



## UNDERWATER TECHNOLOGY

Number 188



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# Permanent on-site insert repair in South-Korea keeps ship out of drydock

**I**n May, Hydrex diver/technicians carried out a permanent insert repair on a 224-meter bulk-er at anchor in Busan, South Korea.

The vessel was being sold and the repair needed to be carried out before the sale could be finalized. The tight working window available was however no problem for the team. Like all Hydrex divers they are trained to perform a wide range of operations within the shortest possible time frame and this without compromising the high standards Hydrex is known for.

A detailed underwater and on-board inspection revealed a stress related 120-mm crack in the ballast tank at the turn of the bilge. A 300 mm x 350 mm plate was therefore con-



*The rounded plate from which the new insert was cut.*

structed. The new insert was rounded to fit the exact shape of the hull. The team then cut away the part

of the bilge keel that was covering the damaged area. Next a cofferdam was installed, allowing the divers to cut away an area around the crack in the ballast tank to the same dimension as the new insert. After preparing the edges of the hole the new plate was positioned and secured with a full penetration weld.

An independent ultrasonic tester then carried out the necessary measurements to make sure the welding was successful. The operation ended with modification of the bilge keel to the specifications of the BV surveyor in attendance who then approved the entire repair.

During the operation the new owners briefly came on board to check the repair. When they learned Hydrex was the company hired by

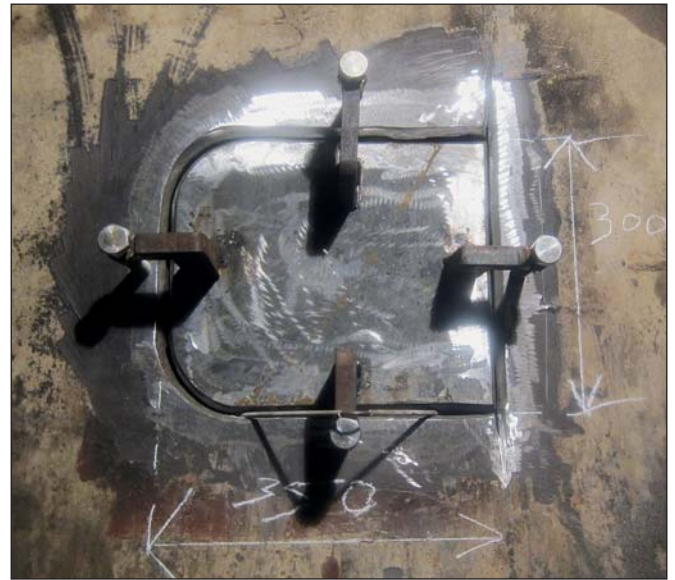


*Hydrex diver/technician cutting away the area around the crack in the shell plating.*





*After the old plating had been cut away, the edges were polished.*



*The new insert plating was secured with screw docks prior to being welded.*



*A full penetration weld finalized the installing of the new insert.*



*Ultrasonic tests were successfully carried out.*

the former owners to perform the repair, they left after only a quick inspection. Having worked with Hydrex before, they knew the insert would be carried out according to the highest quality standards.

The diver/technicians worked in shifts to make sure that the insert would be installed before the deadline. This allowed the old and new owners of the vessel to finalize the sale on schedule. ■



*The new insert seen from the water side.*

# Underwater propeller blade straightening in the British Indian Ocean Territory

**W**ith all five blades of its propeller severely bent, a 290-meter container vessel needed a fast, on-site solution to restore the propeller's balance and efficiency. Hydrex diver/technicians are trained to carry out repairs underwater in the shortest possible time frame and a team was therefore mobilized to the ship's location in Diego Garcia in the British Indian Ocean Territory to perform a cold straightening of the blades.

After the equipment arrived at the vessel's location, the divers installed a monitoring station on a workboat and made all the required preparations. The workboat was then positioned next to the vessel and the team leader went on board to discuss the details of the operation with the



*Hydrex diver positioning the cold straightening machine over one of the blades.*

captain and the chief engineer of the ship and to go over the safety procedures.

Next the team started the underwater operation with a detailed underwater survey of the damaged propeller blades. Because fouling was present on the blades, the divers carried out a polishing to be able to inspect the blades for stress fractures and cracks. The inspection revealed that the five blades had suffered multiple deformations along the trailing edges and that there were stress fractures and nicks in the same areas. Cracks were also found up to 15 mm deep.

Part of the team started the repair

part of the underwater operation with grinding work on the blades to remove the cracks. Once this was done the locations were smoothed to create a hydrodynamic profile on the trailing edges. Meanwhile, the rest of the team also entered the water and prepared the in-house developed hydraulic cold straightening machine for the straightening operation. The divers carefully positioned the machine over the bends of the trailing edges of the first blade and, in close communication with the team leader on the work boat, applied pressure to return the bent blade to its original state. This procedure was then successfully repeated for the other four blades.



*One of the five bent blades of a container vessel propeller.*





*Hydrex/diver technician carrying out grinding work on the trailing edge of one of the blades.*

When the divers had also completed all grinding and polishing repairs on all identified cracks and gouges of the blades, they made a full inspection of the newly modified condition of the blades for the attending ABS surveyor and the

captain of the vessel. With all parties involved satisfied, the divers demobilized their equipment and returned home.

The operation restored the balance and the efficiency of the propeller.



*Straightening the blades and polishing their trailing edges restored the propeller's optimum efficiency.*

By carrying out the straightening on-site and underwater, Hydrex avoided a costly and time consuming drydock visit for the owner of the vessel. ■

## Permanent rudder repairs now possible without drydocking

**H**ydrex has developed an entirely new method enabling permanent repairs of rudders without drydocking the ship. Permanent repairs were hitherto not possible and ships had to drydock in case a major defect was found. The newly designed equipment is lightweight and can be mobilized very rapidly in our special flight containers. Therefore this new service is now available worldwide.

Major defects on rudders very often cause unscheduled drydocking of ships. The new method designed by our technical department allows engineers, welders and inspectors to perform their tasks in dry conditions. Class approved permanent repairs on-site, without moving the ship, are now possible and commercial operations can continue. Steel repairs and replacements can be performed and pintle and bushing defects can be



solved without the loss of time and money associated with drydocking.

The equipment can be mobilized within hours to any port in the world and is available for rapid mobilization from the Hydrex headquarters in Antwerp.

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# Underwater removal and reinstallation of bow thruster on container vessel

**D**ue to a malfunctioning bow thruster, a 334-meter container vessel had to use the services of a tug boat for port maneuvering, so its owners requested Hydrex to take care of the removal, transportation and reinstallation of the unit. The operation was performed in stages on several locations to allow the vessel to keep to its sailing schedule.

Together with all the necessary equipment, the team travelled to Rotterdam where the operation started with a thorough inspection of the bow thruster unit. One by one the blades were then detached and replaced with blind flanges to prevent oil from leaking from the thruster. Then the lifting and hoisting equipment that would be used to secure the unit during the



*Hydrex lightweight equipment ready for mobilization from fast response center.*

second stage of the operation was installed. In the meantime, initial preparations were made in the bow

thruster engine room for the removal of the unit, so that there would be no ingress of water once the unit had been taken out.



*Bow thruster unit brought to the surface.*

The vessel then left for Southampton where it met up again with the team which immediately continued getting the engine room ready. Next the support brackets connecting the gearbox to the thruster tunnel were cut and the unit was secured with chains. It could then be fully disconnected from the thruster room and was carefully lowered, extracted from the tunnel and brought to the surface. The second part of the operation ended with the installation of a blind flange to seal off the thruster tunnel from the engine room. The bow thruster unit was then transported to the Hydrex fast response center



## COLD STRAIGHTENING OF SEVERELY BENT PROPELLER BLADES

In its quest to provide cost effective services to customers, Hydrex developed procedures to address different kinds of damage to propellers. This research led to the design of the Hydrex cold straightening machines first used in 2002.



By taking advantage of this technique damaged blades can be straightened underwater, allowing the ship to return to commercial operations without the need to drydock. Blades can be brought back close to their original form, restoring the propeller's optimum efficiency.

The cold straightening machines have been in use for quite some time now but the Hydrex research department has been looking into ways to expand the technique even further to improve our services. A new version of the straightening machine was recently put into practice. It is compatible with the existing models and is used to restore more severely bent propeller blades to their original condition.

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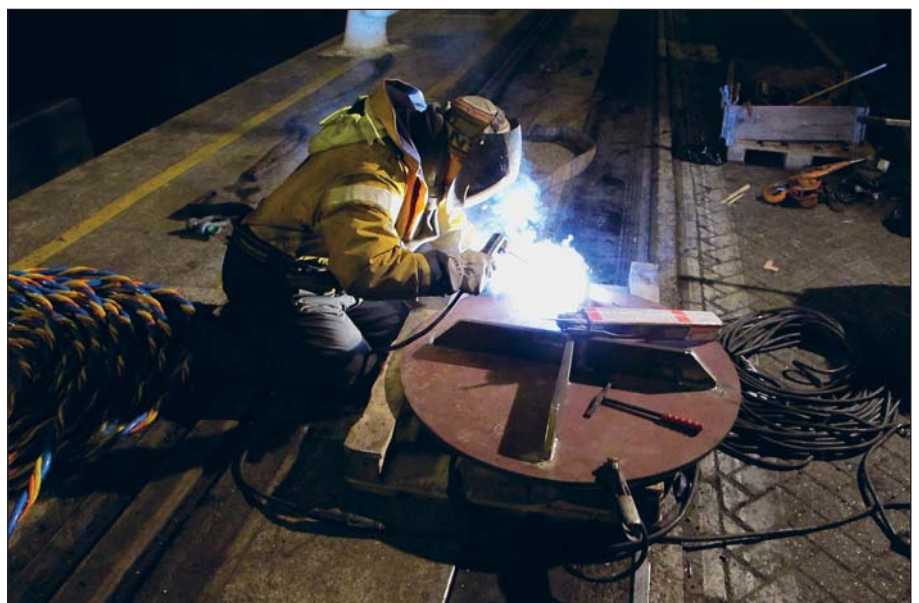
*Bow thruster unit on special cradle ready to be brought back into the thruster tunnel.*

by the team and sent on to Norway for repairs.

As soon as the overhauled bow thruster gearbox was delivered to the Hydrex headquarters, the diver/technician team and the unit were mobilized to the container vessel's next port of call: Le Havre. After a monitoring station had been set up next to the ship the team removed the blind flange inside the thruster tunnel. The unit was then put on a cradle which was designed especially for bow thruster operations



*Thruster unit and propeller blades at Hydrex headquarters prior to overhaul.*



*Welding work on blind flange used to seal off thruster tunnel after removal of thruster unit.*





*Hydrex monitoring station and overhauled bow thruster unit in Le Havre.*

and which prevents the unit from tipping. As it can be adjusted to the

size of the thruster, it allowed the Hydrex divers to bring the unit back

into the thruster tunnel in one take.

Due to the size and weight of the bow thruster unit, special measures were taken to lower the thruster unit and bring it inside the tunnel where it was repositioned using chain blocks. Despite the extra difficulty this entailed, the team was able to reposition the gearbox with only a minimum of delay. The unit was then secured with bolts, but the chains were kept in place because there was no time left to reinstall the brackets before the vessel had to leave for the next port on its schedule.

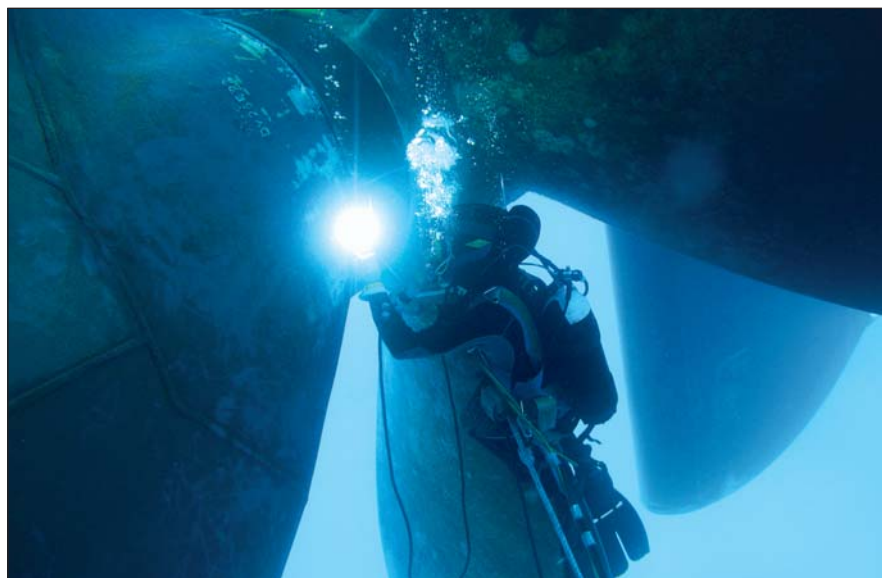
After fast stops in Dunkerque and Hamburg the team met up with the

## Hydrex US ready to mobilize immediately

**H**ydrex has an office located in Clearwater in the Tampa Bay area that is ready to mobilize immediately. The office has a fast response center that is equipped with an extensive range of state of the art logistics, trucks, tools and diving support equipment. This enables Hydrex US to efficiently service vessels and offshore units calling on ports in Canada, North, Central and South America as well as the Caribbean.

All staff members of the Hydrex office in Clearwater undergo stringent training at the Hydrex headquarters in Antwerp. They can carry out both simple and complex high quality jobs even in the harshest of circumstances.

Repairs to thrusters, propellers, rudders, stern tube seals, damaged or corroded hulls and all other underwater repair and maintenance



services are done while the vessel is on-site. This eliminates the need to drydock.

All used methods are fully approved by all major classification societies.

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*Hydrex team members manoeuvring thruster unit.*

vessel in Rotterdam where the chain blocks were removed and the propeller blades were reinstalled one by one. Subsequently, the diver/techni-

cians reinstalled the support brackets that connected the bow thruster unit to the thruster tunnel wall.

The ship then sailed to Southampton. At this location the brackets were secured, the pad eyes removed and the propeller blade bolts secured with wire. This concluded the repair.

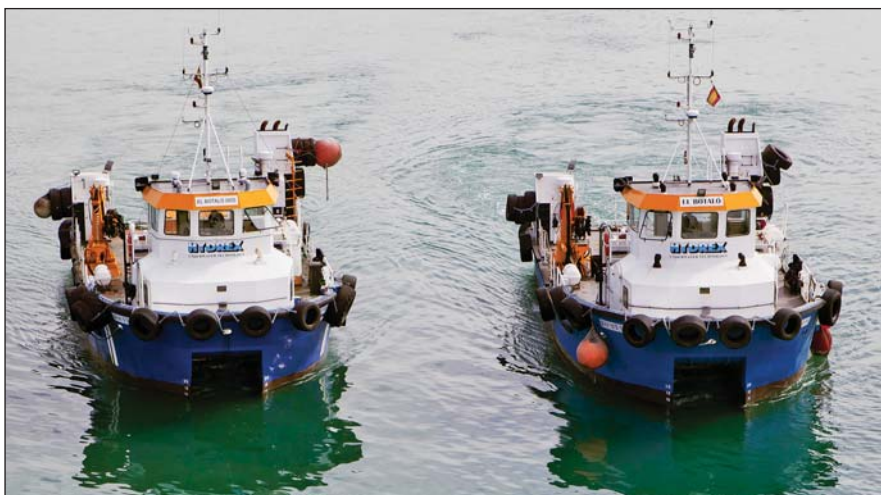
The vessel can now maneuver inside ports again without the need of a tugboat. Hydrex's flexibility allowed the company's technical department to adapt the different parts of the repair to the sailing schedule. The delay for the customer was reduced to the absolute minimum and by performing both the removal and reinstallation of the bow thruster unit underwater the vessel did not have to go into drydock. ■

## Fast and high quality on-site repair services in the Western Mediterranean area and North Africa

**T**he Hydrex office in Algiers is ready to mobilize immediately with their two dedicated dive support vessels. Both vessels are fully equipped as service stations for a wide range of repair operations and allow for a fast response in the bay of Algeciras, Gibraltar and North African ports.

As part of the Hydrex group, Hydrex Spain takes advantage of the companies' 37 years of experience. All operations are carried out by highly certified diver/technicians all of which have been trained in the headquarters in Antwerp and have extensive experience, enabling the office to offer their customers the high quality Hydrex is known for.

Jobs recently carried out by Hydrex



Spain include a propeller modification, pipe repairs, rudder repairs and stern tube seal repairs in Algeciras, propeller modifications in Cadiz and an azimuth bow thruster removal and reinstallation on a pipe laying vessel in Cartagena.

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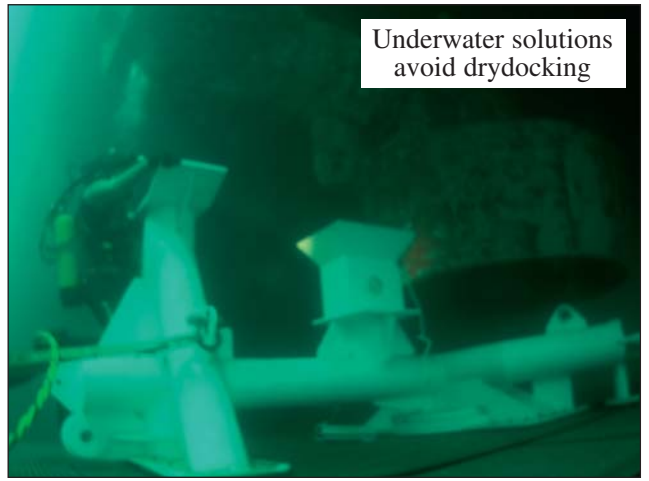
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Hydrex has certified divers at its disposal, ready to perform all types of offshore inspections.



Underwater solutions avoid drydocking



Fully trained and certified diver/technicians



Removal of heavy marine fouling on FPSO and drill vessels



Fast response centers with instant mobilizable equipment



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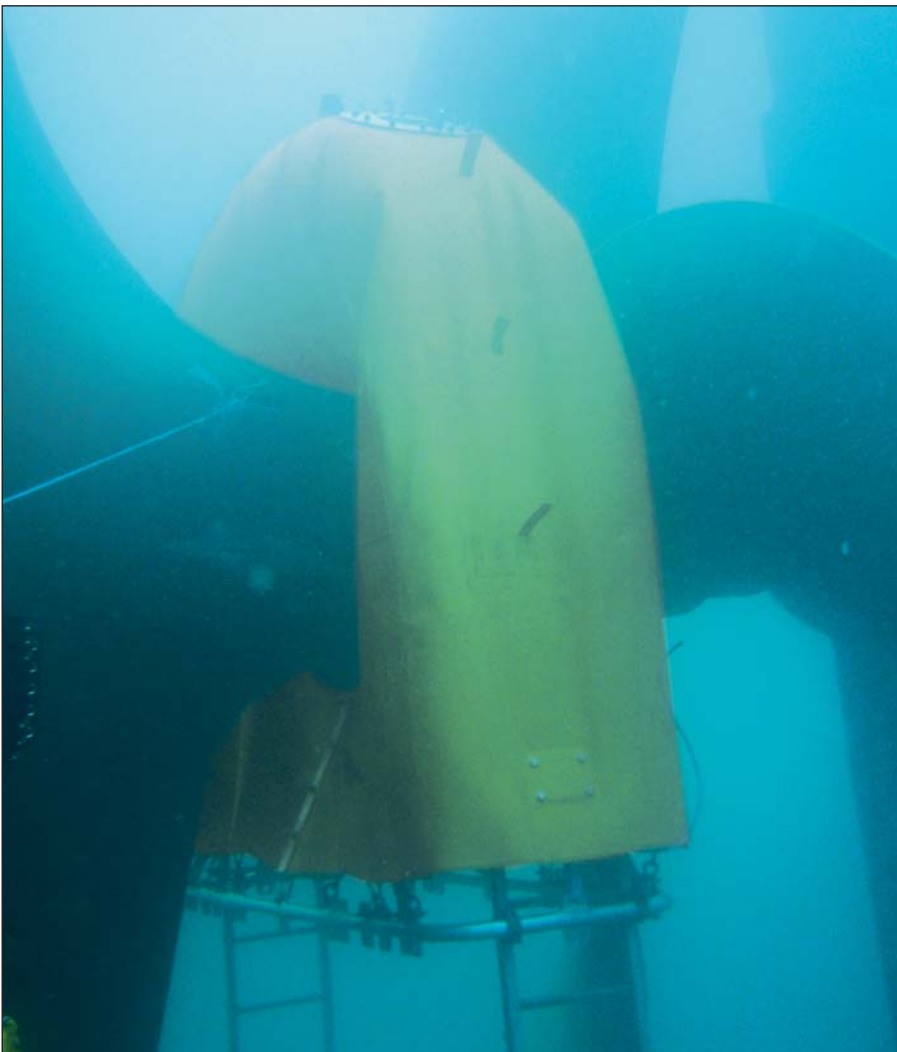
# Underwater stern tube seal repairs in Algeciras and Le Havre

**T**he Hydrex flexible mobdock technique was used to perform two underwater stern tube seal repairs. Three seals were replaced in Algeciras on a 250-meter roro vessel that was leaking oil, while the aft stern tube seal assembly of a 210-meter container ship was partly repositioned in Le Havre to stop an oil blockage.

Every Hydrex office has a fast response center equipped with all the latest facilities, lightweight equipment and tools. These centers



*Preparation for bonding of new seals.*



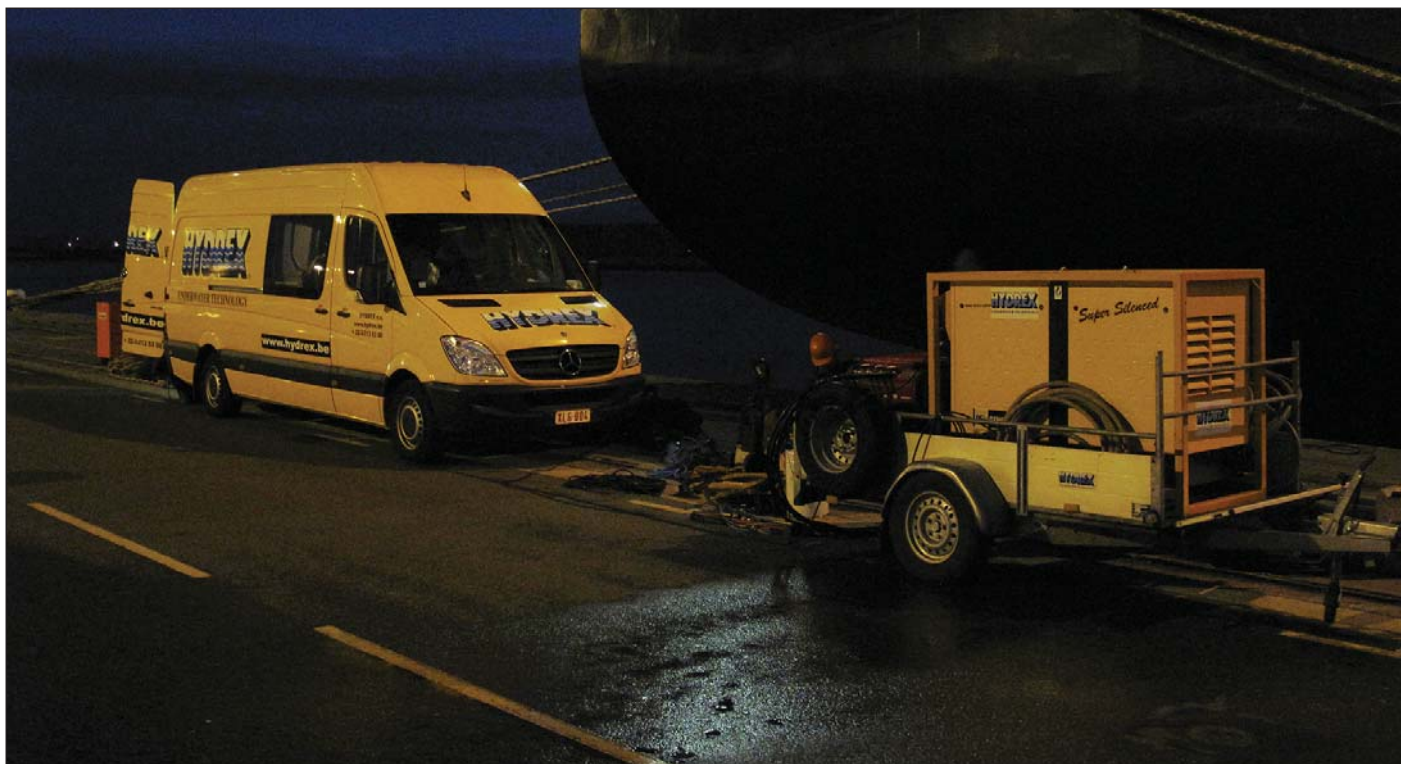
*The Hydrex flexible mobdock repair technique is class accepted.*

were designed specifically to increase speed of service and allowed us to mobilize diver/technician teams to both vessels, from our offices in Algeciras Bay and our headquarters in Antwerp respectively.

After a thorough underwater inspection, the rope guard of the vessel in Algeciras was removed. The split ring was then disconnected and brought to the surface to be cleaned. Next the Hydrex flexible mobdock was installed around the stern tube seal assembly and a dry underwater environment was created in which the diver/technicians could remove the damaged seals one by one and replace them with new ones which were prepared onshore by the attending Aegir-Marine specialist.

After the rope guard was removed during the operation in Le Havre the diver/technicians discovered that the oil flow through the stern tube seal assembly was blocked. This was caused by the intermediate and sup-





*Hydrex diver/technician teams work around the clock if needed to carry out a repair as fast as possible.*

port rings both having been turned 180 degrees the wrong way. After the flexible mobdock was installed, the assembly was opened up and all parts were closely investigated and cleaned. This inspection revealed that all seals were in good condition but that the bonding was in bad condition. The bonding of the seals was

consequently repaired after which the seal assembly was refitted the proper way.

Both operations ended with the conducting of pressure tests with positive results, the removal of the flexible mobdock and the reinstallation of the rope guard.

The ro-ro vessel needed to cross the ocean after its stop in Algeciras, but would not have been allowed entrance to any port in the United States due to the U.S. Coast Guard's very strict policies concerning environmental risks. Thanks to Hydrex's fast response, the captain could continue on his schedule with the

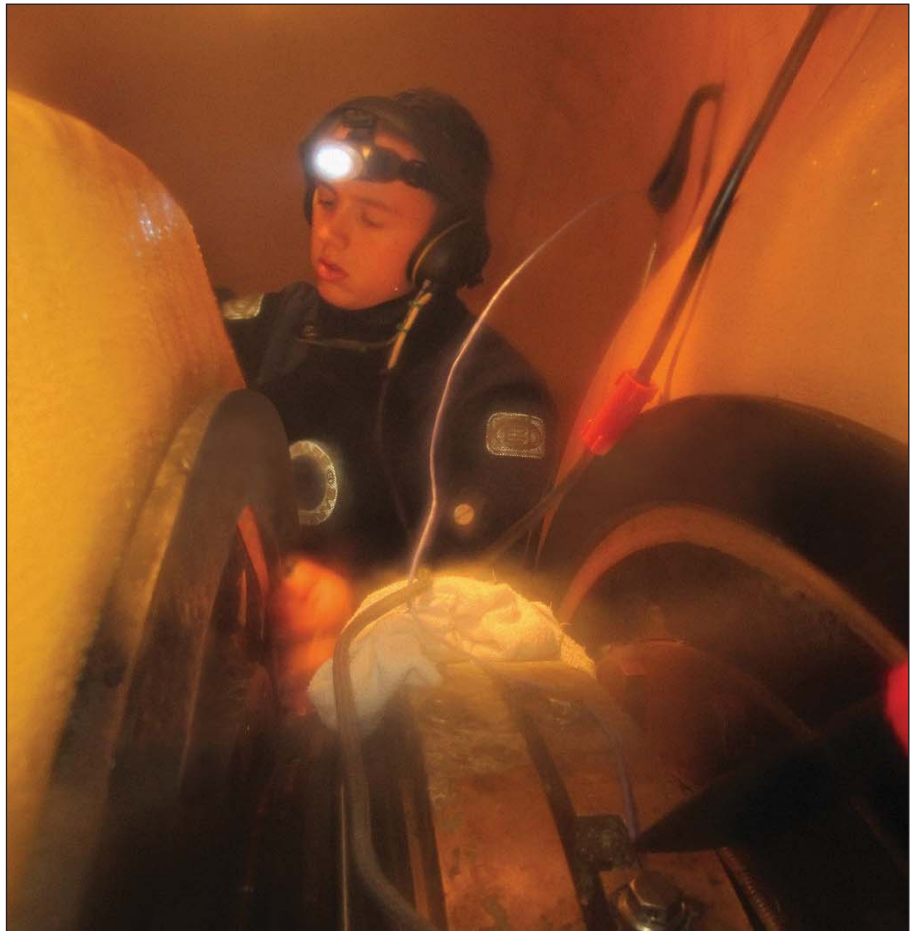


*During a stern tube seal repair the rope guard and split ring are removed before the flexible mobdock is installed.*



oil leak repaired and with only a minimum of delay.

The superintendent of the container ship in Le Havre was also very satisfied with the service offered by Hydrex. He said, "Even after the typical late call on a Friday afternoon and even later that evening, Hydrex still managed to assemble and organize a team of divers that arrived the next day in Le Havre. The job was completed well within the available time frame, including full re-welding of the rope guard and shifting of the vessel to another berth. In between, new divers and technicians arrived, all of whom seemed very professional and skilled in their work. We used Hydrex also the week before on this ship for another job in Dunkerque and the response at that time was also very fast and professionally executed." ■



*Dry working environment inside the Hydrex flexible mobdock.*

## ON-SITE BOW THRUSTER OPERATIONS

**T**he Hydrex lightweight flexible mobdocks are designed to be easily transported around the world and are used to close off the thruster tunnel on both sides, allowing divers to perform repairs and other operations in a dry environment around the bow thruster unit.

This technique enables them to reinstall the propeller blades of an overhauled thruster inside the thruster tunnel after the unit has been secured or replace the blades or seals and perform repair work on a specific part without removing the unit.

Since the development of this flexible mobdock technique, numerous thruster repairs have been



carried out by Hydrex diver/technicians around the world.

There is no need to send the vessel to drydock as all operations can be carried out in port or while the vessel is stationary at sea. Normal commercial activities can therefore continue without disruption.

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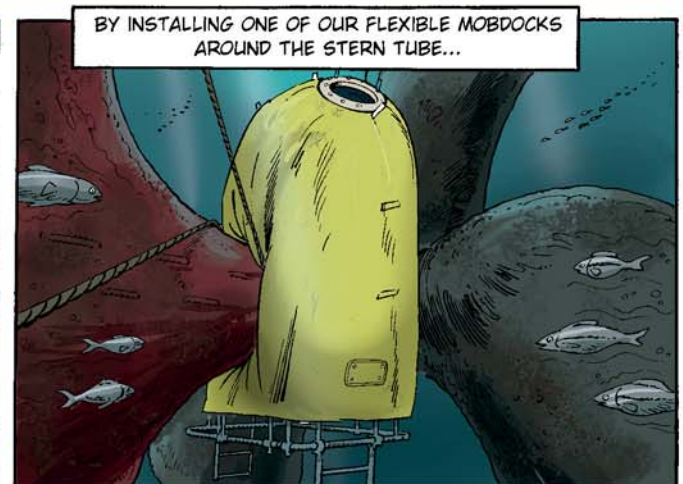
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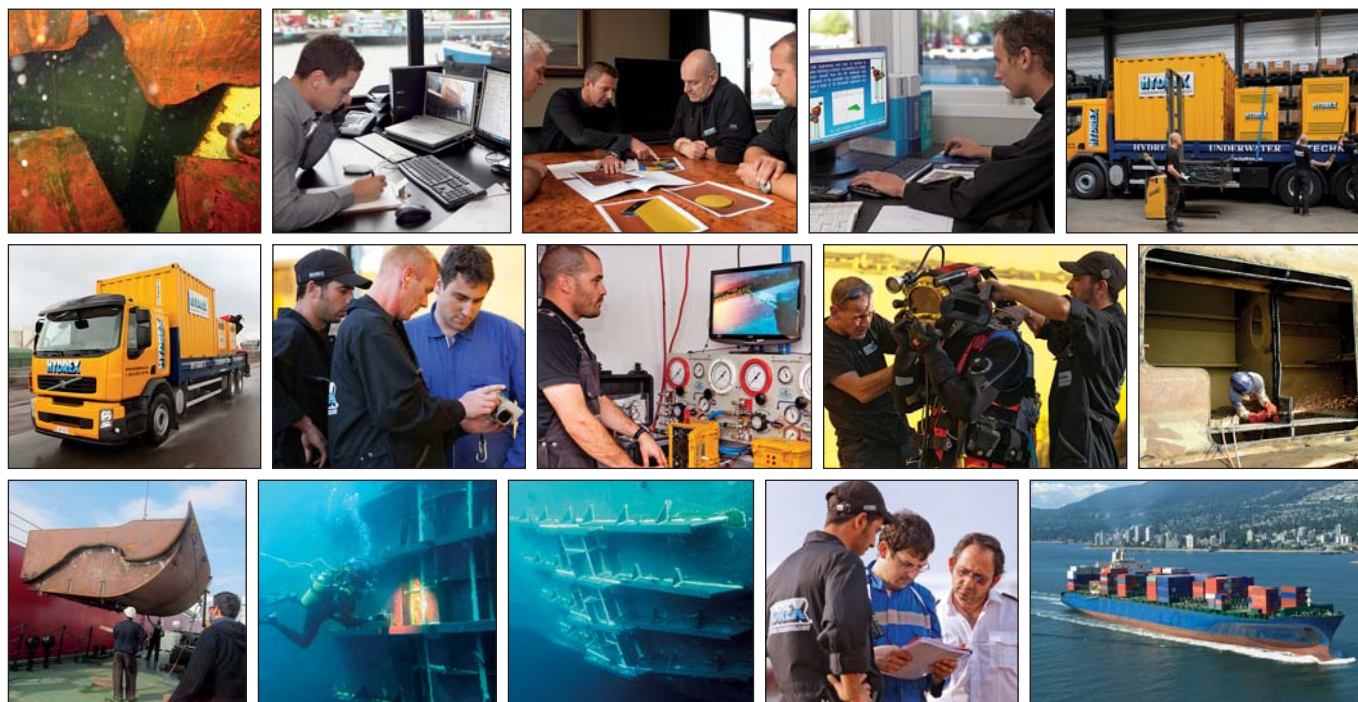


## Keeping ships in business



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## Fast underwater repairs keep ships out of drydock

**H**ydrex offers turnkey underwater repair solutions to ship-owners wherever and whenever they are needed. Hydrex's multi-disciplinary team will help you find the best solution for any problem encountered with your ship below the water line. We will immediately mobilize our diver/technicians to carry out necessary repair work without the need to drydock.

Hydrex has a long track record of

performing complex permanent underwater repairs to thrusters, propellers, rudders, stern tube seals and damaged or corroded hulls. By creating drydock-like conditions around the affected area, our diver/technicians can carry out these operations in port or at anchor.

All the projects we undertake are engineered and carried out in close cooperation with the customer and any third party suppliers, relieving

the customer of all the hassle of coordination, planning and supervision.

Headquartered in the Belgian port of Antwerp, we have offices in Tampa (U.S.A), Algeciras (Spain), Mumbai and Visakhapatnam (India), and Port Gentil (Gabon).

All Hydrex offices have fully operational fast response centers where an extensive range of state-of-the-art equipment is available at all times.



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