DRILLSHIP DESIGN INNOVATIONS
MARTech, 06 July 2016

J. Mendonça Santos – Project Manager - GustoMSC
1862
Start of Gusto Shipyard (The Netherlands)

1977
Start of Marine Structure Consultants B.V. (Sliedrecht)

1978
Start of Gusto Engineering (Schiedam)

1988
IHC Caland completes the repurchase of all Gusto Engineering and MSC shares

2003
Start of GustoMSC alliance

2011
Start of GustoMSC B.V.

2012
GustoMSC acquired by Parcom Capital, management & staff (as of November 2012)
OFFICES

Houston
Sales office for the Americas.

Schiedam
Headquarters in Schiedam.
GustoMSC employs over 200 highly skilled and talented staff.
VESSELS & SEMI-SUBMERSIBLES
FLOATING FOUNDATIONS
ASSOCIATED EQUIPMENT

CONTINUOUS HYDRAULIC JACKING SYSTEMS

HYDRAULIC JACKING SYSTEMS

RACK & PINION JACKING SYSTEM

FIXATION SYSTEM

X-Y SKIDDING SYSTEM
ASSOCIATED EQUIPMENT

- THRUSTER RETRIEVAL SYSTEM
- LEG CRANES
- SMARTCRANE
- HL CRANES
PELICAN (1960)
PIONEERING WITH DP& INTEGRATED DRILLING SYSTEMS - 1ST OF 12 RIGS
INNOVATIONS
CHALLENGING THE EXISTING FLEET

- Technical and commercial drivers for innovations
- Capabilities for deeper water, complex wells
  - Higher hook loads require new hoisting and rig solutions
  - Significant step in rig loading capability supporting complex well programs
    - Large, dedicated deck areas and storage volumes
  - Increasing drilling efficiency to reduce total well cost
    - New drilling techniques, handling solutions and automation
    - Combining drilling and naval architectural considerations increasing overall rig efficiency
- Hull performance
  - Reduce fuel consumption (environment and cost)
  - Accommodate large moon pools for multiple activity
- Overall safety and redundancy
MAGELLAN
COMPLEX WELLS
ULTRA DEEP WATER

 Principal dimensions

<table>
<thead>
<tr>
<th>Dimension</th>
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<tbody>
<tr>
<td>243m</td>
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<tr>
<td>39.8/45.2m</td>
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<tr>
<td>104,000t</td>
</tr>
<tr>
<td>13m</td>
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<tr>
<td>20.3m</td>
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<td>Class 3 (enhanced)</td>
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- LARGE WORKABLE DECK AREA: 7,500 M²
- IMPROVED OVERALL SAFETY: 8 RAM BOPS
- MAXIMUM WATER DEPTH: 15,000 FT
- HIGHER PRESSURE: 20,000 PSI
- LARGE VARIABLE LOAD: 37,500 T
- MAXIMIZING UPTIME: TRS
INTEGRATING INDUSTRY INNOVATIONS
EQUIPMENT FLEXIBILITY

• Traditional derrick drawworks capacities are limiting growth
• Different solutions are developed in the industry to meet the future demands
• Solutions are integrated in the design to ensure performance of both drilling package, as floating rig
STRAIGHTFORWARD HANDLING PRINCIPLES, LARGE SUPPORT AREAS, MULTIPLE ACCESS

- DEDICATED TO COMPLETIONS
- SUBSEA HANDLING
- AUX WELL CENTER
- MAIN WELL CENTER
- RISER HANG OFF

- TUBULAR FEED & DRILLING EQUIPMENT SKIDDING AREA
- X-TREE & COMPLETIONS
- BOP(S) AND SPECIAL SUBSEA TOOLS
- OPEN SUBSTRUCTURE DESIGN CREATING MORE SUPPORT AREA AND ACCESS SPACE

- SEPARATED BOP & X-TREES AREAS SUPPORTING SIMULTANEOUS ACTIVITY

SUBSEA & ADVANCED DRILLING SUPPORT
HULL PERFORMANCE
DESIGN CHALLENGES

• Hull resistance \( \rightarrow \) increase speed/ reduce fuel consumption
  • reduction of cost and decrease environmental footprint
• Drilling activity \( \rightarrow \) large moonpool to facilitate multiple and simultaneous drilling activities
  • well centers and hang off positions
• Utilize CFD design capability and model tests to develop solutions
Hull Performance Optimization

Original hull

Optimized hull -12%

Appendages +34%
Initial concept before CFD +16%
Optimized by CFD +8%
Optimized for constructability +8%

GustoMSC
• Efficient equipment handling and moonpool functionality requires a large moonpool
• In large moonpools standing waves (sloshing) may occur:
  • Added resistance decreases speed and adds fuel cost
  • Possible green water may cause unsafe situation for equipment and personnel

• Sloshing mitigation device to be developed
  • No submerged mechanical components
  • No protruding parts limiting riser angle
  • Integrated in structure

CALLIRRHOE MOONPOOL (PATENT PENDING)
• Multiple ideas and working principles were designed and CFD tested
• Best performing design proved to significantly reduce sloshing, limit resistance and keep drag force variation limited → subject to model testing for CFD validation
MODEL TESTS
MOONPOOL ANTI SLOshING DEVICE AT 14 KNOTS SHIP SPEED

DESIGN D

DESIGN H
• Reduction of moonpool sloshing achieved with Callirrhoe moonpool technology [patent pending]
  • Total resistance at 14 knots is 18% lower than conventional moonpool with mitigation device
  • Increasing speed and fuel saving potential
  • Minimizing risk on green water increasing safety
  • Structurally integrated solution
• Innovative technology enabling operational time on location → more uptime

• Thruster maintenance planning taken out of the critical path

• Rack and pinion jacking system
  • Canister mounted thruster (any make or type)
  • Retract to save cost on fuel in transit
  • Retrieving enabling on site maintenance work
MAGELLAN
INNOVATIONS CREATING THE RIG OF THE FUTURE

INNOVATIVE DESIGN APPROACH
AREA & ACCESSIBILITY

INTEGRATING INNOVATIONS OF 3rd PARTIES
HOISTING SYSTEM FLEXIBILITY

INNOVATIVE DEVELOPMENTS
CALLIRRHOE MOONPOOL

INNOVATIVE EQUIPMENT
THRUSTER RETRIEVAL SYSTEM
THANK YOU FOR YOUR KIND ATTENTION

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