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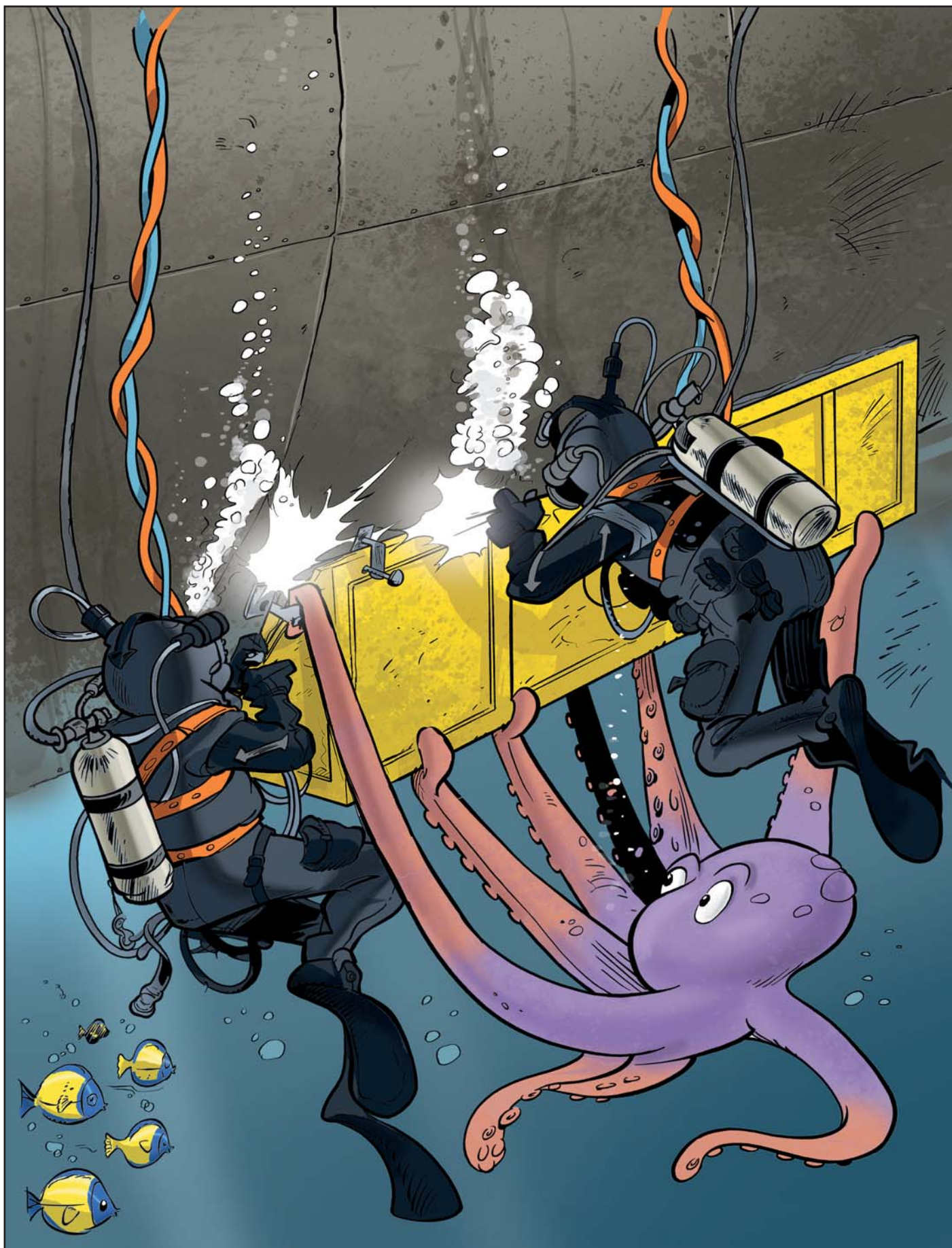
UNDERWATER TECHNOLOGY

Magazine

Number 205



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UNDERWATER TECHNOLOGY

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Editorial



In this magazine you can read about a range of on-site operations carried out by Hydrex diver/technicians around the world. These operations were all performed with the same purpose in mind: to keep the customer's vessel out of drydock and allow him to keep his ship on schedule.

We start off the magazine with an article about an underwater stern tube seal repair done in Trinidad on a 148-meter container vessel. The operation was carried out under constantly changing circumstances. Our divers are, however, trained to handle this kind of operation like any other: to the highest safety and quality standards..

The next article deals with several propeller operations performed on tankers in Europe. Hydrex divers straightened 3 propeller blades on a 248-meter ship in Algeciras, Spain. In the Netherlands a team cropped the four blades of a propeller on a 183-meter vessel in Flushing and installed a Propeller Boss Cap Fins (PBCF) on a 110-meter vessel in Rotterdam. These repairs were all performed on-site and underwater to avoid a costly drydock visit for the owners.

The magazine ends with an interview with Hydrex Production Executive, Dave Bleyenbergh. He talks about the history of underwater bow thruster operations and the benefits this kind of repairs bring for ship owners.

We hope you enjoy reading this issue of our magazine as much as we have enjoyed producing it. Please contact us if you have questions or comments about the magazine or if you need our assistance with one or more of your vessels. In the end that is still our main goal: to help you keep your ship sailing safely, economically and on schedule.

Best regards,

Hydrex founder
Boud Van Rompay



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Underwater services and
technology approved by:



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Underwater stern tube seal repair in Trinidad saves time and money

Last month a Hydrex diver/technician team carried out underwater stern tube seal repairs on a 148-meter container vessel in Port of Spain, Trinidad. The ship was suffering from an oil leak, making an on-site repair necessary. Using one of the company's flexible mobdocks the team was able to carry out the entire operation on-site and underwater, saving the owner an expensive and time-consuming trip to drydock.

Every Hydrex office has a fast response center, equipped with all the latest facilities, equipment and tools. These centers were designed specifically to increase speed of service. The lightweight flexible mobdocks packed in flight containers allowed for a very fast mobilization and a timely arrival in Trinidad of the Hydrex team.

The diving team first set up a monitoring station. The operation then started with a thorough underwater inspection of the stern tube seal assembly.

After the inspection, the team detached the vessel's rope guard. Next the divers installed the flexible mobdock around the stern tube seal assembly creating a dry underwater environment so that they could work in drydock-like conditions. The split ring was then disconnected and brought to the surface to be cleaned. After cleaning the entire assembly, the divers removed the first seal and replaced it with a new one which was then bonded. This procedure was repeated with the other two



Hydrex diver getting ready for underwater operation in Trinidad.



The stern tube assembly before it was cleaned.



Hydrex flexible mobdock installed around the stern tube assembly.

damaged seals.

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

Hydrex has carried out repairs and replacements on all types of seals on-site and underwater, for almost twenty years now. We constantly invest in the research necessary to continue to evolve repair techniques

and procedures. Over the years the Hydrex R&D department has improved the flexible mobdock (mobile mini drydock) technique to make it possible for our diver/technicians to perform permanent repairs on seals, thrusters and almost any other part of the underwater vessel without the need for drydock. The latest generation of flexible mobdocks allow us to carry out on-site replacement of virtually any type of stern tube seals very quickly.



Cleaned part of the rope guard before being installed.

Swift on-site bow thruster operations



The 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 re-pair work on a specific part with-out 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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Fast underwater ship hull repairs save time and money



Hydrex on-site hull repair services include the renewal of both small and large areas of damaged hull plating. These repairs can be carried out above or below water, according to the circumstances, with tailor-made mobdocks. Normal commercial activities can therefore continue without disruption. These operations follow the Hydrex procedure for welding cracks in the vessel's shell plating and they are approved by the major classification societies.

Hydrex diver/technician teams carry out these on-site hull repairs all over the world. In most cases the damaged area can be replaced with a permanent insert and no condition of class is imposed. On the rare occasions where the damage does not allow such a repair, a temporary doubler plate is installed over the affected area. This allows the owners to keep to their schedule and have a permanent repair carried out during the next scheduled drydock visit.

To offer the fastest possible service to customers, Hydrex offices have fast response centers where an extensive range of state-of-the-art tools and diving support equipment is available at all times for the repair teams.

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Diver/technician working inside the flexible mobdock.

Conclusion

Due to the very busy schedule in Port of Spain, the team had to halt the operation on several occasions when one of the vessels next to the container ship left or a new ship arrived. The ship also had to shift several times, making further interruptions necessary. Hydrex divers

are however trained to handle these constant changing and challenging circumstances. They worked in shifts to finish the stern tube seal repairs as quickly as possible. Despite the breaks, the operation was carried out without any loss of quality. The owner could sail his vessel free of oil leaks and without having to go to drydock. ■



Hydrex diver preparing the assembly for the operation.

Hydrex performs a wide range of propeller operations, keeping ships out of drydock

Hydrex teams carried out a wide range of underwater propeller operations on tankers around the world. Among them a propeller blade straightening on a 248-meter ship in Algeciras, Spain, a blade cropping on a 183-meter vessel in Flushing, the Netherlands, and a spinner cone (Propeller Boss Cap Fins – PBCF) replacement on a 110-meter vessel in Rotterdam, The Netherlands.

Underwater propeller blade straightening in Algeciras

With three of the four blades of its propeller severely bent, a 248-meter tanker 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. A team was rapidly

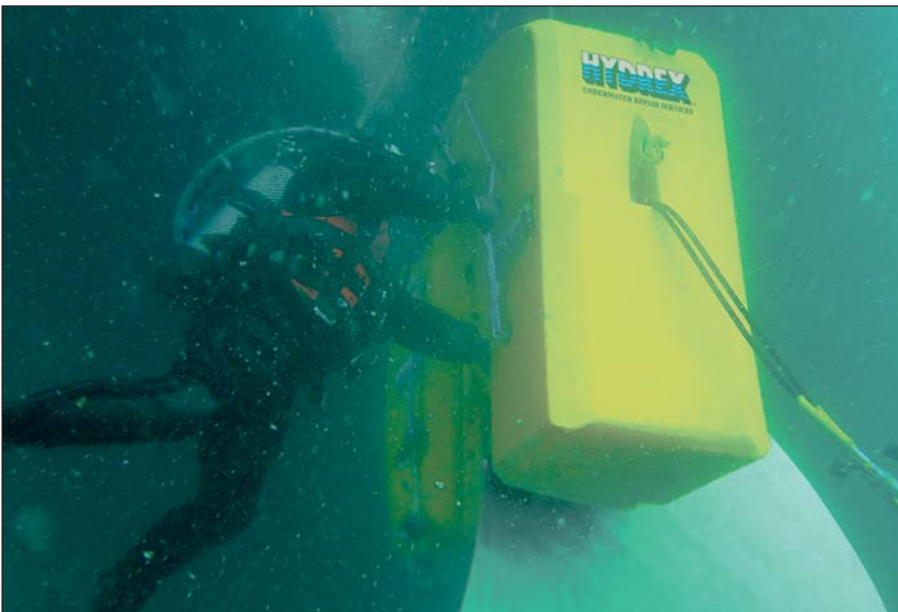


Hydrex diver/technician positioning cold straightening machine.

mobilized to the ship's location close to the Hydrex office in Algeciras Spain to perform a cold straightening of the blades.

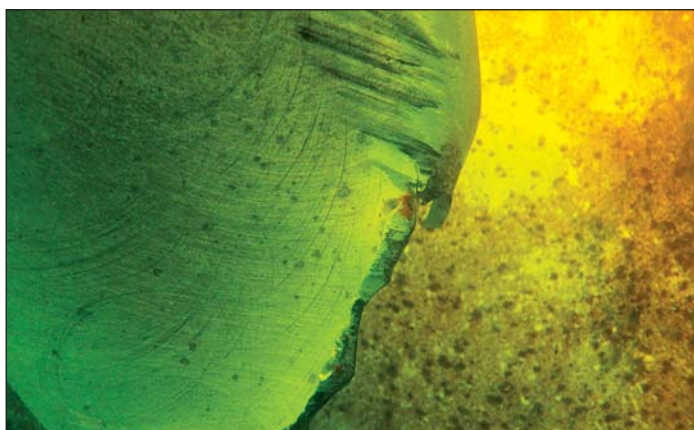
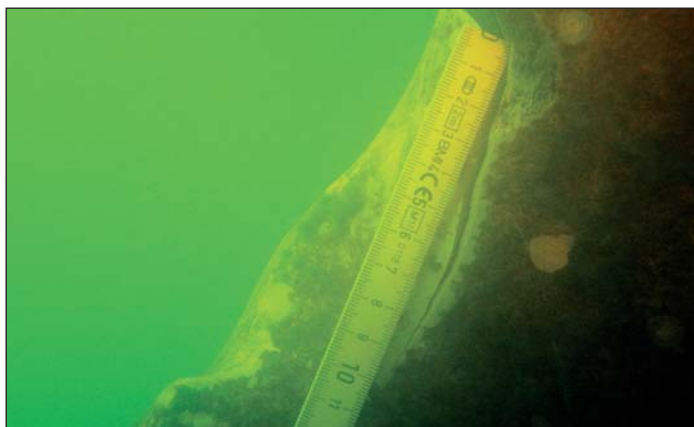
After the equipment arrived at the vessel's location with one of the Hydrex workboats the team started the repair with a detailed underwater survey of the damaged propeller blades. The inspection revealed that the three blades had suffered deformations along the trailing edges.

The team then carefully positioned the straightening 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 damaged blades, restoring the propeller's efficiency.



With the cold straightening machine, bent blades can be restored to their original position.

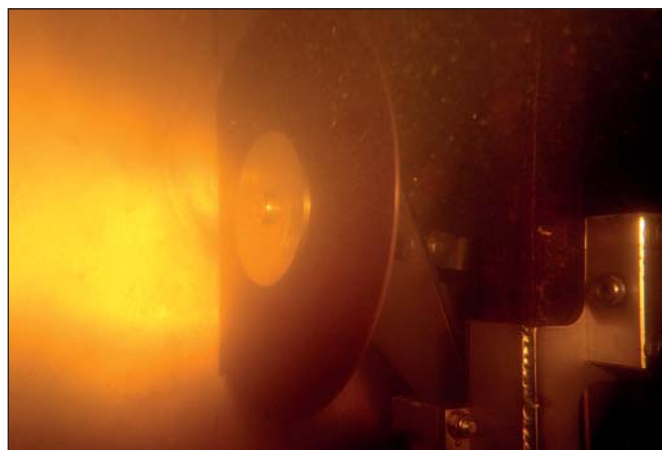




The four blades of a tanker in Flushing were severely damaged.



The cropped areas of three of the four blades.



The damaged areas were cropped underwater to restore the propeller's performance.



After cropping, the trailing edges of the blades were polished.

Underwater cropping of damaged propeller blades in Flushing

Hydrex mobilized a diver/technician team to carry out a detailed inspection and necessary repair to the damaged propeller blades of a 183-meter tanker during the ship's stop in Flushing.

To make a full assessment of the damage, the team first performed

an underwater inspection. This revealed that all four blades had been damaged. The affected areas of the blades therefore needed to be cropped to restore the propeller's balance. The team then used the information acquired during the inspection to calculate and determine the correct measurements needed to modify the trailing edges of the propeller blades. The area to be cropped was marked out on each of the four blades and verified. Next



Hydrex diver/technician getting ready for underwater operation in Rotterdam.

the divers cropped the blades one by one and ground their edges to give them the correct radius. When the cropping was complete, the Hydrex technicians polished the blades to make sure that any remaining loss of efficiency would be minimal.

Underwater Propeller Boss Cam Fins (PBCF) installation in Rotterdam

Hydrex was contacted to install a PBCF during an oil tanker's stop in Rotterdam. After the team arrived at the vessel's location with one of the Hydrex workboats, they started the underwater operation with a full inspection of the propeller. Next the diver/technicians cleaned the area where the spinner cone was to be installed. They then lowered the cone into the water and positioned it on the propeller. When this was done, grease was inserted in the space underneath the propeller cone for lubrication and the bolts were put on torque and secured with wire, finishing the installation of the PBCF. The Hydrex team worked around the clock to finish the operation as quickly as possible.

By performing the operation on-site and underwater, the owner of both tankers could immediately start enjoying the fuel savings the system offers. Otherwise he would have had to wait for the next scheduled dry-docking to have the PBCF's installed. This would have lost him up to two years of savings. Calculations show that he will have earned back the money of the underwater installation in about eight weeks, so the savings for the customer are substantial.

All types of permanent underwater propeller repairs now possible

Damaged propeller blades will have a below average performance. The engine will thus have a higher workload, resulting in increased fuel consumption and added stress. By taking advantage of Hydrex's in-house developed cold straightening technique, damaged blades can be straightened underwater and optimum efficiency of the propellers can be restored.

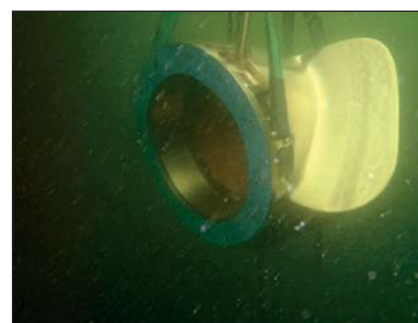
If straightening is not an option, the affected area on the blade will be



The old spinner cone being removed on a tanker.



Old spinner cone brought to the surface.



New spinner cone lowered into the water.



New spinner cone installed and secured.

cropped to restore the hydrodynamic balance. This is done to achieve the greatest possible efficiency for the vessel. This kind of repair is carried out with the propeller blade cutting equipment that was also developed by the Hydrex research department.

Both types of repairs can be carried

Underwater stern tube seal repairs with new generation flexible mobdocks



Using our flexible mobdock method to create a dry underwater environment, we have carried out stern tube seal repairs and replacements underwater for some years now in cooperation with top specialist suppliers.

This technology brings drydock conditions to the ship rather than having to take the ship to drydock, saving a considerable amount of time and money in doing so.

This class accepted method is performed by our diving teams under our warranty. It can be used while the ship is carrying out its usual cargo or other commercial operations in port.

Visit the special stern tube seal repair section on our website for more information and examples of the many seal repairs we have performed in recent years.



PBCF being lifted off the Hydrex workboat.



Hydrex workboat and equipment in Rotterdam prior to the operation.

out on-site and underwater, allowing the ship to return to commercial operations without the need to drydock.

The Hydrex R&D department has also developed a repair system that allows Hydrex to perform permanent underwater repairs to every type of propeller in dry conditions. All kinds of repair or maintenance work can be carried out on propellers, twin propellers, variable pitch propellers, azipod and collapsible thrusters.

This is especially important news for offshore supply and work vessels, navy ships or any vessel under contract or on a location far away from available drydock possibilities. Staying on hire for underwater repairs will save precious time and money.

This new repair system can be transported by air transport to any location around the world from the Hydrex fast response centers within a very short time frame. It can be assembled very quickly (12 hours) on-site. ■

How Hydrex revolutionized underwater bow thruster operations

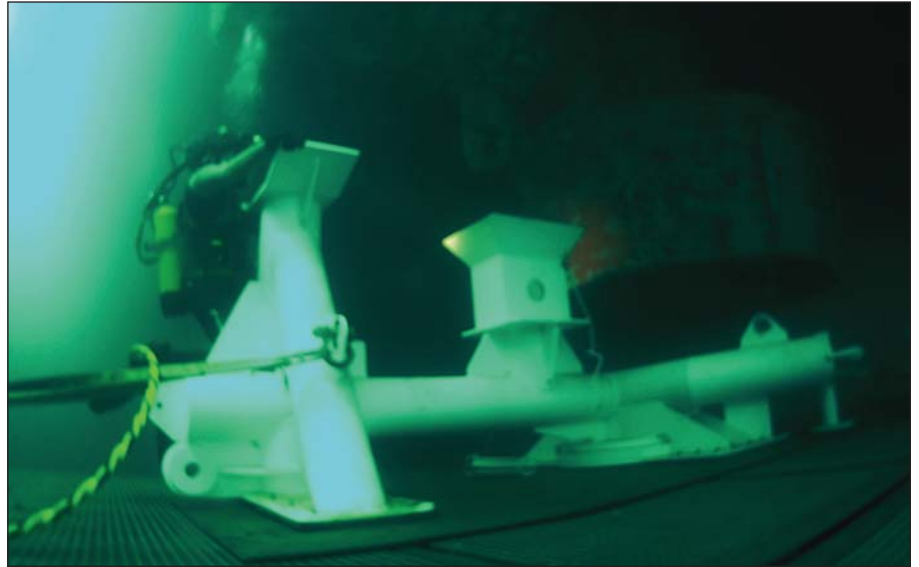


Hydrex Production Executive Dave Bleyenbergh.

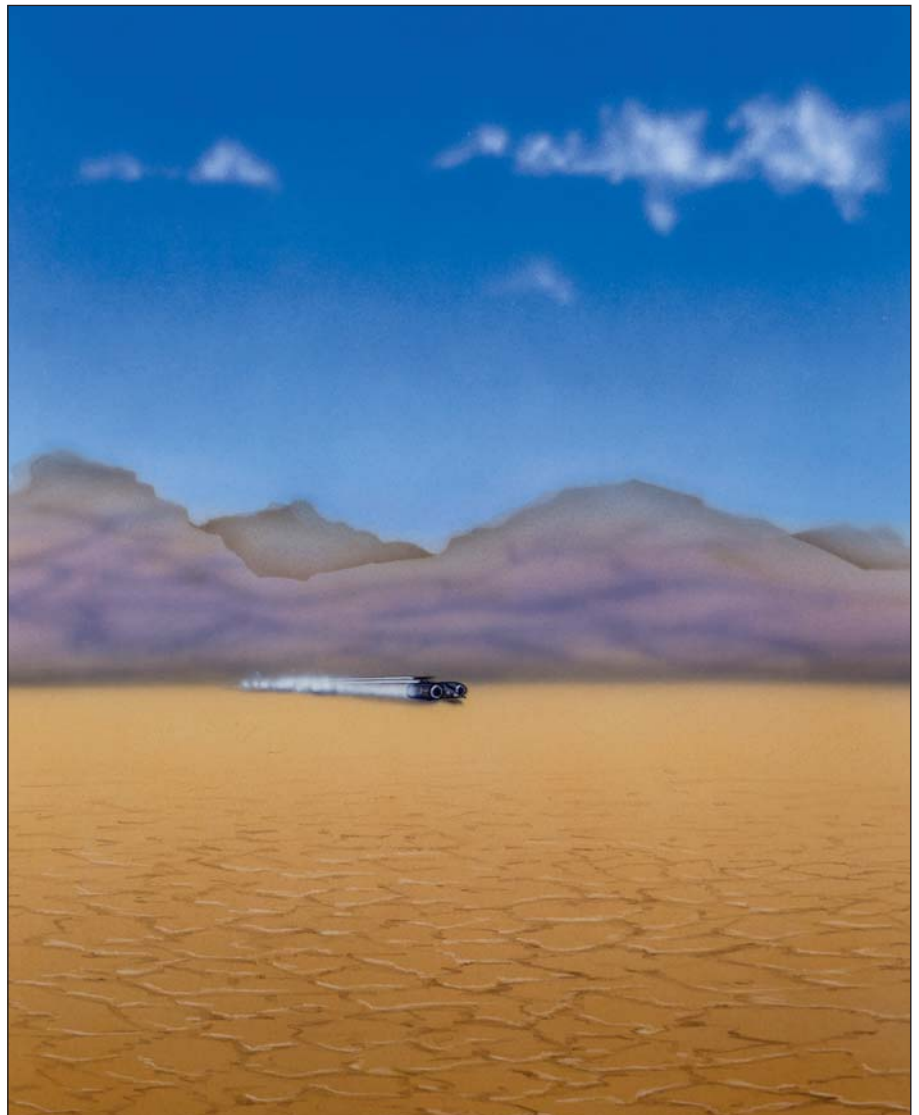
Hydrex was the first company to show that it was possible to remove and then replace thrusters by creating a dry environment underwater. Using the Hydrex-developed steel mobdocks to seal off the thruster tunnel, with an access shaft protruding above the water, work teams accessed the thruster tunnel and removed or repaired the thruster within the tunnel in complete safety. This was done in conditions similar to those above water.

Hydrex has since then developed this technology further using lightweight flexible mobdocks. These modernized mobdocks, which are designed to be easily transported around the world, are used to close off the thruster tunnel on both sides. This allows divers to work in a dry environment around the unit.

Hydrex Production Executive Dave Bleyenbergh talks about the history of on-site thruster operations and tells us the benefits this can have for

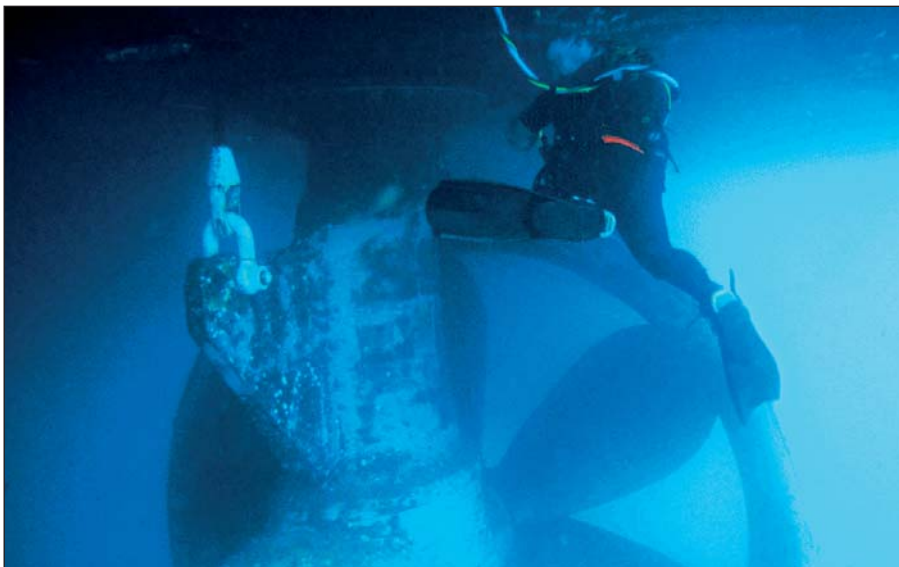


40 ton thruster lowered onto support unit.





The bow thruster unit being lowered onto the workboat.



Hydrex diver/technician guiding azimuth thruster during removal.



Hydrex team members manoeuvring thruster unit.

shipowners in the shipping as well as the offshore industry.

Hydrex: *How did it all start?*

Dave Bleyenbergh: We started off with small repairs on bow thrusters: welding anodes, performing bow thruster blade repairs in the wet, repairing the steel belt,... We then began looking into ways to carry out on-site repairs in dry circumstances. Emptying the thruster tunnel of water was the most logical next step.

In 1995 we started doing this by closing off both sides of the thruster tunnel and blowing air into it. This created a dry environment in which our diver/technicians could remove a blade or perform a seal repair. For its innovative work in this field Hydrex won the 2002 Lloyd's List SMM Award in the category of "Innovation in Naval Shipbuilding and Marine Technology."

Hydrex: *But it did not stop at these smaller repairs, did it?*

Dave: The next step was to perform complex repairs to the thruster unit itself. The easiest way to do this was to remove the unit in its entirety. The difficult part was to find a way of lowering the unit into the thruster tunnel without water coming in through the hole connecting the tunnel to the engine room. If the air in the tunnel escapes through the hole, the tunnel will fill up with water very fast. We needed to find a way the close off the engine room.

After lots of brainstorm sessions around the drawing table, we found the solution. Things went very fast after that and we started putting the idea into practice soon after. We visited engine rooms to get a good idea of how we needed to develop the concept. A universal solution

was not possible and we had to adapt it to different sizes. Good drawings and ideally a pre-inspection (of the vessel or a sister ship) is required to perform a full thruster unit replacement.

Hydrex: *What are the typical problems encountered with a thruster unit that result in a need for it to be overhauled?*

Dave: There can be a number of causes for a thruster's malfunction. The gearing wheels can be worn down so that the unit does not function as it should, one or more hydraulic tubes can be severed so that the correct pitch cannot be established or the feedback cable can be broken, preventing correct readings. If a thruster does not function correctly, the vessel has to use an extra tugboat when entering port and this raises the cost of entering and leaving considerably.

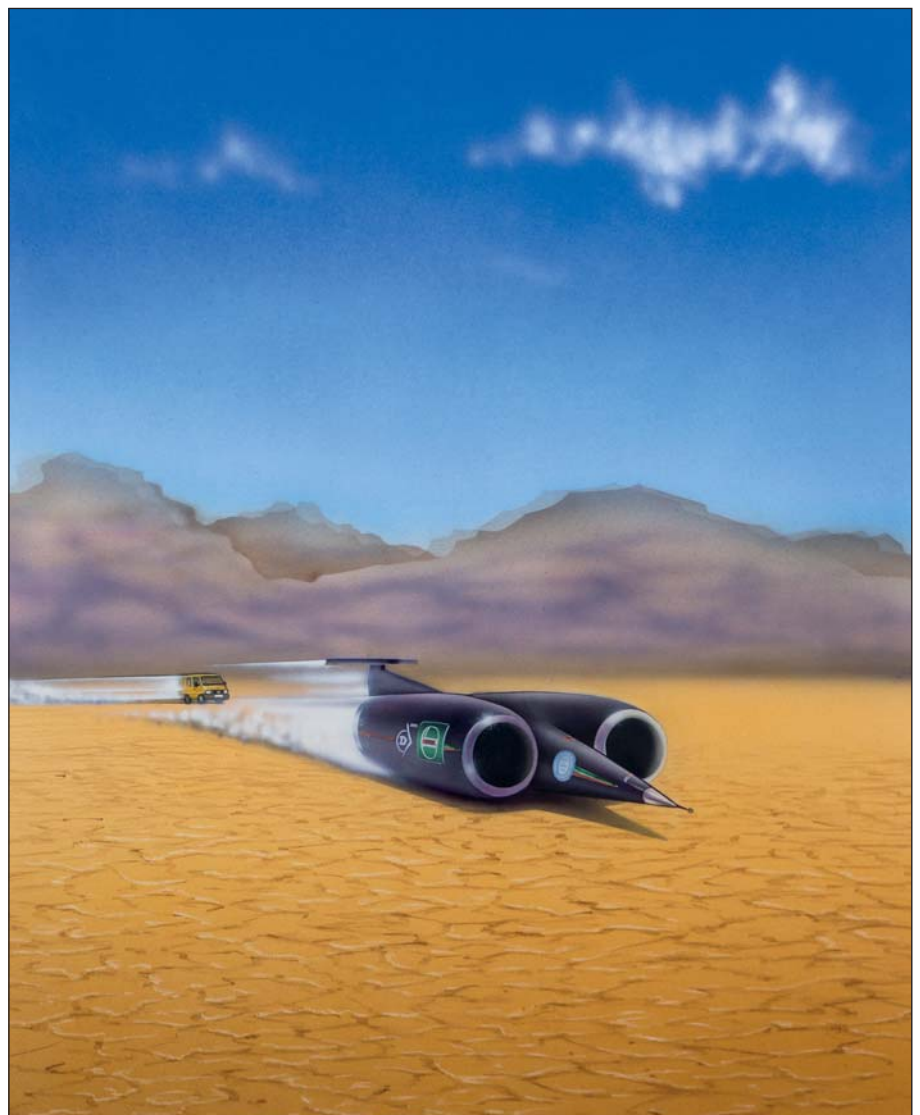
If possible we perform on-site repairs inside the tunnel, to prevent a complete removal of the thruster unit. We recently did a repair of the stainless steel belt on a vessel in Port Gentil (Gabon). An 86-meter research vessel needed the stainless steel belt in one of its thruster tunnels replaced. The belt is installed around the perimeter of a thruster tunnel at the location of the thruster blades. There the impact of the cavitation caused by the movement of the blades is the most severe. Extra protection against cavitation damage is therefore essential. When the stainless steel belt in the thruster tunnel suffered cracks, the underlying steel was exposed to cavitation. The belt needed to be replaced as soon as possible to prevent the tunnel from getting damaged too severely. The owner of the vessel would have had to take his vessel to drydock if no on-site solution

was found. A tailor-made, open-top cofferdam was designed by our technical department. It was constructed in a local workshop under the supervision of Hydrex diver/technicians. At the same time a regular shaped second cofferdam was also built. This allowed us to empty all water from the thruster tunnel and descend into it to carry out the repair. Our diver/technicians removed the old damaged belt and replaced it with a new stainless steel belt. The actual operation was finished in only five days.

Hydrex: *Does the size of the thruster matter?*

Dave: No. We have also performed several offshore thruster operations. We only need a crane with a large

enough lifting capability. For instance, we have replaced one of the 40-ton, swing-up, azimuth thrusters of a crane barge stationed in Gabon with the spare on several occasions. One of these operations had to be carried out in a very short time frame because the crane barge was scheduled to leave for an operation in Nigeria. All repairs and other servicing work needed to be carried out before the start of this operation. For this reason going to drydock was not an option, as the nearest suitable location was South Africa and this would have taken the repairs far beyond the available time frame. When the first azimuth thruster was replaced, a large mobdock (measuring 9 x 6 x 2 meters and weighing over 25 tons by itself) was constructed under Hydrex supervision





Dave Bleyenbergh supervising a thruster blade operation.

in Belgium and transported to Gabon. There it was stored after the repair to be used at short notice whenever future repairs were required on thrusters. This allowed for a very fast mobilization and thruster replacement on the next two occasions.

Hydrex has also developed a permanent thruster repair and replacement system. This system has been developed so it can be tailored to most vessels. It can be included in the planning for a newbuild, installed on a unit going to drydock or constructed and brought onboard at any other suitable time. With such a system on standby any repair work to the thruster that may arise can be dealt with much faster and more easily.

Hydrex: *Despite the difficulty of these operations, they can be performed very fast.*

Dave: That is correct. The removal

of the unit can be done in the wet, because it is overhauled. We only need to remove the blades and close the unit off with flanges. The reinstallation needs to be done in the dry because you need to reinstall the blades without water ingress. Removal can be done within 24 hours. Reinstallation is usually done in 48 hours.

We have now taken it even a step further. On several occasions in 2013 we have removed the old bow thruster unit and reinstalled a new one in a single operation. This saves the customer extra time because we do not need to mobilize our divers and equipment twice.

A vessel can sail after we remove the unit and close off the tunnel from the engine room. The reinstallation can then be done at a later date on-site or during the next drydock visit if required. This saves time in dock because they do not need to remove the old unit and they can have the

overhauled or new unit ready when the ship comes in.

For bow thrusters unit removals or blade replacements in Western Europe we have two workboats available at our headquarters in Antwerp. The transport of the unit to the manufacturer can also be arranged by us if needed. This is a package we offer to customers. If a job comes in we ask if the thruster needs to be overhauled and where it needs to go. Spare parts or thruster blades can be stored at our offices so that they are immediately available when we start the operation.

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.

Hydrex: *Thank you for the interview.*



**KEEPING SHIPS
IN BUSINESS**



Keeping ships in business

Hydrex 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) and Algeciras (Spain).

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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