New benchmark to prove coatings performance

Strong academic research and firm ship operating evidence of the correlation between applying specific fouling control coatings and reducing fuel consumption and CO_2 emissions finds further backing, after a new industry partnership is formed that is likely to silence the doubters once and for all.

International Paint and BMT ARGOSS have come together and will utilise the new BMT SMART^{SERVICES} system to verify, through independent monitoring and software analysis, the contribution to vessel performance, fuel savings and reduced emissions made by International Paint's highest performance fouling control coatings, Intersmooth®SPC (self polishing copolymer) antifouling and Intersleek® foul release coating.

Understanding hull roughness is an important factor in understanding ship performance, International Paint points out. Any increase in hull roughness will increase the hull frictional resistance which will either require additional power and fuel to maintain vessel speed or, if maintaining constant power, will result in speed loss and longer voyage times.

International Paint claims fuel and emissions savings for its Intersmooth®SPC coating, citing evidence gathered from over 5,000 vessel drydocking and inspections for fouling rating, combined with AHR (average hull roughness) measurements.

Behind this specific argument, the International Paint 'Dataplan' system has coating details of over 1.7 billion DWT, representing almost 200,000 drydockings that allow antifouling performance to be predicted and assessed. Results are derived from analysing the in-docking condition of a vessel, its coating performance and assessing the type, severity and extent of any fouling, if present. In conjunction with the vessel's trading pattern, operational profile and drydocking interval, an antifouling performance rating can be calculated.

Dataplan also records the vessel's coating condition, including the type, severity and extent of any corrosion, cracking, blistering, detachment and mechanical damage, all of which contribute to and are included in, hull roughness measurement.

Full back-up

International Paint also cites the report, 'Energy and GHG Emissions Savings Analysis of Fluoropolymer Foul Release Hull Coating', by Professor James Corbett's Energy & Environmental Research Associates. The report is dated the 10th December 2010.

The report analysed the latest fuel consumption data of three vessel types coated with Intersleek®900; *Prem Divya*, a single engine 21,126 horsepower (HP)

tanker, *Ikuna*, a twin engine 3,400 HP bulker and five identical post panamax container vessels, three of which were coated with SPC antifoulings and two with Intersleek®900.

The results are remarkable for the correlation they show between the coating applied and the fuel consumed. The report showed that fuel consumption was reduced by 10% on the *Prem Divya*, 22% on the *Ikuna* and by 5% in five container vessels (based on all five ships carrying a comparable load). The report stated that if similar fuel efficiency results were realised by all tanker and bulk cargo vessels within the commercial fleet that: "annual fuel oil consumption could be reduced by roughly 16 million metric tons (MMT) per year, fuel expenditures could be reduced by $4.4 to $8.8 billion per year, and nearly 49 million tonnes of CO_2 emissions could be avoided annually".

At a more detailed level, the report stated that the latest generation fluoropolymer foul release coating could offer average fuel and emissions savings of up to 9%.

Challenge

For some, though, such claims are always open to challenge. Critics argue that, no matter which coating is applied, a ship will naturally move through the water more smoothly if it has been blast cleaned during drydocking. Furthermore, they argue, the linkage between hull smoothness and reduced emissions is tenuous: traditionally, extra smoothness was more likely to lead to some ships being driven faster, not to fuel savings.

On the face of it, such seemingly persuasive arguments could be readily countered by observing the growing propensity for owners to operate slow steaming policies specifically in pursuit of fuel (and consequently emissions) savings. Again, while no one would dispute that depending upon the fouling control system employed, a newly grit blasted or hydroblasted, freshly coated hull will perform better than a hull at the end of its docking cycle, the point is surely to measure how quickly hull performance deteriorates over time in the context of the coating systems applied.

Methods of measurement

For this reason, International Paint has been explicit in detailing the alternative methods that have been used as the means of establishing linkage between the fouling control system selected and potential fuel savings.

Some common methods are as follows:

1. Directly comparing the in-service vessel performance when using one fouling control system over its full lifetime to that of another fouling control system over its full lifetime

2. Directly comparing a period of time in-service prior to dry docking with one fouling control system to the same period after the dry docking and application of a new fouling control system. Different before and after periods can be used and in general are much less than full in-service periods, i.e. 12 months before a dry docking compared to 12 months after application of the 'new' paint system. Other factors need to remain the same e.g. no engine overhaul at drydock.

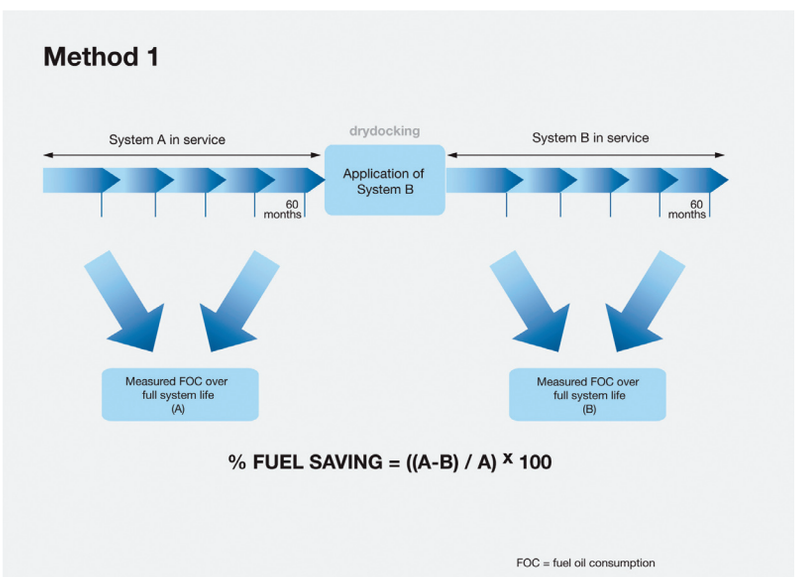
3. Directly measuring the same fouling control system over a given time period. This method uses an 'industry view' that a vessel on average will lose 5% speed over a 60 month period. This 5% speed loss would translate to roughly a maximum average of 15% increase in fuel in order to maintain speed. This assumption is not specific on fouling control type. The baseline data is then compared to the performance predicted or measured in service.

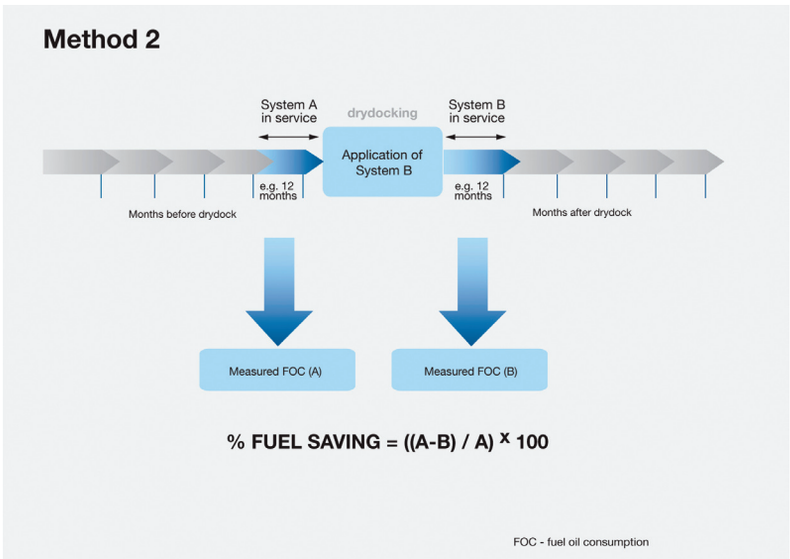
Analysis – using antifoulings as examples

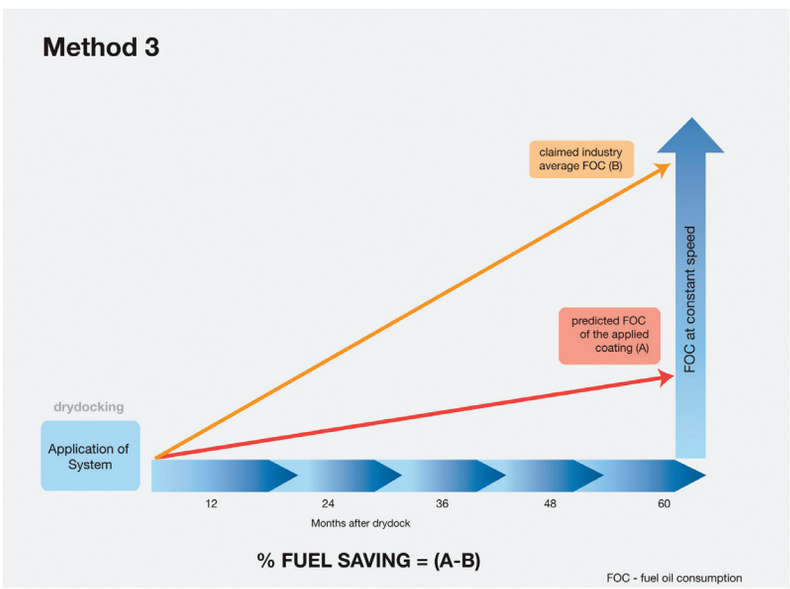
Using method 1, comparing a 60 month docking cycle of a typical rosin-based system with another 60 month docking cycle with Intersmooth® SPC, International Paint has calculated an annual average 4% fuel saving for Intersmooth®SPC over the rosin-based system.

If method 2 were to be used, and compared 12 months before dry dock for a rosin-based system with 12 months after dry dock with Intersmooth®SPC, International Paint has calculated fuel savings would be higher, at 9%. However, as the periods in service are at different time periods in the docking cycle, the company argues that there are limitations of this method, and that the resultant high value of the improvement is misleading. It suggests that this method should not be used.

As for method 3, International Paint points out that in 1986 evidence was published of vessel performance using SPC technology. Townsin et al* showed







that the effect of hull roughness on fuel consumption could be related in a fairly simple formula,

% Power Increase = $A(AHR_2^{-1/3} – AHR_1^{-1/3})$,

that for every increase in hull roughness of 25 microns there would be approximately a one per cent penalty in the fuel consumption of the vessel. For typical rosin based antifouling systems, hull roughness increases by around 40 microns per year. However, due to polishing, smoothing and minimal build up of leached layer, an SPC antifouling increases in roughness by only 20 microns per year.

Therefore for SPC technology, the fuel consumption increase over the full period (of 60 months) would be just under 1% per year, reaching 4% in year 5 (for the vast majority of vessels that return from service in a clean condition).

Using data generated in the comprehensive Townsin paper and a detailed analysis of antifouling performance from Dataplan, the fuel consumption increase over a 60 month period for a rosin based system can be calculated as 15%, the same figure as what has been described as the 'industry view'.

The calculation of 15% is as follows; rosin containing systems were measured to increase in average hull roughness by 40 microns/year. Over a 60 month period, this would be a 200 micron increase. A 25 micron increase in average hull roughness equates to a 1% fuel increase. This means an 8% fuel increase on roughness alone. Between 36 and 60 months a rosin based system is highly likely to foul, typically due to the build up of a large leached layer preventing biocide release. This results in increased roughness and drag. The effect of this on fuel consumption has been measured and then calculated to increase by 7%; this gives the total increase in fuel consumption of 15%.

If *only* SPC products are measured, then the fuel consumption increase over the 60 month period will be 4%. Not being specific on fouling control type highlights a potential flaw in using an 'industry view' average of fuel loss, International Paint says.

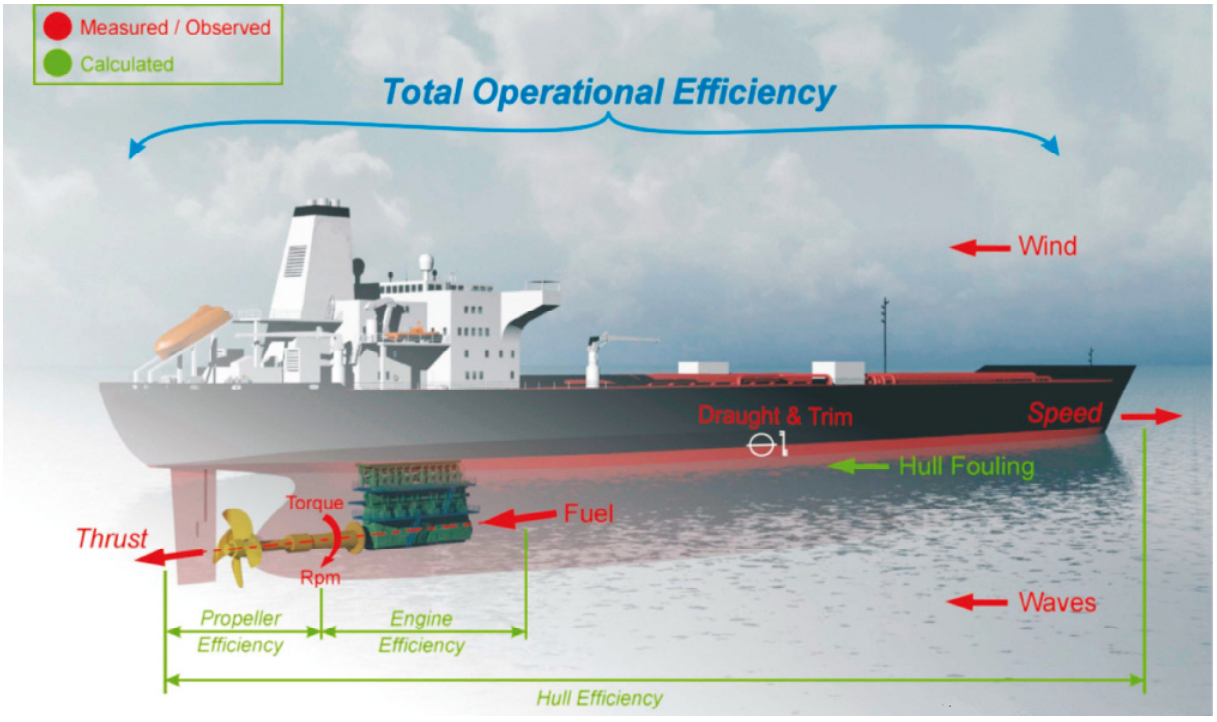
One important omission in Method 3 is that there is no allowance given for any fuel consumption rise effects that are non-fouling related such as a damaged propeller, mechanical damage to the coating or general engine wear and tear.

Going forward, International Paint has stated that it recognises the importance of providing owners with as much information on the performance of its products as it can.

Breaking new ground

The new relationship with BMT looks to do just that; it will provide the independent monitoring that the partners believe will make both the evidence and methodology cited above incontrovertible.

The BMT SMART^{SERVICES} system, developed by BMT ARGOSS, will capture and compile real vessel data and independently monitor and report on vessel performance. It will record data automatically from ships' sensors to monitor engine torque, the speed log, navigational signals (heading and speed over ground), and provide performance information to the crew and to shore-based management for analysis. The system, which can be installed at the newbuilding stage or as a retro-fit, automatically records thousands of



readings per day, providing unparalleled, accurate analysis of vessel performance.

The system will clearly and transparently measure the in-service performance of International Paint's hull coatings, drawing on BMT's 24/7 in house, high quality and validated MetOcean data.

The significance of the MetOcean data gathered automatically from high resolution, highly accurate satellite monitoring for use as part of BMT SMART^{SERVICES} should not be underestimated. While it is clearly essential to monitor information on board, such as the relationship between hull roughness condition and fuel consumption, this information needs to be integrated with the environmental conditions being experienced by the ship. This MetOcean data includes factors such as wind speed and direction, currents (speed and direction) and wave height and direction.

The system has been modelled using weighted performance coefficients to provide the basis for measurement of vessel performance against the condition of the propeller, hull, engine and fuel consumption. In depth analysis can be used to monitor the propulsive performance of a ship and to indicate how much additional power, or fuel, would be required as a consequence of the combined effects of weather and fouling or of the isolated effects of fouling on the hull or propeller. This analysis enables data trending which can be used to optimise any scheduling of hull and propeller cleaning events and can be subsequently used to quantify the effectiveness of any such events.

To ensure complete data integrity, all information collected will be sent to BMT. The client and International Paint will be able to view vessel data in graphical or tabular form to develop trend analysis via a secure access web interface but the data cannot be changed or manipulated.

Wider benefits

The consortium points out that accurate monitoring has several benefits for the ship operator:

1. Proof of compliance to charter agreements

2. Ability to determine the energy efficiency of the vessel within the EEOI (Energy Efficiency Operational Index) encompassed in the SEEMP (Ship Energy Efficiency Management Plan) guidelines.

3. Ability to act immediately on anything adversely affecting the optimum running of the vessel e.g. hull fouling, propeller fouling, trim optimisation, hull damage etc.

In achieving these benefits, it is essential to be able to show that there is an agreed way of recording standardised data, using an agreed scientific approach that will be generally accepted by the industry.

International Paint and BMT say they want to provide shipowners and operators with information in a completely open and transparent way to provide clarity to those using the information. They want owners to get fuel saving benefits, but want to make sure that there is a complete understanding of the actual savings possible rather than just accepting the largest number. It is from many years of proven in-service performance with data from owner/operators, from Dataplan and from independent testimony that they say they know exactly what benefits each of their technology types can deliver. They believe that this new partnership will make that knowledge completely transparent.

**Townsin et al paper entitled 'Fuel economy due to improvements in ship hull surface condition 1976-1986', (Maritime Technical Information Facility, last modified July 27, 1994).*