HYDREX®

UNDERWATER TECHNOLOGY

Number *192*

On-site propeller operations keep your ships sailing

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Editorial

The last couple of months have been very busy for Hydrex with diver/technician teams being mobilized from all our offices to perform repair and maintenance work. At the same time we have been attending several exhibitions and conferences around the world.

The biggest of these exhibitions was of course the SMM exhibition in Hamburg with over 2000 exhibitors from 58 countries and visitors from all parts of the globe. The last article in this magazine is a short account of our experience of the event and our participation in the Marine Coatings Conference which took place at and during SMM.

The first three article of this magazine are dedicated to several underwater operations carried out by Hydrex teams. You can read about a bow thruster repair and reinstallation in the Netherlands, an emergency stern tube seal replacement in Gabon and hull repairs in Belgium and Uruguay.

Further on in the magazine you can also find an article titled "More profitable propeller maintenance" in which we show that the best available practices for propeller maintenance are more efficient than those currently in general use.

Do not hesitate to contact us if you need our assistance with one or more of your vessels. Our Technical Department is ready 24/7 to create a tailor-made solution for any problem.

Best regards,

Hydrex founder
Boud Van Rompay

HYDREX N.V.
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Underwater services and technology approved by:

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Underwater bow thruster removal and reinstallation in Rotterdam

To save time and money for the owner of a 334-meter container vessel, Hydrex removed the bow thruster of the ship and installed a new unit during the vessel's scheduled stop in Rotterdam. By carrying out both parts of the operation underwater the ship could continue its commercial operation and did not have to go to drydock.

Hydrex monitoring station on workboat.

The removal and reinstallation took place in July, but earlier a Hydrex diver/technician team performed a full underwater inspection of the bow thruster unit and removed the propeller blades. This was done during a previous stop in Rotterdam. On the one hand, this allowed the Hydrex technical department to prepare every step in detail to make sure that the team could carry out both the removal of the old bow thruster unit and the installation of the new unit during a single operation. On the other hand the removal of the blades would shorten the removal of the thruster unit and would allow the container vessel to keep its tight commercial schedule. During this first part of the operation the new thruster unit was also brought onboard the vessel.


Video monitoring is used during operations.

When the vessel was sailing towards Rotterdam again, a team mobilized from the headquarters in Antwerp together with all the necessary equipment. They set up a monitoring station in preparation for the vessel's arrival. As soon as the ship was berthed, the diver/technicians went on board and prepared the bow thruster engine room for the removal of the unit so that there would be no ingress of water once the unit was taken out.

Old bow thruster unit brought to the surface.

The team then disconnected the bow thruster from the thruster room and carefully lowered it. The divers then extracted it from the tunnel and brought it to the surface. Simultaneously the team installed a blind flange to seal off the thruster tunnel from the engine room. Once the old unit has been overhauled it will be kept as a spare thruster.

The new bow thruster unit was put on a cradle which was designed specially for bow thruster replacement and prevents the unit from tipping. It can be adjusted to the size of the thruster and allows the Hydrex divers to bring the unit back into the thruster tunnel in one take.

Next the diver/technicians sealed off the thruster tunnel with the Hydrex flexible mobdocks and emptied all water from it. This created a dry working environment in which they could complete the reinstallation of the bow thruster unit in drydock-like conditions. They repositioned the gearbox using chain blocks and secured it with bolts. The

Hydrex divers working on bow thruster unit.

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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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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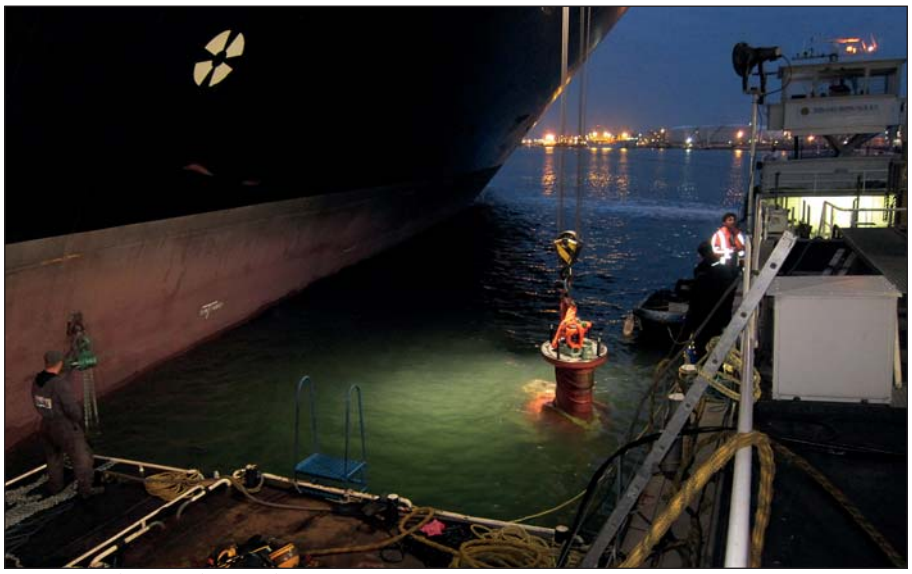
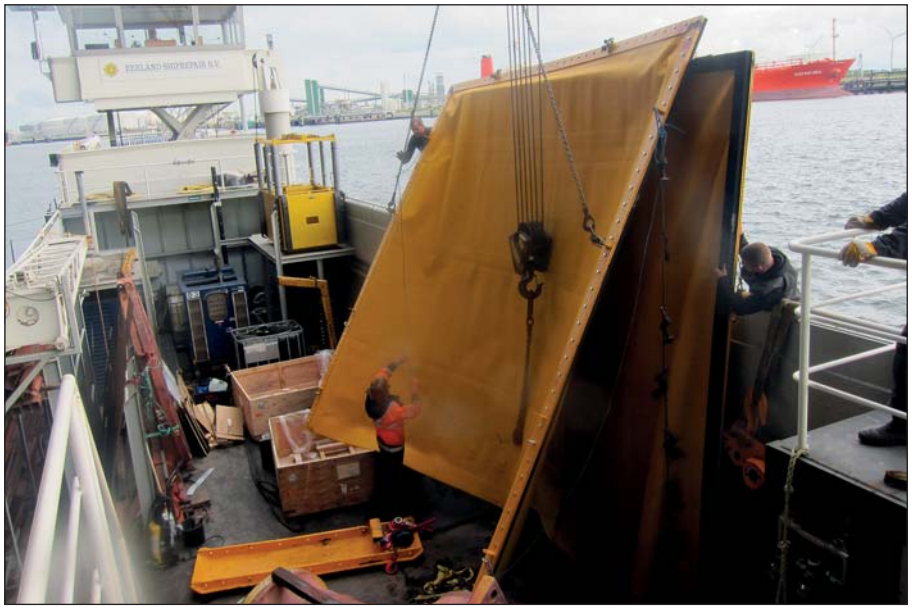


New unit lowered into the water.



The Hydrex flexible mobdocks create a drydock-like environment underwater.

thruster propeller blades were then reinstalled one by one and the thruster unit was reconnected to the engine room.

The Hydrex team worked in shifts around the clock to finish the job within the available time frame. The ship had to shift twice to continue its loading and unloading, but the flexibility of the diver/technicians made sure that this could be done without losing time.

Performing both the removal and reinstallation on such a tight schedule takes a lot of planning. This can only be done successfully by people who have familiarity with such challenges and the relevant know-how. This is why Hydrex has a technical department capable of executing all the required planning, an in-house Research & Development department that can take care of the engineering aspect of an operation and diver/technicians who are trained and qualified to perform the full range of required class-approved repair procedures in even the harshest conditions. An effective, competent team is the only way to consistently achieve a high quality result in the short periods of time usually available to ships. ■

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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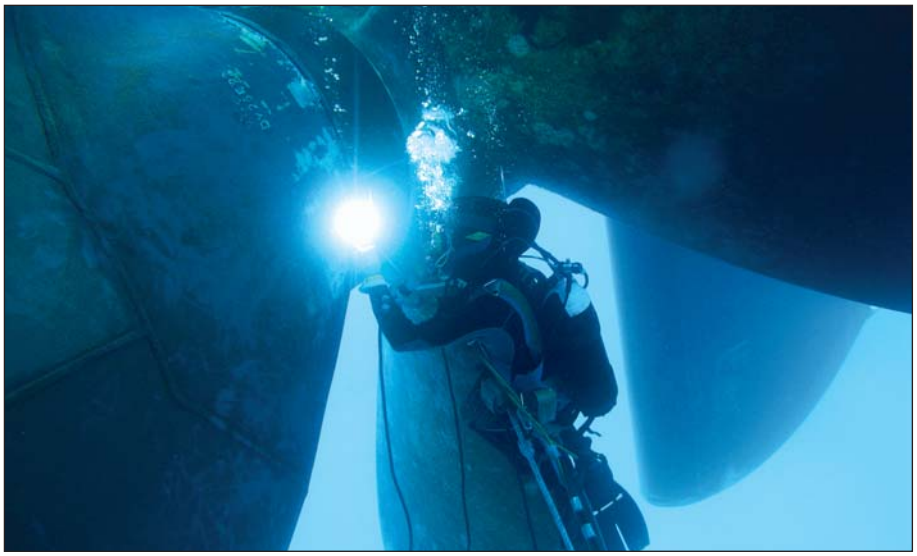
Hydrex US ready to mobilize immediately

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.

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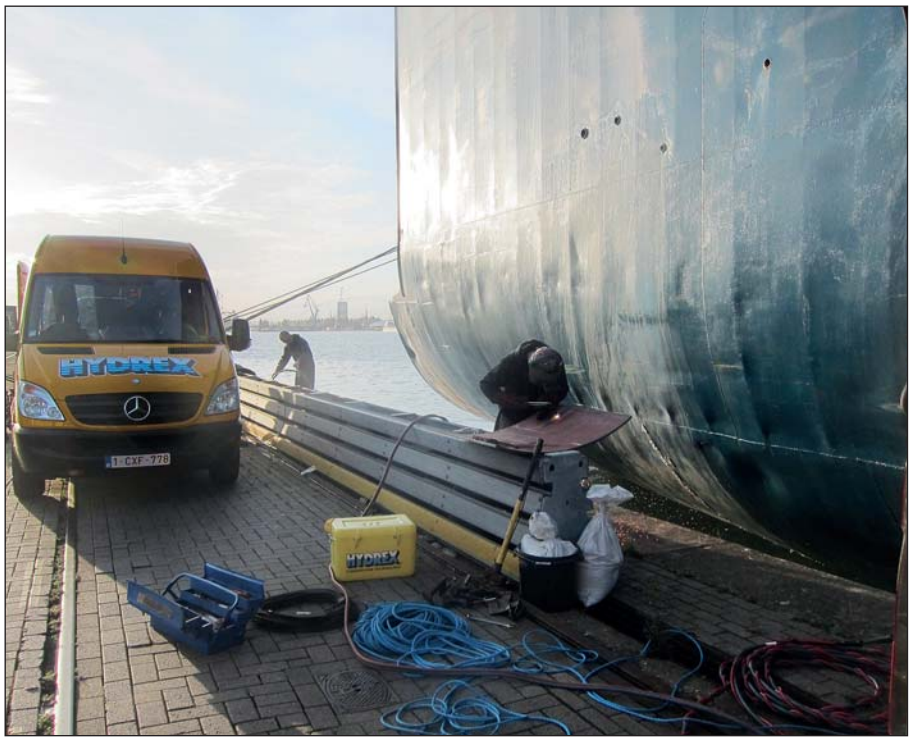
Class approved underwater hull repairs in Belgium and Uruguay

Recently Hydrex teams of diver/technicians mobilized to a 164-meter roro vessel berthed in Antwerp, Belgium and a 235-meter bulker at anchor in Punta Del Este, Uruguay to perform underwater hull repairs. Despite the smaller scale of these operations they are nonetheless vital for shipowners if they want to avoid unscheduled drydock visits for their vessels.

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

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 and inserts in the vessel's shell plating and they are approved by the major classification societies.



On shore preparation during hull repair in Antwerp.

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, as was the case in Uruguay, 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.

New insert plate positioned and ready for welding.

Permanent insert repair in Antwerp

A cavitation hole needed to be repaired in the shell plating of a 164-meter roro during the ship's stop in Antwerp. A Hydrex diver/technician team therefore carried out a detailed inspection of both the onboard as well as the water side of the shell plating, after which they installed a cofferdam over the affected area.

This allowed them to remove the frame covering the damage and cut away a round area with a diameter of 300 mm. Next they positioned a new insert plate of the same dimensions and secured it with a full penetration weld. An independent tester then carried out ultrasonic testing and the repair was approved by the Lloyd's Register surveyor who was present during the operation. The diver/technicians then reinstalled the frame and removed the cofferdam, concluding the repair.

Afloat doubler plate installation in Uruguay

Hydrex was contacted to install a doubler plate over a grounding related crack located on the flat bottom area of the first port side ballast tank of a 235-meter bulker in Punta Del Este. After arriving in Uruguay, a diver/technician team set

Heavily dented frames and shell plating on bulker in Uruguay.

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 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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L-shaped crack with crack arrests on both ends.

Welding work on the doubler plate inside the ballast tank in Uruguay.

Welded doubler plate on bulker in Uruguay.

up a workstation on a workboat and sailed to the location of the vessel.

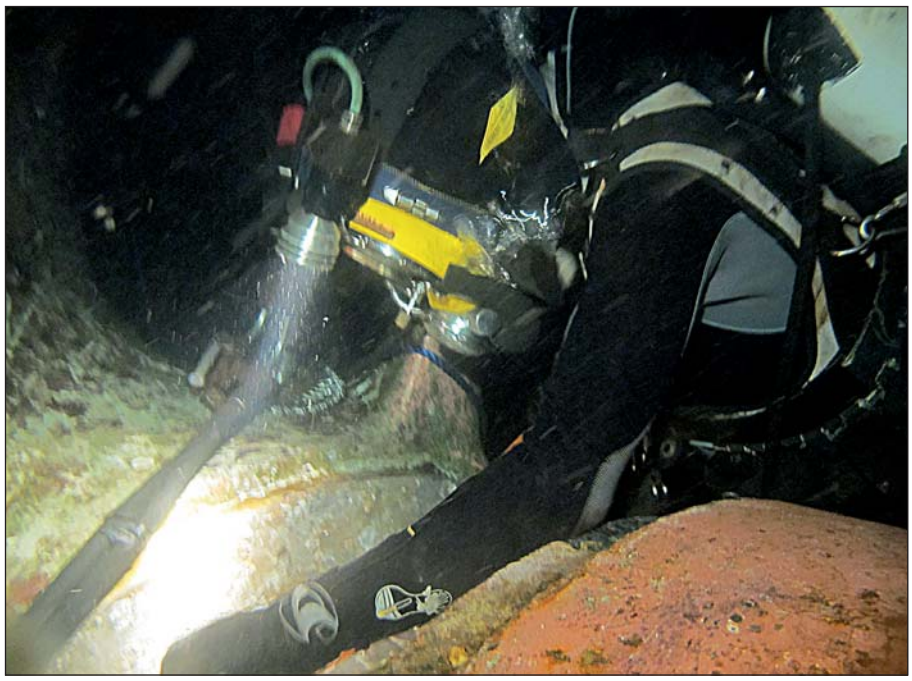
A detailed inspection revealed that the L-shaped crack was 480-mm long and between 4 and 8 mm wide. In the area of impact, a 250-mm deep and 25-meter long indent was also found. In the ballast tank, the team then removed the frames that had bent during the grounding. This allowed the diver/technicians to access the damage and make crack arrests on both sides to prevent the crack from spreading further. The team then installed a doubler plate over the crack on the water side as well as the in board side. The vessel could sail safely until the next scheduled drydocking where permanent repairs will be carried out.

Repairs of this kind can only be done rapidly and successfully by trained divers/technicians who are familiar with them and who have the relevant know-how to resolve all of the technical difficulties encountered during underwater operations. This is why all Hydrex technical staff from all offices undergo stringent training after which they are able to perform a wide range of operations. Throughout these operations they stayed in close communication with each other and with the technical department in the office. This allowed them to finish these jobs within the shortest possible time frame and this without any compromise of the high quality standards Hydrex is known for. ■

Tanker with leaking stern tube seals not permitted to enter ports

Underwater repair allows vessel to continue its schedule

When the fore as well as the aft stern tube seals of a 247-meter tanker were leaking, the vessel was not given permission to enter any ports. Unloading the vessel at sea and going to drydock seemed the only option for the vessel, until Hydrex sent a diver/technician team with one of the company's flexible mobdocks to the ship's location in Port Gentil, Gabon, to replace both sets of stern tube seals on-site.

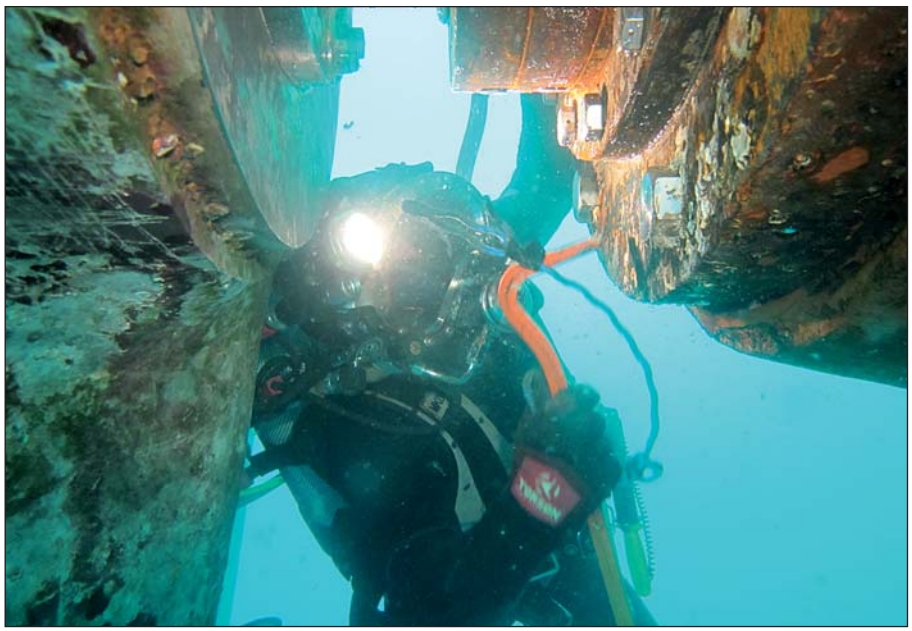


Diver/technician preparing the stern tube seal assembly for mobdock installation.

The team loaded the necessary equipment on a barge on which they set up a work station to monitor all underwater activities. The barge then sailed to the tanker and the Hydrex team leader met up with the vessel's owner and superintendent. The rest of the diving team made all remaining preparations for the main activity, which started, immediately after the meeting, with the removal of the rope guard. This was followed by a thorough underwater inspection and shaft wear down readings.

While the Hydrex flexible mobdock was installed around the stern tube seal assembly to create a dry underwater environment around the assembly, Hydrex technicians replaced the fore stern tube seals which are located on the inside. Next the team started the work on the aft seals. This was done inside the flexible mobdock in drydock-like conditions, which are essential for stern tube seal repairs. The diver/technicians cleaned the entire assembly before they removed the damaged seals one by one and replaced them with new ones. Like the fore seals, these were prepared onshore by the attending Aegir-Marine specialist.

All parts of the stern tube seal assembly were then reinstalled and secured. After a successful leakage test the team removed the flexible mobdock and repositioned the rope guard.



Hydrex diver working on stern tube seal assembly in Gabon.

Grinding work on the stern tube edge.

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You can contact us at:
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or at
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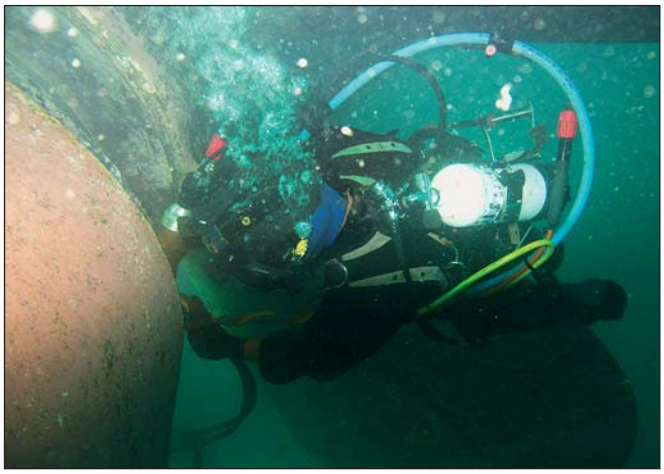
The flexible mobdock allows stern tube seal repairs on-site and underwater.



Hydrex diver preparing the stern tube area for the operation.

Diver preparing the reinstallation of the rope guard.

Stern tube assembly with new seals.

By sending the Hydrex flexible mobdocks in our special fly away cases together with all equipment, fast response to any emergency call like this is guaranteed to locations around the world from the various Hydrex offices. Every day a ship has to go off hire causes a substantial loss of money, and having to arrange the vessel to be unloaded at sea would have been an organizational and financial disaster for the owner. By performing both the repair on-site and underwater, Hydrex made sure that the vessel could keep to its sailing schedule and did not have to go into drydock. ■

The Hydrex flexible mobdock creates a dry environment around the stern tube seals.

During stern tube seal operation in Port Gentil.

Permanent rudder repairs now possible without drydocking

Hydrex 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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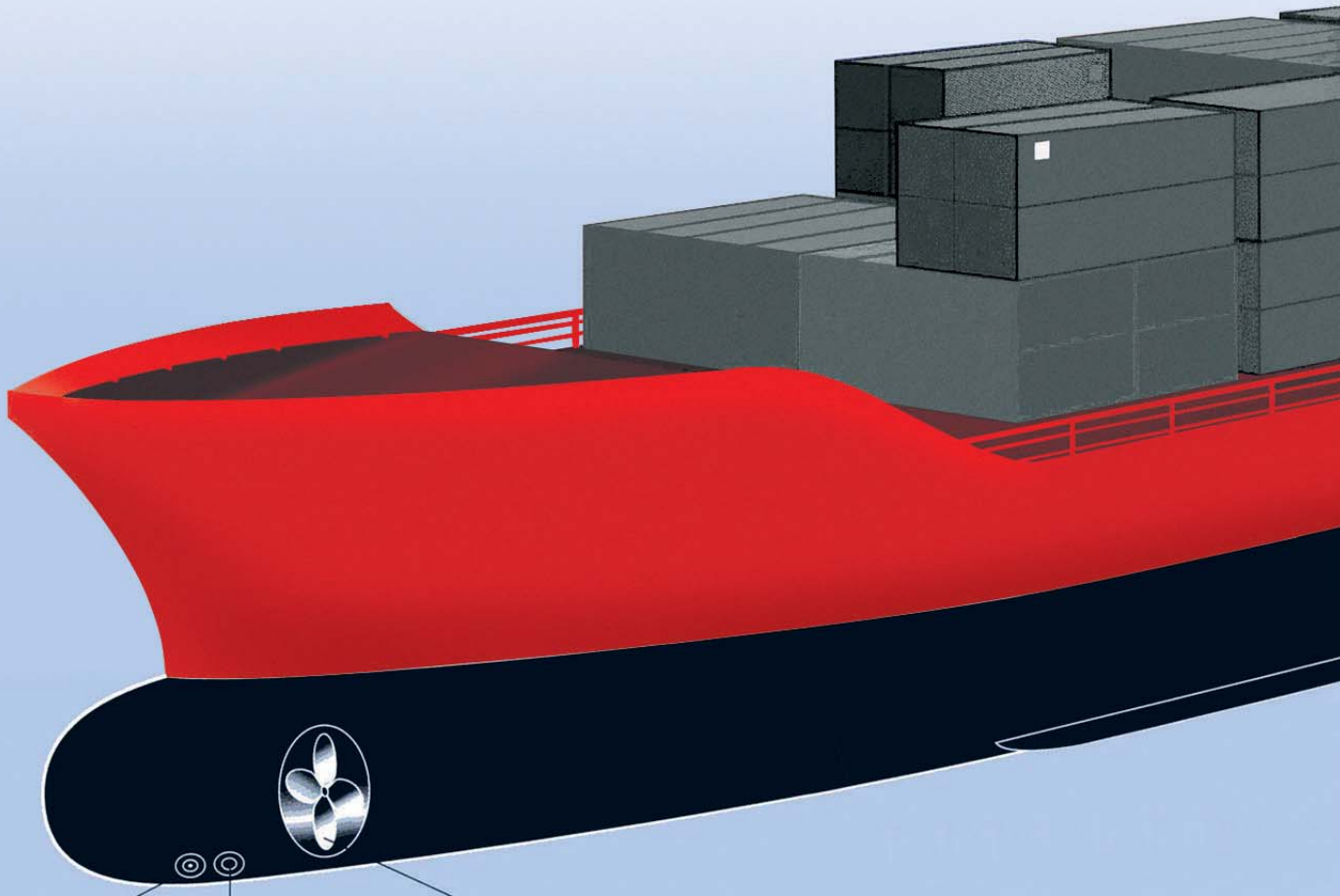
High quality in-water ship rep

Permanent insert repairs
Specialist class approved insert repair work carried out and on a permanent basis. Providing a real alternative to drydock.

Emergency repairs
Fast response emergency repairs worldwide.

Inwater video inspections
Professional video surveys provide a reality of the problem and enable owners and classification surveyors to directly diagnose any problems.

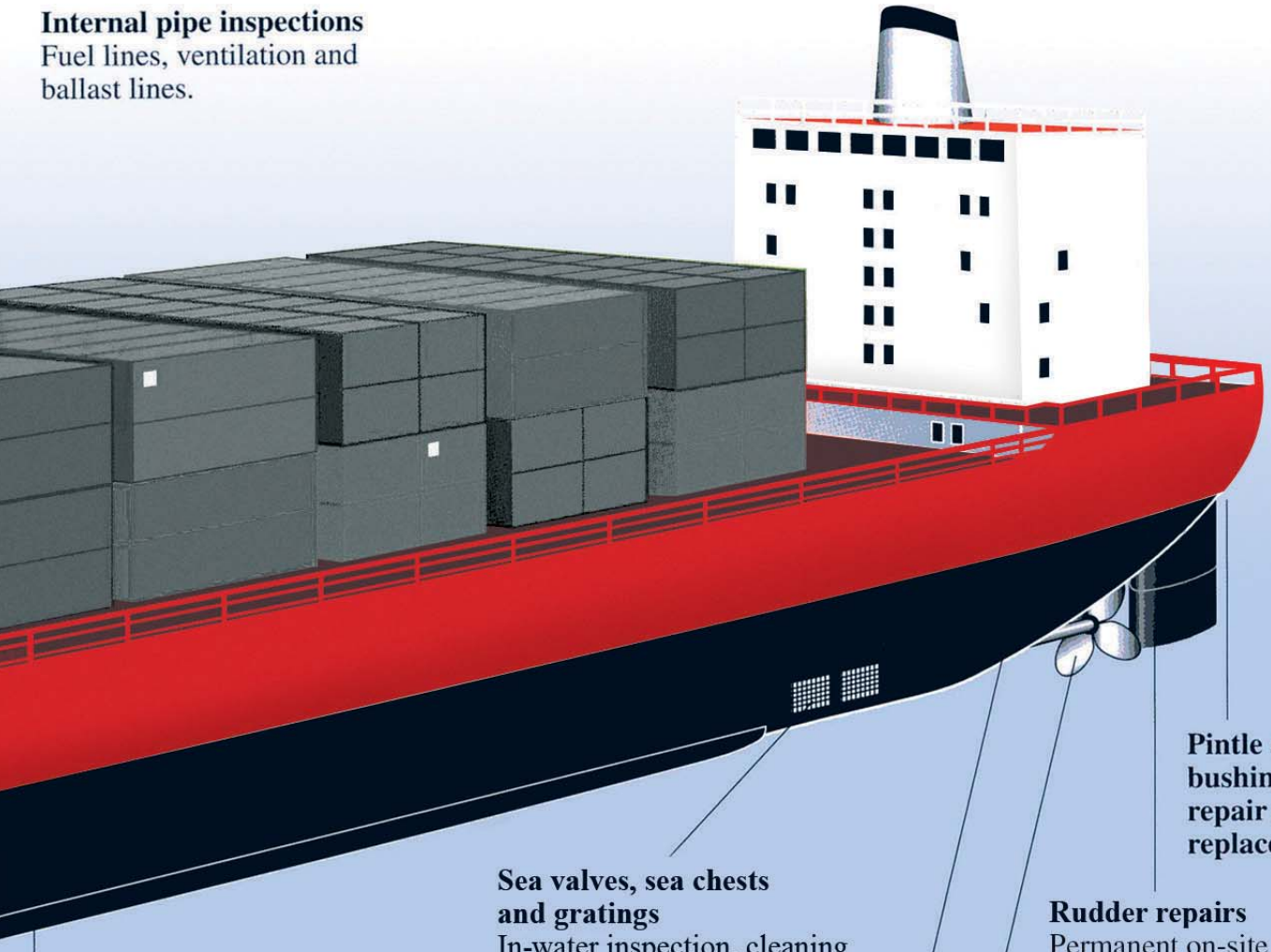


Echo sounder inspection and replacement

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.

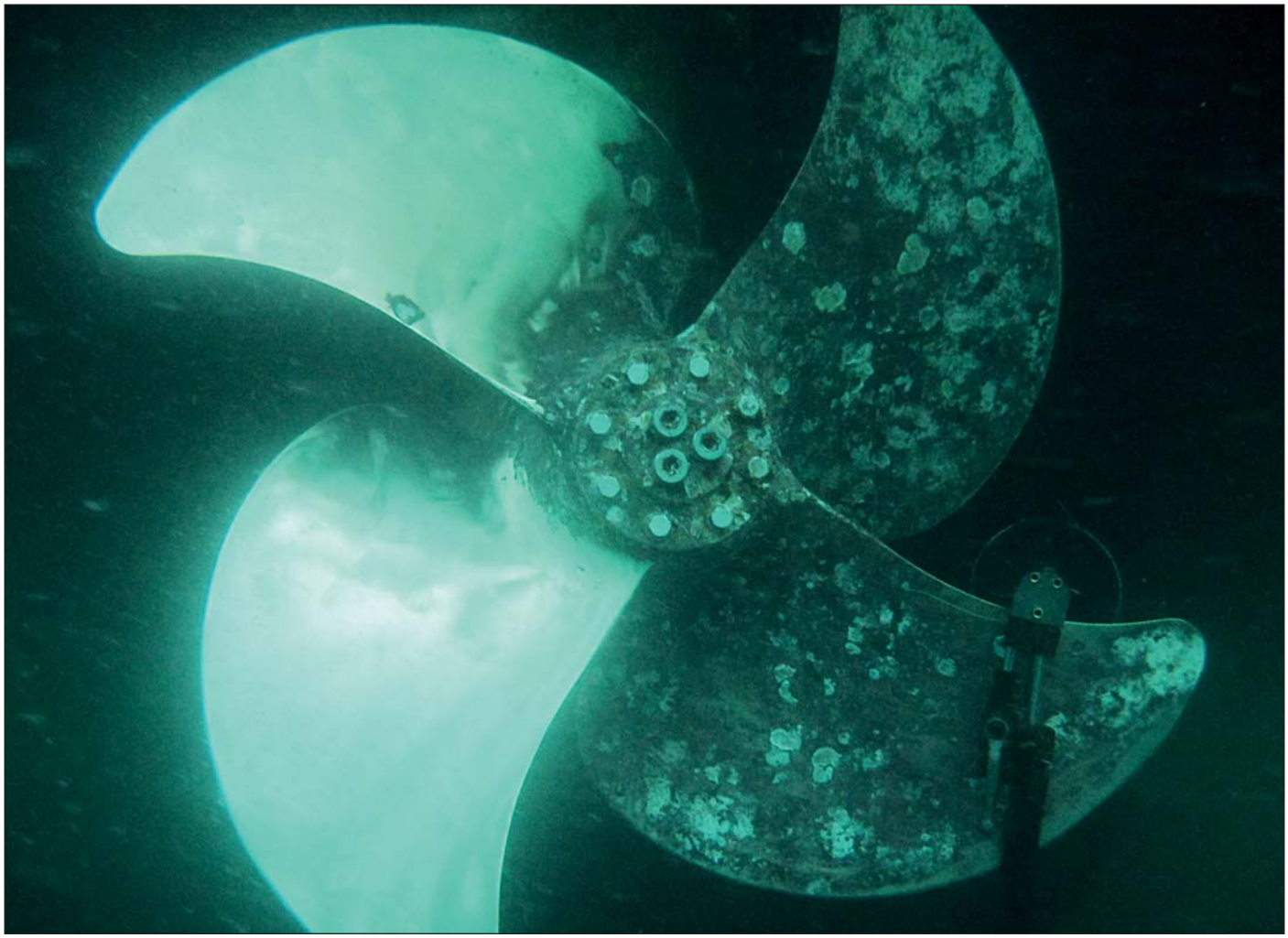
Propeller repairs
On-site straightening or, if the damage is too extensive, cropping of damaged propeller blades.

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

Pintle and bushing repair and replacements

KEEPING SHIPS IN BUSINESS

More profitable propeller maintenance



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

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.

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 CO2, NOx, SOx 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

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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.

Hydrex at SMM and the Marine Coatings Conference, Hamburg 2012

The 25th shipbuilding, machinery and marine technology (SMM) international trade fair in Hamburg in September 2012 was attended by more than 50,000 trade visitors from all parts of the world. The 2,100 exhibitors, including Hydrex, spread out over 90,000 square meters, were very satisfied with the fair. Even the weather was kind with dry and sunny days right up until it was time to take down the booths on the last day, September 7, when the rain began.

According to the closing report on the trade show, "The largest group of visitors was from shipowners and shipping companies, followed by the shipbuilding and shipyard industry, and machinery and plant builders. The naval and defense industry moved up to fourth position. SMM 2012 had 35% of its trade visitors from abroad, up two percentage points from the previous SMM. The share of Asian visitors was double the number at SMM 2010, now 16%."

Environmental emphasis

"It was clearly evident at SMM 2012 that the shipowners have to invest in a green future, more than ever before," observed Torsten Schramm, Chief Operating Officer at Germanischer Lloyd and Global Maritime Environmental Congress (GMEC) Chairman. "Everywhere in the maritime business and industry there are new products and processes, aimed at increasing energy efficiency and reducing emissions – for individual ships and for whole fleets."

The Hydrex booth on a busy thoroughfare at SMM.

Hydrex and Ecospeed

Certainly the Hydrex/Ecospeed booth bore out Mr. Schramm's statement with floods of visitors keen to find out how they could convert from conventional coatings with their biocides to a non-biocidal cost-effective and better alternative, Ecospeed.

Clearly visible at the end of the long outdoor space between halls B4 and B5 and on the route for all visitors

Many visitors enjoyed the relaxed, businesslike atmosphere at the Hydrex booth.

Hydrex CEO, Boud Van Rompay, talking to visitors at the Hydrex booth.

passing between halls, the yellow Hydrex/Ecospeed tent was a popular spot.

The Hydrex tent was well manned by Dave Bleyenberg, Manuel Hof, Sam Williams, Pierre Klein, and David Phillips, and CEO Boud Van Rompay was present for the entire event. The booth maintained a friendly, busy atmosphere throughout the four-day show.

Many existing customers, Hydrex agents, technical people from all phases of shipbuilding and maintenance and many interested newcomers to Hydrex and Ecospeed dropped by and enjoyed the friendly, comfortable but businesslike and informative atmosphere of the Hydrex booth. Much new business was conducted.

As usual, in the background Koen Smouts, Hydrex Equipment Officer, and his team performed flawlessly and efficiently in setting up and taking down the Hydrex booth and making sure that it had everything that was needed, was roomy, comfortable, well stocked and generally fit for purpose, not an easy feat when the logistic lines from Antwerp to Hamburg are considered, but one that is typical of any Hydrex mobilization for any job anywhere in the world.

David Phillips, Communications Exec for Hydrex, gives a presentation on hull-borne invasive species at the Marine Coatings Conference during SMM, Brian Goldie presiding (rear left).

Protective Coatings Europe Marine Coatings Conference 2012

Integrated into the SMM schedule, Protective Coatings Europe hosted the 2012 Marine Coatings Conference on September 5th and 6th in one of the conference rooms in hall B3 of the Hamburg Fair. The conference was chaired by Brian Goldie, Technical Editor of Protective Coatings Europe magazine and speakers on the first day included representatives of Safinah Ltd. (UK), ABS (UK), Huntsman Pigments (UK), IMC Engineering (Italy), Jotun (Norway), Nippon (Japan) and Hydrex (Belgium). The first day of presentation was followed by a panel discussion with representatives of all the major bottom paint manufacturers including PPG, Jotun, Hempel, International Paint, Sherwin-Williams, Nippon Paint and Hydrex (CEO Boud Van Rompay).

On the second day another series of speakers from a variety of international companies including DCNS (France), Leighs Paints, Exova (UK), Optimiza (Spain), TQC (NL), Meyerwerft (Germany) and others.

Marine Coatings Conference panel discussion, Hydrex CEO Boud Van Rompay center, Raouf Kattan at the podium, the other panelists being representatives from the major hull paint manufacturers.

The subject matter was varied but all highly relevant to the overall subject of marine coatings.

The aim of the conference was to provide a forum for the exchange of information on best practices from experts in coatings, shipbuilding and environmental protection.

Hydrex representative, David Phillips, Communications Exec, presented a paper entitled, "Eliminating Hull-Borne Aquatic Invasive Species – An alternate, practical approach," which provided a very different, non-toxic approach to limiting the spread of NIS worldwide. The presentation was generally well-received, opened some eyes and raised some eyebrows (the subject of the talk was by its nature a disruptive technology which tends to swim against the current and disturb the status quo).

The panel session on hullcoatings/fuel savings/emissions which followed was led by Raouf Kattan, Managing Director of Safinah Ltd., a Coating Consultant based in Newcastle UK. Hydrex was represented by CEO Boud Van Rompay, who was able to provide valuable and in many cases surprising answers and information to questions from the attendees, stating the case very clearly for a non-toxic approach to underwater hull protection and fouling control.

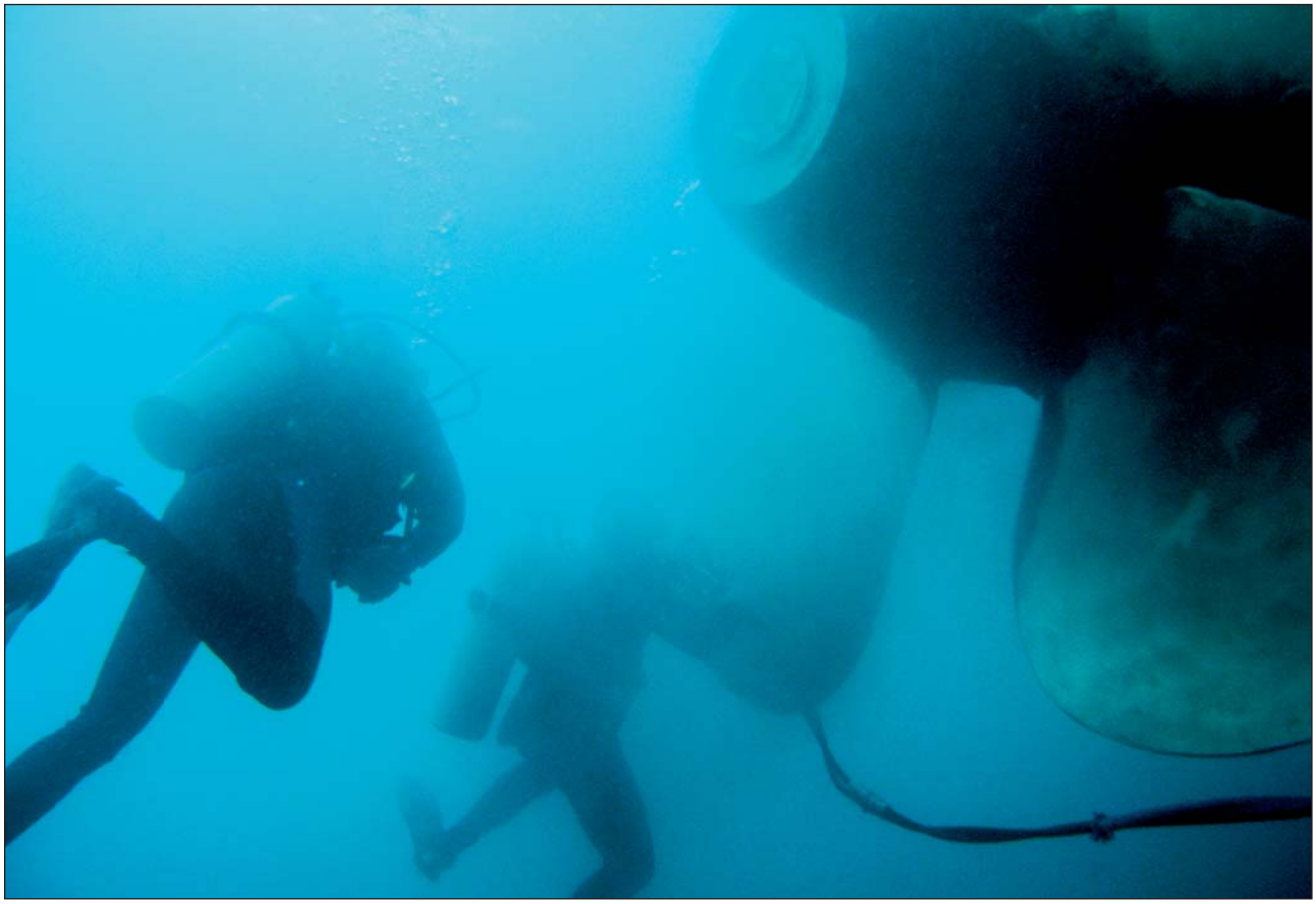
Mr. Kjolberg of Jotun made the case for insisting on numerical metrics for coatings fuel efficiency rather than relying on anecdotal claims from manufacturers. The panel discussion was lively with many questions answered at some length by the panelists. The attendees were interested and involved.

Hydrex CEO Boud Van Rompay (center), representatives for International Paint (left) and Jotun (right) during panel discussion.

Summary

All in all SMM 2012 was the best SMM yet for Hydrex and we would like to thank all of you who visited us there for coming and look forward to working with you on an ongoing basis. We are looking forward to the next SMM in Hamburg in 2014 and will see you all there. ■

Easy and effective propeller cleaning



The effect of a rough propeller on the vessel's fuel consumption is big. The cost of remedying a rough propeller is very minor. Remedies for a rough propeller are not only simple and quick to execute, they also represent a fast, high return on investment.

A rough propeller results in a fuel penalty for the ship. How large that penalty is depends on the degree of roughness. At current fuel prices, the fuel penalty from a rough propeller adds up to a high cost. Conversely, the savings attainable from keeping a ship's propeller clean and smooth are significant.

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 tool is adequate to keep a well-maintained propeller smooth enough for maximum fuel savings.

Thanks to its network of offices and service stations, Hydrex can offer propeller cleanings on a worldwide basis. These operations are carried out using underwater equipment designed and developed in-house specifically for propeller maintenance. Hydrex combines this service with underwater inspections where this is economically advantageous to the shipowner or operator.

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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), 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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