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HAPPY NEW YEAR!

Welcome to 2019 and the second half of our season.

We hope you all remembered to pay your 2019 SPE dues to stay members of SPE. And when you have, please also be sure to take advantage of your member benefits such as free webinars, discounts on events and books, and so much more.

Thank you to GEUS for hosting the SPE DL in October, where Paul Mitchell gave a presentation on 4D Seismic History Matching. I hope you all had a chance to evaluate the DL online to ensure we keep getting interesting and good speakers. If you have not yet done so, please visit <http://www.spe.org/dl/contest.php>.

Here you help ensure the interest and quality of the DL speakers, and you also help the Copenhagen Section to receive Acknowledgment on SPE.org.

Please look carefully at the SPE meeting schedule page 6 as we have made a number of changes

– similar to the changes we have seen and will see in oil players in Denmark.

This year we have two events planned for February. The first event is on 5th February at Maersk Drilling, who will host a SPE event for the first time. This will take place at their premises in Lyngby and includes both a presentation by the SPE DL John Hedengren about Drilling Automation and Downhole Monitoring with Physics-based Models, and a presentation by Jacob Odgaard from Maersk Drilling about their journey of Innovation. The second event is on 27th February at Total. Then Michael Borell will give a presentation on the Yamal LNG project.

I look forward to seeing you all at the upcoming events and wish you all a safe and prosperous 2019.

Miriam Jager Lykke
Newsletter Chairman

FUTURE MEETINGS

FOR MORE INFORMATION REGARDING THE PROGRAMME SEE PAGE 6

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INNOVATING BUSINESS CYCLICAL IN

With renewables on the rise and the oil price coming off a downturn, offshore oil and gas is in a race to produce the most competitive barrel of oil. But with dozens of different suppliers and multiple interfaces involved, the process of delivering a well safely, on time and within budget has become highly complex for operators to handle.

One driller that is determined to address this issue is Maersk Drilling. The Danish-based drilling contractor is determined to reduce complexity, eliminate inefficiency and create better value for its clients by increasingly providing fully integrated services. Maersk Drilling aims to do that by combining operational excellence with new digital solutions and innovative business models in close collaboration with customers and partners.

Significant gains to be made

A central point in the value proposition is the fact that there's a wide gap between what the operator sees from the perspective of the well, and what the drilling contractor or service provider sees from the perspective of the rig.

"Take safety, for example. We don't use the same definitions, which means an LTI for an operator may not be an LTI for the drilling contractor. Non-productive time is another area where there's a gap. Skilled crews and modern rigs have high operational uptime, close to 100%. But when we look at NPT from the operator's perspective and include all of the services and activities on the well, we now see 20-25% NPT," says Jørn Madsen, CEO of Maersk Drilling.

When breaking that number down, Maersk Drilling has found that it takes up to 60 suppliers and 6,000 invoices to drill a typical offshore well. Those figures indicate that there are significant efficiency gains to be made.

This reflects a fundamental misalignment of incentives in the day rate model: It is the operator — not the drilling contractor or the oil-field services company — which bears most of the cost of non-productive time.

"For both operators and drilling contractors, we believe there is an opportunity to address this with new commercial models that reduce inefficiency and align incentives between the different parties. The window for operators to lock in low costs is closing and their incentives to investigate new types of partnerships that share risk and reward are growing," Jørn Madsen explains.

However, for contractors, rising rates will lower their incentives to share risk and reward. Drilling contractors and service providers may hope to be able to ride the uptick like they did in the previous cycle. But Maersk Drilling doesn't believe that's a sustainable choice.

MODELS IN A INDUSTRY

This time it's different

"We believe this time is different — for a number of reasons. The first is the changes underway in the energy system. With a lot of uncertainty and more competition, operators are emphasising lower project breakevens, capital discipline and keeping costs down. The second reason is the disruption that we are likely to see from digital innovation. New uses of data, digital tools and AI will make drilling safer, more automated and more efficient," says Jørn Madsen.

Maersk Drilling is already using data from thousands of sensors on its rigs and expects to be able to leverage that data to reduce maintenance downtime and costs by up to 20%. Another example is the multiple Augmented Reality projects the company is exploring to drive improvements in safety, quality and performance.

"The data revolution has definitely arrived, but it's important to remember that innovation is not only about technology. When digitalisation is combined with new commercial models, we'll see real value unlocked. We aim to do that by continuing to deliver operational excellence while pairing the innovative technologies with new business models to create greater value for our customers," says Jørn Madsen.

Forming alliances to create value

Maersk Drilling's alliance with Seapulse provides a glimpse of what is possible by challenging traditional business models. The two companies have signed a Master Alliance Agreement under which Maersk Drilling will provide fully integrated services for a 12-well global exploration drilling programme.

The programme spans shallow and deepwater wells in several regions, with the integrated well services provided under an incentive payment scheme to drive performance and provide potential upside for all parties involved in the well programme.

"When done right, this type of alliance can lower the cost per barrel and improve safety while unlocking value for all the parties involved. Acting as the central hub for all activities delivered in a drilling campaign, we offer integrated services enabled by digital tools and big data to increase efficiency and reduce complexity for our customers. We call this Smarter Drilling for Better Value," says Jørn Madsen. ◀



Jørn Madsen, CEO of Maersk Drilling.

ABSTRACT

Drilling Automation and Downhole Monitoring with Physics-Based Models

The drilling industry faces challenging market conditions that motivate the use of automation to reduce costs and decrease well manufacturing variability. The objective of this presentation is to motivate automation initiatives that utilize physics-based models for predictive monitoring and control. This presentation explores current progress, challenges, and opportunities to control critical drilling conditions such as downhole pressure in Managed Pressure Drilling (MPD). The 3 essential elements of automation are explored with a perspective on recent advancements in automation due to downhole measurement availability through wired drillpipe. However, only a small fraction of drilling systems currently utilize wired drillpipe. In automated rig systems, there is additional potential to unlock the predictive capabilities of physics-based models to “see” into the near future to optimize and coordinate control actions.

A convergence of several key technologies creates an opportunity to use sophisticated mathematical models within automation. A significant challenge is the size of the physics-based models that have too many adjustable parameters or are too slow in simulation to extract actionable information. This presentation shows how fit-for-purpose models can be used directly in the automation solutions. These fit-for-purpose models have unlocked new ways to think about automation in drilling. For example, rate optimization and pressure control have traditionally been separate applications in MPD. Simulation studies suggest significant potential improvement when combining the two applications. ◀

BIOGRAPHY



John Hedengren
Brigham Young University

John Hedengren is an Assistant Professor in the Department of Chemical Engineering at Brigham Young University. He received a PhD degree in Chemical Engineering from the University of Texas at Austin. Previously, he developed the APMonitor Optimization Suite and worked with ExxonMobil on Advanced Process Control. His primary research focuses on accelerating automation technology in drilling. Other research interests include fiber optic monitoring, Intelli-fields, reservoir optimization, and unmanned aerial systems. In addition to drilling automation, he is a leader of the Center for Unmanned Aircraft Systems (C-UAS), applying UAV automation and optimization technology to energy infrastructure. ◀

ABSTRACT

Maersk Drilling's Journey of Innovation, the Lessons Learnt and the Road to Becoming a Self-Standing Entity

The oil industry is facing new challenges and opportunities over the coming years. Realizing that, Maersk Drilling decided to build a capacity to offer better service to our customer in a quickly changing environment. We decided to assign a considerable amount of resources to an experiment outside the existing organization with key personnel fully assigned and devoted to try out new methodologies, testing ideas and failing fast. The objective was twofold: 1) validate and test ideas; 2) change the culture in the rest of the organization. We learnt a lot. After the first year of experimentation and testing out different innovation methodologies Maersk Drilling decided to integrate the Innovation function in the main organization. A proven innovation process supported by all the necessary capabilities is now being implemented giving the company a much stronger innovation muscle. ◀

PROGRAMME

- 17:00 - 18:00
Welcome drinks and Networking
- 18:00 - 18:30
Drilling Automation and Downhole Monitoring with Physics-Based Models
- 18:30 - 19:00
Maersk Drilling's Journey of Innovation, the Lessons Learnt and the Road to Becoming a Self-Standing Entity
- 19:00
DINNER
- 20:45
Closing Remarks

LOCATION

MAERSK DRILLING A/S
Lyngby Hovedgade 85
2800 Kgs.Lyngby

SPEAKERS

- John Hedengren, SPE Distinguished Lecturer
- Jacob Odgaard, Maersk Drilling

ENTRANCE FEE

None

REGISTRATION

Please indicate your attendance by Thursday 27 January by signing up on the internet www.spe-cph.dk

SPONSOR



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BIOGRAPHY



Jacob Odgaard
Innovation Lead – Maersk Drilling

Jacob graduated from the Technical University of Denmark in 1998 with an M.Sc. in Mechanical Engineering. After an initial offshore part of his career he moved on-shore as Rig Manager in Egypt and thereafter Norway.

Since 2010 Jacob has occupied various head quarter functions such as asset management, starting up seven new builds and headed the Drilling Support team. Jacob is

now Innovation Lead in Commercial and Innovation department. ◀



September 25	MAIN SPEAKER	AFTER DINNER
TOPIC	Tracer Technologies in Reservoir Management	
SPEAKER	Troels Nielsen (DTI)	
LOCATION	DTU	
SPONSOR	SPE	
October 29	MAIN SPEAKER	AFTER DINNER
TOPIC	4D Seismic History Matching	
SPEAKER	Paul Mitchell (SPE DL, Taqa)	
LOCATION	GEUS	
SPONSOR	GEUS	
November 27	MAIN SPEAKER	AFTER DINNER
TOPIC	Natural Surfactants in Oil Production Smart Waterflooding: How it Works?	Things No One Tells About Fossil Fuels
SPEAKER	Simon Ivar Andersen (DHRTC) - DTU Alexander Shapiro, CERE - DTU	Hans Horikx (DHRTC) - DTU
LOCATION	DTU	
SPONSOR	DTU	
February 5	MAIN SPEAKER	AFTER DINNER
TOPIC	Drilling Automation and Downhole Monitoring with Physics-Based Models Maersk Drilling's Journey of Innovation, the Lessons Learnt and the Road to Becoming a Self-Standing Entity	
SPEAKER	John Hedengren, SPE Distinguished Lecturer Jacob Odgaard, Maersk Drilling	
LOCATION	Maersk Drilling	
SPONSOR	Maersk Drilling	
February 27	MAIN SPEAKER	AFTER DINNER
TOPIC	Yamal LNG: The Success story and what it means for Total's strategy in Russia	
SPEAKER	Michael Borrell, Senior Vice President, North Sea and Russia, Denmark Country Chair (Total)	
LOCATION	Total	
SPONSOR	Total	
March 20	MAIN SPEAKER	AFTER DINNER
TOPIC		
SPEAKER		
LOCATION	Welltec	
SPONSOR	Welltec	
April 9	MAIN SPEAKER	AFTER DINNER
TOPIC	Managing Non-Technical Risks Made Practical and Value-driven	
SPEAKER	Christiaan Luca (SPE DL)	
LOCATION		
SPONSOR		
May	MAIN SPEAKER	AFTER DINNER
TOPIC	Energy Transition	
SPEAKER	Lee Hodder, VP Denmark Shell	
LOCATION	Shell	
SPONSOR	Shell	
June	MAIN SPEAKER	AFTER DINNER
TOPIC	SPE Summer party	
SPEAKER		
LOCATION		
SPONSOR	Schlumberger	

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YAMAL LNG:

Pioneering Project Delivery in the Russian Far North

Launched in late 2013, Yamal LNG is one of the largest and most complex LNG projects in the world.

The project aims to tap natural gas reserves totaling more than 4.5 billion barrels of oil equivalent. To do so, more than 200 wells will be drilled and three liquefaction trains built, each with a capacity of 5.5 million metric tons per annum. With the inauguration of the third train on December 11th, 2018, the project met its nameplate production capacity of 16.5 million tons per annum only one year after the start-up of train 1 in December 2017.

Operated by Novatek, who also owns a 50,1% stake, Total (20%) is also partnering with Chinese National Petroleum Company (20%) and the Silk Road Fund (9,9%) to develop the enormous gas and condensate field.

Yamal LNG project is located above the polar circle in the estuary of the Ob River, a wild, remote region that is frozen for seven-to-nine months a year, with winter temperatures dropping as low as -50°C.

Initially, there were no access routes to the site by land or sea. To facilitate transportation of equipment and staff, a large-capacity regional transportation comprising the port of Sabetta and an international airport was built beginning in 2011.

To ensure its stability in the permafrost (a thick layer of frozen subsoil whose surface only thaws in summer months), the LNG plant was built on tens of thousands of piles of varying shapes and sizes - a solution never used on such a large scale before the Yamal LNG project.

Shipping LNG in such extreme conditions also required Total and its partners to design a new breed of vessel: the LNG ice-breaker tanker. This innovative solution allows LNG to be transported without the assistance of ice breakers. Measuring 300 meters and boasting a capacity of 172,600 cubic meters, the ship can sail in ice up to 2.1 meters thick. Fifteen LNG ice-breakers will be gradually commissioned until 2019.

To unlock access to the vast gas resources of Russia's Far North, Total inaugurated a new LNG shipping route – the Northern Sea Route. It enables vessels to reach Asia in 15-20 days via the Bering Strait, compared with 30-35 days using the conventional route through the Suez Canal. The journey can currently be made between July and December, and by 2028, the introduction of a new class of ice-breakers will enable the route to be used year-round.



Despite the challenges inherent in the development, the project benefits from the high concentration of conventional onshore reserves near the coastline, the suitable application of proven traditional development technology, and a highly efficient liquefaction process, favored by the low average annual temperatures.

An iconic Group project, Yamal is a crucial contributor to Total's LNG ambition and cements the Group's status as the world's number 2 LNG player. into their microbial challenges and develop solutions that tap into their needs. ◀



Located **600 kilometers** north of the Arctic Circle

Reserves estimated at **4 billion** barrels of oil equivalent (boe)

32,000+ people working onsite at peak activity

Region frozen **7 to 9 months** a year, with temperatures dropping as low as **-50 °C**

Project budget: equivalent to **\$27 billion**

208 wells planned

80,000 piles driven into the frozen ground, up to 20 meters deep

142 modules built and shipped from 10 yards in Asia

PARTNERS:

- Novatek: 50.1%
- Total: 20%
- CNPC: 20%
- Silk Road Fund: 9.9%

Total owns an 18.9% equity stake in Novatek.

ANNUAL PRODUCTION CAPACITY

More than **450,000 boe/d**
16.5 million tons of LNG

15 ice-class LNG carriers with a capacity of **170,000** cubic meters each

3 liquefaction trains with a capacity of **5.5 million** tons each



● SPE STUDENT.....

Inspiring SPEech on 15th November



On 15th November, DTU SPE student chapter invited four recent graduates and professionals from the oil and gas industry to give an inspiring speech about their journey ended to their career, their daily tasks in the companies and how to pursue a job in the oil and gas industry. The event concluded with a pizza night and get together with speakers providing a chance for students to ask one to one questions.



Poster Competition on 27th November

Active participation of the DTU SPE Student Chapter and generous sponsorship from Nordsøfonden for the best poster awards resulted in a successful turn out of the DTU student poster competition. The poster contest was judged by the Board of the SPE Copenhagen and the four winners of the contest (Ermis Proestakis, Kianoosh Moeini, Ida Krinkel and Sai Vinjarapu), were awarded participation at the “East Meets West” student petroleum conference taking place in Krakow, Poland in Spring 2019. Collaboration between the Student Chapter and the Copenhagen SPE Section makes it possible to establish regular contacts between the students and the professionals, which is very important for the students’ professional development. ◀



Photo by: Christian Carlsson





Michael Borrell
Senior Vice President,
North Sea and Russia,
Denmark Country Chair

Michael Borrell, a graduate of the Cambridge University in Chemical Engineering (MSc 1993, BA 1984), joined Total in 1985. He has worked with its affiliate companies and has held senior managerial positions in the Total group since 1995.

From 2003 he held the position of Vice President Corporate Planning & Business Development for Total E&P Indonesia. In July 2006, he was appointed President & CEO of Total E&P Canada in Calgary. From September 2009 to June 2010, he was Vice President of the Caspian Area and Central Asia for Total Exploration and Production. In July 2010, he became Senior Vice President, Continental Europe and Central Asia. In January 2015, he was appointed Senior Vice President Europe & Central Asia.

From September 2017, he is appointed Senior Vice President North Sea and Russia and Denmark Country Chair, which comprises United Kingdom, Ireland, Norway, Denmark, the Netherlands and Russia.



PROGRAMME

17:00 - 18:00
DRINKS

18:00 - 19:00
PRESENTATION AND SPE NEWS

19:00 - 21:00
DINNER

LOCATION

TOTAL
Amerika Plads 29
København Ø

SPEAKER

Mike Borrell (SVP North Sea & Russia, Total)

TOPICS

Yamal LNG: The success story and what it means for Total's strategy in Russia

ENTRANCE FEE

None

REGISTRATION

Advanced registration is required due to access restrictions at the venue. Please sign up by Thursday 21 February at www.spe-cph.dk.

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