HYDREX®

UNDERWATER TECHNOLOGY

Number *190*

Editorial

In the first article in this magazine you can read about two underwater stern tube seal repairs that were carried out by Hydrex diver/technician teams last month. Both teams used the company's lightweight flexible mobdocks to carry out these operations on-site and underwater, saving time and money for the owners.

The magazine continues with an account of two recent propeller operations. One of the blades of an azipod propeller of a cruise vessel was replaced in Bermuda. Last month a team straightened three of the four propeller blades of a tanker in Rotterdam.

The third article deals with a major civil engineering operation carried out by Hydrex in Cochin, India. Diver/technicians removed a 500-tons dock gate and replaced it with a new one. The original gate and the replacement were 47.5 meters long, 4 meters wide and 11.4 meters high.

The magazine ends with an article titled "More profitable propeller maintenance" that was written for Ship & Offshore magazine and is reprinted here because we feel it is highly relevant for our readers. In the article we show that the best available practices for propeller maintenance are more efficient than those currently in general use.

If you would like to learn more about the Hydrex services, please visit our website (www.hydrex.be) or call us 24/7 with your underwater repair needs, routine or emergency. We can offer turnkey solutions that include the engineering as well as the practical part of any operation. Our technical department is ready to find a solution for your specific needs.

Best regards,

Hydrex founder
Boud Van Rompay

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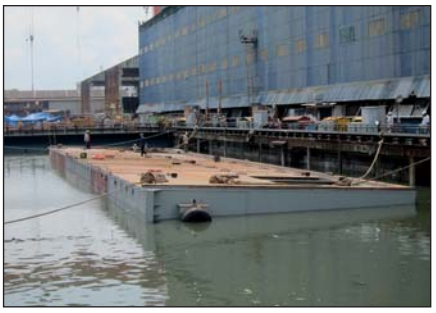
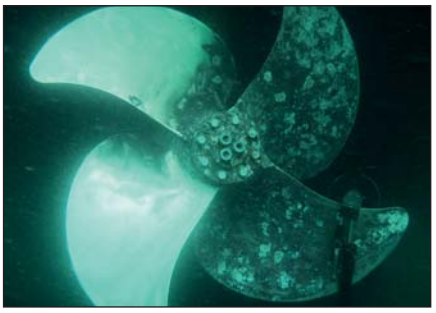




Underwater stern tube seal repairs in the Netherlands and Singapore

Last month Hydrex diver/technician teams carried out underwater stern tube seal repairs on a 130-meter oil tanker in Rotterdam, the Netherlands, and on a 261-meter container vessel in Singapore. Both vessels were suffering oil leaks, making a fast 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 time and money for the owners.

Hydrex diver/technicians can work in drydock-like conditions inside the flexible mobdocks.

Every Hydrex office has a fast response centre equipped with all the latest facilities, lightweight equipment and tools. These centers were designed specifically to increase speed of service and allowed us to mobilize diver/technician teams to both vessels within the shortest possible time frame.

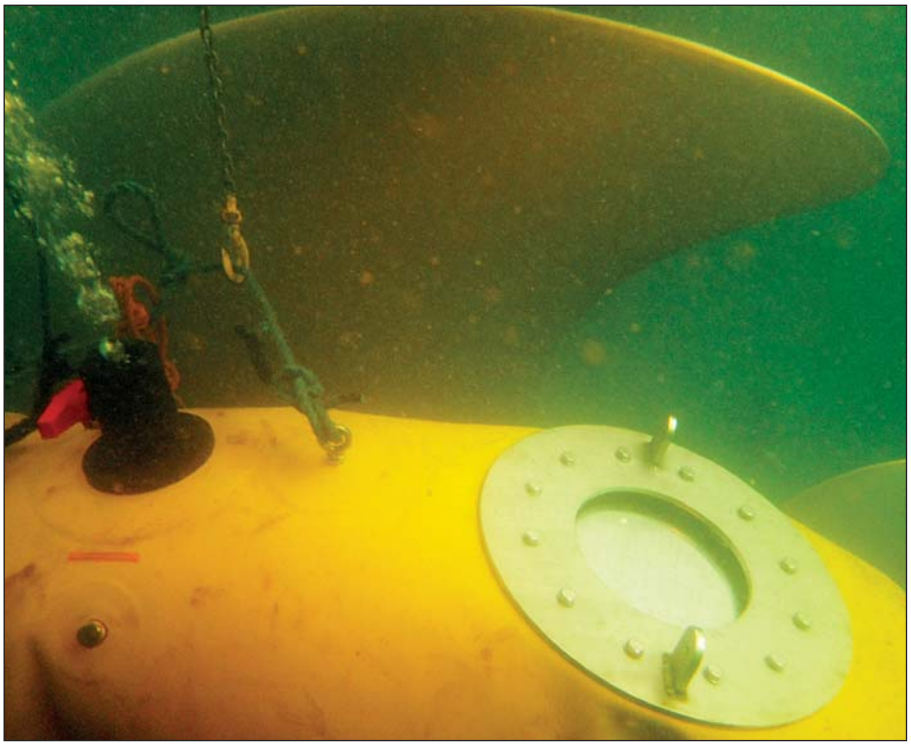
Rotterdam

When oil was leaking from the stern tube seal assembly of an oil tanker, diver/technicians mobilized from the Hydrex office in Antwerp to the vessel's location in Rotterdam together with all the needed equipment. After the diving team had set up a monitoring station, the operation started with a thorough underwater inspection of the stern tube seal assembly.

After the inspection, the team removed the rope guard of the vessel. Fishing lines tangled around the liner had caused the oil leak. These were removed by the diver/technicians. The team then installed the flexible mobdock around the stern tube seal assembly creating a dry underwater environment for the divers to work in drydock-like con-

Hydrex monitoring station during stern tube seal repair in Rotterdam.

Ropes are often the cause of leaking stern tube seal assemblies.



Hydrex flexible mobdocks are lightweight and can easily be transported around the globe.

ditions, a necessity for permanent stern tube seal repairs. The split ring was then disconnected and brought to the surface to be cleaned. Next the team removed the three damaged seals one by one and replace them with new ones.

Singapore

The lightweight flexible mobdocks packed in flight containers allowed for a very fast mobilization and a timely arrival in Singapore of the Hydrex team. A storm was passing over when the team arrived at the

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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Damaged stern tube seals can be replaced on-site and underwater.

container vessel's location. This meant that the Hydrex divers had to pause the repair on several occasions due to strong currents and could only start the underwater operations again when the weather had improved slightly and full safety could be guaranteed for the divers.

After an underwater inspection revealed that a fishing line had caused the leak, the team removed the rope guard and installed the flexible mobdock around the assembly. 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 damaged seals.

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.

Hydrex has carried out repairs and replacements on all types of seals on-site and underwater, for a number of years now. By creating a dry environment underwater, the divers were able to complete the required work on-site. Every day a ship has to go off hire causes a substantial loss of money. The teams therefore worked in shifts to perform the stern tube seal repairs within the shortest possible time frame. This saved both owners the time and money which going to drydock would have entailed. ■

Hydrex diver/technician during on-site stern tube seal replacement.

Underwater propeller blade operations in the Netherlands and Bermuda

In May Hydrex diver/technicians replaced a blade on one of the two azipod propellers of a 294-meter cruise vessel during the ship's stops in Bermuda. Last month a team straightened three of the four propeller blades of a 180-meter tanker while the vessel was stationed in Rotterdam.

Missing tip of azipod propeller blade.

One of the five blades of the port side azipod thruster of the cruise vessel had a missing tip and needed to be replaced. The other four blades were in good condition and required only some polishing, which was also carried out by the Hydrex team.

Because the ship was on a strict schedule, the diver/technicians performed both the removal of the five ton damaged blade and the installation of the new one in shifts. A representative of the manufacturer was present during the operation to give his approval of the replacement.

Last month in Rotterdam a diver/technician team used the Hydrex in-house developed cold straightening machine to bring three blades of the propeller of a container vessel back to their original condition.

Hydrex diver/technician loosening one of the propeller blade bolts.

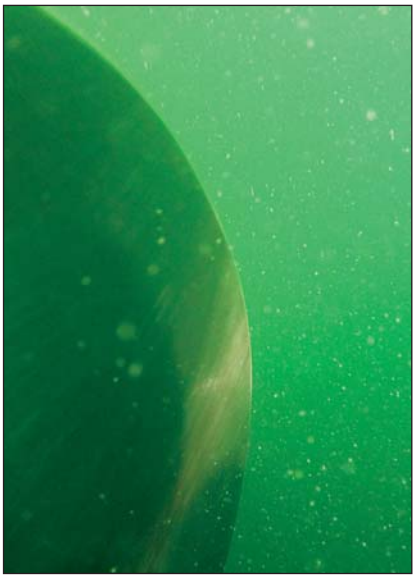
Propeller blades that have suffered from an impact will have a performance below average. Should this be the case, then the engine will have a higher work load, resulting in increased fuel consumption and added stress. By bringing the blades back close to their original form Hydrex can restore a propeller's efficiency and balance.

Hydrex has developed a series of cold straightening machines which have been in use for quite some time now but our research department is constantly looking into ways to enhance the technique even further to improve our services. A new

Replacement azipod propeller blade in Bermuda.

Damaged azipod propeller blade brought to the surface.

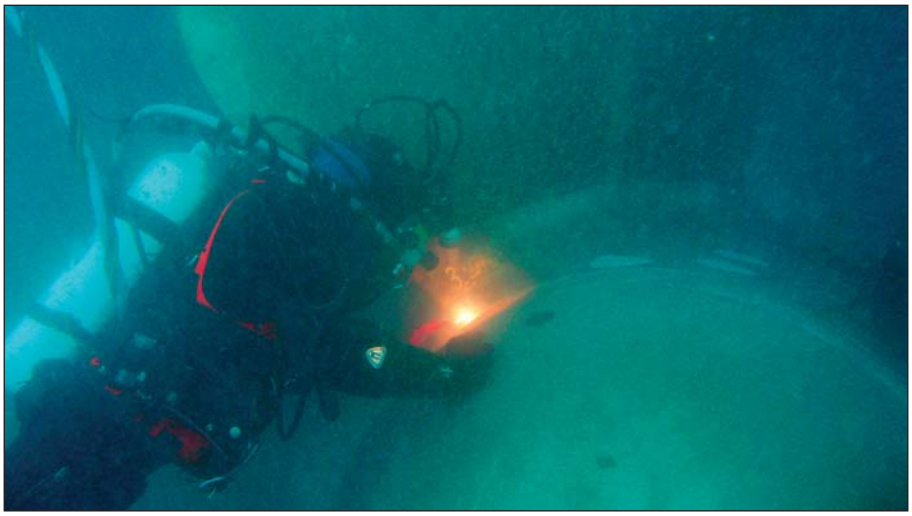
The Hydrex cold straightening machine was used in Rotterdam.



After straightening, the edges of the blades were polished.

model of the straightening machine was recently put into service. It is compatible with the existing model and is used to restore more severely bent propeller blades.

By performing both repairs underwater and on-site Hydrex saved the owners precious time and money. It allowed the ships to return to commercial operations without the need to drydock. ■



Hydrex diver/technician during final inspection of new propeller blade in Bermuda.

Hydrex replaces 47.5 meters long, 500 ton heavy dock gate in India

In May Hydrex diver/technicians removed a dock gate in Cochin, India and replaced it with a new one. Both gates were 47.5 meters long, 4 meters wide and 11.4 meters high and weighed 500 tons.

The old dock gate before the operation.

The old gate was still the original one that had closed off the dock ever since it was built in 1980. Water erosion had reduced the steel thickness of the outside part of the door and a replacement gate was therefore built at the shipyard.

Hydrex had already sent a diver/technician team to Cochin early in 2011 to perform a full inspection of the three bottom hinges of the dock gate. The team carried out thickness measurements of the plate material of the hinges of the gate and of the eyes that keep the locking pins in place. This provided the customer and Hydrex with all the necessary information to prepare the replacement and make the removal of the

The dock was flooded in stages.

The dock gate at a 30° angle.

The gate was maneuvered out of the dock entrance prior to tilting it further.

Replacement gate entering the dock entrance.

The new door was brought in vertical position using reversed procedures.

old gate and the installation of the new one as smooth as possible.

After the Hydrex team had performed a final inspection of the old gate in May of this year, they held a last preliminary meeting with all parties involved.

The first part of the operation was to flood the dock. This was done in three stages to make sure that the gate's ballast chambers leveled in the correct manner.

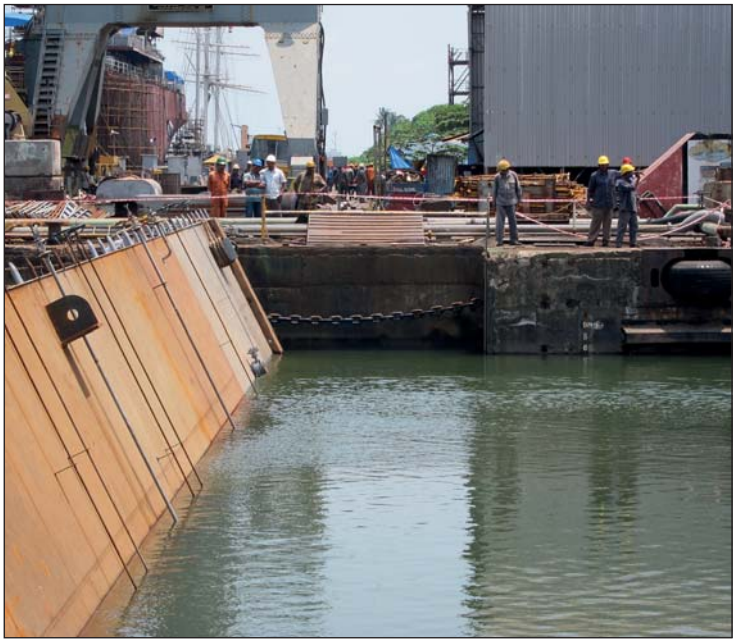
After the water reached sea level, Hydrex diver/technicians removed the securing pins of the bottom hinges of the door while handling ropes were secured to the gate's lifting points and the dockside boulders.

The gate was then opened and, by controlling the ballast tank valves and with the aid of chains and handling ropes, tilted to approximately 35°. Next, the door was connected to two tug boats with towing lines. The ballast tanks were emptied further, which lifted the gate out of its hinges. Both tug boats then pulled the door out of the dock entrance to ensure that further rising would not damage the concrete structure of the entrance. By opening the final valves of the ballast tanks, the gate tilted further until it was completely horizontal, after which it was transported to another dock.

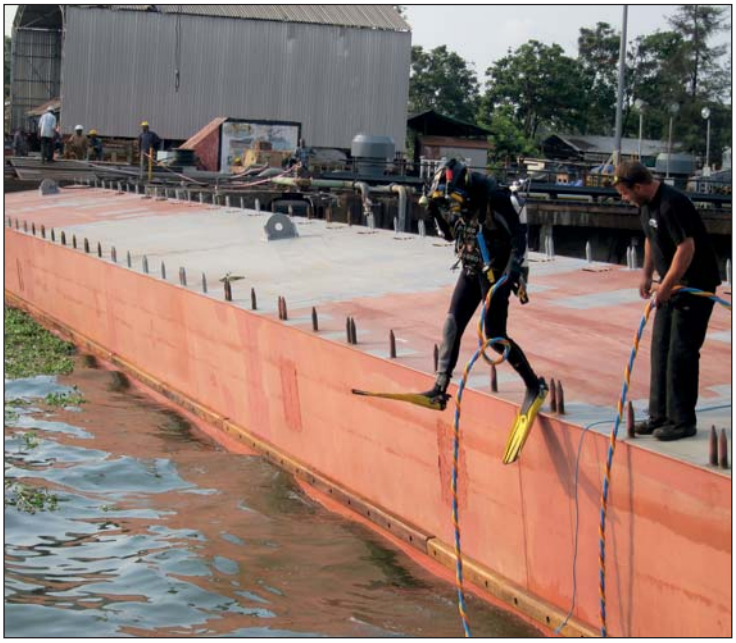
The newly-manufactured replacement dock gate was then brought to

The final stages of the tilting operation.

The new gate afloat and ready for transportation.



New dock gate pulled in position by gate winch.



Hydrex diver/technician entering the water during final stages of new dock door installation.

the dock entrance by tug boats and carefully positioned. By reversing the removal procedure, the new door was slowly tilted and lowered until the hinges connected with their bearings. The gate was then slowly brought to a vertical position and the securing pins were installed.

The entire procedure was carried out in close communication with the Cochin shipyard and the designers of the dock gate, who had a representative on-site during both the removal of the old door and installation of the new one.

Hydrex diver/technicians are trained to carry out complex and exceptional operations like this one in the shortest possible time frame, while maintaining the highest levels of safety and quality. ■

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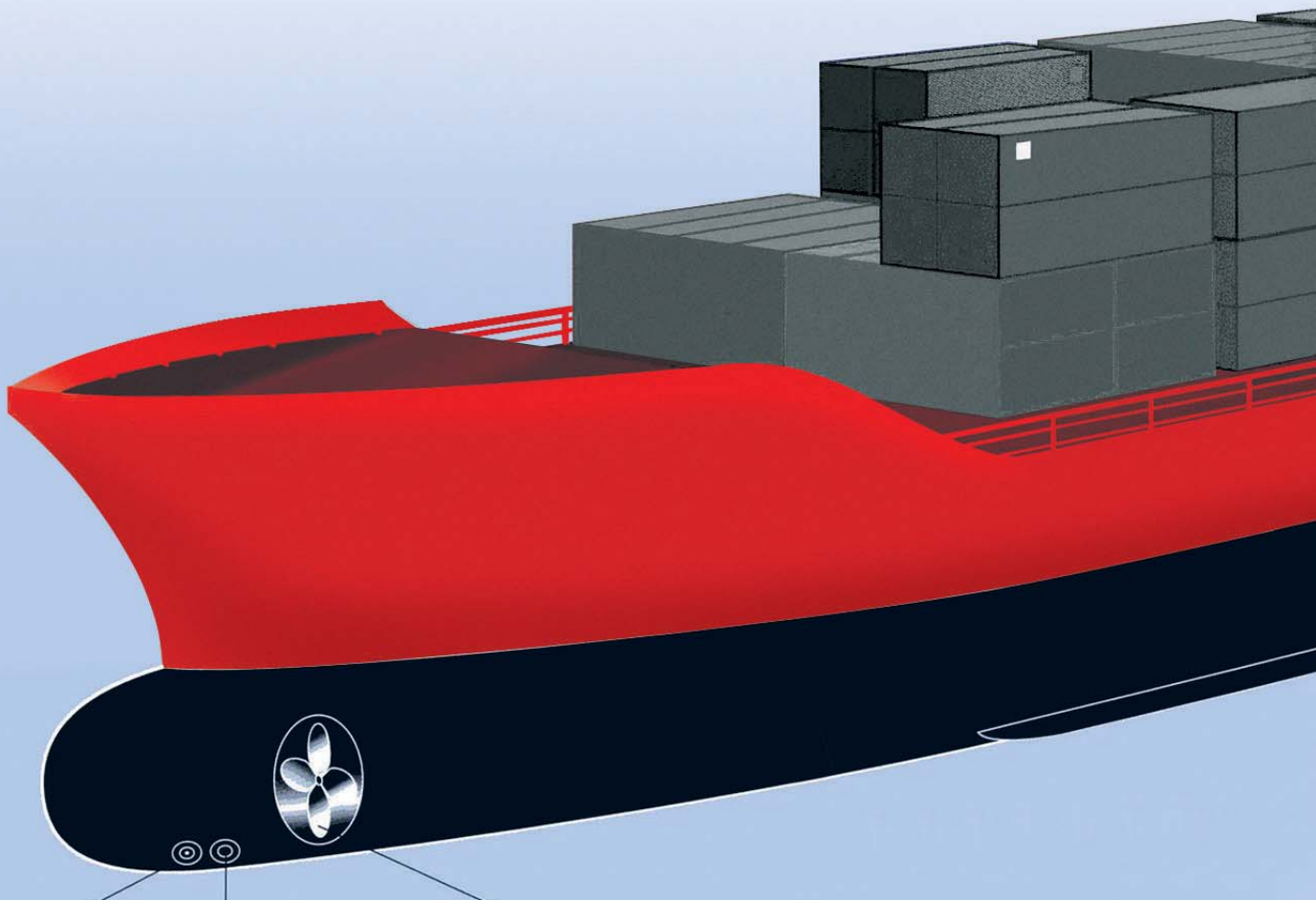
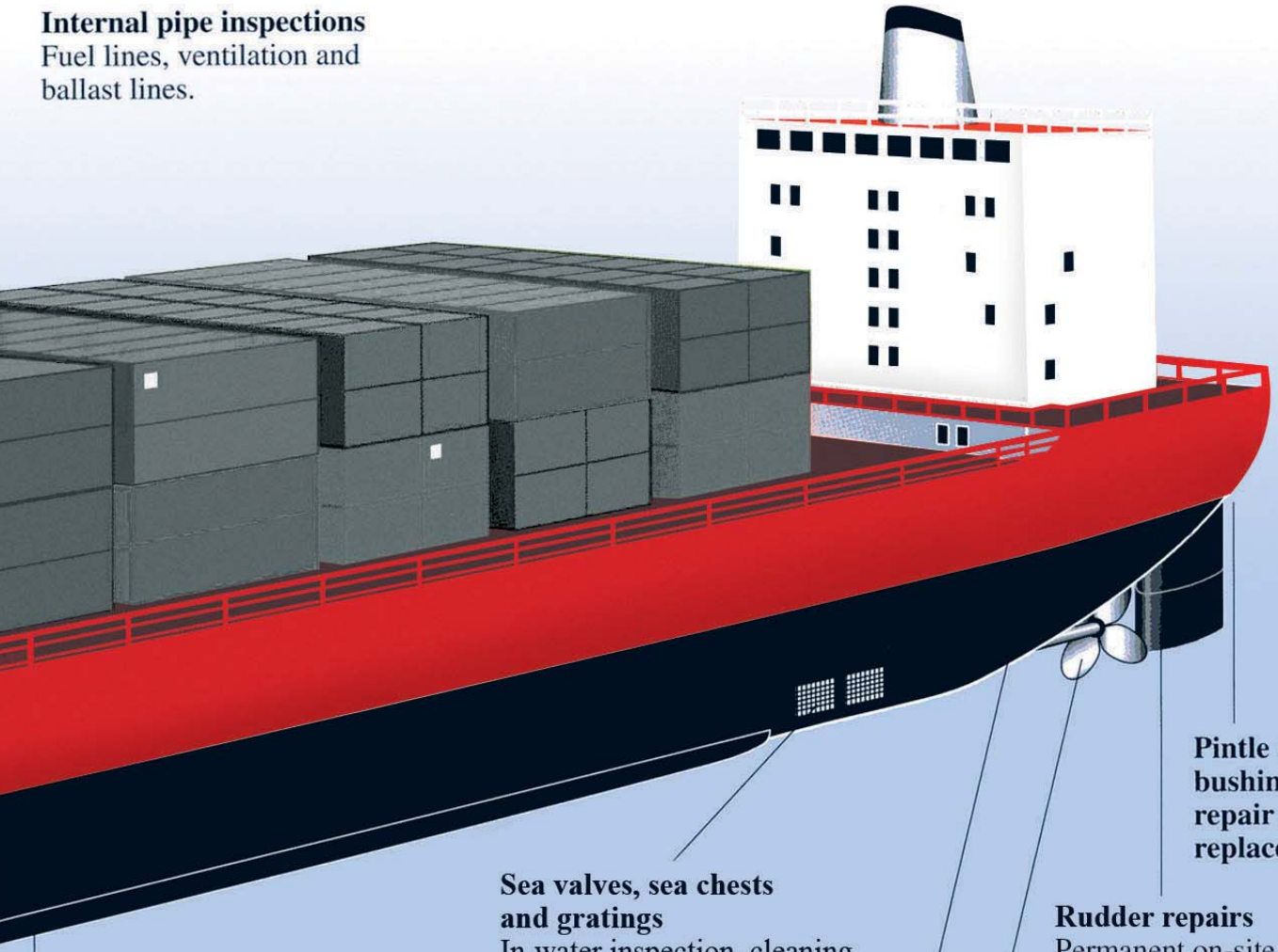


Echo sounder inspection and replacement

Speed log
Checks for damage and marine fouling.

Bow thruster and propellers
Permanent on-site repair, maintenance and replacement with the award winning flexible mobdock technique.

air and maintenance services



Internal pipe inspections
Fuel lines, ventilation and ballast lines.

Bilge keel
Check and repair broken welds, renewal of sacrificial anodes.

Sea valves, sea chests and gratings
In-water inspection, cleaning and repair of intakes and valves, installation of new sea chests, condensers and coolers afloat.

Stern tube seal replacements
Permanent inwater stern tube seal replacements and repairs with the unique Hydrex flexible mobdock technique.

Pintle and bushing repair and replacements

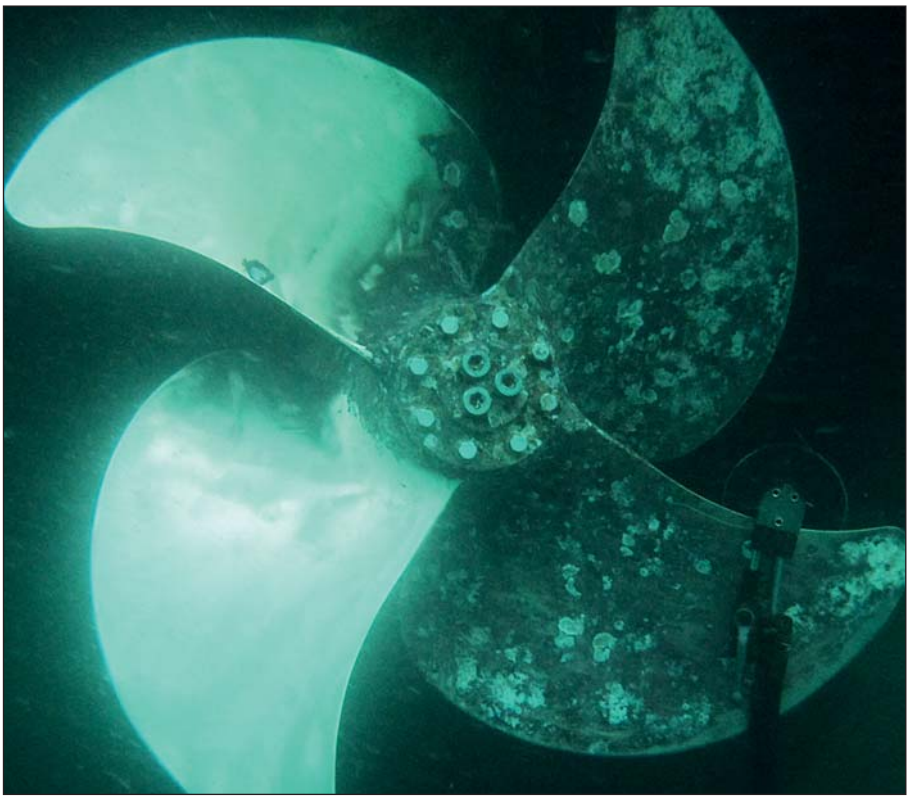
Rudder repairs
Permanent on-site repairs on all types of rudders with groundbreaking new technology.

Propeller repairs
On-site straightening or, if the damage is too extensive, cropping of damaged propeller blades.

KEEPING SHIPS IN BUSINESS

More profitable propeller maintenance

A ship's propeller represents only a very small fraction of the vessel's wetted surface area. Yet the effects of a rough propeller on the vessel's fuel consumption is comparatively large. The cost of remedying a rough propeller compared to that of dealing with an entire rough and fouled hull is very minor. Thus remedies for a rough propeller are not only simple and quick to execute, they also represent a fast, high return on investment. The best available practices for propeller maintenance are more efficient than those currently in general use.



A smaller propeller, half-fouled and rough, half-polished.

Propeller roughness: Causes

New propellers can be relatively smooth or rough as a result of their manufacture. They invariably become rougher during service. The main reasons for increased roughness include the following general categories:

- marine fouling
- calcareous deposit (chalk layer)
- impingement attack
- corrosion
- cavitation erosion
- mechanical damage from impact with objects
- improper polishing or cleaning

Most propellers are made of a bronze alloy and are uncoated. The tip of a propeller can be traveling at speeds of 100-120 kph through the water. The water contains salt and other abrasives. The propeller is also a cathode in the electrolytic cell created by hull and propeller. The dynamics of the propeller in the water creates cavitation. Marine growth attaches to the propeller as it does to any other object immersed in the water. Thus a number of different elements conspire to damage and roughen the propeller's surface and reduce its efficiency. The salt water corrodes the bronze through a chemical reaction. Electrolysis causes erosion and also results in the build-up of a rough calcareous deposit. Cavitation damage shows up in the form of a pitted surface. Biofouling in the form of slime, weed, barnacles and other organisms adds to the surface roughness.

The impingement attack consists of the abrasives in the water acting against the rapid motion of the propeller, affecting the tips and leading edges. The tips in particular are likely to come in contact with solid objects of one type or another causing mechanical damage.

These different causes tend to work together, with each source of roughness complementing the other sources and accelerating the propeller's decline in overall smoothness. The rougher a propeller is allowed to become before the condition is remedied, the more rapidly further roughness will accrue. It is an accelerating downward spiral.

But this is a double-edged sword. Effectively dealing with one source of roughness will diminish the effects of the others. By frequent maintenance, the overall decline can

be greatly diminished.

Effects

A rough propeller results in a fuel penalty for the ship. How large that penalty is depends on the degree of roughness. In practice it is not very easy to separate the fuel penalty arising from propeller roughness from the fuel penalty associated with a rough and fouled hull. Very often one sees figures for combined hull and propeller fouling fuel penalties. Nevertheless there is data available which gives an indication of the fuel penalty associated with propeller roughness on its own. In the book *Marine Fouling and its Prevention* by the Woods Hole Oceanographic Institution (1952) tests involving the destroyer *McCormick* are described. In seven months out of dock the average fuel consumption to maintain a given speed was up to 115.8 per cent compared to unfouled hull and propeller. The propeller alone was cleaned and consumption dropped to 105.5 per cent, showing that the propeller fouling/roughness alone resulted in a 10 per cent increase in fuel consumption. [i]

In his "Green ship of the Future" seminar at Asia Pacific Maritime in Singapore in March 2010, Christian Schack of FORCE Technology states that the added annual fuel consumption of a Panamax container ship due to propeller fouling may be up by 5-6%. [ii]

In Chapter 7 of *Advances in marine antifouling coatings and technologies*, the authors, T. Munk and D. Kane estimate that increases in fuel consumption from normal propeller fouling range from 6% to 14% citing Haslbeck, 2003. [iii]

In that same chapter of *Advances in marine antifouling* coatings and technologies, the authors cite the performance increases after propeller polishing on container ships: at 24 knots, the propeller polishing at six-month intervals resulted in a fuel savings of five tons per day for each propeller polish.

In its *Naval Ships' Technical Manual*, the US Navy estimates that approximately 50 per cent of fuel savings attained by full hull cleaning can be attributed to the cleaning of propellers and shafts. [iv]

In *An Introduction to Dry Docking*, the authors state that "even a 1mm layer of accumulated fouling or calcium deposits on a propeller will significantly increase its roughness, and within 12 months or so can increase an ISO class I to an ISO class II, or a class II to a III. This causes large increases in fuel consumption. Practical figures and elaborate tests indicate a 6 to 12% gain in fuel consumption in polishing a propeller from a class III condition to a class I condition. Some propellers support marine growth up to 20 mm thick, which obviously has a major effect." [v]

Based on information available, it can be seen that propeller surface roughness from fouling and surface deterioration can cause a fuel consumption penalty of somewhere between 5 and 15 per cent.

At current fuel prices, the fuel penalty from a rough propeller adds up to a lot of money. Conversely, the savings attainable from keeping a ship's propeller clean and smooth are significant.

Current propeller maintenance practices

Shipowners/operators, technical superintendents and those responsible for keeping ships operating efficiently are aware that there is a fuel penalty associated with rough, fouled propellers. It is common for some maintenance measures to be in force to take care of this.

These measures usually consist of scheduled propeller polishing. Often this is done only when a ship goes to drydock. Since this might be every 2 ½ - 4 years, it is too infrequent to keep a propeller operating at optimum efficiency.

Some vessel operators therefore schedule in-water propeller polishing, perhaps once or twice per year which in most cases is still not frequently enough.

While most ship propellers are bare metal, some experimentation has been carried out to try to remedy some of the propeller's inherent problems through the application of various coatings. While no universal, fully workable and tested solution has yet been placed on the market, this line of research shows promise.

In general, most ships afloat have propellers which are rough enough to cause a sizable fuel penalty.

The weakness in current practices

If a propeller is not maintained with sufficient frequency but is allowed to become quite rough and fouled, then economic and environmental problems ensue. The economic problem is the additional fuel penalty which could have been avoided had the propeller been cleaned or polished sooner. This brings with it the additional emissions of CO_2, NO_x, SO_x and particulate matter which the additional fuel consumption entails.

Restoring a very rough propeller to its original state (or close to it) requires grinding away a considerable amount of the material itself, mostly copper but also zinc, nickel and other metals from which the propeller is made. While the amount

of material removed from a single propeller may be relatively small, when this is multiplied across all the propellers used in the entire world fleet, this polishing can represent a significant emission of heavy metals and thus pollution and contamination of water column and sediment which cannot be ignored.

Badly done polishing with a polishing disc or grinding wheel can in itself create a rougher surface than that of the new propeller, leaving scratches which not only increase the propeller's roughness but also invite easier attachment of fouling organisms.

It is the infrequency and poor quality of cleaning or polishing which are the major drawbacks of propeller maintenance practices which currently prevail.

Propeller maintenance best practices

Caught early enough, the propeller can be cleaned with a rotating brush and abrasive material removing almost no metal, preventing the effects of cavitation damage from spiraling and avoiding the formation of calcium deposits. This early attention can speed up the cleaning process considerably, extending the useful life of the propeller and preventing the emission of heavy metals into the water and sediment. This approach also eliminates the dangers of a roughened surface due to inexpert grinding and polishing.

Economically, the fuel saving from the more frequent cleaning of a propeller before it has become seriously fouled and rough greatly outweighs the cost of the cleaning itself. This propeller cleaning can be combined with a general hull inspection by divers making it even more economically viable.

The trick in establishing the best practices for propeller maintenance, assuming an uncoated propeller, is to work out a routine for propeller cleaning which permits rapid, easy (and therefore economical) propeller cleaning which is frequent enough to minimize the fuel penalty from propeller roughness and fouling and which results in the minimum removal of propeller material in order to achieve a smooth, fuel-efficient surface.

As stated in *Marine Propellers and Propulsion* by John Carlton, "With regard to the frequency of propeller polishing there is a consensus of opinion between many authorities that it should be undertaken in accordance with the saying 'little and often' by experienced and specialized personnel." [vi]

Of course propeller cleaning can be overdone. Scheduling propeller cleaning once a week would not prove to be economically viable. However, cleaning a propeller once every month or every two months would in many cases be optimum. If carried out this frequently, cleaning with a relatively soft brush and abrasives is adequate to keep a well-maintained propeller smooth enough for maximum fuel savings. It would prevent the accelerating spiral of cavitation damage plus corrosion plus fouling which, if allowed to continue uninterrupted, requires major polishing with grinding or polishing wheel and the removal of a great deal of metal into the marine environment if the polishing is carried out in the water. Cleaning propellers "little and often" would be beneficial to the environment as a minimum of copper, zinc, nickel and other heavy metals would be ground off into the water.

Case study

A recent experiment was carried out with a 134-meter cruise ship. The propellers were cleaned with a rotating brush alone, no grinding or polishing disk required, by one of the ship's crew who is a diver. It took one diver approximately 40 minutes to complete the cleaning of the ship's two propellers. The fouling was not very heavy since the propeller is cleaned quite often. Calculations of subsequent fuel savings showed that on a 30-hour trip from Aruba to Barbados, the ship saved $2,100 compared to the same trip with a mildly fouled propeller. The ship consumes 1.6-1.7 tons/hour of fuel. The fuel saving as a result of cleaning the propeller was calculated at 6%. A 30 hour trip with the propeller before cleaning would have used 51 tons of fuel which is $35,700 at $700 per ton. 6 per cent of $35,700 is $2,142. In this case the propeller cleaning was carried out by a member of the crew. Had the propeller been cleaned by an outside company it would not have cost more than about $2,000. So the cost of cleaning, even if carried out by a contractor, would have been recouped in the first trip the ship took after cleaning. Since the propeller would not have had to be cleaned again for at least a month or two, the cost of the cleaning would have been recouped many times over.

Cost of cleaning

Obviously the cost of cleaning is a factor which cannot be overlooked. If the savings in fuel costs did not substantially outweigh the cost of propeller maintenance, then one would question the value of frequent propeller cleaning.

The cost varies from one location to another and from one provider to another. Cheapest is not always best. The need for skilled and competent propeller cleaning and polishing has already been stressed.

Vendors usually charge per propeller size and number of blades. Polishing a 4-blade, 6-meter propeller would cost somewhere between $1,900 and $3,000. Polishing a 6-blade, 8-meter propeller might cost between $3,100 and $4,000. The costs vary by location and company.

One of the better propeller cleaning vendors charges 15-20% less for propeller cleaning (brush plus abrasives) than for full polishing with grinding or polishing discs. Which method is used depends on how rough the propeller is and this is determined largely by how frequently or infrequently the propeller is polished or cleaned.

As covered in the short case study above, the cost of the propeller cleaning can be recouped in the first voyage the ship makes after the cleaning. Not only is it cheaper to clean than to polish, it also is economically advantageous.

Cleaning takes less time than polishing. The best companies offering propeller cleaning and polishing can polish a large propeller in about four hours.

Conclusion

Best available practices for propeller efficiency at this time consist of the use of uncoated propellers with frequent, routine in-water cleaning to prevent heavy fouling, the formation of a calcareous deposit layer and the spiraling damage of cavitation erosion and corrosion.

Further research is needed into the use of strongly adherent, highly cavitation and corrosion resistant glass or ceramic reinforced coatings which can stand up to the extremely challenging conditions in which propellers operate.

Until such technology has been perfected and proven in service, frequent light cleaning remains the best technology available.

This article appeared originally in the June 2012 issue of Ship & Offshore magazine (www.shipandoffshore.net) and is reprinted here with the permission of Ship & Offshore. ■

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i Woods Hole Oceanographic Institution, *Marine Fouling and its Prevention*, US Naval Institute, (1952), pp 32-33

ii Christian Schack, FORCE Technology (presentation) March 2010. http://www.greenship.org/fpublic/greenship/dokumenter/APM%20Singapore/7%20Force%20Technologies%20%20Operational%20initiatives%20to%20reduce%20emissions%20from%20ships.pdf accessed 16 April 2012.

iii T. Munk, D. Kane, D. M. Yebra, "The effects of corrosion and fouling on the performance of ocean-going vessels: a naval architectural perspective," Chapter 7 of *Advances in marine antifouling coatings and technologies*, edited by Claire Hellio and Diego Yebra, Woodhead Publishing in Materials, (2009) p 161

iv Naval Sea Systems Command, *Naval Ships' Technical Manual* Chapter 081 "Waterborne Underwater Hull Cleaning of Navy Ships," Revision 5, 1 Oct 2006, 081-2.1.1.1

v David Martin et al. *An Introduction to Dry Docking*, http://www.angelfire.com/rnb/drydocking/home.htm, accessed March 2012.

vi John Carlton, *Marine Propellers and Propulsion (Second Edition)*, Butterworth-Heinemann Elsevier, (2007), p 383.

Fast and high quality on-site repair services in theWestern Mediterranean area and North Africa

The Hydrex office in Algeciras 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 company's 38 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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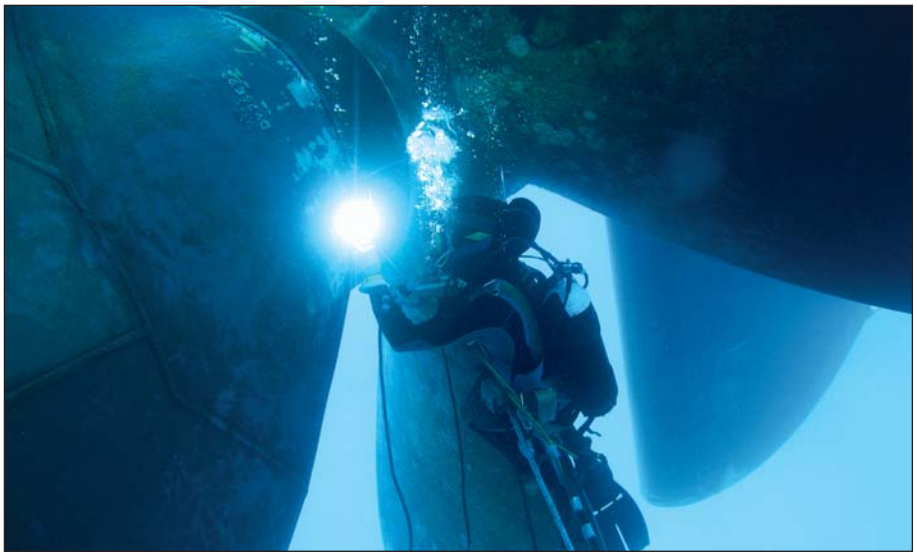
Hydrex US ready to mobilize immediately

Hydrex 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 dry-dock.

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

www.hydrex.us

KEEPING SHIPS IN BUSINESS

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Fast underwater repairs keep ships out of drydock

Hydrex offers turnkey underwater repair solutions to shipowners wherever and whenever they are needed. Hydrex's multidisciplinary 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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UNDERWATER TECHNOLOGY

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