Upstream: Oil & Gas

design • analysis • testing

STRESS ENGINEERING SERVICES INC.®

an employee-owned company

Floating Systems

For more than 35 years, Stress Engineering Services has been a leading provider of floating systems solutions. Our extensive industry experience, technical distinction, and advanced software programs uniquely position us to successfully optimize the performance, reliability, and safety of your floating system.

At the core of our floating system analytical capability is our proprietary in-house dynamic analysis program, RAMS (Rational Approach to Marine Systems). Unlike other analysis tools, it performs fully coupled dynamic analysis of floating production systems with the mooring, risers, and floating host platform all connected in a single model. The capability of RAMS – combined with our renowned expertise in testing, riser design/analysis, reliability, and materials – uniquely positions us to provide a comprehensive range of services.

Project Phases

- Concept Evaluation/Selection
- Front-End Engineering Design (FEED)
- Execution / Fabrication / Installation

Services

- Component/Equipment Specification
- Fitness-for-Service Evaluations
- Lifetime and Short-term Instrumentation
- Third-Party Verification
- Certified Verification Agent (CVA) Services
- Monitoring System Data Interpretation
- Mechanical and Thermal Laboratory Testing
- Vibration Measurement and Analysis

Systems Design/Analysis

- Floating Hosts (Marine/Hydrodynamic, Structural)
- Monitoring Systems
- Moorings
- Risers (Production, Drilling, Water-injection, Export, Top-tensioned, Catenary)
- Riser Support Structures
- Tendons
- Tensioners

Analysis Capabilities

- Coupled Global
- Drive-off/Drift-off
- Dynamic Positioning/Station Keeping
- Engineering Criticality Assessment (ECA)
- Finite Element Analysis (FEA)
- Flow Induced Vibration (FIV)
- Frequency-domain Dynamics
- Hull Hydrodynamics (WAMIT)
- RAO Determination
- Riser Strength and Fatigue
- Seismic
- Signal Processing
- Stability and Ballast
- Structural Strength and Fatigue
- Time-domain Dynamics
- Vessel Motion
- Vortex-induced Vibration (VIV)

Riser Systems Engineering

Since 1975, Stress Engineering Services has been providing quality riser design and analysis services to clients around the world. Our extensive structural, mechanical, and materials experience, in combination with our proprietary in-house riser analysis tools, allows us to fully address complex riser design and analysis issues and deliver the most effective solutions within our clients' scheduling constraints.

Our renowned expertise centers on the design and analysis of production, drilling, combo (combined production and drilling), export, water-injection, and completion riser systems. We have design experience with a variety of riser configurations, including top-tensioned risers (TTRs), flexibles, hybrid risers, steel catenary risers (SCRs), steel lazy-wave risers, as well as a variety of other less mature concepts.

Production, Water Injection, and Export Risers

Production and export risers are typically deployed for 20 years or more. They are therefore exposed to a high risk of very extreme environmental conditions as well as smaller-amplitude daily loading over a very long period of time. These extreme and fatigue-damage causing loads (together with potentially high pressure and temperature for production risers) must be accommodated by the riser systems' components, including tensioners and hang-off structures. Top-tensioned production risers consist of a set of tubes, one inside another, which contributes additional complexity to the engineering of these systems. Understanding how to address the composite action of the multiple tubes under dynamic loading is an important aspect of top-tensioned production riser analysis.

Drilling Riser Configuration Optimization

We specialize in determining the best riser assembly for a given rig, mud weight, water depth, sea state, current, tensioner system, hook load limit, and riser joint inventory. Our focus is to assure that the riser system and floating host vessel stay within proper load and motion limits and that the riser system is capable of safely enduring any fatigue or corrosion damage that may occur.

Drilling and Completion Risers Operating Limits

Risers used to drill and complete wells in deep- and ultra-deep water are typically deployed from MODUs (mobile offshore drilling units) or drill ships. Each of these host vessels has its own particular set of characteristics that affect the loading on the drilling riser and the subsea wellhead to which it is connected. While these risers are not deployed for long periods of time, their deployment poses unique risks to the well and to the environment. We perform a variety of analyses to determine safe operating envelopes that drilling and completion operations must remain within, including:

- Weak Point Analysis
- Operability Envelope Analysis
- Riser Recoil Analysis
- Drilling Riser Tensioner Analysis
- Wave Fatigue Analysis
- Hang-off and Deployment Analysis

Offshore Drilling

We serve operators, drilling contractors, and equipment vendors with our wide range of global analysis, system optimization, and component design services including weak point analysis, drift-off / drive-off analysis, riser recoil analysis, operating envelopes, wave fatigue analysis, vortex-induced vibration analysis, seismic analysis, and hang-off analysis.

Operability Analysis

Using a global analysis approach we can confirm operating envelopes defined by top tension, allowable rig offsets, flex joint angles, and maximum riser stresses for a given riser configuration, environment, water depth, and mud weight.

Performance Analysis

We assess the global performance of drilling risers to optimize the use of components such as flex joints, gas handlers or surface BOP's, telescopic joints, keel joints, fill valves, and suspension joints for storm hang-off or transit. Similar analytical approaches can be used to optimize tensioner systems for new-builds and upgrades.

Riser Recoil Analysis

With our proprietary STARR software, we can determine operating limits such as heave, tension, and stroke imposed by riser recoil requirements. We can also analyze rig-specific tensioner configurations, recoil control systems, riser stack-up, tension settings, mud weight, heave, and stroke to limit impact force, avoid rope slack, and lift the LMRP clear of the lower BOP stack.

Drift-off / Drive-off Analysis

We can determine maximum loads and stresses on riser and rig as it is pushed by wind and/or surface current with a suspended, disconnected riser. We can also perform Time Domain Drive-off / Drift-off Analysis of vessel offset limits to establish operational green/yellow/red zones for emergency disconnect planning.

Hang-off Analysis

We can optimize riser configuration to eliminate dangerous potential problems in both hard and soft hang-off scenarios. Results of the analysis will estimate the possibility of axial compression during severe down-heaves; determine possible near-resonance riser axial response for long suspended risers; calculate maximum bottom package vertical motion, as well as maximum heave-magnified loads and stresses in the riser assembly.

Riser Deployment/Retrieval Analysis

We can establish maximum current profiles and sea states for safely running or retrieving riser, casing, or trees/manifolds, and maximum sea states for safely landing BOP. This can include analyzing the effects of drifting with surface current to achieve operational success in high current profiles.

Weak Point Analysis

We can identify the "weak link" in a riser, wellhead, or riser tensioner system when a DP vessel drifts off station, combined with failure to achieve emergency disconnect. This service includes modeling of tensioners, riser, wellhead, structural casing, and near surface soil properties.

Vortex-induced Vibration (VIV) Analysis

We can identify potential riser and/or conductor casing fatigue problems in high currents during deployment, or while connected. We can also evaluate the effectiveness of VIV suppression devices. Going beyond RP16Q when necessary, we can develop Advanced Design and Operational Strategies that combine the results of VIV, Weak Point, Deployment, and Riser Recoil Analyses.

Integrity Management

Stress Engineering Services is an industry leader in Integrity Management for deepwater oil and gas operators. Integrity Management, as it applies to deepwater floating and subsea systems, provides assurance that the infrastructure, facilities, and equipment are operating properly and efficiently without comprising personnel safety or damaging the environment. Additionally, deepwater Integrity Management is concerned with maintaining informational readiness to address needs for facilities expansion, modifications, and regulatory compliance.

Development of a reasonable yet robust Integrity Management program requires both a depth and a breadth of understanding and experience. Good execution of an Integrity Management program requires a strong management commitment to proper implementation throughout the entire life cycle of the asset.

Whether you are developing a comprehensive Integrity Management program from scratch or expanding on your existing program, our substantial expertise—in Floating Systems, Subsea Systems, Fitness for Service, Materials & Metallurgy, Process Technology, and Forensic Engineering—positions us well as your partner in developing or expanding your Integrity Management program. We can provide the engineering support you need to meet your needs, including satisfaction of existing and potential future regulatory requirements.

One challenging and possibly unexpected aspect of deepwater Integrity Management is project memory—being able to know or recall the what, where, why, and when of facility systems and their upgrades. Organizational changes can interrupt the continuity of this knowledge within an operating company so that finding historical information when needed often poses significant challenges. With 50 years of industry service, and our deep commitment to thoroughly knowing your systems, you can be assured that we will be there when you need us.

Marine Assurance
Fitness for Service
Data Analysis
Mechanical Integrity
System Diagnostics
Records Keeping
Life Extension
Hazards Analysis and Risk Assessment
Health Monitoring
Operating Procedure Assessment and Development

Subsea Engineering

At the core of our subsea engineering services is a team of highly qualified engineering experts with many years of applied industry experience. This experience spans all facets of subsea production, including pipelines, flowlines, subsea trees, manifolds and control systems. We have the skills and knowledge necessary to quickly identify the most efficient solutions available, minimizing the time from discovery to first oil.

Field Architecture

Using our extensive field development expertise we are able to provide clients with viable solutions that will significantly enhance and complement the specifics of their projects. Additionally, we have the distinct ability to roll the various aspects of a subsea development into an integrated conceptual approach that is safe, efficient and economical.

- Alternative Field Layout Considerations
- Operability Considerations
- Architecture Definition
- Installation Alternatives
- Cost Alternatives (CAPEX-OPEX)
- Pipeline Routing Options
- Hydraulic Considerations

Project Management

Our approach to project management begins with forming partnerships with our clients and taking ownership of the projects we're involved in. We utilize proven tools and procedures and provide available facilities for project teams. We're experienced in managing tasks, resources, costs and schedules and companies.

- Insuring On-Time Product Delivery
- Providing a Safe Work Environment
- Completing Work Within Budget Constraints
- Keeping Clients Aware of Progress
- Insuring Product Safety Compliance

Subsea Systems Engineering

Our history of product development and hardware knowledge keeps us on the cutting edge of subsea engineering innovation especially when it comes to subsea system design and subsea tiebacks. As energy exploration and production continues to venture into new horizons, we will continue our efforts as a prominent leader in the design and analysis of subsea production systems.

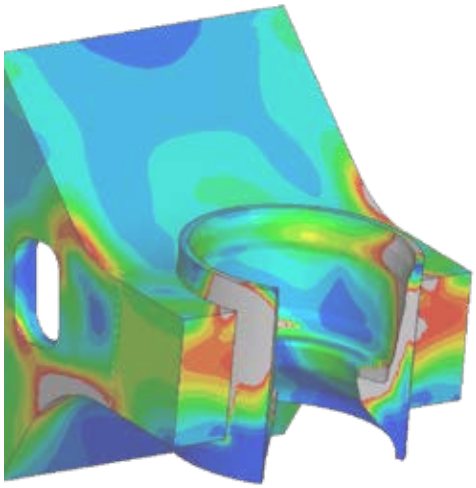
- Safety and Environmental Management Systems
- Risk Management
- Controls Reliability / Availability Assessment
- Tree and Controls Standardization
- Controls Logic Design
- Component System Integration
- Equipment Selection
- Umbilical and Termination Requirements
- Delivery Management
- Performance Verification Planning
- Interface Management

Offshore Flowlines / Pipelines

Our flowline and pipeline engineering expertise stems from an unparalleled background in product development, industry recognized analysis, and unrivaled leadership in testing. By utilizing our extensive pipeline engineering expertise, resources, and technological capabilities we are able provide clients around the world, effective and efficient solutions.

- Flowline / Pipeline Design
- Flexible Pipe Applications
- Span VIV and Fatigue Analysis
- Material. Installation and Specifications
- Thermal Expansion Analysis
- Pipe & Equipment Installation Analysis
- Permit Documentation
- Pipeline Damage Investigation
- Pipeline Repair, Tooling and Procedures

Component Design and Analysis



Stress Engineering Services has performed design and analysis work on almost every type of component that makes up today's deepwater production and drilling systems, including several downhole components.

The nature of our component design and analysis work is very project specific, but the one key attribute common to all of these projects is our client-focused approach. Whether performing detailed finite element analysis (FEA) to determine suitability of a certain design geometry or sitting with the client to discuss conceptually their particular needs for a new component, our commitment to getting you what you need is paramount.

The close relationship between our analytical staff and our test labs is a key to our component engineering success. Our component design and analysis specialists spend a significant of time in the test labs and understand what works in the real world. They have testing and analytical experience reaching back forty years, and real first-hand knowledge of what has and has not worked in the past. This level of information is not learned in a classroom, nor can it be quickly obtained. There is no substitute for experience.

We have extensive experience in the design and analysis of the following components:

- Threaded and Coupled (T&C) Connections
- Weld-on Riser Connectors
- Flange Connections
- Dog-type Connections
- Wellheads
- Steel and Titanium Stress Joints for Risers
- Tensioner Joints and Load Rings
- Steel Catenary Riser Baskets and Porch Structures
- Riser Tensioner Systems
- Mooring Components
- Drilling Derricks/Masts

Instrumentation and Data

Measured data contains a lot of valuable information about the performance and integrity of an offshore system. Accelerometers, angular rate sensors, strain gages and Global Positioning Systems (GPS) can be used to characterize the response of an entire Floating Production System (FPS) in various weather conditions. Some of these instruments can also be used to record the behavior of subsea or subsurface equipment, such as risers, jumper, manifolds and pipelines in cyclic loading environments. Additionally, anemometers, wave radar, current meters and pressure transducers can be used to measure the environmental or internal loading conditions.

Our extensive expertise in these areas was the basis behind the development of our NeoSight® FPS & DCI, Realtime Fatigue Monitoring System (RFMS®) and ROV-deployable Subsea Vibration Data Logger.

NeoSight is our advanced asset integrity management system that gathers data from your existing instrumentation to create digital models that provides a universal representation of asset response including fatigue. NeoSight creates a comprehensive model of the system, allowing you to simulate different operating scenarios, under a variety of environmental conditions, in virtual space and accurately predict the outcomes.

The Realtime Fatigue Monitoring System (RFMS) calculates stress and fatigue at any location from accelerometer and angular rate measurements, which are placed at strategic locations on the riser system.

Together with analytical mode shapes, the only required inputs are the dynamic riser response, mud weight and top tension, weld/connector SAF/S-N characteristics;

The Realtime Fatigue Monitoring System (RFMS) calculates stress and fatigue at any location from accelerometer and angular rate measurements, which are placed at strategic locations on the riser system. Together with analytical mode shapes, the only required inputs are the dynamic riser response, mud weight and top tension, weld/connector SAF/S-N characteristics; thus fatigue damage can be determined without knowledge of currents or other forcing events. This monitoring system tracks the damage on a joint-by-joint basis and provides a “fatigue odometer” for each riser joint.

Our Subsea Vibration Data Loggers (SVDL) that have been deployed on drilling riser systems, the BOP stack, and low pressure housing wellhead, to characterize fatigue damage in the wellhead and structural casing system. Our engineers have created an efficient methodology to use the SVDL measurements on the BOP stack and low pressure housing to directly reconstruct time histories of stress and fatigue in the wellhead accurately. The loggers provide timely assurance especially in harsh environments and where design calculations indicate limited design life. In addition, we have successfully used the measured data to calibrate predictive tools and models for riser/wellhead fatigue assessments.

NeoSight® for Floating Systems

Global Performance Monitoring

Riser and Wellhead Fatigue Monitoring

Seafloor Equipment Fatigue Monitoring

Subsea Vibration Data Logger (SVDL)

Neosight Drilling, Completion, & Intervention (DCI)

Condition Based Maintenance for Drilliing Risers

Offshore Wind Energy

Engineering Design and Analysis

Complex design and analysis of offshore structures is one of our core competencies. Our engineers have a deep understanding of structural design and the dynamics associated with the marine environment. Our expertise can provide vital support in the design of fixed or floating offshore wind farms through concept evaluation, global structural analysis (coupled aero-servo-hydro-elastic analysis with OpenFAST and Orcaflex), component design and analysis, fatigue analysis, material selection and corrosion engineering.

In addition to these capabilities, our engineers have an extensive background in floating systems, mooring, and anchoring design. Thus, for floating offshore wind farms, we provide support in coupled global analysis, mooring and power cable systems, and anchor design.

Testing

For decades, we have been providing superior testing services for large offshore structures and components. Our vast testing facilities are also well suited to support the testing needs of the offshore wind industry. Additional information about our advanced testing facilities and capabilities can be found here.

Condition Monitoring

As a leader in remote monitoring solutions, we have designed, manufactured, and implemented numerous offshore condition monitoring systems. Our solutions are designed to provide accurate, reliable data about the condition of your assets and customized to monitor numerous parameters including loads, strains, vibration, corrosion, inclination, and water level. We design condition monitoring solutions for all types of offshore wind turbines and components including monopile and jacket found foundations (for both turbines and offshore substations), transition piece, tower, mooring lines and power cables. Additionally, our condition monitoring solutions are designed for both long-term monitoring to support integrity management and short-term field monitoring that can be deployed on an operating wind farm.

Integrity Management

Maintaining your assets and tracking the health of critical systems is essential to keep operational and maintenance costs down. Our integrity management solutions for offshore wind farms are designed to reduce operational and maintenance costs by managing risk and reducing downtime. This is achieved by monitoring asset performance through condition monitoring and/or digital twin concept and providing the developer actionable insights from the data.

Our flagship brand of integrity management solutions, known as Neosight®, was developed by our Digital Solutions Group, who provides physics-based engineering solutions to help reduce operational and maintenance costs via digital technologies.

The Neosight® Wind integrity management platform utilizes physics-based digital twins, measured data and machine learning /AI techniques to help the developer manage risks, reduce unplanned downtime and maximize energy production. Furthermore, the physics-based digital twin allows the developer to track any location on the asset using virtual sensors. This low cost, minimum sensor solution can economically be deployed on many offshore wind turbines (fixed or floating) and serve as a whole wind farm solution. Additionally, our integrity management services provide the data needed to support life extension and repowering foundations.

Testing Services

Full-Scale Testing

Stress Engineering Services is a leader in both standardized and custom full-scale testing in force, load, fatigue, temperature, pressure, torque, noise, and vibration. With more than 130,000 square feet of laboratory space and a large inventory of advanced testing equipment, we can simulate a wide range of operational conditions for a variety of industries, applications and materials.

Our test labs are equipped with load frames capable of forces up to 18 million pounds, pressure chambers up to 30,000 psi, and a variety of fatigue and bending frames. These are just a few of our vast capabilities in testing heavy industry and oilfield equipment including tubing and casing threaded connections, riser connectors, drilling equipment, umbilicals, mooring ropes, anchors chains, riser joints, downhole tools, and more.

As oil and gas exploration and production advances into deeper and more extreme environments, there is a growing concern that equipment or components may not perform as expected under the harsh conditions. We have addressed these issues with our harsh-environment testing services that include high pressure and high temperature, full-scale sour service, and a wide range of materials testing.

Materials Testing

Our independent materials testing laboratories are equipped with state-of-the-art equipment for a wide range of material-testing methods including static tensile, compression, fatigue, chemistry, impact, environmental-related loading, creep, and relaxation. In addition, we offer a wide range of custom testing procedures designed to accurately define failure modes and assist in dependable material selection.

- Material testing for mechanical properties and material degradation, such as aging and environmental stress cracking
- Product performance testing under various conditions
- Life assessment testing of components and devices
- Instrumentation of components for use in actual devices in order to quantify in-use loads, temperature, pressure, strain, etc.

Engineered Solutions

HOUSTON
281.955.2900

CINCINNATI
513.336.6701

WALLER FACILITY
281.671.2550

CALGARY
403.256.2527

STRESS ENGINEERING SERVICES INC.®

www.stress.com

US2022