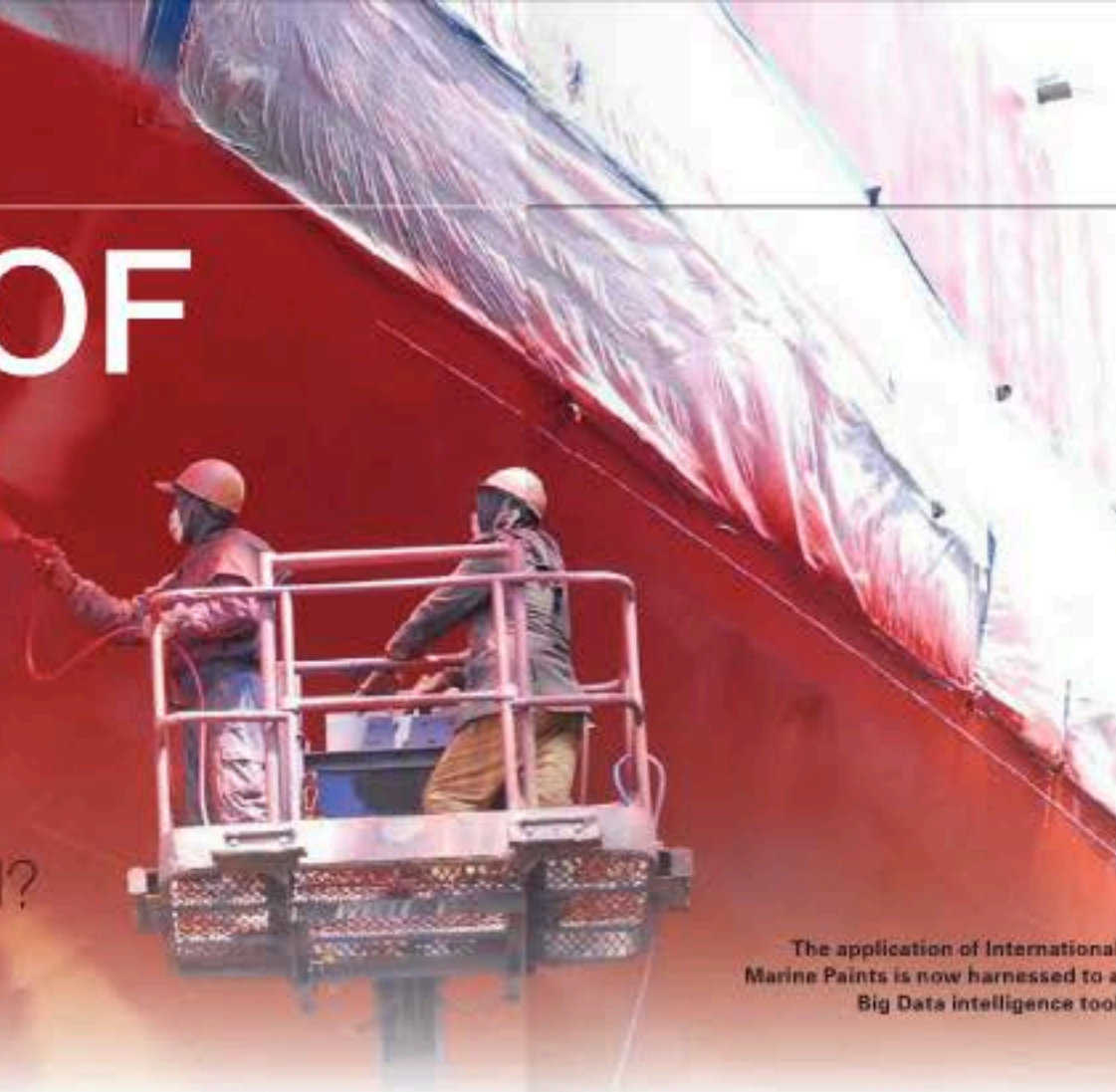


THE FUTURE OF ANTIFOULING

How is the paint sector adapting to demands for less toxic antifouling coatings – both inside and outside the hull? Jake Kavanagh reports



The application of International Marine Paints is now harnessed to a Big Data intelligence tool

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There are two ways to prevent marine growth from fouling a hull – poison it, so it dies and falls off, or prevent it from adhering in the first place. That's how fish do it. They secrete a slime from under their scales that makes most marine organisms slip away as the fish swims.

Huge improvements in chemistry and coatings technology have helped to create significant developments in minimizing marine growth between dry dock schedules, although, so far, the ability to be as free from marine growth as the average dolphin remains the Holy Grail for all coatings manufacturers.

In the shipping industry, it's all about numbers – speed over fuel, uptime over downtime. Preserving the environment hasn't really been a primary concern until quite recently, but ship owners now realize that they can do their bit towards greening the industry whilst also increasing their ships' performance.

And antifouling coatings are having a critical role in this approach.

"In the years before 'smart' ships, the promise of good performance and approximations of fuel savings formed the backbone of marketing campaigns for underwater coatings," explains Jotun's sales manager, Lars Erik Hoem Høier.

"Nowadays, most vessels have the ability to collect and store highly accurate performance data, so paint companies must have much greater transparency.

"That is why our HFC – X200 self-polishing antifouling, which was introduced in 2001, carries a special guarantee. Once the paint has been correctly applied to a clean hull, Jotun will refund a ship owner their money if the subsequent speed performance falls by more than 1.5% during the guarantee period.

"This has led to an ISO (International Organization for Standardization) standard that is now recognized across the shipping industry, as the X200 also includes a measuring system to confirm its effectiveness. The ISO standard concerned is 19030-1: 2016 – which is described as 'outlining the general principles for the measurement of changes in hull and propeller performance, repair and retrofit activities'."

The ISO website explains that the standard only applies to ships with a conventional fixed-pitch propeller, and the objective is 'to compare the hull and propeller performance of the same ship to itself over time.'

Shipping currently accounts for some 1,000m tonnes of CO₂ annually, or about 2.5% of global greenhouse gas emissions.

This is predicted (somewhat vaguely) to increase by 50%-250% by 2050, although the development of the hydrogen fuel cell may have the opposite effect. Either way, in the short-term, increasing fuel efficiency from a weed-free hull has the welcome bonus of also reducing greenhouse gases.

Another company using the ISO 19030 framework is Hempel, which recently launched two new premium antifouling, Globic 9500M

(for maintenance) and Globic 9500S (for static). The new coatings use Hempel's patented nano acrylate technology to control the release of biocides at a stable rate. Hempel has been measuring the effectiveness of the Globic range with SHAPE, its very own 'System for Hull And Propeller Efficiency.'

"Hull performance remains a crucial element in understanding fuel performance," says Andreas Glud, group segment manager, marine (dry dock). "At Hempel we started focusing on fuel performance over a decade ago when we launched the first fuel savings guarantees in the industry.

"Our new Hempel SHAPE system allows us to gather high quality data and so provide expert coatings analysis irrespective of the type, age, size and the operating patterns of a vessel. Essentially, we are offering our customers fuel efficiency intelligence to make their ships more competitive."

Coatings crossroads

With the coatings industry coming at the fouling problem from two different perspectives, kill it off or slide it off, there has been ongoing research in each direction.

With the challenge of finding effective but preferably non-toxic solutions, there is an increasing meeting of minds.

"About ten years ago, the industry was at a crossroads," says Jotun's Høier. "Some companies, like ours, decided to travel the road of self-polishing antifouling, where biocides are used to prevent the food chain establishing

itself on the hull. Others went down the fouling release road, where slippery, non-toxic coatings are used so fouling simply can't get established in the first place. Over the years, the two roads have begun to converge again with new discoveries."

For example, the giant paint company AkzoNobel provides both biocidal and fouling release treatments to keep hulls clean.

"Effectively managing biofouling is critical – but it is also a highly complex issue," insists Carl Barnes, AkzoNobel's antifouling business manager. "Different vessels, with different operating profiles, in different locations will each face different fouling challenges. There are coatings out there for each eventuality. The International marine coatings product range from AkzoNobel includes solutions for any vessel, from biocide-free, Intersleek foul release coatings that control slime, to Intercept 8500 LPP, aimed at helping vessels in locations with high fouling risk."

AkzoNobel has also developed its own coatings intelligence to help ship owners deal with so many global variables.

"We have created the consultancy Big Data tool Intertrac Vision," says Barnes. "It uses advanced analytics to accurately predict hull performance, depending on factors such as operational profile, fouling risk, and vessel type. This gives insight into lifecycle cost, emissions and potential fuel savings, and tangible proof of return on investment from the comparison of different coatings choices.

This is part of our wider 'Digital Voyage' strategy of using the latest digital technology to put as much of our knowledge and expertise as possible into the hands of industry stakeholders."

New additives

New discoveries for effective antifouling treatments are arriving all the time.

Amongst these are products such as I-Tech's Selektepe, a paint additive that has just completed a successful two-year trial on the 46,067DWT chemical tanker *Calypso*. Selektepe is described as 'an organic non-metal compound that makes it impossible for barnacle cyprid larvae to settle on the hull.'

Effective in remarkably small concentrations (0.1% w/w) it does this by stimulating the larvae to simply swim away, whether they want to or not. The result is a hull that after two years has shown a speed loss of just 2% against new build sea trial performance, all confirmed by independent analysis. Perhaps more importantly, the hull resistance factor remains 'flat', meaning that the coating continues to be effective despite spending at least 50% of its time in the world's fouling hot spots.

Remarking on this result, I-Tech's CEO Philip Chaabane says: "Our general outlook on the continuous performance of the coating containing Selektepe is very positive. This proves our unique antifouling ingredient can offer ship operators guaranteed hard fouling prevention for any type of vessel activity and trading patterns."



The results from a two-year test patch trial of Selektepe on the tanker *Calypso*. Independent verification suggests steady performance against variables

Cruise ships

A literal sea change in marine antifouling was the banning of organo-tin compounds such as tributyl tin (TBT) in 2008 by the International Maritime Organization. Although cheap and highly effective as an additive, TBT was blamed for settling in the seabed and causing long-term environmental damage to a wide

range of sea creatures, including mammals.

Whilst a new tranche of far less harmful biocides is in use today, non-toxic alternatives are gaining a lot of interest, especially in the cruise ship industry. Here, ship owners not only want the savings in fuel, especially as a large liner will average 0.129 miles a gallon, but they also need good environmental credentials and a spotless waterline. Image is everything.

Another issue is that many smaller cruise lines are exploring environmentally sensitive areas, where cosmetic hull scrubbing of toxic coatings is not an option.

To help them, Subsea Industries has developed a 'durable and non-toxic solution' called Ecospeed, a smooth coating that they say is strong enough to prevent damage from debris and scrubbing whilst also resisting corrosion. Designed to remain in place for many years, the coating can be safely cleaned in any location without the release of toxins.

For rudders and propellers, there is an Ecoshield variant, designed to minimise the effects of cavitation.

"Hard coatings offer a complete solution for those who have to deal with the issues around biocidal coatings on cruise ships," says Subsea Industries founder Boud van Rompay.

"Ecospeed's cruise customers are now experiencing better fuel savings and enhanced public image and environmental credentials. They are also able to get their ships out of dry-dock several days sooner than similar ships with conventional coatings, resulting in cost savings and increased revenue."

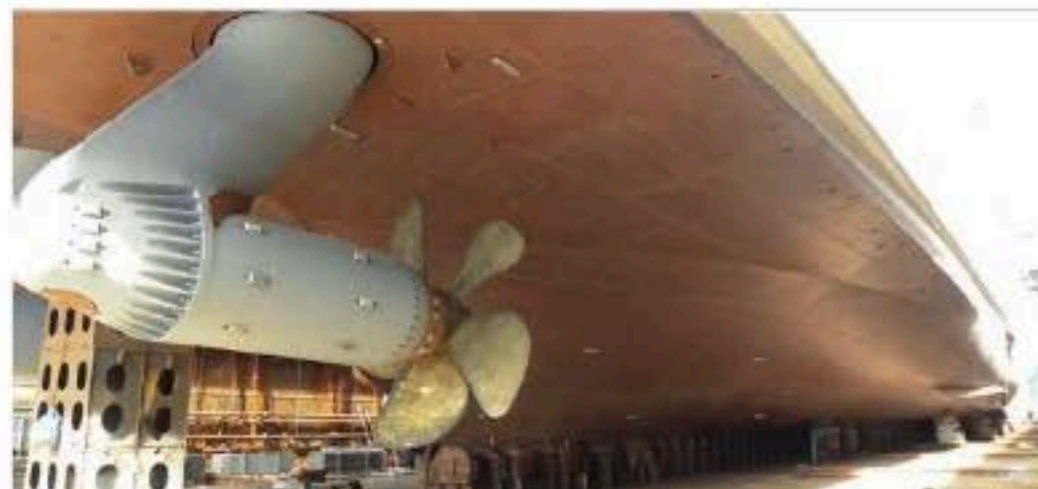


A wide range of foul release coatings has been developed for propellers, such as Ecoshield from Subsea Industries which has been designed to withstand cavitation damage

Greener alternatives

Apart from addressing the loss of performance, another key role of antifouling is to prevent the transportation of invasive marine species between habitats. The damage being done by aggressive invaders hitch-hiking on ships, and then being dispersed locally by pleasure craft has prompted some countries to greatly tighten their environmental laws.

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Coppercoat is a suspension of copper powder in epoxy resin and is proving a cost-effective long-term solution for ships and superyachts

Two companies that have successfully used technologies from other applications where species have to be deterred in a non-toxic way are AMC, with its copper-resin suspension, and NRG, with the ultrasonic Sonihull system developed from the swimming pool sector.

The latter has proved very effective with ships that are laid up.

"With current market overcapacity, efficient mothballing and reactivation is becoming critical for ship owners and operators," explains Darren Rowlands, commercial director of NRG Marine. "If critical equipment like box-coolers, keel-coolers and their associated sea chests, pipework and valves are not kept free from fouling, owners can be faced with very expensive repairs and downtime when recommissioning."

Ultrasonic technology has been used in the brewing, food and hydroponic farming industries for decades to keep algae at bay, so is ideal for areas where no biocides can be used.

Sonihull systems produce multiple bursts of ultrasonic energy in a range of targeted pulse frequencies underneath each carefully positioned transducer. The ultrasound creates a pattern of microscopic agitation that has a cleansing effect on the outside of a hull, or the inside of a tank, mainly by destroying the surface algae. Disrupting this first link in the food chain makes it a much less inviting habitat for larger organisms that feed on the algae.

The microscopic movement of water also prevents barnacle and mussel larvae from embedding on the surface.

"By focusing the same technology in the marine sector, we have developed a solution that requires no specialist fitting or maintenance, is cheap to run and leaves no poisonous environmental legacy," Rowlands continues. "With no specialist fitting, current isolation or expensive anodes to replace, Sonihull can reduce lifetime cap-ex and maintenance costs by 95% when compared to impressed current systems."

Meanwhile a copper-resin system – originally developed for use on pleasure boats – has been expanded to cover commercial shipping and superyacht sectors with the advantage of a very long life.

"Coppercoat is the unique combination of high-purity ultra-fine spherical copper powder, suspended in a modern two-pack water-based Bisphenol-A based epoxy resin," explains AMC's Ewan Clark. "Being VOC free, Coppercoat gives off no toxic fumes during application so can be applied anywhere at any time with no disruption to other works nearby."

Coppercoat has had a long trial within the yachting industry, with AMC claiming over 60,000 vessels treated over the last 25 years. Documented cases show that it is common for a single treatment of this hardwearing epoxy product to provide a high level of antifouling for up to 20 years. This longevity greatly reduces lift-out and dry-docking expenses.

"This product is increasingly being used within the renewable energy market," Clark continues. "Many subsea installations of tide-powered turbines and wave-powered installations have already been treated."

NEW ZEALAND DEMANDS CLEAN HULLS FOR ARRIVING SHIPS

From May 2018, New Zealand's Ministry for Primary Industries (MPI) will be implementing new biofouling rules for all vessels arriving in their territorial waters. The new Craft Risk Management Standard for biofouling is seeking to manage the 'biosecurity risk' posed by invasive species and other 'marine pests' being carried into New Zealand on the hulls of ships and boats.

"The rules will help protect New Zealand's aquaculture industry and local marine life," insists Paul Hallet, MPI biosecurity group manager.

However, cleaning or freshly antifouling the hull before arrival can meet the standard.

Ship operators will need to keep verifiable records to prove the correct action has been taken.

The guidelines also state that the treatments must extend to marine growth prevention systems on sea chests and other niche areas, and will include regular inspections.

Changing rules

Copper was used as the world's original antifouling agent and applied as sheet metal on the underwater hulls of sailing ships.

However, as it is now used widely as an additive in antifouling paints, there were concerns about its cumulative effect in the seabed under moored vessels.

The EU has embarked on a programme of strict new biocide regulation in which all existing antifouling paints will be harmonised within the Biocidal Products Regulation (BPR). These only apply to products that contain biocides, and copper was included.

However, after intense research, it was decided that copper compounds such as dicopper oxide, coated copper flake and copper thiocyanate can be used safely by both commercial and leisure applicators.

The British Coatings Federation (BCF), which played a key role in finalising the detail of the BPR, explained the situation.

"The objective of this legislation is to create a 'level playing field' of effective and safe products throughout Europe," the BCF said in a recent circular. "Whilst proving to be a complicated and expensive process for antifouling paint manufacturers, we trust that the objective will be achieved if industry, users and regulators all work together."

All the manufacturers TMP spoke to have already submitted their paints for testing and approval, with some taking the opportunity to update and streamline their range as soon as the regulations became known.

With great concern about the cleanliness and sustainability of our oceans, we can expect to see a much greater drive towards less toxic, but equally effective, antifouling solutions in the future. ■

MARINE COATINGS SPECIALISTS

Aquarius Marine Coatings (AMC)

Founded in the UK and now based in Blandford Forum, Dorset, AMC produces copper-resin antifouling for yachts and commercial ships. www.coppercoat.com

AkzoNobel

A giant paint and coatings company based in Amsterdam, the Netherlands, with 46,000 employees in over 80 countries.

Brands: International Paints and Awlgrip. www.international-marine.com

Boero Group

A marine coating specialist based in Genoa, Italy with a dedicated yachting subsidiary in France.

Brands: Boero Yacht Coatings, Veneziani Yachting, Attiva Marine www.boerogroup.com

Chugoku Marine Paints

Based in Tokyo, Japan, Chugoku Marine Paints produces yachting and commercial coatings.

Brands: Seajet www.cmp.co.jp/global/

Hempel

Founded in Denmark in 1915, Hempel is now one of the world's largest marine coating suppliers with a turnover of €191m in 2016.

Brands: Hempel www.hempel.com

I-Tech

Based in Gothenburg, I-Tech is a private Swedish bio-tech company and a member of the Astra Zeneca BioVenture hub.

Antifouling brands: Selektope www.selektope.com

Jotun

Established in Norway in 1926 and headquartered in Sandefjord, Jotun is now ranked as the world's ninth largest paint manufacturer. Around 27% of total coatings produced are for marine, with sales of NOK 4.407 billion in 2016.

Brands: Jotun www.jotun.com

NRG Marine

NRG Marine was founded in Coventry, UK, in 2006 to develop an environmentally friendly antifouling based on ultrasonic technology.

Brands: Sonihull, Sonishaft www.nrgmarine.com

Subsea Industries

Founded in 1983 in Antwerp and originally named Subsea Cleaning Systems, the company was established to develop non-toxic antifouling solutions for hulls and propellers.

Brands: Ecospeed, Ecolock, Ecolast, Ecoshield. www.subind.net



IMAREST SPECIAL INTEREST GROUP

If you are interested in this topic, get involved with the IMarEST's Biofouling Management Special Interest Group by emailing technical@imarest.org. The group recently worked with the International Paint and Printing Ink Council to develop a template for the completion of a biofouling management plan to help ship owners and operators comply with their obligations under the IMO Guidelines for the Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species, which were adopted in July 2011. The IMarEST is also a strategic partner in the GEF-UNDP IMO GloFouling Partnerships Project which aims to assist participating countries to build their capacity to implement these 2011 guidelines. For info go to: www.imarest.org/tv/latest/item/3808-the-glofouling-partnerships-project



Supreme anti-fouling here, there and everywhere

We introduce our Globic 9500 series with nano acrylate technology for supreme anti-fouling protection everywhere from outfitting to re-docking.

Globic9500.hempel.com

