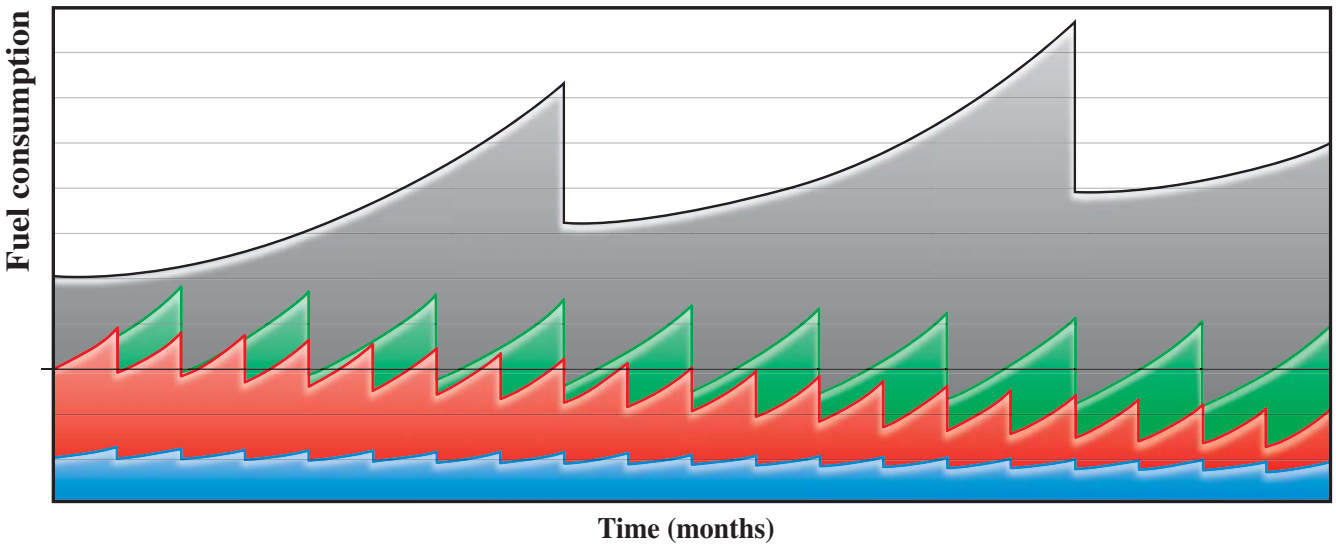
ECOSPEED®

SHIP HULL PERFORMANCE TECHNOLOGY

Magazine

Millions in fuel savings

Development of additional fuel consumption over time



Ecospeed with 2 cleanings per year
Ecospeed with 4 cleanings per year
Ecospeed with optimum cleaning intervals
Active antifouling paints

Most ships sail with a chartering contract that includes a penalty clause if fixed distance/fuel consumption ratios are not met. However, this is unpredictable with regular paint systems and will also worsen over the years. The ship becomes more expensive and profits are reduced.

The protective Ecospeed ship hull performance technology however not only keeps the ship's performance stable but even improves it with repeated underwater maintenance. The coating is designed to be cleaned routinely with specially designed underwater hull cleaning tools. These simultaneously clean and improve the smoothness of the paint surface. This avoids penalties as well as producing enormous fuel savings.

One major cruise line has been quoted as saying that they are saving 10% on fuel costs with Ecospeed compared to the earlier TBT coating which they replaced. Another cruise ship found that they gained 1.5 knots over sea trials speed when they replaced their hull coating with Ecospeed.

Contact us to find out how Ecospeed can help you achieve major fuel savings.

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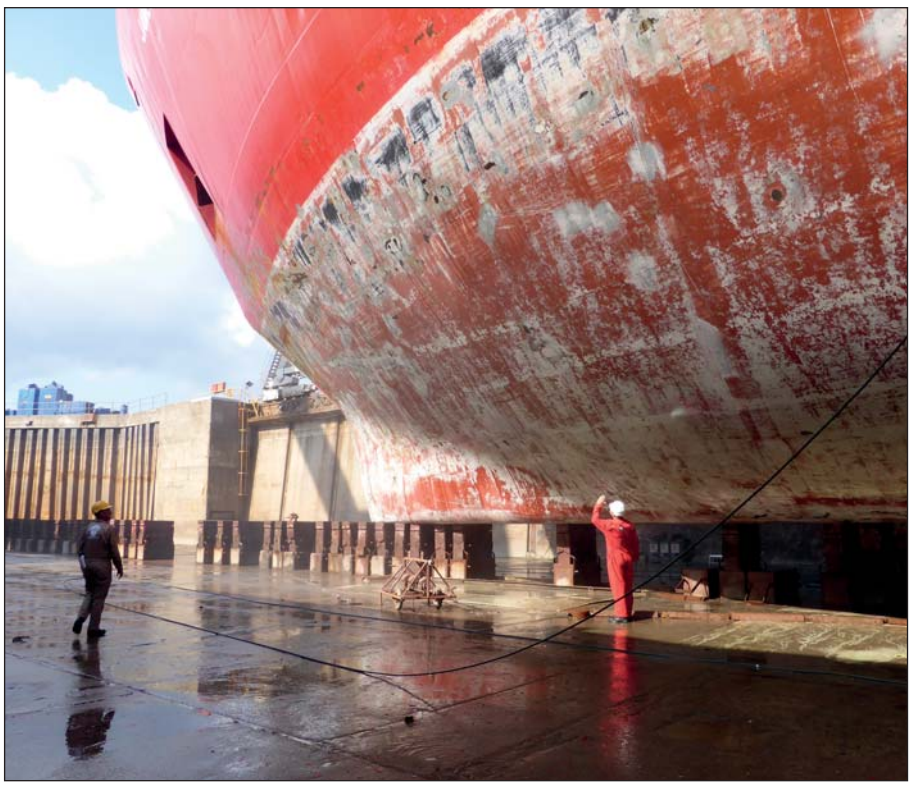
Ice-strengthened research vessel given lifelong Ecospeed protection

In August the bow area of the underwater hull of Royal Research Ship (RRS) *James Clark Ross* was coated with Ecospeed in Frederikshavn, Denmark. The ship is one of two ice-strengthened research vessels operated by British Antarctic Survey (BAS).

The other, RRS *Ernest Shackleton* has been sailing with Ecospeed on her hull for five years without requiring repainting. Despite battering its way through ice up to 2.5 meters thick with a high content of gravel and volcanic lava adding to its abrasiveness, the hull coating remains virtually intact and undamaged. This is in strong contrast to when the *Shackleton's* hull was still covered with a conventional ice-going underwater hull coating and almost the entire hull was practically stripped to bare, unprotected steel in between dockings.

RRS James Clark Ross *moored in sea ice in the Weddell Sea, Antarctica. Scientists can be seen returning to the ship following deploying IMB (Ice Mass Balance) buoys.*



The condition of the bow area when the vessel came into drydock.

This excellent result led BAS to coat the bow area of *RRS James Clark Ross* with Ecospeed. The vessel can steam at a steady two knots through level sea ice one meter thick. The bow area has to endure a constant impact with the ice and needs the best possible protection. Ecospeed low friction coating demonstrates excellent attachment to the hull and successful resistance to extremely icy conditions. The coating has proven an ability to withstand the harshest winter conditions on nu-

Surface preparation prior to Ecospeed application.

Application of the first layer.

Bow area of RRS James Clark Ross *after application of the first layer.*

merous occasions, as BAS has experienced firsthand.

Ecospeed has received the Lloyd's Register certificate that recognizes the coating as an abrasion resistant ice coating. This allows owners of vessels intending to navigate in ice conditions to reduce the scantlings of the ice belt, the area on the bow just above the waterline that is most prone to mechanical damage from sailing through ice, if this area is coated with Ecospeed.

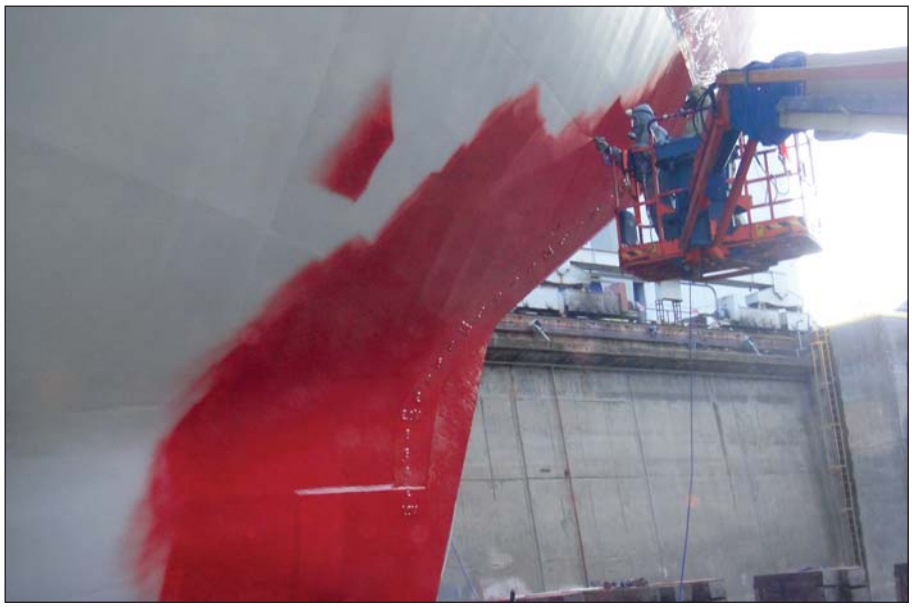
Researching the Antarctic continent

British Antarctic Survey (BAS) is a component of the Natural Environment Research Council (NERC). Based in Cambridge, United Kingdom, it has, for over 60 years, undertaken the majority of Britain's scientific research on and around the Antarctic continent.

Their two ice-strengthened ships sustain the Antarctic operations. While RRS *Ernest Shackleton* is primarily a logistics ship used for the re-supply of stations, RRS *James Clark Ross* has some of Britain's most advanced facilities for oceanographic research on board and is the platform for most of the marine science undertaken.

The vessel was launched in 1990 and was named after British naval officer and explorer Sir James Clark Ross (15 April 1800 – 3 April 1862). He is remembered today for his exploration of the Arctic with his uncle Sir John Ross and Sir William Parry and his own expedition to Antarctica.

To assist passage through heavy pack ice, a compressed air system rolls the ship from side to side freeing the passage. RRS *James Clark*



Application of the second layer of Ecospeed.

Ross is equipped for geophysical studies and has large aft and starboard decks for scientific equipment deployed by aft and midships gantries. The ship is designed with an extremely low noise signature to allow sensitive underwater acoustic equipment to operate effectively.

Each year she leaves the UK for the Antarctic laden with supplies for British Antarctic and sub-Antarctic bases. She stays in the southern ocean for the austral summer carrying out oceanographic and biological survey work in between supplying and re-supplying the bases and moving personnel around. Before the start of the Antarctic winter, she heads back to the UK again returning equipment, garbage to be disposed of and returning Antarctic base members. They have been away from the UK for periods ranging from just a few months to nearly two and a half years.

One-time application, lasting solution

Due to its unique composition, Ecospeed is not only the best protection available for underwater hulls of icebreakers and ice-going vessels, the coating also provides excellent hull performance and is the easiest ice-going paint to apply and maintain. The coating is the perfect way to offer a ship like the RRS *James Clark Ross* a lasting and full protection against the icy conditions it is faced with. ■

The bow area of RRS James Clark Ross *will be protected for the rest of the vessel's service life.*

Why Ecospeed®?

Ultimate hull protection

Complete corrosion protection

- Hard, tough, glassflake-based
- Flexible, very strong adhesion, thick coating
- Impermeable and impenetrable

Long-lasting – one application lasts the life of the ship.
No reapplication needed, only minor touch-ups in drydock.

- 10-year extendable warranty

Cleanable in the water

Gets smoother with underwater hull cleaning

Ultimate protection for rudders and underwater gear

- Ecoshield – a very strong version of Ecospeed designed for rudders, bulbous bows and underwater gear, prevents cavitation and corrosion damage
- Protects rudders, stabilizer fins, bulbous bow (ice), thruster tunnels, nozzles and other underwater gear

Ice class coating (certified)

- Abrasion resistant
- Low friction
- Stays on when other coatings are removed by the ice

Protection for offshore, stationary vessels

Economic

Enormous fuel savings (10 - 25
AF and FR coating systems)

- A smooth hull
- No long term paint degra
- Becomes hydrodynamica routine cleaning
- AF and FR coatings typic 20 - 45% fuel penalty aft
- Easy to keep clean of fou slime at most)

Reapplication costs saved (no r

Drydock savings (fewer and sh need to repaint)

Ease of application

- Two homogeneous coats, tie coat or any other coat
- 3 hour minimum overcoa
- No special environmental
- No special equipment nee

Easy and quick to repair in dry

Does not interfere with other w

Greatly reduced total ownershi

What is Ecospeed? Ecospeed is an underwater ship hull protection and fouling control system. It consists of a tough, long-lasting, glassflake reinforced coating combined with routine in-water cleaning/conditioning. One application lasts the life of the hull. It does not degrade but becomes smoother over time with regular in-water cleaning. It can be used on any ship or submerged structure, steel, aluminum or GRP. It has the potential of great financial savings. It is designed with environmental protection in mind and is entirely environmentally safe.

al benefits

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500µm each, no primer, midcoat,
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Environmental benefits

Reduced GHG

- Smoother hull = lower fuel consumption = reduced emissions

No toxic emissions to environment

- No heavy metals such as copper, zinc, tin
- No co-biocides such as Irgarol, Diuron and others

No contamination of water column or sediment

No harmful effects on non-target marine life

Prevents hull-borne invasive aquatic species spread

- Ships sail with clean hull, potential invasive species removed

Very low VOCs

Can be cleaned in the water safely

- No damage to coating
- No harm to environment

No repeat application, no cumulative environmental impact from preparation and application

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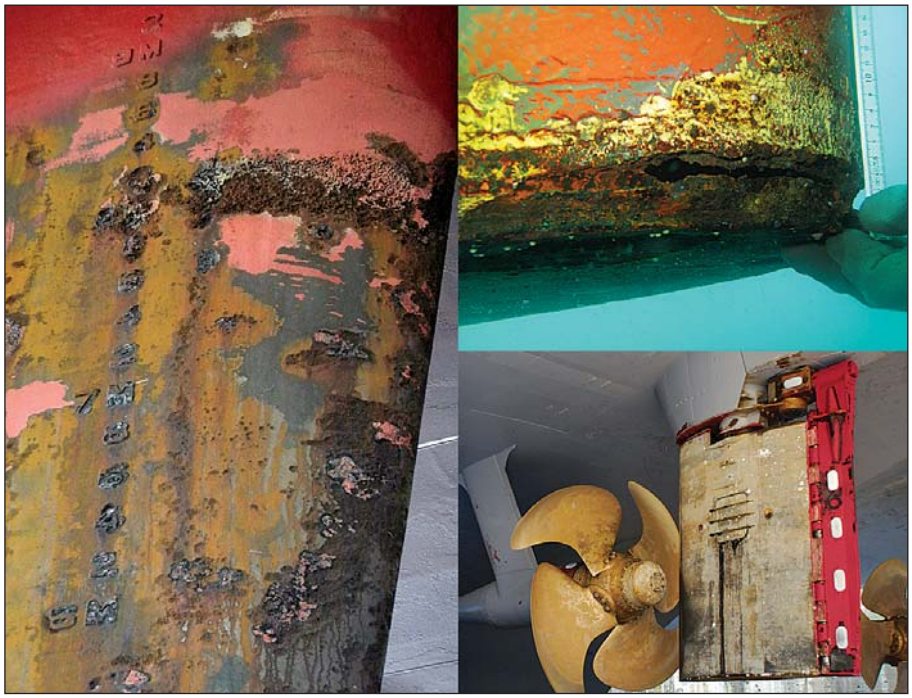
Eliminating rudder cavitation damage

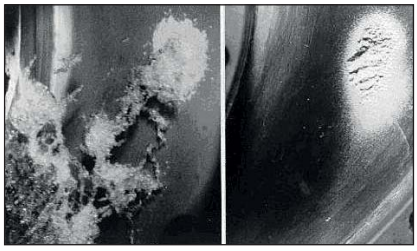
A ship's rudder is particularly prone to damage caused by erosion and corrosion. The problem figures more prominently in high-speed container carriers and other fast ships than in slower vessels. However, it is a potential hazard for all vessels, points out David Phillips, editor of the Journal of Ship Hull Performance.



Rudders with cavitation erosion damage.

A ship's rudder, placed directly behind the propeller to give the ship maximum manoeuvrability, is particularly prone to erosion followed by corrosion. The erosion in this case is caused by hydrodynamic cavitation.

Hydrodynamic cavitation is a phenomenon that accompanies turbulent fluids. The turbulence in the fluid, caused by the ship's motion through the water and particularly by the action of the ship's propeller, results in areas of greatly reduced fluid pressure. Due to the low pressure, the water vapourises. This creates small, vapour-filled cavities or bubbles in the fluid up to about 3mm in diameter. The cavities travel through the water and the pressure around them increases, causing them to suddenly collapse. The implosion of the cavities is accompanied by a complex set of physical processes. It is the collapse of the cavities and the attendant high pressure pulses, speeds and temperatures in the water that cause the damage.



Cavitation bubbles and resulting damage.

The forces involved are very large. It is as if the surface affected has been subjected to repeated, heavy blows from a hammer accompanied by high temperatures. This causes what is known as cavitation erosion as the surface material, first paint and then steel, begins to flake away. The process can be greatly magnified by the presence of gravel or other hard particles in the water.

One need only examine a ship's rudder that has been subjected to cavitation damage to see that very real damage is caused by this phenomenon. Rudders become deeply pitted, paint coatings and hard steel simply disappear, whole plates can fall off and the rudder practically disintegrates altogether – all as a result of this cavitation damage.

The process can take place in a remarkably short period of time. Sometimes six months is all it takes for serious rudder damage to occur. The first step is that the cavitation causes the paint coating on the steel to erode, eventually exposing bare steel. The erosion of the steel is then accompanied by the electrochemical process of corrosion because the steel is no longer protected. The effect is multiplied as the cavitation continues, and the erosion it causes is augmented by the natural corrosion of bare steel exposed to water – the electrochemical process and the oxidation that this brings about.

Cavitation damage is not limited to the ship's rudder. The propeller is also subject to the phenomenon, as

The damage caused by cavitation (left) and a typical welding repair (right).

are stabilisers, the vessel's hull and other parts of the underwater vessel where the water flows are particularly swift or turbulent. But the rudder is especially prone to this problem due to its position and form.

Attempts to solve the problem

Rudder cavitation damage is not new, nor are attempts to solve the problem. Naval architects, shipbuilders and scientists have been working on a solution since the current propeller/rudder combination came into use. There are references to cavitation observation experiments being carried out as early as 1895.

The attempts to solve cavitation damage to rudders have been numerous since then. They come under the broad classifications of

- design changes to the ship and/or rudder
- efforts to contain erosion after the cavitation erosion has set in, as in the use of sacrificial anodes, and
- attempts to "cavitation-proof " the rudder through coatings, metal facings, different materials and similar methods.

The lack of success (until recently) of these approaches is well summed up in the following quote from a paper presented by J. Friesch at the Sixth International Symposium on Cavitation in Wageningen, the Netherlands, in 2006: "Rudder cavitation is a long-recognised problem in the shipping industry. Nevertheless, we are still far away from practical, final solutions to improve the situation."

Preventing cavitation damage

The ideal approach to cavitation erosion would be protecting the hull to prevent any such damage from occurring. Add to this a rudder design that is efficient and yet reduces cavitation as much as practicably possible, and one would have the solution.

This solution does exist. It consists of a coating that is tough and flexible enough to withstand the forces of cavitation so that they do not cause a breakdown of the coating, which then begins the cycle of eating away the underlying steel.

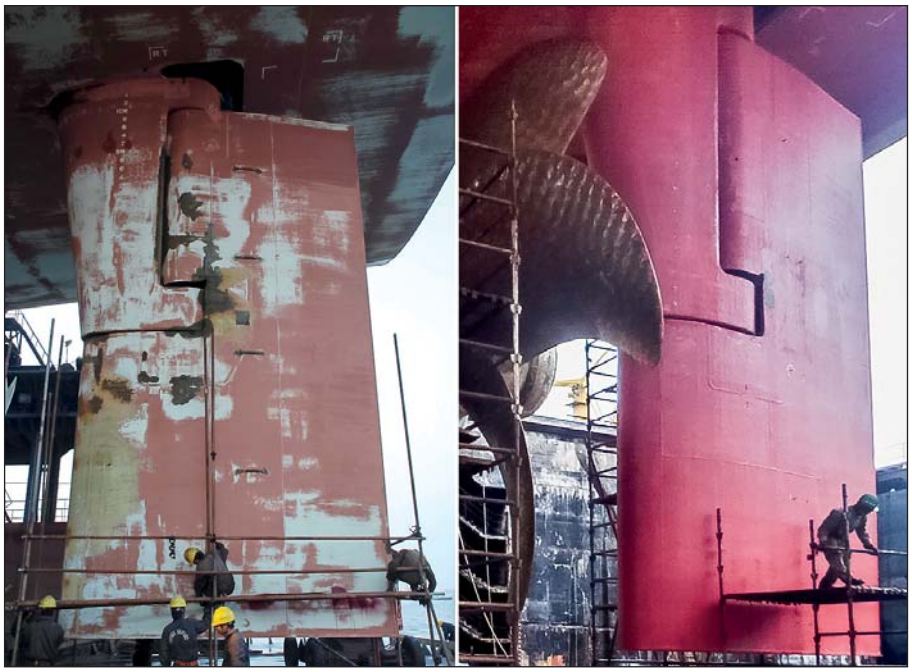
There is a type of coating that has been in use on rudders and ships' running gear for about ten years and has proven to be "cavitation-damage-proof" on the rudders to which it has been applied. Aside from some minor touch-ups, none of the rudders that were properly prepared and coated have had to be recoated, even after nearly ten years. None have suffered from cavitation damage since the coating was applied. For

those shipowners and operators who have tried this coating for their rudders, the cavitation damage problem ceased to exist. It is a specially formulated, glassflake-reinforced coating. One such coating is Ecoshield, supplied by Subsea Industries in Antwerp, Belgium.

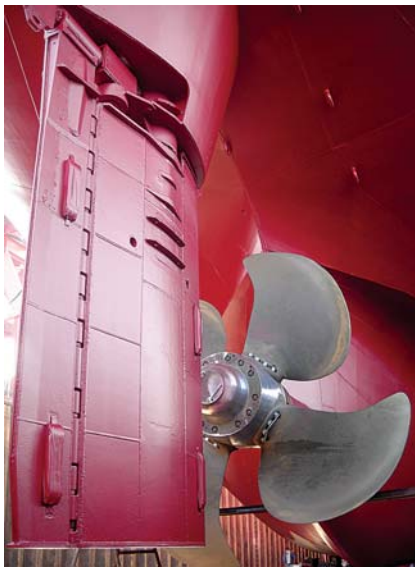
In terms of preparation and application requirements, the coating is not particularly demanding. The surface must be grit-blasted to remove any previous coating and create an adequate anchor profile and clean surface. Either on newbuildings or when an existing coating is being replaced, two coats about 500 microns thick each are applied, adding up to a dry film thickness (DFT) of at least 1,000 microns.

The second coat can be applied approximately three hours after the first, allowing very rapid completion of the coating job. The curing time is minimal (the vessel can leave dry dock 24 hours after the final coat). The coating has very low VOC (volatile organic compound) content and consists simply of two homogenous coats: no primer, no epoxy, no tie-coat, no antifouling or foul-release topcoat. Once applied and cured, the coating, technically a variation of a surface-treated composite (STC), forms an extremely tough and durable surface that will continue to protect the rudder for the full service life of the ship without the need for replacement. The coating can be cleaned as often as needed to keep the rudder or other running gear free of fouling. Since this approach to rudder protection was first discovered and applied in 2004, a large number of rudders, well over 200, have been successfully coated or recoated in this fashion on a wide variety of vessels. Further experiments are needed on very fast ships, but the coating promises to protect even them from cavitation damage.

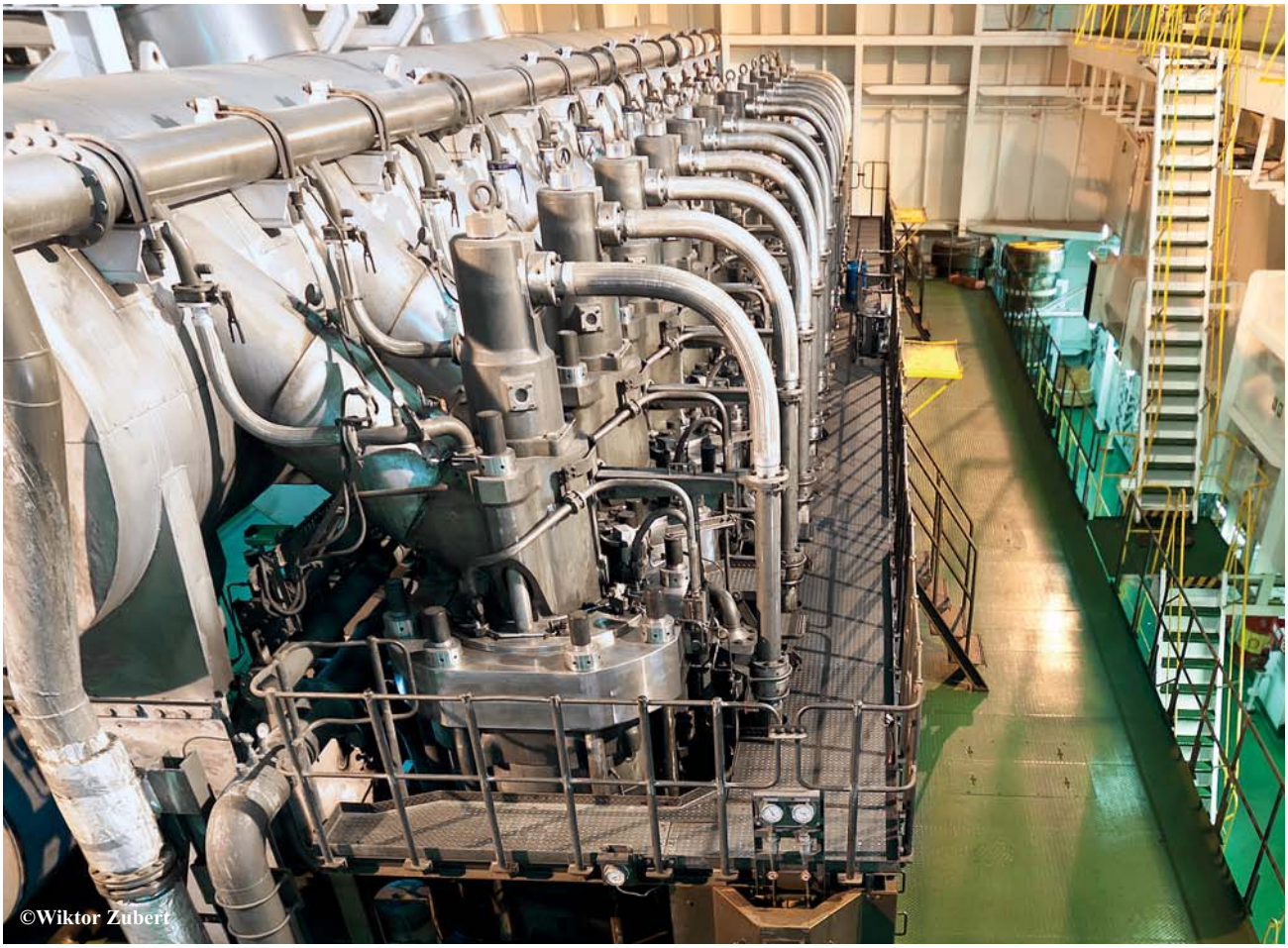
This article appeared originally in the special 2014 SMM edition of Ship & Offshore magazine (www.shipandoffshore.net) and is reprinted here with the permission of Ship & Offshore. ■



The rudder of the Maersk Diva *after five years in service with conventional rudder coating (left), and five years after Ecoshield glassflake rudder coating was applied.*



The only hull performance system that gives your engine a break



Ecospeed provides your vessel with long-term protection and dramatically improves the ship's performance.

An impermeable and extremely tough coating is combined with an underwater cleaning system. This keeps the hull roughness at an optimum level and results in a major saving in fuel.

Ecospeed gives a very thorough and lasting defense against cavitation and corrosion damage for a ship hull's entire service life. The coating comes with a ten year guarantee. No repaint will be needed during future drydockings.

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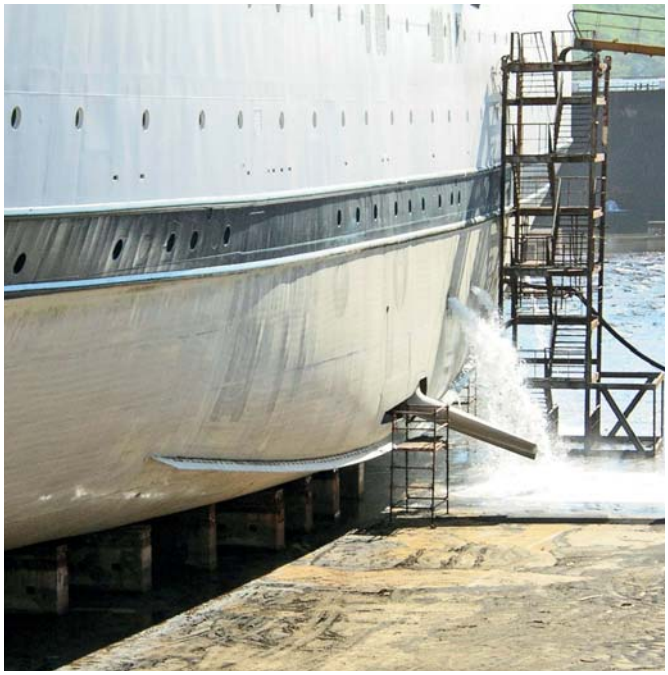
Save millions in drydock expenses and off-hire time



Hull of cruise ship after 5 years with Ecospeed coating with no replacement or major repair. This is the state of the hull when the ship came out of the water, without any cleaning or touch-up in drydock.

When your hull coating never needs replacing or major repair, you can save a lot of money in drydock fees, off-hire time, materials and labor.

Most hull topcoats are designed to be replaced once or twice every five years. The full hull coating scheme has to be fully replaced every 10 - 15 years down to bare steel. Over that time period, the coating degrades and becomes rougher until it's no longer worth trying to patch it up. And it costs you a fortune in fuel to compensate for the additional hull friction.

Imagine a coating that's guaranteed for 10 years and is expected to last 25 without replacement or major repair. A coating that gets smoother over time, not rougher.

Imagine coming into drydock after 3 or 5 years and finding that your hull coating only requires a few minor touch-ups and doesn't even need to be washed off.

Just think how much money you will save.

Call us today for a quote to convert your hull to Ecospeed or start off right, with Ecospeed, on a new build.

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