

# INSIDE

NOVEMBER #32

# UNFOLDING OPPORTUNITIES



**GustoMSC**  
an NOV company

THE PIONEERS OF OFFSHORE ENGINEERING

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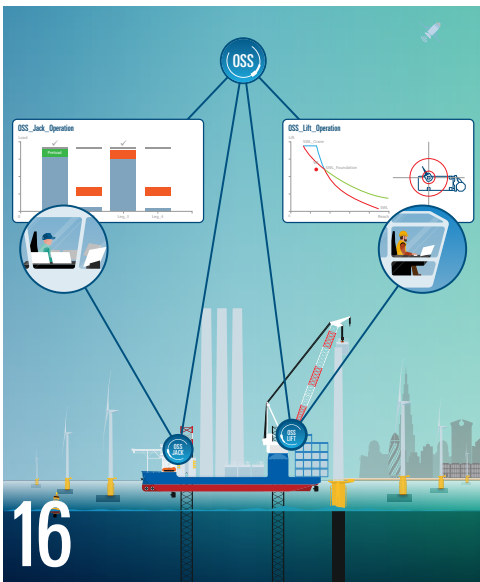
## INTERVIEW REACHING FOR HIGHER GOALS

On 2 August 2019, GustoMSC welcomed its client Shimizu Corporation and Fukada Salvage & Marine Works for a demonstration of the working scale model of the Telescopic Leg Crane.



## MENA'S OIL & GAS IS STILL KING

Cyril Widdershoven is a veteran global energy market expert and founder of Verocy. With his regional expertise of the Middle East and North Africa (MENA) he oversees the development of the oil and gas sectors in these important regions.



## PIONEERING TECHNOLOGY REAL-TIME DATA TO INCREASE EFFICIENCY AND SAFETY

GustoMSC developed the new Operator Support System (OSS) to enable the operator to work more efficiently and effectively.

## COLOPHON

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# PREFACE EXPANDING THE OPERATIONAL ENVELOPE



Dear readers,

The crane has been a symbolic bird since ancient times. It is seen as a messenger of wisdom, creativity, knowledge and discipline. All these aspects are of importance for us as designers and engineers. In order to develop the technology and services that enable our clients to expand their operational envelope and remain relevant in the offshore markets, the crane is an inspiring image. To underline how we put this into practice, this issue of InSide provides insight into how our colleagues from GustoMSC's Equipment department carry out their activities and how they contribute to expanding operational envelopes.

Expansion of established envelopes of energy supply is a worldwide phenomenon and is reflected in the changes that are occurring in the Middle East and North Africa (MENA). The oil & gas producers in these regions are addressing new options and are expanding their boundaries. We certainly appreciate that global energy market expert Dr. Cyril Widdershoven has been so kind to share his professional view on these changes in MENA. Although oil and gas are still king, here as well, the energy supply diversification is an unstoppable process. Read all about this in the main article of this edition of InSide.

Travelling further eastwards, we learn that in Japan the crane is supposed to bring good luck. Coincidence or not, at the beginning of August, we were fortunate to welcome Mr. Takeshi Sekiguchi and Mr. Takashi Sakamoto from Japan to attend the prototype scale testing of our new telescopic heavy lift crane, especially developed for the offshore wind market. After the successful completion of the test, Shimizu Corporation awarded us the order for the design of their new SC-14000XL wind turbine installation vessel, which will be equipped with the first Telescopic Crane. In the article "Reaching for Higher Goals", Mr. Sekiguchi and Mr. Sakamoto reflect on developments in offshore wind in Japan and the role they expect the SC-14000XL and the Telescopic Crane to play in their Japanese ambitions.

The item Pioneering Technology focusses on one of our latest developments: the Operator Support Software (OSS). By storing and intelligently analyzing data, the OSS maximizes operational safety and performance, which unlocks new capabilities for the existing fleet.

Whatever innovations we are talking about, we could never have developed these without great cooperation with our clients, business partners and suppliers. Your challenges to expand your operational envelopes spark our imagination. If you are interested in the many innovative solutions we can provide, then do not hesitate to unfold your plans, in any stage of maturity, and challenge us.

Looking forward to hearing from you and have a nice read.

**Nils van Nood**  
Managing Director GustoMSC





## KOREAN COMPANIES AND GUSTOMSC SIGN MOU FOR FLOATING WIND AMBITION

In September, GustoMSC and three Korean companies, Hyundai Heavy Industries (HHI), Sejin Heavy Industries (SEJIN) and Korea Maritime Consultants (KOMAC), signed an MoU with the intention to strengthen the position of the Tri-Floater as a floating foundation for Korean offshore wind projects. The MoU anticipates a growing market and upcoming projects for floating wind in Korea.

The signing companies cover the entire supply chain for the delivery of the Tri-Floater as a floating foundation. With GustoMSC and KOMAC responsible for the design, SEJIN for the construction and assembly and HHI for

the offshore installation of the Tri-Floater. The objective of this MOU is to express the intention to participate together in the floating wind projects that are currently under development by developers and initiated by the Metropolitan City of Ulsan, offshore Ulsan Korea.

The strong combination and synergy of the signing companies show developers, the local Ulsan government, central Korean government and the Korean public, the inclusion of first class and highly qualified and trusted Korean companies. A cooperation that is capable of adding highly valued local content to floating wind projects.



## UPGRADE OF DIAMOND OCEAN BLACK SERIES

Diamond Offshore Drilling is upgrading the Ocean Black series of drill ships in an effort to enhance the competitiveness of their drilling fleet. The first vessel in the yard for an upgrade was the Ocean BlackHawk on

which a NOV designed Crown Mounted Compensator was installed. As this upgrade involved a heavy weight at the top the derrick and an increase in wind area, which would both affect the vessel's stability, a solution



## DECOMMISSIONING OF DEEP PANUKE

Since mid-2018, GustoMSC has supported the decommissioning of the Deep Panuke gas field, located about 250 kilometers southeast of Halifax on the Scotia Shelf. Encana permanently ceased production from Deep Panuke in May 2018 and has recently begun the work required for decommissioning.

GustoMSC is responsible of the reinstatement of the GustoMSC hydraulic jacking system and the engineering related to the removal of the MOPU which was designed by GustoMSC. The jacking system shall be fully operational again in early 2020. GustoMSC will subsequently assist with the platform jacking down and removal operations.

Encana anticipates finalizing the decommissioning work of the production field center by the summer of 2020.

had to be developed to support the upgrade while not limiting the operation of the vessel. A fixed ballast slurry in the bottom of the hull was installed in May 2019.

GustoMSC provided support at multiple stages of the process by engineering the required fixed ballast, stability and strength analysis, and preparing the dead-weight survey. The dead-weight survey turned out to be especially challenging because of the uncertainty of the fixed ballast weight and the required 1% weight target. In the end, the dead-weight survey was successful and the Ocean Blackhawk is now operating again in the Gulf of Mexico.

GustoMSC remains committed to supporting P10,000 owners with enhancing their vessels. Workshops were held with Diamond's engineering and operations teams in 2018 to support this process in which good alternatives were identified that continue to be discussed with Diamond for the future. The next vessel in the yard for an upgrade is the Ocean BlackHornet, where the process will be completed again and improved based on the lessons learned from the Ocean BlackHawk.



## A FIRST TELESCOPIC LEG CRANE FOR SHIMIZU'S SC-14000XL

Early August, Japanese construction conglomerate Shimizu Corporation ordered the construction of the GustoMSC SC-14000XL jack-up vessel at the shipyard Japan Marine United. This unit will be the largest self-elevating platform for offshore wind installation to date in Japan and will be capable of installing the next generation WTGs with a capacity of over 12 MW. This positions Shimizu Corporation as one of the key players in offshore wind installation in the region, as there is no installation capability available of this size that can cope with the installation of the new WTGs. The GustoMSC SC-14000XL jack-up design

and VSD Jacking System are specifically tailored to Shimizu's requirements and will be equipped with the first Telescopic Leg Encircling Crane from GustoMSC. This crane offers an innovative combination of high hoisting capability for turbine installation (1,250 t at 161 m) and heavy load capability for foundation installation (2,500 t at 121 m). With the right capacity at the right height, this tool is future-proof for the installation of the new generation offshore WTGs.

GustoMSC has worked with Shimizu Corporation on the design of the vessel, while Shimizu is cooperating with Fukada Salvage & Marine to manage the jack-up vessel operations. The construction will take place in Japan at the facilities of Japan Marine United shipyard, with an expected delivery late 2022.

## BOOM ELONGATION STRENGTHENS JAN DE NUL



In July, GustoMSC received the order for the 15 m boom elongation of the Jan De Nul Taillevent. The vessel, acquired by Jan De Nul Group in 2018 (at that time named MPI Discovery), is an NG-7500 GustoMSC wind installation jack-up design outfitted with a 1,000 t crane. The feasibility study for the 15 m boom elongation had already been carried out in 2018 for MPI, its former owner. And after several engineering studies for Jan De Nul, this eventually resulted in the order.

The order consists of the delivery of a boom insert piece, a new boom hoist winch and strengthening of the boom near the boom rest. Inevitably, the vessel itself also needed some modifications for which GustoMSC delivered the engineering expertise and design. The helideck and block pockets were repositioned and the boom rest was redesigned in order to integrate the new boom section seamlessly in the Taillevent.

The delivery of the insert truss is scheduled for May 2020, after which Jan De Nul will take care of the installation work. This crane boom extension enables the vessel to handle the installation of the ever growing size of wind turbines, strengthening Jan De Nul's position in the offshore sector.



## IMI AND GUSTOMSC SIGN JACK-UP DESIGN LICENSE AGREEMENT

The agreement entails a new GustoMSC drilling jack-up design which will utilize the modern capabilities at International Maritime Industries (IMI). As a result of the agreement IMI will be fully prepared for its first production operations anticipated in 2021.

GustoMSC, responsible for delivering the basic design, will tailor one of its well established CJ-series of drilling jack-ups. Combined with a focus on IMI's specific construction and installation capabilities, overall rig construction time will be reduced.

About one year ago ARO Drilling announced plans to order at least 20 drilling jack-ups for construction at IMI. It is anticipated that initial rig ordering will get finalized in the second half of 2020.

## AGENDA

11 – 14 NOVEMBER 2019

ADIPEC  
ABU DHABI

Participation in the Dutch Pavilion

26 – 29 NOVEMBER 2019  
WIND EUROPE OFFSHORE  
COPENHAGEN

Stand C2-B6

4 FEBRUARY 2020  
OFFSHORE WIND  
EXECUTIVE SUMMIT  
HOUSTON

4 – 7 MAY 2020  
OTC HOUSTON  
HOUSTON

Stand 109

16 – 17 JUNE 2020  
GLOBAL OFFSHORE WIND  
MANCHESTER

Stand 116

22 – 25 SEPTEMBER 2020  
HUSUM WIND  
HAMBURG

Stand B7.517



# MENA'S OIL & GAS IS STILL KING

RENEWABLES TO COUNTER DOMESTIC DEMAND  
AN ARTICLE BY CYRIL WIDDERSHOVEN

“Renewables are largely targeted in the region as a means to enhance energy supply diversification.”

Cyril Widdershoven

The global energy sector is in a major flux, as global warming, renewable energy and politics are grabbing the spotlight. A major drive to decarbonize energy and industry is ongoing, preponing ideas that the world could soon be weaned from its hydrocarbon addiction. However, reality presents a different picture. For the coming decades, hydrocarbons will not only be supplying a majority of the energy supply, but economic growth will also lead to an increase in demand. The future is not black or white, but will be a place where hydrocarbons and renewables are both needed to quell the world's thirst for energy. However, changes are occurring, even in the Middle East and North Africa (MENA). After decades of hydrocarbon addiction, MENA is heading towards a restructuring of its economy. Lower government income, combined with high levels of youth unemployment, and the need for future economic sustainability and geopolitical status, are forcing Arab oil and gas producers to address new options and expand their operational envelope.

The latter is already being put in place as shown in Saudi's Vision 2030. The targets are clear, as Arab economies will need to set up a future-proof economy that is able to deal with the challenges. Still, hydrocarbon addiction is hard to change, while renewables will clearly be playing an intricate role in the future of the region. Solar and wind will not remove hydrocarbons from the economy, they will support economic diversification, while additionally providing new sources of income to generate the much needed investment volumes to support the changes.

#### Economic diversification

Historically, MENA countries have been formed by their vast oil and gas reserves, generating immense inflows of cash to form a strong but one-sided economic system. However, the hydrocarbon addiction is under pressure. The immense amount of young people currently vying for work opportunities in the still largely state-controlled hydrocarbon economies is a major challenge that needs to be countered. Full-scale economic diversification is needed, not only to provide jobs for the millions of young men and women entering the labor market, but also to mitigate the challenges the oil and gas sectors face globally.

#### A continuous demand for oil & gas

Nevertheless, MENA's oil and gas future is not looking bleak at all. With a continuing growth in demand for crude oil, gas and petroleum products, countries such as Saudi Arabia, UAE, Iraq, Kuwait and Qatar will remain leading producers. They will be able to counter perceived threats, such as US shale, non-OPEC production increases or the media frenzy about peak oil, as OPEC's leading producers have set up a major transition from being the sole providers of crude oil and gas to global product providers, targeting downstream markets in Asia, Europe and even MENA.

Demand for oil and gas for MENA producers is not being threatened, in stark contrast to a perceived threat of renewables and global warming. For most Gulf countries, the main drivers to diversify their economies are not peak oil, global warming or electric vehicles (EV), but price volatility of hydrocarbons, growing domestic consumption of energy, lower prices for products and crudes and the need to increase job opportunities. In contrast to the

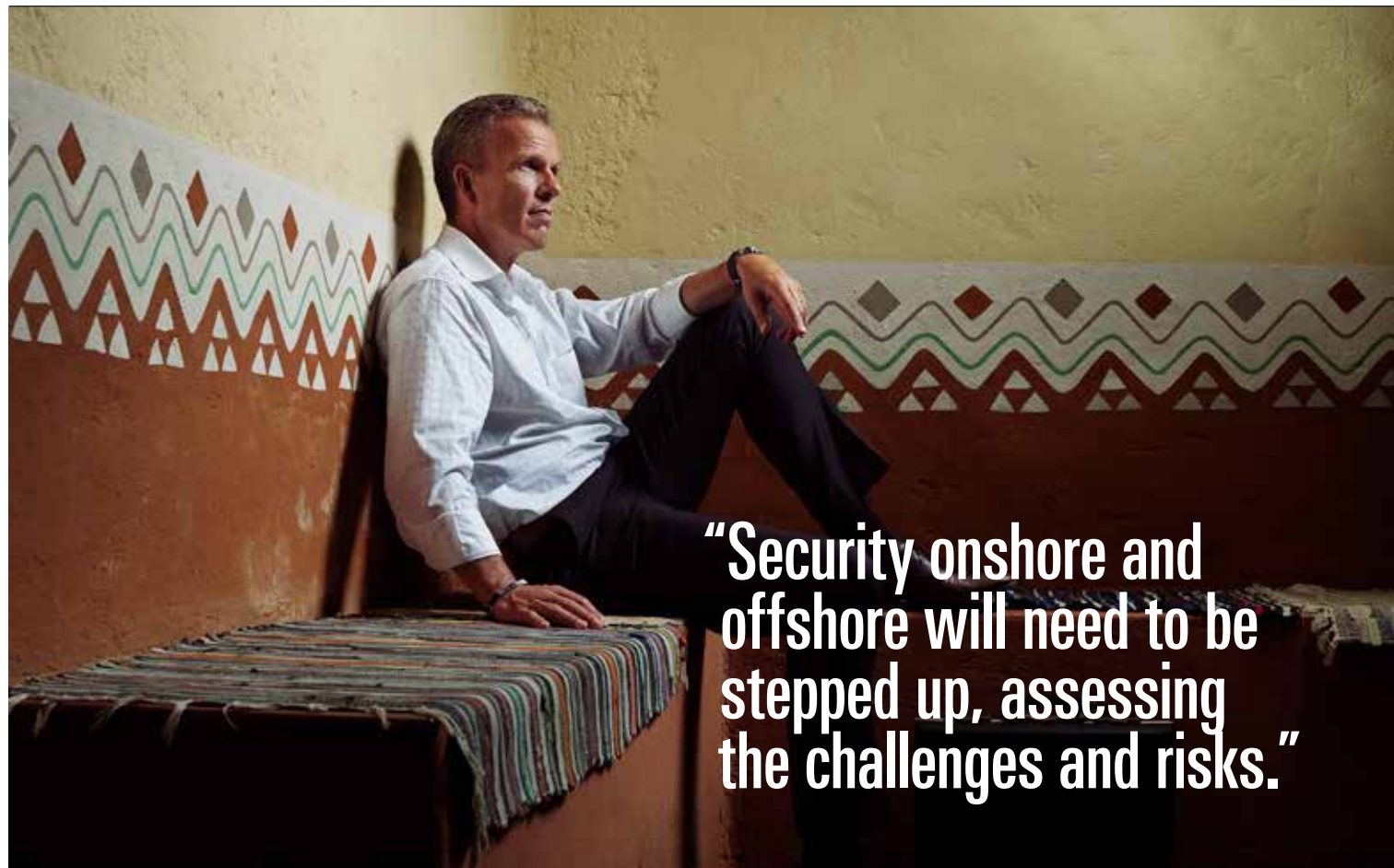
West, where global warming strategies, green economy or political choices are changing hydrocarbon habits, MENA producers are investing in renewables to cover part of the domestic demand for oil- or gas-fired power production, freeing up additional barrels for export and petrochemical products. The cost of using oil or gas as an energy provider are staggering, especially due to high levels of power and water subsidies in the respective countries, while exporting crude or petroleum products to global markets still has high profit margins. The drive for renewables in the MENA region is not a global warming strategy but primarily a cost-benefit analysis.

#### Different investments perspectives

Economic diversification is ongoing, but energy investments in MENA are still king, as shown by the fact that around \$1 trillion will be invested between 2019-2023. Even though the majority still is hydrocarbon focused, renewables are showing a steep increase. The Arab Petroleum Investment Corporation (APICORP) reports that the power sector constitutes 36% of total investment as electricity demand rises and momentum for renewables continues, accounting for 34% of total power investments, with more than half the investments in North Africa. Still, hydrocarbons rule, receiving \$490 billion (oil sector \$304 billion, gas \$186 billion). One major focus investment area in all is the petrochemical sector, looking at investments of around \$123 billion. MENA investments are very high, but more is needed in the coming years. Sultan Jabr, CEO of the Abu Dhabi National Oil Company (ADNOC) stated at WEC 2019, \$11 trillion in investment is needed to meet future global energy demand.

The figures are contrary to beliefs in the West that peak oil demand has almost been reached. Most OECD countries, except the US and Canada, are setting up immense renewable energy programs to counter possible supply shortages, as the end of oil is near. Hydrocarbon producers, such as Saudi Arabia, UAE and other OPEC players, are looking at this from the opposite perspective. Demand is not a threat, supply is the main issue. Even though it might sound strange, Arab producers continue to believe in the adagio that “to support continuing increased volumes of hydrocarbons supply to the markets, more renewables are needed”.





**“Security onshore and offshore will need to be stepped up, assessing the challenges and risks.”**

#### Renewables needed to continue supply of hydrocarbons

The latter drive has now been making headlines in the media, as the multibillion solar power projects in Dubai, Abu Dhabi, Saudi Arabia and Morocco, have increased the attractiveness of the renewable energy drive globally. The UAE is a frontrunner in renewables, as shown by Abu Dhabi's Masdar City and Dubai's Mohammed bin Rashid Al-Maktoum Solar Park. Saudi Arabia has chosen renewables as one of the spearpoints of its Vision 2030, shown by announcements of the futuristic mega city NEOM and the Sakaka solar power plant project. Global warming issues also have repercussions for the Arab world, as worldwide temperature increases will also have a detrimental effect on the Arab world. MENA is a largely arid area, lacking water resources.

Although environmental issues are a concern that is taken into account, the other main underlying issue is that it lowers overall domestic crude oil usage. For countries such as Saudi Arabia and the UAE, as main oil producers, substituting oil barrels for solar, wind and possibly nuclear energy, will release additional barrels of oil to be exported or to be used in petrochemicals. Renewables are largely targeted in the region as a means to enhance energy supply diversification. However, to counter growing power generation demand there is still a long and expensive way to go.

#### Unconventional and Offshore as an answer for new volumes

In the coming years, OPEC producers, such as Saudi Arabia, UAE, Iraq and Kuwait, will stay on a path of full-scale oil and gas production expansion. As long as global demand for hydrocarbons is expected to increase substantially, new production is needed. At the same time, the whole region will have to address new production challenges, such as unconventional and offshore. In recent years, a dramatic change has been witnessed inside Saudi Arabia, UAE and

Egypt, as onshore production, which is still king, is being supported by new offshore production. The need for new volumes, not only to sustain domestic consumption but also to meet global demand, is pushing Saudi Arabia (Aramco), Abu Dhabi (ADNOC) and Egypt (EGPC/EGAS) to explore technically challenging production regions offshore. In the coming years, new technology will increasingly open up exploration and production areas in the Arab Gulf, Red Sea and East Med arena. The region is also witnessing a “gas drive”, as natural gas is increasingly being used to substitute crude oil as an energy provider, but also as feedstock for petrochemicals. After relying on other gas supplies, such as Qatar (Dolphin), most Arab countries are currently actively seeking new gas production areas, such as Saudi's Red Sea adventures or Egypt's East Med.

After the US shale revolution, Arab countries are slowly adopting to other hydrocarbon options as well. Unconventional oil and gas plays are being targeted, as shown in recent years by ADNOC's major sour gas Al Hosn adventure. Having been able to deal with Sour Gas (and Crudes), Arab national oils are now eager to address shale oil and gas reserves too. The latter is the most remarkable as unconventional is not as easy or cheap as the current immense conventional onshore oil and gas reserves. Nevertheless, targets are being set, even offshore unconventional is not out of range. At present, Bahrain is still assessing the option of a potential 80 billion barrels of unconventional offshore, which would be the world's first.

#### Localization of value chain

Offshore developments are still challenging, especially when entering into new areas or the unknown of offshore unconventional. The region is set for a possible technology leap in these areas, as national oils such as Aramco, ADNOC and possibly NOGA (Bahrain) and Egypt, are looking not only to open up new offshore plays, but also want to set up

the necessary infrastructure to build and operate offshore jack-ups, production platforms and OSVs in the coming years. After spending billions of dollars outside of the region on technology and capabilities, Saudi Arabia, the UAE and Egypt have embarked on localization of capabilities and production facilities for on- and offshore production. Saudi's Ras Al Khair Shipyard project is one of the prime examples of this new drive. The latter is meant to increase domestic technical maritime capabilities, diversify the local and regional economy, and present new job opportunities. New JVs are being set up to support the latter, all with a major focus on Saudization of the overall value chain. The same approach is being discussed inside the UAE, Bahrain and Egypt. The rest will certainly follow suit.

#### Big Bang

Middle East oil and gas are also looking for ways to counter possible security threats. After a focus on the possible risks of cyber security, due to increased automation and need for data, another risk has returned. Oil and gas structures are still threatened by conventional security, as proven by the ongoing drone war in the Arab Gulf region or currently witnessed by the Aramco Al Abqaiq attack. Security onshore and offshore will need to be stepped up, assessing the challenges and risks. Oil field services providers will need to address these challenges increasingly in their services or designs provided to Middle East clients. A full-scale automated operations environment will need an integrated security platform approach in which conventional (hardware) and unconventional (cyber) threats are being mitigated or countered. Integrated designs are needed, in which all aspects of the operation and environment are taken into account.

#### Digitalization and automation

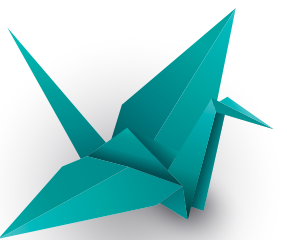
At the same time, Arab oil producers are entering into the IOT/AI/ICS and IndustryX.O discussion. The need for digitalization and automation of the hydrocarbon sectors has long been recognized. Aramco and ADNOC already have put in place their own digitalization programs. Abu Dhabi's ADNOC has become a major proponent of what they call “Oil & Gas 4.0”, a full-scale strategy to increase digitalization of processes, production, and workforce, to increase and enhance a sustainable hydrocarbon future. Besides production automatization and digitalization of upstream and downstream processes, new ideas such as automated vessels and production platforms are already being

addressed. Without minimizing the challenges, offshore production could be a major sector in which full-scale automation and possibly unmanned rigs and production platforms will see the light. The latter, formerly challenged by advisors as a threat to jobs, is now regarded as an integral part of the workforce of the future. To get young Arabs (men and women) to enter the oil and gas sector, new high-tech environments need to be in place to attract their interest. Unmanned fully automated rigs of the future could be an instrument to attract and support the gaming and internet loving young Arabs. The latter also falls fully within the national strategies of Saudi Arabia and the UAE, as presented in the Saudi Vision 2030 or “Oil & Gas 4.0”. The current millennials or 21st century youngsters need to enter the oil and gas world as soon as possible. Without their internet and cyber capabilities, oil and gas will be facing a steep and difficult uphill battle.

#### Need for cooperation

In the coming years, an increased need for cooperation between all parties is clear. Offshore maritime capabilities are needed inside the MENA region, as a major offshore drive is being planned. Dutch maritime knowledge is known, but could still make a difference in the MENA region. Offshore experience in the North Sea, GOM, Atlantic Ocean, combined with high-tech and futuristic new technical approaches, can be developed in close cooperation with Arab counterparts. Now is the time for all parties to address these issues, time is of the essence. When looking at the major gas drive in the region, Dutch knowledge and experience are available to address regional challenges too.

**“The future is not black or white, but will be a place where hydrocarbons and renewables are both needed to quell the world's thirst for energy.”**



#### Cyril Widdershoven

Cyril Widdershoven is a veteran global energy market expert and founder of Verocy. He holds several advisory positions at various international think tanks and Western energy firms. He is also a Fellow at the Payne Institute of the Colorado School of Mines and lecturer at the Erasmus University Commodity and Trade Executive MBA. Dr. Widdershoven, with his regional expertise in Africa and the Middle East, oversees the Mediterranean Energy Political Risk Consultancy. Across the MENA region, he has been heavily involved in the oil and gas sectors throughout his career, holding positions at Capgemini Consulting (Principal Consultant Centre of Excellence Oil and Gas International (Calgary, Canada), Deloitte Financial Advisory Services (Senior Manager, Oil & Gas), and as Senior Financial Analyst Oil & Gas Sector FDA, where he managed and advised the oil and gas department on equity and bond markets.

Dr. Widdershoven has led energy publications, including North Africa Oil and Gas Magazine (now called Petroleum Africa), the Middle East Oil Gas Newsletter and Africa Oil Newsletter at Newsbase (UK). Over the span of several decades, he has lived and worked in Egypt, Lebanon, Jordan, Sudan, Iraq, and the UAE, and also taken on extended projects for clients in Oman, Iran, Syria, Tunisia, and Turkey. Dr. Widdershoven earned a post-graduate degree at King's College, University of London, Department of War Studies, and a master's degree in Middle East Studies at the University of Nijmegen, the Netherlands.



3.7M  
DRAFT

**NG-1800XL  
MAKING SHALLOW  
ACCESSIBLE**

Jack-up platforms have been a backbone of the offshore industry since its beginnings. The understanding of the use and the potential application of jack-ups have developed greatly over the years and have allowed an ever expanding envelope of possible uses of this type of offshore unit. By applying our experience, deep knowledge of jack-up technology and practical understanding of the use of jack-ups as well as the feedback that we obtain from providing operational support to our clients we were able to push the envelope even further. Our new NG-1800XL jack-up design allows operations in extreme shallow water.

The NG-1800XL addresses the developing requirements for operations in all areas of the Middle East, featuring a shallow draught of 3.7 m combined with a reduced spudcan pressure. At the same time, it features a water-depth capability of 55 m providing usability over a large area of the region, combined with variable load capabilities and a deck area to meet the requirements of the oil companies in the region today.

The multi-purpose jack-up design builds on GustoMSC's NG-1800X design which is a versatile unit and a smaller sister of the popular NG-2500X. The NG-1800XL undertakes transit and positioning offshore without tug assistance. While the four legs and diagonal preloading capability allow for easy, fast and secure jacking and preloading operations.

Accessibility of shallow water areas has become increasingly important to broaden the potential area where jack-up platforms can work. This is particularly true in the Middle East region, which traditionally is an area where jack-ups have been used extensively. Developing new fields in ever shallower water, reduced spudcan bearing pressure allowance to preserve the seabed and an increasing need for maintenance and workover in existing deeper and shallow water fields have led to evolving requirements. In South-East Asia, deeper water and particularly soft soils pose their own set of challenges.

DYNAMIC  
POSITIONING  
**DP2**

PRELOAD  
PER LEG  
**1,800 T**

FREE  
DECK SPACE  
**750 M<sup>2</sup>**

VARIABLE  
LOAD (MAX.)  
**900 T**

SHALLOW  
DRAFT  
**3.7 M**





This is the fifth article in a series addressing developments around the theme of working safely and efficiently at sea. In this edition three staff members of GustoMSC shed their light on how they and their colleagues contribute to the safe and efficient execution of working at sea. What are the improvements and innovations to increase efficiency and safety? And what are the elements that determines mid- and long-term strategy? These issues require searching for new and better ways of expanding the envelope.

# CREATING NEW OPPORTUNITIES BY EXPANDING THE ENVELOPE

An important responsibility of GustoMSC is to ensure that technology remains at the highest level. One of the core activities of the company is the design and supply of equipment. René de Bruijn, Equipment Manager, together with Spyros Magripis, Mechanical & Structural Engineer, and Arjan van der Spek, Technical Equipment Coordinator, shed light on how they and their colleagues carry out their activities and how they contribute to 'expanding the envelope' and to the safe and efficient execution of work on board of the units in their operational environment.

## Efficiency is key in the equipment department

The activities of the GustoMSC Equipment department comprise two main elements: design and supply of the specific offshore equipment and the servicing of this equipment in operation. For both elements, it is important that all aspects are in order to ensure that people can work efficiently and in a good and open atmosphere. We often face challenging and complex projects involving numerous engineers, project managers and third parties. In the case of servicing equipment, a tight schedule is often added to the equation. Retrieving the right information, estimating the costs, looking at what should be put out to tender and the actual scope of supply are often the first steps in our process. To be able to work quickly and efficiently, we need to have the right qualified personnel available at all times and deploy robust systems. This and the close cooperation with our suppliers, with whom we have developed long-term relationships, enable us to assess the relevant components, at the right costs, minimizing surprises for the client.

Besides responding to the market, we also anticipate market movements going forward. Continuous improvements and initiatives to innovate, so that our designs and equipment work more efficiently and safely, are elements determining our mid- and long-term strategy. To be ready for future market requirements, we at GustoMSC are always finding new and better ways to extend the current limits of performance.

## Expanding the envelope drives innovation and development

A common industry theme is that prices are always under pressure and competition is fierce. Owners want to get as much as possible out of their existing units. This has



a major influence on innovation and the development of new equipment or technologies. We must continue to innovate to maintain our leading position. We have a product expert in place for each main equipment component who is responsible for making sure our equipment is technically and commercially viable for current and future market demands. Studying the market and listening to the needs of our clients are key. Moreover, we investigate state-of-the-art materials and technologies that can, for example, make a design more robust and lighter and we take the time to brainstorm with other colleagues whenever there is a new idea. This not only leads to innovation but also to the improvement of existing equipment to enable our customers to work more efficiently and safely, expanding the capabilities of their equipment.

#### Innovative data-linking operations

Data of our equipment generated under operational conditions help us to define the room that allows us to increase the capacity within the capabilities of the equipment and within the applicable safety standards of the regulatory bodies, owners, operators and ourselves. Our Operator Support System (OSS) is analyzing this data real-time on board of the unit. The data generated by different equipment are analyzed by algorithms, and linked to each

other, providing advice to operators on the safety level of their operations while these are being carried out. These innovations directly expand the operational envelope and enable possibilities for existing wind turbine installation units to follow the growing market demands with respect to weight and installed height a little longer. It is important to look at the possibilities within the standards set in which safety is key. Innovations are possible within this context. Risk assessments, failure mode and effect analysis, we do everything to ensure no issues have been overlooked.

#### Integration of equipment and design

An important distinguishing aspect of GustoMSC is that we do not look at equipment as a standalone item, we consider equipment as part of a total system. This way, both the design of the unit as well as the equipment can be optimized for installation, operation and maintenance.

The interaction between both disciplines creates a complete picture. For example, if something changes on the equipment side, we immediately see what the impact is on the design of the unit and vice versa. What is needed in terms of equipment and design adjustments to the unit itself? How long will a project take? All information with which the customer can make a well-considered

## From piece of paper to huge machines

*“Our projects, from prospect to completion can take years. It starts with a piece of paper but at the end a huge machine has been created. This end goal drives each engineer. For this specific product, the process culminates in the jacking trials and hull-height test. Even though we know the test is going to be successful, as soon as that little jacking joystick is released after reaching full height, an important milestone is attained for all parties involved. And we create a temporary landmark showing this off to the local community. And the view is great!”*

**Arjan van der Spek**  
Technical Equipment Coordinator

estimate. For our equipment, this is regarded as a standard procedure if there is physical adaptation to the equipment.

As an example: it doesn't need a lot of imagination to realize that strength and safe operation of the jacking system are essential for the overall safety of the jack-up and thus for its crew, the environment, our customer and our company. This all starts with mechanical engineering and manufacturing. The goal is to lift “a little village” weighing more than 30,000 tons while the scale of microns can be the difference between success and failure. During the construction of the jack-up, because of the integral position of the jacking system in there, the challenge is that construction and launch of the jack-up, and installation, commissioning and testing of the jacking system progress in parallel. In order to fully test the jacking system, you need the jack-up around it, but in order to build the jack-up efficiently, you need the jacking system to jack the incomplete hull immediately after undocking or launch.

#### Teamwork is crucial

In our complex environment, teamwork is crucial in every phase of a project. Internally within the project team, within the department and between the different departments, and externally with classification societies, third parties and, of course, our customers. All in order to ensure proper integration and a successful project.

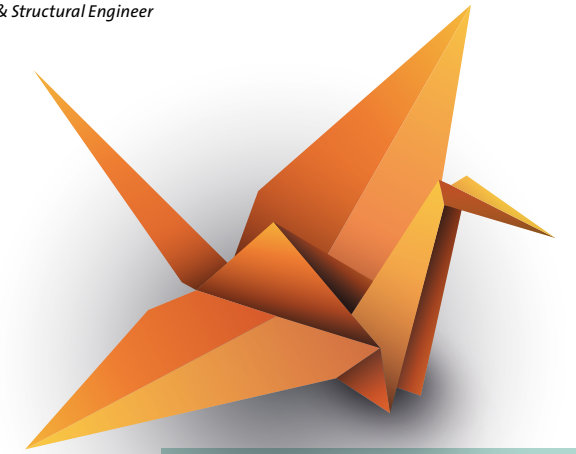
For example, we have recently completed the basic design phase representing a step change in our VSD control system of our Rack & Pinion Jacking System. The teamwork with colleague engineers working on the jack-up itself and the contribution by our long-term partners that work with us during R&D, concepting and project execution are essential in this process. The target was to simplify the control system to lower the barrier for some customers, but not to make any concessions in the area of safety and performance. With our partner Siemens, new technology was brought in followed by a rationalization round, leading to very significant reductions in electronic components both in type and quantities. Maybe going against the trend, the amount of data collection points was also reduced a bit. Meanwhile, the engineers involved in our logging and remote access features started to expand these features with the capabilities available within NOV, so at the end, we will have more meaningful data for us and the jack-up operator.

GustoMSC has been part of NOV for a year now and this has given us access to even more advanced technology. For example, the NOV technology developments in the field of big data and the Internet of Things accelerated the evolution of our OSS. Technology that can strongly strengthen our competitive position and that of our clients.

## Joining forces, sharing ideas

*“In my role as Mechanical & Structural Engineer within the Equipment department, I know that communication is the key for a successful project execution. By joining forces, sharing ideas and listening to the demands, we can accomplish a wide range of tasks. The customer's needs become the “big picture” which is then communicated to the team, so everyone is working towards a common goal efficiently. One of the most satisfying aspects of my work is to realize how the end deliverable adds value to the operations of the end-user. Being part of this accomplishment inspires me to keep on going.”*

**Spyros Magripis**  
Mechanical & Structural Engineer



## Collaboration is most inspiring

*“For me collaboration is the most inspiring aspect of my job. Working with a whole group of enthusiastic and smart people, being able to do beautiful things together in terms of design and new innovative products. The Chela and the telescopic crane are good examples. Such products are created through cooperation between many people across the company. This makes me proud to be a part of GustoMSC.”*

**René de Bruijn**  
Equipment Manager

## THE PIONEERS OF OFFSHORE ENGINEERING

GustoMSC is a 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. 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.

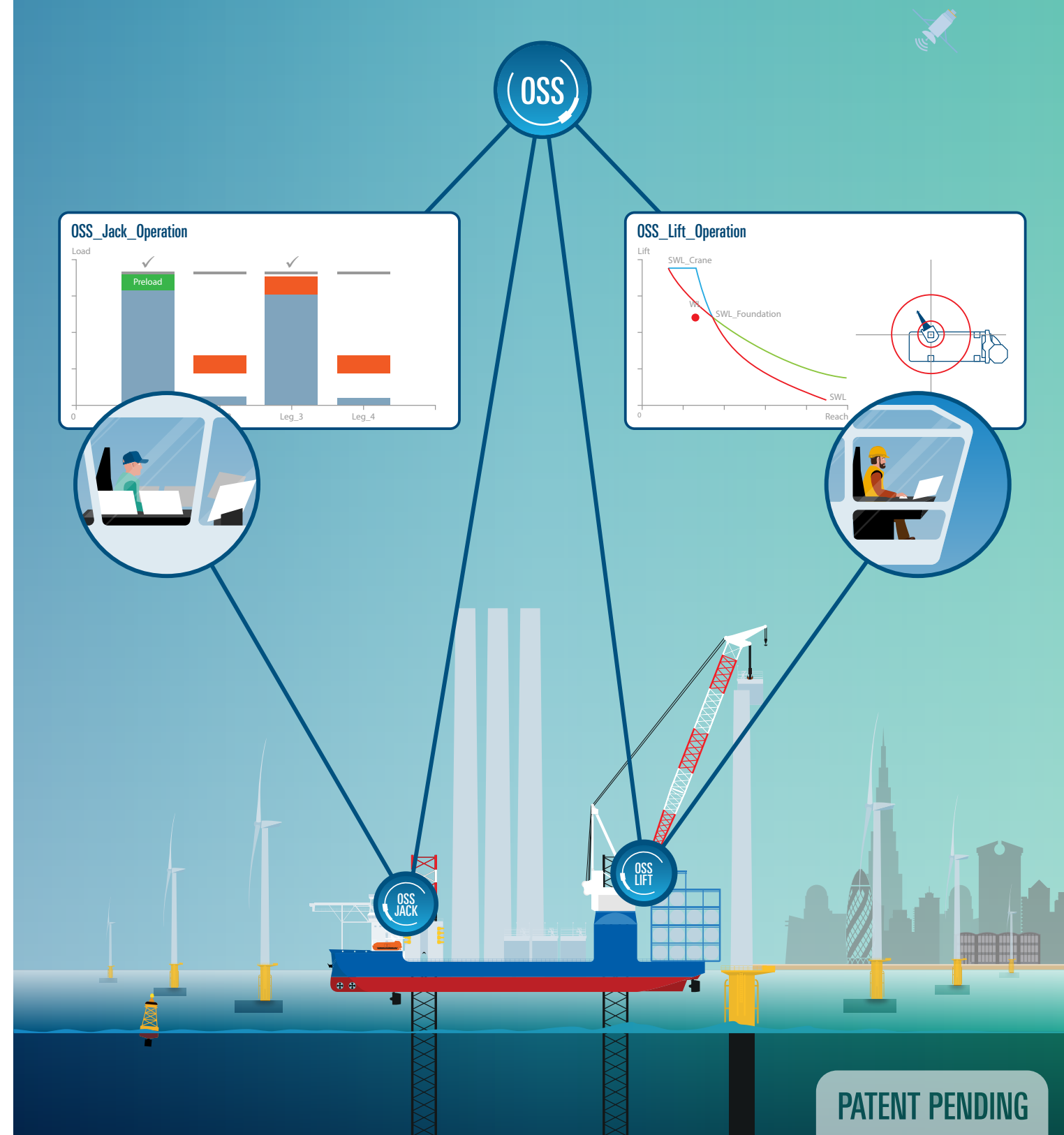
From left to right: Spyros Magripis, René de Bruijn, Arjan van der Spek





OPERATOR SUPPORT SYSTEM

# REAL-TIME DATA TO INCREASE EFFICIENCY AND SAFETY



All mobile offshore units generate a constant stream of data. At present, only a fraction of this information is utilized because offshore data usually travels no further than to the nearest operator. However, when we store this wealth of data and analyze it intelligently, it is transformed into something valuable. When making data more accessible, on land as well as at sea, it becomes information that benefits both operational safety and performance.

Human operators still actively control the equipment and the process flow, whether they are drilling a well or installing a wind turbine. GustoMSC developed the new Operator Support System (OSS) to enable the operator to work more efficiently. The operator can maximize efficiency by having all relevant information available real time. At the same time, safety is maximized because the information of multiple sub-systems can be combined and manual misinterpretation can be prevented. The OSS connects systems, extracts and intelligently combines the available data and translates the relevant information into key operational support. The system is built on NOV's Industrial Internet of Things platform MAX. This platform allows real-time data to be handled, analyzed and stored, locally and in the cloud. The data can be shared and stored securely through the NOV access portal and cloud, when a connection is available. The data can safely be accessed by the operator in the cloud, anytime and real-time and it can be forwarded to any third-party cloud service.

**Benefits for the operator**

As overall unit designer and the supplier of key equipment, GustoMSC has the exceptional capability to combine decades of experience and insight in each onboard sub-system and in the interaction between the different systems. With this expertise integrated in operational algorithms and the availability of the data, valuable operational information can be obtained which was not available previously. The OSS enables the relaying of real-time operational information to the operators thus improving safety and efficiency. As the OSS runs autonomous onboard on the MAX system, connection to the cloud is not required for the system to work. The MAX platform allows for remote installation of updates and installation of new applications when a data connection is available. In this way, data security is always up to date and the operator is continually provided with the latest insights.

**OSS.Jack, foundation capacity made objective**

At present, operators use their personal expertise to determine at what point in time the foundation preload has been established, based on the load at which the foundation has

been tested for a period of time. This makes the determination of foundation capacity sensitive to personal interpretation and errors.

The application OSS.Jack uses an algorithm to calculate the established preload in real time based on leg load levels, foundation settlement and time. The algorithm that is used for the objective determination of the achieved preload makes use of these real-time measured parameters. An essential parameter is time: one needs to apply a minimum load level for a sufficient amount of time, depending on the soil type. Furthermore, the foundation settlement needs to be below a threshold value in a specified period of time. It is only when a load level has been exceeded for a sufficient amount of time, while the settlement rate is below a certain threshold, that this load level becomes the established preload on the foundation.

The criteria that are used by OSS.Jack to determine the preload can be set by the operator. These can be job and site-specific and possibly determined in conjunction with the warranty surveyor. Based on the agreed combined criteria, OSS.Jack determines the foundation capacity objectively and in a repeatable manner.

The algorithm works in (near) real time, so the operator is provided with direct feedback and insights on foundation and jack-up behavior during the preload operation. This allows him to focus on the jacking operation itself thus improving efficiency and safety. The final judgement of the preload operation remains of course with the operator. His own personal judgement and expertise remain leading. With OSS.Jack, an automated jacking report can be generated to be sent to those that need or wish to be informed, onboard and onshore.

**Unlock the full potential, OSS.Lift**

Crane operations on a jack-up do have an effect on the loads of the foundations. For relatively small cranes, this poses no threat to the overall foundation safety. This no longer holds for large cranes on a jack-up. Without the proper precautions, crane operations can lead to dangerous situations. When the load on the foundation or preload exceeds the foundation capacity there is a risk of punch through. Safety is currently ensured

by calculating a truncated crane capacity/envelope using the foundation capacity as a limit. As this has to hold for all loading and environmental conditions, this results in a high degree of conservatism in practice and thus the full capacity of the unit is not utilized.

The application OSS.Lift monitors and verifies foundation loads in real time during lifting operations and the system provides both the crane and jacking operator with information about the interaction between the crane, the jacking system and the foundation. With OSS.Lift, the jacking operator is informed of the loads in the jacking system and the foundation it is positioned on. OSS.Lift informs the crane operators real time about how close the crane is to utilization of the foundation capacity, as established by the OSS.Jack application during jacking and preloading operations. In this way, OSS.Lift increases safety during heavy lifting operations.

By coupling real-time foundation loads and the crane operation, OSS.Lift can unlock the full potential of the jack-up unit. GustoMSC's proprietary pre-torque technique optimizes the distribution of foundation loads between the jack-up legs, providing maximum crane capacity for lifting operations. To put it simple, the load on the leg where the crane is positioned can be reduced by operating the jacking system, thus creating leg load capacity to be utilized by the crane operation. As a result, the crane can be used at maximum capacity. In this manner, jack-up platforms can be outfitted with larger cranes without compromising safety.

## OSS PLATFORM FOR EMPOWERING

The GustoMSC OSS is not limited to a particular unit or application. Rather, it provides a platform for translating data into information with more value. GustoMSC is working on several applications in different stages of development. OSS.Jack and OSS.Lift will be the first two applications to be launched, with many more applications to follow. Once tested and launched, these applications will undergo continuous development. The idea and development of these applications has come from within GustoMSC. Feedback from the systems and the operators is needed for continuous improvement of existing applications and for the generation of new applications. The OSS empowers end-users to utilize their equipment safely and efficiently anywhere in the world at any time.





**“We must be ready for future turbine capability expansion. Therefore, Shimizu decided to build the SC-14000XL.”**

Takeshi Sekiguchi



SC-14000XL WITH TELESCOPIC LEG CRANE

# REACHING FOR HIGHER GOALS

## SHIMIZU AND FUKADA REALIZING JAPANESE OFFSHORE WIND FARM DEVELOPMENT

Just as many other countries, Japan is working on increasing the sustainability of its economy. Last December, the Japanese congress passed a new law which allows construction of offshore wind farms beyond port-related areas. As a result, Japan’s development of offshore wind farms is accelerating quickly and the market will soon outgrow the pioneering phase. According to research carried out by Wood Mackenzie, Japan is expected to reach 4 GW offshore wind capacity by 2028, enough for more than 3 million households. In this article, an insight into how GustoMSC’s innovative power supports Shimizu and Fukada in reaching these higher goals.



**“The biggest improvement the Telescopic Crane offers is that it limits damage risks during transportation stages.”**

Takashi Sakamoto



On 2 August 2019, GustoMSC welcomed its client Shimizu Corporation and Fukada Salvage & Marine Works from Japan for a demonstration of the working scale model of the Telescopic Leg Crane at the Hersbach test location in Schiedam.

The Telescopic Leg Crane has been developed by GustoMSC to provide a solution for the demand for increased lift height and weight, associated with the developing wind-turbine market. Placed on GustoMSC’s self-elevating wind-turbine installation jack-up SC-14000XL the Telescopic Crane will provide a range of advantages over a conventional crane.

Shimizu Corporation expressed their interest in the Telescopic Leg Crane and requested GustoMSC to build a scale model (1:20) and perform tests to demonstrate the correct functionality of the telescopic boom principle. During the test program, the operating cycles were run through several times in order to be able to observe all details, such as the guiding system and the locking pins. The basic controls, control sequence and sensors were demonstrated. The unlocking, telescoping and locking actions were performed fully automatic by means of a single joystick movement controlled by the operator.



**“Without a specialized partner like GustoMSC, it would have been impossible to start within a year.”**

Takashi Sakamoto

The successful test was followed by an interview with two key members of the Japanese delegation: Mr. Takeshi Sekiguchi, Executive Officer at Shimizu and owner of the SC-14000XL jack-up design. And Mr. Takashi Sakamoto, Group Manager Offshore Wind Group at Fukada and future operator of the SC-14000XL with Telescopic Leg Crane.

**What is the most important innovative driver of the Japanese offshore wind energy industry?**

Mr. Sekiguchi: “The Japanese government has decided that electricity from renewable energy sources shall compose 22 to 24% of the total electricity supply in 2030 in accordance with Japan’s basic energy program. This means that our renewable energy supply must be increased significantly. Last December, our congress enacted a new law which accelerates offshore wind farm development. The Japanese offshore wind energy market will develop rapidly from now on. But unlike the EU, we will start with big wind turbines with an individual capacity of 8 MW. And we plan to install even larger turbines in the near future. We must be ready for future turbine capability expansion. Therefore, Shimizu decided to build the SC-14000XL.”

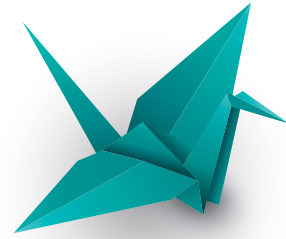
**In the light of offshore wind turbines what geographical challenges, such as the seabed, earthquakes and deep sea have to be overcome?**

According to Mr. Sekiguchi the geographical challenges are tough: “Japan’s seabed is generally steep which is different from the North Sea. Good locations for offshore windmills are therefore limited in Japan. We have typhoons from summer to autumn, every year. We also have to deal with earthquakes and tsunamis in the Pacific Ocean. Our SEP (Self-Elevating Platform) must operate under these circumstances with high availability. The SC-14000XL is the ideal model to operate in such difficult conditions.”

According to Mr. Sakamoto, the SC-14000XL with Telescopic Crane makes a huge contribution to the efficiency in installation work: “At this moment, in Japan, we only use small jack-up vessels. With the SC-14000XL, we can operate on the Pacific Ocean side with these year round rough conditions.”

**What was the overriding reason for Shimizu to opt for the SC-14000XL design?**

“We think the SC-14000XL will offer Shimizu a strong competitive edge in the upcoming wind farm construction market in Japan and Asia. Specifically because we need to install 8 MW wind turbines and monopile foundations effectively and install 12 MW wind turbines adequately. That requires a large SEP which offers sufficient capability to operate with high availability. Also, having to use a large crane in combination with our SEP, you need to be integrated in both design and operation. The SC-14000XL with



## TELESCOPIC LEG CRANE

The Telescopic Leg Crane has been developed as part of GustoMSC’s innovations to address the challenges imposed by the next generation of offshore wind turbines. The required extreme lifting heights in excess of 150 m with a load of over 1,000 t and even heavier foundations require a new generation of heavy lift jack-ups and special cranes.

### Highlights

- Innovative combination of high lifting height and heavy lift capability at reduced lifting height
- Extended mode provides extreme lifting height required for the next generation wind turbines
- Superior heavy lift capability in retracted mode for wind turbine foundations and general heavy lift operation
- For use on heavy lift jack-ups – integrated solution – optimized weight and dimensions
- Boom does not extend beyond hull in transit – avoids sailing and maneuvering restrictions
- Fast change-over between retracted and extended mode in operation

Telescopic Crane is the answer to this. The Telescopic Crane and SEP have the required installation ability for the future of the offshore wind energy industry in Japan and Asia. I think further acceptance in the industry will grow as we proceed.”

Mr. Sakamoto added to this: “Furthermore, during the transportation stage from the port to the installation site, the crane boom should be shortened, otherwise there is a risk of serious damage. However, we need a very long crane boom to install these very high offshore turbines. Here, I believe the telescopic feature of the crane is quite important to us. In Japan, we have many types of telescopic cranes. Although, for use on the ocean, I have never seen such a big telescopic crane. Actually, Fukada has operated with many different type of cranes having a maximum capacity of more than 3,000 tons. However, these are fixed crane types so this telescopic concept is completely unique.”

**Fukada is the first to work with the Telescopic Crane, do you expect that more installation jack-ups will be equipped with the Telescopic Crane?**

Mr. Sakamoto: “We hope more installation jack-ups will be equipped with the Telescopic Crane. However, it is not going to be easy for other contractors to have such a special crane since Shimizu was interested in this jack-up and crane way in advance. It requires a lot of preparation and development time.”

**How did the collaboration with GustoMSC proceed, why did you choose this design?**

Mr. Sekiguchi: “This is the first time we are building a SEP. Therefore, we preferred to work with GustoMSC, a company that has a good track record. GustoMSC has answered many questions sincerely and met all our demands. As a result we succeeded in having a basic design and a shipbuilding contract within our time schedule.”

Mr. Sakamoto: “In Japan we have several shipbuilders, however they have no experience in special purpose vessels including a jack-up vessel for building offshore wind turbines. We have only spent one year to prepare the shipbuilding contract in order to start. So in this case, without a specialized partner like GustoMSC, it would be impossible to start in such a short time.”



Mr. Takeshi Sekiguchi  
Executive Officer at Shimizu



Mr. Takashi Sakamoto  
Group Manager, Offshore  
Wind Group at Fukada

**“The SC-14000XL is the ideal unit to operate under the difficult conditions of the Pacific Ocean.”**

Takeshi Sekiguchi



## PROJECT SPECIFICATIONS

Last August, Shimizu Corporation ordered the construction of the GustoMSC SC-14000XL, a highly efficient self-propelled wind installation jack-up equipped with the world’s largest telescopic crane. Shimizu is investing roughly 50 billion yen in the project and plans to bring in orders for the construction of offshore windfarms of the cost of Japan, a market estimated to be over 5 trillion yen.

The shipyard Japan Marine United Corporation will manufacture the jack-up. The vessels’s completion is scheduled for October 2022.

GustoMSC was selected by Shimizu for planning the specifications and basic design of the jack-up beginning in October 2018, as well as the design of the SC-14000XL jacking system and the Telescopic Leg Crane.

The jack-up has a total width of 50 m, a total length of 142 m, a total displacement of 28,000 t, a maximum lifting capacity of 2,500 t for the crane, and a maximum lifting height of 158 m. It can operate in water depths of between 10 m and 65 m. It will be capable of loading, transporting, and installing seven 8 MW wind turbines at a time.



# MAERSK INVINCIBLE, WORLD'S FIRST WITH CHELA CRANE

Maersk Invincible is the first rig in the world to have the new innovative Chela crane installed. Designed by GustoMSC, Chela offers striking efficiency benefits and is a major improvement in terms of safety. Chela is capable of lifting 22 tonnes at 21 m radius underneath the cantilever at any position. In this way, Chela provides a large lifting envelope without obstructing any wellhead deck space. Both are value drivers for Maersk Drilling and AkerBP.

The technology was introduced in 2016. In the presence of and with input from Maersk, AkerBP, JB Systems and Breman Factory, the FAT test was successfully performed showing the tool's capabilities and facilitating a fast-track start-up for Maersk.

In the summer of 2019, GustoMSC delivered Chela to Maersk and at present the tool is in operation on Maersk Invincible, a GustoMSC CJ70 design. This XL enhanced ultra-harsh environment jack-up rig is operating offshore in the Valhall field, a giant oilfield in the southern Norwegian North Sea for AkerBP.





# MAKE YOUR UNITS SMARTER WITH OSS

REAL-TIME DATA TO  
INCREASE EFFICIENCY  
AND SAFETY



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**GustoMSC**



an NOV company

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