PULSE

Structural Monitoring

an ACTEON company

The Pulse way

Pulse is the leading provider of marine structural monitoring services and has been providing highly successful monitoring systems since 1998.

Quantifying the unknown

We focus on providing project critical information that drives operational insight, confidence and performance, ultimately protecting your corporate and individual reputation by quantifying the unknown.

Our people

Pulse's key strength is the agility and experience of our people. We employ a team of highly skilled individuals across all areas of operations, helping us to deliver practical and innovative solutions to our clients.

Our technology

Our ideology is to reduce complexity, creating simplified yet smarter solutions. Our products are designed and qualified to deliver reliable performance to suit the increasing demands of the offshore industry.

Our analysis

At Pulse we understand that value is only created when gathered data is analysed intelligently, creating a quantitative basis for decision making. We supply dependable, smart information that provides you with a unique level of actionable insight.

Our track record

Our success has been built on more than 15 years of pioneering work in the field of structural monitoring. Our advantage is an implicit understanding of offshore structures and an unrivalled track record as technical and dynamic leader in our field.

> Our systems and services allow safe and efficient operations in challenging environments.

At Pulse everything we do is focused on two core values: maximising potential and minimising risk. These values have driven our growth over recent years, making us the leader in the field of structural monitoring.

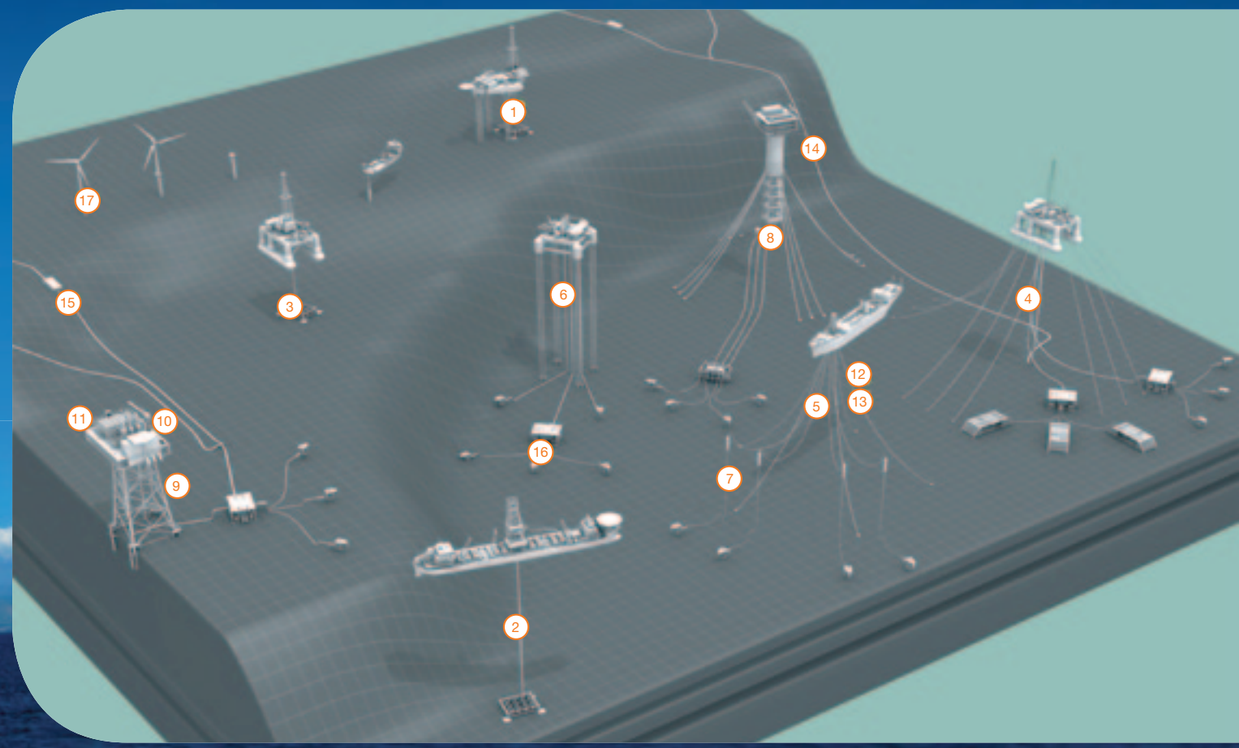
This brochure shows how Pulse has continually led the industry with pioneering technologies and systems, whilst never reducing our focus on safety.

Pulse has built up a strong reputation by advancing solutions that allow our clients to conduct safe and efficient operations in new and challenging environments.

We look forward to developing a robust solution to meet the demands of your next operation.

Richard Kluth
Managing Director

Introducing Pulse



As the offshore industry moves into harsher environments and increasing water depths, engineers face increasingly arduous challenges.

Pulse supplies structural monitoring services which allow operators and drilling contractors to comply with international regulations, allow safer operations, increase uptime, improve productivity and extend the life of offshore assets.

Why structural monitoring?

Safety	Efficiency	Asset Life Extension	Design Verification	Design Improvement	Proactive Integrity Management
Tracking fatigue over an asset's lifetime to control hazards and help prevent equipment failure.	Better understanding of asset condition helps improve scheduling of inspection and maintenance strategies.	Evidence based knowledge to support field life extension and brownfield tie-in justifications.	The use of empirical data helps to reduce the conservatism of mathematical models.	Current philosophy in design is 'design for life'. This approach employs redundancy which can be removed through monitoring.	Demonstrating a continuous understanding of asset behaviour to ensure regulatory compliance.

Pulse services

Drilling, completion and workover riser management systems for:

1. Shallow water risers
2. Deep water risers
3. Wellheads and conductors.

Production riser management systems for:

4. Steel catenary risers
5. Flexible risers
6. Top tensioned risers
7. Free standing risers
8. Buoyancy cans.

Marine and mooring line monitoring systems for:

9. Platform jackets
10. Environmental and Metocean
11. Life extension of ageing platforms
12. Mooring line inclination
13. Mooring line tension.

Pipelines and subsea infrastructure systems for:

14. Subsea pipeline spans
15. Pipeline vibration
16. Flowlines, manifolds, spools, trees, jumpers
17. Offshore wind farms and marine turbines.

These are just some of the structures that we have monitored over the years but it is by no means an exhaustive list. Our excellent R&D capabilities, quality engineers and flexible working culture allow us to constantly develop innovative solutions to meet our clients' needs. Contact us today to see how we can meet the demands of your next operation.

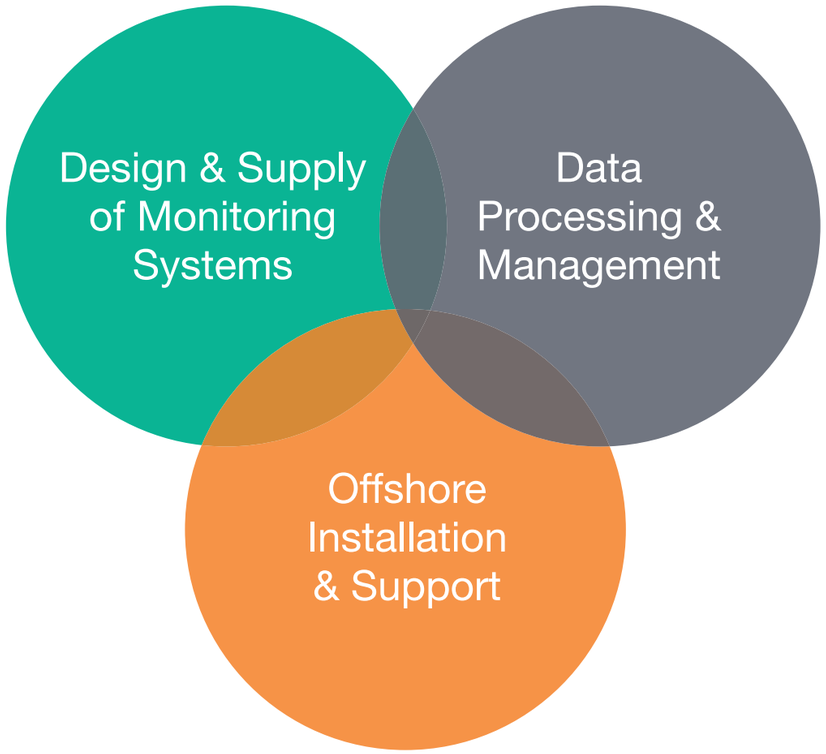
Total monitoring solutions

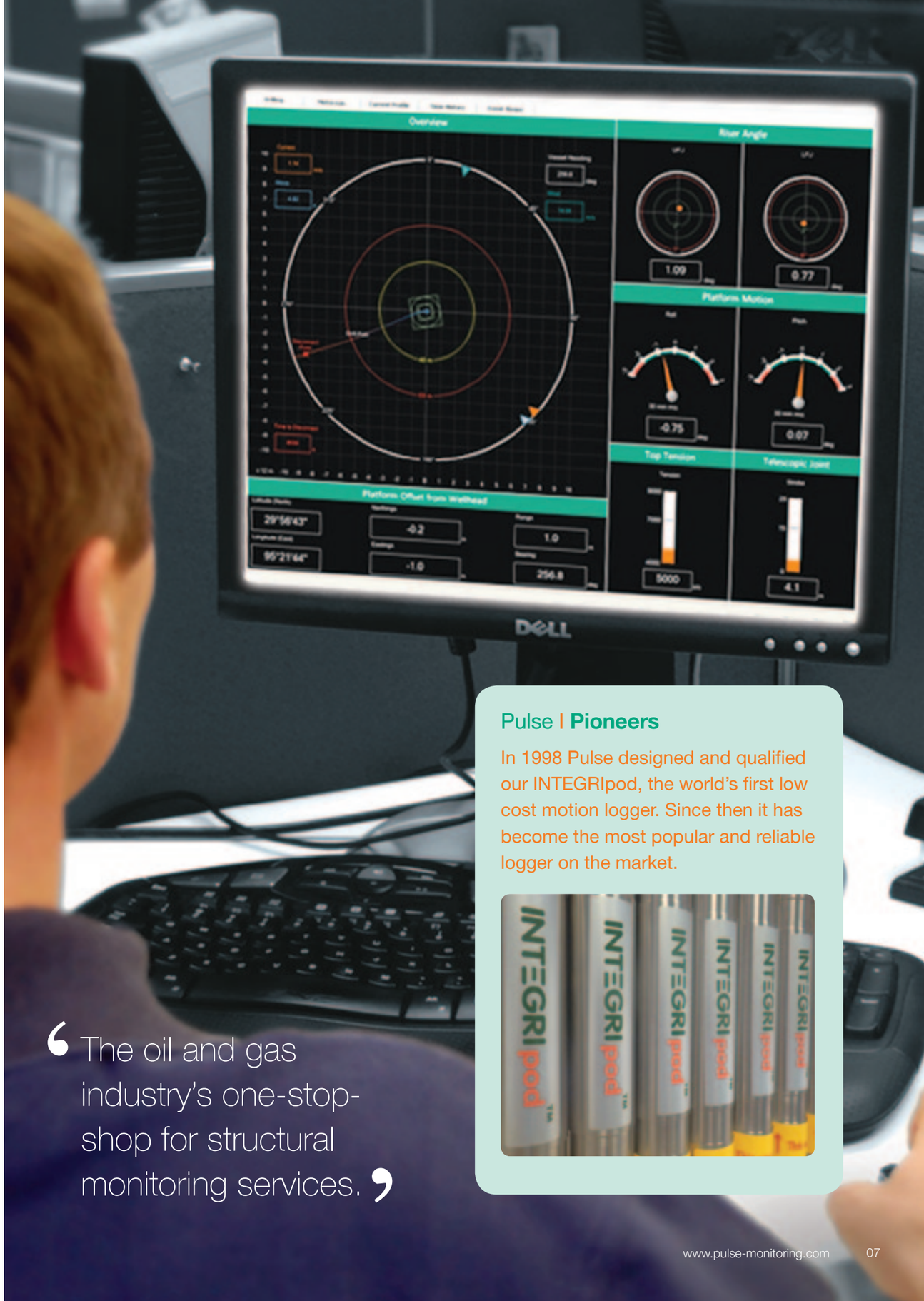
Pulse provides total monitoring solutions, from client specifications to detailed data evaluation and custom reporting, making us the one-stop-shop for the oil and gas industry's structural monitoring requirements. Our services allow for a comprehensive understanding of the structural response and performance of critical assets.

Design and supply of monitoring systems and services

At Pulse we listen to and understand your requirements, allowing us to develop integrated monitoring systems to meet the specifications of each individual project. All our bespoke systems are comprised of off-the-shelf, modular components.

Our robust subsea sensors are qualified and verified with a typical mean time before failure of over 40 years. Our industry standard interfaces allow us to integrate with third-party equipment, such as current meters and wave radars, as well as with central vessel systems.





"The oil and gas industry's one-stop-shop for structural monitoring services."

Pulse I **Pioneers**

In 1998 Pulse designed and qualified our INTEGRIpod, the world's first low cost motion logger. Since then it has become the most popular and reliable logger on the market.

Offshore installation and support

Pulse has a global team of experienced and dedicated offshore engineers who are on call to provide expertise for the installation of new monitoring systems or for the support of ongoing projects.

We take great pride in the excellence of our employees who are qualified in a range of disciplines to meet the demands of our work. All our engineers are familiar with the offshore environment and have extensive, practical knowledge of Pulse and third-party equipment.

Data processing and management

Pulse offers a range of services that simplify data management and processing to ensure we get the most out of the data and enhance value for our clients.

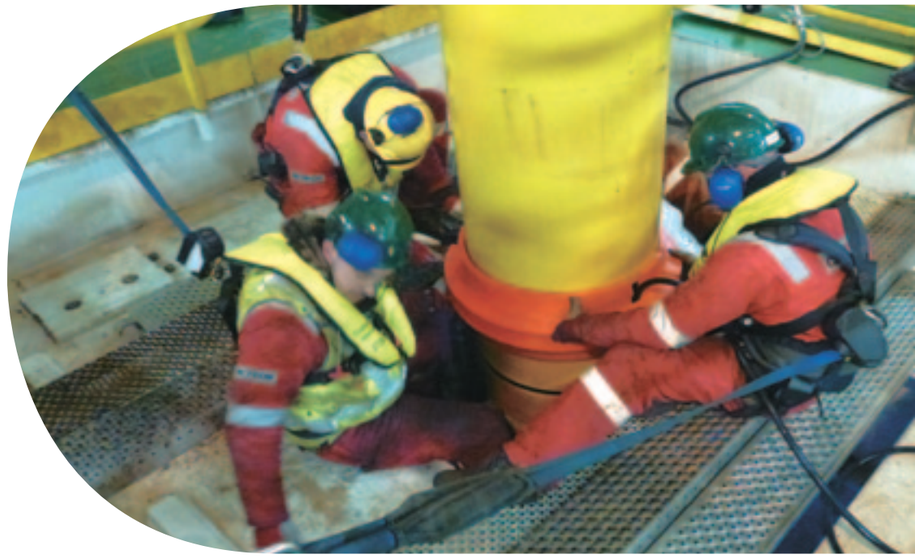
We understand your needs, allowing us to conduct thorough analysis of the relevant data, delivering the information that enables you to make better decisions.

Reports are customised to your requirements and typically include fatigue calculations or spectral and modal analysis of structural responses.

This quantitative approach to integrity management reduces uncertainties, increases confidence and minimises risk.

Drilling, completion and workover

“The Pulse RMS improves the safety and efficiency of drilling operations.”



As drilling activities move into deeper water and increasingly inhospitable environments, the potential for fatigue loading on critical components has continued to grow.

Wellhead and conductor fatigue

Dynamic loads are imposed on the wellhead and conductor by response of the MODU and riser, generating elastic stress cycles in the wellhead and upper portion of the conductor. Damage accumulates at certain critical points (fatigue hotspots).

Vortex induced vibration (VIV)

Under strong, steady currents the vortex shedding at the leeward side of the riser may lock on to the natural frequencies of vibration of the riser system. This is a key driver of dynamic loading in the riser, wellhead and conductor.

Riser fatigue

Vessel motion, hydrodynamic loading (from waves) and VIV can all lead to dynamic loading in the riser system. This causes riser fatigue to accumulate over time, potentially leading to a riser failure if not managed adequately.

System overview

Pulse riser management systems (RMS) combine asset management with structural measurements and metocean data to track historical riser performance and predict behaviour in the prevailing conditions. The system improves safety and efficiency of operations, as well as helping extend the life of equipment by reducing fatigue and wear on critical components.

- Metocean and environmental monitoring.
- Asset management to track the fatigue on individual riser joints.
- Strain and motion monitoring of the riser, the wellhead and conductor.

Pulse I **Pioneers**

In 2013 Pulse supplied a drilling riser monitoring system for the first ever dual gradient drilling riser.

The monitoring system measures dynamic bending, vibration and fatigue accumulation to help the operator better understand the dynamic behaviour of the drilling riser.

Production

Calculating fatigue performance of production risers is necessary to reduce cost and prevent a potential catastrophic failure. However, this also poses a significant challenge due to the large number of contributing factors to long-term riser fatigue. Pulse provides a range of systems to measure degradation on many types of subsea risers.

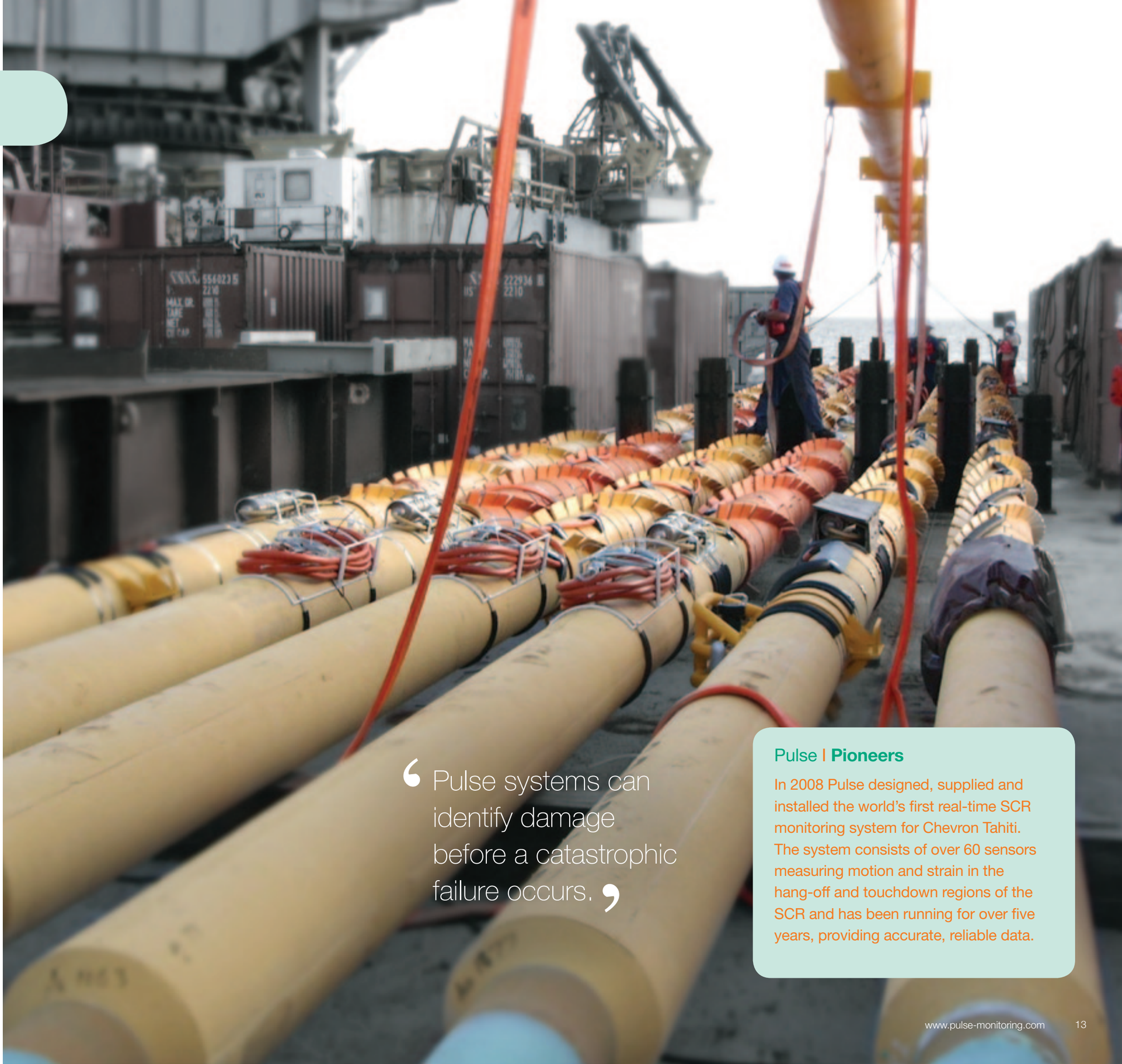
Steel catenary risers

Despite the perception that SCRs are a simple concept, the structural response observed is highly complex and there remains a degree of uncertainty in the ability to accurately predict long-term fatigue life.

Factors that can contribute to long-term structural damage include:

- first order loading and vessel motions
- low frequency second order vessel motions
- vessel springing
- vibration due to vortex shedding.

The Pulse SCR monitoring system measures motion and strain in the two most fatigue-critical locations: VIV in the hang-off region and the riser/soil interaction in the touchdown zone.



‘ Pulse systems can identify damage before a catastrophic failure occurs. ’

Pulse | Pioneers

In 2008 Pulse designed, supplied and installed the world’s first real-time SCR monitoring system for Chevron Tahiti. The system consists of over 60 sensors measuring motion and strain in the hang-off and touchdown regions of the SCR and has been running for over five years, providing accurate, reliable data.

Production

Flexible risers

It is continuously critical that risers are designed and qualified according to challenging operating conditions. Flexible riser integrity management and complex riser qualification processes have consequently become the main focus for major operators in guaranteeing the safety of offshore operations to reduce the risk of human, environmental and material losses.

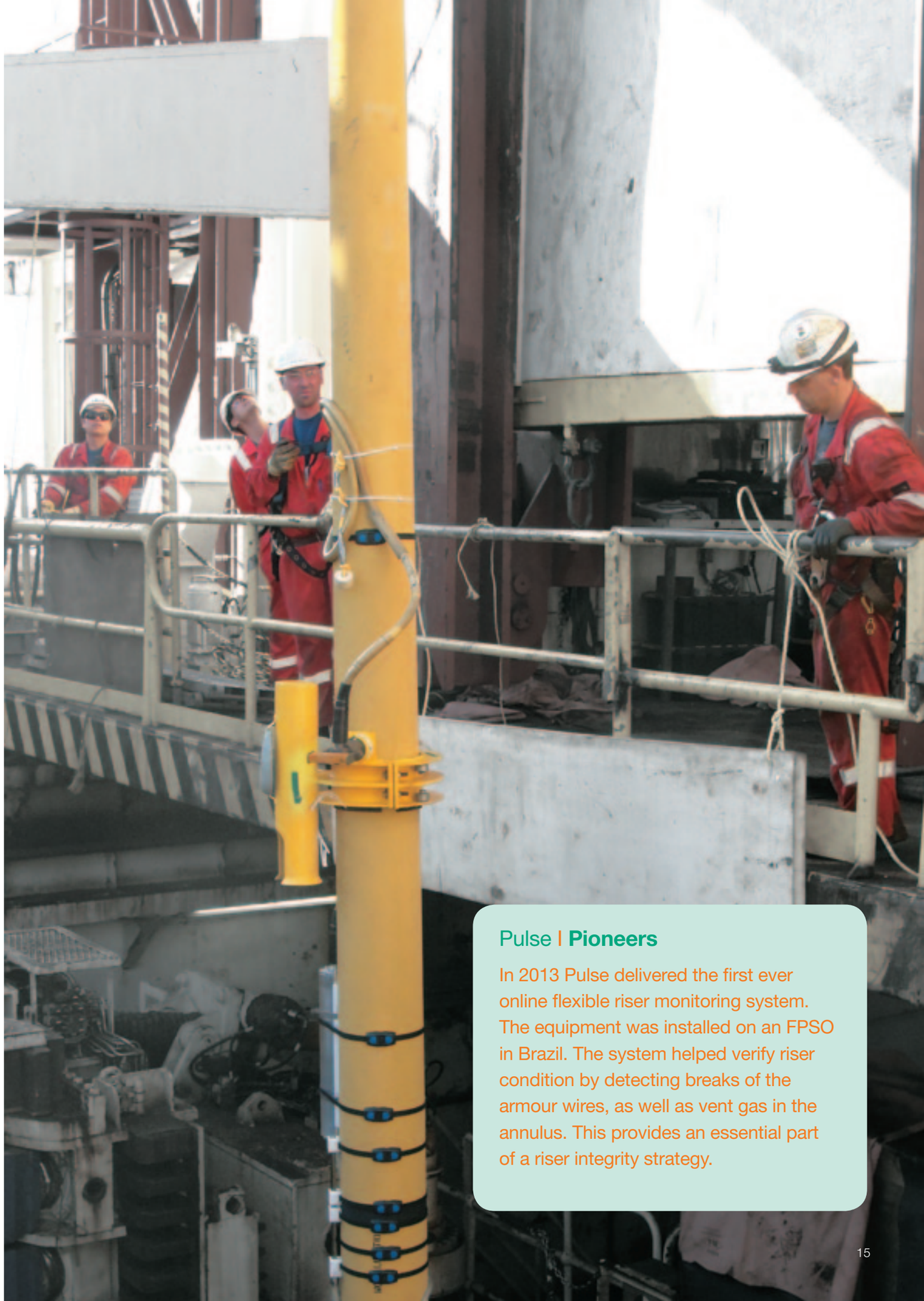
Flexible pipes are characterised by a complex design with several failure modes. Unlike traditional rigid risers which are of a solid steel construction, it is generally not possible to verify the condition of a flexible pipe using non-destructive tests alone.

The Pulse flexible riser monitoring system detects armour wire failures during operations. Monitoring the integrity of flexible risers can identify damage, leaks or excessive loading before a catastrophic failure occurs.

Hybrid risers

The key advantage of using a hybrid riser arrangement is the decoupling of the vertical riser response from vessel motions, making the riser less susceptible to fatigue. Problems can arise, however, as a result of a loss of buoyancy tank integrity. The Pulse tension monitoring system is used to confirm the integrity of the buoyancy tanks that support the freestanding risers, by measuring the up-thrust tension in the riser below the buoyancy tanks.

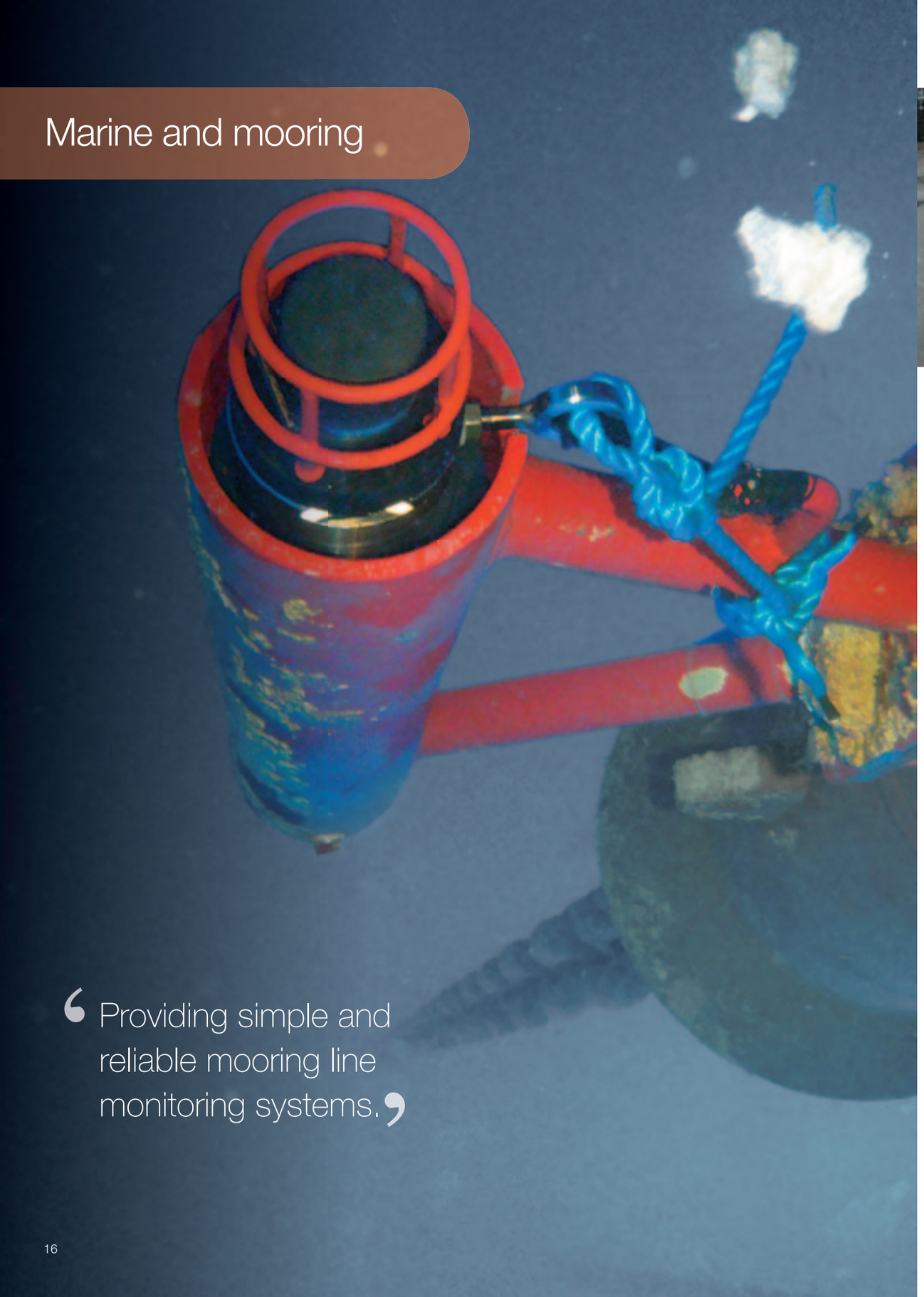
Pulse also has a strong track record monitoring the installation of hybrid riser systems. We have supplied systems for projects in the Gulf of Mexico, Brazil and offshore Angola, designed to ensure the integrity of the risers and buoyancy modules during installation. Pulse's solution measures tension, VIV, buoyancy module upthrust and compartment pressure in order to manage risk during the ballasting and de-ballasting operations.



Pulse I **Pioneers**

In 2013 Pulse delivered the first ever online flexible riser monitoring system. The equipment was installed on an FPSO in Brazil. The system helped verify riser condition by detecting breaks of the armour wires, as well as vent gas in the annulus. This provides an essential part of a riser integrity strategy.

Marine and mooring



‘Providing simple and reliable mooring line monitoring systems.’

To extend the life of assets in increasingly inhospitable environments, operators require systems to track the long-term integrity of their offshore assets.

Marine

Pulse’s Integrated Marine Monitoring Systems (IMMS) provide real-time data on the meteorological and oceanographic (Metocean) environment and vessel motions, and can be integrated with other Pulse structural monitoring systems. Monitoring the impact of the Metocean environment on vessel structure and motion is critical to determining an asset’s safety and integrity. This provides operators with a better understanding of the environment and its effect on the facility.

Measurement options

Response	Environment
Vessel positioning (DGPS)	Air temperature
Vessel motion	Wave height
Hull stress	Wave direction
Mooring line monitoring	Current profiles
Riser tension	Wind speed

Mooring

Pulse supplies two systems for the monitoring of mooring lines to confirm the integrity and performance of mooring systems on both floating vessels and Catenary Anchor Leg Mooring (CALM) buoys.

1. Pulse’s Anchor Leg Load Monitoring System (ALLMS) uses inclinometers to measure mooring line angles and calculate mean tensions. The system alerts the operator in the event of a mooring failure, as well as determining average mooring line tension in order to deduce the fatigue life of the mooring lines.

2. The Inter-M Pulse is a proven, qualified mooring connector that directly measures actual line tension with secondary readings of angle. The unique unit was jointly developed wth our Acteon group sister company InterMoor and is a combination of existing technologies that provide operators with a simple and reliable mooring line monitoring system.

Pulse I **Pioneers**

In 2012 Pulse, along with our Acteon group sister company InterMoor, developed the Inter-M Pulse, the world’s first system for direct inline tension monitoring of mooring lines.

Pipelines and subsea infrastructure

‘Practical deployment methods ensure accurate and robust solutions.’

Pulse’s range of subsea sensors have been deployed to monitor pipelines as well as various items of subsea infrastructure from jumpers to marine turbines. Our engineering team has developed practical deployment methods and interfaces for topside and ROV installation to ensure our monitoring systems are accurate and robust.

Pipelines

Pulse supplies a number of solutions for the monitoring of offshore pipelines, including:

- span motion
- pipeline vibration
- pipeline fatigue
- pipeline slugging through motion.

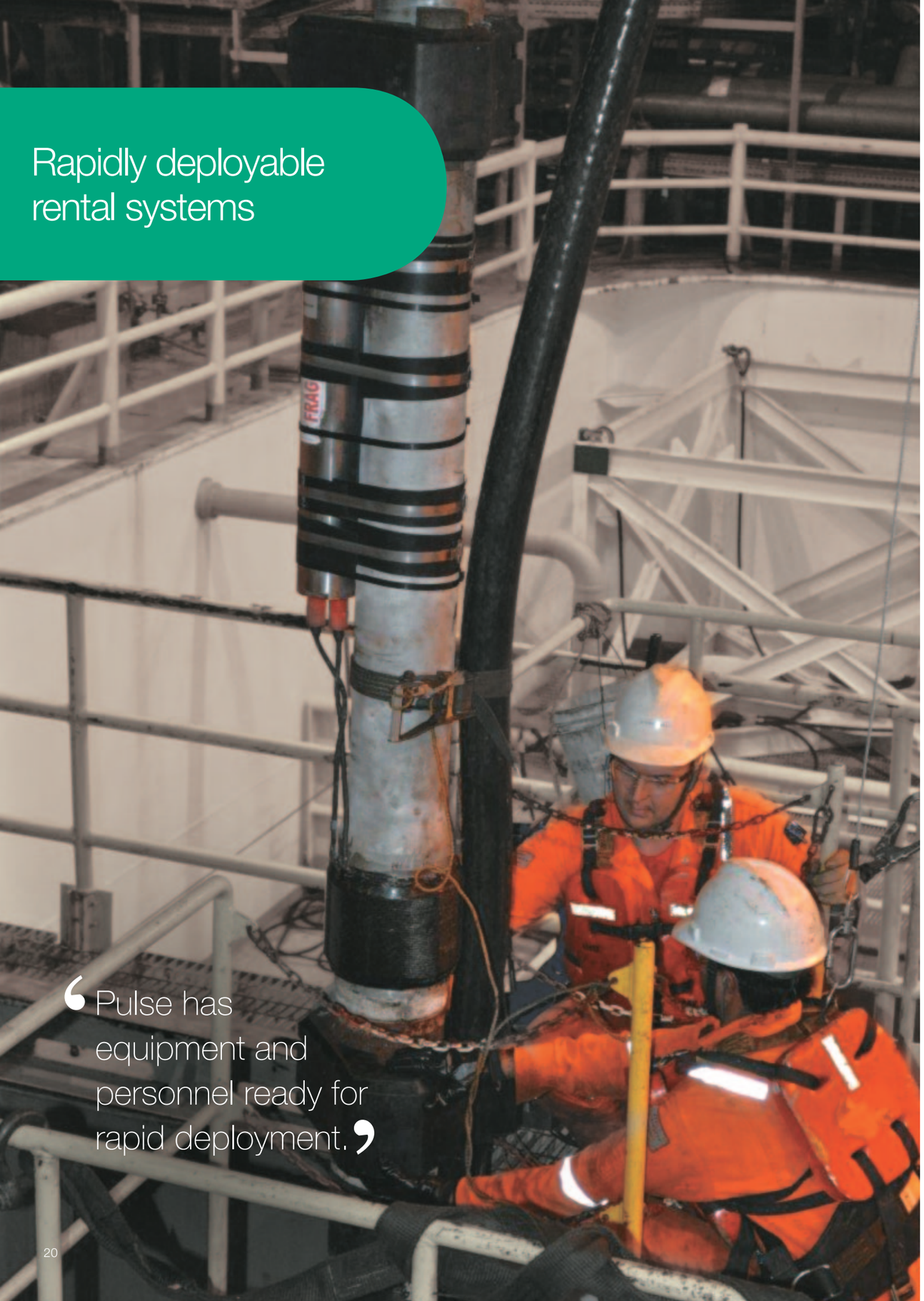
Our systems use a combination of Pulse and third-party equipment, interfaced together to ensure robust and reliable data collection.

Subsea infrastructure

Pulse has the capability to deliver bespoke subsea monitoring solutions to clients. We have off-the-shelf systems ready for deployment on a wide range of subsea infrastructure, including:

- subsea wells
- jumpers
- flowlines
- manifolds
- spools
- offshore wind farms
- marine turbines.

Rapidly deployable rental systems



‘Pulse has equipment and personnel ready for rapid deployment.’

Need a system fast?

Pulse has the equipment and the personnel ready to go, straight away.

We understand that when something goes wrong offshore you don’t want to be kept waiting. That is why we keep a constant stock of qualified and calibrated sensors that are ready for deployment all year round.

Offshore support

We have support available in a number of the world’s major offshore oil centres and we can mobilise quickly wherever you are. Shore-based back-up support is on hand 24/7 365 to ensure that we are there whenever you need us.

Track record

Pulse has been at the forefront of the structural monitoring field since 1998, continuously developing robust, qualified solutions to meet the ever-changing demands of the industry.

ACTEON

Pulse is part of Acteon, a group of 19 companies providing a range of subsea services in moorings, foundations, risers, conductors, flowlines, marine electronics and instrumentation. Being part of this group provides us with extended support for the execution of projects in non-core disciplines, as well as giving us a global presence in the oil and gas industry.

2H offshore · aquatic · CAPE · CIS · claxton · core Grouting Services · FLUKE ENGENHARIA LTDA · InterAct · INTERMOOR · LBD · LM HANDLING · MENCK · MIRAGE · NCS survey · OIS · PULSE · seatronics · SRP · TEAM Energy Resources

PULSE

Global and local support

At Pulse we recognise the need for a responsive and flexible service. We have support available in a number of the world's major offshore oil centres and we can mobilise quickly wherever you are. Shore-based back-up support is on hand 24/7 365 to ensure that we are there whenever you need us to work alongside you for the entire length of the project.

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