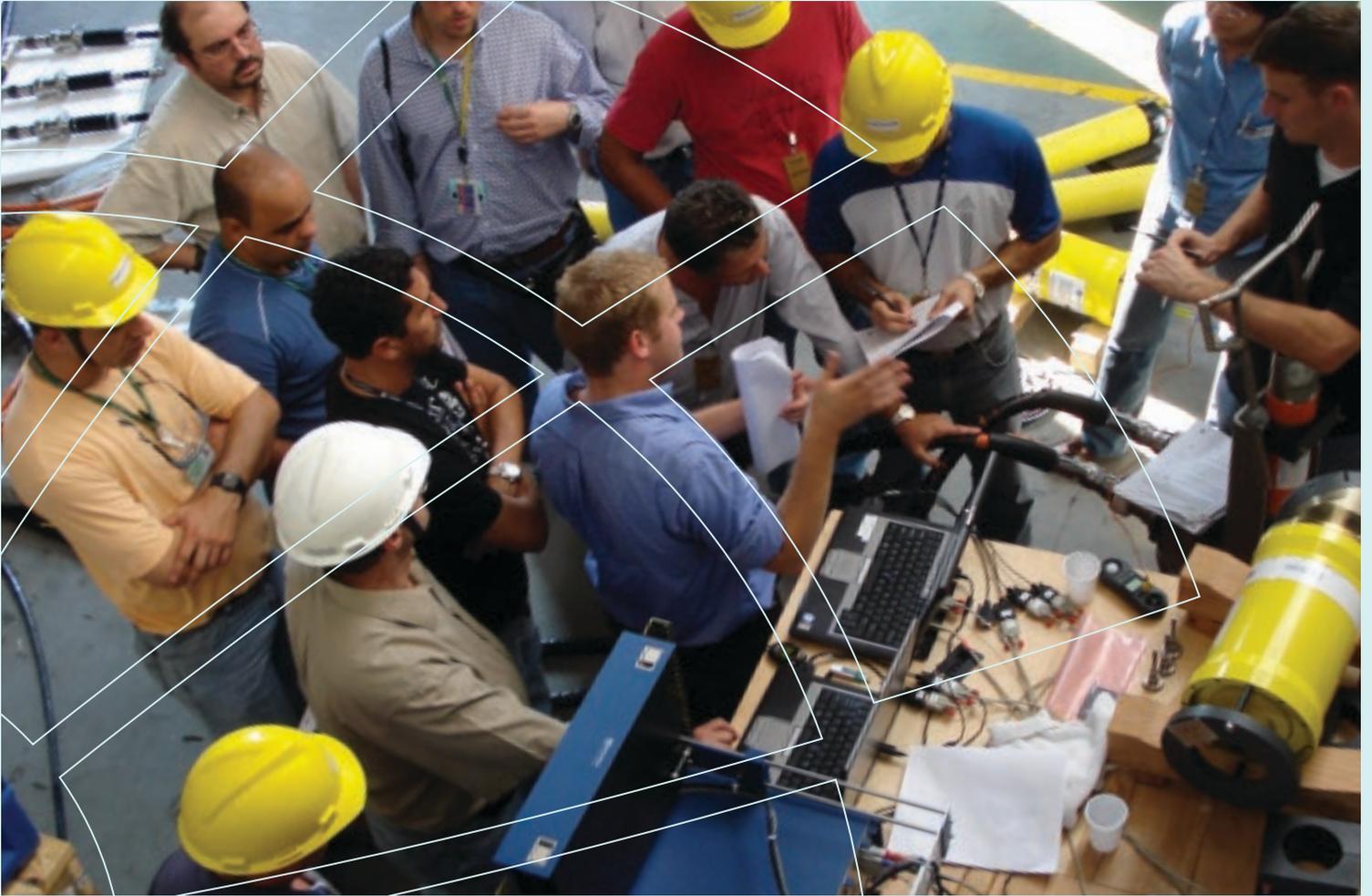


Marine integrity monitoring

Offshore oil and gas



Where will our knowledge take you?

BMT has over 20 years experience in the design, procurement, integration and installation of monitoring systems worldwide.

Understanding the response of structures to environmental conditions enables our engineers to develop custom-designed solutions exceeding client expectations for the life of a field.

Our systems are found on a wide range of floating offshore oil facilities (e.g. floating production storage and offloading vessels,

semi-submersibles, tension leg platforms, spars) and subsea risers (steel catenary and free-standing).

Dedicated and experienced personnel are committed to providing quality systems from initial design through to data delivery and consultancy on asset integrity.

In order to continually strive for excellence, BMT implements and maintains management systems compliant with internationally recognized standards covering quality, health and safety and environmental management. BMT is certified in ISO 9001, ISO 14001 and ISO 18001.

“ BMT Integrity Monitoring Systems provide critical data to determine performance and mitigate risk. ”



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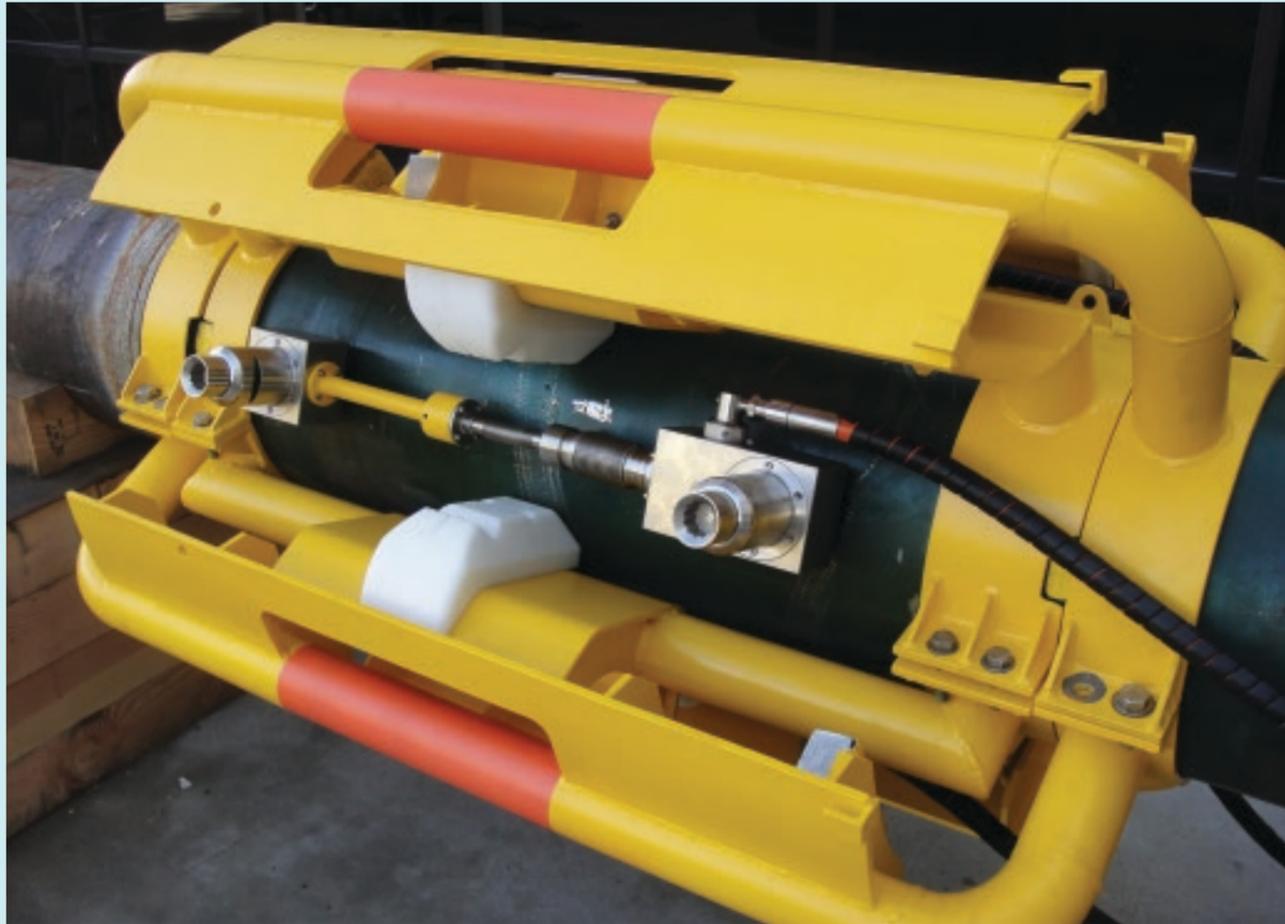
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Riser and Flowline Integrity Monitoring Systems

BMT Riser and Flowline Monitoring Systems measure bending and fatigue to assess degradation on many kinds of subsea risers. BMT's ROV-Serviceable

SSSA combines the accuracy of BMT's strain sensors with the convenience and safety of being ROV serviceable.

BMT are able to provide monitoring systems for many types of risers and flowlines, including: Buoyancy Supported

Risers (BSRs), Steel Catenary Risers (SCRs), Single Line Offset Risers (SLORs), Free-Standing Hybrid Risers (FSHRs), Multi-Bore Hybrid Risers (MHRs) and Oil-Offloading Lines (OOLs).

Integrity Monitoring Systems

By taking a more holistic approach to monitoring the environment and the structural response, BMT integrated systems provide a complete understanding of an asset's long-term integrity. Integrity management is essential for determining whether assets are operating as designed, reducing potential downtime and minimizing risk.

Integrated Marine Monitoring Systems

BMT's Integrated Marine Monitoring Systems (IMMS) reduce operational risk and costs and contribute to an overall safer platform environment. The IMMS provides operators with a greater understanding of the environment and its effect on the facility.

Platform performance and environmental conditions, such as wind speed, current profiles, air gap, and wave height, can be simultaneously monitored in real time using components of the IMMS. The system archives the data for accessing the facility's integrity over time and interfaces with the other platform control systems. BMT also provides postprocessing and forensic studies based on archived data.

Tendon Tension Monitoring Systems

Tendon Tension Monitoring Systems (TTMS) monitor tendon health and platform weight distribution in both Installation and Operation Mode. BMT provides two types of TTMS: porch-based systems and in-line systems.

Platform safety is a key concern through the life of the platform and the TTMS plays a key role in maintaining operational safety by displaying information regarding the weight distribution and tendon tension.

Top-Tensioned Riser Monitoring System

Maintenance of the correct top tension ratio in vertical risers is essential for safe operations. BMT provides a system for directly monitoring tension in top-tensioned risers that is without parallel in the industry.

BMT's Top Tensioned Riser Monitoring Systems (TTRMS) use hydraulic cylinders to tension the production risers. The system consists of a junction box per riser containing pressure transducers, a string potentiometer, and hardware to digitize signals and transmit them to an IMMS console.

Anchor Leg/Load Mooring Monitoring Systems

Anchor Leg/Load Mooring systems provide valuable information for safe operations, forensic engineering and the validation of design codes for floating moored structures, particularly when mooring line tension is collected simultaneously with metocean parameters on a common time base via an IMMS.

Several technologies may be customized to match the requirements for monitoring the tension of a mooring line during the installation and operation of an asset, including the telemetry of data to a vessel control room and bespoke alarm displays.

Single Point Mooring Monitoring Systems

BMT Single Point Mooring (SPM) Monitoring Systems provide tanker masters and FPSO or shore-side control room operators with real time operational and environment data. These data are essential in the management of the integrity of the asset and for operational decisions related to the efficient hook-up and disconnect during offloading.

The system can be customized to fit specific requirements including integration into an existing telemetry system, implementation of a newer, more robust redundant telemetry system, or additional functionality and measurement options.



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1: BMT's Independent Remote Monitoring System provides the ability to monitor environmental conditions and the dynamic performance of offshore facilities remotely during evacuation.

2: Single Point Mooring Monitoring Systems measure hawser tension and data transmission to a shore station or moored vessel.

Independent Remote Monitoring Systems

The Independent Remote Monitoring System allows operators to maintain communications with their floating assets (exploration or production) and receive key environmental and performance data in real-time during an evacuation. Real-time data and accompanying video (or images) are displayed on the BMT IRMS web page.

The IRMS automatically transmits high quality environmental and dynamic performance data to provide an early assessment of post-evacuation platform conditions for expedited reboarding.



Image courtesy of Shell

Client Support Services - Data Analysis and Consulting

Structural and metocean data generated from BMT monitoring systems provides indispensable information for validating the integrity and behavior of offshore platforms. Our highly qualified and experienced data analysts and ocean engineers provide consulting to the offshore and marine industries and government agencies on all aspects of interpretation and understanding of marine systems.

Operation Support: Analysis and Reporting

Regular and periodic system health reporting addresses instrumentation health quality issues based on data examination. Reports provide short and long term trend statistics for environmental and global motion data, including Vortex Induced Motions (VIM). These reports also provide feedback to BMT's Service Group to help them provide efficient and effective system maintenance.

Metocean Data and Forecasting

BMT's extensive metocean databases are used to derive metocean statistics and identify operational risks. Forecasting services include focused predictions for a platform's near future behavior based on prior established relationships between environmental forces and the platform-specific responses.

Client Data Center

In order to assess the long-term performance of a platform, data sets from monitoring systems should be processed and managed regularly. Through the Client Data Center (CDC), BMT offers efficient, rapid access service to measured and post-processed data.

All raw and post-processed data is uploaded and downloaded to and from the CDC by authorized users, without breaching security issues with a client's internal network. Authorized users have individual secure access via their Internet web browser.

CDC services come in 3 phases, tailored for a client's needs:

- CDC Data: standard data transfer and archiving, processing and records repository.
- CDC Visual: a visualization service for platform-specific statistics trends and specialized data cross-correlation.
- CDC Beyond: customized reporting per client request.



Additional Services

Physical Model Testing:

BMT has expertise in configuring physical model test programs in support of a design, providing knowledgeable representation on-site while experiments are conducted and interpreting the experimental results.

Detailed Analyses:

BMT provides special studies to address specific issues for platforms in cases such as storm events, forensic studies or other circumstances affecting integrity.

Artificial Neural Network:

Networks are generated to simulate sensor failures and the data produced helps determine how systems continue to function in times of sensor failure.

Adaptive Kalman Filter:

BMT has deployed an innovative fusion system which applies adaptive Kalman filtering to the problem of combining Global Positioning System (GPS) and Inertial Navigation System data and provides best estimates of platform position and attitude.



“ Regular maintenance of BMT integrity monitoring systems reduces potential operational downtime for the life of a floating asset. ”

Client Support Services - System Maintenance

Regular servicing of sensors provides health checks on asset integrity and ensures long-term quality data is archived for marine assurance managers to regularly assess the asset's design life. We provide service, maintenance, consulting and training services to maintain these monitoring systems.



Ensuring Safety in Offshore Work

BMT technicians are certified in all necessary courses and procedures prior to offshore travel, such as BOSIET, HAZCOM, SEMS, LOTO, SafeGulf and more.

BMT personnel also strongly adhere to the guidelines for offshore safety set forth in the BMT Health and Safety Manual to ensure general safe work practices. BMT's health and safety management system is OHSAS 18001 certified.

Hurricane Preparation

For the Gulf of Mexico and areas of the world experiencing seasonal weather extremes, BMT's Service team can individually inspect and maintain monitoring systems in preparation. If necessary, repairs are made, damaged units are replaced and outdated equipment is upgraded.

Operators have found that such preparations for hurricane season pay off when the environment and vessel response data acquired during hurricane evacuation feeds into and informs of the vessel and mooring inspections that are required before restarting production.

BMT's services include:

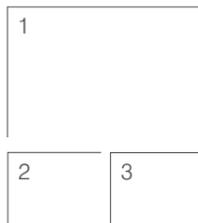
- On-site yearly trips to run health diagnostics and perform maintenance, helping to avoid expensive repairs and downtime.
- Expedited trips with well-trained field engineers and technicians to troubleshoot, repair and bring down systems back to full health.
- Training classes to get your operations team familiar and knowledgeable on BMT systems. We can conduct classes at customers' offices, offshore facilities or local BMT offices.

Client Support Services - System Upgrades

Long-term commitment to the performance of our monitoring systems on a global basis is the foundation of BMT's philosophy for supporting operators throughout the design life of an asset, often over 25 years.

As sensor technology improves, BMT ensures that operators are provided with informed decisions on new technology and presents options for upgrades. BMT also regularly reviews modifications to design codes and recommended practices for the offshore industry to assess whether system upgrades are needed to support the most current standards.

BMT has upgraded a number of the 60+ marine monitoring systems it has originally installed on offshore platforms around the world. Upgrades have ranged from the addition of a few new sensors or data channels to full replacement of outdated computers and software. We can even consolidate disparate sensor suites and multiple data acquisition systems to place the important marine data within a single system on a common time base.



- 1: Spar production platform
- 2: BMT service technician with ADCP
- 3: BMT engineer testing Subsea Strain Sensor prior to deployment



Worldwide Offshore Oil & Gas Support

In recent years, the Offshore Oil and Gas segment has seen tremendous growth in new areas around the world as the global energy demand has risen. With offices and representatives strategically located to support each major offshore oil and gas region, BMT provides oil and gas companies and their major contractors with insight and solutions to the engineering and environmental challenges of operating within, upon and around the world's oceans and seas.



1: US and Gulf of Mexico

BMT supports offshore oil and gas clients operating in the Gulf of Mexico with integrity monitoring, metocean services, maintenance, design support and risk assessment. Our Houston, Texas office is conveniently located to serve our clients and maintain the 40+ marine integrity monitoring systems that BMT has installed on GoM platforms.

2: Brazil

In 2011, BMT opened an office in Rio de Janeiro as part of the ongoing effort to enhance product sales, delivery and service support to Petrobras and other oil and gas clients in Brazil. That next year, BMT built upon this presence by acquiring a share in NAVCON, a company located in Sao Jose dos Campos, SP who specialize in metocean monitoring, data acquisition, motion and inertial navigation systems for offshore applications.

3: Asia Pacific and Australia

BMT understood the increasingly important role of the Asia Pacific region in the world of oil and gas exploration and production. BMT has offices in Singapore, Indonesia and Hong Kong, and in multiple locations throughout Australia. In 2013, BMT recognized a new opportunity in Malaysia, a rapidly growing country with many new oil and gas developments. BMT Asia Sdn Bhd was established in Kuala Lumpur to offer regional support.

4: UK and Europe

BMT is headquartered in the UK and maintains a large representation throughout the UK and Europe. Many BMT clients are based in Europe with a growing number of projects in the region, particularly in the North Sea.

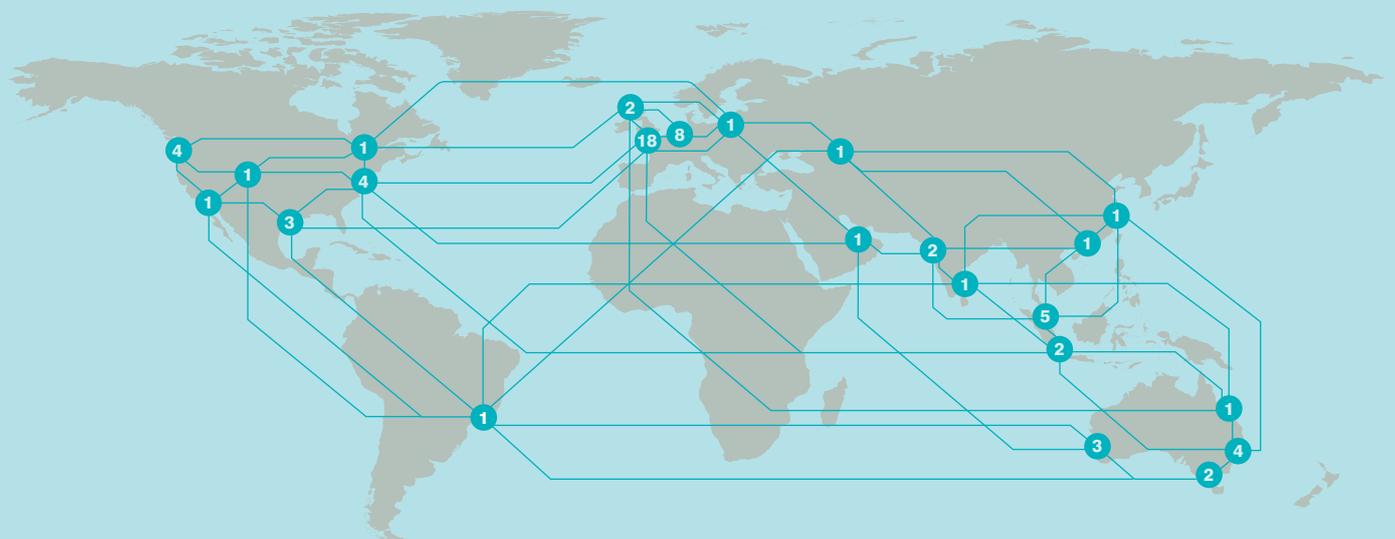
5: West Africa

A spate of discoveries in the last few years has caused an oil and gas boom in West Africa, making it one of the most important areas of the world for exploration and production. BMT has been contracted to provide systems and services to many of these West Africa projects and can enlist localized resources as needed to service major oil and gas producers and facility owners.



BMT is an international design, engineering and risk management consultancy, working principally in the energy and environment, transport and defence sectors.

With locations in all of the major markets we serve, ours is an active network that sees us sharing skills and knowledge, combining disciplines and building international teams to create integrated answers to the questions of our national and international customers.



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