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The Chronicles

The Subsea Solutions Alliance

August, 2012

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Dear Rick,

As I ride yet another airplane across the world, I have a chance to reflect on the past months within the **Subsea Solutions Alliance**. We continue to draw our member companies together, we continue to develop new innovative methods of repair for ships and offshore structures and we remain focused more than ever on delivering unrivaled service. My colleagues and I remain focused on every detail so you can keep your vessels in service.

It has been an exciting month allowing the diver / technicians of the **Subsea Solutions Alliance** to travel to the far-reaching corners of the globe. This month also included specialized training with our OEM partners on new products to be

introduced shortly. Remaining on the cutting edge of technology keeps our diver / technicians qualified to meet your vessel's needs. Maintaining our close relationship with our OEM partners allows us to continue to develop specialized equipment and processes that assure a rapid underwater repair anywhere required.

August afforded the member companies of the **Subsea Solutions Alliance** to participate in the first ever conversion of a shaft seal from one manufacturers lip seal design to it's face seal system when an emergency occurred forcing an underwater rapid repair. Utilizing the specialized flexible hyperbaric cofferdam of the **Subsea Solutions Alliance** and working "hand in hand" with our OEM partners we turned a potentially disastrous casualty into a glorious new repair alternative. Read on to learn more!

We appreciate your continued support, patronage and interest in the **Subsea Solutions Alliance**. We look forward to supporting you in your time in need!

Sincerely Yours,

Rick Shilling
Subsea Solutions Alliance

Monthly Summary of Major Projects Performed by the Subsea Solutions Alliance

The **Subsea Solutions Alliance** was very busy in August meeting the needs of the industry by performing multiple high value repairs in various ports around the world. The summary below illustrates just some of the major projects performed.

One Rudder repair was performed in the South America

Two Shaft Seal repairs with hyperbaric lip seal bonding was performed on Azipods in Bermuda

One Shaft Seal repair with hyperbaric lip seal bonding was performed in the Western Caribbean

One Shaft Seal conversion was performed with a flexible hyperbaric cofferdam in the Western Caribbean

One Tunnel Thruster repair was performed on the US East Coast

One Propeller repair with sectional reduction was performed in South Africa

One Propeller repair with cold static load straightening and sectional reduction was performed in the Western Caribbean

One CPP Propeller blade palm seal exchange was performed in the US South East

One underwater weld repair with an atmospheric cofferdam was performed in Italy

Water and Electricity don't mix- 2 ships same port- same repair

Underwater Hyperbaric replacement of shaft seals on Azipods

How many times do you think lightening strikes twice in the same location at the same time? The likelihood is slim to none, but when it occurs the results are never good. Well, this unlikely occurrence took place when two separate cruise vessels developed seal leakages on critical propulsion equipment; Azipods. The good news is that the **Subsea Solutions Alliance** was there to keep the customer "grounded" and execute the repairs while keeping the vessels in service. This just demonstrates the depth, capabilities and professionalism of the **Subsea Solutions Alliance**.

Azipods are fitted with very specialized sealing systems since a failure of this critical component will cause considerable damage to the propulsion unit. However, these critical seals are also susceptible to the same modes of failure that affect conventional propulsion shaft systems. With this being the case, the **Subsea Solutions Alliance** has created specific flexible hyperbaric cofferdams to support these repairs. By staging these systems in strategic locations throughout the world the **Subsea Solutions Alliance** is able to support repairs quickly when the need arises.



While both vessels operated cruises in and out of Bermuda, both vessels could not maintain the volume of seawater passing by the shaft seals. With both having a favorable itinerary and sufficient periods of time in Bermuda, it was decided to execute the seal replacements at this location. Each vessel was fitted with multiple Azipods and two Azipods per vessel required shaft seal renewal. Equipment and personnel was staged to Bermuda over sequential voyages in order to maintain the vessel in service and avoid any delays or changes to the cruise itineraries. Since Azipods are designed with enhanced rope guards and fairing plates over the seal assemblies, preparations for the repair were done in advance of the actual seal exchange. Utilizing separate Flexible Hyperbaric cofferdams for each seal assembly, two separate teams of diver / technicians from the **Subsea Solutions Alliance** were utilized on each vessel during each intervention. Each team consisted of two shifts of OEM trained diver / technicians that worked around the clock

to execute the repairs in the time allotted by the schedule.

The proven systematic approach developed and implemented by the **Subsea Solutions Alliance** was employed on both vessels. This included the installation of the Transhab, a flexible hyperbaric cofferdam. With the Transhab installed the seal assemblies were disassembled and new sealing rings were bonded in a dry hyperbaric environment by OEM trained and certified Diver / technicians. Once new sealing rings were installed, the seal assemblies were fully assembled, tested and prepared for service. By being the exclusive underwater service agent for Blohm and Voss shaft seals, the **Subsea Solutions Alliance** is able to provide a fully backed and warranted permanent repair. Utilizing the same bonding



equipment, bonding agents and following OEM procedures assures a top quality repair each and every time meeting the same stringent standards of repairs performed in the dry dock or service facility.

Both vessels remained in service and maintained their itinerary with no delay. Our focus on delivering unrivaled service assures you, our valued clients, that each and every member of the **Subsea Solutions Alliance** is determined to keep your vessels in service. Let us know what we can do for you in your time of need.

Get that Buoy Chain off my Tail Shaft!

Shaft Seal conversion and Propeller repair

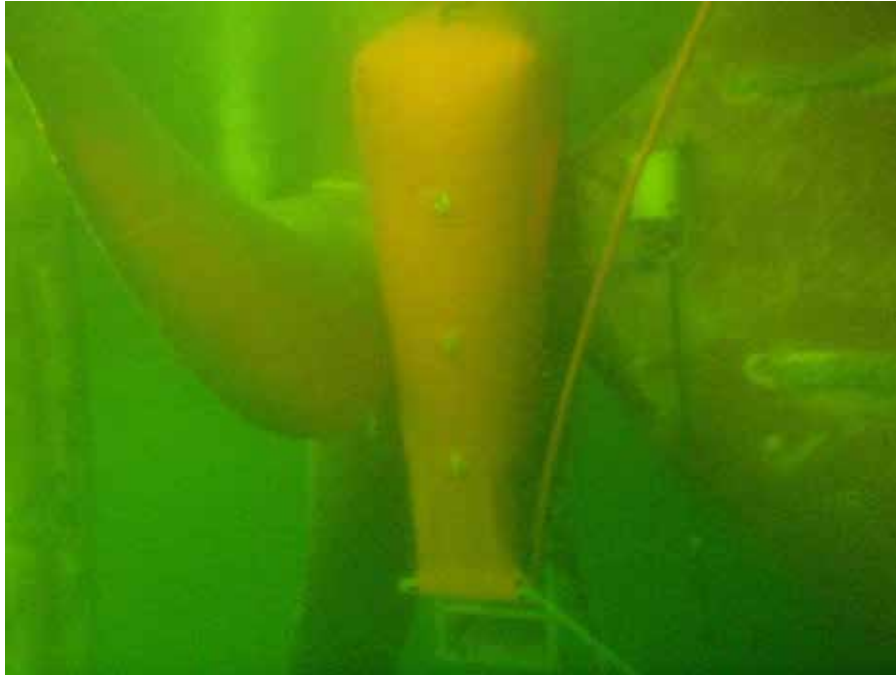
While sailing fully loaded down a river in Venezuela, the vessel's main engine suddenly stopped. A chain from a buoy was wrapped between the propeller blades and the rope guard causing severe damage to the rope guard, seal housing and seal assembly. The oil from the stern tube was immediately lost leaving the vessel completely disabled. The crew attempted to refill the stern tube with fresh oil but the oil was lost again to sea. In addition to the stern tube seal damage, the crew reported strong vibrations during the short operation of the main engine after the accident; thus indicating that the propeller was damaged. The actual extent of the damage would not be revealed until a detailed inspection was performed by qualified propeller technicians from the **Subsea Solutions Alliance**. With such severe damage occurring to the vessel, the port authorities immediately confined the vessel to its current location and would not allow the vessel to maneuver under its own power until repairs were performed. With the vessel being fully loaded and conditions on the river where the vessel was confined not suitable for an underwater repair, the owners of the vessel towed the vessel to Trinidad where the **Subsea Solutions Alliance**, the diving partner of the Original Equipment Manufacturer, had personnel and equipment in place. An inspection and eventual repair of the sealing system and propeller commenced.



The inspection revealed severe damage to the seal assembly, seal housing and seal liner. A complete seal renewal with a new liner was required. Considering the lead-time for a "split type" system for the existing seal assembly was over six (6) weeks, the client considered an alternative "face type" seal assembly from the same OEM. This "face type" seal system could be provided in less than 2 weeks; however it had never been installed underwater. After detailed discussions and planning meetings were completed with the client, OEM and the **Subsea Solutions Alliance**, the repair was initiated.

The complete existing seal assembly was removed from the vessel. This required the diver / technicians of the **Subsea Solutions Alliance** to cut away the severely damaged rope guard with a carbon arc gouging system and then split the entire seal housing, seal assembly and liner. Care was taken to release the liner from the propeller shaft in order to avoid damaging

the riding surface of the propeller shaft. Once all the original components were removed the diver / technicians installed the **Subsea Solutions Alliance** flexible hyperbaric cofferdam. With the flexible hyperbaric system in place the area around the seal assembly was dewatered and a dry environment was created so that a new seal assembly could be installed. Installation included a full assembly in a dry environment as well as underwater vulcanizing of O-rings and other seal components. The processes, equipment, glue and techniques utilized by the **Subsea Solutions Alliance** underwater were exactly the same process employed by the OEM while working in the dry dock.



The Original Equipment Manufacturer produced a conversion Face Type seal system to exchange their existing Lip Type seal system. As this was a revolutionary installation done for the first time in water with this Face type sealing system, trained technicians from the Original Equipment Manufacturer joined the **Subsea Solutions Alliance** team in Trinidad to install the new seal system. This included the step-by-step installation of the complex face type seal system underwater. With the sealing system installed, tested and commissioned, the **Subsea Solutions Alliance** fabricated a new rope guard and installed the new rope guard utilizing their class approved AWS D3.6M "A" class weld procedures and diver / welders coded to these procedures.



Once the new sealing system was installed the team then focused on the underwater repair of the propeller as it was also damaged and bent due to the wrapping of the chain around it. Utilizing a proprietary process, the diver / technicians with the **Subsea Solutions Alliance** released the propeller of its bents, removed



the damaged sections of blades utilizing a sectional reduction process that will minimize changes to the propeller efficiency so that the propeller performance could be restored as close as possible to its original parameters. As the bends in the blade were quite substantial a hydrodynamic repair solution was required to restore the hydrodynamic balance close to its original position.

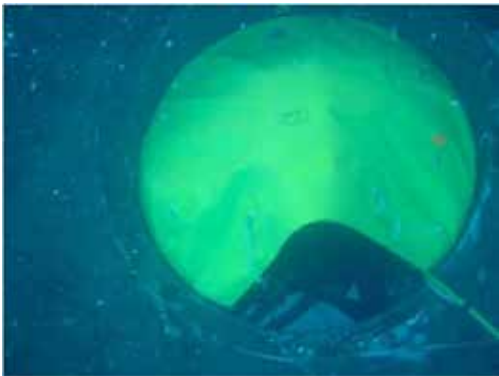
Working together, applying proven techniques, and thinking "in the water as opposed to out of the water", proved to be successful for the OEM/ **Subsea Solutions Alliance** team. The happy client continued on its voyage with a fully approved Original Equipment Manufacturer and class-approved repair.

The conclusion to this project is that if you have the need; the Subsea Solutions Alliance has the way.

NO Pitch, NO PROBLEM!

In-Situ Tunnel thruster repairs on cruise vessels

Operational Tunnel thrusters are necessary maneuvering tools when it comes to operations in the cruise business. With vessels entering and departing ports each and every day and some of these ports do not have tug support for a vessel's needs, severe penalties and costs could be incurred by the cruise operator if these essential pieces of equipment are not in service. Considering the focus on safety and reliability that exists in this market, operators are reluctant to take their assets out of service for repairs as this will require cancellations and skipping of ports. This is where the **Subsea Solutions Alliance** is called upon to make critical repairs.



Instead of taking the vessel out of service for a period of time and exchanging the affected tunnel thruster, a critical in-water repair was selected to put the system back into service. Developing a repair time line and repair procedure in accordance with the Original Equipment Manufacturers and Class requirements, the **Subsea Solutions Alliance** performed the critical exchange of the OD box together with the OEM in the Southeastern USA. As required by the client and regulatory bodies in the port, the OD Box was exchanged in a completely dry environment utilizing the **Subsea Solutions Alliance** flexible hyperbaric door

system. Cruise operators and port authorities where these vessels operate require the reporting of ANY risk of oil discharge to the sea; irrespective of how low the risk maybe. Considering this severe focus on the environment, a hyperbaric dry repair was selected.

With the vessel along side the diver / technicians from the **Subsea Solutions Alliance** went to work. Access to the tunnel thruster was achieved by removing part of the tunnel thruster grating system with our carbon arc gouging system. Attachment points were wet welded into place utilizing the **Subsea Solutions Alliance's** "A" class wet welding procedures. Once attachment



points were in place the flexible door system was installed and a dry hyperbaric environment was developed. Just like in the dry dock, the factory trained diver / technicians of the **Subsea Solutions Alliance**



opened the rear section of the tunnel thruster and exchanged the affected OD box. Within 12 hours, the damaged parts were replaced and the vessel's tunnel thruster was put back into service. The vessel left on schedule with a newly repaired tunnel thruster.

By maintaining diver / technicians factory trained in the performance of these complex repairs adds value to any customer's operation. With equipment stationed on a global basis and systems design to fly on standard commercial aircraft, we are able to mobilize anywhere in the world quickly and efficiently. The **Subsea Solutions Alliance** understands your needs and requirements. We are there to support you!

The **Subsea Solutions Alliance** (SSA) consists of underwater ship repair specialists: Miami Diver LLC, Parker Diving Service LLC and Trident BV. With a dedicated staff of over 150 diver / technicians globally, the SSA has revolutionized the methods of repair for ship equipment underwater. Through a common shared system of dive equipment, specialty tools and diver personnel, the SSA is able to mobilize quickly anywhere throughout the world with diver / factory trained service technicians for most OEM equipment. From the replacement of aft propeller shaft seals to the exchange of thrusters to the straightening of large bends in propellers, SSA has become the OEM's choice for all types of complex repairs. With class approved techniques and a highly motivated and trained staff, the SSA is the clear choice for vessels operating in sensitive environments on critical trade routes.

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