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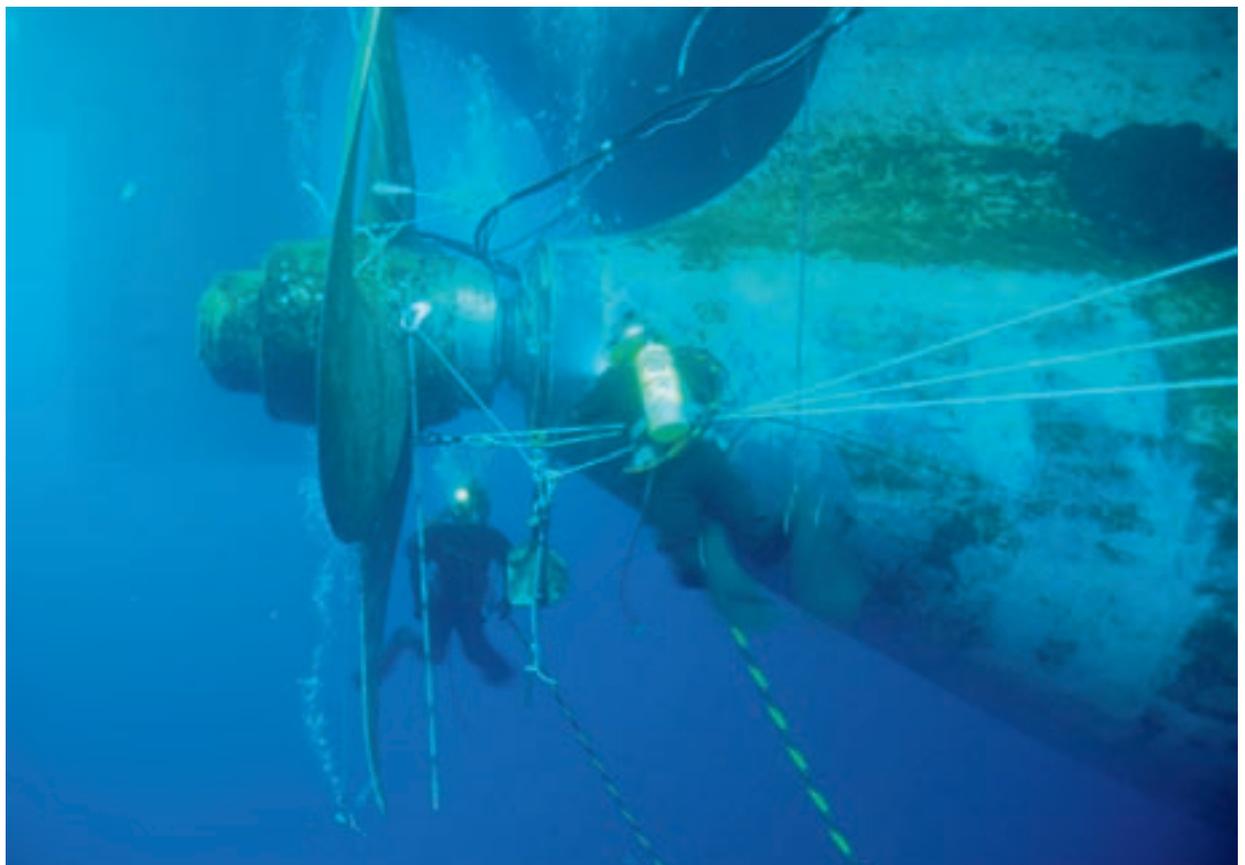
Underwater Repair

Accomplishing Mission Impossible

Time is money in the offshore industry. This is especially true today, with installations going farther and farther offshore and remaining dynamically positioned or single point moored on location. FPSOs, drilling rigs, offshore supply vessels and other specialty vessels continue to enjoy strong day rates since the available supply of these types of installations remains slim. Vessel availability on station is paramount; thus requiring operators to find innovative repair solutions for the vessels on station with minimal or no disruption to the vessels mission.

Once Impossible Repairs

The member companies of the Subsea Solutions Alliance are among the global leaders in underwater ship equipment repair. With the ability to mobilize anywhere in the world at a short notice with specialized equipment, approved procedures and trained personnel, the alliance can provide class approved and factory authorized repairs to vessel structures, major propulsion equipment and sealing systems. The company continues to dedicate resources to serve the offshore industry by performing once



Significant savings can be made by performing maintenance and repairs on FPSOs, drilling rigs and other vessels, on station offshore. Mr. Rick Shilling, Business Development and Sales Manager of the Subsea Solutions Alliance, provides an overview of the pioneering techniques that have been developed by member companies of the alliance.

impossible underwater equipment repairs, while the vessel remains on station offshore. Azimuthing thrusters, tunnel thrusters, stern seals and other vessel propulsion and steering equipment can be repaired or maintained with the vessel in the water and on station. This is why the Subsea Solutions Alliance has become the exclusive underwater service provider for Blohm and Voss Simplex seals and the underwater provider of choice for Wärtsilä and Rolls Royce propulsion equipment.

Underwater Seal Replacements

Stern-tube seal failures on any vessel require immediate repair if operating performance and environmental safeguards are to be maintained. The conventional solution has been to immediately take the vessel out of service and steam to the nearest dry-dock. For FPSOs in particular, this solution would result in massive losses because production will have to be disrupted. In close cooperation with Blohm and Voss Industries GmbH, the member companies of the



Powerful Alliance

The Subsea Solutions Alliance is a consortium of underwater ship repair specialists- including All-Sea Enterprises LTD, Miami Diver Inc, Parker Diving Service Inc. and Trident B.V. With a dedicated staff of over 130 divers globally, it has revolutionized the methods of repair for ship's structure and equipment underwater. Through a common shared system of dive equipment, specialty tools and dive personnel, the alliance is able to mobilize quickly anywhere in the world, with diver/factory trained service technicians for most OEM equipment. The Subsea Solutions Alliance has become the OEM's choice for all types of complex repairs, from the replacement of aft propeller shaft seals to the exchange of thrusters or straightening large bends in propellers.



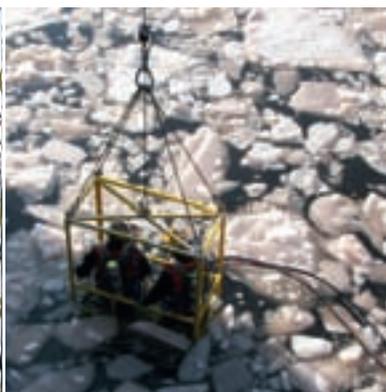


alliance have developed, certified and performed critical seal repairs and replacements on FPSOs in operation at the remotest locations in the North Atlantic and the North Sea. For this purpose, the Subsea Solutions Alliance has developed the unique Transportable Habitat (TransHab) flexible cofferdam system. TransHab is a lightweight, inflatable habitat that is fitted around the stern seal between the stern tube and propeller, thereby providing a dry and stable environment large enough for two technicians to carry out repairs. The erected habitat assembly is extremely durable and stable and it can withstand conditions up to sea state 5 and currents of 3.3 knots. By using stock adapters, TransHab is designed to fit any seal arrangement, including azipod drives, with liner sizes from 480 to 1,000 mm and can be easily modified to fit sizes outside this range. This procedure can not only be

performed while at sea, but it also offers a solution for vessels that are in port with no dry-dock available.

Recoup Revenue

The Subsea Solutions Alliance has pioneered in-water repair techniques for all types of azimuthing and tunnel thrusters. The utilization of thrusters in the offshore industry has revolutionized the capabilities of the vessels operating in this market. With properly placed azimuthing units, vessels can remain on station dynamically positioned in the deepest waters, even in the strongest sea states. Repairing or exchanging azimuthing thrusters has typically been performed in shallow waters or in dry-dock, depending on the vessels size. This has forced operators to take their installations off hire and off station for considerable time to refit or exchange its thrusters.





The member companies of the alliance have developed the underwater extraction of azimuthing thrusters offshore and without the assistance of any external cranes or crane barges. With advanced buoyancy control techniques, the thrusters are safely moved from their mounted position in a controlled manner to lifting apparatus mounted onboard the vessel. Once lifted out of the water, they are placed on normal deck barges by the vessels crane for transport back to shore for overhaul. By exchanging one thruster per day with the installation on station but not connected to the well head, the Subsea Solutions Alliance save clients over twenty days of off hire time in some locations and allow the client to recoup millions of dollars in unbudgeted revenue.

Hours Opposed to Days

Dry repairs to the lower gear boxes in thrusters could include the repair of an OD box, exchange of a push-pull rod, feedback rod adjustments and could also include a complete overhaul of a unit in place. Working in close cooperation with the Original Equipment Manufacturer (OEM), coupled with four-way communication systems with full video feed, the diver technicians apply repair processes they have learned from OEMs like Wärtsilä and Rolls Royce and act as the 'in-place tools' to support a repair activity directed by a factory representative. There is no need to pull a vessel off station; most repairs can be performed in place. Considering the exchange pool of refurbished thrusters available from OEMs, a complete exchange of a unit can be accomplished in hours as opposed to days. The alliance continues to develop specialized equipment that will make this procedure quicker and safer to perform in the future. By setting a new industry standard, the offshore industry will enjoy a higher availability rate for its equipment, with reduced off hire time.

New Training Facility

The Subsea Solutions Alliance currently runs two training schools in the USA for its in-house diver and underwater welding training; one in Long Beach, California and one in Miami, Florida. A third state-of-the-art training facility is currently being constructed in Terneuzen, the Netherlands at member company Trident B.V. This new training facility consists of two massive training tanks with a height of 7 m and a diameter of 6 m. A tunnel measuring a diameter of 2.5 m will connect to the two tanks and thus create a perfect situation for practicing bow thruster replacements.

The Dutch Member

A Dutch member company of the Subsea Solutions Alliance is Trident B.V. with headquarters in Terneuzen, the Netherlands, and a branch office in Malta. Mr. Adrie Huijbregts, Managing Director and one of the founders of Trident: "Diving is a way



of life for me. I have always been working as a diver myself for another subsea repair company. In 1993 I started my own business, together with a partner. After a challenging start we were soon able to build up a solid business and I think I can say that we are now a recognized subsea repair company." Adrie Huijbregts is no longer actively involved with the diving operations on site. Today he is more involved in the day-to-day management of the company as Managing Director. Trident joined the Subsea Solutions Alliance in 1998. "The Subsea Solutions Alliance offers significant benefits for our clients. As an alliance we offer global coverage and extremely fast response times, by sharing each other's divers and equipment. We operate in a highly specialized field, and knowledge sharing between the members is therefore vital. Our new training facility in Terneuzen will make a significant contribution to the training of our divers."

By being unique in South-West Holland, the new training school will be able to provide training to regional fire brigades as well. The new facilities are expected to be completed later this year.

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