

INSIDE

MAY 2018 #29

REFLECTING ON SAFETY

GustoMSC



THE PIONEERS OF OFFSHORE ENGINEERING

CONTENTS

4 UP-TO-DATE AND AGENDA

- Lamprell / GustoMSC LJ43 design selected by IMI and ARO Drilling.
- How GustoMSC helped move three of the world's largest jack-ups.
- GustoMSC involved in Jacket Lift System beams design of Allseas' Pioneering Spirit.

10 FACTS & FIGURES

The OCEAN1100-HE: A safe working environment in the harshest conditions.

22 OPERATING IN ITS ELEMENT

In our last issue we wrote about the GustoMSC Rainbow crane. Now see it in action as it installs its first wind turbines in China.

23 PIONEERING TECHNOLOGY

Safely pushing the boundaries with jack-up & crane dynamic response analysis.



12

GUSTO MSC INSIDE OUT FROM EVOLUTION TO REVOLUTION

Driven by the quest for ever greater safety and efficiency, constant innovation and development are a must for GustoMSC.



16

CHELA RISK ASSESSMENT COLLABORATING IN SAFETY AT SEA

GustoMSC, along with its partners Aker BP, DNV GL, JB systems, Maersk Drilling and Statoil, performed a risk assessment on its newly re-named smart crane, Chela. Find out how this contributes to GustoMSC's vision of performing safe operations at sea.



KNRM SEARCH AND RESCUE AT SEA

An insight into the Royal Netherlands Sea Rescue Institution (KNRM) and its commitment to keeping people safe at sea.



18

INTERVIEW GEOSEA

For GeoSea, the specialist in complex offshore marine engineering projects, part of the Belgian DEME Group, safety is the number one priority. Attention to safety goes beyond rules and procedures to permeate all facets of the company's operations. We talk to GeoSea's directors, Koen Vanderbeke and Bart De Poorter.

COLOPHON

GustoMSC InSide is a publication of GustoMSC B.V.

Total circulation: 3,000
Edition 29, May 2018

Editing, design and production
Total Identity, Amsterdam

Editors
Sieds de Boer
Lizanne Schipper
Lucas Ligtenberg
Monique van der Have
Sjoerd Hendriks
Tessa Vleugels

Design, photography and illustrations
Karoly Effenberger
Arjen Firet
Adam Lane
Leroy Manuhutu / MyLee Media
Julius van der Woude

GustoMSC
Karel Doormanweg 35
3115 JD Schiedam
The Netherlands
+31 (0)10 2883 000
info@gustomsc.com

www.gustomsc.com

All editorial material is the property of GustoMSC and may therefore not be copied or reproduced without our approval.

PREFACE REFLECTING ON SAFETY



Dear readers,

The general outlook has become brighter in the past months for GustoMSC. We are honored and excited that ARO Drilling and the shipyard IMI have selected the LJ43 design for their 20-rig new build program in Saudi Arabia. The LJ43 has been jointly developed with Lamprell, which is the rig technology partner in the IMI shipyard joint venture. We particularly enjoyed the cooperation with the ARO team, who turned out to be very open minded in its rig design selection process. We have improved the rig's efficiency in particular by introducing GustoMSC's new blowout preventer carrier system that is integrated in our standard and unique X-Y cantilever. The carrier significantly saves well construction time and provides safe handling of BOP components. In addition, we are pleased with Maersk as a launching customer for Chela, our cantilever-mounted crane which we have further developed since its concept introduction in 2016. Due to its crablike motion characteristics, the key attributes of Chela are significantly improving operational efficiency: less well construction time by simultaneous operations; as well as much improved safety by almost full lifting coverage under the cantilever and no more hand-shakes of loads lifted from the rigs deck.

Both these successes originate from our continuous focus on improving operational efficiency and safety of the mobile offshore units we design. This edition of InSide further elaborates on GustoMSC's safety focus. We are very pleased that one of our oldest and biggest clients for construction jack-ups, GeoSea, has been so kind as to share its high safety ambitions and practices. In an interview with Koen Vanderbeke, operational manager, and Bart De Poorter, financial manager, they illustrate that complying with the highest safety standards also brings an important role for management and the establishment of a positive health and safety culture.

The main focus of our work related to safety is to design our mobile offshore units and equipment in such a manner that they are inherently safe. However, incidents still happen at sea, which is why we decided years ago to sponsor the Royal Netherlands Sea Rescue Institution (KNRM). In an interview with KNRM, we are given an insight into how the KNRM does its utmost to ensure that everyone – both the victims and the KNRM crew – gets home safely at the end of the day. We discuss how cooperation with the offshore industry, sharing knowledge, training,

technical progress and the right mentality are key when making the Dutch seas and waterways safer.

In accordance with our company's mission, we aim to eliminate hazards and reduce risks over the whole life cycle of our designs and equipment. In order to do so, we are constantly developing the required knowhow and overall understanding of our clients' offshore operations. We are always up for the mutual challenge of bringing safety levels to new records in the near future.

We hope you enjoy reading this new edition of InSide magazine and be safe.

Nils van Nood
CEO GustoMSC

UP-TO-DATE



LAMPRELL / GUSTOMSC LJ43 DESIGN SELECTED BY IMI AND ARO DRILLING

International Maritime Industries (IMI) and their drilling client, Saudi Aramco Rowan Offshore Drilling Company (ARO Drilling), have selected the Lamprell/GustoMSC LJ43 design as the base for the drilling jack-ups

which are to be built at the new IMI yard in Ras Al Khair, eastern Saudi Arabia. The LJ43 design has been developed by Lamprell and GustoMSC, with a view to meeting ARO Drilling's specific operational needs and

drilling requirements for use in the Gulf region.

Lamprell and GustoMSC are collaborating on the LJ43 drilling jack-up design which translates into a combination of the robust and advanced technology of GustoMSC designs, as well as Lamprell's system integration capability, detailed engineering expertise and construction experience. The design is a further development of the well-established CJ46 and CJ50 worldwide operating drilling jack-ups and is tailored to the local footprint dimensions. Designed to operate in water depths up to 200 feet, it features field proven GustoMSC's sturdy X-bracing leg design, jacking systems as well as enhanced skidding capabilities via the X-Y cantilever system. This LJ43 design is targeting the highest level of safe, efficient and reliable drilling in the Middle East region.

ARO Drilling has announced plans to order at least 20 drilling jack-up rigs for construction at the new IMI yard. It is anticipated that engineering, procurement and construction of the first rig will begin in July 2018.

Rutger Baan
Commercial Director



The keel laying ceremony of Penta-Ocean's GJ-3750C took place last October 2017. Mr. Takuzo Shimizu, President of Penta-Ocean Construction Co. Ltd., Mr. Shinjiro Mishima, President of Japan Marine United and Mr. Kenshi Hino, President of JMU Amtec pressed the ceremonial button together and prayed for safety during the construction phase. Modified to Penta-Ocean's requirements, the GJ-3750C design is the first jack-up vessel that is being built in Japan. It will be used for wind and civil construction projects off the coast of Japan.

PROGRESS CONSTRUCTION OF THE GJ-3750C

Penta-Ocean, one of the largest civil construction companies in Japan, ordered the GJ-3750C at the JMU Shipyard in the summer of 2016. JMU's Tokyo office is executing the detailed design, and thanks to the fast delivery

of the robust basic design, the construction is proceeding quickly. The first sets of the jacking system were delivered already in June 2017. This jacking system is a new 3750C continuous jacking system, a derivative from the larger and proven systems used in the NG-9000Cs and NG-5500C. The entire project is being built under Class NK, and will be the largest DP jack-up registered by Class NK.

On March 16th this year the hull was launched and is being outfitted at the shipyard. The project is progressing well and on schedule, thanks to the excellent cooperation between Penta-Ocean, JMU, JMU-Amtec, Class NK and the GustoMSC team.

Jan-Mark Meeuwisse
Commercial Director

GUSTOMSC RAINBOW CRANE II COMMISSIONING AND LOAD TEST

In November 2017, the second leg encircling crane in collaboration with manufacturer Rainbow finished commissioning and completed the load test. The load test consisted of a main hoist functional 1,000 t and overload 1,100 t test (unsplit main block), a main hoist functional 500 t and overload 550 t test (split main block) and an aux hoist functional 100 t and overload 110 t test. Also both the tugger and sling handling hooks were tested. All tests were completed successfully.

GustoMSC/Rainbow crane II is an exact copy of the first crane; a 1,000 t leg crane which is a further development of our successful series of 800 and 900 t leg cranes of which five were delivered in the period 2011-2014. GustoMSC delivered the basic design for the crane and associated key components, mainly comprising of the slewing bearing system and the electrical and control system. The leg crane is mounted around one of the legs of the unit and is generally used for installation and maintenance of wind turbines.

In 2015, GustoMSC signed a collaboration agreement with Nantong-based crane manufacturer Rainbow for the manufacturing of these leg encircling cranes. The first GustoMSC/Rainbow crane already installed the first wind turbines in August 2017.

Assistance and training by GustoMSC and Rainbow were provided during the installation of these first wind turbines.

Arjo van Putten
Project Manager Cranes



CJ70 RIGS MOVE ASSISTANCE

After a few months waiting for suitable weather windows, West Elara, Askepott and Askeladden - three of the world's largest jack-ups - were recently moved to new locations with the assistance of GustoMSC. We performed site-specific assessments, installation assessments, and on-board assistance during the jacking operations of these giants. All three jack-ups were built with GustoMSC's CJ70 design. Our assistance with these rig moves illustrates that our involvement does not end after delivery of our design and equipment. In over 200 projects per year, GustoMSC provides services for units and equipment in operation.

Seadrill's West Elara was moved from the Valemon field in the North Sea to Hanøytangen just outside Bergen, Norway. In Hanøytangen, the platform

will be upgraded for a 10-year contract with ConocoPhillips on the Ekofisk-Field in the North Sea.

Statoil's brand new jack-ups Askepott and Askeladden have been moved to locations for their first jobs. Both units will be operated by KCA Deutag. Askepott will perform drilling activities on the unmanned wellhead platform Oseberg Vestflanken 2. The water depth at this location is 109 m. It will remain here for about 2.5 years to drill a total of nine wells. Askeladden is going to perform well maintenance to existing wells on a subsea template at a water depth of 135 meters on Gullfaks I. According to plan, the jack-up will move several times a year to different templates in the Gullfaks area.

Frank Scheffer
Manager Customer Service



GUSTOMSC INVOLVED IN JACKET LIFT SYSTEM BEAMS DESIGN OF ALLSEAS' PIONEERING SPIRIT

GustoMSC has been awarded a contract to perform design and engineering services for the Jacket Lift System (JLS) beams of Allseas' platform installation and removal vessel Pioneering Spirit. Pioneering Spirit is already able to remove topsides up to 48,000 t using the Topside Lift System (TLS) at the bow of the vessel. With the addition of the two 170 m long

JLS-beams, Pioneering Spirit can also install and remove jacket structures and modules up to 20,000 t. The JLS is located at the stern of Pioneering Spirit.

The jacket lift system beams raise the jacket at the main legs. The jacket is subsequently reclined onto the vessel deck and skidded further inboard.

GustoMSC is responsible for the basic and detailed design of the JLS-beams steel structure. Furthermore, GustoMSC provides mechanical assistance for the sub-systems connected to the JLS-beam, such as the main hoist, the derrick hoist, the skidding system and the main hinge. GustoMSC is proud to work together with Allseas on this unique and innovative design. It shows GustoMSC's dedication to deliver services over a large range of products.

Koen Legrand
Lead Structural Engineer

AGENDA

30 APRIL – 3 MAY 2018
OTC HOUSTON
HOUSTON
Stand 3567

10 – 15 JUNE 2018
ISOPE
SAPPORO

Paper: Using CFD to predict the breaking wave forces on cylindrical jack-up legs near a steeply declining seabed

17 – 22 JUNE 2018
OMAE
MADRID

Paper: Coupled dynamics of a Vertical Axis Wind Turbine (VAWT) with active blade pitch control on a semi-submersible floater
Paper: Effect of moonpool shape and dimensions on drillship operability

19 – 20 JUNE 2018
GLOBAL OFFSHORE WIND
MANCHESTER
Stand 118

27 – 30 AUGUST 2018
ONS
STAVANGER

Participation in the Dutch Pavilion

13 – 14 SEPTEMBER 2018
OFFSHORE WIND SUMMIT
HOUSTON

Presentation: Assessment of requirements and solutions for US Jones Act compliant installation vessels

25 – 28 SEPTEMBER 2018
WINDENERGY HAMBURG
HAMBURG

Stand 502 Hall B7

12 – 15 NOVEMBER 2018
ADIPEC
ABU DHABI

Participation in the Dutch Pavilion

SEARCH AND RESCUE AT SEA

ALWAYS IN THE HIGHEST STATE OF READINESS

The Netherlands has been conducting a fierce battle against the sea for ages. After all, more than half of the country is prone to flooding and that is why we keep the sea at a safe distance with dikes and dams. In addition, the Netherlands has a professional rescue organization that is always ready to ensure safety at sea: the Royal Netherlands Sea Rescue Institution (KNRM).



IN 2016:

2,349

RESCUE MISSIONS & ASSISTANCES

3,974

PEOPLE RESCUED

1,300

VOLUNTEERS

90,000

CONTRIBUTORS

Safety at sea is an important topic for both GustoMSC and the KNRM. The KNRM lifesaving service is funded entirely by voluntary contributions, donations and legacies. All contributions are spent directly on saving lives at sea. That is why GustoMSC is a proud sponsor of the KNRM. With support from GustoMSC, KNRM has trained an additional 13 certified lifeguards.

The KNRM has been operating as an independent rescue organization in the territory of the Netherlands Coast-guard since 1824. Every year, about 1,300 professionally-trained KNRM volunteers rescue over 3,000 people at sea and on inland waterways.

A real vocation

The volunteers are stand-by 24 hours a day to go out on rescue missions under all weather conditions. In order to make the Dutch seas and waterways safer, the KNRM volunteers regularly enter into high-risk situations to rescue others. Needless to say, the KNRM does its utmost to ensure that everyone – both the people in danger and the KNRM crew – gets home safely at the end of the day.

An important part of safety at sea is the cooperation with the maritime industry, for example, in joint training sessions. We arranged to meet with Edward Zwitter, who is responsible for the KNRM's business network, and Riemert Moleman, head of technical & operational service, at the maritime training center of STC-KNRM in Rotterdam, where the most realistic, and quite spectacular, training simulations take place in special facilities.

“Our training center,” Edward states enthusiastically, “reflects our mission: rescuing people. We do that now in a very professional manner – and good and intensive training contributes substantially to this. This was not always the case, as historically the KNRM has gone through a long development. It started long ago with a small rowboat that went out from shore to help a large stranded ship. As time went by, technological progress fortunately offered more possibilities and the rescue boats became larger. They also offered more and more possibilities to deal with various disaster scenarios.”

According to Edward and Riemert, this also contributed to a change in the KNRM's culture: “Our approach is a lot different today than it was in the past. In addition to a reactive approach, we now also make use of a proactive approach. We make optimal use of sharing knowledge – and you also see this reflected in the KNRM's prevention program which mainly centers on awareness.”

Awareness

In response to the question whether there are interesting technological developments in this area, they reply: “An interesting new technological development is, for example, our new app ‘KNRM helps’. Of course, our organization also keeps up with the times. Not everyone has a marine phone, but everyone does have a smart phone these days. So, then you have to make use of that.” And it is clearly a success, thousands of people at sea and on inland waterways are making use of it – free of charge as our services are always provided free of charge.

Courtesy: KNRM



“After all, as a rescue organization, we have to offer the best guarantee for safety!”

“A significant reduction of the G-forces and noise levels was crucial in the development of the new KNRM all-weather boat.”

Edward Zwitter

Riemert Moleman

Edward: “It is very functional in use: it helps determine the ship’s position via a simple button. Users can also submit a shipping route plan – in the event of a ‘no show’ and the absence of contact, an alarm signal will be sent out. The app also provides support for the timely finding of fueling stations. You can imagine that it is thus possible to avoid a lot of ‘unnecessary trouble!’ ... “Yes,” Edward confirms, “and, moreover, we only have to launch a rescue mission when it is really necessary – and that saves time and money.”

Nevertheless, the KNRM’s rescue activities remain people’s business, Edward and Riemert both agree, “We train our people in a wide range of activities. You can imagine that the conditions under which rescue activities are carried out can be very severe. Just take, for example, physical complaints such as seasickness. In this case, you cannot just disembark. The mission has to continue, and you will have to just pull through. This does require a certain amount of stamina.”

But the work is also mentally challenging: “We come from a culture in which the older generation is not used to expressing its emotions. And with disasters at sea, you can be confronted with heart-rending suffering. Therefore, we always make sure that several crew members have followed a trauma recognition course so they can help others deal with stressful situations.”

A person’s mental state is one of the largest challenges in rescue work. According to Edward, you do see a change in this among the new generation of volunteers: “The present generation aims for a better life – volunteer work balance. In the past, there was more of an ‘everything or nothing’ mentality. It is a challenge for our organization to maintain the balance in the comradeship among the crew and avoid a generation gap.”

Safety as common goal

Comradeship brings us to the topic of collaboration. Edward then names the IMRF or the International Maritime Rescue Federation: “Knowledge is shared worldwide through this organization. All ‘serious’ rescue organizations are members of the IMRF. The directors meet regularly to discuss matters and the technical services also exchange a lot of information. In this manner, we don’t always have to discover the wheel again – after all we have a common goal.”

“Of course, that is not to say that everything is adopted immediately,” he continues his story. “For instance, Britain has a rocky coast – therefore, they face dilemmas that we do not have to think about, and that is also the case the other way around. Therefore, different countries work with different types of boats, simply because the specific working area demands that. Nevertheless, sufficient shared issues remain, so consulting with each other does offer a lot of added value.”

Edward and Riemert indicate that the Netherlands and the UK are leading in rescue work at sea: “The British rescue organization Royal National Lifeboat Institution (RNLI) was founded in the same month as the KNRM – around two hundred years ago and based on the same principles. In this case, it is about the following principles:

1. Rescue is free of charge for the person in need of assistance.
2. Rescuers are professional volunteers.
3. Rescue work is paid completely with voluntary contributions.”

How is it possible that such a relatively small country can deliver such an impressive performance? “Besides the huge effort of our volunteers, this is also due to our self-governing status,” they explain. “We are an independent organization. We determine our own priorities and innovate exactly where and when we consider this necessary. Because of this independent position, we do not receive any government support. The voluntary donations of many contributors enable KNRM to carry out its rescue work.”

The importance of technological progress

Edward spontaneously cites the following striking example: “This is the prototype of our new all-weather boat Nh1816. The boat was financed by an insurance company. Our point of departure for this new prototype was mainly the improvement of the features of the boat for the crew. For instance, the G forces during a storm have been reduced considerably thanks to the installation of an axe bow. This results in less slamming and vibrations, as the boat cuts through the water more sharply. In addition, the noise level in the boat has been reduced by nearly half: from 90 to 50 decibels.”

“The focus of our technological innovation is improving the working conditions. It is actually very simple. The rescue missions are then less tiring for the crew and are carried out more safely,” according to Edward. “And such innovations also have a practical advantage; after a rescue mission, the crew members have to resume their regular jobs. And we keep their employers happy as well when their personnel can function properly when they return to their jobs!”

Combining knowledge is the best way to make progress. “We continue to work on improving the boat. It is a combination of technical expertise and the practical knowledge. After all, the captains do not want too much technology on board, as the boat has to also remain solid.” Riemert calls this “the right balance between practical usefulness and ‘vulnerable’ technology”.

In any case, the combination of the various technological partners does give a boost to progress. Edward and Riemert cite, in particular, Damen Shipyards, Delft University of Technology and De Vries Lentsch Ship Architects, with whom the KNRM worked together on the prototype of the all-weather boat. However, the ascendancy of the offshore wind industry is also bringing new partners. For instance, the KNRM is now also working together intensively with Siemens in this area: “Fortunately ‘safety thinking’ is already very well developed at companies such as Siemens. And this, in turn, forms an impulse for us. As far as that is concerned, it is a matter of keeping up. After all, as a rescue organization, we have to offer the best guarantee for safety!”



Courtesy: KNRM

THE ALL-WEATHER SEARCH AND RESCUE BOAT NH1816

“The Nh1816 is the first rescue boat of a new class of all-weather rescue boats.” According to Riemert Moleman “We developed this new generation of all-weather rescue boats together with Damen Shipyards, Delft University of Technology and De Vries Lentsch Ships Architects. The Nh1816 is the result of a successful combination of innovative technology and years of experience in carrying out rescue missions under extreme weather conditions. The main priority in the design was increasing the wellbeing of the crew and the safety on board.”

Riemert: “With its new all-weather rescue boat Nh1816, the KNRM has succeeded in resolving two major issues regarding the wellbeing of the KNRM crew members:

- A reduction of the noise level by nearly 50%
- A significant reduction of the G-forces

These two aspects were addressed in the Nh1816 by:

- designing a new cabin with a maximum noise level of 70dBA
- opting for an axe bow that allows the boat to cut through water more sharply in order to reduce slamming and vibrations
- installing special seats to reduce whole body vibration and repeated shocks.”

Specifications

Weight	33.6 tons
Dimensions	19.30 x 6.54 x 1.10 m
Engine capacity	2 x 1200 pk
Maximum Speed	31 knots
Capacity	120 rescued persons
Crew	6 persons

STC-KNRM TRAINING CENTRE

STC-KNRM is an offshore training facility situated in Rotterdam. It is a collaboration between the STC Group, a global leader in the field of training and education for all marine activities, and the KNRM, a charity foundation that saves lives at sea. It is STC-KNRM’s mission to ensure that everyone working at sea can safely return to their homes.

www.stc-knrm.nl

7,500 M² DECK AREA

OCEAN1100-HE COST EFFICIENT PERFORMANCE IN HARSH ENVIRONMENTS

Harsh environment drilling solutions call for a focus on safety and enabling high uptime. Based on a large portfolio of successful semi-submersible units, GustoMSC launched a series of OCEAN-HE semi-submersible designs, ranging from the OCEAN850-HE, a low-cost moored solution to the OCEAN1600-HE, the top of the range design. The most recent prototype of the series is the OCEAN1100-HE design.

The OCEAN-HE designs are all characterized by safe and efficient working areas, excellent motion characteristics, large airgap and low environmental loads ensuring high uptime. The OCEAN1100-HE design anticipates the expected demand as a result of harsh environment fleet renewal. The design offers a top of the range performance in a reasonable size, offering cost efficiency for operations in harsh environments. An in-house technical benchmark study on global performance criteria such as uptime, deck space and drilling load shows that the OCEAN1100-HE offers a competitive design in this market segment.

The OCEAN1100-HE design is arranged to accommodate a dual derrick drilling layout. This lay-out offers flexibility in operations as simultaneous drilling and stand building can be performed without any interference between the two. In addition, the drill floor is arranged to support easy skidding of various tools into and out of the derrick footprint, allowing safe and efficient handling in all weather conditions. The main deck is laid out for forklift operations for secure and easy handling of drilling and auxiliary equipment without requiring deck cranes.

The spacious moon pool area offers two-way unrestricted access to the well center. This arrangement allows independent handling of the BOP from one side and subsea trees and auxiliary equipment from the other side of the moon pool. Dedicated moon pool carts, main deck skidding systems, and enclosed working areas with overhead cranes can efficiently and safely handle subsea equipment sheltered from the elements.

The mud system is based on a separate completion and drilling fluid system, where the drilling fluid system is split in an oil base and a water base system.

The design offers flexibility with respect to station keeping lay-out. It can accommodate a full DP3 dynamic positioning system with 8 thrusters combined with 8 to 12 mooring lines, or it can be fitted with a 12 to 16 line mooring system with assistance of 4 thrusters. In both cases, the unit will be self-propelled.

The OCEAN1100-HE semi-submersible is designed to the highest standards to offer a cost-efficient unit for safe and efficient drilling operations in harsh environments.

Robbert Kant
Design Manager Semi-Submersibles



OPTIMIZED DRILLING DUAL DERRICK

Simultaneous operations and optimized logistics

STATION KEEPING DP3 & MOORING

Various possibilities for station keeping:

- Dynamic Positioning
- Thruster assist mooring
- Mooring only with up to 16 lines

HARSH ENVIRONMENT OPTIMIZED COLUMN SHAPE

The shape reduces environmental loads

LARGE VARIABLE DECK LOAD 14,000-MT

High variable loads offers flexibility in operations

LARGE DECK AREA 7,500 M²

Suitable for various drilling and completion operations

SIMPLE CONSTRUCTION TRANSVERSE BRACINGS ONLY

Low cost building and easy inspection

FROM EVOLUTION TO REVOLUTION

“What customers ask for is evolutionary, while we ourselves try to be revolutionary. We have to respond to what customers will be asking for in the years to come. We always try to stay ahead of the game.”

Remco van der List

“We don't physically build any of our products in our office we conceive them.”

Jeroen van Dop

For GustoMSC constant innovation and development are a must. Major drivers here are greater safety and increased efficiency. Teams of employees brainstorm on how they can push boundaries and take designs a step further.

We design different mobile offshore unit types, ranging from floating units for deeper waters, such as all kind of vessels and semi-submersibles, to various jack-ups for shallower waters, distinguished by three-leg jack-ups and four-leg jack-ups. Safety is of the greatest importance in the design process of these units as in our field even the slightest miscalculation can have huge consequences. Any situation where safety is an issue attracts a lot of media attention. Examples that come to mind are the Macondo disaster in the Gulf of Mexico in 2010 and the loss of the platform Piper Alpha, a little longer ago, in 1988. These are cases that are widely known and have made a lasting impression on the public consciousness.

Safety is our responsibility

The general aspects of the mobile offshore units that we design are our responsibility, while the day-to-day use of the mission equipment, such as the drilling equipment or wind turbine installation crane, is the responsibility of the contractor or field owner. Integral structural safety and operational safety fall under our responsibility because they are closely related to the design of the unit.

The most important aspect of safety is that the unit must not capsize during transit or at its operational location. It sounds very basic, but it requires specialist work. The units and the associated equipment that we design and supply have to be able to operate and survive in its intended environment. The number of environmental factors that play a role are innumerable. In that respect, our geographical location, close to the North Sea, gives us an advantage since it has one of the harshest environments in the world and we have a long history of designing units for this area. With the required advanced technology, we are then able to apply this to other parts of the world where the conditions are less severe, but still require a similar safety level.

This is the second article in a series, addressing developments around the theme of 'working safely and highly efficiently at sea'. In this article, Remco van der List, member of the GustoMSC Management Team and Jeroen van Dop, Senior Patent Engineer, will shed light on our hands-on approach to constantly improving on performance while safeguarding the overall safety of the unit and its operation. A team effort from brainstorm sessions to groundbreaking products.



Remco van der List (l)
Remco van der List's current position at GustoMSC is Manager Designs and as such he is responsible for the technical and commercial viability of all GustoMSC jack-up, semi-submersible and vessel designs. In addition, he is responsible for the Research & Development efforts within the company, including all intellectual property related matters. He graduated from the Delft University of Technology in the Civil Engineering department with a specialization in Offshore Construction in 1998 and started working at GustoMSC directly after graduating. His previous positions include Design Manager Jack-ups and Project Manager.

Jeroen van Dop
Jeroen van Dop is Senior Patent Engineer at GustoMSC, responsible for securing intellectual property rights, maintaining the portfolio and assessing patent information. He graduated from the TH Rijswijk (BSc), now part of 'The Hague University of Applied Sciences', in the Mechanical Engineering department with a specialization in Product Development. After having had various engineering positions, his career took a turn when he became a patent consultant at an international construction company. Meanwhile, he looks back on 18 years of experience in intellectual property, gained in various positions at Dutch government institutions as well as innovative industrial companies.

We have to meet a minimum safety classification level, but we feel it is necessary to go beyond that and do not take any shortcuts. The relevant industry standards change every year and typically become stricter, which usually has little effect on our designs because we already apply our own advanced and safe standards. In the past, we used to work out how to make something using pen and paper and manual calculators, but now we have almost limitless computer capacity to do all that calculation work. By applying all this computational power, the units we design now are lighter and more efficient, and therefore less expensive in terms of materials and fuel. But it also means that available reserve capacity of the units is becoming less and less.

In the old days, units used to have too much steel, so in one way they were safer than was strictly necessary. But instead of by design this was mainly due to lack of knowledge and the state of technology. Nowadays, we can find the most optimal solution that is as light as possible but still meets the required safety levels. The result of this general industry trend is that, as a company, we have to invest in new technology and keep our knowledge at the cutting edge in order to stay ahead of the competition.

Knowledge base

Optimum safety remains the priority – that is not something you can skimp on. And the laws of physics never change, so neither do the main principles you apply. But what can change is how you use your materials. Over the past thirty years, we have acquired a massive amount of knowledge in a whole range of fields, from structural design to floating stability, mooring, dynamic positioning using thrusters and most recently Computation Fluid Dynamics. Using this knowledge, you can change the design of, for example, the jack-up legs as you learn more about how they are affected by the waves. You have to determine the extent to which the jack-up can move and sway with the waves by looking closely at the dynamics involved, requiring a lot of expertise on soil behavior and structural properties. You can compare it to the technique used for building skyscrapers, which has also evolved over time and skyscrapers are also very slender but

heavy structures and are being built to ever increasing heights. We see a similar trend for jack-ups as they are being used in ever deeper water in the harshest parts of the world.

During the design process, we can work out anything to the finest detail, but if it turns out that the particular location at which the unit will be work is different from our assumptions, which it usually always is, you still have to do a re-assessment of your design. That is why we can also provide site-specific assessments as an additional part of our services, in which we determine if the unit is safe to operate at that location or whether modifications are necessary. We do not generally have extensive discussions with our customers about the technology behind our calculations. They expect us to possess the relevant knowledge and that is why they come to us. They know what they have to ask and we provide what they request. However, some customers have their own specific additional requirements, so in those cases we may need to get out our calculators.

Much of our knowledge is found in the people who design our units and equipment and who have many years of experience. A really important aspect of the design process is the collaboration between the people in our different fields of expertise, as one single design choice may have an impact across many disciplines and you therefore cannot make design decisions in isolation. Add in all the advanced technology, and the links

between people and the various departments is where the strength of our company lies. We therefore continue to actively develop and innovate across the board: you simply cannot drop a single aspect, because it will affect the whole design process and within a few years you will be lagging hopelessly behind.

Pioneering

We have to be prepared for what customers will be asking for in the years to come. This usually results in evolutionary development of the next generation of existing products and technology. On top of that, we need to conceive new products and technologies that set us apart from the competition and that draw customers to us. We have set ourselves the target to be revolutionary to stay ahead of the game.

One of the opportunities to revolutionize the way units are operated is increasing the level of automation. This will increase operational efficiency and improve safety. Automation means a reduction in the operational involvement of people, thereby minimizing human error and, in many cases, even eliminating it altogether. This happened already a long time ago for the dynamic position of units, where computers have taken over control of the unit and its station keeping at a location and almost no human interaction is required any longer. If, with a jack-up, you do not need to press all kinds of buttons or push joysticks in order to lower or raise the legs, but instead can achieve this through automation and on-the-fly assessment of safety levels during the installation phases, you can make progress. The aim is therefore to have as much work as possible transferred from the operators to automation.

New inventions

We devise solutions for our clients and actively pursue innovation. Sometimes, new ideas for products come from one person within our organization, but due to the complexity and interdependence a lot of times it originates from within a small group of colleagues. And occasionally, we actively form teams to create something new in a direction we believe has a lot of potential. For example, we looked at the blades of wind turbines and how they should be attached to the nacelle, even in adverse weather conditions and increasing size and weight of the components to be installed. As turbines grow in size, the blade sizes increase and are more susceptible to wind forces (what they are designed to do once they are installed) during the final stage of installation. One of our solutions is our telescopic crane, providing a very high lifting point in order to reach the nacelle while still having a short boom during the transit phase. We are also developing methods to better understand the combined jack-up and crane boom behavior as well as finding ways to have more control of the blades in the final stage of attaching them to the nacelle.

Fig. 1A

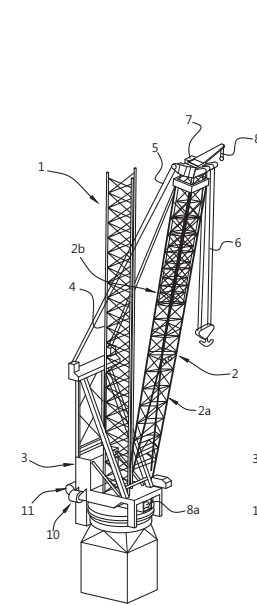
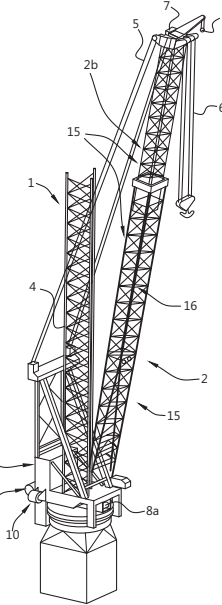


Fig. 1B



Patent drawing of GustoMSC telescopic boom

Chela, one of our recent inventions, is also the result of one of our brainstorming sessions. It was a sidetrack from our internal X-Y cantilever patent investigations and what we came up with can definitely be described as revolutionary. Chela is a type of horizontal knuckle boom crane attached to the side of a cantilever, providing access below the cantilever of a drilling jack-up for simultaneous operations or material handling, where this area is traditionally blocked from crane access by the drilling cantilever itself.

Although the industry is generally fairly conservative, we have shown that we are capable of conceiving of something groundbreaking from brainstorm sessions. How it works is that we get a group of talented and critical people together, who find all the flaws in existing concepts and tear these to shreds. Once we have razed everything to the ground, we have created the perfect mindset to come up with new ideas. That is the aim of these sessions and we are able to produce some excellent results that push out products or technology to the next level.

“If you are better able to calculate and adapt your equipment accordingly, it is easier to comply with the safety requirements.”

Remco van der List

THE PIONEERS OF OFFSHORE ENGINEERING

GustoMSC is an independent and reputable design and engineering company of mobile offshore units and equipment. In close cooperation with our clients, we translate experience, science and technical knowledge into realistic and innovative ideas. The performance of new and existing jack-ups, vessels and semi-submersibles is further optimized by our operational support and engineering consultancy. In this way, GustoMSC enables and supports safe and efficient operations at sea, contributing to a sustainable future.

“Automation improves safety because it means minimizing human error and, in many areas, perhaps even eliminating it altogether.”

Jeroen van Dop



CHELA RISK ASSESSMENT COLLABORATING IN SAFETY AT SEA

“Safety is a prerequisite offshore: it is simply expected to be at the highest level.” With this mission and vision regarding Safety at Sea, the GustoMSC Executive Board stresses the importance of the matter within and outside the company. In order to make the GustoMSC SmartCrane – just recently renamed Chela – meet this ambition, a risk assessment was performed in Stavanger, Norway, on December 6th and 7th last year.

Creating safe solutions together

When it comes to safety at sea, all stakeholders have a mutual interest in creating the safest solutions. Optimal safety can only be achieved when all stakeholders are aware of the risks. Because of this, we were all involved in a thorough risk assessment. Our partners Aker BP, DNV GL, JB systems, Maersk Drilling and Statoil willingly contributed to this event.

In the months before the assessment, it became clear during discussions with our potential clients that Chela is not only seen as a tool to upgrade efficiency, but just as much as a means to increase safety for the people working on the wellhead platform underneath the cantilever. The risk assessment was planned in order to maximize Chela’s role as a safety upgrade, while simultaneously gaining more insight into the potential new hazards that an ‘industry first’ brings.

Encountering all hazards

During the preparation phase of the risk assessment, together with DNV GL, the decision was taken to use the HAZID methodology for the assessment. In a nutshell, the HAZID methodology studies and identifies potential hazards and sets additional mitigating actions when these are required. The HAZID risk assessment workshop was prepared and facilitated by DNV GL at their local office in Stavanger. Maersk Drilling, AkerBP and Statoil contributed from an operator point of view, while GustoMSC and its vendor JB systems were present to provide a designer’s perspective.

During the risk assessment itself, the potential hazards of the crane configuration for use on and below the cantilever, necessary to provide crane coverage below the cantilever and above the wellhead platform, were considered. Other main topics in the discussion were the crane anti-collision system and the human machine interface. As Chela has two rotating arms,



“Continuous improvement of safety at sea is a key driver for developing new and innovative technical solutions. Risk assessment techniques are used to support the development; to document and track identified risks and failure modes, as well as existing safeguards and further mitigating measures.”

Erling Håland
Senior Consultant, Safety at DNV GL



“Chela will improve the safety when performing lifting operations underneath the cantilever since the crane driver is present at the location; so there are no blind lifts.”

Per Stockholm
Project Manager, Safety at Maersk Drilling



the controls are going to be different than those in a standard crane. After the second day, the workshop focused on making an inventory of all the hazards encountered which resulted in the following list of conclusions:

- The Human Machine interface (HMI), the training and the future development of site-specific lifting procedures can all have a major impact on the safety of the crane. These items were flagged with the highest priority level;
- Several other items, such as programming and verification of the anti-collision system, implementing interface signals between the crane and cantilever – which will have to be incorporated in the crane controls – were rated as actions with a medium priority;
- Several confirmation items such as an indicator of available power on the Walk Around Box (WAP), is included in the design, and together with an inclusion of the harness suppression points, was considered to have a low risk potential.



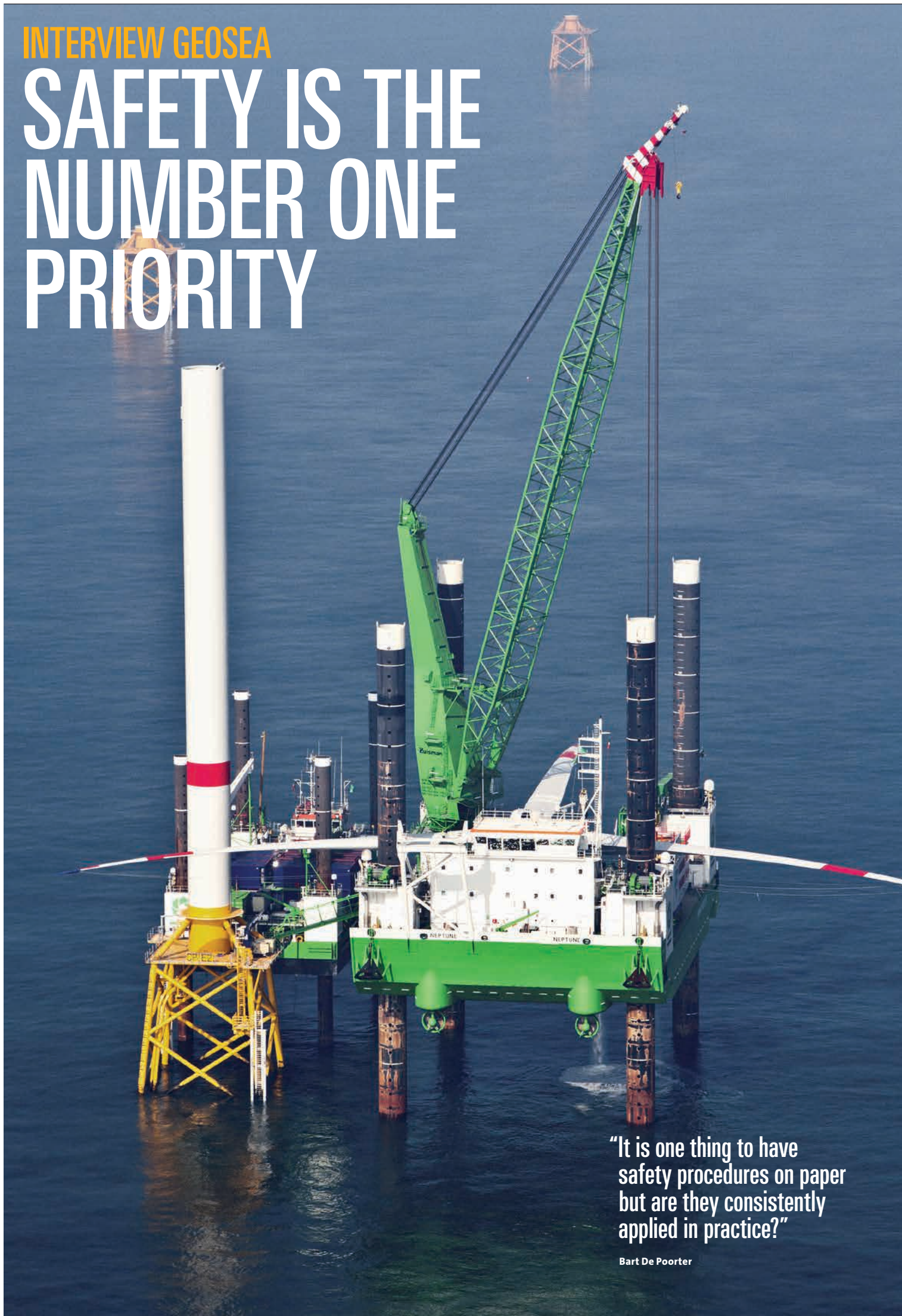
Adding efficiency and safety

The conclusions of the risk assessment provided very useful input for increasing the safety and usability of the crane. Many discoveries have already been implemented, for example, in the design of the control system of the crane. In order to test the HMI, a simulator of the crane is being built – which is almost finished now – so that a realistic experience of the intended controls can be provided. This will allow the testing of the intended controls with actual crane drivers and will ensure that, once in place, the controls of the crane will be completely intuitive.

Sibren Bonte
Project Manager Chela Team

As a designer of units and equipment that should be able to demonstrate our value in adding efficiency and safety, we are grateful that we were able to organize this risk assessment and for the attendance of all the parties involved. Therefore, once again, we would like to take the opportunity to thank AkerBP, DNV GL, Maersk Drilling, JB Systems and Statoil for contributing to the risk assessment, which allowed us to get closer to that ultimate and mutual goal: the highest level of safety at sea.

SAFETY IS THE NUMBER ONE PRIORITY



“It is one thing to have safety procedures on paper but are they consistently applied in practice?”

Bart De Poorter

Neptune (GustoMSC SEA-2500) working at the Thornton Bank offshore wind farm.

For GeoSea, the part of the Belgian DEME group that specializes in complex offshore marine engineering projects, safety is the number one priority. Attention to safety goes beyond rules and procedures to permeate all facets of the company’s operations. We talk to GeoSea’s directors, Koen Vanderbeke and Bart De Poorter.

Why is safety so important to GeoSea?

“We often work in a remote environment, exposed to the most extreme weather conditions, such as gale force winds and high waves,” explains Koen Vanderbeke. “There is no room for complacency – that’s how accidents happen.”

Bart De Poorter agrees. “We cannot work without taking every possible aspect of safety into consideration. Safety systems are fully integrated into all our procedures and it is second nature to us.”

“Times have changed,” suggests Vanderbeke. “Things were different ten or twenty years ago. People worked hard, but not always safe. Today, we have to contend with more frequent weather extremes, while projects are larger and the materials we handle are much heavier. There is pressure from all sides to prioritize safety – and quite rightly so.”

Do you mean pressure from clients?

Vanderbeke: “Clients do impose certain requirements, although we are very strict about what they can and cannot expect from us. We apply a very broad definition of ‘safety’, which encompasses both human health and environmental responsibility. We are not only concerned with the safety of our own personnel, but also of our subcontractors. We cannot claim to be a responsible partner otherwise.”

Does this affect your selection of subcontractors?

De Poorter: “Obviously, our choice will always be influenced by a number of factors. On the technical side, subcontractors must be able to supply what we need, on time and within budget. Equally important, however, is whether they can do so safely.”

Vanderbeke: “One thing we try to avoid is ‘blacklisting’ potential partners because they score below par in a safety audit. It would be easy to reject a tender outright, but that’s not going to help anyone. Provided they score well on all other aspects, we are willing to invest time and resources to help them attain the required level of safety.”

How important is certification?

De Poorter: “During the selection process, we see certification as the first step. It establishes the organization’s credentials and suggests that an effective system is in place. However, we like to dig a little deeper. It is one thing to have safety procedures on paper, but they also have to be consistently applied in practice.”

Do your staff receive regular safety training?

Vanderbeke: “Absolutely. No one can set foot on a platform without the necessary training. And we’re nothing if not thorough. Everyone is required to take a survival training course which includes learning how to escape from a ditched helicopter. I regularly go on these courses myself, because I have to set an example. Last year we invited a group of about twenty shareholders to visit an offshore platform. They were due to spend only a couple of hours there, but they had to attend a full day of survival training first.”

DEME and GeoSea have significantly reduced the number of incidents on offshore platforms. How?

De Poorter: “It did not happen overnight. An accident in Angola prompted us to introduce the CHILD programme, which stands for Colleagues Help Injuries Leave DEME. Everyone in a management position is now required to attend risk-awareness training. You can train a crew member to perfection, but it will be a waste of time and effort if the manager in charge doesn’t know what he’s doing.”

“Safety does not stand in splendid isolation it is part and parcel of everything we do.”

Koen Vanderbeke



Goliath (GustoMSC SEA-2000) able to work in various specialist areas.

Vanderbeke: “Another important aspect is our ‘no blame’ culture. No one is ever penalized for making a mistake or reporting an unsafe situation. If they were, the true cause of the problem might never come to light. In fact, the same problem would probably occur somewhere else before long. Moreover, all personnel are entitled to stop work if they believe that there is any risk to their safety. That might mean a ten-minute break while someone goes to fetch a fire blanket and an extinguisher, ‘just in case’. But it could also mean an entire vessel and its crew of a hundred stopping work for a day. It can sometimes be difficult to convince staff that this is their right. A few years ago, the CEO of DEME made a video explaining the principle, which was shown to everyone throughout the organization.”

GeoSea has a system of ‘process owners’ who are responsible for the detailed work. Does this also enhance safety?

Vanderbeke: “Yes. A risk analysis based on ‘lessons learnt’ is an important component of the process owners’ work report, although we can never be sure that anyone will actually read these lengthy documents before starting the next project. Safety must never be a question of what is ‘on file’. It is all about the interaction between people, not piles of paper. That is the key message we have to get across.”

As the largest player in offshore wind, and our oldest customer of construction jack-ups, GeoSea owns a large “GustoMSC fleet”

Vagant SEA-800 (2002)
Goliath SEA-2000 (2009)
Neptune SEA-2500 (2011)
Apollo NG-5500X (To be delivered in 2018)



Koen Vanderbeke and Bart De Poorter
Managing directors, GeoSea

Koen Vanderbeke and Bart De Poorter have been joint managing directors of DEME subsidiary GeoSea for the past five years. Vanderbeke is in charge of operations, while De Poorter is responsible for the financial side. Koen Vanderbeke has been with DEME for over twenty years, having joined as a project manager in 1996 following his graduation from Vrije Universiteit Brussel. Bart de Poorter studied structural engineering at the University of Ghent and began his career as a project engineer with Hydro Soil Services. He went on to spend over ten years with Smet-Tunnelling before joining GeoSea as assistant director in 2005.

What are the specific safety issues on an offshore platform?

De Poorter: “We have undertaken several challenging projects in recent years, working in gale force winds amid very high waves. Wind turbine components and their foundations are far heavier than in the past. Moreover, we wanted to be able to work all year round, not just in the summer. We now do so whilst maintaining the highest levels of safety. How? By introducing innovative systems and methods with the help of GustoMSC. To give one example, GustoMSC has designed extensions for the footings of one of our jack-ups for a site with soft clayey subsoils. This allows us to work in very difficult conditions by increasing the protection against additional leg penetrations during crane operations. It is not just a question of economic continuity but also one of safety. If a severe storm is on the way, we can evacuate the location quickly and easily.”

Doesn’t the use of such innovative methods make it even more difficult to meet all the safety requirements?

De Poorter: “We join GustoMSC in examining the design at the earliest possible stage. The aim is to identify any safety risks that a new technique or piece of machinery may bring. In the past, we would conduct a risk assessment after the project had been completed. Clearly, it is better to consider the operational implications beforehand. Suppose an offshore jack-up does not have the capacity to withstand the lateral forces of currents and tides. Then its crane cannot do the job for which it is intended. If you know this during the design phase, you can stay one step ahead.”

Are there new technologies that actually improve safety?

Vanderbeke: “We are developing systems that can safely and efficiently jack up structures on various types of subsoil and in various weather conditions. We are working on ‘smarter’ control systems for the cranes themselves. On standard construction sites, small cranes are now routinely operated by remote control without the need for someone in the cabin. As yet, this has never been tried with larger cranes such as ours, which can lift weights of more than one thousand tons. Why not? It is certainly worth looking into and we are now discussing the possibilities with GustoMSC.”

Are there new challenges for which technological solutions must be found?

De Poorter: “We are increasingly called upon to work in earthquake zones. We are currently involved in a project off the coast of Taiwan, for example. Clearly, we need to know how our vessel would be affected by an earthquake. Would the systems be damaged? This is a new area of study for us, in which GustoMSC could be of service. We must be able to model all conditions, including the worst-case scenario, if we are to arrive at an effective design. We can’t just go ahead and hope for the best.”

Koen Vanderbeke has the final word. “When we talk about ‘safety’, we are also talking about quality, innovation and environmental responsibility. Safety does not stand in splendid isolation: it is part and parcel of everything we do.”

“We join GustoMSC in examining the design at the earliest possible stage. The aim is to identify any safety risks that a new technique or piece of machinery may bring.”

Bart De Poorter

See page 23 for innovations focused on safely pushing the boundaries.

OPERATING IN ITS ELEMENT

GUSTOMSC RAINBOW CRANE INSTALLING FIRST OFFSHORE WIND TURBINES IN CHINA

Courtesy: GE Renewable Energy

The GustoMSC 1,000 t leg crane has successfully installed the three GE Haliade™ 150-6MW offshore wind turbines as part of the Fujian Xinghua Gulf demo project. Fujian Xinghua Gulf demo is an important project for China's ambitious plans for offshore energy.

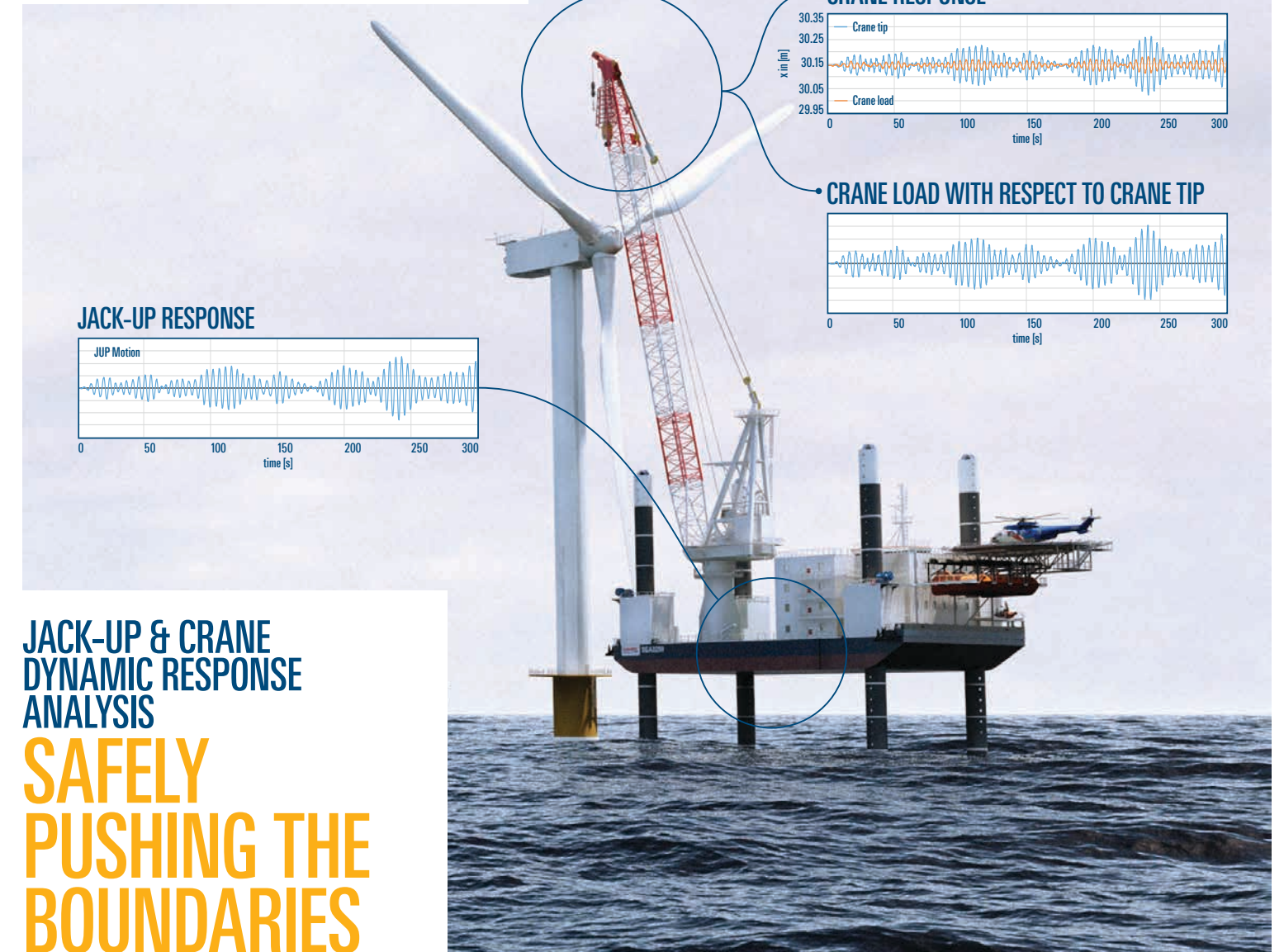
The process on site went smoothly. The GustoMSC 1,000 t leg crane has a lifting height of 110 m above the vessel deck for the installation of wind turbines. The crane is a further development of GustoMSC's successful series of 800 and 900 t leg cranes of which five were delivered in the period 2011–2014.

GE Renewable Energy is one of several wind turbine suppliers to participate in the 73 MW wind farm project which will comprise 14 wind turbines in total and is able to provide enough power to satisfy the needs of more than 20,000 households in the region.



PIONEERING TECHNOLOGY

GustoMSC focuses on designing and engineering advanced technology that helps the offshore energy market move forward. In this article, we highlight our latest innovative solutions.



JACK-UP & CRANE DYNAMIC RESPONSE ANALYSIS SAFELY PUSHING THE BOUNDARIES

Installation of a wind farm with a large number of turbines, consists of a chain of operations tailored to optimize the available weather window and eliminate schedule risks where possible. To meet the demands for installation of the current wind turbines and to anticipate the future growth of turbine weights and installation heights, the jack-up and its crane are used right up to their boundaries.

Based on the key principle of safety first, GustoMSC believes that successful wind turbine installation starts with a well-designed jack-up that provides a solid and stable basis for the required operations. Operational boundaries can only be optimized based on a thorough understanding of jack-up characteristics, the installation equipment capabilities and the risks associated with handling large loads at high altitudes, in an offshore environment.

To provide an insight into the workability of its jack-ups, GustoMSC has developed

a portfolio of tools. As part of the engineering portfolio, methods for analyzing the time domain response of a jack-up from floating to the elevated condition have been under continuous development by GustoMSC:

- GustoMSC's LIMP is used to calculate the response of a jack-up in the transient stage where the legs first impact the sea bottom, 'Leg-bottom impact'. A comprehensive model and leg-soil interaction is used to assess the relevant motions and forces in the time domain.
- GustoMSC's SIMSEP is used to calculate the dynamic response of jack-ups in the elevated condition when simpler methods do not suffice. That can be the case when the frequency of the excitations nears the natural frequency or when non-linearities (e.g. in the wave kinematics, foundation stiffness etc.) should be accounted for when calculating the extreme responses.
- GustoMSC's MINIFEM is used to calculate the response of a jack-up to earthquake actions in a response spectrum analysis (RSA). Time domain analyses according

to the latest ISO standard (19901-2) can be performed if required.

As a recent addition to this suite of programs, GustoMSC has developed an add-on in which the crane is modeled as a multibody system. The add-on program performs a model analysis and calculates the response of the crane and its suspended load to the jack-up motions in the time domain.

The above (combination of) tools allows a thorough yet fast assessment of the motions and internal loads for any given unit and its crane, which enables contractors to safely push the boundaries of their equipment.

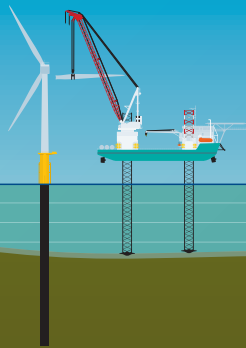
Kayo Vanderheggen
Engineer

Andries Hofman
Senior Engineer

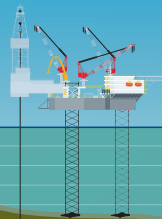
THE PIONEERS OF OFFSHORE ENGINEERING



NG-9800-US
SELF-PROPELLED
INSTALLATION JACK-UP
EFFICIENT UPGRADED
CAPACITIES &
TAILORED LOGISTICS



NG-5500X
SELF-PROPELLED
MULTI-PURPOSE JACK-UP
DEEPER WATERS
& LIFE CYCLE
SUPPORT



LJ43
CANTILEVER
DRILLING JACK-UP
SAFE & EFFICIENT
DRILLING
IN ME REGION



OCEAN1100-HE
DRILLING
SEMI-SUBMERSIBLE
COST EFFICIENT
HARSH
ENVIRONMENT

GustoMSC

GustoMSC is an independent and reputable design & engineering company of mobile offshore units and equipment. In close cooperation with our clients, we translate experience, science and technical knowledge into realistic & innovative ideas. In this way, GustoMSC enables and supports safe and efficient operations at sea, contributing to a sustainable future.

GustoMSC

Karel Doormanweg 35
3115 JD Schiedam
The Netherlands
+31 (0)10 288 30 00

GustoMSC US

840 West Sam Houston Pkwy North
City Center 4 - Suite 410
Houston, TX 77024 USA
+1 713 380 2600

www.gustomsc.com