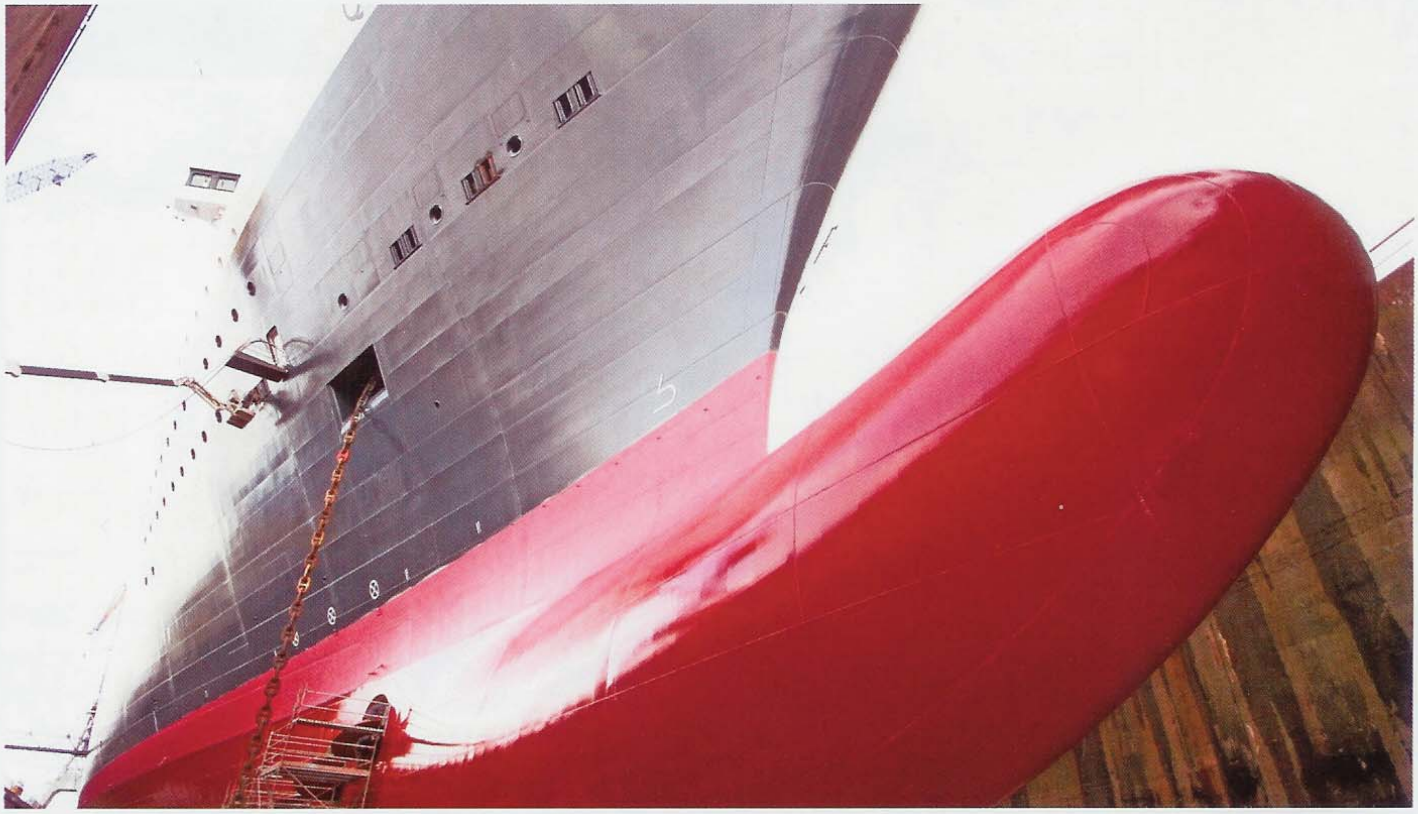
How a Coating can cut Carbon and Cost



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Queen Mary 2

An Environmental Position Report from International Paints with COP 15 update by the editor.

Shipping was exempted from consideration on greenhouse gas emissions under the Kyoto Protocol, but December's United Nations Framework Convention on Climate Change (UNFCCC) summit in Copenhagen (COP15) was expected to bring both international aviation and shipping within the overall UN carbon reduction framework.

Whilst shipping is the most energy efficient means of transport, it consumes around 300 million tonnes of bunker fuel per year, and according to the Second International Maritime Organization Study on Greenhouse Gas Emissions (IMO GHG), is responsible for 2.7% of global CO emissions. In the absence of global policies to control greenhouse gas emissions from international shipping, the IMO suggests that emissions may increase by between 150 and 250 percent by the year 2050 due to growth in international seaborne trade.

In July 2009, at it's 59th session, the Marine Environment Protection Committee(1) (MEPC) of the IMO agreed to disseminate a package of interim and voluntary technical and operational measures to reduce greenhouse gas (GHG) emissions from international shipping; and also agreed a work plan for further consideration, at future meetings, of proposed market-based instruments to provide incentives for the shipping industry.

The agreed measures are intended to be used for trial purposes until the Committee's sixtieth session (MEPC 60) in March 2010, when they will be refined, as necessary, with a view to facilitating decisions on their scope of application and enactment. The measures include:

- interim guidelines on the method of calculation, and voluntary verification, of the Energy Efficiency Design Index for new ships, which is intended to stimulate innovation and technical development of all the elements influencing the energy efficiency of a ship from its design phase; and
- guidance on the development of a Ship Energy Efficiency Management Plan, for new and existing ships, which incorporates best practices for the fuel efficient operation of ships; as well as guidelines for voluntary use of the Ship Energy Efficiency Operational Indicator for new and

existing ships, which enables operators to measure the fuel efficiency of a ship.

Market-based Instruments

The MEP Committee held an in-depth discussion on market-based instruments and agreed a work plan for its further consideration of the topic, as of its next session (MEPC 60, March 2010), to build on discussions and submissions to date, also taking into account any relevant outcomes of (COP 15). Such instruments would have purposes such as: climate change mitigation and adaptation activities; research and development; offsetting of emissions; and serving as an incentive for the industry to invest in more fuel-efficient technologies.

The Committee noted that there was a general preference for the greater part of any funds generated by a market-based instrument under the auspices of IMO to be used for climate change purposes in developing countries through existing or new funding mechanisms under the UNFCCC or other international organisations.

Report to COP 15

The outcome of the MEPC on GHG emissions from ships was reported to COP 15, which in considering a successor instrument to the Kyoto Protocol for the UNFCCC, agreed the Copenhagen Accord, which noted that climate change is one of the greatest challenges of our time and that deep cuts in global emissions are required to combat global temperature rises, but without any specific reference to the shipping industry.

The Committee agreed that any regulatory scheme applied to GHG emissions from international shipping should be developed and enacted by IMO as the most competent international body, which was not challenged at the COP 15 meeting.

Speaking at the close of MEPC, the IMO Secretary General Efthimios E. Mitropoulos urged delegates to brief their government colleagues about measures already taken by IMO on emissions, so that "the complexities of this most international of all industries are duly taken into account when shaping official policies and positions on the issue at hand - both at Copenhagen and at any post-Copenhagen rounds of consultations at IMO."

It is fair to point out that the pace of work on the GHG issue at IMO has come in for criticism and that it was hoped that COP 15 would offer pivotal guidance on the way this issue will be regulated. What is not in doubt is the key role technology will play in meeting over-arching ambitions to protect the environment.

Prior to the COP 15 Meeting, AkzoNobel Chief Executive Hans Wijers threw his weight behind 'The Copenhagen Communiqué on Climate Change' by adding his name to those of hundreds of other global business leaders who called on world leaders to close a deal on climate change when they meet in Copenhagen in December.

The move by the CEO of International Paint's parent was significant for several reasons. Firstly, Mr. Wijers was agreeing with key points of the Communiqué, including the statement that global economic development cannot be sustained in the longer term unless the climate is stabilised. Secondly, the document points out that the right economic backdrop is required if industry leaders are expected to invest billions of dollars in low carbon products, services, technologies and infrastructure. And thirdly, Mr. Wijers was aware that international shipping had found itself in the environmental spotlight recently amid criticism that it has not done enough to limit its emissions. Yet various technologies already exist today to cut shipping's emissions by very significant margins. One of these is hull coatings (discussed below), a sector in which AkzoNobel's subsidiary, International Paint, is a market leader.

As the Communiqué stated: "The problem of climate change is solvable – many of the technologies required are available today while others can be developed if the right incentives are in place."

In September 2009, the UK Chamber of Shipping said that it expected new technologies and designs to deliver energy efficiency savings of up to 40% on new ships relative to typical ships delivered in the 1990s. The IMO itself has suggested that, "by application of known technology and practices, shipping could be 25-75% more energy-efficient, depending on the ship type and the degree of compromise".

High profile items, such as new methods of combustion and the gas scrubbers designed to cut emissions at source, tend to occupy front and centre when emissions are considered. However, in both cases, manufacturers are in the development phase.

The GNV Vessel La Superba

Wightlink's Fast Cat

Furthermore, many newer engines designed to cut emissions actually consume more fuel than earlier, more polluting counterparts.

Available Technology

In fact, there are technologies available today that have been proven to cut emissions from ships substantially. Hull roughness, for example, has a direct effect on power requirement (and thus emissions). If ships did not use antifouling coatings at all, their fuel consumption would be as much as 40% higher. Research undertaken in the 1970's and 1980's (2) showed that, should average hull roughness (measured in microns) increase over a given period from around 140 microns to 280 microns, around five per cent more power would be needed for a fast container ship to maintain its schedule.

The emergence of self polishing copolymer coatings, with their superior antifouling properties, went some way to reducing the hull roughness penalty paid by owners, but as fuel costs have escalated, newer generation coatings have emerged that have been specifically designed with reducing the friction between a ship's hull and the sea in mind.

While self polishing copolymers remain mainstay products, leading manufacturers have fast tracked the development of 'biocide-free' foul release coatings as an alternative. Silicone-based coatings, for example, provide a very smooth, slippery and low friction surface, to which fouling organisms simply have difficulty attaching in the first place.

International Paint, which introduced the first ever commercially available silicone-based biocide free foul release coating for fast craft back in 1996, in the shape of Intersleek 425, went on to produce a deep sea equivalent in Intersleek 700 in 1999.

As well as their antifouling properties, the resulting hull smoothness has direct consequences for fuel consumption, costs and the environment. Measured against conventional self-polishing copolymers, silicone foul release coatings have been proven as achieving an average of over 4% fuel saving, and a corresponding reduction in emissions.

Customer Confidence

That is no idle manufacturer claim. Grandi Navi Veloci (GNV) first began using Intersleek 700 in 2005 on board the 32,700gt ferry *Majestic*. GNV Technical Consultant Bruno Dionisi has gone on record as saying: "On average, this product provides undisputed advantages which, in our case, are represented by a bunker saving of around 6-7%."

Given these results, the advent of a further coating, achieving even lower levels of friction, should be of interest to those seriously concerned with the environment, but also with economics. Intersleek 900 represents a 'next generation' foul release coating technology, using fluoropolymer chemistry to improve on silicone's performance. Through its launch, International Paint has once more demonstrated that hull coatings can play as significant a role in saving on fuel and emissions as other, perhaps more obvious, aspects of ship design.

Marine organisms stick to a ship's hull by secreting an adhesive that is either hydrophobic or hydrophilic in nature. The fluoropolymer-based product is a patented foul release coating, which presents the organisms with an amphiphilic surface, combining hydrophilic and hydrophobic properties in order to minimise the chemical and electrostatic adhesion between the surface and the fouling organism, whether the adhesive is hydrophobic or hydrophilic.

The technology confers 40% better foul release properties overall than previous silicone-based, and a 50% reduction in slime build-up. It also produces unprecedented low levels of average hull roughness - at 72 microns -yielding a 38% improvement in the coefficient of friction over the silicone-based product.

Ikuna

The ultra smooth hull produced reduces water resistance, cutting fuel consumption and emissions.

What all this adds up to is a massive extension in the reach of foul release technology to take in lower speed vessels that were previously off limits. Now, for the first time, even bulk carriers, tankers and container feeder vessels operating at speeds as low as 10 knots can benefit from foul release coatings. These vessels often trade on the spot market and may have static periods awaiting charter or waiting to discharge/load cargo. It is worth noting, then that fluoropolymer-based product's static fouling resistance in port is some 80% better than that of silicone-based product..

At the same time, ships operating at higher speeds gain greater fuel efficiency, or their operators may be able to quote higher speeds during charter contract negotiation to command higher rates.

Depending on the application and the in-service conditions, fuel and emissions savings recouped using fluoroolymer technology were originally predicted to be 6% compared to biocide-containing self polishing copolymers, according to the official International Paint position. International Paint estimates that, over a five year period, a single VLCC currently coated with a self polishing copolymer antifouling could reap savings of 9,000 tonnes of fuel if coated with the fluoropolymer product, reducing its CO emissions by 31,000 tonnes and saving around US$3.6 million.

Again though, it is not the supplier's claims that are of interest; rather it is the testimony of those using the new coating. In-service experience on a range of vessels has shown savings of up to 9%.

Energy Efficiency

For some, the greatest imperative has been improving service speed. The first shipowner to apply fluoropolymer technology was Sydney-based Inco Ships, which had its bulk carrier *Ikuna* coated in March 2006 during a routine maintenance drydocking at Singapore's Sembawang shipyard. The coating was applied in place of a standard, biocidal self polishing copolymer antifouling. With the new coating applied, the shipowner reported a 1 knot increase over its typical 10.5 knots operating speed without any increase in the amount of fuel used.

Even after 37 months in service, Inco Ships Pty Ltd managing director Andrew Dally reported that the one knot gain had been sustained. "This increase in available speed and vessel efficiency is a significant benefit to us commercially," he said. "The hull was clear of any animal or weed fouling growth with the exception of the sacrificial anodes, which were covered in marine organisms, thereby indicating the high level of fouling faced by the vessel."

Since this first application, Inco Ships has gone on to coat three further vessels with the fluoropolymer-based product, in the shape of the cement carrier *Goliath*, the livestock carrier *Torrens* and bulk carrier *Hakula*.

At the other end of the speed spectrum, Wightlink opted for fluoropolymer technology as the antifouling coating for three of its high speed catamarans. *Fastcat Ryde*, Our *Lady Pamela* and *Fastcat Shanklin*, which typically operate at speeds of between 30-35 knots, were drydocked in turn in April, May and July of 2008 for application of the coating to their vertical sides. This project was combined with a complete overhaul of the engines on the three vessels, through which the operator expected significant efficiency gains. As well as identifying a speed increase of 2 knots after the application of the new antifouling, Wightlink has acknowledged the way the coating has allowed it to keep to its rigorous shortsea shuttle schedule between the UK south coast and the Isle of Wight, while at the same time saving on fuel and emissions. Mark Parsons, Wightlink technical superintendent, said: "The Fastcats now run at a reduced rpm complemented by associated fuel savings."

Meanwhile, Indian shipping company Mercator Lines first applied fluoropolymer-based antifouling to the underwater hull of the 109,610dwt Aframax tanker *Prem Pride* in October 2007, in Dubai. The owner went on to apply the coating on a larger hull area on board *Prem Divya* in June 2008. Mercator Lines general manager, Amit Agarwal, said: "We continued to closely monitor the performance of both vessels in service. In 2008 we achieved up to 6% fuel savings on *Prem Pride*. This year, with even more data, we can confirm that the fuel and emission

Prem Divya

savings have been maintained on this vessel.

"Whilst we continue to be happy with the performance of the antifouling on *Prem Pride*, we fully expect an improvement on *Prem Divya*, as we had increased the areas of the underwater hull coated to include the flat bottom. The detailed monitoring of the performance of Prem Divya has confirmed that we are now achieving up to a 9% reduction in fuel consumption under comparable conditions."

Fuel savings of this order add up to an environmental benefit equivalent to almost 11,000 tonnes less CO_2 emitted, 100 tonnes less SOx and 200 tonnes less NOx.

Ultimate Reference

For any ship equipment or ship service supplier, perhaps the ultimate reference remains *Queen Mary 2* and, even in the case of this much lauded ship, the fluoropolymer-based product can lay claim to having improved performance.

In this case, Cunard has made an explicit pledge to reduce the environmental impact of vessel operations through "practices, which set a high standard for excellence and responsibility". A part of this programme saw the famous liner having 6,000m² of her hull coated during a recent maintenance and repair docking at Blohm & Voss, Hamburg.

Previously coated with a self polishing copolymer (SPC) antifouling, the decision to switch to fluoropolymer technology was an integral part of a strategic initiative to reduce fuel usage, cost and associated CO emissions whilst still maintaining operational schedules.

David Strawford, head of Technical Services, Carnival UK said: "The vessel is achieving operational speed whilst utilising less power than was previously the case. [There is] a significant improvement compared to the previous SPC system."

Following its introduction in 2007, Cunard is currently upgrading all existing silicone coated vessels to fluoropolymer technology, which has most recently been applied on the P&O Cruises cruise ship *Arcadia* and has been specified on the four AIDA cruise vessels currently under construction at Meyer Werft, Papenburg.

GNV, which as noted, made efficiency gains as a result of opting for the fluoropolymer-based product, has gone on to choose it as part of its latest hull coating projects, including *La Superba*.

In fact, to date over 250 vessels have already been coated with Intersleek 900, fluoropolymer foul release system and, where Intersleek 425 won the Seatrade Awards for Countering Marine Pollution in 1997, and Intersleek 700 won the 2007 Queens Award for Enterprise, Innovation, Intersleek 900 itself has gone on to pick up the 2008 Seatrade Insider Cruise Award and, in September 2009, the 2009 Lloyd's List Global Award, Clean Seas Category. ■

References

(1) http://www.imo.org/Newsroom/mainframe.asp?topic_id=109&doc_id=11123

(2) Fuel Economy Due to Improvements in Ships' Hull Surface Condition 1976-1986 by R.L. Townsin, D. Byrne, T.E Svensen and A. Milne.