InSide

GustoMSC

#15
APRIL 2010

THIS EDITION

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Gregers Kudsk, Mærsk Drilling

Building the Bullies

The NG-9000C: 'State-of-the-Art' Wind Turbine Installation Unit

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SBM OFFSHORE GustoMSC

InSide
Inside is a publication of GustoMSC

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As shown in the "matrix", GustoMSC has a wide range of mobile offshore units with which to serve the industry. We design Jack-ups, Semi-submersibles and Vessels for a wide range of applications, ranging from exploration (drilling) to construction and production.

Preface

Before you lies yet another issue of GustoMSC magazine 'InSide', this time with a focus on our activities in the drilling and construction markets.

This issue features an interview with Gregers Kudsk, who joined Mærsk Drilling and our industry at about the same time as I did; an astonishing (almost) 40 years ago! A large part of these 40 years Gregers and I have been working together in the Jackup Joint Industry Committee that produced the SNAME Guidelines and Recommended Practice for Site Specific Assessment of Mobile Jack-up Units. The same committee is currently working on turning this into an ISO Standard. We also worked closely together in the realization of the 11 drilling rigs (jack-ups and semi-submersibles) that Mærsk Drilling had built to GustoMSC design over the last 20 years.

Currently GustoMSC's main activity is with the jack-up vessels for the installation of wind turbines. We have been active in the design of jack-ups for offshore construction since 1959, and over 60 jack-ups have been built or are under construction to GustoMSC design in this market sector. Of these some 18 jack-ups and or jack-up vessels to our design are currently active in or are under construction specifically for wind turbine installation projects. These include the recently ordered NG-9000C jack-up vessels from Drydocks World SE Asia and Lamprell. In addition to the NG-9000C basic design we also supply the jacking systems and the 800 ton main cranes mounted on top of a jackhouse and 'around the leg', in a fashion very similar to the crane on the Cowrie One jack-up designed and built by the Gusto Yard in 1970, just before I joined the company.
Several articles highlight our current WTI activities, together with an overview of our ongoing crane projects.

On an entirely different note this issue of InSide also provides an overview of our activities with the Offshore Support Systems (OSS), software that is used by many of our clients on board their units to assist the crew in the management of weight, loading conditions and stability with various additional options specific for jack-ups, semi-submersibles or ships.

Enjoy your reading (and the pictures).

Han Mommaas,
President - Marine Structure Consultants (MSC) B.V.

SBM OFFSHORE GustoMSC

Trends in deepwa

By Gerrit Jan Schepman

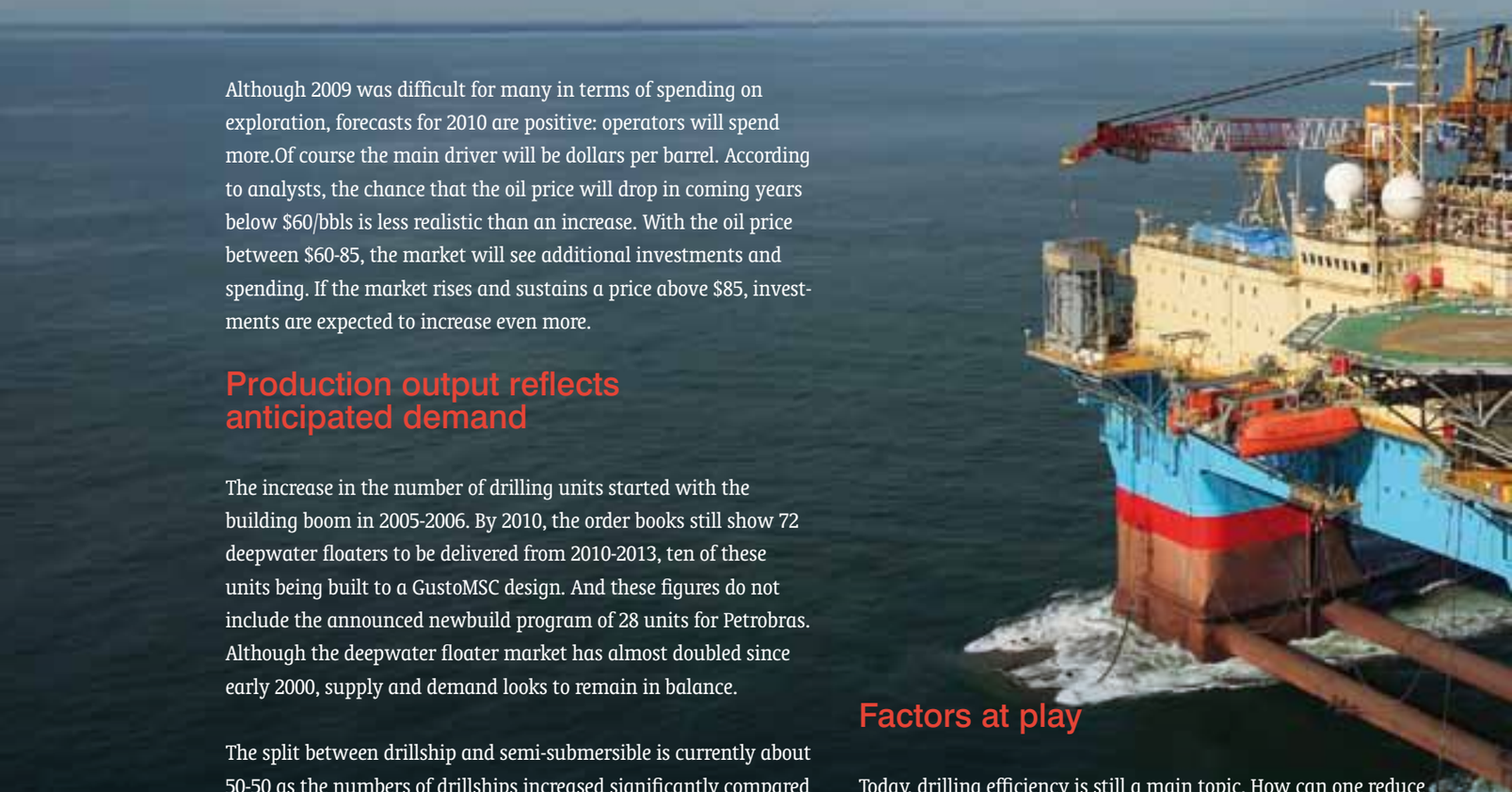
A review of the deepwater drilling market in waters deeper than 5,000 ft. Many companies are being challenged to replace declining production with new discoveries. For some time many majors have seen a reduction in output. National oil companies such as Petrobras and PetroChina, by contrast, see their output figures continuing to increase. Petrobras announced that by 2020 they would double their production figures to 5.7m boe/d in 2020. To counteract depletion, oil majors are searching for new reserves but this is taking place in what are mostly more challenging regions: deep and ice-infested waters – challenging worlds

Although 2009 was difficult for many in terms of spending on exploration, forecasts for 2010 are positive: operators will spend more.Of course the main driver will be dollars per barrel. According to analysts, the chance that the oil price will drop in coming years below $60/bbls is less realistic than an increase. With the oil price between $60-85, the market will see additional investments and spending. If the market rises and sustains a price above $85, investments are expected to increase even more.

Production output reflects anticipated demand

The increase in the number of drilling units started with the building boom in 2005-2006. By 2010, the order books still show 72 deepwater floaters to be delivered from 2010-2013, ten of these units being built to a GustoMSC design. And these figures do not include the announced newbuild program of 28 units for Petrobras. Although the deepwater floater market has almost doubled since early 2000, supply and demand looks to remain in balance.

The split between drillship and semi-submersible is currently about 50-50 as the numbers of drillships increased significantly compared to semi-submersibles. The quest for deepwater oil and gas reserves will only be carried out by units with specific deepwater capabilities. Before 2005, a large number of drilling semi-submersibles were upgraded, for example the conversion programs of Noble Drilling and Diamond Offshore. These conversions were centered on improving both drilling capabilities and capacities.



Factors at play

Today, drilling efficiency is still a main topic. How can one reduce the flat parts of the drilling curve? Automation of operations is a key issue whereby drillpipe handling, casing and riser handling are the areas to consider. Off-line standbuilding of drillpipe and casing are focal points. The introduction of the double derrick or a main derrick with an auxiliary system are solutions for this. The deepwater regions are, of course, located in more remote areas and

ter drilling

Going to ever more challenging worlds - deep and ice-infested.

the logistics is another design consideration. The distances between drill sites and ports are increasing. Thus variable load capacity and deck space requirements need to be carefully determined. Variable load capacities between 10,000 and 20,000 tons have been seen to be the current target values. Deck space is important: besides the 'real drilling equipment', additional space is also needed for third party equipment used for well completion and well testing activities.

With the GustoMSC units we have paid attention to the above design requirements and incorporated them. The GustoMSC contribution in the deepwater market is through drilling semi-submersibles and drillships. Together with Keppel Fels DTG, GustoMSC developed the DSS series, 6 units of which have been built for operation in deepwater. On these units GustoMSC initiated the Vertical Riser Storage. The deck space needed for vertical storage is less compared to horizontal storage, thus freeing up deck

space. As the riser storage is in front of the derrick, the aft deck can be used completely for drillpipe and casing storage and all subsea equipment and well testing, etc. With the BOP handling on starboard, and the X-tree handling on portside, all areas around the drillfloor and moonpool are efficiently used.

More on schedule

Mærsk Drilling has contracted the first series of three units of the DSS21. The Mærsk Developer and Mærsk Discoverer are presently operating and the third unit is scheduled for delivery in 2011. Transocean is operating the Development Driller III, a DSS51. Queiroz Galvão Óleo e Gás has taken delivery of the Gold Star and has a sister unit, the Alpha Star, under construction at Keppel Fels. Both units are of the DSS38 class. Sister company SBM Atlantia currently has three units under construction in the UAE for three Brazilian clients for delivery later this year. The design engineering of the TDS2000 and TDS2500 is being provided by GustoMSC. In addition to the above units, GustoMSC has also developed the OCEAN1100 and OCEAN850, incorporating experience from earlier projects in terms of design, layout and fabrication. The OCEAN1100 is designed as a development and exploration rig, while the OCEAN850 can be characterized as a compact exploration rig.

OCEAN850BR

GustoMSC has been involved with drillships from the early days through the well-known Pelican class; 13 units have been built, and 11 are still in operation as drillships. The next step in this line of development was the P10,000 class of drillships. The Pride Africa and Pride Angola, the GSF CR Luigs and GSF Jack Ryan were built in the late 1990s. The most recent additions to the class are the three P10,000 NG units under construction at HHI in Korea: the Deep-water Champion of Transocean is scheduled for delivery later this year, while the Deepsea Metro I and II are scheduled for delivery in 2011. The P10,000 NG can be classed as a full-sized drillship, whereby the GustoMSC philosophy from the early days has been to integrate the marine and drilling equipment into the hull, store the risers in the cargo hold and make optimum use of the space inside the hull. In this manner, a more efficient and cost-effective unit is created with an unrivaled amount of valuable free deck space and 25% lower overall dimensions against other units in the market.

Mærsk Developer. Courtesy Mærsk Drilling

Deepwater Champion

The compact option

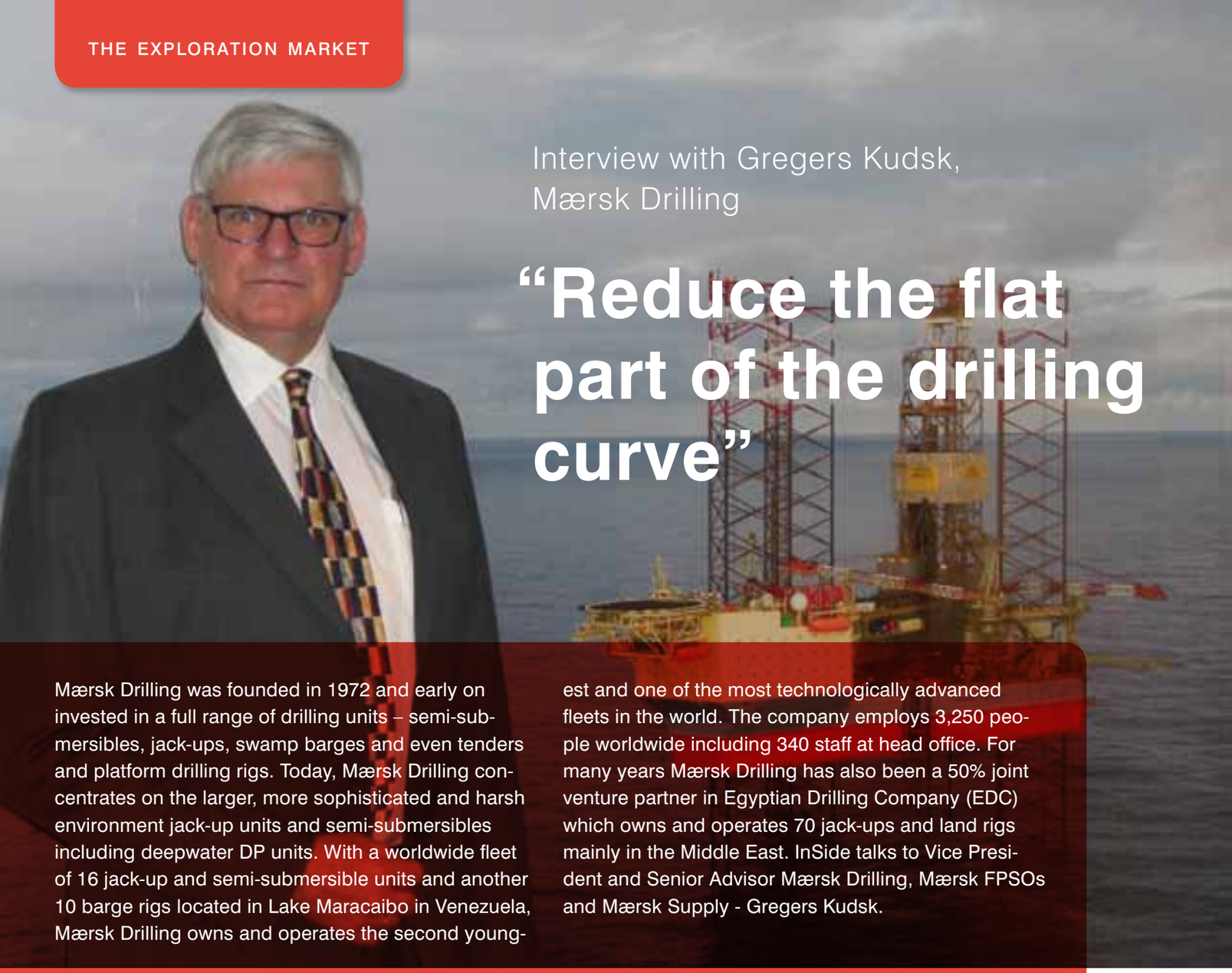
A next step was the development of the GustoMSC drillship into a compact type which has been named the PRD12,000 class. Initially focusing on pressurized riser drilling, the vessels are now our standard as generic compact drilling vessels. The first units to be built in this PRD12,000 class are the Bully I and Bully II. A joint venture of Shell and Frontier Drilling ordered these vessels, which are currently being outfitted at the Keppel Shipyard in Singapore. Delivery is scheduled for 2010. Special features include the Arctic reinforced hull and associated marine systems and the MPT drilling tower. The most recent version of the PRD12,000 class is the Qdrill, which will be capable of operating in up to 10,000 ft as an exploration unit.

Setting the pace to the far north

With all these floating drilling units, GustoMSC has set the pace for the deepwater drilling rigs of today and the future. With the Arctic and ice infested areas opening up due to climate changes, oil companies are starting to schedule their drilling programs. The present Arctic regions are in shallow water, but the challenges are still there: low temperatures, remoteness, ice conditions, ecosystem and safety (relief wells). Again, the roots of GustoMSC go back to the early days, as the Canmar Explorer III and Pacnorse drillships are derivatives of the Pelican class of vessels; these vessels drilled in the Chukchi Sea and Beaufort Sea back in the 1980s. More recently, GustoMSC designed and engineered the Orlan platform drilling rig for KCA-Deutag and the land rig Parker 62L. Both units are operating for ExxonMobil on- and offshore Sakhalin Island. The latest offshoot is the Bully I and Bully II, see above. Besides floating units, the engineering challenge is to investigate the use of jack-ups in ice-infested waters. GustoMSC has been involved in feasibility studies for 3rd parties. Arctic jack-ups seems to be an alternative.

Bully drillship ice-testing

PRD12,000 Qdrill



Interview with Gregers Kudsk, Mærsk Drilling

"Reduce the flat part of the drilling curve"

Mærsk Drilling was founded in 1972 and early on invested in a full range of drilling units – semi-submersibles, jack-ups, swamp barges and even tenders and platform drilling rigs. Today, Mærsk Drilling concentrates on the larger, more sophisticated and harsh environment jack-up units and semi-submersibles including deepwater DP units. With a worldwide fleet of 16 jack-up and semi-submersible units and another 10 barge rigs located in Lake Maracaibo in Venezuela, Mærsk Drilling owns and operates the second youngest and one of the most technologically advanced fleets in the world. The company employs 3,250 people worldwide including 340 staff at head office. For many years Mærsk Drilling has also been a 50% joint venture partner in Egyptian Drilling Company (EDC) which owns and operates 70 jack-ups and land rigs mainly in the Middle East. InSide talks to Vice President and Senior Advisor Mærsk Drilling, Mærsk FPSOs and Mærsk Supply - Gregers Kudsk.

By Gerrit Jan Schepman

What about your role in Mærsk Drilling?

I joined Mærsk Drilling in 1973 with an engineering background, and I very much wanted to work in the newbuild department. In 1989 I was appointed Director of Engineering, responsible for engineering and newbuild activities. My first contact with GustoMSC dates to 1975 with the construction of the jack-up drilling unit MÆRSK EXPLORER at the Gusto BV Schiedam yard. This was later followed by the construction of the jack-up MÆRSK ENDEAVOUR, also in Holland. In the early 90s, contact was established with Han Mommaas of MSC, resulting in the development and construction of the GustoMSC CJ62 MÆRSK GALLANT, delivered in 1992 by KeppelFELS.
The good relationship with GustoMSC continued with several newbuild projects: both jack-ups and semi-submersibles as well as essential support to our rig operations. The co-operation has been based on mutual trust and understanding of the objectives and has created very good value in the development of the many rigs that are today the backbone of the Mærsk Drilling fleet.

After 36 years in Mærsk Drilling - including more than 20 years as Head of Engineering and more recently as CTO - I now have a new role as Vice President and Senior Advisor for Mærsk Drilling, Mærsk FPSOs and Mærsk Supply.

Would you explain what's behind the efficiency of your high efficiency jack-up rigs?

Yes, the main objective was to "reduce the flat part of the drilling curve" which means more than only looking into drilling the well. Our emphasis has been on the full range of operations on board, not only reviewing the systems but also the logistics of material and layout of storage areas. In early days we developed the capability of stand building of casing while drilling, using the foxhole patent.

Mærsk Developer

With the introduction of the GustoMSC X-Y cantilever on the MÆRSK INNOVATOR and the MÆRSK INSPIRER, new developments could be incorporated and efficiency enhanced. Examples are the quadruple pipe racking and the simultaneous activity on the drill floor with two workstations. The X-Y cantilever enhanced the cantilever load chart as the maximum combined load can be achieved over the full drilling envelope. The drill floor is fixed to the cantilever, which improves the handling of the BOP system and reduces the nipple up time significantly. A major benefit with the X-Y cantilever is the increased availability of useful deck space. The cantilever on its "skidding blocks" is about 4.5 m above the main deck, allowing the deck below the cantilever to be utilized for storage.

The Mærsk Innovator and Mærsk Inspirer are the largest jack-ups with deepwater capability. Do you foresee even larger units in the near future?

In the near future I would not expect much larger units. Our CJ70 rigs are close to some practical boundaries with the present technology. The 150 m North Sea water depth capability was achieved by the use of skirted footings. With this capability the rigs are competitive with the floaters and the majority of the North Sea subsea wells can be serviced with our rigs. As an example MÆRSK INNOVATOR drilled in the Glitne field with a subsea BOP and marine riser system.

Speaking about floating units, you added two deepwater development units last year, the Mærsk Developer and Mærsk Discoverer. What are the specialties on these rigs?

When we entered into deeper water with the MÆRSK EXPLORER (DSS20-CAS-M), we adopted the Vertical Riser Storage as a first step to improve the rig. This means that we occupy less deck space and at the same time we have a more efficient riser handling system. With the introduction of the development drilling units, we started out by consulting the operators, vendors and service companies. We discussed what we saw as essential elements for an efficient development drilling unit; including how to lower equipment to the sea floor. The logistics and the handling of casing, marine

Mærsk Innovator drilling a subsea well using a marine riser

riser, BOP, Xmas-trees and jumpers were then all reviewed. This resulted in three possible positions to hang off the riser in the moonpool and a large fully compensated knuckle boom crane that could reach down 3,000 m water depth. Another element we discussed was an efficient layout of the main deck to facilitate accommodating all completion equipment. Last but not least, with these units we aimed at having a high degree of redundancy in critical components such as stand building, pipe handling, riser handling etc.

We have touched upon a few developments already. What was the biggest leap forward in the past and what do you foresee in the near future?

In my view it was the introduction of the topdrive in 1985. This was the key to mechanized drilling solutions. We added to this with further automation on the drill floor on our units with the iron roughnecks and automated pipe handling systems. As mentioned, our foxhole development enabled the start of stand building during drilling. The use of AC drives and variable speed technology helped increase efficiency. The future will bring more reliable systems that will be fully automated and will include some downhole systems as well.

With the Copenhagen climate conference in mind and the long winter season, what do you foresee in the ARCTIC region?

For sure it will be a technical challenge to explore and develop in these new areas. Mærsk Drilling was working with Arctic technology back in 1982, focusing on the Beaufort Sea, but projects never materialized. Today the interest in the Arctic region is opening up, as seen from the activity in the Russian Arctic, Greenland, Canada and Alaska. To work up there it is essential you have equipment capable of operating in low temperatures and winterization is a must. Another important aspect is the protection of the environment, which is essential in the Arctic. Seasonal variations play a major role in the planning and when activities are restricted by the seasons everyone would like to start as soon as possible to have the largest possible drilling window. Ice reinforced hulls will be important, while full coverage of all systems is not necessarily a requirement. Some of the interesting areas will be in shallow water, which presents its own challenges. Should we use Arctic jack-ups or can we moor drill ships in shallow water? Another aspect will be the capability to drill relief wells in case of a well control situation. Will we have support units available? To conclude: yes, there are certainly interesting challenges in the future, but keep in mind that to reduce the flat part of the drilling curve is even more necessary in exposed areas where time is critical.

Mærsk Gallant

The Gold Star - a DSS38 semi-submersible drilling unit

By Robbert Kant

With the Brazilian Government's objective to explore and develop more deepwater offshore oil and gas fields, Petrobras needs to ensure more offshore production capacity. The objective is to increase today's level of 2,500,000 boe/d to a production of 5,700,000 boe/d by 2020. Reaching such an ambitious goal will require a significant increase of available exploratory and development drilling units in Brazilian waters.

More useable deck space

Petrobras has set up a program to expand the number of available drilling units. During the first round of the program in 2006, Brazilian drilling contractors were given preference and a number of deepwater drilling units were ordered from international shipyards. GustoMSC and Keppel DTG developed the DSS38 deepwater drilling semi submersible, combining their available design technology and shipyard fabrication experience. The DSS38 class drilling semi-submersible meets the stringent Petrobras requirements. The compact-sized unit can carry out all drilling in water depths of up to 9,000 ft, with a derrick of 2,000 kips rating and a 4 mud pump configuration.
The vertical riser storage enables an efficient riser handling. At the same time, this requires 40% less deck storage area compared to conventional riser storage, thus more useable deck space remains available for such as well-testing equipment. For station keeping the DSS38 is equipped with 8 high efficient azimuth thrusters.

Queiroz Galvão Óleo e Gás (QGOG) Company of Brazil recognized the advantages of these efficient DSS38 drilling units. In August 2006 QGOG ordered the first of two units from Keppel FELS in Singapore. The first DSS38, named Gold Star, was delivered to QGOG in October 2009.
The second unit, Alpha Star, is scheduled for delivery mid-2011.

When both DSS38 units, the Gold Star and Alpha Star, are operating in the Brazilian waters, they will contribute to the Brazilian objective to explore and develop more deepwater offshore fields.

Design	**DSS38**
Deck size	69.5 x 69.5 m
Displacement	39,000 t
Draft	20.5 m
Variable deck and column load	5,622 mt
Water depth	9,000 ft
Main derrick	2,000 kips
Mud pumps	4 x 2,200 hp
Power generation	10 x 3,560 kW
Thrusters	8 x 3,000 kW

Riser storage

Derrick

Thruster Retrieval System

In 2006 and 2007 GustoMSC designed an Arctic drilling vessel which has become known as the Bully class drillship. To be operated by Frontier Drilling in a joint venture with Shell E&P two vessels of this design are now under construction, the 'Bully I' and the 'Bully II'; both nearing completion at the Keppel shipyard in Singapore. They have a story to tell.

Building the Bullies

By Alain Wassink

Bully I and Bully II

Design

The design is based on the GustoMSC proprietary PRD12,000 compact drillship design. Its compact size means the vessel is more economic to build and more economic in operation. Emissions will be reduced thanks to lower power consumption. The principal characteristics of the vessels are a length overall of 187.50 m, a width of 32.00 m, a depth of 15.06 m and a displacement of around 45,000 tons. The vessels are capable of drilling with a conventional marine riser in a water depth of up to 8,250 ft, and with a pressurized riser in a water depth of up to 12,000 ft.
These features are complemented by an Arctic class notation, a novel concept Multi Purpose Drilling Tower and a thruster retrieval system on all thrusters.

Building progress

Building and outfitting of both Bully I and II are now well advanced at the Keppel shipyard in Singapore. The hulls were built at the Shanghai shipyard in China and subsequently towed to Keppel for outfitting and completion. Completion of Bully I is scheduled for mid-2010, with Bully II following later in 2010. Outfitting of accommodation and marine systems is near completion and Bully I is starting to reveal its final appearance with exterior painting almost finished.

The first Multi Purpose Drilling Tower arrived in Singapore mid-December 2009 for installation on Bully I. The tower was subsequently upended and installed on the unit and outfitting and completion has continued since. Installation and completion of the drilling package is also underway as can be seen in the pictures accompanying this article.

Thruster Retrieval Systems

Also underway is installation of the GustoMSC designed Thruster Retrieval System (TRS), for which GustoMSC is also supplying key components. The GustoMSC TRS is based on the integration of a regular bottom-mounted azimuthing thruster and its supporting systems in a container, capable of being retrieved inside the hull of the vessel. This allows for on board maintenance or even removal, thereby eliminating the need for dry-docking or even a port call for thruster maintenance. Thruster container movement inside the thruster well is based on the proven rack and pinion technology that is also used in GustoMSC jacking systems.

A key advantage of the system is that it allows thruster installation at a very late stage during vessel building, as the container housing the thruster is outfitted completely separately from the vessel and can be dropped down into the hull when the vessel is quayside, with final hook-up being limited to connecting to power supply, control system and utilities.

Beyond Bully

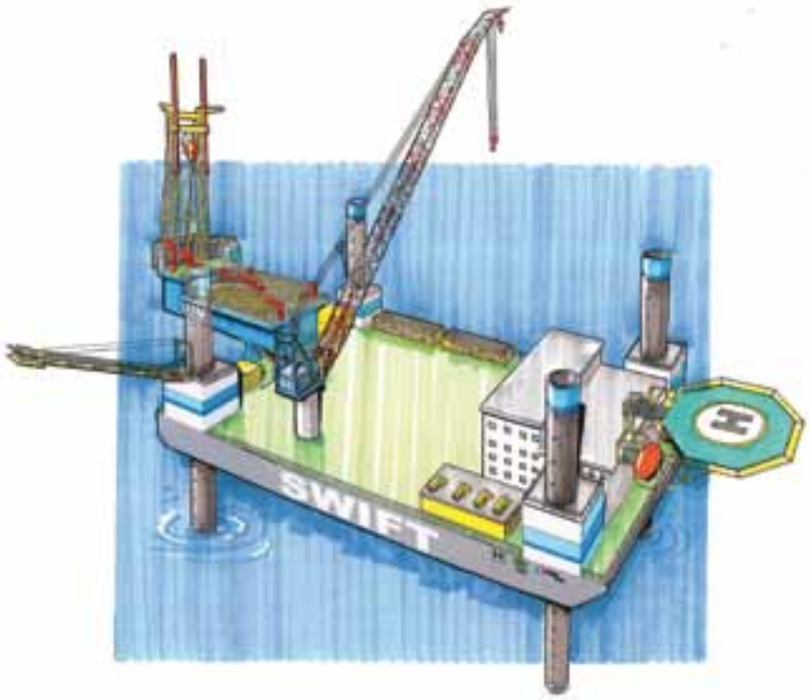
As the offshore oil & gas industry increasingly turns to the Arctic to explore for new reserves, GustoMSC is also expanding its design portfolio to address the challenge of Arctic work. Realizing that year-round drilling in severe ice and climatic conditions will be required for full development of the Arctic's resources, GustoMSC has embarked on an ambitious design program. Its purpose is to develop the key technologies and designs to enable oil companies and their contractors to cost-effectively tap Arctic resources. The design program is focused on drilling units and encompasses jack-ups and drillship technology, both based on dynamic positioning and turret mooring, in turn based on expertise from sister companies within the SBM Offshore group.

Swift Drilling: High Value Drilling Solution

By Jochem Rutgers

Swift 10 is a cost-effective light drilling unit for shallow waters down to 45 m. A four-legged jack-up is combined with light drilling equipment integrated onto an X-Y cantilever. The result is an answer to operators' demands for slim-well drilling and work-over drilling. For maturing fields the emphasis is on controlling drilling and development costs to enhance field life.

In an effort to reduce drilling costs, new solutions are to be thought of. Leaving the original thinking behind, some out-of-the-box work revealed the new directions. Swift Drilling NV, a joint venture of Cofely Oil & Gas and Van Es Group, accepted the challenge as put forward by NAM/Shell UK. For shallow water operations (down to 45 m - typical for Southern North Sea areas), the answer was a combination of slim-well drilling technology and a cost-effective jack-up unit, to enable economically viable exploration and development of small hydrocarbon prospects.



Fewer folk on board too

Swift Drilling NV selected the GustoMSC SEA series of jack-up barges as support platform; the SEA series was well-known to the joint venture partner as they were already operating the SEA-2000.
The rig will provide accommodation for 66 persons although the standard drilling crew is only 24, less than half that on a conventional rig. The high degree of automation of the rig and the related pipehandling systems mean lower operating costs which favours the operator.

The slim-well drilling equipment is centered around the X-Y cantilever. The box type X-Y cantilever is an integration of the cantilever (with drilling equipment) and the drill floor. The X-Y skidding of this integrated cantilever allows a small footprint with a maximum hook load capacity over the full skidding envelope. The efficient Herrenknecht Vertical hydraulic derrick and pipe handling equipment is fitted on the drill floor. Significant savings in capital expenses have been achieved by right sizing of the Swift light offshore drilling unit: fit-for-purpose.

Five year contract as of Q4 2010

The GustoMSC SEA-2750 was ordered by Swift Drilling NV from Drydocks World, South East Asia in early 2009. The jack-up Swift 10 will be delivered mid-2010. The X-Y cantilever system was constructed at Cofely Oil & Gas BV and the cantilever structure has been delivered and is currently awaiting assembly with the drilling equipment at Herrenknecht Vertical in Germany.

Mid-2010, the jack-up and the X-Y cantilever will be assembled and commissioned in the Netherlands. Swift Drilling has started recruiting for the operational organization. The Swift 10 will go on a 5 year contract for Shell/NAM at the end of Q4 2010.

X-Y cantilever Load-out

Some technical details

Hull (L x B x D)	67.4 m x 40 m x 5.5 m
Leg length	90.11 m
Leg diameter	3.5 m
Water depth	Max 45 m
Derrick system	280 t
Mud system	2 x 1,070 kW pumps
Cantilever loading	250 t
Variable operational load	1,400 t
Accommodation	66 POB
Power generation	3 x 2,000 kW plus 800 kW emergency generator

NG series of Wind Turbine Installation & Offshore Construction Units

A tour d'horizon of an extraordinary stable

By Paul Groote Woortmann and Jan Mark Meeuwisse

BARD Wind Lift I

Ready to start the installation of the BARD Offshore 1 wind farm in the German Bight, the GustoMSC designed Wind Lift I is a dedicated unit. The vessel is equipped with a GustoMSC 500 ton pedestal crane and a GustoMSC high performance hydraulic jacking system.

Seajacks Kraken and Leviathan

These units of the GustoMSC NG-2500X class started their operational lives in the offshore oil and gas market and the wind turbine installation market. Seajacks Kraken's first contract was for ExxonMobil Canada at the Thebaud project, followed by a couple of contracts in the North Sea. From 2010 both vessels will work on the Greater Gabbard project, the world's largest wind power development to date.

GMS Endeavour and Endurance

Another pair of units from the NG-2500X family, presently under construction at the Gulf Marine Services Yard in Abu Dhabi. Construction is taking shape with the intended start of operations in the second half of 2010.

NPCC for number 5 NG-2500X

Mid-2009 National Petroleum Construction Company (NPCC) awarded the design and engineering contract and the delivery of the jacking systems to GustoMSC. The unit has an enhanced accommodation capacity for a personnel complement of over 200 and can operate in up to 70 m water depth in relatively mild conditions.

MPI Adventure and Discovery: GustoMSC NG-7500/6 units

Based upon the successful operations of the MPI Resolution - for which GustoMSC was contracted for the jack-up technology, engineering of leg and leg hull interface and the delivery of the hydraulic jacking systems - these two new wholly GustoMSC designed units were ordered by MPI/Vroon Shipping at Cosco Nantong Shipyards in 2008 for delivery early 2011. The new vessels are part of the GustoMSC NG series namely the NG-7500/6, and equipped with the GustoMSC high performance hydraulic jacking system and 1,000 ton GustoMSC pedestal crane.

NG-9000C

Fred. Olsen Windcarrier has contracted two vessels from Lamprell Energy Ltd. Shipyard. Drydocks World SEA is also building one. See special article.

The NG-9000C:

'State-of-the-Art' Wind Turbine Installation Unit

By Paul Groote Woortmann and Jan Mark Meeuwisse

The NG-9000C Wind Turbine Installation units are currently State-of-the-Art. With three under construction at two yards, the standard has been set. Drydocks World SEA started construction of the first NG-9000C in December 2009 for delivery early 2012. In February 2010, Fred. Olsen Windcarrier ordered two units from Lamprell Energy Ltd. in Dubai for delivery mid-2012. This yard also recently built the Seajacks Kraken and Leviathan to a NG-2500X design.

Offshore wind farm projects are rapidly expanding. Over recent years, one GigaWatt of offshore wind farm capacity has been installed annually in Europe and with the present development projects significantly more wind farms are to be installed in the years to come. GustoMSC plays a dominant role in the wind turbine installation sector. The majority of units presently active in this market have their roots in GustoMSC designs. Latest additions are the first of the successful NG series: Seajacks Kraken and Seajacks Leviathan (NG-2500X class) which are active in the Greater Gabbard field. The Wind Lift I (NG-5300 class) will start work on the BARD Offshore 1 project and the MPI Adventure and MPI Discovery (NG-7500/6 class) are under construction at the Cosco Nantong Shipyards in China for delivery in 2011.

Based on our understanding of offshore wind farm installation requirements, combined with our years of experience with jack-ups, GustoMSC offers the NG-9000C class to the market with considerable confidence. This State-of-the-Art Wind Turbine Installation unit is able to install the latest wind turbines of 5 MW units or above.

Significant features of the NG-9000C include:

- Large variable load of up to 6,500 tons
- High transit speed of approx. 12 knots
- Full DP2 positioning
- Continuous cylinder jacking system
- 'Wrap around the leg' 800 ton crane

Ten at a time

The variable load and the net deck space of the unit enables ten complete wind turbine sets of 3,6 MW each to be transported in one haul. For the different projects it will be obvious that the selection of the hub port will determine the sailing time of the vessel. With all the new field developments, these hub ports are also under development. In general, sailing distances will be around 300 miles for a number of fields. Consequently the transit speed of the vessels needs to optimized.

The NG-9000C has a proven hull shape and the three 3,500 kW azimuthing thrusters allow a transit speed of 12 knots. For a 300 mile haul this means below 30 hours transit time.

Drydocks World SEA

Once on location, the vessel's DP2 dynamic positioning system enables it to position at exactly the desired location. The DP system capability is tuned to suit the maximum jacking condition. In 1.8 m significant waves, 14 m/s wind and 1 m/s current, the vessel can remain on location with the legs lowered near to the seabed. DP is a must for fast and efficient operations, as no tug boats and/or mooring system needs to be deployed.

Fred. Olsen Windcarrier

Fast jacking

The vessel is equipped with the latest version of the continuous cylinder jacking system. This pin-in-hole system operates with four jacks per leg with three jacks engaged (elevating or lowering) and one jack in recycle mode. This jacking system achieves a lift speed of 24 m/hr at maximum elevated weight. Leg handling speed is up to 40 m/hr.
After touchdown of the legs, the preloading operation takes place to secure the vessel. The advantage of the four-legged unit is the fast diagonal preloading. In elevated condition with full variable load, the vessel can withstand the survival condition of 10.8 m significant waves, 41 m/s wind and 1.25 m/s current at a maximum water depth of 45 m. In milder conditions, the water depth can rise beyond the 45 m. The maximum leg length of the NG-9000C is 84 m.

Latest wrap-around-the-leg crane

GustoMSC has developed special cranes for the Wind Turbine Installation market. On the NG-9000C the latest version of the 'Wrap-around-the-leg' crane will be installed. This 800 ton capacity crane is situated on top of the jack-house which frees up useful deck space and allows use of the existing leg and jackhouse. Besides the 800 tons capacity, the hoisting height of over 100 m above deck is a must in the wind turbine installation field. With the latest developments of wind turbines of 5 MW and over, the nacelles will be 95 m above sea level.

The accommodation deckhouse is situated at the forward end of the vessel, while the engine rooms are in the ship's center – away from the accommodation spaces. The vessel is powered by four diesel generator sets of 4,300 kW each. The diesel-electric system powers the 6.6 kV main bush bars. The thrusters, HPUs and main crane are powered through the 690 V switchboards. The 440 V and 220 V switchboards complete the electric system.

Some technical details

Vessel	L * B * H	130 * 39 * 9 m
	Power	4 generator sets of 4,300 kW 1 emergency set of 600 kW
	Thrusters	3 * 3,500 kW azimuthing 3 * 1,750 kW bow tunnel
	Accommodation	90 POB
	Variable load	6,500 t
	Leg length	84 m
Crane	Type	GLC-800-ED
	Main hoist	800 t @ 24 m
	Whip hoist	50 t @ 90 m

GustoMSC offshore cranes: A gallery

By Richard Noordermeer

GCC-500-HD offshore crane

The 500 ton crane is operational on the Wind Lift I, here seen at the port of Emden.

GCC-550-ED offshore crane

The 550 ton crane is installed on the GustoMSC designed ARB-3 jack-up and is currently undergoing the final stages of commissioning.

GLC-800-ED offshore crane

Three 800 ton 'wrap-around-the-leg' cranes were ordered in December 2009 and February 2010. The first will be fitted on the GustoMSC NG-9000C unit, under construction at Drydocks World SEA for delivery early 2012. The two others will be fitted on the GustoMSC NG-9000C under order from Fred. Olsen Windcarrier at Lamprell Shipyard for delivery mid-2012.

GCC-1000-HD offshore crane

Two 1,000 ton cranes have been ordered by Cosco Nantong Shipyard, to be fitted on the GustoMSC designed MPI Adventure and Discovery. Delivery is scheduled for mid-2011.

GDC-4000-ED heavy lift offshore crane

The 4,000 ton crane was ordered by CNOOC Engineering and will be placed on their vessel 'Hai Yang Shi You 201', a GustoMSC DPV7500C pipelay crane vessel.

GDC-5000-ED heavy lift offshore crane

The 5,000 ton crane was ordered by IHC Merwede and will be installed on the Seaway Heavy Lifting newbuild 'Oleg Strashnov', a GustoMSC HLV5000 design.

GustoMSC wraps the crane around the leg

A pretty design; saving space, money, and a bunch of operations hassle.

By Wim de Boom

The current market for specialized wind turbine installation vessels focuses on jack-ups, with cranes suitable to pick-up loads from their own deck, and lifting those to substantial heights (the nacelle of a 5 MW turbine has an average elevation of 95 m above sea level). The large vertical reach of the cranes requires long slender booms and a limitation of the dynamic forces on them. That is the main driver for executing such lifting operations from a jack-up vessel with sufficient air gap clear of the wave zone. The loads to be lifted are preferably stowed on the deck of the jack-up itself. If the equipment is to be lifted from a floating barge, the crane allowable hoisting load has to be downgraded because of dynamic factors for Ship-to-Jack-up transfer.

Freeing up deck space

The description above makes clear there is a great demand for free deck area to stow the equipment to be installed. Moreover by locating the crane at the edge of the free deck area, the deck area served by the crane hook is maximized. With the crane centerline close to the side of the jack-up the crane outreach is most effectively used. However, obstruction of the work space by the legs themselves must be minimized.
Observing these criteria, the mind-step necessary to design the crane around one of the jack-up legs is easily made. The principle of this arrangement is not new. Back in 1968 the jack-up Cowrie One was built at the Gusto Shipyard with a small crane built around the leg. However, on this occasion, the specification of the crane around the jack-up leg (800 t at 24 m outreach) is much more ambitious than that modest example from the past.

New times, new challenges

Since GustoMSC currently has an order portfolio of cranes in the range of 500 to 5,000 ton capacity, the development work is more oriented towards a proper combination of proven components into a new crane concept than to using novel technology to meet the design criteria.

The column cranes with a lifting capacity in the range of 500 to 1,000 tons, that are being built for installation on a jack-up, are located on an individual pedestal and supported by an integrated 3-race roller bearing or a king-post type bearing arrangement.

The large offshore cranes with a lifting capacity of 4,000 to 5,000 tons, that are being built for large offshore construction vessels, are located on a large diameter tub and supported by a bearing system of bogie-wheels.

Using the known and most suitable components

The latest development on the GustoMSC 'Wrap around the Leg' crane picks the most suitable components from the crane concepts described above. Since the jack-up leg penetrates the centre of the crane, the bogie-wheel bearing system was selected. A relatively large diameter circular bulkhead supporting the bogie-wheels was designed on top of the jack house, thus providing sufficient internal free opening for the leg to penetrate. The fitting of individual bogie-sets as the bearing system also very conveniently decouples the construction of crane and jack-up leg. Obviously, the use of an integrated roller bearing around the leg (if the leg diameter were still to permit the use of such a bearing, the internal clear opening of which is limited to approximately 7 m) would impose stringent requirements on the sequence of fitting the bearing and inserting the leg.

The A-frame of the 'Wrap around the Leg' crane also more closely resembles the configuration as applied on large offshore cranes in order to achieve the spacious configuration required for fitting the jack-up leg through the centre. Compact building of the winch house, to minimize tail swing, and the slender, steel-efficient, geometry of the boom was borrowed from column cranes. The engineering team made a great effort to integrate the individual building blocks of proven technology into the new crane design.

Appreciation expressed

The 'Wrap around the Leg' crane has been successfully introduced to the market and several installation contractors have expressed their appreciation of the advantages for operations: more available deck space, less interaction with the legs during lifting and reduction of slewing angles working over the side.

The 'Wrap around the Leg' crane (type GLC, GustoMSC Leg Crane) is installed on GustoMSC wind turbine installation vessels NG-9000C. Drydocks World SEA is building the first unit with the GustoMSC GLC-800-ED. Fred. Olsen Windcarrier A/S contracted two NG-9000C units from Lamprell Energy Ltd. to be fitted with the GustoMSC GLC-800-ED. Recently, Seajacks announced the design of two NG-5500C GustoMSC units having similar cranes. More GustoMSC designed jack-ups will be able to carry the 'Wrap around the Leg' cranes, from 500 to 1,500 tons and with holes in the middle that can even accept the larger diameter truss type leg.

Operation Support Systems

Operations Support Systems is part of the product range of GustoMSC for use aboard offshore rigs. This comprises software which performs specialized tasks such as loading and stability, towing resistance, motions and mooring.

By Joost van Santen

On board loading and stability software

Many GustoMSC designs are equipped with loading and stability programs, tailor-made to a specific unit. The program assists the vessel engineer efficiently to prepare the daily loadsheet. From the calculations, he obtains detailed insight into the stability of the unit in terms of GM and margin in vertical centre of gravity relative to the pre-calculated allowable VCG curves. When afloat, the program calculates the position (draft, trim and heel) of the rig. For a jack-up in elevated condition, it calculates the leg forces at jacking level.

Apart from the basic operational information, the program checks the calculated data against limitations as found in the operations manual such as draft, static leg forces, eccentricity when elevated and cantilever combined load. For GustoMSC's X-Y cantilever, special attention is paid to checking the cantilever and skidboxes for both overloading and ability to skid the cantilever.

Schematic topview of Acergy Piper (now Castoro 7) pipe laying barge showing pipe storage areas and firing line

Customized to the rig and graphics for visual feedback

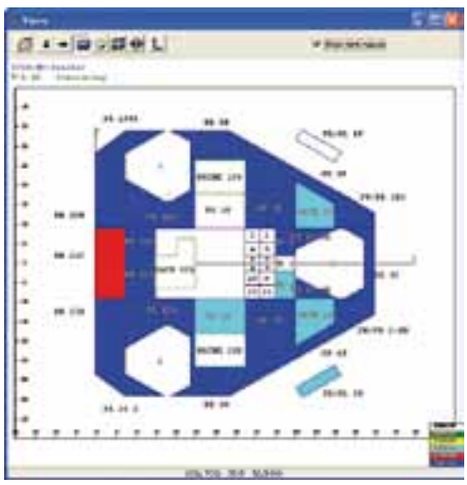
For each rig, the program is customized to the specific requirements of that unit. Each rig will have its own tank arrangement, and there will also be differences in deck layout, location of pipe racks, riser storage and BOP position; these differences all require a certain degree of customization.

Visual feedback is provided for major weight items like tanks, cantilever and deckloads. Apart from providing a quick situation overview, visual feedback is also useful in showing the effect on major parameters due to changes in the loading condition. For example, consider simulating a ballasting sequence where the user wants to see the effect of changes to the content of some ballast tanks on draft, trim and heel (or leg forces). Another example is when performing crane operations where the user can easily change the slew and boom angle and get the feedback on the location of the hook and vessel position or leg forces. At the same time, checks are made to ensure that the crane load does not exceed the capacity curve(s).

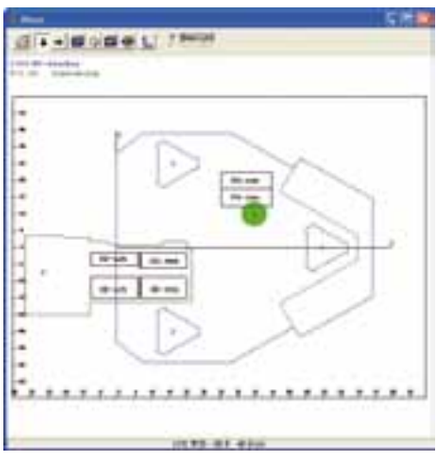
Focuses on the relevant issues

The program has a simulating and monitoring mode. In simulation mode the user has access to all data. In monitoring mode, data such as tank levels is imported from a measurement system at regular time intervals.

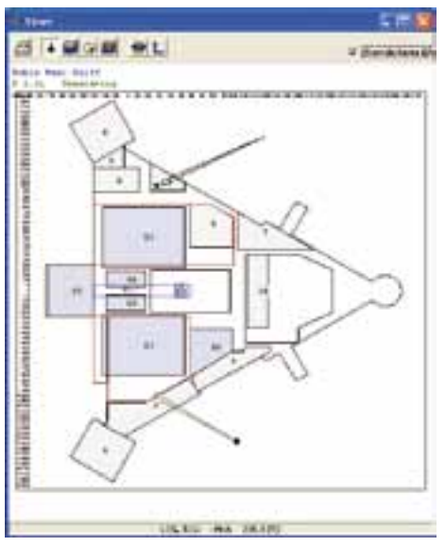
As we are involved in the design of the rigs for which the software is intended, we are able to deliver a program which focuses on the relevant issues. Being responsible for on-board installation provides us with useful feedback from users which in turn helps us in ongoing program development.



Top view of GustoMSC's CJ50 jack-up with schematic view of tank contents



Topview of GustoMSC's CJ50 with piperacks, deckloads and cantilever



Topview deck Noble Paul Wolff with deck cranes

Recent projects

- Basic design package and delivery of jacking system and main crane for an NG-9000C at Drydocks World SEA.
- Basic design package and delivery of jacking system for a SEA-3250 at Drydocks World SEA.
- Basic design package and delivery of jacking system and main crane to Lamprell Energy Ltd. for two NG-9000C units ordered by Fred. Olsen Windcarrier A/S.
- Basic Design contract for an NG-5500C for Seajacks.
- Delivery of jacking system and jack-up technology for a Type-900 system to Caspian Energy Group LLC (Astrakhan, Russia) for a shallow water drilling Jackup ordered by PetroResurs LLC.
- Joint Development Agreement with Keppel Fels DTG for development of the DrillDeep DS10,000 drillship.

Recent deliveries

Unit name	GustoMSC design	Builder	Owner	Date
COSL 936	CJ46	CMHI	COSL	December 2009
COSL 937	CJ46	Dalian Shipyard	COSL	December 2009
Wind Lift I	NG-5300	Western Shipyard	Bard Engineering	February 2010
Floatel Superior	DSS20-NS	Keppel FELS	Floatel International	March 2010

14 units to GustoMSC design delivered in 2009

Colophon

GustoMSC Inside is a publication of
• Gusto B.V.
• Gusto Projects B.V.
• GustoMSC Houston
• Marine Structure Consultants (MSC) B.V.

Total circulation: 4,000
This publication is edition 15, April 2010
Edited by Monique van der Have and
Gerrit Jan Schepman

Design and compilation
Stijlmeester communicatievormen,
Utrecht (NL)

Print
RS Drukkerij, Den Haag (NL)

InSide

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