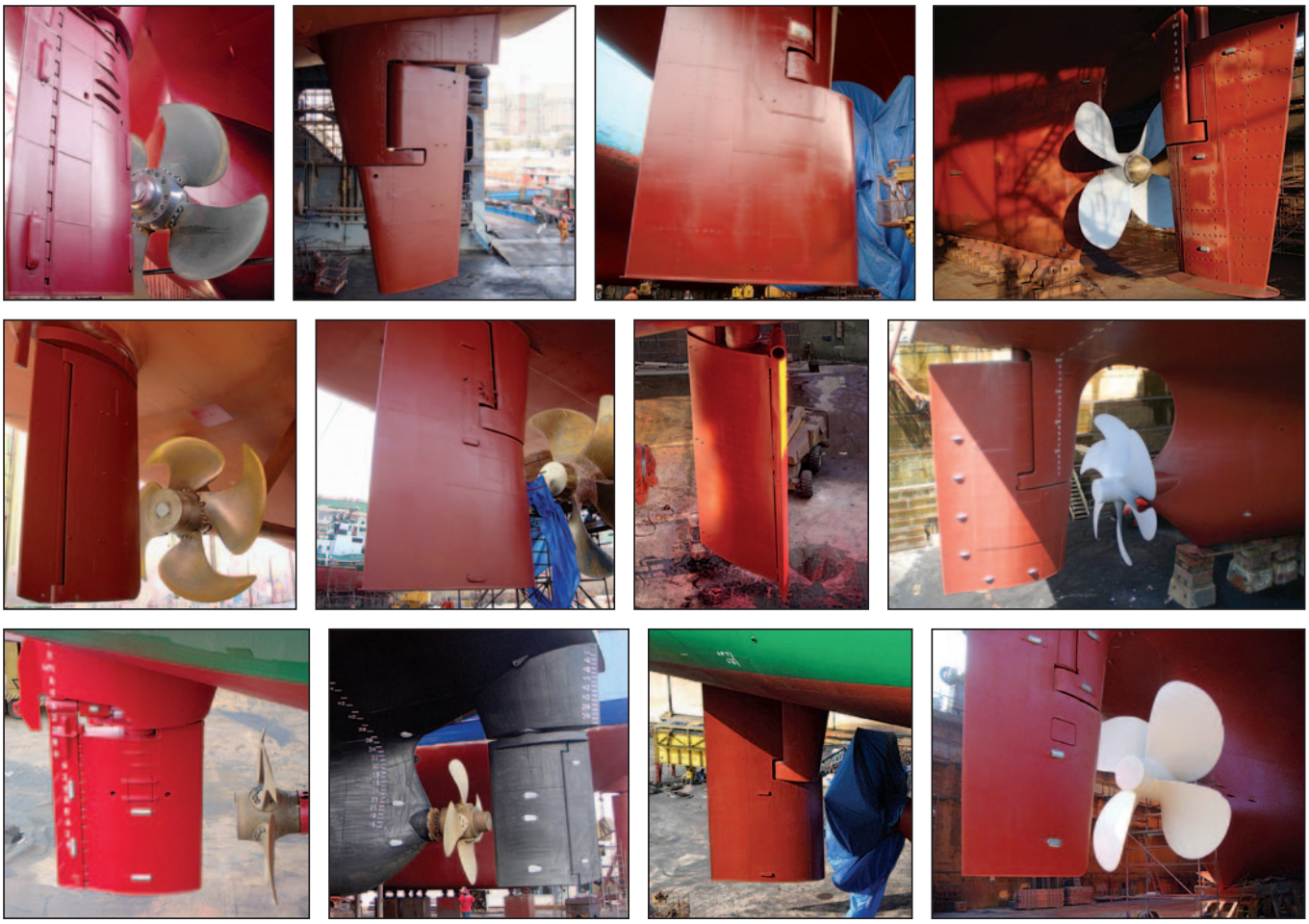
SUBSEA

PROTECTION AND PERFORMANCE

Magazine

276

SAY GOODBYE TO CAVITATION DAMAGE



Ecoshield gives a very thorough and lasting defense against cavitation and corrosion damage for a ship hull's entire service life.

The coating equally provides the rudder with an impenetrable protective layer while its flexibility enables absorption of the forces that are produced by cavitation. This prevents the damage normally caused by this phenomenon.

Without proper protection against cavitation and the resulting erosion and corrosion damage, the financial consequences can be severe.

By removing the existing paint layers and applying Ecoshield on the rudder we can break the never ending cycle of painting, suffering damage, having to perform extensive repairs in drydock followed by a full repainting, again and again.

With an Ecoshield application no full repaint will be needed during drydocking. Ecoshield is guaranteed for ten years. At the most, minor touch-ups will be required.

Subsea Industries NV
+ 32 3 213 5318
info@subind.net
www.subind.net

ECOSHIELD®
ULTIMATE PROTECTION

Cover photo of RRS Sir David Attenborough:
Jamie Anderson – British Antarctic Survey

Editorial

The newbuild phase is the only moment at which hull coatings can be applied to the ship before it has suffered performance loss due to corrosion or mechanical damage.

Choosing the right coating at this moment secures the future longevity and economy of the vessel. The initial investment in Ecospeed during the newbuild phase is relatively small and will be recovered even faster than if applied after some years in service.

Ecospeed will remain intact, protecting the hull for the lifetime of the vessel. This represents an enormous saving in paint costs throughout the next 25 years or more. Time in drydock for recoating is therefore also eliminated completely. The choice of future drydock locations increases as these are no longer tied to weather conditions suitable for repainting. Remaining on-hire for longer periods gives greater flexibility and, because the cost of repainting is eliminated, the opportunity to go to yards that have a higher technical capacity becomes less expensive.

With Ecospeed, a ship avoids building up layer upon layer of paint with a subsequent deterioration of the vessel's performance. Each application with a conventional hull paint brings about a thicker, non-uniform covering of the hull, negatively affecting speed and efficiency. Should the occasional mechanical impact occur to an Ecospeed coating, it is easy to repair, as touch-ups are very simple and quick to do in almost any weather condition.

Stable performance

Many ships sail with a chartering contract that includes a penalty clause if fixed distance/fuel consumption ratios are not met. However, the distance/fuel ratio is unpredictable with regular paint systems, and it will also worsen over the years. This is due to wear down, buildup of paint layers, corrosion and other damage which reduces the vessel's performance and increases fuel consumption. In this way the ship becomes more expensive and profits are trimmed.

Ecospeed offers ships excellent protection against corrosion, keeping the hull in its original state throughout its lifetime. As a result, the ship's performance remains stable. A fixed distance/fuel ratio can be determined in advance and penalties are therefore avoided.

Advantages of application during the newbuild phase:

- Large savings on future repainting costs
- Increase in choice of locations to drydock
- No paint layer buildup
- Low fuel consumption
- Stability in the ship's performance
- Protection against corrosion
- No time pressure with application
- Great flexibility due to Ecospeed's no maximum overcoating time
- 100% environmentally safe

Ecospeed benefits all newbuilds from the start. It is *the* coating that provides an all-round protection and is economically viable and ecologically sound.

Subsea Industries NV
Boud Van Rompay
Founder

Fleet readiness and marine coating systems

The fleet protects our nation – but what protects the fleet?

There is a direct correlation between the coating chosen for a naval ship's hull, rudders and running gear, decks, tanks and other surfaces, and that ship's readiness for action. It is vital to choose the right coatings for protection and performance of the ships that are being counted on for national defense.

Enemies of the Fleet

1. Hull roughness

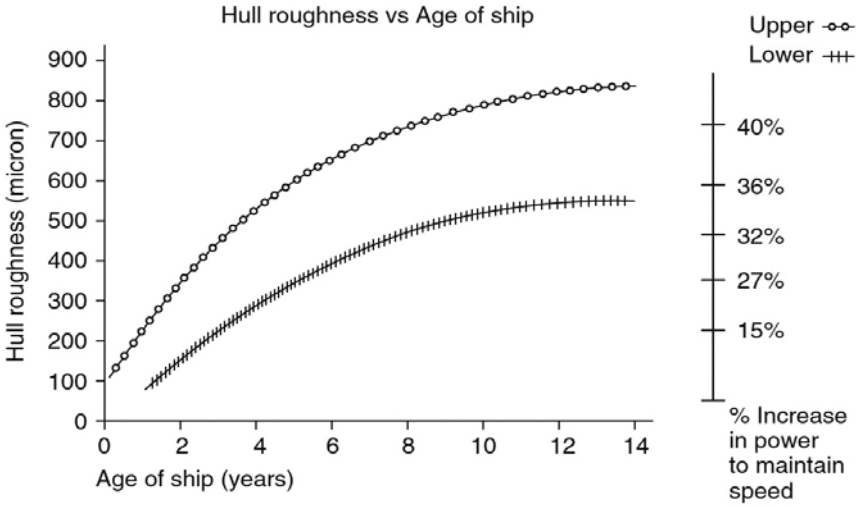
A rough hull is a serious strategic and tactical handicap in any ship operations, impairing a ship's speed and maneuverability, increasing fuel consumption, and reducing the ship's range.

There are two usual causes for a rough ship hull: paint, and biofouling.

Paint

Inferior paints degrade over time so that even if smooth when first applied, they become rougher in service. Antifouling paints are designed to wear away as they leach their biocidal content in an effort to deter marine fouling from settling on the hull. The coating is self-sacrificing.

These coatings are usually repaired in drydock and a fresh topcoat of antifouling is applied. The results can be a very rough hull.



7.9 Increased average hull roughness with ship age and effect on powering.

The chart above shows the increase in hull roughness as the ship ages. It is from *Advances in marine antifouling coatings and technology* by Torben Munk and Daniel Kane.

Biofouling

As soon as a ship or other object is placed in the water, especially salt water, it begins to attract marine fouling, first developing a slime

[Hull condition]	Additional shaft power (%)	Additional fuel in 2020 (million tonnes)	CO_2 emissions (million tonnes)	Additional fuel cost (billion $)
Freshly applied coating	0	0	0	0
Deteriorated coating or thin slime	9	44	134	22
Heavy slime	19	92	279	46
Small calcareous fouling or macroalgae	33	160	486	80
Medium calcareous fouling	52	253	768	127
Heavy calcareous fouling	84	408	1,238	204

(Fig. 2) Estimated effect of effective fouling control on annual fuel consumption and CO_2 emissions [for all shipping]. All figures are projected to 2020 and are compared to a fouling free hull. (The increased shaft power as a function of the fouling degree is obtained from Schultz (2007) and is based on his calculations for an Oliver Hazard Perry class frigate sailing at 15 knots.)

"The environmental importance of using effective antifouling coatings in relation to GH emissions," IPPIC report (April 2009).

layer, followed by algae and then barnacles and other calcareous fouling which continues to increase.

This biofouling progressively increases the hull's friction in the water, resulting in reduced speed for the same engine power/revs, increased fuel consumption, decreased range and a more sluggish ship which is harder to maneuver. The so-called "fuel penalty" can be very high. This relationship is shown in the table on the previous page.

Problem with existing hull coating systems in general use

Antifouling paints are supposed to prevent biofouling from accumulating during the entire drydocking interval of the ship. In practice they are usually unable to accomplish this. The hull fouls despite the toxic antifouling coatings, and in-water cleaning is needed to try to reduce drag.

However, these types of coatings are not suitable for in-water cleaning. Any attempt to do so seriously depletes and damages the remaining coating, and creates a pulse discharge of toxic substances causing short and long-term damage to the marine environment.

The coating surface is made rougher, and biofouling accumulates more rapidly after such cleaning.

Because of the environmental concerns, in-water cleaning of antifouling coatings is regulated and, in many ports and locations, completely forbidden.

2. Corrosion

Corrosion is an electrochemical reaction which results in the wasting away of steel and other materials. The marine environment promotes corrosion heavily. This is a serious enemy to fleet readiness.

There are a number of forms and causes of corrosion in addition to the general corrosion commonly known as rust, which is perhaps the most visible.

Cavitation

A special case of corrosion results from the damaging effects of cavitation, a phenomenon that accompanies turbulent fluids. It is particularly noticeable on rudders, inside thruster tunnels, on energy saving devices such as Kort nozzles, twisted fins, and on the propeller. Cavitation quickly destroys conventional anti-fouling hull coatings and exposes the steel to rapid erosion and corrosion.

Abrasion and wear

Ice, narrow locks, tugs, sand and gravel, floating debris and many other causes of abrasion and wear on a ship's hull can remove the paint and expose the underlying steel to corrosion.

In the case of decks, heavy vehicle traffic can remove any protective coating and again expose the substrate to corrosion.

Chemicals

Tanks and pipes are particularly susceptible to the corrosive effects of chemicals such as the acidic effluent from scrubbers or the corrosive effect of sewage and even salt water. This can pose a threat to the ship's integrity.

Defeating these enemies

There is a relatively simple solution to all of these corrosion and performance related problems. While many approaches have been tried, the one that has proved successful in all cases where it has been applied is simply the use of the correct coating – one which is tough and durable

Hull of cruise ship 5 years after being coated with conventional antifouling paint (left) and five years after being coated with Ecospeed (right).

Rudder of new navy corvette after a few days of sea trials with conventional antifouling paint (left) and 6 months after being coated with Ecoshield (right).

Rudder of large container ship after five years with conventional antifouling paint (left) and the same rudder 10 years after Ecoshield was applied, with no repainting over that period (right).

enough to prevent all forms of corrosion listed above, and which is not harmful to the marine environment. Such a coating (for example, the Ecospeed family of coatings from Subsea Industries) can be cleaned in or out of the water whenever needed without damaging the coating itself or the marine environment. Not only is protection provided, hull performance is also greatly improved.

The family of coatings mentioned above are glass-platelet reinforced vinyl esters that are also highly resistant to most chemicals, including the acids in scrubber effluents and the contents of sewage and other tanks as well as salt water. It is also highly abrasion resistant and has been classified as ice-abrasion resistant Polar Code (PC) 1 - 7. And it has even been found suitable by class for use in lieu of cathodic protection (sacrificial anodes or ICCP).

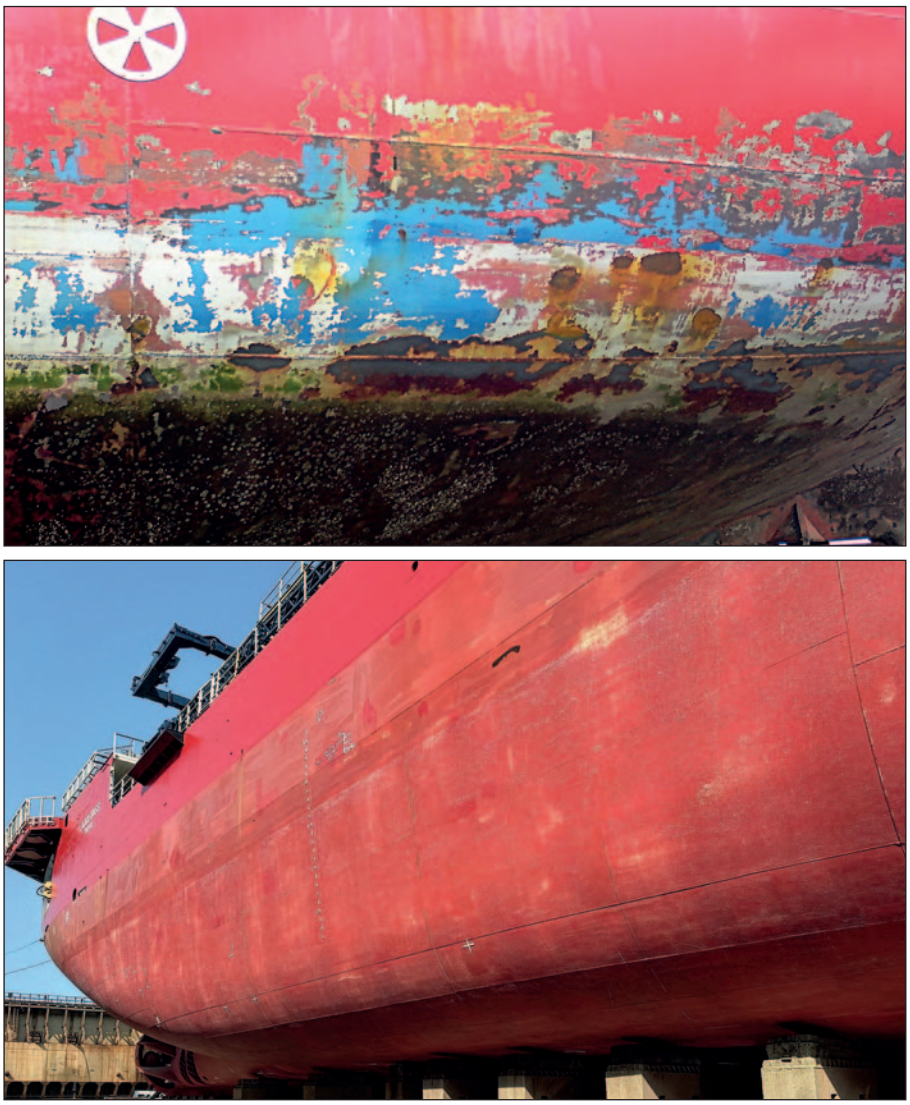
Thousands of applications attest to its effectiveness in all these regards.

A major cruise line found that it was able to save 10% of its fuel consumption with Ecospeed compared to the antifouling paint system it had been using before.

New Navy corvettes were having very severe cavitation problems with their rudders. This was solved by the use of Ecoshield.

Container ships which used to suffer severe cavitation damage to their rudders and thruster tunnels, found these problems solved when Ecoshield was applied.

Container ship scrubber recycle tanks that previously would be almost completely eaten away from one drydocking to the next, remained in excellent condition when Ecospeed was applied.



Hull of icebreaking Antarctic research/supply ship after a year in the ice with conventional ice-class paint (top) and sixteen (16!) years after being coated with Ecospeed (bottom) with no repainting, only some touch-ups.

Several Antarctic research and supply icebreakers found that where previously they had to repaint their ships every year, Ecospeed remained intact year after year (16 years and counting in one case) without the need for recoating in drydock.

Six mine hunters were coated with Ecospeed and did not need repainting for the remainder of their service life.

A ro-pax ferry was in danger of being declassified due to the heavy corrosion and pitting on the main vehicle deck. Ecospeed was applied and four years later the ferry was still in business with a well-protected deck.

The Ecospeed family of coatings has been shown over and over again to provide complete protection against corrosion while at the same time lending itself to excellent fuel efficiency, abrasion and chemical resistance, and longevity.

Major contribution to fleet readiness

The use of the correct coating for ships' hulls, rudders, running gear and tanks, solves the problems of corrosion and hull performance and can contribute greatly to fleet readiness and tactical capability. ■

How to protect ice-going vessels for their entire lifetime

We have been coating ice-going ships for over 15 years. The technical, economic and ecological results we have witnessed are nothing less than spectacular.

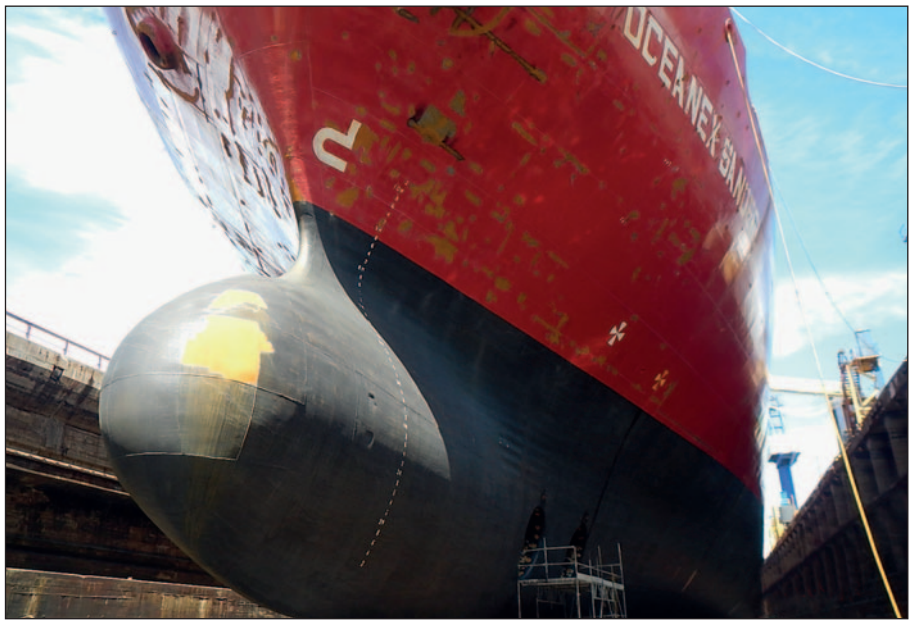
Technical

The first thing one looks for in an ice-going coating is a resistance to the ice. The reason why Ecospeed is such a success in ice is because of the adhesion to the steel. In itself the coating is not flexible, but due to its superior adhesion the coating flexes with the steel. There is no delamination and no detachment from the substrate.

Economic

Ecospeed ships do not have to be recoated. Ice-breaking (and other) ships save an enormous time in dry-dock. Instead of twelve days you only have to spend four or five days in dock because only small touch-ups are required. These are very easy to do, even in bad weather and any repair done to an Ecospeed coating will have the same qualities and strength as the original layers. This is even the case if they have been applied 10 or 15 years before.

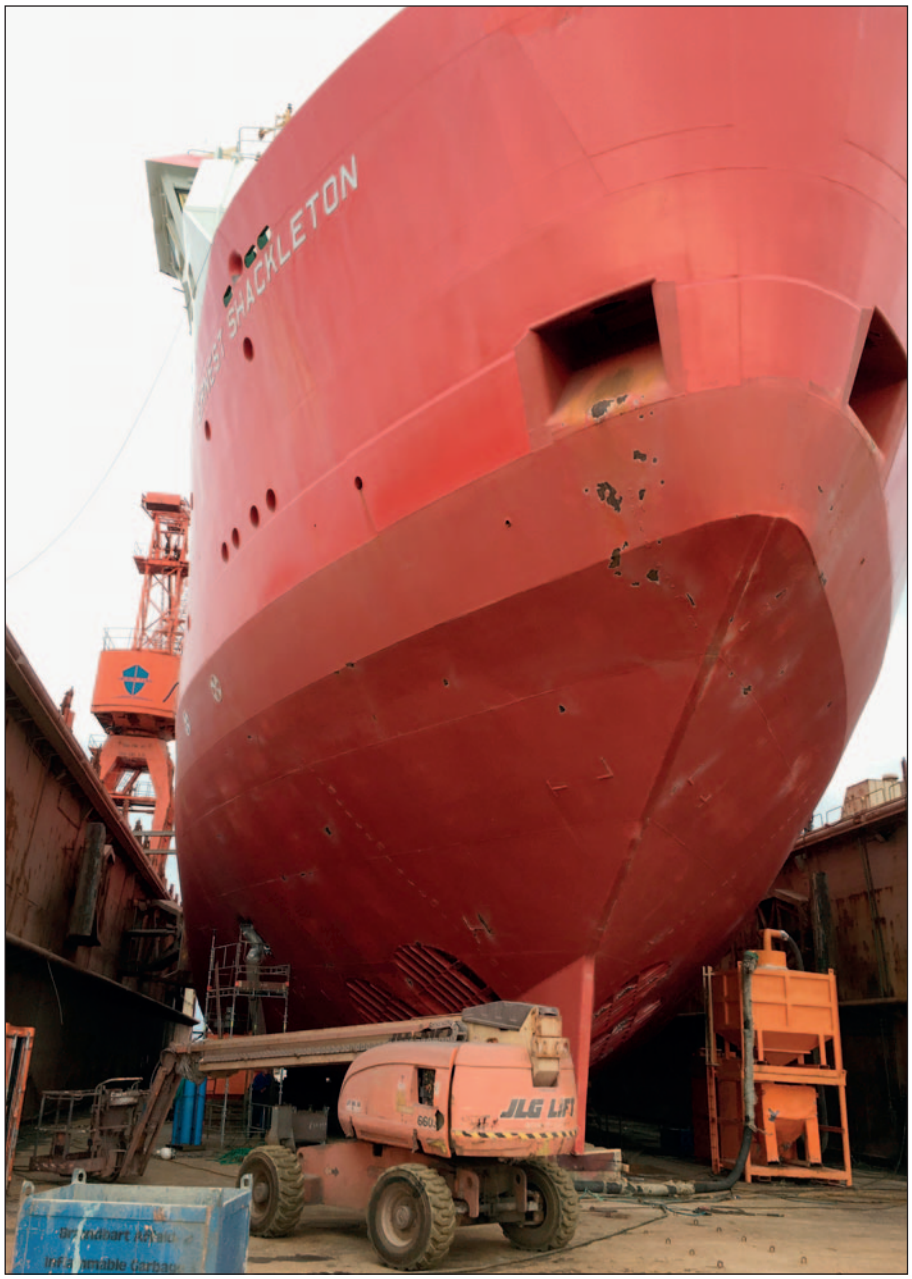
Many case studies have shown that our coatings can withstand the impact of ice for many years on end.



Only small touch-ups are needed to those areas of the underwater hull most prone to mechanical damage.

Ecospeed has proven on many occasions that it can withstand even the harshest winter conditions.

Applying Ecospeed is quite straightforward.



Since the RRS Ernest Shackleton *was coated with Ecospeed in 2009, only those areas most susceptible to ice impact have needed minor touch-ups.*

A combination of the corrugation of the coating and the absence of marine growth in ice results in a proven reduction of consumption. Depending on the size of the ship, the engines used and other specifications these fuel savings can go from 10% tot 20% or even 30%.

The smoothness of the coating also provides for easier breaking of the ice. The ship slices through the ice because hull friction is substantially reduced.

Ecospeed has been recognized as an abrasion resistant ice coating by Lloyd's Register. Using our coating allows the plate thickness to be reduced by 1 mm. Ships can be build with less material and will be less expensive to build and lighter to use.

Ecological

With Ecospeed on the underwater hull there is no loss of coating. There is no disbondment, no detachment and no delamination caused by ice impact. Our coating systems leave no paint behind. There is no spreading of anti-fouling toxic particles and heavy metals, because they are simply not used in our coating. Ships can safely be taken to the Polar regions without having a damaging effect on the environment or coloring the ice.

Because of the quality of the coating Ecospeed requires no use of anodes. As a result there is no loss of zinc materials in the Polar or other regions. No corrosion takes place on ships coated with Ecospeed.

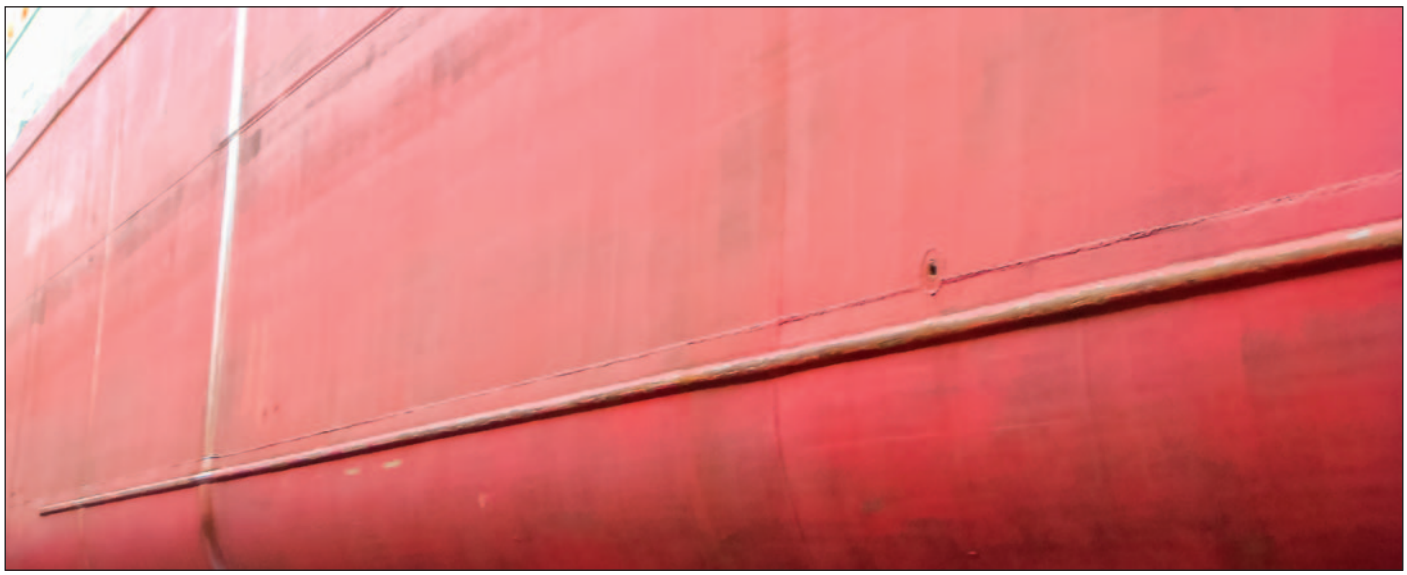
When the cleaning effect of the ice is not sufficient all animal growth can be removed easily with intermediate underwater cleaning. There is no detrimental effect on the marine life. There is no chemical influence.

Ecospeed is not a coating system that you get for one or two years, it is a system that you get for twenty years and longer.

Before Ecospeed

General cargo ship, before Ecospeed, one season trading in Baltic ice.

After Ecospeed



Same ship, same conditions, five years after Ecospeed applied, no repaint.

The problem of biofouling is therefore completely handled. The animals are removed and left behind in their native environmental zone. They are not transported to another environmental zone. We promote this as a total solution because achieving this only depends on the cleaning of the ship.

Conclusion

Well over a hundred ice-going ships have been coated with our products with great and conclusive results. Our Ecospeed coating was also selected for the newbuild research vessel *RRS Sir David Attenborough*.

Over a period of fifteen years these have shown that Ecospeed can withstand the impact of ice for many years. It is not a coating system that you get for one or two years, it is a system that you get for twenty years and longer. ■

Corrosion damage very repair made ✓easy

Subsea Industries has a product for filling and building up a corroded and pitted steel surface to its original form prior to recoating with Ecoshield. Ecofix is as tough as the steel itself, machinable, and can be used to repair most pitting or corrosion damage on rudders, stabilizer fins, thrusters and other underwater gear.

Ecofix is used in combination with Ecoshield, the ultimate rudder protection coating. When a rudder or other piece of underwater ship gear has not been properly protected, the surface will become corroded.

Cavitation can cause severe pitting. The steel needs to be restored to its original shape with a smooth surface prior to recoating.

This is where Ecofix comes in. It is a superior, tested and proven filler. Because it uses the same basic resin as Ecoshield, the coating can be applied just one hour after the filler. The bonding and hardness are extraordinary. This is the effective alternative to very expensive fillers. And because it is part of the Ecospeed/Ecoshield family, it is fully compatible with our coatings.

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+ 32 3 213 5318
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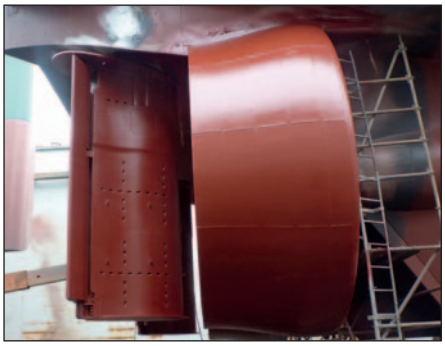
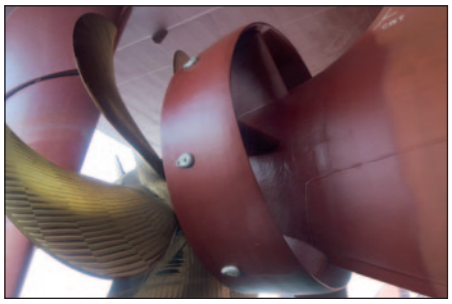
ECOFIX®
CORROSION REPAIR

SUBSEA

PROTECTION AND PERFORMANCE





Subsea Industries NV, was founded in 1983 specifically to take care of the design, development and marketing of what has become an evolving line of underwater hull and propeller cleaning equipment as well as the line of hard hull coating systems.

All products produced by Subsea Industries have the same goal in mind: To keep the underwater part of your vessel in the best possible condition for its entire lifetime at the best possible performance.

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