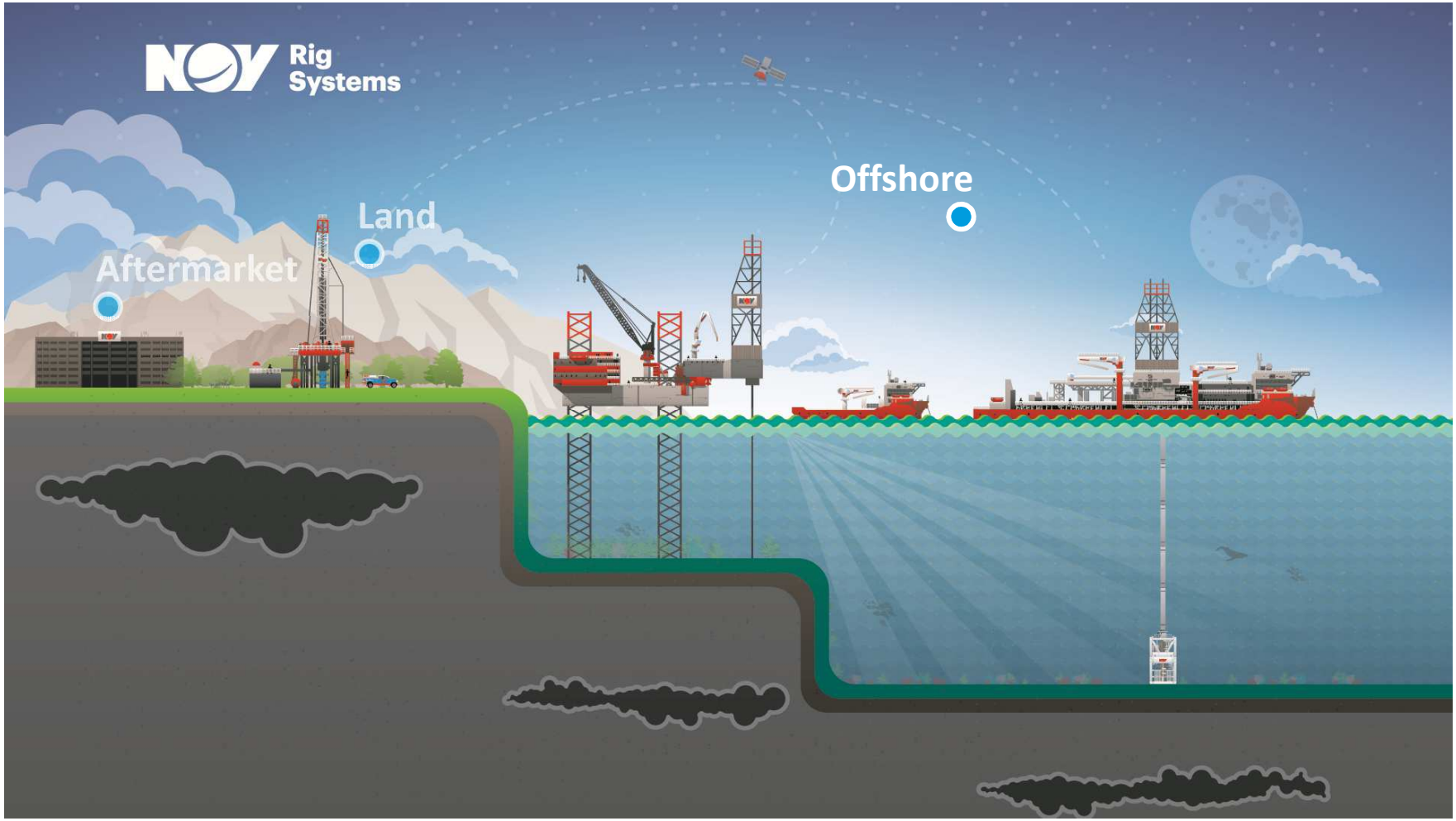
Completion & Production Solutions

NOV Rig Systems
Presentation

We provide comprehensive upstream solutions that include technically advanced, field-proven equipment and services that increase drilling efficiency, enable safe operations consistent with the most rigorous HSE standards, and maximize life cycle economics.



NOV Rig Systems Presentation



NOV Rig Systems Presentation

Office Segment – Rig Systems Offshore

Floaters

Drillship

Differentiated from other offshore drilling units by their easy mobility;
Capable of holding more equipment;
While capable of drilling in deep and ultra-deep waters, a disadvantage to using a drillship is its susceptibility to being agitated by waves, wind and current.

Semi-Submersible

Drillships are capable of holding more equipment but semisubmersibles are chosen for their stability.
The most stable of any floating rig, chosen for harsh conditions.

Jack-Up

Jack-Up

Jack-Ups have become the most popular type of mobile offshore drilling unit (MODU) for offshore exploration and development purposes.
The premise of a jackup rig is that it is self-elevating; here, the legs are stationed on ocean floor and the drilling equipment is jacked up above the water's surface.

NOV Portugal
Presentation

Structural Engineering
Group

Structural Group includes all the Calculations/Simulation divisions and Derricks Systems.
Calculations/Simulations divisions support all engineering groups with technically advanced analysis and solutions in accordance with all relevant standards and regulations.
In Derricks Systems we provide field-proven design and solutions for the main drilling structure where most of operation equipment's are fixed.

Structural Engineering Group

Departments, Products and Engineering Team

Departments

- Derrick Systems [10 Eng.]
- High Pressure Manifolds & Mud Mix Systems [1 Eng.]
- Multidiscipline Simulation [2 Eng.]
- Structural Calculation [2 Eng.]
- Bulks Storage & Transfer [1 Eng.]
- Drilling Operations Cabins [1 Eng.]
- End Fitting Design (NOV Flexibles) [2 Eng.]

7 Different Departments

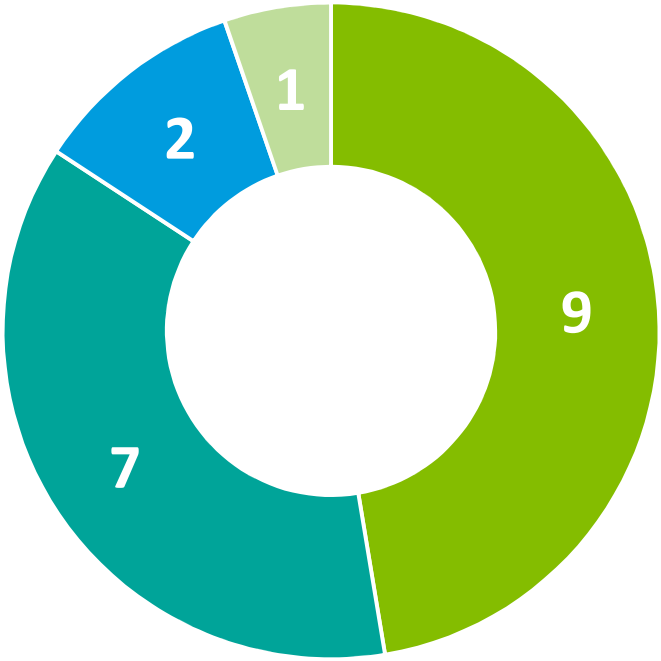
19 Engineers

1 Drawing Checker

2 Piping engineers

8 Years Average Experience

31 Years Average Age



Structural Engineering Group
Derrick Systems

What We Do

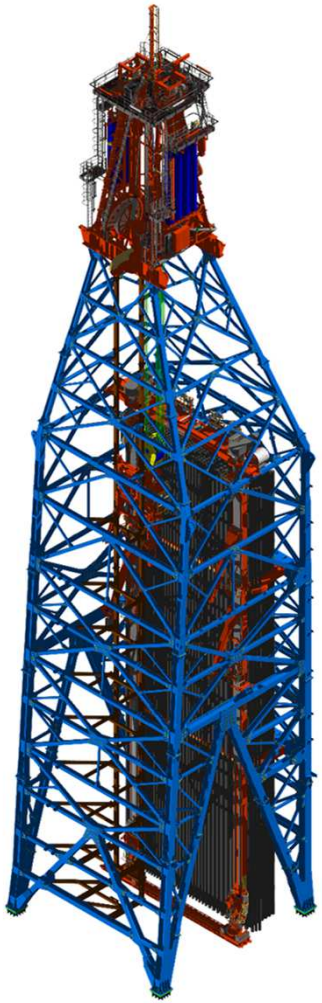
- Design/3D modeling and drawing preparation;
- Creation of customer material part lists;
- Responsibility for managing the interaction with other equipment;
- Production and assembly follow up in China and Korea.

Products Developed

- Simple and double derricks and hoisting towers, i.e., steel truss towers where drilling and operation equipment are supported.

Software Used

- Autocad/ProSteel, Autodesk Inventor, Navisworks and Caesar II;
- Concorde, RigDoc, RigOffice, RigParts and Team Center.



Structural Engineering Group

High Pressure Manifolds & Mud Mix Systems

What We Do

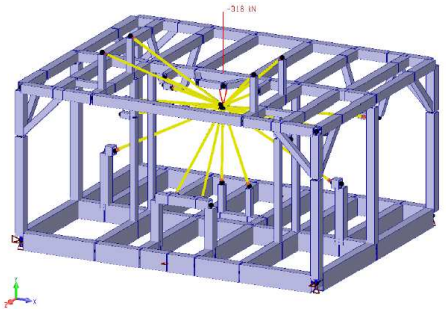
- Structural analysis of skids for installed and lifting condition;
- Structural check of lifting lugs and bolted connection.

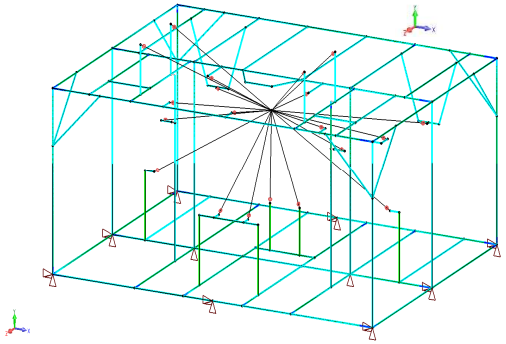
Products Developed

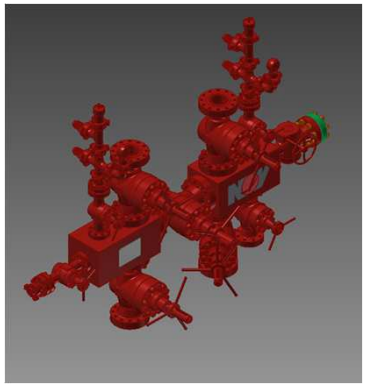
- Choke & Kill Manifold;
- Mud Gas Separator;
- Mud Standpipe Manifold;
- Cement Standpipe Manifold;
- Mud Mix System Equipment.

Software Used

- AutoCad Mechanical, Autodesk Inventor;
- Safi, ANSYS Workbench, Mathcad;
- Concorde, RigDoc, RigOffice, RigParts and Team Center.







Structural Engineering Group
Multi-Discipline Simulation

What We Do

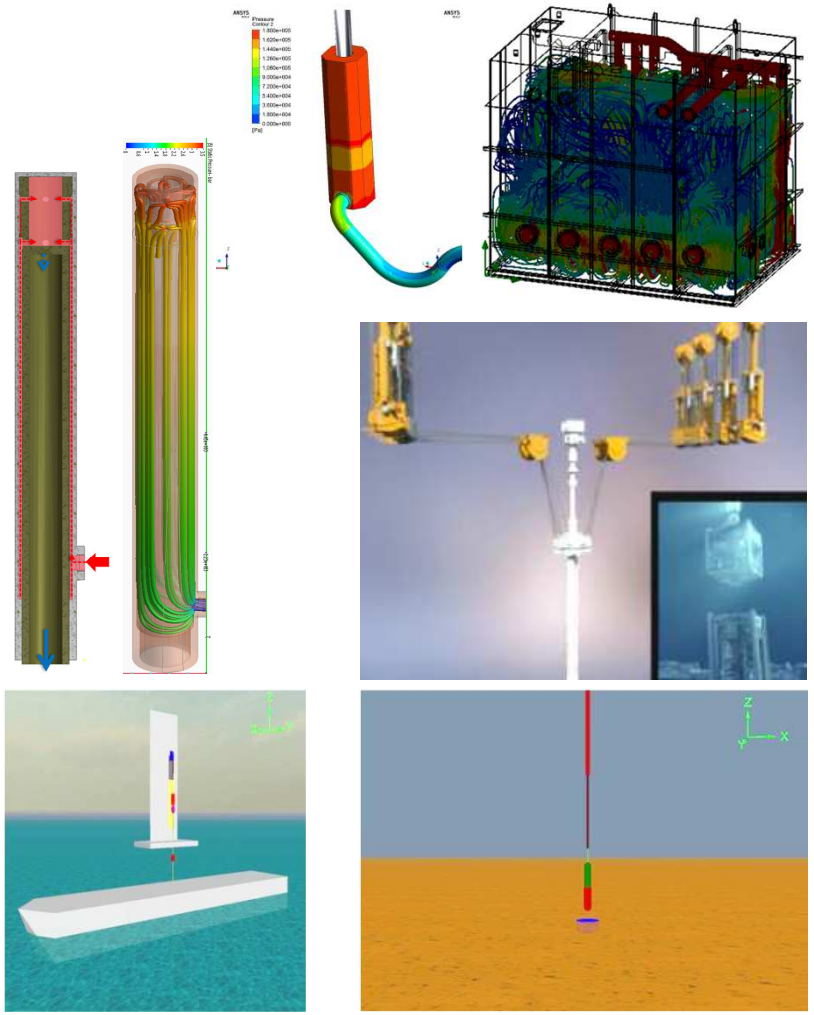
- Computational Fluid Dynamics (CFD) simulation;
- Thermodynamic simulation;
- N-Line and Wireline Tensioners – Tension Variation;
- CMC and AHC systems;
- Weight-On-Bit Variation;
- Global Riser Analysis.

Products Developed

- All types of hydraulic equipments, motion controls, piping, cylinders, valves, risers, etc.

Software Used

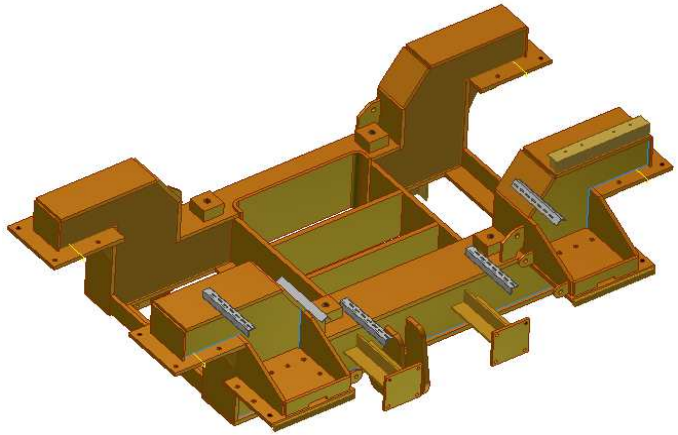
- ANSYS (Fluent or CFX) and Autodesk Simulation CFD;
- SimulationX;
- OrcaFlex;
- Concorde, RigDoc, RigOffice, RigParts and Team Center.



Structural Engineering Group
Structural Calculation

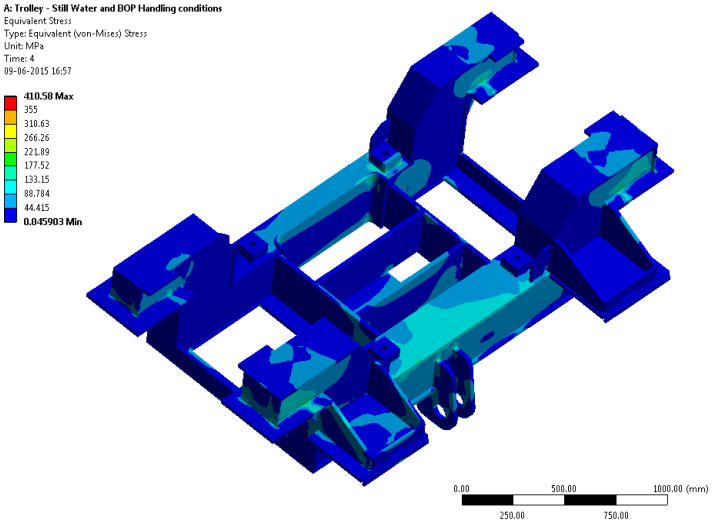
What We Do

- Structural analysis and calculations;
- Elaboration of reaction forces and design calculations reports;
- Calculations of slew bearing forces;
- Sequence of failure analysis;
- Elaboration of crane load diagrams.



Products Developed

- Derrick systems;
- BOP handling systems and horizontal pipe handling;
- Column rackers ,cranes and winches.



Software Used

- AutoCad Mechanical, Autodesk Inventor, STAAD.Pro;
- ANSYS Workbench, Mathcad, StruProg AB;
- Concorde, RigDoc, RigOffice, RigParts and Team Center.

Structural Engineering Group
Bulks Storage & Transfer

What We Do

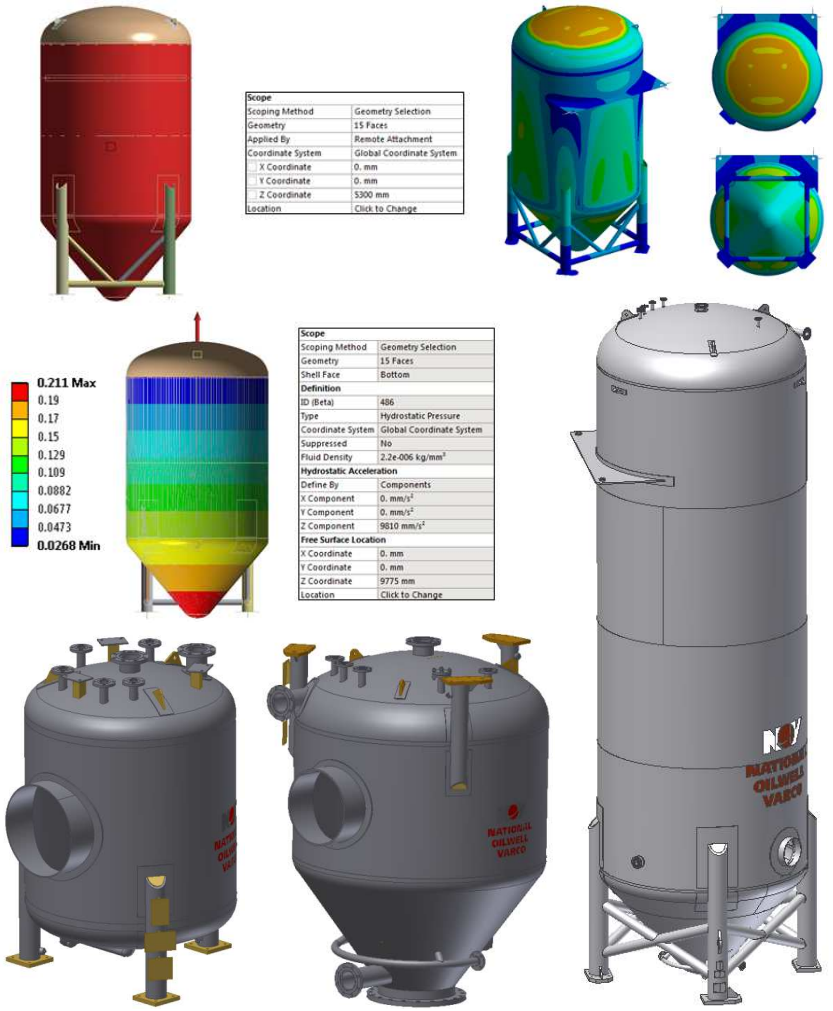
- Structural analysis considering Rig accelerations, wind loads, content weight and for lifting conditions;
- Elaboration of reaction forces and design calculations reports.

Products Developed

- Bulk tanks;
- Surge tanks;
- Dust Collector tanks.

Software Used

- AutoCad Mechanical, Autodesk Inventor;
- ANSYS Workbench, Visual Vessel Design, Compress and Mathcad;
- Concorde, RigDoc, RigOffice, RigParts and Team Center.



Structural Engineering Group
Drilling Operations Cabins, LER and LIR

What We Do

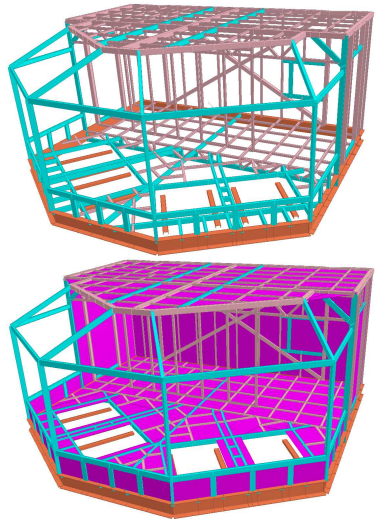
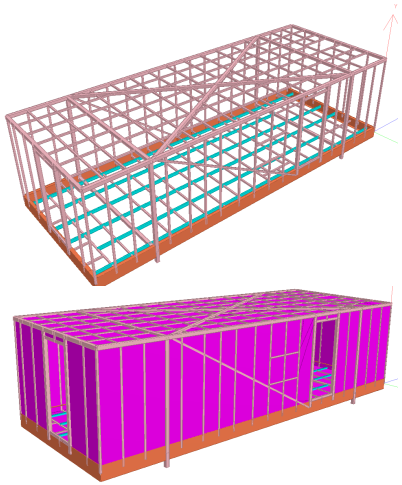
- Structural analysis and calculations;
- Check of multiple support conditions: workshop, lifting, truck transportation, vessel transportation and operation.
- Elaboration of design calculations reports;
- Structural check of lifting lugs and bolted connection.

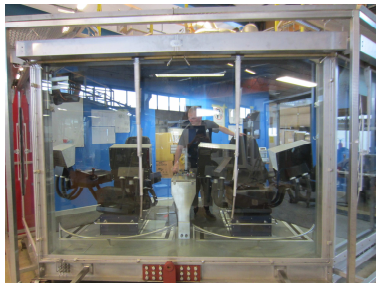
Products Developed

- Drilling Operations Cabins, Local Equipment Room (LER) and Local Instrumentation Room (LIR).

Software Used

- STAAD.Pro and Inventor;
- ANSYS Workbench, Mathcad;
- Concorde, RigDoc, RigOffice, RigParts and Team Center.


Mechanical Engineering Group

Mechanical Group is involved in the main Drilling and handling equipment spread all over the rig.
Design of critical and complex machines complying with all the standards and regulations required.
Perform of 3D Design of both primary and secondary steel and 2D detailing are today's core competences.
Reliable and efficient design solutions are possible due to close communication with calculation/simulation groups.

Mechanical Engineering Group

Departments, Products and Engineering Team

Departments

- Horizontal Pipe-handling Equipment
- Column Rackers
- Compensation and Cylinder Hoisting Equipment
- BOP Handling Systems
- NOV Flexibles- End Fitting Designn

5 Different Departments

10 Engineers

2 Drawing Checkers

1 Working for Visual Works

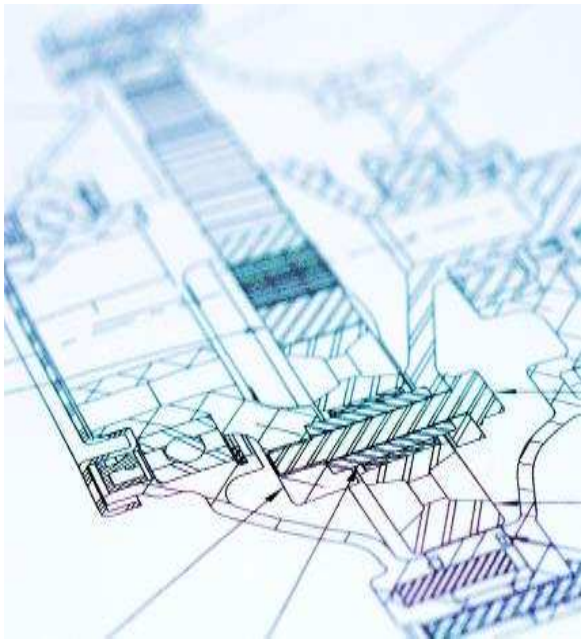
5 Years Average Experience

10% Female Engineers

Mechanical Engineering Group
Our Technical Competences

We are skilled to perform tasks in mechanical engineering fields:

- 3D modeling + preliminary structural FEA simulations;
- 2D Detailing;
- Drawing checking (Item checking, dimensioning, tolerancing, welding, S. roughness);
- Machine element design;
- Materials selection;
- Hydraulics and pneumatics;
- Product development;
- Root cause analysis;
- Metrology, alignment.



Mechanical Engineering Group

Horizontal Pipe Handling Systems

What We Do

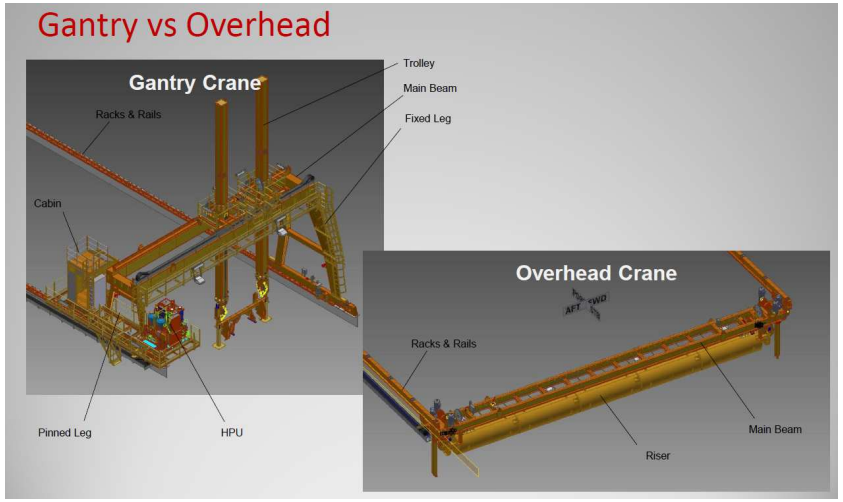
- 3D modeling and 2 D detailing of both primary and secondary steel based on GA drawings;
- Manufacturing follow-up.

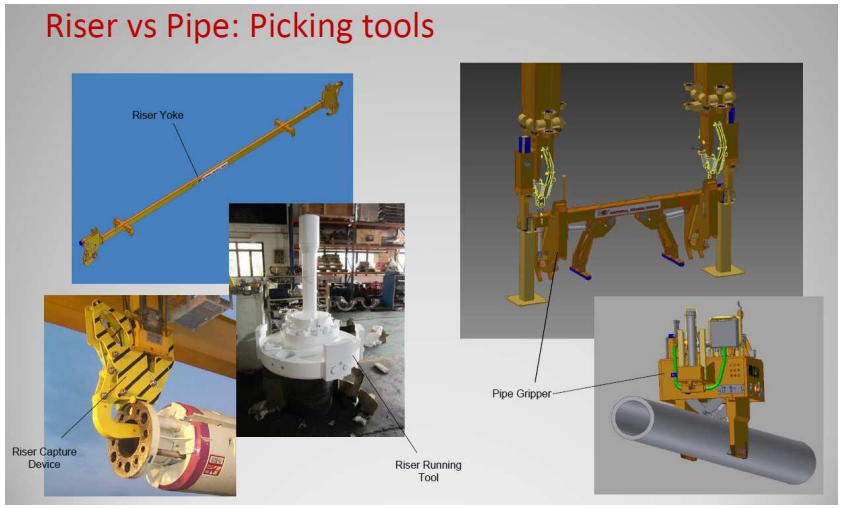
Products Developed

- Gantry cranes;
- Overhead cranes;
- Catwalks;
- Picking tools.

Software Used

- Inventor, Vault, Autocad Mechanical;
- Concorde, RigDoc, RigOffice, RigParts and Team Center.





Mechanical Engineering Group
Column Rackers

What We Do

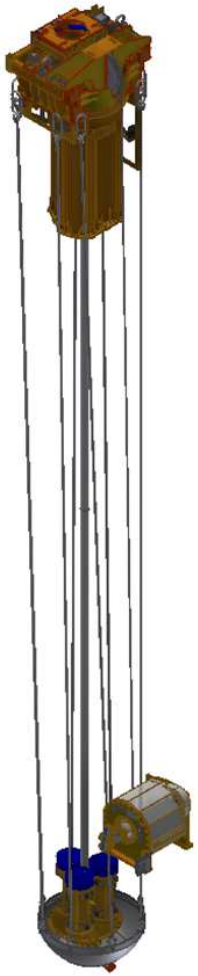
- 3D modeling and 2 D detailing of both primary and secondary steel based on GA drawings;
- Mechanical design development of Lower Column, Tail Arm and Upper Arm of this equipment;
- Manufacturing follow-up.

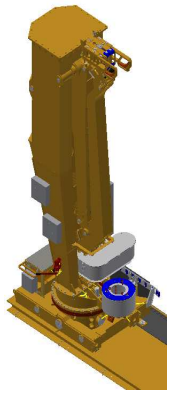
Products Developed

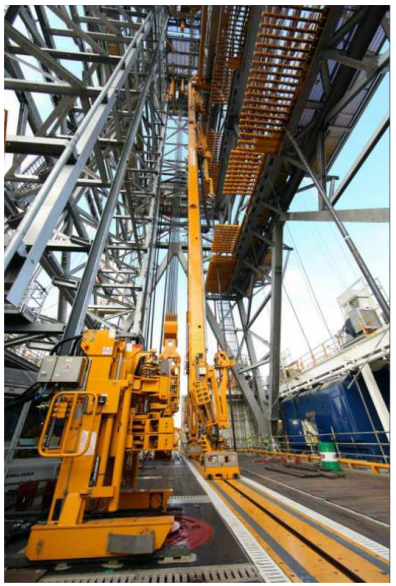
- Mouse-hole Racking System;
- Hydra-racker CRX.

Software Used

- Inventor, Vault, Autocad Mechanical;
- Concorde, RigDoc, RigOffice, RigParts and Team Center.







Mechanical Engineering Group
Compensation and Cylinder Hoisting Systems

What We Do

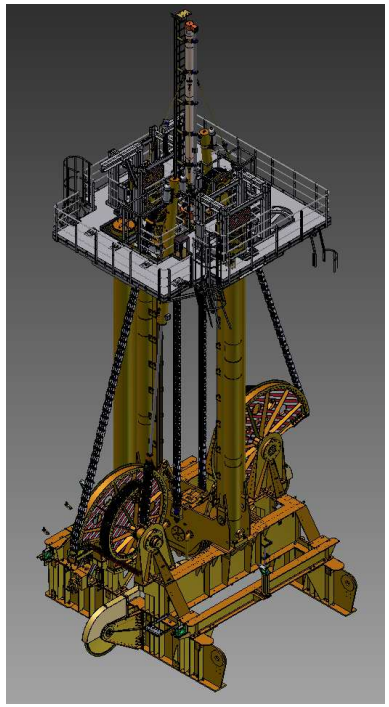
- 3D modeling and 2D detailing of both primary and secondary steel;
- SCM-Entire Product management.

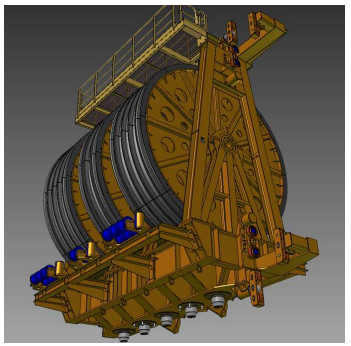
Products Developed

- Crown Mounted Compensator/CMC-E;
- Active Heave and Deadline Compensator;
- Lifting Cylinder;
- Sheave Cluster.

Software Used

- Inventor, Vault, Autocad Mechanical;
- Concorde, RigDoc, RigOffice, RigParts and Team Center.

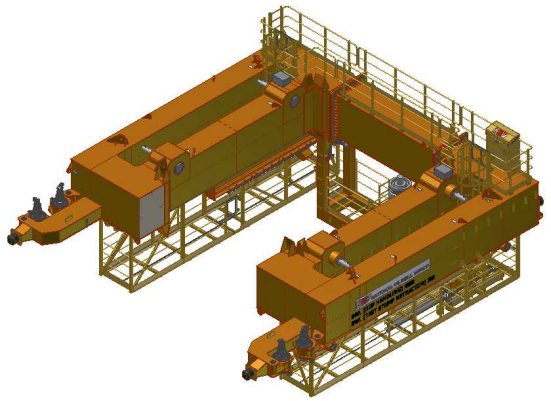




Mechanical Engineering Group
BOP Handling Systems

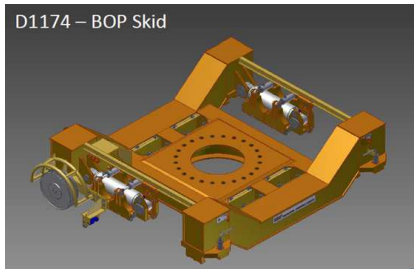
What We Do

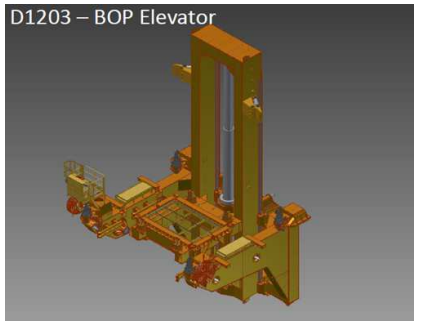
- 3D modeling and 2D detailing;
- CMDL documentation, namely measuring reports;
- Manufacturing follow-up.

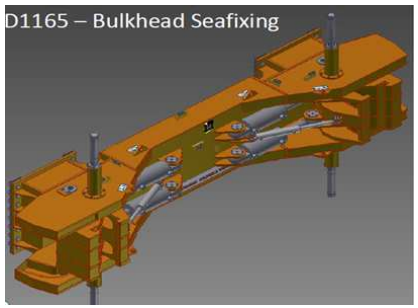


Products Developed

- Wide range of 14 different BOP handling equipment;
- Trolleys;
- Skids;
- Guiding, sea fixing systems;
- Elevators;
- Moonpool closures.







Software Used

- Inventor, Vault, Autocad Mechanical;
- Concorde, RigDoc, RigOffice, RigParts and Team Center.

Electro & Systems Engineering Group

Work with the hardware and software part of the control systems, field instruments, control cabinets with PLCs, cables and system connection to network.

Do all necessary calculations and assessments against rules, regulations and standards.

Develop software tools following functional, quality and performance requirements.

Electro & Systems Engineering Group

Departments and Engineering Team

Departments

- Drilling Fluid Control System
- Electro & Instrumentation Drilling
- Hydraulic Crane & Winch
- Cyberbase Engineering
- Drilling Equipment
- Drilling Automation
- Rig Data Center

7 Different Departments

11 Engineers

10 Different Products

9 Different Areas

10 Years Average Experience

- 1 Drilling Fluid Control System
- 1 Electro & Instrumentation Drilling
- 1 Hydraulic Crane & Winch
- 2 Cyberbase Engineering
- 2 Drilling Equipment
- 1 Drilling Automation
- 3 Rig Data Center

Electro & Systems Engineering Group

Drilling Fluid Control System

What We Do

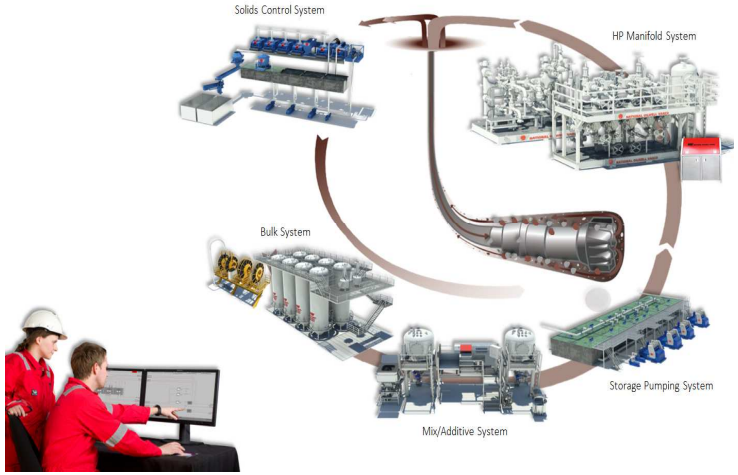
- Human Machine Interface design;
- Support to Factory acceptance tests.

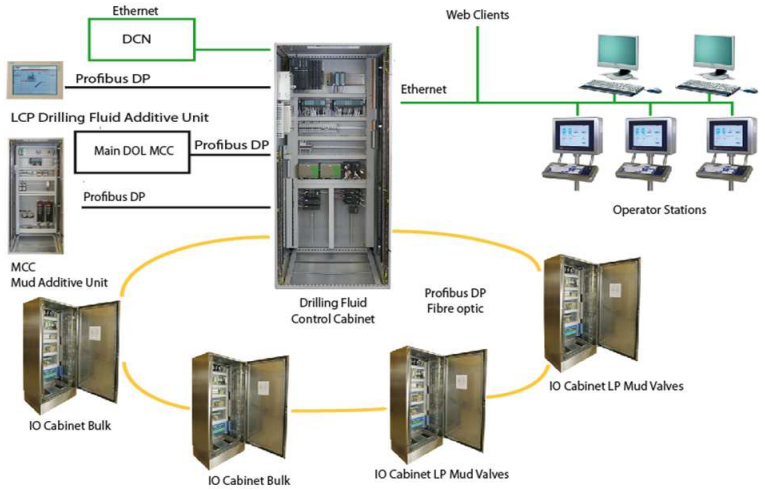
Products Developed

- All products related to Drilling Fluid System;

Software Used

- Autocad Electrical, Aquila, Intouch;
- Siemens Step 7, Win CC;
- Concorde, RigDoc, RigOffice, RigParts and Team Center.





Electro & Systems Engineering Group

Electro & Instrumentation Drilling

What We Do

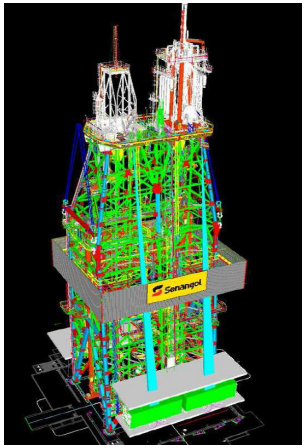
- Perform all Electro and Instrumentation tasks for the equipment located on derricks;
- Factory Acceptance Tests
- Commissioning follow-up.

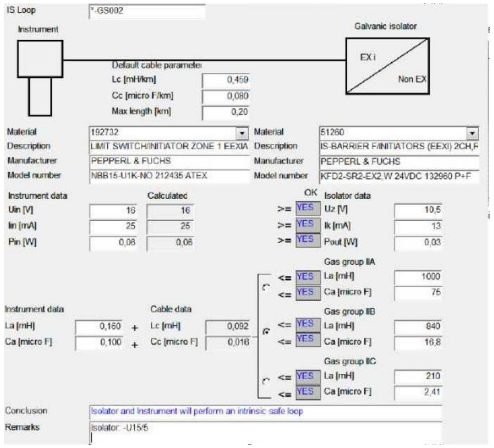
Products Developed

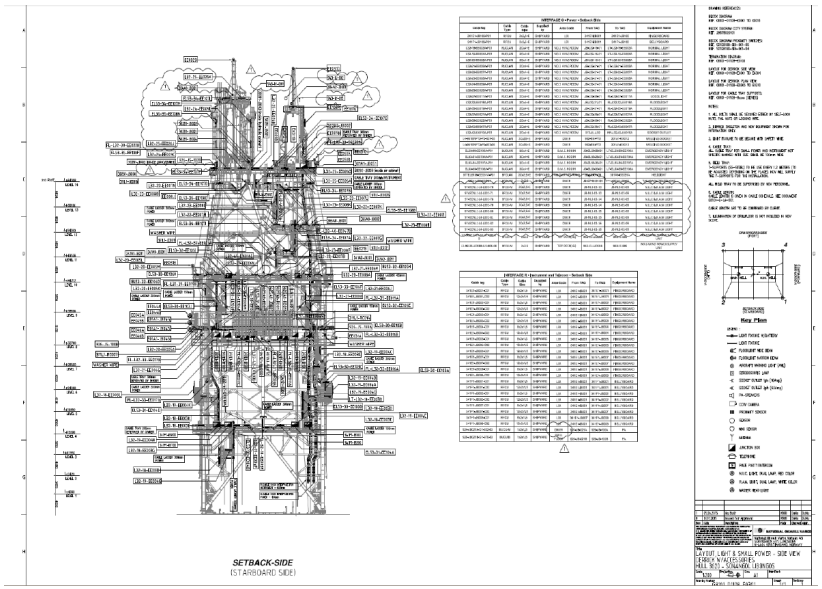
- Gantry cranes;
- Catwalks;
- Hydratong; etc...

Software Used

- Autocad Electrical;
- Concorde, RigDoc, RigOffice, RigParts and Team Center.







Electro & Systems Engineering Group

Hydraulic Crane & Winch

What We Do

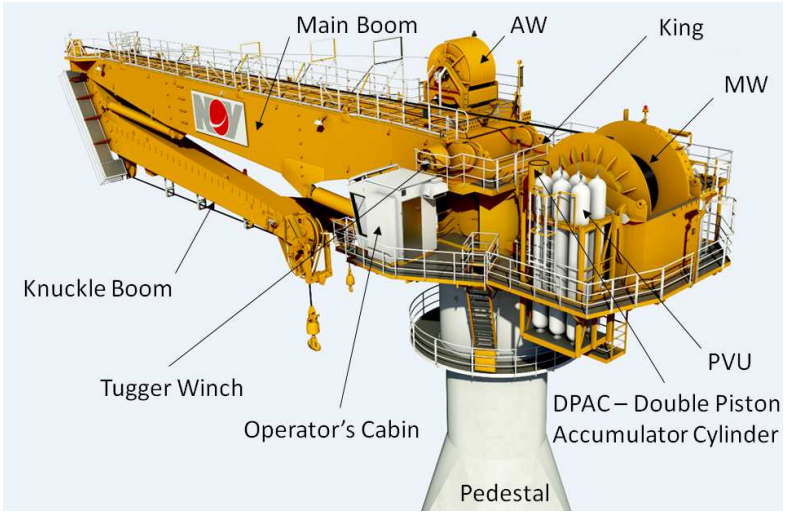
- Hydraulic design review, Calculations Order components;
- Issue functional Specifications and Procedures
- Perform In-House tests and Offshore acceptance tests.

Products Developed

- Subsea Knuckle Boom Cranes;
- Offshore Knuckle Boom Cranes;
- Pipe Handling Knuckle Boom Cranes;

Software Used

- Autocad Mechanical;
- Concorde, RigDoc, RigOffice, RigParts and Team Center.

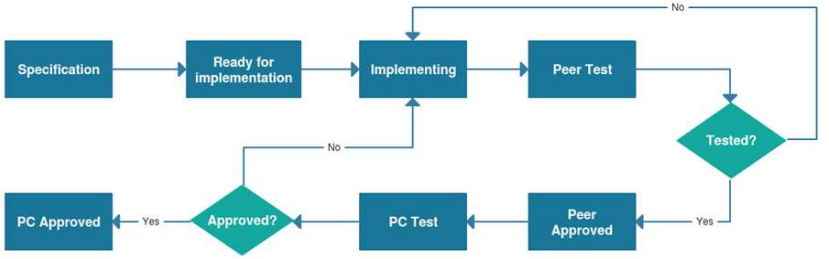


Electro & Systems Engineering Group

Cyberbase Engineering

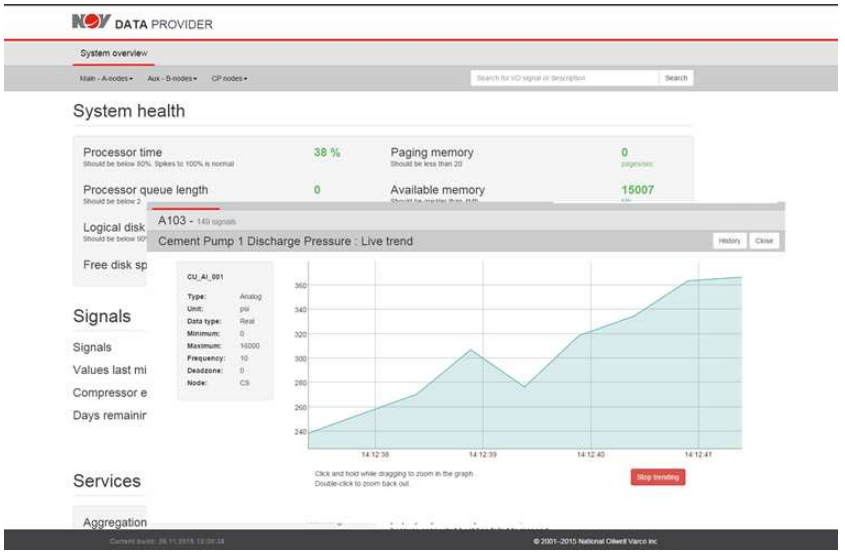
What We Do

- Develop software tools;
- Functional testing and bug fixing.



Products Developed

- CSE – Cyberbase System Engineering Suite;
- Proport - Product Configurator;
- NDP - NOV Data Provider;
- MADLT; CCT.



Software Used

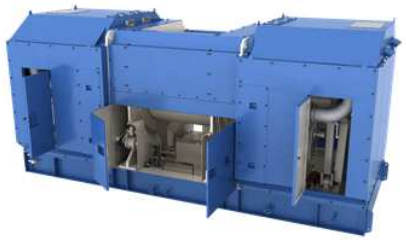
- C# .NET 4.5 (Visual Studio); WPF; WCF; TFS
- MongoDb; SqlServer;
- Concorde, RigDoc, RigOffice,.

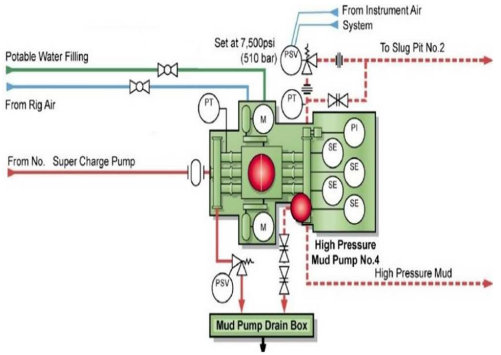
Electro & Systems Engineering Group

Drilling equipment

What We Do

- Product development;
- Perform all PLC software and E&I tasks for the Drawworks and Mud Pumps products ;
- Perform Factory acceptance tests.



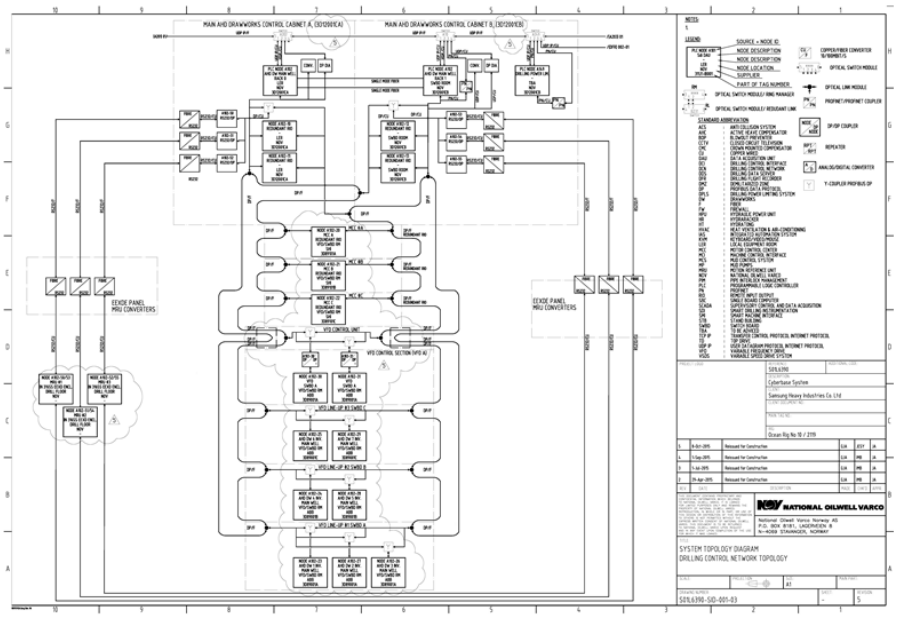


Products Developed

- Drawworks;
- Mud Pumps

Software Used

- Siemens Step 7, Autocad Electrical;
- Concorde, RigDoc, RigOffice and Team Center

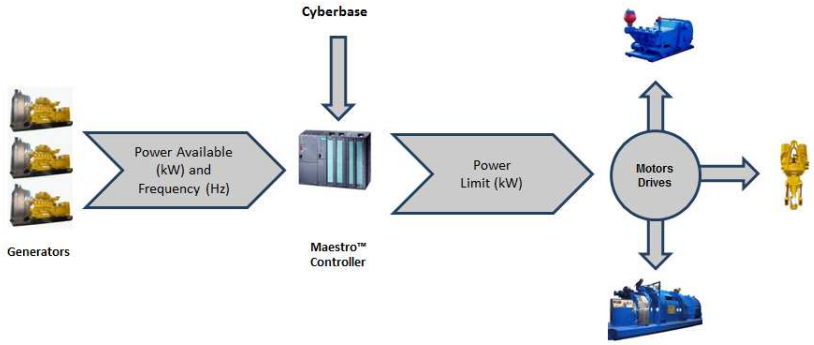


Electro & Systems Engineering Group

Drilling Automation

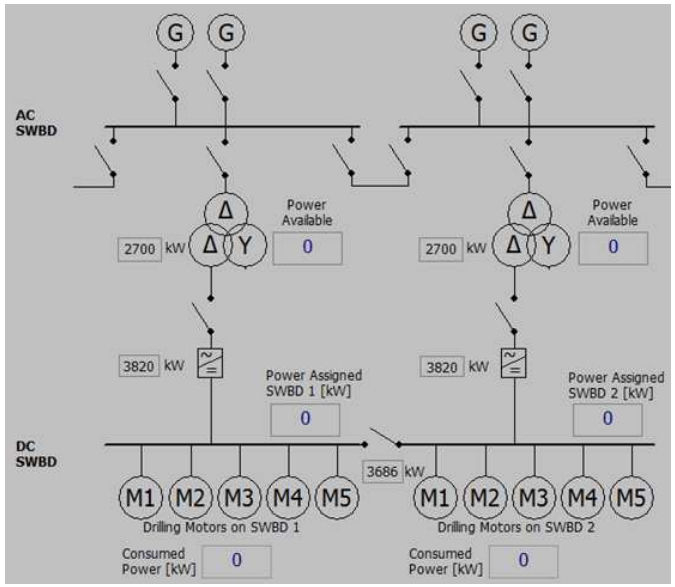
What We Do

- Product development;
- Perform all PLC software tasks for the Maestro product;
- Perform Factory acceptance tests.



Products Developed

- Maestro Drilling Power Allocation;



Software Used

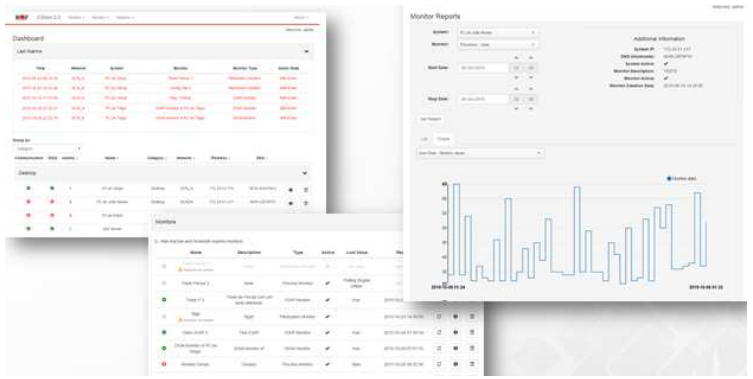
- Siemens Step 7, Autocad Electrical;
- Concorde, RigDoc, RigOffice and Team Center.

Electro & Systems Engineering Group

Rig Data Center

What We Do

- New in-house developed solution to fully replace CSMonitor ;
- Perform all Electro and Instrumentation tasks for the DFR product.

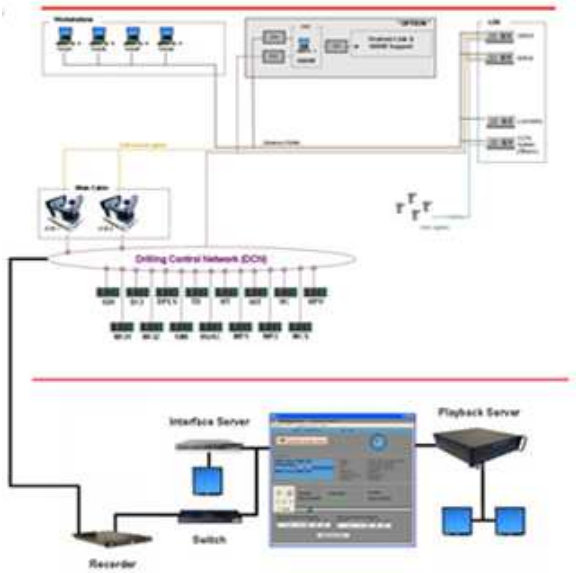


Products Developed

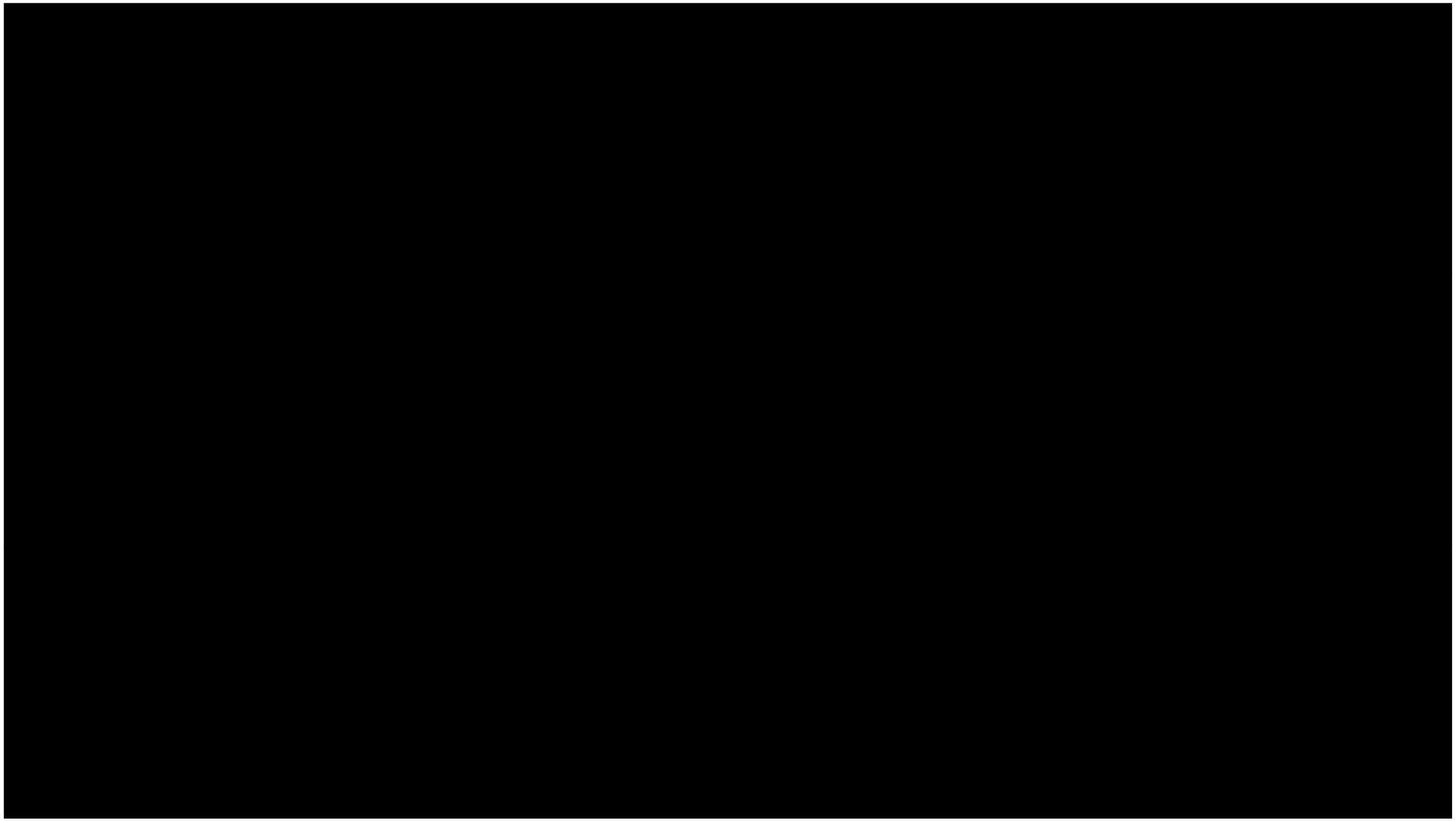
- CSMon;
- DFR;

Software Used

- C# .NET 4.5 (Visual Studio); WPF; WCF; TFS
- MongoDb; SqlServer;
- Autocad Electrical;
- Concorde, RigDoc, RigOffice



NOV Portugal
Drillship West Saturn



We **power** NOV Engineering.

Thank you Mange tak Obrigado Tusen takk