

# InSide

GustoMSC

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**Buzzard** as wind turbine installation platform at **Thorntonbank**

**TDS series** under construction at **GPC yard**

**OCEAN series** of drilling semi-submersibles



GustoMSC

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Picture: Courtesy of GeoSea

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# Preface from the management

This edition of GustoMSC Inside once again gives you an overview of some of our recent projects, this time with a particular focus on a very rapidly expanding part of our business: the design and equipment supply for Wind Turbine Installation Vessels.

As there are currently more than 50 units being built to our designs world-wide, including the supply of equipment such as jacking systems and cranes (ranging from 500 up to 5000 tons), we will cover just a few of our projects. The articles presented give a good overview of our range of products, as almost all types of designs are covered, including drilling jack-ups, semi-submersibles, drilling vessels and construction/installation jack-ups.

In the midst of our busy activities, we have also seen some changes to our organizations in Schiedam and Houston.

In Schiedam, **Willem van Haaren**, Gusto's Operations Manager retired after working for the company for 29 years. This is an appropriate place to once more express our gratitude to Willem for his valued contribution to the GustoMSC companies and to wish him all the best in his retirement. **Andries Mastenbroek** has taken over the position as Operations Manager, one in which he is responsible for all execution projects within Gusto. **Coen Landa** has taken the position of Manager Marketing & Sales, responsible for Gusto's sales activities. Andries and Coen, together with **Bertus Bernhard** (Engineering Manager) and **Wim Janse** (Managing Director) now form Gusto's new management team.

In Houston, SBM Atlantia and GustoMSC Inc have been working very closely together on a number of drilling unit projects and on semi-submersible production units like Thunderhawk and IHUB, which have both proven to be successful experiences.

In view of this unique combined experience and anticipated further similar projects, it has been decided to integrate both companies into one organization, in which the GustoMSC scope of business will be fully retained. The following people will remain your contacts (although some of them might have new job titles), and form the management team for the GustoMSC activities in Houston: **Marco Beenen** (VP Engineering), **Rajan Bhambhani** (Manager Mobile Offshore Units Engineering), **David Fetterly** (VP Sales Mobile Offshore Units Products) and **Fernando Frimm** (Sr. VP Sales Mobile Offshore Drilling Units). These changes will strengthen our ability to execute more projects in Houston while continuing to market and sell the products and services of GustoMSC.



**Gusto's management team**  
(from left to right: Andries Mastenbroek, Coen Landa, Bertus Bernhard and Wim Janse).

With these changes, we trust that for the future we can offer the same high level of service that you expect from us. We look forward to a successful continuation of our cooperation, and to working together with you on challenging new projects.



**Wim Janse**  
Managing Director - Gusto B.V. and Gusto Projects B.V.



Vagant

Wind

# GustoMSC company involvement in Offshore Wind Farms

Within the field of renewable energy sources, the wind energy industry is rapidly expanding to offshore wind farms, especially in Europe. Wind energy will be a significant contributor for the reduction of greenhouse gas emissions as per Kyoto's obligations. The EU target is to have 20% of energy coming from renewable energy sources by 2020: 20 for 20. The installation and maintenance of offshore wind farms is an evolving market, for which new installation vessels and equipment will be required. Market prospects are booming, with a presently installed power capacity in Europe of over 1,200 MW, growing steadily to 30,000 MW in 2030. New developments are also being planned for China and the USA. For the European projects the majority of offshore wind farms will be installed in water depths of around 30 meters, with some in 40-45 meters. This is a typical water depth for the use of jack-up units/vessels as installation and maintenance units of the offshore wind turbines.

## Offshore wind farms

Typically, offshore wind farms are developed in a grid of 50-100 units. Speed is of the essence for the installation of this number of units, especially in view of weather window restrictions. The power capacity of the individual wind turbines ranges between 2 and 5 MW. Typical sizes are: rotor diameters of 80 to 125 m, turbine weights (nacelle + rotor) of 200 – 450 t, nacelle elevations 70 – 90 m above sea level. It is expected that 3.6 MW and 5 MW machines will be the standard for the coming years, and most new installation equipment is being designed for these sizes.

Currently foundations are bottom fixed, with the majority comprising monopiles, but gravity base foundations are also being used; for deeper water, tripods and jackets are being developed. Installation generally occurs in separate pieces: foundation, transition piece, column, nacelle, rotor/blades. There are several possible procedures, e.g. install complete rotor or install nacelle and blades separately, the choice largely depending on the preference of the turbine manufacturer and the capabilities of the installation equipment.

## Logistics and installation equipment

Offshore wind turbine installations are normally installed by offshore installation contractors, using dedicated equipment or the equipment presently on the market. The trend is towards dedicated equipment for installation, feeder services and maintenance services. Each has its own design requirements, but all of them are centered around jack-up technology. The installation units tend to be self propelled, DP units with offshore cranes from 500 to 1,000 tons. The feeder units could be self-propelled or tug assisted, and will carry the equipment from shore to the offshore locations. Deck load capacity is the number one priority. The maintenance units are smaller units, self-propelled and DP. Transit speed around 6 knots. These units have cranes of around 75 ton lifting capacity at high reach.

GustoMSC has developed two series of jack-up units for the construction market in general and for the wind farm installation market in particular:

- The SEA series, non-propelled 4-legged units with variable loads from 500 to 4,000 tons.
- The NG series, self-propelled full DP units with crane capacity from 500 to 1,500 tons and variable load up to 10,000 tons. Leg configurations and jacking systems depend on the actual application.



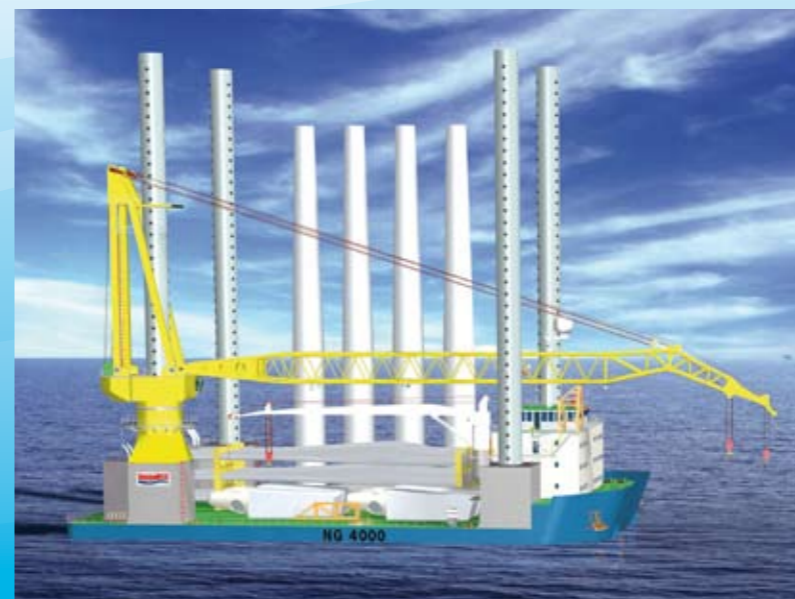
Vagant and Buzzard



NG-2000 artist impression

SEA series	Vagant (SEA-800)	Buzzard (SEA-1250)	Sea Worker (SEA-2000)
Hull	43.5 x 22.5 m	43 x 30 m	55.5 x 32.2 m
Variable load	1,000 t	1,400 t	1,600 t
Leg length	57.5 m	65 m	73.2 m
Water depth	30 m	40 m	40 m

NG series	Wind (NG-600)	NG-2000	NG-4000	Wind Lift 1 (NG-5300)
Hull	55 x 18 m	58.2 x 31.2 m	81 x 40 m	89.8 x 36 m
Variable load	550 t	1,000 t	2,750 t	2,600 t
Leg length	45 m	70 m	75 m	72 m
Max. operational water depth	25 m	40 m	45 m	45 m



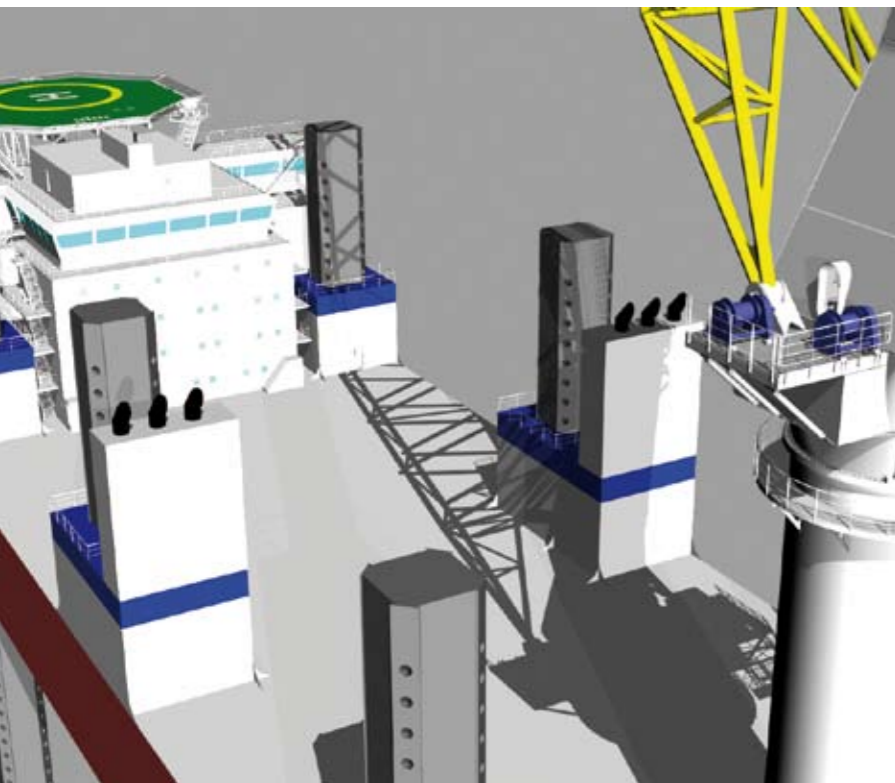
NG-4000



Wind Lift 1



by Joop Mikx, Nils van Nood and Gerrit-Jan Schepman



# MPI's offshore projects

MPI Offshore Limited is a UK company that operates marine vessels on behalf of the owners Vroon; they predominately work on Offshore Wind Turbine projects. GustoMSC was involved in the design and engineering of their first vessel, the "Resolution", and also delivered the jacking systems. The "Resolution" was delivered in 2003 and was involved in quite a number of installations of wind turbine farms including the Kentish Flats, North Hoyle, Barrow and Lynn & Inner Dowsing, Robin Rigg and Horns Rev projects.



In the first year of operation it was found that the foundation piles had increased in weight beyond the crane capacity. GustoMSC designed a special upending tool for those piles and supplied this on a turnkey basis to MPI. The upending tool is attached to the stern of the vessel, which facilitates installation work on monopiles of up to 600t in weight, 6m in diameter and 60m in length.



Based on the experience gained with the "Resolution", and given the booming market for Offshore Wind Farms, MPI Offshore continued discussions with GustoMSC for two additional self-propelled jack-up vessels. These units will have six legs and will be equipped with a GustoMSC jacking system, allowing a jacking cylinder speed of 60m/hr. As the offshore wind turbines and foundations tend to weigh more with increasing water depth and increasing power generation, the offshore crane capacity of the new jack-ups has been increased to 1,000 tons. GustoMSC will design, engineer and deliver the two cranes turnkey.

In July 2008, Vroon announced the construction contract with Cosco Nantong yard for two vessels, MPI "Adventure" and MPI "Discovery". The vessels will be delivered in 2011, Adventure scheduled to be operational in Spring 2011 and Discovery in Autumn 2011.

### Vessel characteristics

	MPI Resolution	MPI Adventure MPI Discovery
Hull	130 x 38 m	137 x 40 m
Variable load	4,000 t	6,000 t
Water depth	35 m	40 m
Main crane	300 t @ 25.5 m	1,000 t @ 25.5 m
Speed	11 knots	12.5 knots
Positioning	DP	DP II



Resolution

# Buzzard as wind turbine installation platform at Thorntonbank



GeoSea's Vagant transporting a 126 m diameter wind turbine rotor to the Thorntonbank

This summer, GeoSea's jack-up platform Buzzard installed six wind turbines on the Thorntonbank, situated approximately 30 km off the Belgium coastline. GustoMSC provided engineering and consultancy services for this project. Three GustoMSC designed jack-up platforms cooperated to install the 5MW REpower turbines.

For this project, the Buzzard was equipped with a Liebherr LR1750 crane on top of a truss tower. GustoMSC designed load spreading structures below the tower and reinforcements in the hull. In addition, two rows of 18 padeyes were designed for the hull shell, such that four superlift backstay wires would allow the crane to lift its load at the required reach, while keeping the counterweight as low as possible.

The Buzzard was towed to the Thorntonbank, with the crane boom sea fastened in the upright position. As this implied that the tip of the boom was more than 100 m above the main deck of the platform, preparatory analyses were performed by GustoMSC to ensure that the stability and the sea fastening during tow would be sufficient.

Two other GustoMSC designed platforms were used as transportation platforms. The Pauline, owned by Besix,

carried the nacelle and the wind turbine tower in two parts. The 126 m diameter rotor was transported fully assembled from Zeebrugge to the Thorntonbank by GeoSea's platform Vagant. GustoMSC provided consultancy work such as site-specific assessments, sea fastening analyses, motions analyses and stability analyses for these platforms. In addition, the support frame for the assembly and transportation of the rotor on the Vagant was designed by GustoMSC.

The installation of the six wind turbines went well and the concept of the LR1750 crane on the Buzzard proved to be a success.

Early this year, GeoSea decided to expand their fleet of self-elevating platforms with a SEA-2000 unit. GustoMSC is providing the basic design of the unit and is supplying the hydraulic jacking system. The unit is being built in Belgium and is scheduled for delivery in mid 2009.



Superlift backstay wires allow the crane to lift the 320 tons nacelle at a reach of 22 m while using only 150 tons counterweight

The rotor is lifted by the LR1750 crane on the Buzzard, assisted by a TC1100 tailing crane on the Vagant

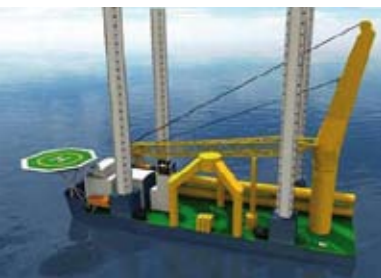
	SEA-800 Vagant	SEA-900 Pauline	SEA-1250 Buzzard	SEA-2000 New build
Hull	43.5 x 22.5 m	48 x 23.5 m	43 x 30 m	55.5 x 32.2 m
Variable load	1,000 t	1,100 t	1,400 t	1,600 t
Water depth	30 m	30 m	40 m	40 m



by Jack Dalmaijer



by René de Bruijn and Fons Huijs



Ever increasing energy prices have resulted in a growing number of initiatives for exploring offshore wind energy generation concepts. BARD Engineering GmbH, Emden, clearly distinguishes itself from other parties in this field by an unprecedented total solution concept. They are not only building their own wind turbines, but also building up their own installation group and a newly developed jack-up with handling tools - all part of that same concept.

# Total Concept Offshore Wind Energy Solutions by BARD Engineering GmbH



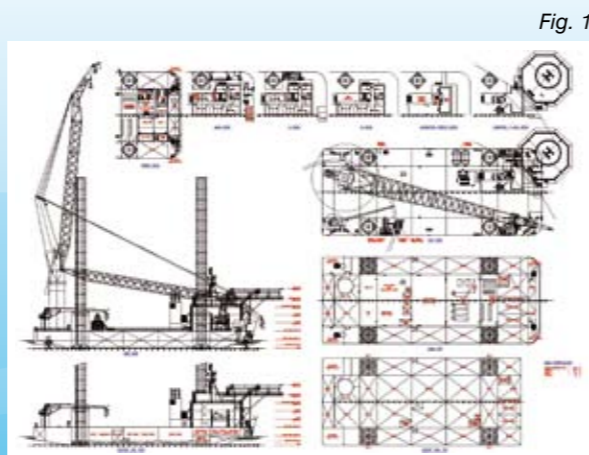
BARD has the concession for exploring and operating a large scale offshore wind farm in the German Bight approximately 100km off the coast of Germany. A total of 80 VM-5 (5MW) turbines will be installed in that field which has been designated "BARD Offshore 1". Plans have been developed to explore more and larger fields in the near future. The wind turbine assembly for the first field is positioned in water depths of 45meters and consists of a foundation structure of three (3) piles, transition piece, mono pile tower, nacelle (houses the generator), hub and three (3) blades. The circle of span of the blades is approximately 120meters. The nacelle is positioned 90meters above mean sea water level. The foundation piles measure 3,350mm OD and 90meters in length, weighing approximately 450tonnes each; clearly different from the common foundation piles found in offshore jacket foundations.



The development and fabrication of all the turbine components is controlled in-house by BARD. The turbine foundation structure, piles and transition piece are assembled at BARD's subsidiary Cuxhaven Steel Construction GmbH, from where they are transported offshore by barge. The nacelle, hub and blades are fabricated and assembled at BARD's premises in Emden (D) from where these components are shipped offshore. This all requires a careful planning and logistics process during fabrication and installation offshore, which is again controlled by BARD in-house. For the offshore installation, BARD approached GustoMSC to develop a self elevating installation jack-up, the basic engineering for which was completed in Q3 2007. The main particulars of the jack-up called "Wind Lift 1" are presented below:



GustoMSC	NG-5300
Hull	89 x 36 m
Variable load	2,600 t
Water depth	45 m
Main crane	500 t @ 31 m
Jacking speed	35 m/hr
Station keeping	4 thrusters, DP



The vessel is a four-leg jack-up with accommodation fitted at the forward end of the vessel and a 500tonne fully revolving main crane at the transom, FIG 1 and 2. The unit has been designed according to Germanischer Lloyd's rules and regulations; Hull 100 A5 DP 1 Self Elevating unit. BARD contracted the construction of the jack-up from Western Shipyard in Klaipeda, Lithuania. The keel-laying ceremony was celebrated early in April and delivery of the unit is due for March 2009. Progress of the various jack-up components is shown in FIG 3, 4, 5 and 6.



by Taco Terpstra



Fig. 8

GustoMSC not only provided the basic design of the unit but also supplies - turn-key - the hydraulic double acting jacking systems (maximum lifting load 2,500tonnes per leg), FIG 7 and 8, and the fully revolving 500tonne main crane (type GCC-500-HD). Supplying all these main elements through one single contractor provides BARD with a tailored integrated package.

The "Wind Lift 1" jack-up has two different types of operational modes:

- installation of foundation piles and transition piece;
- erection and installation of tower segments, nacelle, hub and blades.

Special handling systems have been developed for BARD for the installation of the foundations, piles and transition piece:

- Pile Tilting and Storage System;
- Pile Guidance Frame.

The Pile Tilting and Storage system comprise two (2) storage racks, a 450tonne pile up-ending tool, an up-ending saddle and suspension wires and hook. The functionality of the system is presented in FIG 9. Two racks are positioned on the main deck, FIG 10, to store three (3) foundation piles in three different positions within the racks. Skidding systems allow the piles to be moved from their respective storage positions into the so-called firing line. Within this line the piles are skidded aft and up-ended by means of suspension wires and the 500tonne main crane. A dedicated saddle is fitted at the stern of the unit over which the pile can be rotated. All-in-all a cost effective and efficient system!

Once the piles have been skidded aft and up-ended, they will be positioned into a specially developed guidance frame suspended from the transom of the jack-up. The pile guidance frame is a lattice type structure measuring 26m x 23m x 9.6m, as shown in FIG 11. At the three corners of the guidance frame, moveable arms are provided on which roller boxes are fitted, FIG 12. Once the arms have been closed and locked into position the rollers are engaged and guide the piles into the vertical position within the tight tolerances. Tight tolerances are required for a smooth mating of the transition piece into the foundation piles.

After installation of the transition piece, the arms of the guidance frame are opened and the "Wind Lift 1" can be jacked down and sail in-field to the next turbine positions without first up-righting the frame. This allows for an increase in efficiency and hence uptime for the complete installation process.

For the installation of the hub and blades, GustoMSC has developed a hub rotation tool, FIG 13, which allows for manoeuvring the hub and three pre-assembled blades in the air from horizontal lift-off to vertical installation position. This frame has already been tested on two on-shore turbine assemblies. Since the hub and only two (2) blades are assembled in Emden and transported to the "Wind Lift 1" offshore, a dedicated transport and tilting frame has been developed to allow for both transport and rotation of the assembly. The third blade is fitted on board the jack-up offshore, which is done in a horizontal position. This frame is currently under development.

To further improve the technology and train the staff, a special trials program has been developed by BARD for a prototype turbine near shore Hooksiel in Germany for further optimizing procedures and processes. A complete assembly is being installed in limited water depth, see FIG 14.

Not only has BARD built up their own fleet but they have also ordered their own transformer platform from Western Shipyard in Klaipeda, making them independent of any third party! This demonstrates their far-stretching vision and the GustoMSC-team congratulates BARD on their achievements to date and wishes them every success in further realizing their total solutions concept and becoming Germany's number one wind offshore energy provider!

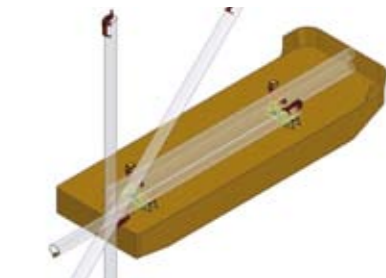


Fig. 9

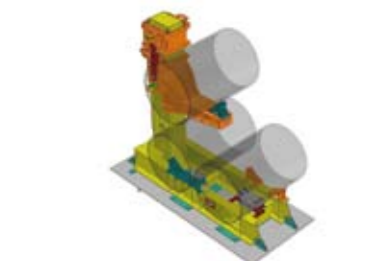


Fig. 10



Fig. 11

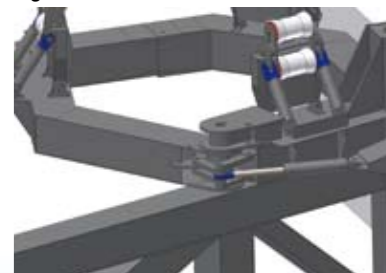


Fig. 12



Fig. 13



Fig. 14



# Update on the construction of the DSS series

GustoMSC and Keppel's Deepwater Technology Group have been cooperating in the development of the DSS series since 1985. The DSS series has grown into a successful series of drilling semi-submersibles, characterized by their efficient layout, vertical riser storage, high variable drilling load capacity and good constructability. The first unit introduced to the market - built for Maersk Drilling in 2003 - was the DSS20-CAS-M, named "Maersk Explorer" and now operating in the Caspian Sea. In 2005, Maersk Drilling decided to build the next series of DSS units, specifically designed for development drilling. The first DSS21 unit "Maersk Developer" has been delivered and the two other units are scheduled for 2009 and 2010. A unit of the same class, the DSS51 "Development Driller III", is currently under construction for Transocean with delivery 2009. The DSS38 was developed specially for the Brazilian market, and 3 units are under construction (2 for Queiroz Galvao Oleo e Gas for delivery in 2009 and 2011, and 1 for Scorpion Drilling for delivery in 2011).

Maersk Developer

Besides drilling units, the DSS series can also be adapted to other applications. An accommodation and multi service vessel, the DSS20-NS-DP3 design, is under construction for Floatel (delivery in 2010). This is a dynamic positioned semi-submersible with accommodation for 440 persons, and suitable for operations in the North Sea area.

DSS series	DSS20-CAS-M	DSS20-NS-DP3	DSS38	DSS21/51
Units	1	1	3	4
Hull size	63.5 x 64.5 m	63.5 x 64.5 m	69.5 x 69.5 m	78.5 x 78.0 m
Displacement	30,500 mt	29,200 mt	39,300 mt	53,700 mt
Variable deck load	4,000 mt	2,200 mt	5,800 mt	8,500 mt
Pontoon consumables	2,300 mt	2,400 mt	4,000 mt	5,000 mt
Power generation	4 x 2,700 kW	6 x 3,680 kW	10 x 3,500 kW	8 x 4,750 kW
Station keeping	Moored	Moored & DP-3	DPS-2	Moored & DPS-2



Jacking system



Fixation system

Naga 2

## CJ46-X100-D at Drydocks World Graha yard

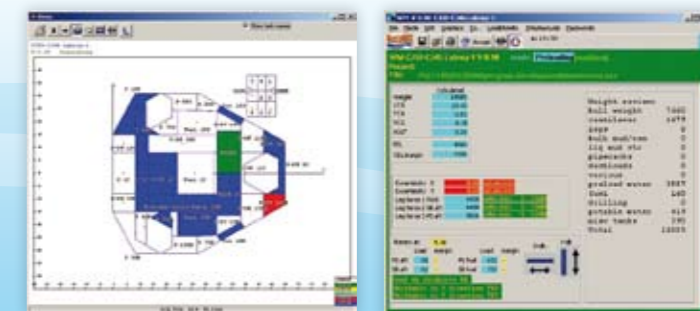
In 2006, Standard Drilling ASA ordered 4 units of GustoMSC's CJ46-X100-D design from Labroy Offshore, currently the Drydocks World Graha Yard. To date, UMW Standard Drilling Sdn Bhd, a joint venture between UMW corporation of Malaysia and Standard Drilling ASA will operate two of these units, Naga 2 and Naga 3. A third unit is sold to Saipem, named Perro Negro 6.

GustoMSC is supplying the Basic Design, Operation Support System (weight management and hydrostatic stability) Program, Leg Fixation System, leg Jacking System and the X-Y Cantilever Skidding System for these rigs. The first rig, named Naga 2, was successfully launched on July 10th 2008 at the yard in Batam, Indonesia, and will be contracted to PCPP Operating Co Sdn Bhd (a JV between Petronas Carigali, Malaysia, Petrovietnam, Vietnam and Pertamina, Indonesia) for a three year contract.

The basic design documentation was delivered to the yard mid 2006, with continuous detail engineering support still ongoing. The leg fixation systems have been delivered to the yard and were installed on the unit in summer 2008. The leg jacking systems have been delivered to the yard and were installed on the unit in autumn 2008. The X-Y cantilever skidding system will be installed on the unit together with the full cantilever around autumn 2008.

### Main particulars CJ46-X100-D:

- Class: ABS - 1A1 Self-Elevating Drilling Unit
- Water depth: 350 ft
- Hull length: 65.25m
- Hull width: 62.00m
- Hull depth: 8.00m
- Leg length: 147.4m
- Accommodation: 100 POB
- Drilling depth: 30,000 ft
- GustoMSC Fixation system: Type 5000
- GustoMSC Jacking system: Type GDRL-100/6
- GustoMSC X-Y Cantilever reach: 70 ft longitudinal / 2x 20 ft transverse
- Cantilever capacity: 1500 kips over full reach, 2700 kips up to 50ft longitudinal reach (independent of transverse position)



OSS Program on screen

GustoMSC will deliver an Operation Support System (OSS) program which will help the barge engineer to define the loading condition in an efficient manner. For this purpose, a great deal of data has been preprogrammed, thereby minimizing the possibility of input errors. Both the floating and elevated mode can be handled. When afloat, the draft, trim and heel are calculated, and while in elevated condition the 3 leg forces are determined. Derived data such as VDL, cantilever loading and safety margins are also presented.



by Robbert Kant



by Remco van der List

# Frontier Drilling's Bully I and Bully II under construction

In 2006 and 2007 GustoMSC customized a PRD12,000 into an arctic drilling vessel for Frontier Drilling in the USA and prepared the full basic design package. On the 8th of January of this year the first plate was cut for 'Bully I', the first vessel in this series. Early this year, Frontier Drilling also exercised their option for a second vessel in the series, to be delivered 6 months after 'Bully I'.

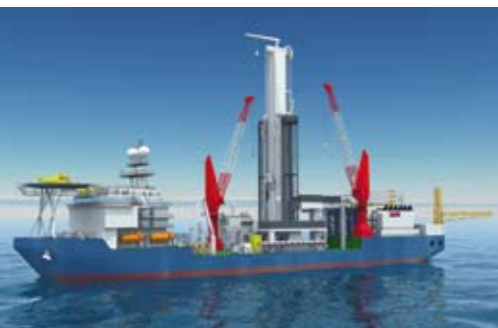
The vessels are the first PRD12,000 'fit-for-purpose' designs to be built. They are characterized by an arctic class notation, a novel concept Multi Purpose Drilling tower and a thruster retrieval system. The principal characteristics of the ship are a length over all of 187.50 m, a width of 32.00 m, a depth of 15.06 m and a displacement of around 45,000 tons. The vessel is 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. Both complete drilling spreads are always on board.

The hulls for 'Bully I' and 'Bully II' are being built in China at Shanghai Shipyards, where the detailed engineering for the steelwork has also been carried out under the guidance of a GustoMSC engineer. The hull of 'Bully I' was launched at Shanghai Shipyards on the 20th of October, and by the end of the month the hull will be towed to Singapore. There the outfitting of the unit will be carried out by Keppel Shipyard.

At the end of 2007 GustoMSC was also awarded the contract for the hardware supply of a six thruster retrieval systems for the 'Bully I'. This system allows the thrusters to be retracted flush with the baseline of the vessel, for transit and for operations in ice, by means of hydraulic motors and a rack and pinion system. The retrieval mechanism is being supplied by GustoMSC, while Frontier Drilling will supply the thruster and the canister that houses the thruster motor. The detailed engineering of the canister is being carried out by GustoMSC in Houston.

In July of this year the first steel was cut for 'Bully II', which will be almost a copy of 'Bully I'. The project approach for the 'Bully II' is, however, slightly different from 'Bully I'. While for 'Bully I' the hull was fitted out only with bilge and ballast system, fuel oil piping and P-tanks, for 'Bully II' the scope of Shanghai Shipyard's work will be extended to all piping systems and cable trays within the hull and deckhouse. Main engine exhausts, and probably the mud pumps as well, will also be installed in China.

There will also be slight differences between 'Bully I' and 'Bully II' in terms of vessel specification. After completion, due by the end of 2009, 'Bully I' will serve a five year contract in the Gulf of Mexico, which is why the owners have skipped a number of the typical arctic features in the design. 'Bully II' will most likely be deployed in the arctic following completion in the middle of 2010, which means that 'Bully II' will be equipped with a full suite of arctic equipment, such as steam lances to keep the decks clear of ice, heating coils in tanks and a mooring system with sub-sea fairleads to position the ship in shallow waters.



by Jort Brouwer



# TDS semi's under construction at GPC yard

The TDS rigs are twin pontoon column stabilized semi-submersibles of which the design and engineering is provided by GustoMSC. The rigs are being built by SBM Atlantia at the Gulf Piping Company yard in Abu Dhabi. The first rig in this series of three is the TDS 2000 Lone Star for QGP, the second in the series is the TDS 2000 Norbe VI for Odebrecht, and the third is TDS 2500 Delba III for Delba Maratima. The pontoons of rigs 1 and 2 are 320 feet long and 50 feet wide, from the bottom of the pontoons to the main deck it is 96 feet. Rig 3 is a larger unit with an overall length of 320 ft and width of 246 ft.

Rig 1 left dry dock on April 17th 2008 and is now in the process of completing the structural work so the outfitting and commissioning activities can commence. Rig 2 is currently in dry dock. Engineering work on rig 3 is moving forward at full speed to assist the pontoon and column module fabrication.

All three of the TDS rigs are dynamically positioned. Rigs 1 and 2 have a maximum operating water depth of 2,400 m (7,873 feet) and a drilling hook load of 2,000,000 pounds. They are capable of carrying 7,700 short tons of variable drilling load, and can drill wells over 25,000 feet deep. Rig 3 will be capable of operating in a water depth of up to 2,744 m (9,000 ft) and drill up to 10,000 m (30,000 ft).



by Yong Luo (SBM Atlantia) and Aaron St. John

# GustoMSC SEA-2000 – JB-114 and JB-115 under construction

As the first two SEA-2000 jack-ups, JB-109 and JB-110, were delivered last April, the yard - Drydocks World - continued the construction of the next two SEA-2000 jack-ups for Jack-Up Barge B.V. GustoMSC provided the yard with the basic design for these units and supplied the hydraulic positive engagement jacking systems to Jack-Up Barge.

SEA-2000	
Hull	55.5 x 32.2 m
Variable load	1,600 t
Leg length	73.2 m
Water depth	40 m

The jacking systems were delivered in batches between February and June this year. The yard assembled the jacking systems under the supervision of our own service engineer.

The JB-115 was launched on a rainy September 4. Installation of the legs is scheduled for the first week of October. Once the legs are installed and the jacking systems are hydraulically and electrically connected, commissioning of the jacking system will commence.

Construction of the JB-114 is approximately 6 weeks behind the JB-115. The launch is scheduled for mid October. Contrary to what we reported in the previous issue of the GustoMSC Inside, Jack-Up Barge has decided to also provide a 300 t pedestal crane for the JB-114. GustoMSC received an order from the yard to design a new "stand alone" boom rest support for this crane instead of an integrated helicopter deck/boom rest support as fitted on the JB-115.

The units are scheduled for delivery in the first quarter of 2009.



Seafox 7

Seafox 7

## Drydocks World delivers JB-109 and JB-110 to Jack-Up Barge

The Drydocks World yard in Batam, Indonesia (formerly Labroy shipyard) delivered the JB-109 and JB-110, a GustoMSC SEA-2000 design, to Jack-Up Barge last April. Both units were transported to Europe on the heavy lift vessel O.H.T. Heavylift Eagle. On arrival in Rotterdam, the necessary activities to prepare the units for their first projects were performed at the Keppel Verolme yard.

### JB-109 and Seafox 7 at Keppel Verolme yard

The JB-109 has been sold to A2SEA and renamed Sea Worker. The Sea Worker's first job is to install 60 three megawatt Vestas turbines. The 180 MW Robin Rigg Wind Farm is located in the middle of the Solway Firth.

The JB-110 has been sold to Seafox Contractors and renamed Seafox 7. The Seafox 7 has successfully completed her first 2 jobs for Tullow Oil plc and Cirrus Energy Nederland BV in the southern North Sea. For Tullow Oil the unit has supported the planned activities at the Horne and Wren Platform as part of the Wissey Field Development. For Cirrus Energy the Seafox 7 has contributed to the further development of the M7-A Field, by supporting activities and providing facilities for the installation of a monopile wellhead platform.

### Seafox 7 at L9FF field

GustoMSC takes this opportunity to congratulate Drydocks World, Jack-Up Barge, A2SEA and Workfox on the successful completion and delivery of the Sea Worker and Seafox 7 and wishes the rigs and their crew a safe and prosperous future.



JB-114 under construction



JB-115 successfully launched



by René de Bruijn



# GustoMSC NG-2500X for SEAJACKS

## Project Update

In February 2007 the contract was signed between Seajacks Ltd and Lamprell Energy for the construction of two self propelled jack-ups of the GustoMSC NG-2500X design (design and jacking system have been described in previous INSIDES). GustoMSC delivered the Basic Design for the units and provides the rack and pinion floating jacking systems. The Seajacks "Kraken" and "Leviathan" are due for delivery in respectively February and May 2009.

Construction of the two units is well underway at Lamprell's Jebel Ali Yard in the UAE. Currently (October 2008) the hull of the first unit is almost finished, the accommodation block installed and lower leg sections with spudcans have been lifted into the leg wells. Installation of the first of the GustoMSC jacking systems on the first unit has commenced at the yard. Construction of the second hull is already roughly 80% complete. Launch of the first unit is scheduled for end of November 2008 after which the unit will be finalized at the quayside.

### Design Particulars

Hull	
Length (at waterline)	61.0 m
Width	36.0 m
Depth	6.0 m
Legs	84.0 m
Accommodation	60 persons
Water depth	40.0 m (all-year Survival North Sea Conditions)
Propulsion	4*1500 kW Azimuthing thrusters
Main Crane	300 t



# GustoMSC NG-2500X for Gulf Marine Services WLL

In February 2008 the License Agreement between Gulf Marine Services WLL and GustoMSC was signed for two GustoMSC NG-2500X self propelled jack-up designs followed by a contract for two sets of associated GustoMSC jacking systems.

The hull which incorporates all major marine systems will be built at Sainty Marine Yard in China. Last June the construction contract for the second hull was signed between GMS and Sainty Marine and both the hulls will be built simultaneously at the yard.

Cutting of first steel for the hulls was performed at the yard in September 2008.

After completion of the steel structure of the hulls and installation of major piping, the hulls will be transported to the GMS Yard in the UAE. Upon arrival at the yard the hulls will be completed and all the equipment, including the jacking systems, will be installed. Legs and spudcans will be fabricated and installed at the GMS Yard.

### Design Particulars

Hull	
Length (at waterline)	61.0 m
Width	36.0 m
Depth	6.0 m
Legs	94.2 m
Accommodation	150 persons
Water depth	60.0 m (all-year Survival Arabian Gulf Conditions)
Propulsion	4*1200 kW Azimuthing thrusters
Main Crane	170 t



by Paul Groote Woortmann



Yme substructure installation, ballasting



... and almost successfully installed

# MOPUstor for Talisman's Yme field; construction update

The MOPUstor is a self installing platform, integrating well support, production and storage. Talisman Energy awarded SBM a FEED study in 2006, resulting in a contract early 2007 for the design, construction and installation of the unit.

## Submersion of storage tank

In September 2008 a major milestone was achieved with the installation of the subsea storage tank. The storage tank departed from the MMHE yard in Malaysia early in April for the Keppel Verolme yard in Rotterdam. At this yard the main scope was the upending of the caisson which was successfully achieved at the beginning of July. The storage tank and caisson were then wet-towed to Norway using 3 ocean going tugs. The main activity at Westcon in the Norwegian fjord was to ballast the storage tank with concrete and prepare a concrete layer on the deck as protection against falling objects. At the site, the storage tank was controlled by four tugs with the "Polar Prince" acting as control center for the submerging operation. This took 24 hours and was followed by suction of the skirt piles and final grouting to fill the gap between the seabed and the tank bottom. The unit is currently available for the drilling operations of the Maersk Giant which are likely to start at the end of October or early November 2008.

## Hull structure

Construction of the MOPU hull and topsides is advancing well at the construction site of Adyard in the Middle East. The hull is nearly finished and the jacking structures, including the hydraulic jacking systems, are being installed.



Yme MOPUstor subsea storage tank - under tow in Rotterdam - Beerkanaal, Maasvlakte



Under tow in Norway

# OCEAN series of drilling semi-submersibles

GustoMSC introduces the OCEAN series of drilling semi-submersible vessels. In this design we combine our knowledge from the DSS designs and the construction experience of the TDS units.

The DSS series will continue to be maintained and developed jointly and exclusively in close cooperation with Keppel's Deepwater Technology Group for exclusive construction by KeppelFels. Within this DSS series, 9 units have been or are in the process of being built.

The OCEAN series of designs will be available for construction at yards worldwide.

The OCEAN series provide adjustments and improvements in the layout of the box deck structure in terms of generating power sets and drilling related equipment.

The main layout of the deck has been maintained:

- Piperacks aft of derrick structure
- Vertical riser storage, forward of derrick structure
- Raised drillfloor with BOP and LMRP handling from SB side
- Raised drillfloor with X-tree handling from PS side



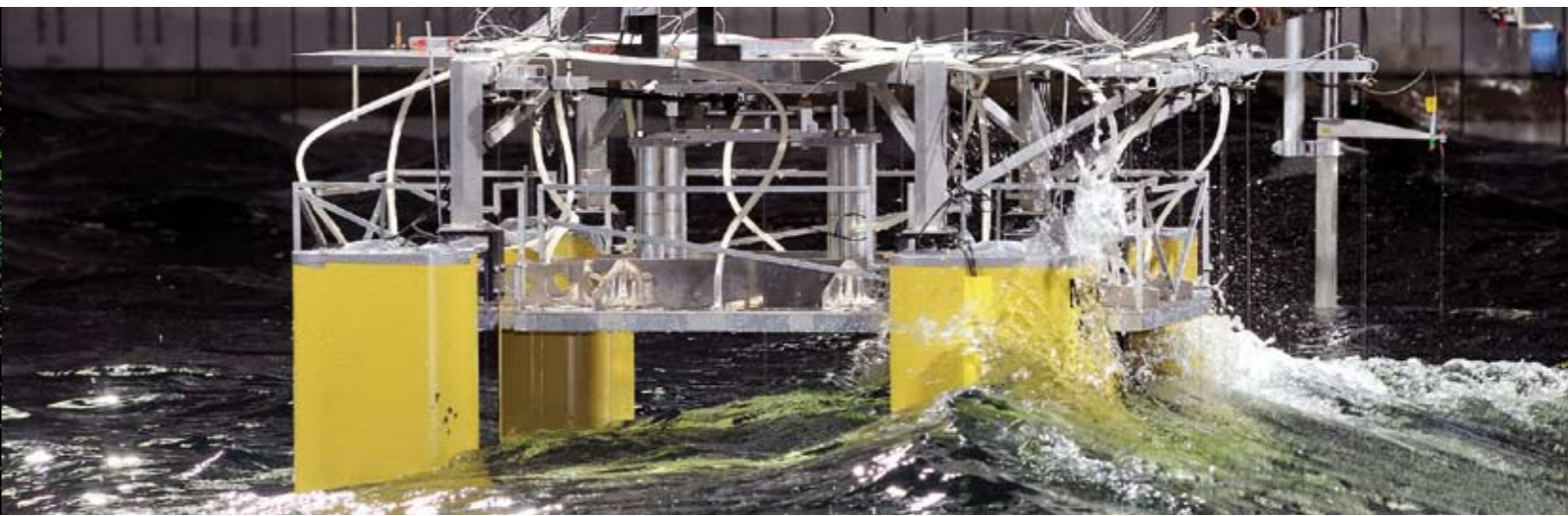
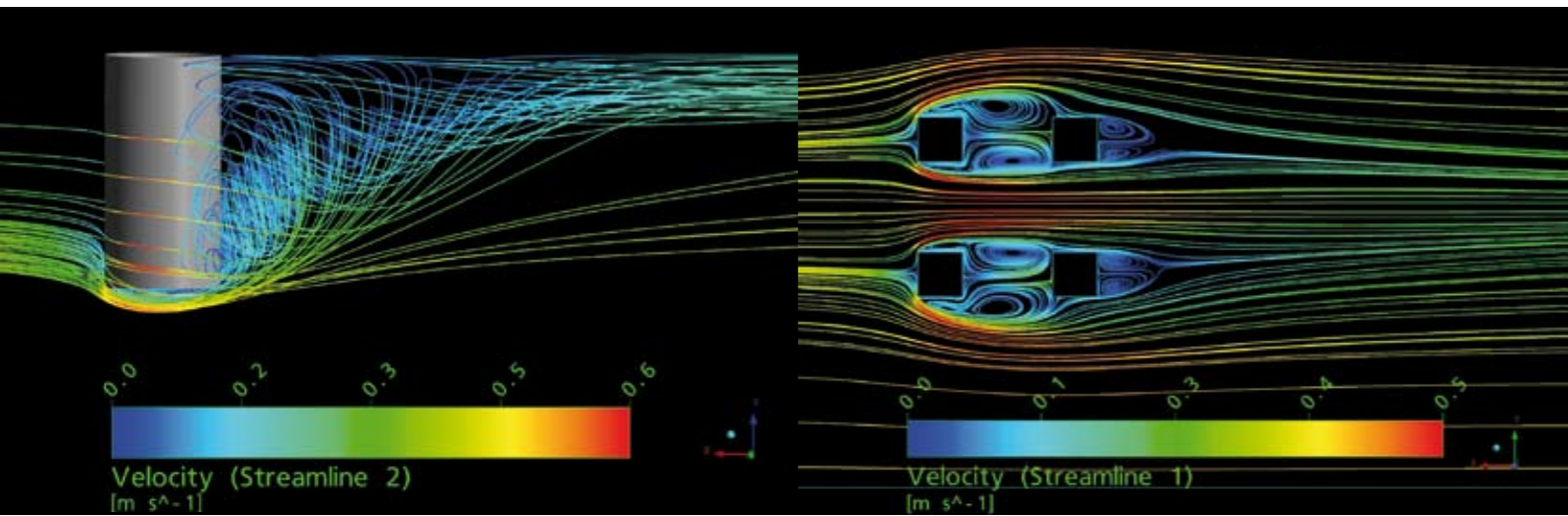
Description	OCEAN 450	OCEAN 850	OCEAN 1100
LOI		1	
Deck size	65 x 65 m	73 x 73 m	78 x 78 m
Draft	20.5 m	19.8 m	20.5 m
Displacement	32,000 t	43,500 t	55,000 t
VDL operating	4,000 t	8,000 t	8,500 t
Total VL	7,000 t	12,000 t	14,000 t
Gen Sets	4 x 2,500 kW	10 x 3,800 kW	8 x 4,800 kW
Positioning	Moored	DP2	DP2
Thrusters	-	8 x 3,000 kW	8 x 4,000 kW
Accommodation	120 POB	140 POB	200 POB
Derrick	1,500 kips	2,000 kips	2,000 kips
Mud pumps	3 x 2,200 hp	4 x 2,200 hp	4 x 2,200 hp
Mud capacity	1,000 m3	1,750 m3	3,000 m3



by Andries Mastenbroek and Cees Wallenburg



by Han Mommaas



Currently, GustoMSC is participating in two Joint Industry Projects named 'Current Affairs' and 'CresT'. Both projects were initiated and are being managed by MARIN in the Netherlands and have a duration of about two years.

The Current Affairs JIP aims at the following main aspects:

- provide insight into current-related phenomena such as vortex induced motions, boundary layer separation and shielding/interaction between columns
- provide a tool for current load estimation
- perform model testing to generate a database for loads on multi column types of structures (semi-submersible and TLP)
- compare the model test results with CFD (computational fluid dynamics) calculations and provide guidance on the use of such programs
- Provide Best Practice Guidelines for CFD estimation of current coefficients
- Benchmark different commercial and research CFD software on given test cases



A common problem in the design of Semi-Submersibles, TLPs and Jack-Ups is the size of the airgap needed to keep the deck above the wave crest. Although some experience has already been gained, measurements made during hurricanes in the Gulf of Mexico indicated that the statistics of extreme waves are more complex than the usual approach based on the Rayleigh distribution. Therefore, this JIP was initiated with the aim of developing models for extreme waves so as to arrive at a design methodology for the loading and response to such extreme waves. For this purpose, various aspects are looked at, including analysis of actual measurements, hindcasting of extreme seas, statistics of extreme waves and loading due to these extreme waves.

The study covers both theoretical work as well as analysis of data from full scale measurements and from long duration testing in the wave basin. The model basin test allowed for a detailed measurement of the development of the wave profile over time. This was achieved by using an array of wave sensors. The testing has allowed insight to be obtained in the degree of coupling of the various first and second order components leading to the extreme wave event.

## GustoMSC participation in Joint Industry Projects



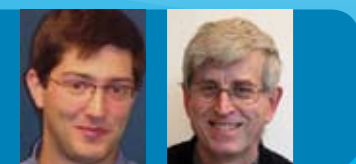
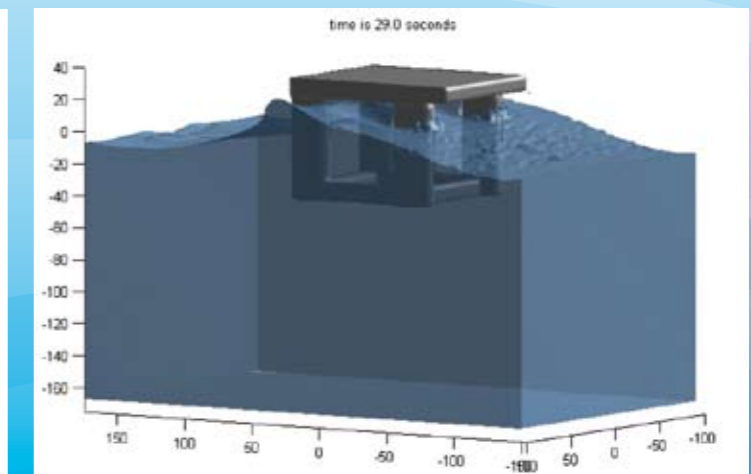
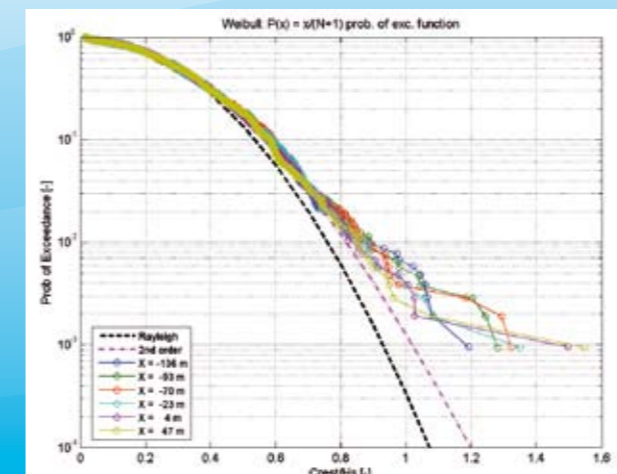
Numerous tests at MARIN's large towing basin have already provided a wealth of information on the effects of current on various underwater shapes. The test data are used for comparison via blind and optimized calculation with several CFD programs. The CFD calculations as performed by GustoMSC are carried out with the CFX software package.

All results and test data are made available to all participants. Having contributions from various sources allows for a comparison of the differences in calculation method as influenced by:

- grid size and type
- time step
- numerical scheme
- convergence criteria
- turbulence model used

The figures show some examples of a model used for these tests and CFD results.

Further information can be found on: [www.marin.nl](http://www.marin.nl)



by Michael Gachet and Joost van Santen

# ATWOOD FALCON Upgrade III



ATWOOD OCEANICS, INC. is an international offshore drilling contractor. Its current fleet consists of eight active, wholly-owned drilling units which includes three semi-submersibles capable of drilling in up to 5,000 feet of water, one semi-submersible capable of drilling in up to 2,000 feet of water, one 400 feet cantilever jack-up, one 300 feet cantilever jack-up, one semi-submersible self-erecting tender-assist rig, and one submersible.

The ATWOOD FALCON is an upgraded Korkut New Era semi-submersible constructed in 1983 and capable of drilling in water depths of up to 5,000 ft. It underwent water depth upgrades in 1998 and 2006 which included the addition of pontoon sponsons and column blisters as well as mooring and tensioning equipment replacement. Since the upgrade, the rig has participated in the massive four (4) year Malampaya Gas Project for Shell in the Philippines and has worked throughout Southeast Asia from Australia to Japan, China and Malaysia. The rig is currently operating offshore Malaysia under a long-term commitment with Shell that extends to July 2009.

For this latest contract, Atwood Oceanics contracted GustoMSC for the following scope of work:

- Design of new local structures such as:
  - Support structure for new aluminum helideck pancake
  - Forward and aft lifeboat platforms
  - 3rd party storage platform
  - Forward column access ways
  - Pedestal and associated reinforcement required to support a new port rig crane to replace the existing one at a new location on the deck
  
- Naval architectural and global structural analysis such as:
  - Global and redundancy analysis performed using plated model created with ANSYS analysis software. The ATWOOD FALCON was analyzed for mild environmental conditions such as Gulf of Mexico, Southeast Asia, and Mediterranean utilizing design waves selected according to the ABS Rules deterministic method.
  - Fatigue analysis
  - Stability analysis

Two new cross pontoons, 20' wide and 9' high, are being added transversely in between the corner columns of the unit to mitigate the following issues:

- The weight distribution used for the analysis reflects the latest lightship estimate of the unit, including the weight of the new local structures mentioned above. Because of the lightship increase, additional buoyancy is needed to maintain the VDL (Variable Deck Load) capacity at transit draft.
- ATWOOD OCEANICS wishes to extend the fatigue life of the unit. All new and existing connections will have a minimum REMAINING fatigue life of 20 years as specified by ABS. This requires evaluation of the accumulated historical damage to the existing connections which is estimated using the contract history of the unit.

After completion of the analysis work in late spring, GustoMSC will proceed with the final design of the new cross pontoons and with the development of the global reinforcement dictated by the analysis.



by Olivier Sureau

# RECENT PROJECTS

## EXPLORATION PROJECTS

- Basic design package to Keppel FELS for DSS38 no. 2 and 3, for Queiroz Galvao and Scorpion Offshore
- Detailed design of a pipe barn for Parker Arkutun-Dagi Drilling Rig
- Upgrade Engineering Atwood Falcon
- Upgrade Engineering GSP Saturn
- Supply of a thruster retrieval system for "Bully II", for Frontier Drilling

## CONSTRUCTION PROJECTS

- Basic design, two sets of jacking systems and two 1,000 ton cranes for two wind turbine installation units, for Resolution Shipping
- Basic design package of a second NG2500X jack-up for Gulf Marine Services, including delivery of jacking system

# IMPORTANT DATES

## 3 – 5 December 2008

Deep Offshore Technology International Conference & Exhibition Asia Pacific, Perth

## 3 – 5 February 2009

DOT International Conference & Exhibition, New Orleans

## 16 – 19 March 2009

European Wind Energy Conference & Exhibition, Marseille

## 17 – 19 March 2009

SPE/IADC Drilling Conference & Exhibition, Amsterdam

## 31 March – 2 April 2009

MCE Deepwater Development Conference & Exhibition, Copenhagen

## 4 - 7 May 2009

Offshore Technology Conference & Exhibition, Houston

## GustoMSC

### Applications for offshore energy

Exploration	Construction	Production	
			Jack-up
			Semi-submersible
			Vessel

# COLOFON

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