Spring 2016 issue

BMT Group

Energy Matters

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16-04-20

Message from the President BMT Energy Inc.

Jan van Smirren

As part of its commitment to delivering enhanced services to its clients and improved efficiencies across the business, BMT, has announced an internal reorganisation which will see the existing operating companies grouped into five market-aligned units and my role in this will be focused in the energy sector.

Today's market in the oil and gas sector does not come without it's challenges, with a historic second year of reduced capital spending and continued uncertainty in the future, we are all awaiting the upturn.

At BMT, the restructuring will allow us to improve the overall effectiveness and efficiency of our activities, enabling us to provide more integrated products which will enhance operational efficiency and integrity in existing and future offshore developments.

Moreover, we continue to focus on adopting new technological developments, both in instrumentation and analytics, to provide our clients with services of the highest level of integrity and availability.

In this issue of Energy Matters, we have focused on the oil and gas sector to highlight the services that improve the operational efficiency and life extension of offshore and coastal assets - from the initial feasibility assessment through to production.

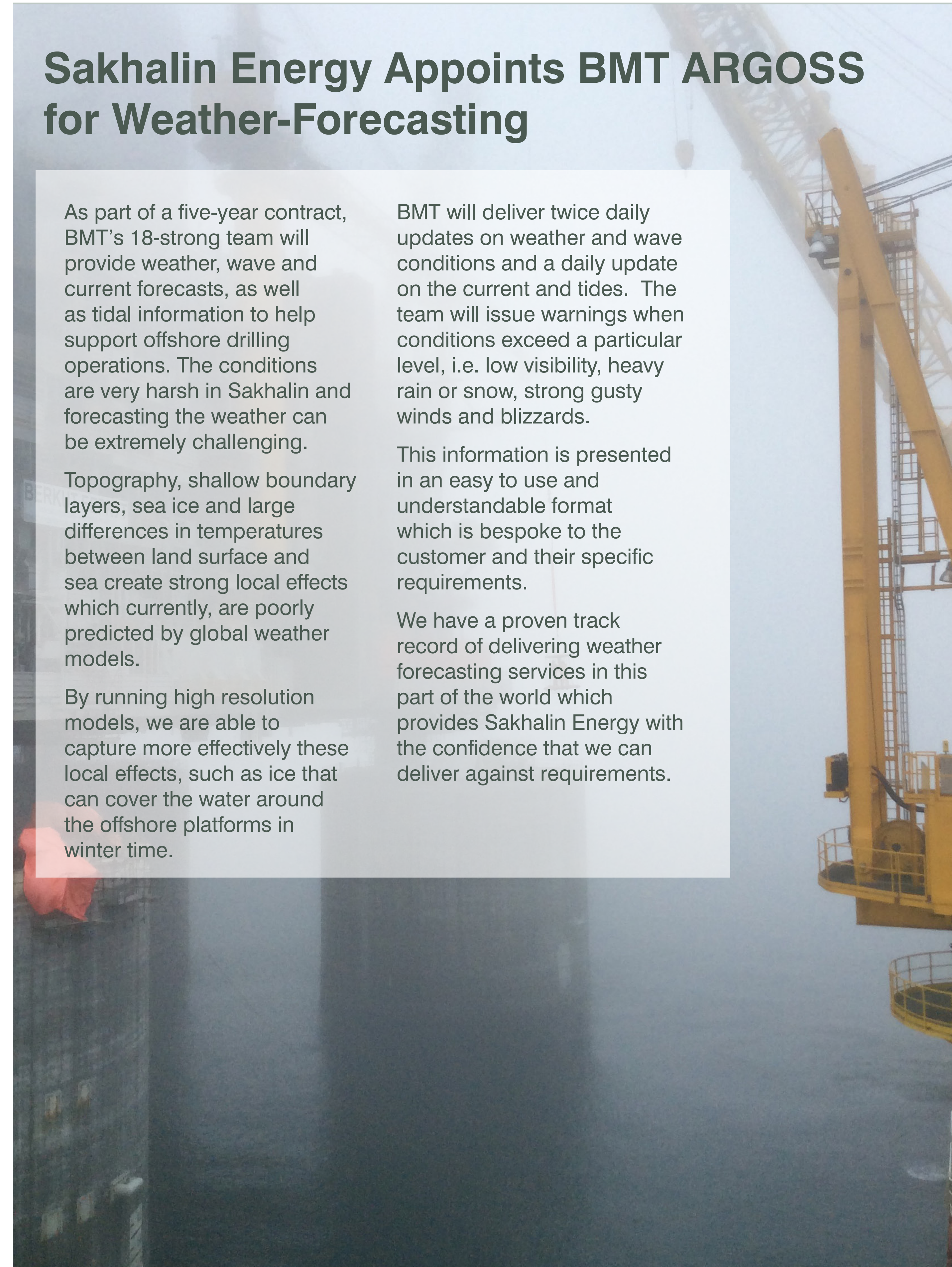
In this arena, the services of BMT cover many different scales: wind tunnel and CFD analysis of wind circulation around and through an offshore structure to support design; local and coastal modelling; and the analysis and prediction of ocean scale winds, waves and currents to improve operational forecasts and provide input into design.

Our monitoring and advisory systems provide data critical to the integrity of individual subsea elements, through to the overall response of large offshore structures to ensure their safe and long term operation.

I am dedicated to meeting the challenges of the current market conditions. I look forward to meeting with you over the next few months to learn how we can support you with existing and integrated, innovative solutions for your project requirements.

Upcoming Conferences

2016 APPEA
Conference and Exhibition
Sane Event Group Pty Ltd
PO Box 149 Hurstville BC NSW 1481
BMT is presenting



Sakhalin Energy Appoints BMT ARGOSS for Weather-Forecasting

As part of a five-year contract, BMT's 18-strong team will provide weather, wave and current forecasts, as well as tidal information to help support offshore drilling operations. The conditions are very harsh in Sakhalin and forecasting the weather can be extremely challenging.

Topography, shallow boundary layers, sea ice and large differences in temperatures between land surface and sea create strong local effects which currently, are poorly predicted by global weather models.

By running high resolution models, we are able to capture more effectively these local effects, such as ice that can cover the water around the offshore platforms in winter time.

BMT will deliver twice daily updates on weather and wave conditions and a daily update on the current and tides. The team will issue warnings when conditions exceed a particular level, i.e. low visibility, heavy rain or snow, strong gusty winds and blizzards.

This information is presented in an easy to use and understandable format which is bespoke to the customer and their specific requirements.

We have a proven track record of delivering weather forecasting services in this part of the world which provides Sakhalin Energy with the confidence that we can deliver against requirements.

BMT Validates FLNG Design with CFD and Wind Tunnel Testing

The emergence of the floating liquefied natural gas (FLNG) concept has seen an unprecedented focus on development activity and has reinforced the commercial interest in these facilities.

Floating above an offshore natural gas field, the FLNG facility will theoretically produce, liquefy, store and transfer LNG and potentially liquefied petroleum gas (LPG) and condensate at sea, before carriers ship the product direct to market. Although this approach has its benefits, it also presents challenges. When considering design and construction of the FLNG facility, every element of a conventional land-based LNG facility needs to fit into an area a fraction of the size, whilst maintaining appropriate levels of safety and giving increased flexibility to production. Furthermore, the offshore environment and associated metocean conditions, including wave motions, can create significant challenges.

Ensuring optimum design

“Owners must anticipate future requirements and deliver long-term performance, which in turn places even greater pressure on ensuring optimum design and asset integrity management of the facility.”

As the number of proposed FLNG facilities increase to meet the demand for transportation of gas reserves stranded in remote offshore locations such as South East Asia and Africa, it is essential that the safety risks are fully understood within the concept design phase.

These risks relate to: metocean conditions; impact on marine environment; possible likelihood and consequence of fire and explosion; security and evacuation and in-service maintenance. The effective management of all of these risks should involve a quantitative assessment to help optimize the design, incorporate mitigation measures and devise hazard and management strategies.

Consequence assessment

Certain hazards that are deemed to have the potential to cause a major accident event (MAE) are taken forward to the consequence assessment stage. In the final stage, hazards are quantified in terms of risk to personnel, environment and asset through techniques such as Quantitative Risk Assessment (QRA) so as to demonstrate everything has been done to ensure that risks are reduced to as low as is reasonably practicable.

Within the consequence assessment stage, Computational Fluid Dynamics (CFD) can be used as a design tool to achieve an inherently safer design. Through assessment of gas releases and fire scenarios and natural ventilation of the FLNG process topsides, recommendations can be made concerning process equipment arrangement and mitigation and prevention strategies.

Optimization of the process topsides layout can be achieved to ensure less congestion and less confinement.

Assisting FLNG designers

Wind tunnel testing can also help ensure we are designing for safety. Over the last six years, BMT has carried out testing on FLNG designs to assist designers in understanding potential mean forces and moments acting on a vessel. Wind and current measurements can be combined to determine heeling moments for a stability analysis and wind forces and moments are also necessary inputs to analyses of the mooring and thruster systems.

Reducing risks in helicopter operations

By bringing the two techniques together, the risks surrounding helicopter operations can be greatly reduced. Two of the biggest impacts to helideck environmental conditions are turbulence and hot turbine exhaust. Wind turbulence generated from airflow over obstructions such as the process topsides and turbine exhaust can significantly increase the risk involved with helicopter approach and landing.

Read more >>

With the CFD model validated against the wind tunnel testing, we can then rapidly run simulations testing further scenarios and optimize the design such as estimating the likely helideck downtime.

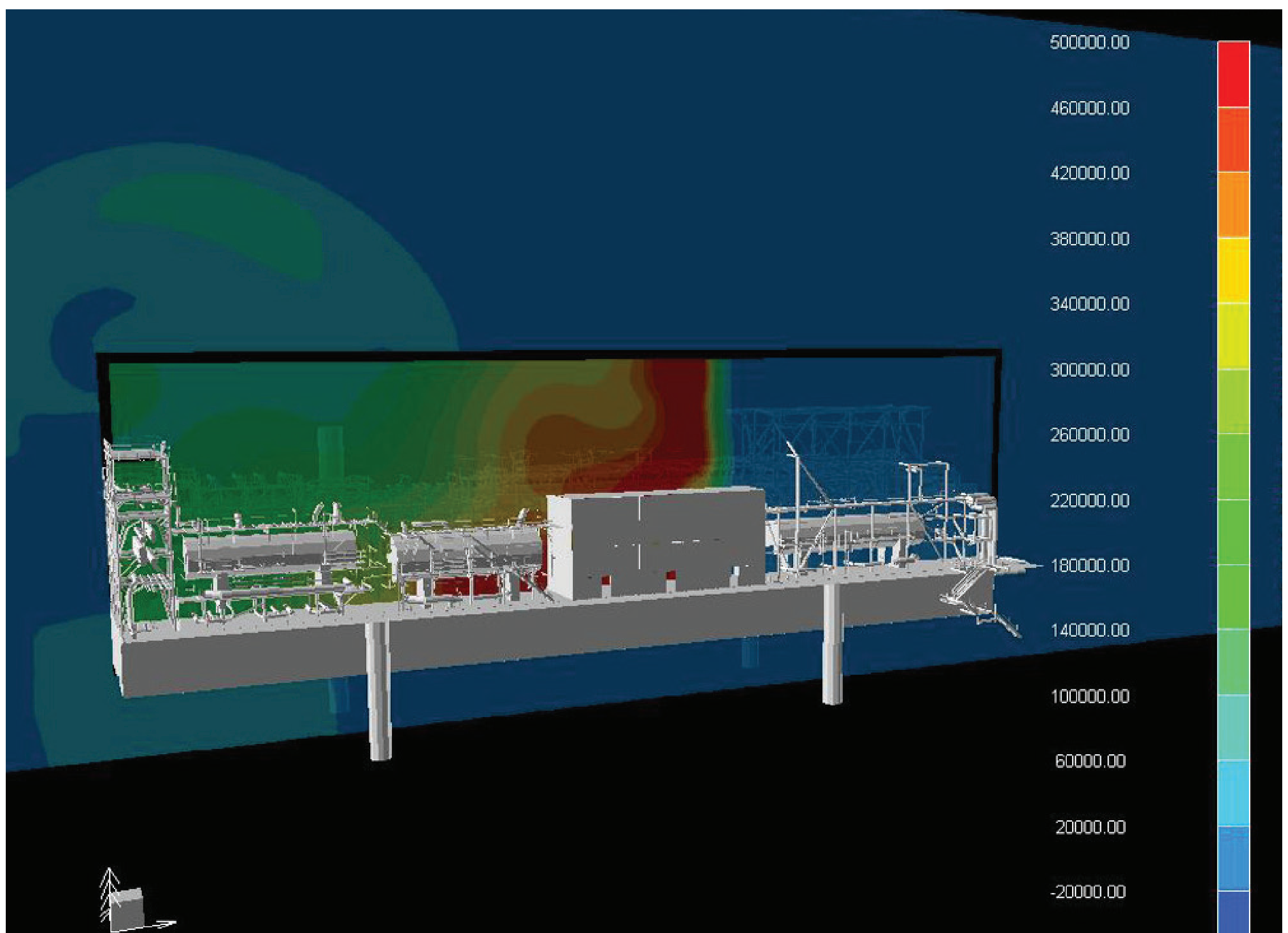
A combined approach

Developing advancement and most importantly, commonality in the methodology that combines reliable testing and simulation-based prediction of 3D wind fields and forces acting on large scale offshore vessels and floating production systems is key. Such an approach-will provide operators and designers of these structures with the opportunity to drive forward these designs with ever increasing reliability and efficiency.

"In today's current economic climate when it may seem tempting to take short cuts and save on capital expenditure, optimising design early on in a project can help to not only reduce risks to personnel, environment and asset but also reduce costs by avoiding conservatism."

A thorough approach to design and a clear understanding of the risks present to an FLNG project can also be used to increase confidence with investors and financial institutions.

Taking a risk based approach to design will ensure there won't be any nasty surprises further down the line.



Computational Fluid Dynamics is used as a design tool for FLNG topside processes.

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BMT Delivers CFD Current Loading Study for Oil Major

BMT recently carried out, on behalf of an oil and gas major, an assessment of the current loading to which an FPSO hull is subjected to, enabling it to ensure its mooring systems are fit for purpose.

CFD is becoming more commonplace in the oil and gas sector with many customers recognising it to be an effective tool for solving challenges the industry faces in a less conservative and more efficient manner.

In this project, BMT was able to use CFD to more accurately analyse the hydrodynamic forces caused by current and waves and assess the subsequent effect these forces have on the bilge keels of the vessel which are designed to stop the vessel from rolling.

3D CAD model

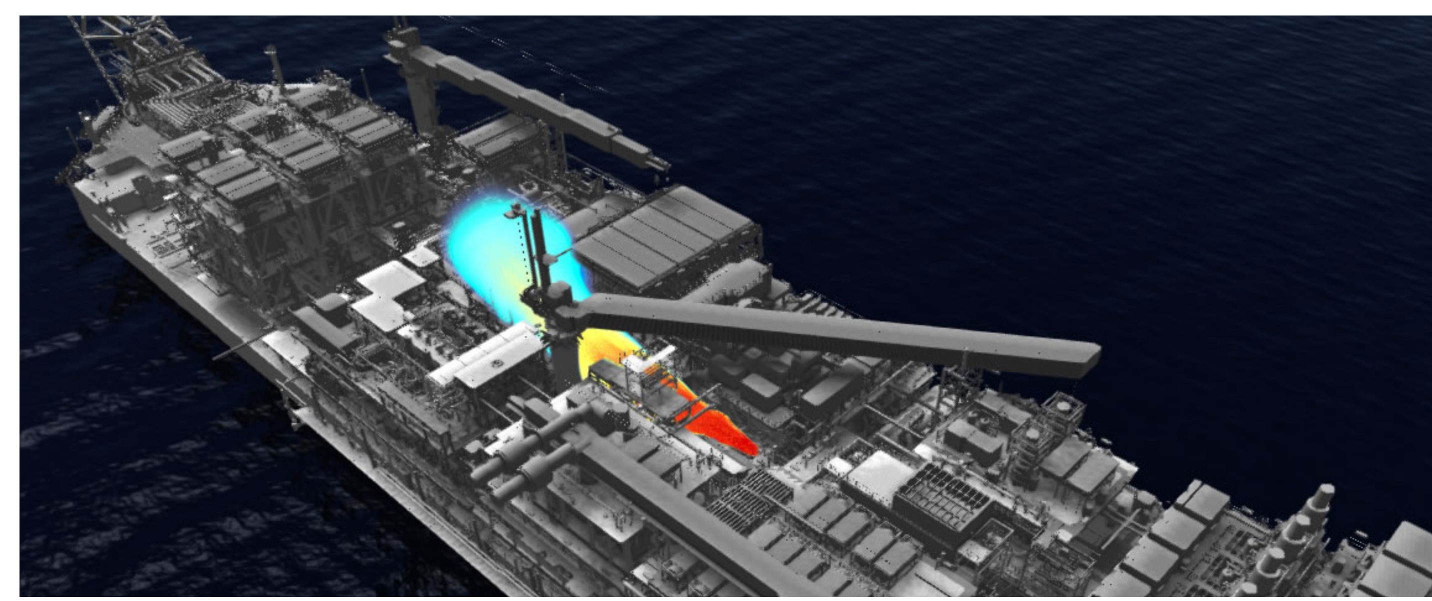
Through the creation of a 3D CAD model and representation of the FPSO below the water line, the team of specialists at BMT were able to run a comprehensive experimental and numerical study of the manoeuvring characteristics.

This looked at different parameters of current conditions to help build up a picture of how the forces and motions impact the vessel and how it performs.

Our extensive experience with shallow water hydrodynamics, manoeuvring simulation, hydrodynamic model testing and CFD allowed us to deliver against the customer requirements. The benefit of using CFD in this study is that the customer can use the less conservative loads estimated to help design the mooring systems.

CFD has a number of applications within the oil and gas market. BMT regularly uses CFD for consequence modelling (e.g. hydrocarbon fire & explosion and gas dispersion), flow assurance, and helicopter operations.

Whilst the aim of all of our work is to ensure that risks to personnel, asset, and environment are reduced to as low as reasonably practicable (ALARP) and although there may be a focus in today's current economic climate on reducing capital expenditure, BMT strongly believes that optimising design early on in a project can considerably reduce costs by avoiding conservatism.



Assessment of fire scenarios and gas releases on FPSO topside using Computational Fluid Dynamics

BMT Provides Metocean Support to Energean's Prinos and Epsilon Oil Field Developments

Customers Challenges

More and more often we are being asked to provide critical metocean information in the less well observed regions of the world, and regions with no clear precedent for design extreme values. It is what makes the task of the metocean advisor extremely interesting and often challenging. Increasingly, we are faced with fresh technical challenges and often limited local data with which to solve them.

Model simulations (hindcasts or forecasts) of metocean conditions have, for many years, been one of the main assets in our arsenal of tools with which to quantify key phenomena. However, all models have their limitations, and it is vitally important that we understand these and correct them or militate against them wherever possible.

BMT has recently completed an assessment of metocean conditions in support of Energean's Prinos and Epsilon oil field developments in the Gulf of Kavala. The Prinos oil field is the main structure in the Prinos-Kavala basin, located northwest of the island of Thassos and some-18 km south of mainland Northern Greece.

The Epsilon oil field is a satellite field within Prinos–Kavala basin. Energean will execute a 15–well drilling programme, aiming to develop 30 mmbls of oil (2P reserves) that have been independently audited in the Gulf of Kavala.

The study location offered a number of interesting challenges with regard to quantifying the wave climate.

Of particular interest were: (1) the available spatial resolution of our local hindcast; (2) additional regional complexities, namely the representation of the many small islands in the Aegean Sea through sub-grid representations within the hindcast, which is often a potential source of error; (3) the study site's proximity to shore restricting the veracity of satellite-based calibration. Neither were measured wave data available for the specific location of interest for us to perform additional site-specific calibrations.

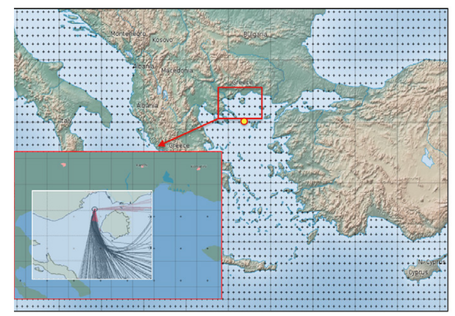
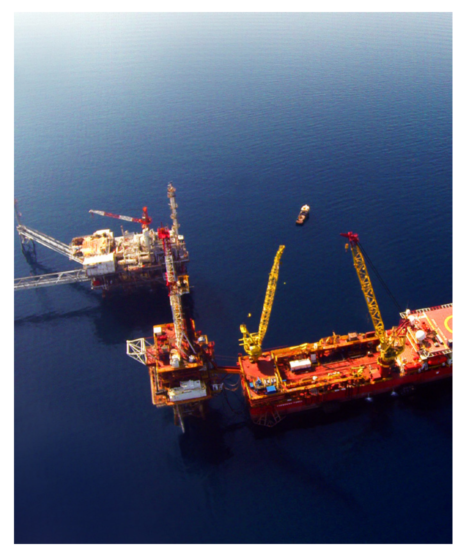


Figure 1: BMT's Mediterranean Hindcast Grid and the Final Calculated Wave Rays to the Study Site (Inset)



BMT Solutions

In order to represent wave conditions at the Kavala study site several levels of analysis were required to overcome these challenges.

Wave buoy statistics from a location between the Mount Athos peninsula and the island of Limnos (yellow circle in Figure 1) allowed us to verify the performance of the wave model at that specific location. Results suggested that the model and its associated sub-grid representations had performed well in terms of magnitude (Table 2).

	Time Period	Mean Hs	Max Hs	Mean Tp	Max Tp
Poseidon Wave Buoy	Jul 2007 - May 2008	0.84	3.52	4.7	10.0
Calibrated BMT Hindcast	Jul 2007 - May 2008	0.82	4.09	4.8	9.9
Calibrated BMT	Jan 1992 - Dec 2014	0.82	6.77	4.8	17.4

Table 1: Comparison of BMT Hindcast vs. Poseidon Wave Buoy – Basic Statistics

The directional distributions were also shown to be favourable (Figure 2).

In summary the calibrated wave model was performing well at the buoy location and would make a suitable boundary for subsequent Spectral Wave Ray Transformation (SWRT) to the specific study site.

Wave hindcast and satellite altimeter

Collocated pairs of wave hindcast and satellite altimeter data within a varying radius were then generated and used to further verify the hindcast data at five SWRT boundary locations.

Due to the proximity of land creating non-representative pairs of sea state, some locations had their respective search radii reduced slightly to minimise land effects. The reduction in data did not appear to have had any adverse effects on the quality of the calibrations.

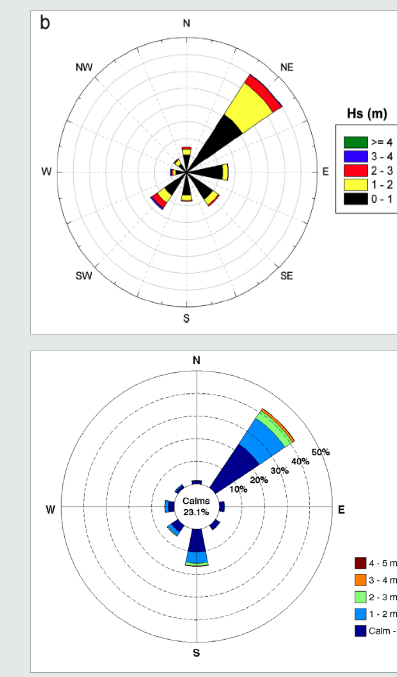


Figure 1: Contemporaneous BMT Hindcast vs. Poseidon Wave Buoy – Wave Roses

The SWRT transformation takes account of the following:

- Sheltering of certain wave directions by islands and capes
- Refraction of waves by varying bathymetry
- Wave shoaling due to changing water depth
- Wave breaking at the nearshore location of interest due to the limited water depth or steepness of waves
- Fetch-limited growth

The SWRT transform from the boundary sites to the locations of interest (wave rays are shown in the inset from Figure 1 displayed the expected changes in wave heights. Analyses representing the location of interest were then performed on these transformed data.

Read more > >

Exceedance Duration Analysis

Our primary method of deriving extreme values is BMT's own 'Exceedence Duration Analysis' method.

This method is considered extremely statistically robust and offers several advantages over alternate methods (e.g. the statistical independence of a 'Peaks Over Threshold' (POT) approach, whilst not being limited by the small sample sizes associated with that approach).

In ocean engineering, the Weibull distribution is commonly used as a model for the tails of distribution functions such as that associated with significant wave height, and of many other variables like forces or accelerations derived from sea state or wind parameters.

The processes associated with obtaining metocean criteria at this study site demonstrate the multiple methods that we are increasingly required to employ.

However, above all else we still need to be mindful and to keep check on 'reality' as the methods become increasingly multifarious. The experience of the metocean advisor is, therefore, still essential in that particular role.

Unmanned Facility Monitoring – Safeguarding the Asset

The ability to remotely monitor unmanned offshore assets is becoming increasingly important in terms of security, safety, and regulatory considerations. There are several reasons why facilities may be left in a partially or fully unmanned condition including hurricane evacuation, downscaling of production operations, or cold stacking of a drilling rig.

Monitoring platforms in evacuations

During periods of hurricane or cyclone evacuation, accurate monitoring of both environmental conditions and dynamic vessel performance is vital. This is especially true in the Gulf of Mexico with the associated reporting requirements following an abandonment event and restrictions on production startup.

A major concern is the ability to monitor facilities back on shore during an unmanned period and this is not always possible when either power to, or communications from, permanent monitoring systems are lost when a platform is evacuated.

BMT's Independent Remote Monitoring System (IRMS) operates independently of existing facility power and communication systems, providing an invaluable solution to this problem.

The system automatically transmits high quality data allowing operators to maintain communications with the asset during the unmanned event.

The environmental and dynamic performance data can then be used by stakeholders and technical experts in risk assessments for re-boarding preparations.

Following an evacuation event, offshore image and video capture, from multiple IRMS cameras, allow assessments to be made on the condition of the helideck and whether helicopter flights can immediately restart.

This negates the need for fixed wing aircraft flyovers to visually inspect the helideck prior to planning re-boarding operations.

Operational-assessments made from the IRMS allow the crew to re-board ahead of time and commence production startup routines.

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The system also provides operators with information in support of regulatory compliance to accurately demonstrate the environmental loadings the platform has been subjected to during the abandonment period.

This can lead to the operator being exempt from performing lengthy and costly underwater inspections of mooring systems.

The IRMS is a fully independent unit that is controlled by the operator on shore, via the integrated satellite communication system, and does not require intervention from offshore personnel for operational use.

The system reports back to shore using a web-based user interface allowing the user to view data files, performance statistics, and imagery.

Examples of the IRMS user interface screens are shown below. The standard IRMS includes monitoring of: pitch, roll, surge, sway, heave, yaw, position, wind speed, wind direction, barometric pressure, temperature, humidity, and battery condition. The sensor suite is customizable and can be expanded depending on the project requirements.

For example, third party inputs from mooring systems and ballast systems can be incorporated into the system to allow operators to view key vessel parameters remotely.

Power is supplied by internal batteries coupled to an integrated solar charging system, allowing the IRMS to operate independently from shipboard power systems.

BMT field engineers are able to install and commission the complete system within 24 hours, thereby minimizing installation costs and providing options for re-deployment.

Since 2006, multiple IRMS have been successfully deployed in the Gulf of Mexico on deepwater production platforms.

BMT has recently enhanced the design to provide greater installation flexibility. The system lends itself well to a range of applications including-the-monitoring of unmanned cold stacked rigs, tow monitoring, and decommissioned platforms.

Typical data and camera stream presentations from BMT IRMS system offshore

BMT Employee Spotlights - New Faces and Key Contacts

Noel Bernatt

BMT Fluid Mechanics hired Noel as their new Operations Director. With over 20 years' experience in mechanical engineering consultancy, Noel joined BMT Fluid Mechanics as their new Operations Director based in London.

Noel is a qualified chartered engineer with a Bachelor's degree in mechanical engineering and a Master's degree in Renewable Energy Technology.

Jamie Dollman

Jamie recently joined BMT ARGOSS as a Metocean Consultant. After earning a BSc in Ocean Sciences and an MSc in Applied Physical Oceanography at Bangor University, he worked for Fugro EMU as a Senior Metocean Scientist.

He has 6 years of practical experience in the oil and gas, renewable energy, government, and research sectors.

Eric Crumpton

BMT Scientific Marine Services hired Eric Crumpton as their new Service Manager. He has over 30 years' experience in operations, manufacturing and maintenance and has had professional training from the US Navy.

His most recent position prior to BMT was as ROV Operations Manager for Global Diving and Salvage in Seattle.

Ingvar Lukas

Ingvar joined BMT ARGOSS as a Metocean Advisor. He has a BSc in Engineering Physics from Tallinn University of Technology, Estonia, and MSc in Oceanography from the University of Southampton, UK.

He has worked on a number of metocean consultancy projects, ranging from data deliveries to detailed desktop studies and analyses.

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