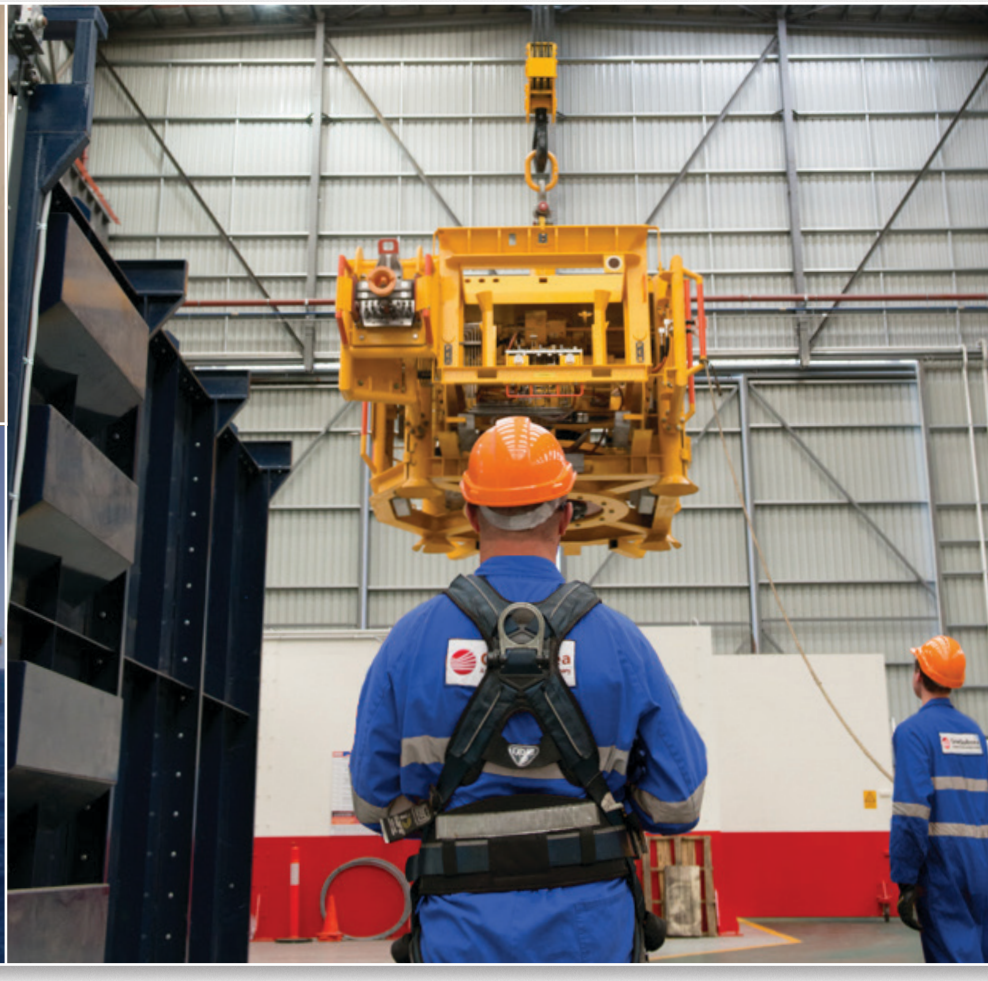
OneSubsea
A Schlumberger Company



Subsea Services

Providing the full scope of services,
from installation to abandonment

Global Reach, Life-of-Field Focus

Throughout the entire life cycle of a subsea field, from first discovery to abandonment, OneSubsea offers a full range of services to help you optimize production and enhance the profit potential of your offshore assets. We combine a global footprint; a pool of seasoned industry experts; rental equipment tailored to meet all installation, commissioning, and workover requirements; and real-time operational monitoring and technical support to boost the performance of subsea fields by making them more productive and cost effective.

Worldwide subsea services locations.

Installation and Commissioning—Providing a Seamless and Efficient Path to First Production

With decades of global experience in virtually every offshore environment, we take a field-proven approach to delivering scalable and comprehensive installation and commissioning services. These services leverage our world-class customer support and field service, as well as a continually expanding scope of rental tools and equipment, to get you to first production as quickly and efficiently as possible. Throughout this process, we conduct our work to meet all applicable HSE standards.

A commitment to efficiency, onshore and offshore

Our roles and responsibilities for the installation and commissioning of subsea production equipment and processing systems begin at the shipyard and do not end until the equipment is onstream. From there, our life-of-field experts can take over to help your system run as effectively and efficiently as possible. This approach enables OneSubsea to collaborate with customers long after the equipment is installed on the seafloor.

Onshore, our support crews coordinate logistics and mobilization—a vital first step toward driving operational excellence in installation campaigns.

Project management—to help ensure that all necessary subsea equipment and related installation tools are designed to project specifications and are ready for deployment, where and when they are needed.

- Operations supervision and engineering
- Preinstall action inspection and maintenance operations
- Equipment and personnel logistics management
- Management of spare parts
- Customized reporting
- Training, technical, and operational support

Mobilization activities—to provide assurance that all equipment is properly placed and secured on the installation vessel prior to leaving the dock.

- Ensuring equipment readiness
- Preshipment checks
- Transportation support
- Lift planning and job hazard analysis (JHA)

So that equipment mobilization runs as smoothly and safely as possible, OneSubsea advocates early engagement with the installation contractor. We foster a seamless handover to the installation vessel crews by providing the following services.

Safety management systems

- Control of work
- Permit systems
- Standardized job risk assessments (JRAs)

Equipment hookup and utilities

- Tooling hydraulic power unit (HPU)
- Controls for the HPU and umbilical (in readiness for an in situ test system)
- Workshop container

Proper interfaces

- Familiarizing the ROV crew with the installation equipment
- Developing the optimal processes for ROV basket loading and sequencing
- Subsea tree sea-fastenings (in case of transit on wire)

Efficient tool storage and access

- Working with the vessel crews to develop suitable tooling test and staging areas

Offshore installation and commissioning services focus on ensuring that subsea equipment is deployed and hooked up as safely and seamlessly as possible.

- **Field services**—predeployment testing, equipment installation, subsea commissioning, and reporting
- **Training and competency development**—training programs for field crews on product designs and installation procedures plus regular audits to ensure that crew competency meets company criteria and regulatory requirements
- **Rental tooling**—providing tools for installation and workovers, maintaining operational readiness, repairing, and testing tools.

Life of Field—Unlocking the Full Potential of Your Reservoir

OneSubsea is a committed partner, focused on helping you unlock the full economic potential of your subsea field. We have the unique capability to monitor subsea fields from the reservoir to the production facility, which can lead to maximized production and asset uptime, optimized recovery, and reduced operational risk and cost.

Maximizing recovery with a range of resources

Our portfolio of life-of-field services are organized in three distinct but integrated offerings: surveillance and monitoring, subsea intervention, and subsea sampling.

Surveillance and monitoring

Because you cannot properly maintain what you cannot monitor, OneSubsea offers a full suite of surveillance and monitoring services that enables you to continuously assess the working order of your subsea equipment. Such ongoing monitoring allows problems to be addressed early, before they become significant, more complicated, and more costly.

For example, OneSubsea offers riser annulus condition surveillance (RACS), which was developed to monitor the working condition of a subsea annulus. The system continuously measures the level of water in the flexible riser annulus and looks for changes in the amount of gas migrating up the pressure sheath. A failure in the sheath could lead to a hazardous event. To help prevent such an event, continuous monitoring and trend analysis allows the system to provide advanced warning of armor wire fatigue acceleration or accidental sheath breach, giving operators time to address and resolve the issue.

Distributed temperature sensing

For detecting the presence of leaks and measuring flow assurance, OneSubsea provides distributed temperature sensing (DTS) systems that deliver high-resolution distributed temperature profiles along the entire length of the riser and flowline. Such information is used to

- improve the effectiveness of flow assurance systems
- warn of hydrate formation
- help to optimize the quantity of chemical inhibitors
- improve production system uptime
- reduce active heating cycles.

Other applications include leak detection, temperature profiling in power cables, and distributed strain measurements for integrity monitoring.

An optical fiber serves as the DTS element and data transmission medium and can be installed in small conduits after pipeline commissioning. Using a single optical fiber may eliminate the need for low-reliability optical connectors. This fiber can be replaced and upgraded at almost any time to help ensure the availability of data throughout the life of the asset.

FRIEND remote surveillance and diagnostic system

Condition monitoring based on real-time data is an integral part of the operational support that OneSubsea provides for all of our products and systems. The FRIEND* remote surveillance and diagnostic system provides real-time condition monitoring that enables a 24/7 proactive support designed to optimize performance and increase availability, thereby

- ensuring operational best practice
- extending the lifespan of equipment
- safeguarding equipment uptime while minimizing unplanned interventions
- partnering with customers to provide early detection of potential operational issues
- reducing operational costs.

In operation since 2006, the FRIEND system is the industry-leading real-time surveillance and monitoring system for entire subsea production and processing systems. Our monitoring portfolio includes pumps and subsea processing systems, subsea trees and production systems, multiphase meters, and swivel and marine systems.

FRIEND System Service Levels

Control system
- Product protection
- Product operation control

Optimization
- Well, network, and asset optimization
- Reservoir focus
- System integration
- AVOCET* production operations software platform

Surveillance
- Product surveillance
- Operations best practices
- Proactive 24/7 support
- Equipment availability
- Collaboration environment

Production analysis
- Production performance
- Well inflow focus
- Data integration/analysis/modeling
- System-centric flow assurance
- OLGA* dynamic multiphase flow simulator

Condition-based maintenance
- Equipment integrity monitoring
- Equipment performance metrics and predictive analysis
- Product-centric flow assurance
- Production system surveillance

Subsea Well Intervention—Enhancing Production While Minimizing Downtime

We realize the vital importance of keeping production flowing freely without interruption. Our suite of subsea well intervention offerings aims to deliver on this goal, with subsea well access and control systems that enable performing intervention services in a minimally invasive and cost-effective manner.

Workover risers

OneSubsea provides the complete workover riser system, including the installation workover control system (IWOCS), riser, emergency disconnect package (EDP), and the lower riser package (LRP). We have delivered numerous dual-bore and monobore completion workover riser systems worldwide. We also have provided systems in both 10,000-psi and 15,000-psi pressure ratings for shallow-water interventions in the North Sea and deepwater interventions offshore Africa and Brazil.

Subsea sampling

As fluid properties change over the producing life of the field, operators continue to look for more practical and cost-effective alternatives to downhole and surface sampling methods. OneSubsea offers a suite of subsea sampling services that provides high-quality multiphase fluid samples for full recombination and equation of state modeling.

Our sampling systems possess several features that make subsea sampling safe and efficient, including

- pump-driven (isobaric) sampling
- phase detection and phase enrichment
- three-phase (oil, water, and gas) representative sampling
- remotely controlled systems
- transportable and pressure-compensated sample receptacles
- easy and flexible integration into a variety of subsea hardware
- compatibility with work-class ROVs
- flexibility for different sampling applications.

Our sampling services cover the entire spectrum of fluid sampling and analysis, from collecting samples at the seafloor to reporting the final results. OneSubsea maintains a complete chain of custody throughout each sample's journey, with proper controls and procedures in place to maintain the sample's integrity.

MARS Multiple Application Reinjection System

A cornerstone of our intervention services is the patented MARS* multiple application reinjection system, an insert installed in the subsea tree choke body that enables the addition of production-boosting technologies without the need to modify the tree. The insert effectively replaces a conventional production choke and allows access to process flow through the tree while keeping existing well barriers in place.

The MARS system includes a suite of specially designed inserts that perform specific intervention functions, and are available in two main configurations.

Concentric dual bore for process integration

- Subsea pumping and boosting technology
- Pressure sensor solutions for subsea trees
- Subsea metering solutions for greenfield, brownfield, and manifolds
- Solids handling technologies

Single bore for fluid interventions

- Scale squeeze and chemical injection applications
- Well kill equipment for emergency control and containment of the well
- Well abandonment operations for pumping cement during well plugging

The MARS system has been deployed successfully on more than 120 wells as of July 2015 for offshore operators around the globe. Its impressive track record, coupled with the growing industry need for lower cost and less complex intervention solutions, promises to extend its application in the coming years.

MARS system insert

Fluid injection skid


HYDRAMARINE
MÆRSK ACHIEVER

Asset Management Services to Maximize Returns and Minimize Risks

OneSubsea offers comprehensive asset management services with an aim that each piece of subsea equipment is maintained so that it can run at its optimal condition throughout its operating life. We are dedicated to helping customers maximize returns while enabling and supporting safe operations and environmental compliance.

Asset management solutions

- Equipment upgrades and refurbishment
- Inventory management
- Obsolescence management
- Planned preventive maintenance (PPM)
- Preservation and storage
- Spare parts management
- Workover programs

Full-time equipment safety and reliability with planned preventive maintenance

A foundation of our asset management services is our PPM program. The program consists of comprehensive engineering procedures that target regular maintenance and testing of equipment at predetermined intervals pre- and postmobilization.

Depending on your particular requirements, the PPM program can include

- function and pressure testing
- flushing
- complete disassembly and dimensional inspections
- corrosion inhibitor maintenance
- proper storage—inside, outside, or climate controlled.

Asset managemenet in Perth, Australia.

Subsea equipment in the Shekou, China facility.

Horsøy, Norway

Berwick, Louisiana, USA.

Facilities for a global asset management footprint

OneSubsea maintains operational facilities worldwide to support the asset management needs of our global customer base. Each facility is tailored to the asset management requirements of the region it serves.

We have a state-of-the-art asset management facility in Horsøy, Norway, which expands our service offering for the maintenance of processing systems worldwide.

The facility's capabilities include

- research and development
- qualification
- factory acceptance testing (FAT)
- system integration testing (SIT)
- system operations testing
- ongoing, long-term customer support
- service and repair
- monitoring
- PPM.

State-of-the-art test facilites.

Notes

Subsea Services

onesubsea.slb.com/services

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