

Getting into Deep Water

Trelleborg Sealing Solutions is a strategic sealing partner with Bluewater. Touch Oil and Gas takes a look at their offshore activities and discovers just why this relationship has been so successful.

In 1978, Wim van Heijst and Pieter Schelte Heerema started their company in a Portakabin in Heerema's garden. From these humble beginnings, Bluewater has grown to be a global force in the oil and gas industry. It now operates from its modern headquarters in Hoofddorp, just outside Amsterdam in The Netherlands. Four hundred people are based there, while a further 600 are employed elsewhere around the world. The majority of Bluewater's employees spend their time offshore, involved in the company's main areas of business: the design, development, management, construction and operation of floating production, storage and off-loading vessels (FPSOs), along with the design, delivery and fabrication of mooring systems.

Serving an Expanding Market

Originally, Bluewater designed single-point mooring systems (SPMs). However, these days FPSOs account for the majority of the company's business.

When an FPSO is loading oil onto a tanker, the two ships may rotate in a circle with a diameter in excess of 1km (0.6 miles), often in difficult weather conditions. In all Bluewater designs, safety and protection of the environment are the top priorities. For instance, all of the company's vessels have double hulls, which prevents spillage in the unlikely event of a collision.

"The floating platforms give operators real benefits over fixed ones, and we are seeing demand continue to grow," stated Peter Burger, Head of Engineering at Bluewater. "Our clients choose to lease FPSO vessels, of which we now have seven, for a number of reasons.

It may be that an oil field will have a short life and it is not economically feasible to build a fixed rig. They are also an ideal option when an oil field is too distant from the coast for it to be economical to lay a pipeline to it. This is a growing trend, as oil companies are digging wells in ever-deeper water, even further from shore."

"We are also seeing their use in areas at risk of severe weather, such as experienced last year when Hurricane Katrina hit the Gulf of Mexico. This is leading to the latest FPSO models being designed for easier uncoupling from wells and anchors."

Solving Technical Challenges Uniquely

"Tackling technical issues such as those listed above is where our innovative character is a real advantage. We aim to provide creative

and cost-effective solutions and are never afraid of challenges, which we look to solve in effective ways," continued Burger.

Busak+Shamban, now Trelleborg Sealing Solutions, began working with Bluewater over 12 years ago, at which time Bluewater was searching for seals that would provide maximum reliability in their first swivel stack. This was for one of their own FPSOs, the Usige Gorm, developed for the Fife field in the North Sea.

"Until we entered the FPSO market, the majority of our applications were low-pressure and were processing mainly stabilised oil; therefore, sealing was less problematic," Burger told us. "The design of FPSOs brought new challenges. These operate at high pressures and they process multiphase flows, including gas, water and oil, as well as chemicals."

Realistic Solutions, Not Big Promises

Bluewater recognised that reliable sealing solutions were vital. Faced with a large number of offerings from several suppliers, identifying the right option from all of these was so important that Bluewater set up its own test laboratories.

"We needed to find the best-quality parts for the job. When you consider the loss of income to our customers in production downtime if a seal fails and must be replaced, the cost of seals is much less relevant than their reliability. We are looking for components that will last for the design life of an FPSO, which is a minimum of 20–30 years."

"Other seal manufacturers made big promises, but they made realistic suggestions," explained Burger. "We liked their ability to co-operate, as well as their openness. Most importantly, they were 'thinking with us' when it came to developing the best solutions for our clients."

Goal-driven, Creative and Flexible

"They have become our strategic sealing partner. They have a good understanding of and experience within the offshore industry, which allows them to offer proven solutions. We pride ourselves on being goal-driven, creative and flexible, and we have found the same qualities in Busak+Shamban."

"Since 1994, we have continuously assessed various seal materials, geometries and applications to ensure reliability," Burger continues. "We have tested their solutions back to back with comparable

Figure 1: Floating Production, Storage and Off-loading Vessel Loading Oil onto a Tanker



In all Bluewater designs, safety and protection of the environment are the number one priorities. For instance, all of their vessels have double hulls, which prevent spillage in the unlikely event of a collision.

Table 1: Floating Production, Storage and Off-loading Vessels – Vital Statistics

Aframax size:

- Length: 250m (820 feet)
- Breadth: moulded 40m (131 feet)
- Depth: moulded 20m (65.6 feet)
- Dead-weight tonnage: 100,000dwt
- Deck area: 8,000m² (9,568yd²)
- Accommodation for 90 people

Fluid capacity: 150,000 barrels per day

Crude oil: 100,000 barrels per day or 15.7 million litres (4 million gallons) per day

Water production: 135,000 barrels per day

Gas: 60MMscfd at 270 bar (3,915psi)

Off-loading: 33,000 barrels per hour

MMscfd = millions of standard cubic feet per day.

products, and we can see no reason to change vendors when their products consistently perform well.

As long as they continue to meet our technical and commercial needs, we are pleased to maintain our partnership with them.”

The integral component of the FPSO is the turret mooring system. These systems can be internal, where the turret is located inside the ship’s hull, or external, for instance connected to the bow of the vessel.

The turret mooring system consists of a geostatic part connected to the sea-bed via anchor chains and a rotating part. This allows the vessel to find a neutral position that results in the lowest environmental loads on the FPSO and the safest vessel sea-keeping.

An anchor arrangement connects the FPSO to the sea-bed. The optimal anchor-leg layout is calculated based on predictions for dynamic behaviour in wind, wave and current. At the heart of the turret is the product transfer system. Within this system are risers, flexible hoses that connect the subsea piping to the FPSO and a swivel stack linking it to the FPSO piping.

The swivel stack provides multiple fluid paths for the transfer of gas, water and crude oil. In addition to the swivel stack, a utility swivel is used for hydraulics and chemical injection, and an electrical/instrumentation slip-ring provides electrical power and instrument signals, including optical signals, where needed.

Within the turret mooring system there are hundreds of seals. These measure from just a few centimetres in diameter up to sizes greater than two metres in diameter. They must withstand temperatures well below 0°C (32°F) up to those in excess of 100°C (212°F). Pressures are high, sometimes beyond 350 bar (5,000psi); in addition, seals must be capable of operating at slow rotational speeds.

Finally, it is also important that the seals are resistant to explosive decompression, where rapid changes in pressure can cause the seal to rupture.

“Transferring oil from a tanker to onshore processing units once involved extensive dredging of harbours and building of jetties and quays where a vessel could be moored,” detailed Patrick Ottolini, Section Head Structural and Mechanical at Bluewater.

“The cost of that practice was often prohibitive, so one type of SPM system, which is basically a large buoy, was developed. A pipeline goes from the processing terminal to a pipeline-end manifold (PLEM) located on the sea-bed.”

The SPM is anchored to the sea-bed and connected to the PLEM via underwater hoses. The tanker is moored to the SPM in shallow or deeper water, transferring its cargo to shore via a floating hose, SPM buoy, underwater hoses, PLEM and, finally, the pipeline.

“The floating storage off-loading vessel (FSO) was a further development on this concept. Designers took the SPM and added a tanker to it. This meant that crude oil could be taken from a fixed platform or other production facility and then be stored in the tanker, ready for off-loading to another ship for transport to the production site.”

“The next development was the FPSO, which added production to the functionality of the vessel, including the processing of crude oil, as well as separating the oil from gas, water and other media. Today, the FPSO continues to provide a very attractive and economical alternative to conventional platforms, pipelines and onshore storage and export facilities.”

Freek Teunissen began the relationship with Bluewater. He told us, “We pride ourselves on the service we give to Bluewater, always aiming to be where we are needed, when we are needed.

The back-up team includes a full-time technical support person. There is also someone looking after documentation, which is a critical element of supply, order handling and purchasing. Hopefully, emergencies involving our products will not happen very often, but if one does occur, we are on hand to help out 24/7, whatever the requirement.” ■



Cool under Fire

In today's environment, you're drilling deeper, faster and farther than ever before. Temperatures run high and so do the risks and rewards. In these conditions, the cost of product failure is extensive. Why take chances? Trelleborg Isolast® sealing solutions can take the heat and keep their cool.

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