

Proving the Benefits of Foul Release Coatings

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International's Fouling Control Range

International Paint have been at the forefront of fouling control for a number of years

- International have the widest selection of fouling control technologies available which empowers the ship operator to make the choice of product which is right for their requirements
- Our Intersleek[®] foul release products are one of many different technologies available which are
 - Biocide-free
 - High solids
 - Low in volatile organic compounds (VOC) content
- Foul release coatings operate through a pure physical means and influence the settlement and adhesive strength of fouling organisms



 **International.**

Developments in Foul Release

Foul release coatings have been commercially available for over 18 years

- Based on polydimethyl siloxane chemistry (“Silicones”), the first commercial product, Intersleek®425 was launched in 1996 for fast craft >25 knots
- Over the years, the technology has been tailored to suit wider vessel applications and market concerns
 - Intersleek®700 launched in 1999 as the first silicone system for the liner trade
 - Intersleek®900, the first fluoropolymer, launched in 2007 for the wider market of bulkers & tankers as well as to tackle the growing concern of slime.
 - Intersleek®1100SR launched in 2013 specifically targeting slime formation



Intersleek®700 on VLCC after 60 months



Intersleek®900 (red) on postpanamax containership after 60 months compared to Intersleek®700 (grey)



Intersleek®1100SR (left) on LNG carrier after 25 months compared to Intersleek®700 (top) and Intersleek®900 (right)

Propeller Coatings

Intersleek® foul release technology has been used to coat propellers for a number of years

- Ship operator reports indicated potential to reduce noise, vibration and fuel consumption
- Study by Mutton et al however failed to confirm any of these findings
- Main positive effect of coating propellers with foul release coatings is that they are protected from fouling
 - Annually, around 50 propellers are coated



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Fuel Savings

One of the most discussed attribute of foul release coatings is their ability to generate fuel savings

- The main aspect to consider about fuel savings is how they are measured and where they come from;
 - **Technology provider** may give simulated or actual data to show fuel savings
 - **Customer** of the technology provider may provide testimonial evidence of fuel savings
 - Assessment of data by **independent specialists** may show evidence of fuel savings
- All of these methods to show fuel savings still leaves uncertainty in the minds of the customer
- Only way to demonstrate fuel savings is an **independent** and **transparent** standardised methodology for the collection of data from vessels
- International with Intersleek® have been very vocal about the fuel saving potential



Fuel Savings – How it Started

The most common source of fuel saving is from customer testimony

- For foul release coatings, the first customer testimony comes from Buqubus Espania S.A.
- *“The most important result to mention is that the benefit of using Intersleek has been immediate. For instance, in our catamarans we have found an increase in their speed of 1 to 1½ knots, and in the single hulls it has been of 1½ to 2 knots.”*
- Similar results were also observed in the speed trials for the Patricia Olivia II which was coated in Intersleek® 425¹

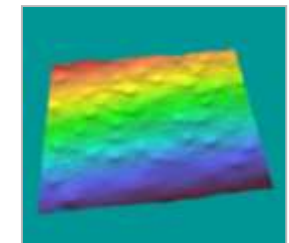
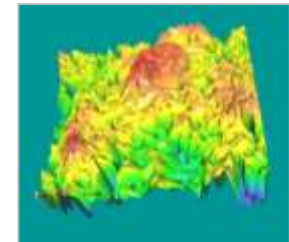


¹ J. Bonafoux, G. Higgins, "Patricia Olivia II. Development of the first 50+ Knot Fast Ferry in North America." 15th Fast Ferry International Conference, Boston, Massachusetts, February 1999

Why do Foul Release Coatings result in Fuel Savings?

Foul release coatings give the smoothest commercially applied films

- Due to their basic chemistry, foul release coatings naturally spread out when applied
- Self-leveling of foul release coatings can even mask the roughness of earlier fouling control systems
- Surface roughness increases of 20-25 microns, in the form of Rt50 is attributed to increase power requirement for vessels by 1%¹
- Having smooth films at the start of a docking cycle gives the vessel the best opportunity for efficient operations

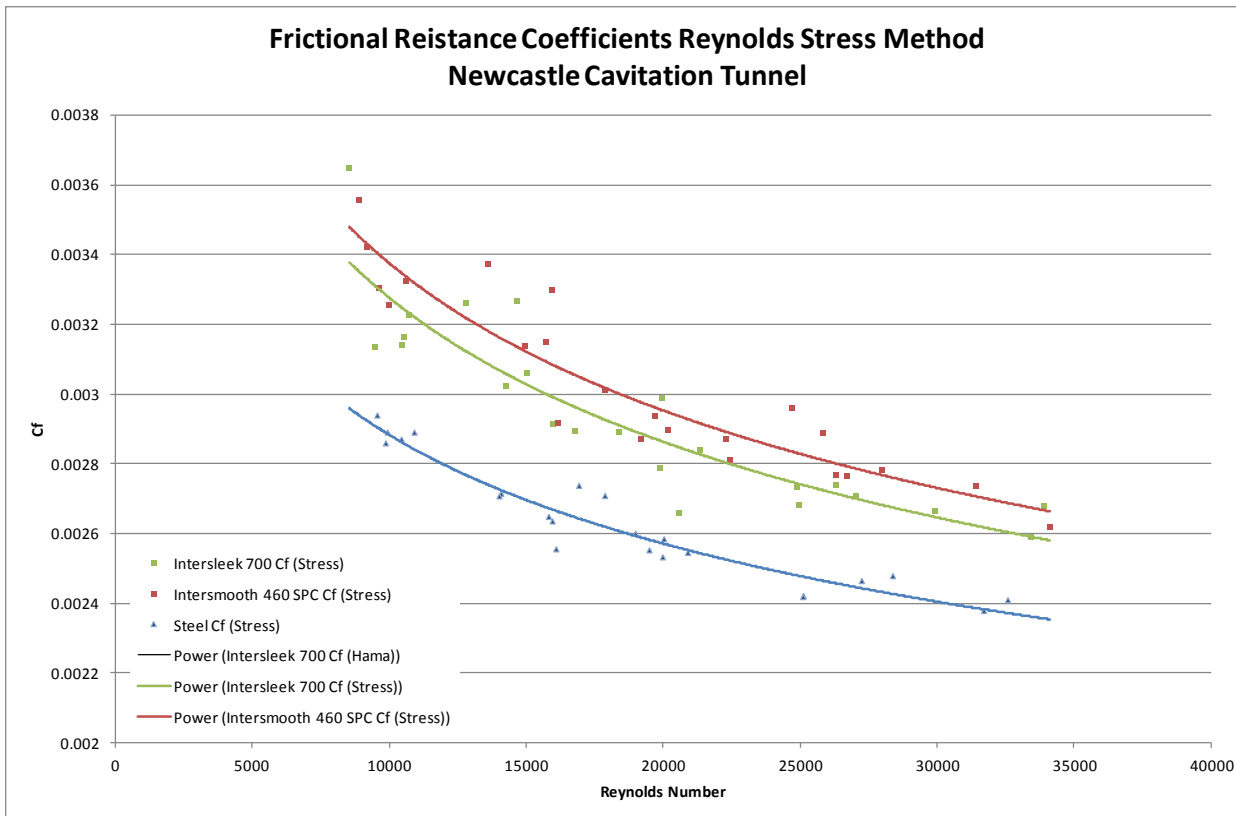


CDP with Intersleek®
scheme using
Intersleek®7180 Linkcoat

¹R.L. Townsin, D. Bryne, T.E. Svensen and A. Milne, Fuel Economy Due to Improvements in Ships Hull surface Condition 1976-1986, Published International Shipbuilding Progress, 33 (383), July 1986

Why do Foul Release Coatings result in Fuel Savings?

Hydrodynamic studies¹ in the late 1990's and early 2000's showed film smoothness for foul release coatings influenced frictional resistance

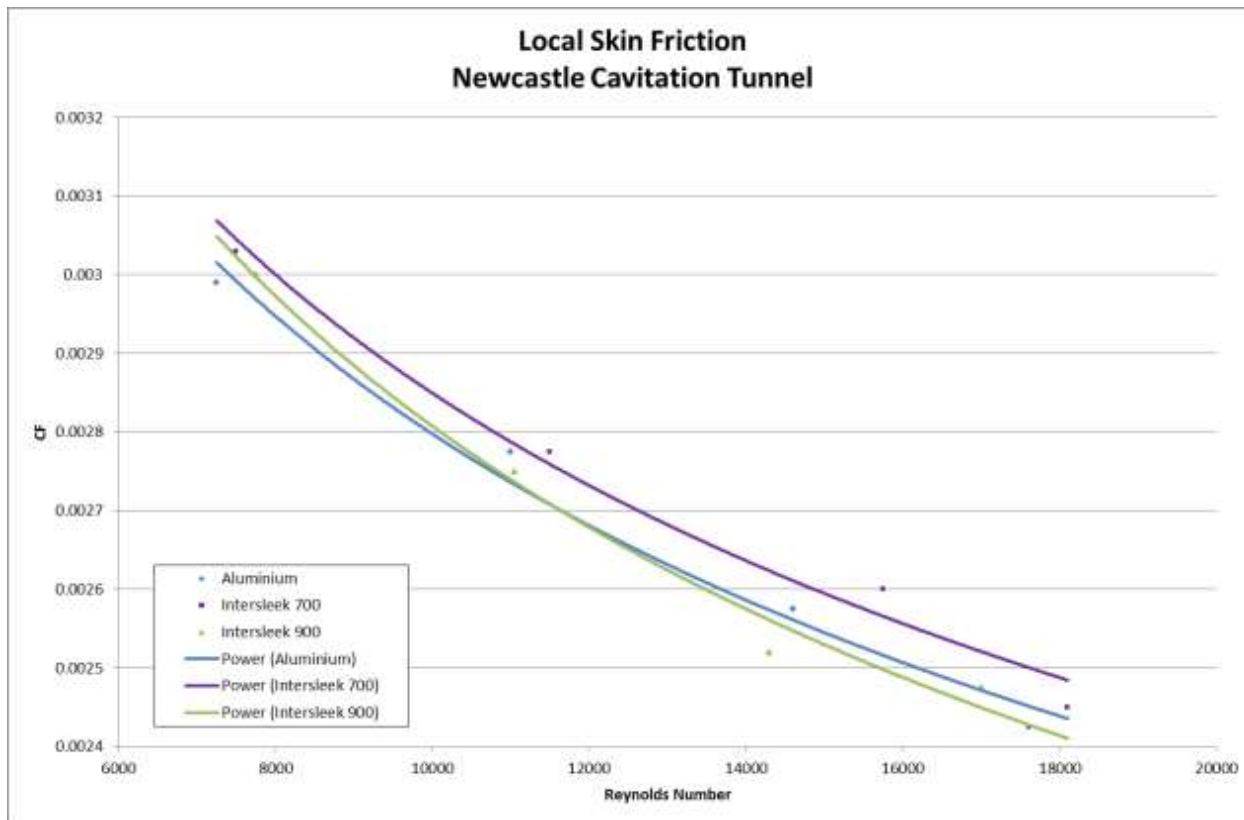


- Intersleek[®] foul release showed to significantly reduce frictional resistance compared to antifouling
- Evidence that both surface roughness and compliance of the coating contributed to the reduced friction

¹M. Candries, Drag, Boundary-Layer and Roughness Characteristics of Marine Surfaces Coated with Antifouling, Thesis, December 2001

Why do Foul Release Coatings result in Fuel Savings?

EU-funded project AMBIO hydrodynamic studies¹ in the 2009 showed that foul release technologies also influenced skin friction



¹Atlar M, Unal B, Unal UO, Politis G, Martinelli E, Galli G, Davies C, Williams D. An experimental investigation of the frictional drag characteristics of nanostructured and fluorinated fouling-release coatings using an axisymmetric body. *Biofouling* 2013, 29(1), 39-52.

Can These Customers all be Wrong?

Inco Ships get free ride with Intersleek® 900

Sydney based Inco Ships Pty Ltd. were the very first

Wightlink get faster!

With a total fleet of eleven ferries and three catamarans, Wightlink Ltd operates on average 68,000 sailings a year. Carrying 5.5 million passengers annually, Wightlink's key focus on the Fastcat routes is vessel speed and efficiency.

Committed to operational excellence, the company which began over 100 years ago, wanted to use the best foul release coating technology available for their three fast ferries. After comparing various in-service performance results on their vessels they selected Intersleek® 900.

April, May and July 2008 saw the dry-docking of the vessels 'Fastcat Ryde', 'Our Lady Pamela' and 'Fastcat Shankin' respectively. These vessels all typically operate at a speed of 30-35 knots.

The vertical sides of all three vessels were coated with Intersleek® 900, offering exceptional cost benefits, including improved fuel consumption and reduced emissions.

In conjunction with major engine overhauls on the Fastcats Ryde and Shankin, Wightlink have kept a close watch on the effect of Intersleek® 900 and have identified a significant speed increase after application. The Fastcats now run at a reduced engine rpm complemented by associated fuel savings.

Intersleek® 900 represents the latest advances in foul release technology offering excellent performance benefits, very low levels of hull roughness and an exceptionally smooth surface.

Mercator Lines reduces consumption by up to 9%

Mercator Lines Ltd is one of India's fastest growing shipping firms. With a diverse fleet including tankers and bulk carriers, they are pioneers of latest generation Intersleek® technology.

Mercator Lines Ltd are proud to be the first shipping company in the Indian sub-continent to apply Intersleek® 900 foul release coating. In October 2007, Intersleek® 900 was applied to the underwater hull of MT 'Prem Pride', a 109,610 dwt Amaxmax operating at 14-16 knots, in Dubai. Having witnessed positive in-service performance results, Mercator Lines Ltd applied Intersleek® 900 on the 'Prem Divya' in June 2008.

Mr Anil Agawil, General Manager of Mercator Lines Ltd commented, "We continued to closely monitor the performance of both vessels in service. In 2008 we achieved up to 8% fuel savings on 'Prem Pride' using Intersleek® 900. This year, with even more data, we can confirm that the fuel and emission savings have been maintained on this vessel."

"Whilst we continue to be happy with the performance of Intersleek® 900 on the 'Prem Pride', we fully expected an improvement on the 'Prem Divya' as we had increased the area of the underwater hull coated to include the flat bottom. The detailed monitoring of the performance of the 'Prem Divya' has confirmed that we are now achieving up to a 9% reduction in fuel consumption under comparable conditions."

With the resulting combined fuel consumption savings the coating has reduced emissions to the environment by almost 11,000 tonnes of CO₂, 100 tonnes of SO_x and 200 tonnes of NO_x.

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Visit our website: www.international-marine.com



"K" Line reduces emissions with Intersleek® 900

Kawasaki ("K" Line) world's 1st operator is committing the envite of their fleet

"K" Line was the first to apply Intersleek® 900 coating on its 'Comma Ace'

Following hull and applicable October 2008, efficiency class the efficiency in Australia and Japan was over 2%.

For "K" Line, it continued to be

Resistance to a number of oil cargo oil flow rate periods in the 20 day trial was carried out

Reduced fuel in China in May only limited to 2000 tonnes a day, a solvent emission



Cunard makes ro with Intersleek® 900

Qunard, the famous brand operated by Carnival UK, has confirmed significant savings on its flagship liner Queen Mary 2 since converting from a silyl-based TBT-free self-polishing copolymer antifouling in November 2008 to International Paint's fluoropolymer foul release coating Intersleek® 900

From its own detailed studies on the propulsion efficiency of Queen Mary 2, Cunard has confirmed that since the application of the Intersleek® 900 system to the vertical sides, vessel efficiency has improved by over 10%.

Mr. Romie Kier, Chief Engineer of Queen Mary 2, explains how this was calculated: "Prior to the drydocking, in order to achieve the necessary speeds to meet our demanding schedule, we would need to utilise all four 34,800kW diesel engines and not a single one"



National Shipping Company of Saudi Arabia (NSCSA) Reduces CO₂ Emissions by over 20,000 MT with Intersleek® Foul Release Coating

Mideast Ship Management (owned by The National Shipping Company of Saudi Arabia "NSCSA") manages a fleet of over 30 vessels including 17 Very Large Crude Carriers (VLCC's) owned by NSCSA. The company is committed to maximising vessel efficiency and reducing Greenhouse Gas (GHG) emissions.

During 2006 and 2007, Mideast converted eight VLCC's from self polishing copolymer (SPC) biocidal antifoulings, to our biocide free, silicone based foul release technology, Intersleek® 700.

The vertical sides of the VLCC m.v. Ramlah, were blasted and coated with Intersleek® 700 and following application, detailed performance monitoring was carried out.

The analysis covered the entire docking period prior to the application of the Intersleek® 700 system (60 months) and the performance to date since application (up to 64 months).

The results showed an overall 6.4% improvement in fuel efficiency compared to the previous SPC coating, which can be directly attributed to the in-service performance of Intersleek® 700. This data has been independently verified by vessel performance specialists BMT.

This 6.4% efficiency improvement means a saving of over 6,500 MT of fuel or more than US \$3.2 million (at \$500/tonne). Translating this into emission savings, this reduction in fuel consumption has prevented over 20,000 MT of CO₂ being emitted into the atmosphere.



REDUCTION IN CO₂ EMISSIONS AND FUEL CONSUMPTION ACHIEVED WITH INTERSLEEK® 700 OVER 64 MONTHS



Interested in finding out how your company could benefit from using Intersleek® 700?

Call: +44 (0)7920 727 124 / +44 (0)191 401 2584

Send an email: john.wilsher@akzonobel.com

Visit our website: www.international-marine.com/intersleek



Taking the Independent Step

International Paint believe that independence in determining fuel savings is the most important factor for credibility

- In 2010, James Corbett from the Energy & Environmental Research Associates published his paper concluding that foul release coatings could achieve savings on average of up to 10%¹
- In 2012 International Paint partnered with BMT in recognition that their automated vessel monitoring and analytical package offered the ship owner independent proof of the performance of our products
- We are the technology leaders in understanding how marine biology and hydrodynamics influence vessel efficiency through continuing to work with and fund leading academic institutes around the world
- We participate in the ISO working group for the development of the standard for determining hull and propeller performance

¹Energy and GHG Emissions Savings Analysis of Fluoropolymer Foul Release Hull Coating, Energy & Environmental Research Associates, December 2010.

Taking the Validation Step

In 2014, International Paint announced the first voluntary carbon credit initiative for shipping

- Based on fuel and emission savings calculated from the vessels' own data, the generation of carbon credits give complete independent proof of fuel savings
 - Publically available and peer-reviewed methodology detailing how to calculate emission savings
 - Third party independent auditing of the emission savings
 - Third party independent validation of the emission savings by The Gold Standard
 - For every **3 carbon credits** issued, there is independent validation of **1 tonne** of fuel saved
 - The first claim has been submitted for almost **130,000 carbon credits** for two ship operators
 - Equivalent to just over **41,000 tonnes** of fuel saved

In Conclusion

Fuel saving claims from technology providers can be real and unexaggerated

- Technologies do exist which can save fuel in the marine industry
 - Foul release coatings are one of many options available
 - Significant quantities of scientific and real in-service data exists to support this
- However, in order to reduce skepticism and doubt, the process of calculating the saving must be
 - Robust
 - Reproducible
 - Transparent
 - Independent
- With our carbon credit generating methodology, we feel that we have demonstrated those key attributes

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Thank you for your attention



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