Subsea 7 provides riser technology best suited to your field characteristics such as extreme water depth, harsh environmental conditions, host specification and hydrocarbon composition, for deepwater and ultra-deepwater installation.

**Key benefits:**
- Uniquely adaptable, comprehensive suite of riser solutions
- Able to meet a full range of field characteristics
- Preparing for the future with development of high strength steel and composite materials
- Improved fatigue performance
- Enhanced thermal performance
Systems

Riser systems installed on a worldwide basis by Subsea 7 fall into two categories: those coupled directly to the host facility, and un-coupled systems which in most cases are connected by flexible jumpers.

Coupled Risers
- Steel Catenary Risers (SCRs)
- Weight-Distributed SCRs
- Steel Lazy-Wave Risers (SLWRs)
- Flexible riser systems

Un-coupled Risers
- Single Hybrid Riser (SHR)
- Hybrid Riser Tower (HRT)
- Buoy-Supported Riser (BSR)
- Tethered Catenary Riser (TCR)
- Catenary Offset Buoyant Riser Assembly (COBRA)

Coupled Risers

Steel Catenary Risers (SCRs) have been adopted for many field developments and can be installed by all three methods of installation offered by Subsea 7 with J-lay, reel-lay and S-lay. Subsea 7’s widespread experience includes the metallurgical-clad riser for the Shell Bonga field by J-lay (six SCRs each 2km in length) and for the Exxon Mobil Erha field (ten SCRs each approximately 3km in length).

Subsea 7 has also installed SCRs by reel-lay in Brazil and the Gulf of Mexico.

One of the main challenges in any SCR design is the fatigue performance of the weld. Through the application of advanced welding technology, Subsea 7 has developed high-quality SCR welding solutions, especially for metallurgical-clad or lined SCRs.

Through extensive in-house research and development, Subsea 7 has further developed the Weight Distributed SCR concept, which enhances the applicability of SCRs to harsher environments. In this concept, ballast elements are attached at certain sections of the SCR to reduce the stresses around the touchdown point and enhance the fatigue performance of the SCR.

Using the reel-lay vessel Seven Oceans, Subsea 7 installed the first Steel Lazy-Wave Riser (SLWR) in the BC-10 field offshore Brazil at a depth of 1,800m for Shell International. The overall BC-10 scope included fabrication and installation of seven steel lazy-wave risers, totalling approximately 21km.

Un-coupled Risers

Un-coupled riser systems are increasingly being applied in deepwater and ultra-deepwater field developments.

Hybrid Riser Towers (HRTs) are recognised to have significant benefits for deepwater riser applications.

Specific characteristics of the Hybrid Riser Tower include:
- Custom-designed and built for optimum flow performance and adapted to the specific characteristics of each field development
- For ultra-deepwater flow assurance (pressure, temperature and heat transfer characteristics)
- Highly suitable for remote and hostile environments
- Simplifies field layout with no interference between numerous risers
- Low in-situ fatigue damage
- Additional equipment such as gas lift, separator unit and booster pumps can be incorporated in the vicinity of the riser base

The first HRT application installed by Subsea 7 was Girassol in Angola for Total in 2001. The field, incorporating three HRTs, has been producing for more than 15 years to the specified stringent flow assurance requirements.

The latest Subsea 7 HRT technology has been applied to Total’s CLOV projects where two HRTs were installed in 2013 in 1300m water depth.

Subsea 7 has experience in designing and installing Single Hybrid Riser towers in offshore West Africa by the J-lay method, most recently for the Total CLOV development and previously for ExxonMobil AB15 GG, both in Angola.

The Buoy-Supported Riser (BSR) System was developed and installed by Subsea 7 for the Sapinhoá-Lula NE field development in Brazil.

The BSR concept consists of submerged buoys each weighing approximately 2,000 tonnes installed at approximately 250 metres below sea level and anchored to the seabed by eight tethers, two on each corner of the buoy. The buoy supports 27 steel catenary risers of 3.9km which are connected to the FPSO by non-bonded flexible jumpers. This BSR system absorbs the dynamics from the FPSO, resulting in almost no dynamic stresses on theSCRs.

Since there is very little dynamic response for the SCRs, mechanically-lined pipe can be used for the SCR section, thereby providing a cost-effective solution.
Riser Technology

Un-coupled Risers continued

The Tethered Catenary Riser (TCR) concept consists of a number of Steel Catenary Risers supported by a subsurface buoy which is tethered to the seabed by a single pipe tendon connected to a suction pile. Flexible jumpers are used to make the connection between the floating production unit and the buoy. This concept features the following key advantages:

- It is possible to access all risers individually, allowing riser replacement if needed
- The system can be preinstalled prior to FPSO arrival, what reduces the back-end schedule to first oil
- The deployment and fabrication of the system does not require a fabrication yard located near the field
- The TCR system is the most cost effective decoupled riser system, with a saving of 20% to 30% compared to conventional SHRs

Subsea 7 continues to develop further un-coupled riser concepts designed for harsh environments. A recent example is the Catenary Offset Buoyant Riser Assembly (COBRA), which consists of a catenary riser section with a long, slender buoyancy module on top, which is tethered down to the seabed. Similar to the multi-riser BSR, the top of the catenary riser section is connected to the host by a flexible jumper.

For further information contact
Blaise Seguin, Specialist Engineer
blaise.seguin@subsea7.com