

James Fisher
Straininstall



James Fisher
Renewables



OFFSHORE RENEWABLES MONITORING SOLUTIONS

EXPERTISE FOR
THE EXTREMES



WHO WE ARE

James Fisher Strainstall (JF Strainstall) designs, manufactures and installs load monitoring and asset monitoring systems to offshore and onshore engineering industrial sectors.

Formed in 1966, JF Strainstall has over 55 years of experience in all areas of load measurement using a diverse range of measuring techniques and specially developed data acquisition systems. We operate from sites across the United Kingdom (Bristol, Cowes and Warrington) and also within the Middle East (Dubai) and South East Asia (Singapore and Kuala Lumpur).



Design



Assembly



Installation



Monitoring



Data management

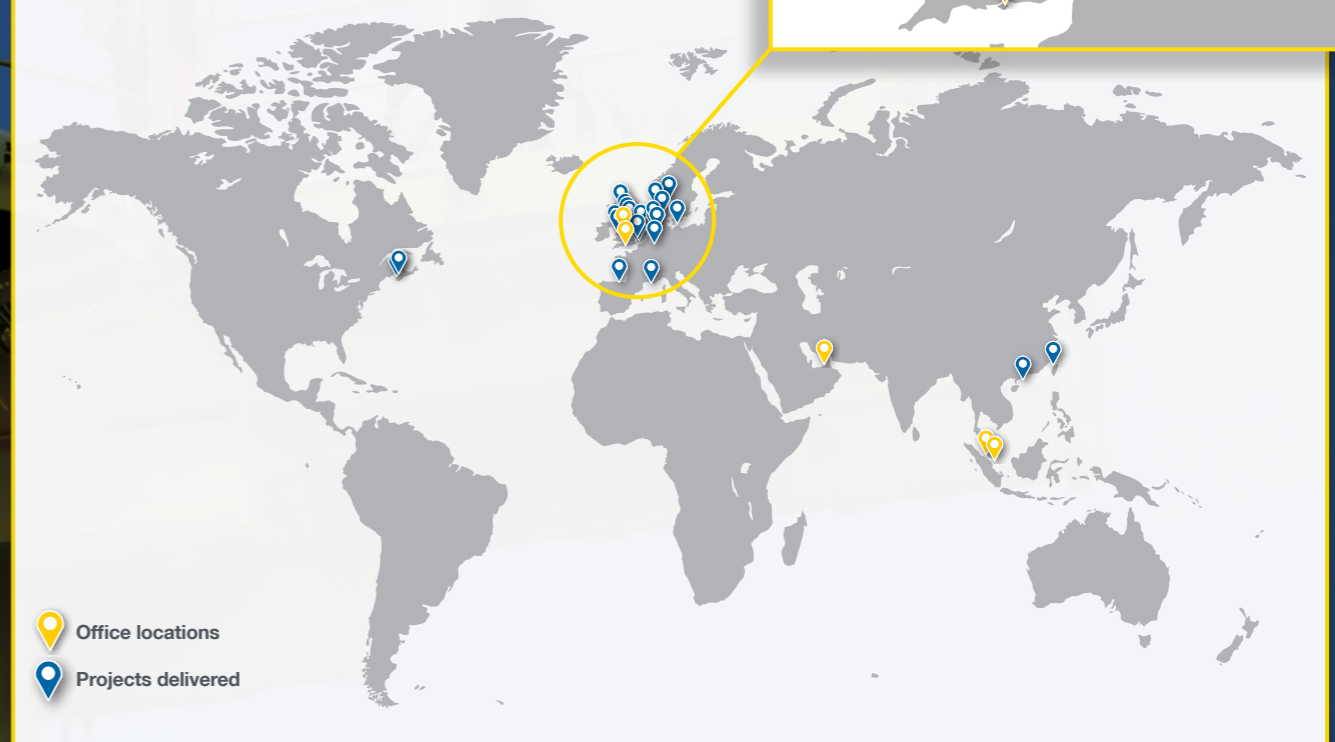
THE JAMES FISHER GROUP

As a part of James Fisher Renewables, we have access to a wide range of support services including confined space safety support teams, rope access teams, subsea diving teams, and a variety of vessel support options – all of which can be offered as an integrated group deliverable under a single contract.

Our parent company James Fisher and Sons plc is a leading service provider in all sectors of the marine industry and a specialist supplier of engineering services worldwide. With offices in over 40 countries, the company serves both the private and public sectors, while building on the experience and expertise gained over more than 170 years of operating in the marine environment.



JF Strainstall's offshore renewables projects



Office locations

Projects delivered

Pioneering, safe and trusted solutions to complex problems in harsh environments, to create a sustainable future.

For more information:

www.jamesfisherrenewables.com and www.james-fisher.com

OUR OFFERING TO THE RENEWABLES INDUSTRY

- We use our knowledge from the oil and gas industry (and other established sectors) to help develop the renewables supply chain with proven technology.
- Our solutions de-risk projects whilst meeting the challenging growth expectations and the industry's LCOE trajectory.
- We have a proven track record of providing solutions for use in the harshest of environments.
- Our data provides the basis for insurers to see validation of design and identify warranty claims successfully.
- When called upon JF Strainstall combines efforts with other James Fisher Renewables companies to provide a collective solution.
- We have a range of products for fixed wind, floating wind and other renewable technologies (ORE).
 - Structural Health Monitoring – Application in fixed, floating wind and ORE
 - Condition Monitoring – Application in fixed, floating wind and ORE
 - Mooring Monitoring – Application in floating wind and ORE

James Fisher group companies that offer renewables services:



WHY US?

JF Strainstall has a reputation for technical innovations and meeting challenging objectives through the delivery of creative and cost-effective solutions.

Our highly skilled team of engineers have the knowledge and experience to assist you at all stages of your project. We provide customised product design and manufacturing support which is tailored to the project's technological requirements, as well as project management services to ensure delivery of a quality solution on time and budget while adhering to the strictest safety rules.

OUR CUSTOMERS

Within the Offshore Wind Energy sector, JF Strainstall has supplied and installed monitoring systems on over a 190 fixed bottom foundations from 20+ offshore wind farms in the UK, Germany and China. Along with foundation test sites in Denmark, South Korea and Taiwan.

In the Floating Wind sector, JF Strainstall has supplied mooring line monitoring systems for eight structures, spanning over four floating windfarms in the UK, Spain and France, plus three system prototypes for test purposes in Spain and Norway.

Projects delivered:

Fixed wind:

190+

assets instrumented to date



20+

offshore wind farms



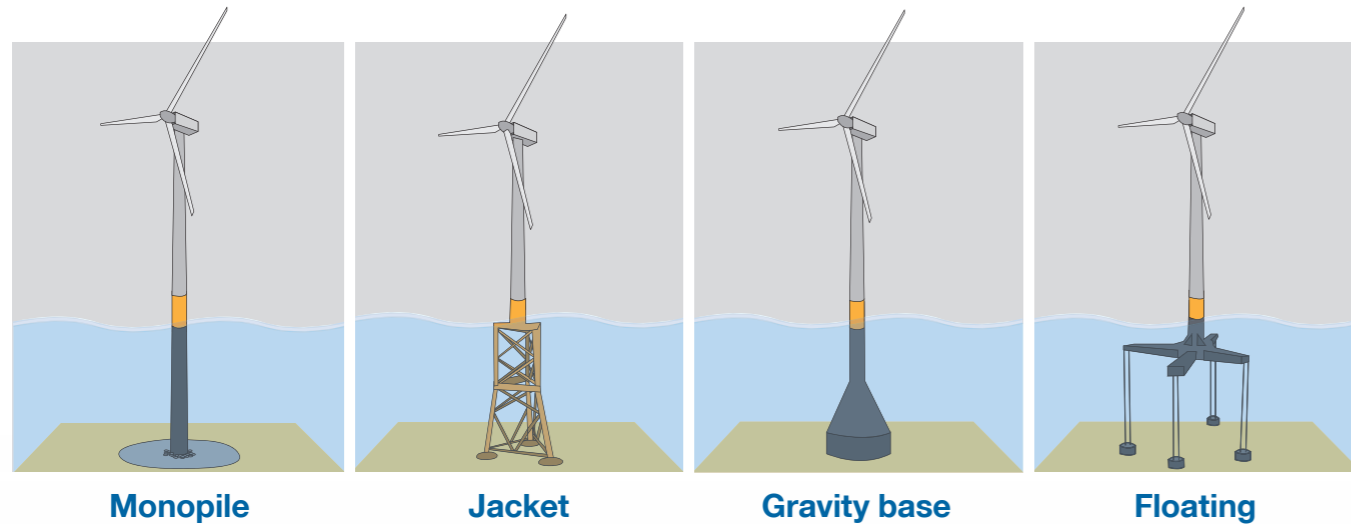
Floating wind:

4 wind farms

3 demonstrator projects



STRUCTURAL HEALTH MONITORING



JF Strainstall's structural health monitoring systems enable designs to be validated, optimised and focused for remedial work where required. Saving time and resources, our solutions measure displacement, inclination, vibration, oceanographic changes, and component deterioration without the need for regular diver and ROV inspections.

Alarm-linked, real-time data alerts operators to overload situations and to the possibility that structural stability may have been compromised, improving safety offshore. Our solution provides a full specialist support function.

Our systems are designed to incorporate a modular network of data acquisition units (DAUs), sub-units and third-party connections. Each DAU can receive multiple inputs from a variety of sensors distributed throughout the foundation structure and WTG tower. The data processing system consists of hardware servers which collect, and store data received from the DAUs. The server displays the structural performance of the turbine real-time, monitoring key predefined parameters, and where requested we can perform post-processing of the collected data.

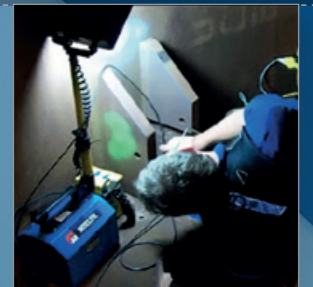
SENSORS

- **Strain gauges:** located at stress concentration hot spots and to measure global bending above and below the waterline.
- **Accelerometers and inclinometers:** for vibration and tilt monitoring.
- **Displacement sensors and load cells:** for grouted and bolted connections to the turbine and at MP/TP interface.
- **Environmental sensors:** measuring air temperature, humidity and gas presence. Along with water column level, PH, O2 and reference electrodes.
- **Wave radars:** measuring surface level, wave height and direction.
- **Wind speed and GNSS position.**



INSTALLATION OPTIONS

- **Offshore retrofit** onto existing operational assets.
- **Onshore installation** onto new build at the appointed fabrication yards or holding port facilities, followed by offshore final commissioning.



REASONS FOR MONITORING

- **Design validation,** obtaining structural response data under a variety of conditions to verify the design model assumptions.
- **Quantifying suspected structural problems** and the effectiveness of any resulting structural remediation work.
- **Long-term asset management.** Allowing for preventative maintenance decisions to be scheduled.
- **Life extension,** allowing engineering assessments based on fatigue life history.
- **Insurance:** Our data provides the foundation for insurers to successfully validate design and identify warranty claims.
- **Project certification:** Our solutions support projects in meeting the guidelines set by each country for their monitoring scope.



CONDITION MONITORING

JF Strainstall's condition monitoring system is designed to suit the needs of both technology designers and operators in obtaining clear and reliable data for either fixed or floating structures.

Our technology optimises the safety and performance of offshore assets by integrating data from multiple essential sub systems and sensors into a single location to store and access data. This enables developers to track asset performance and tailor technology for future projects.

CMS also plays a vital part in operational safety, enabling the development of informed and effective platform management, inspection and maintenance plans.

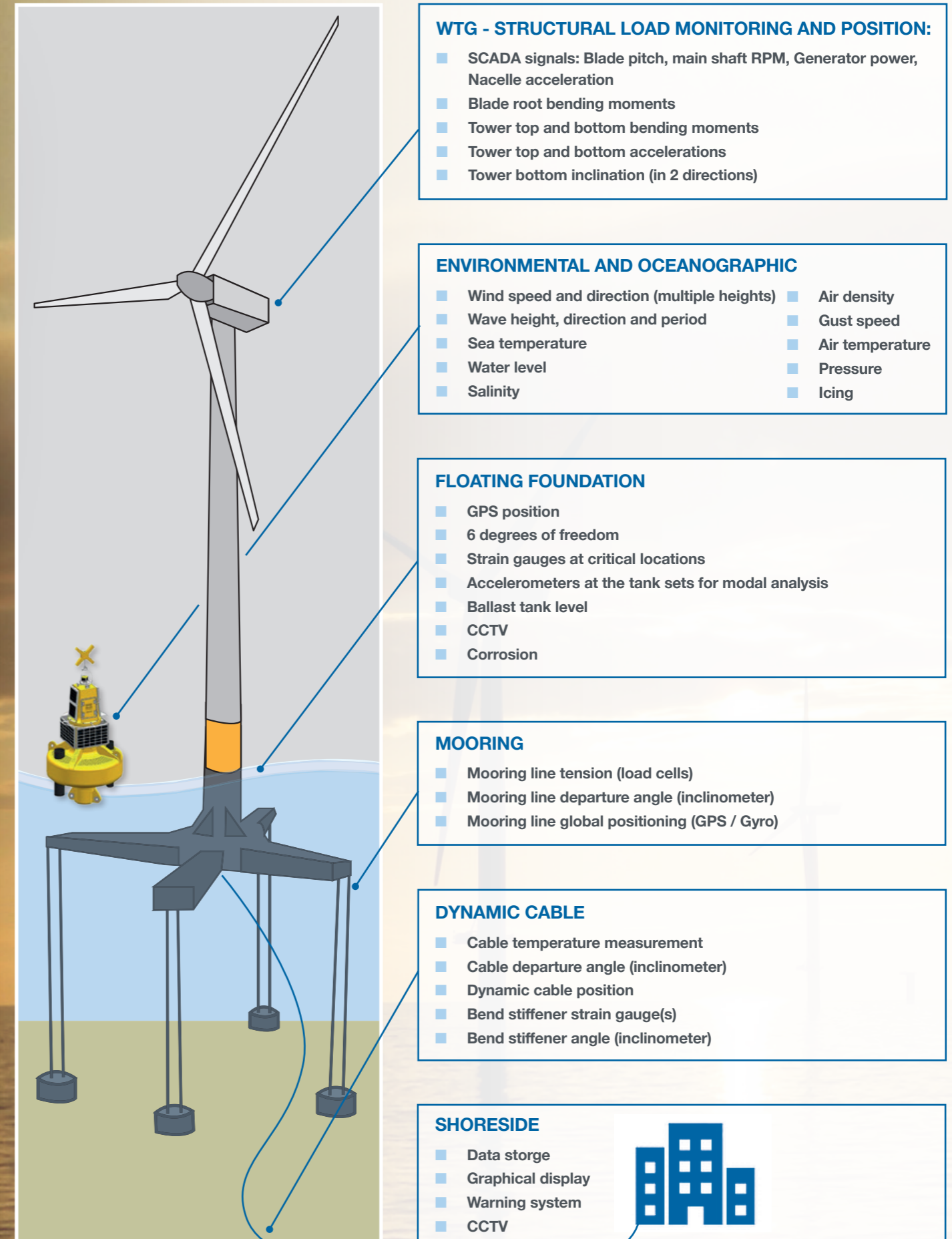
For real-time data processing and analysis, our in-house Smart Asset Management System (SAMS) may be linked with any third-party sensors. Data is collected and reported from a number of key parameters, allowing for remedial action to be made if safe working limits are exceeded. The system can also communicate with WTG SCADA to provide parameters for safe operation based on predetermined safe working limits.

CMS IS A MODULAR SYSTEM TAILORED TO INDIVIDUAL CUSTOMER REQUIREMENTS, BUT CAN INCLUDE:

- Mooring tension
- Dynamic cable monitoring
- Structural health monitoring
- Ballast tank monitoring
- Vessel draft and inclination
- Motion reference units (6-DoF)
- Met-ocean, wave, and tidal conditions
- Vessel position, including station departure
- Cathodic protection warning system

CMS BENEFITS:

- Reduces risk
- Enhances the safety and performance
- Permits the consolidation of purchasing and project management
- Enables a common, multi-system approach to redundancy
- Acts as a key aid during platform installation
- Simplifies remedial action if the system reports safety parameters out-of-range
- Provides key parameters in real-time, which can be archived for post-processing
- Delivers in-depth data insights



MOORING MONITORING

JF Strainstall's reputation was established by monitoring moorings within the oil and gas industry. Our products are developed to meet the operational requirements where longevity and reliability are key to the safe operation of the platform. Our renewables mooring load monitoring systems improve designs in terms of strength and reliability and also provide critical data during mooring line installation.

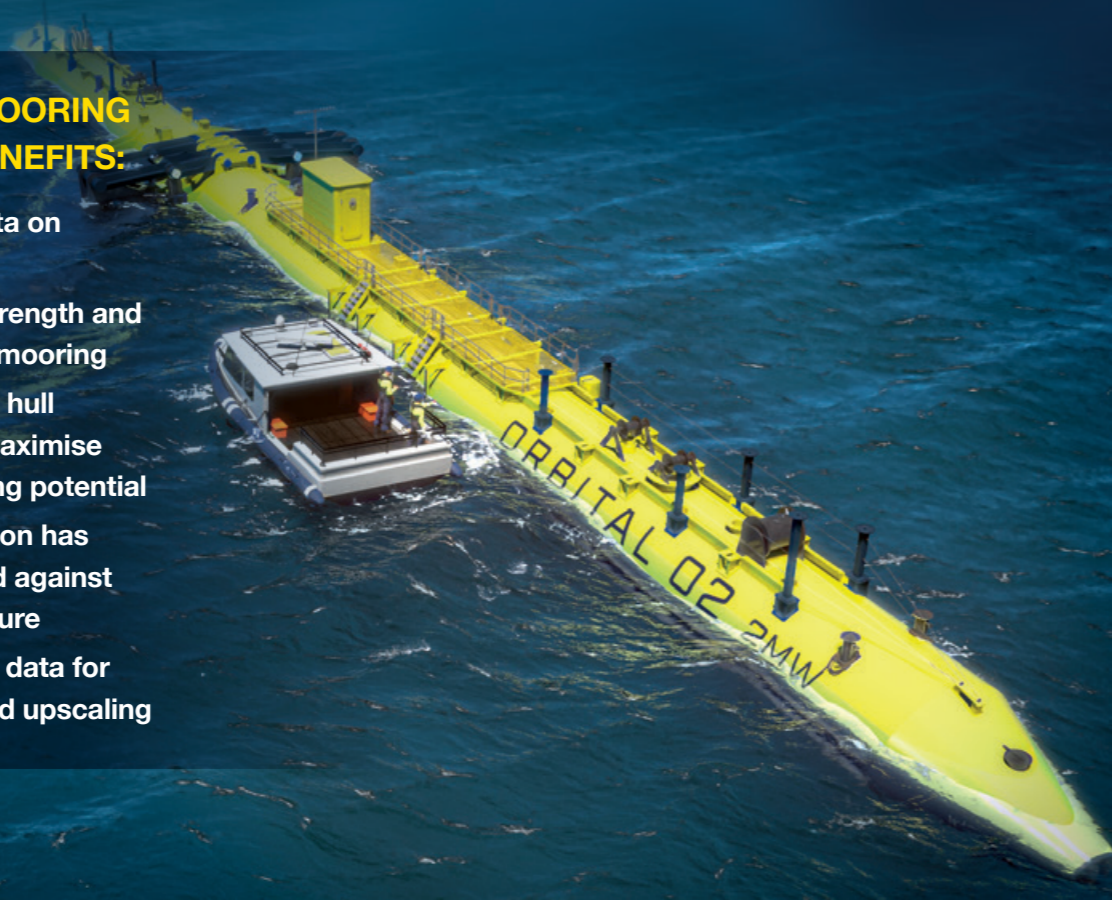
WHY SELECT JF STRAINSTALL?

During operational deployment, continued mooring load data collection and feedback mitigates the risk of mooring line failure. Our solutions are used on tidal, wave and floating offshore wind projects, helping refine the design for future technologies. Products can begin with an off the shelf subsea shackle and develop into a bespoke solution, potentially including both load and angle monitoring.

JF Strainstall engineers work with hull and mooring vendors to design bespoke products for integration into the mooring connections, offering a seamless solution, which is installed prior to hook up. Our project management team offer support throughout to make the delivery and commission fit into the project schedule without disruption.

RENEWABLES MOORING MONITORING BENEFITS:

- Provides live data on loads measured
- Measures the strength and reliability of the mooring
- Allows optimum hull positioning to maximise energy harvesting potential
- Ensures mitigation has been considered against mooring line failure
- Provides critical data for development and upscaling



With several systems already installed on offshore floating renewable applications across UK and European waters, JF Strainstall offers mooring load monitoring systems tailored to meet the requirements of the specific project. They range from the supply of a single load cell, pins, shackles or strain rings.

RENEWABLES MOORING MONITORING SYSTEM FEATURES:

- Non-intrusive installation
- Plug and play solution
- Provides a real-time display of mooring loads
- Uses proven redundant technology
- Reliable, low or zero maintenance design
- Can replicate and replace an existing mechanical part

DATA MANAGEMENT

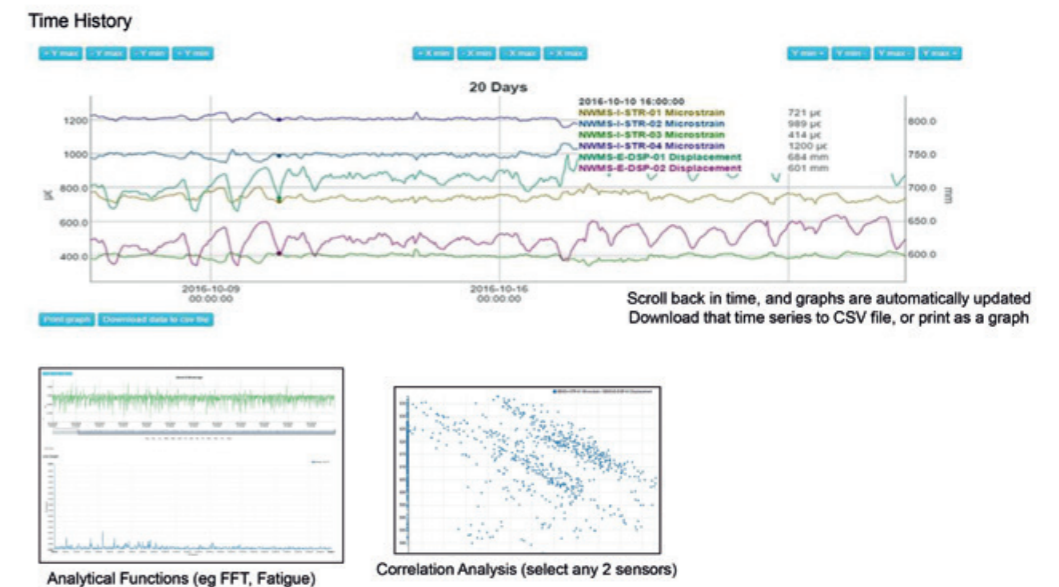
MONITOR | IDENTIFY | ACT

Our Smart Asset Management System (SAMS) is a sophisticated, web-based software package that provides a complete monitoring solution by combining sensors and data acquisition hardware with data processing algorithms. Our sensors and monitoring systems are built to withstand the most extreme conditions, ensuring safe operation when it matters most.

Features include web-based access to real-time data, with monitoring data displayed on a custom graphical user interface based on drawings or photographs of the asset. Graphs can be created for a selected time period, for viewing, printing and downloading, and alarm notifications can be seen within software or sent to clients by text message or email.

Extra features include post processing algorithms to cover functions such as rain flow counting (for fatigue analysis) and FFT transforms (for frequency analysis).

This provides real-time monitoring and data management software for integrity monitoring 24 hours a day, 7 days a week.



Scotrenewables: Tidal energy mooring load monitoring

UK

2013: The SR2000 – developed, constructed and tested by Orbital Marine Power (formerly Scotrenewables) – launched at the European Marine Energy Centre (EMEC), in Orkney, as the largest and most powerful tidal turbine in the world. For the structure, JF Strainstall supplied six shear load cells to measure tension in the moorings and the power generation turbine. The 500-tonne turbine began its testing programme at EMEC, the 2MW generated by the machine being enough to power 1,000 homes.



Suction bucket foundation

Germany

2015: Together with the Norwegian Geotechnical Institute (NGI), JF Strainstall successfully installed sensors on an innovative offshore wind turbine foundation designed and deployed for the Borkum Riffgrund offshore windfarm in Germany. Part of the UK Carbon Trust's Offshore Wind Accelerator (OWA) programme, the insights provided by the monitoring equipment helped evaluate the suction bucket foundations' viability for commercial use across the offshore wind industry.



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O2 Tidal Platform: Floating wave energy converter

UK

2020: Deployed off the Orkney coast, Orbital Marine Power completed construction on the latest tidal turbine to claim the world's most powerful status. The 73m floating structure included rotor diameters of 20m and covered a 600sq m rotor area, making it the largest single tidal generating platform. JF Strainstall supplied two 3500kN subsea shear load cells to measure the mooring loads while the device is in operation. Placed in an environment that holds some of the strongest tidal currents in the world, the O2 Tidal Platform – when connected to the local electricity grid – can power the local communities of Orkney cleanly and sustainably.



Jacket foundation

UK

2010: JF Strainstall installed its first structural monitoring system on offshore wind jackets. The hardware was installed onshore at a fabrication yard, followed by the commissioning of the monitoring systems once the structures were standing in UK waters. JF Strainstall's sensors provided key information to the client and consultants regarding the foundation's structural integrity, including data from the subsea grouted connection at the pin piles.



Floating offshore wind

UK

2016: In collaboration with MacGregor Pusnes, JF Strainstall supplied a vital mooring monitoring solution for the innovative first floating offshore wind farm, Hywind. The monitoring solution was crucial to asset data analysis and helped to demonstrate the potential commercial success of this new approach to renewable energy.



2020s

Monopile foundation

UK

2010: JF Strainstall entered the UK's offshore wind sector and installed monitoring equipment on its first monopile-based structures, following the well-publicised 'Grout Slip' issue that affected several operational assets. A fundamental flaw in the design of such structures led to the grouted connection failing, resulting in the transition pieces and turbines slipping vertically downwards around the monopiles. Assisting several UK-based end clients, JF Strainstall sensors were installed offshore as a retrofitted solution to quantify the problem, assess the remedial solutions, and provide crucial structural data readings on an ongoing basis.



2010s

Sustainable Marine: Floating tidal energy mooring load monitoring

UK

2017: JF Strainstall supplied a load monitoring solution for Sustainable Marine Energy's (SME's) PLAT-I floating tidal energy project. The equipment measures the effect that extreme conditions have on floating tidal energy converters (TECs), the data produced by the equipment will enhance future design developments, increasing durability and reliability of TECs.



Concrete gravity base foundation

UK

2017: JF Strainstall installed systems on Concrete Gravity Base Foundations for the first time. The hardware was installed onshore by rope access at a dry dock construction yard before the structures were floated, towed out to sea and carefully sunk onto the seabed, in UK waters.



Kincardine Floating Offshore Wind: Mooring load monitoring

UK

2019: In collaboration with First Subsea, JF Strainstall assisted in supplying specially designed strain ring sensors to the Kincardine Offshore Windfarm Limited (KOWL) project. Located off the coast of Aberdeen, the strain rings provided real-time monitoring of the loads exerted on the platform mooring connector (PMC), with a similar series of sensors being used on the Hywind project.



Installation for offshore wind

China

2020: JF Strainstall entered the offshore wind sector in China with its first installation on the jacket foundations in Shanghai, delivered for the Yangjiang Nanpeng Island offshore wind farm. The collective effort between JF Strainstall Malaysia, Singapore and Middle East saw the successful installation of strain gauges, temperature sensors, and more to assist in the monitoring of the structure's foundation, transition pieces and towers.



Installation for offshore wind

Taiwan

2019: JF Strainstall entered the Taiwanese offshore wind sector with an installation of fibre optic sensors on test piles, which formed part of a geotechnical study during the early wind farm project development stages. During offshore pile driving operations, additional support was provided by our James Fisher sister companies – which now sit within the James Fisher Renewables brand – including ROV works and bubble curtain technology.

2000s

Wavestar: 600kW wave energy converter

Denmark

2009: Wavestar's 600kW wave energy converter was installed at Hanstholm in Denmark, JF Strainstall supplied two 800kN XY shear load cells measuring the force transferred by the wave float. This innovative method of extracting energy from the ocean's waves worked to develop a cleaner energy source, with the machine's design making it adaptable to the harshest sea conditions.



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