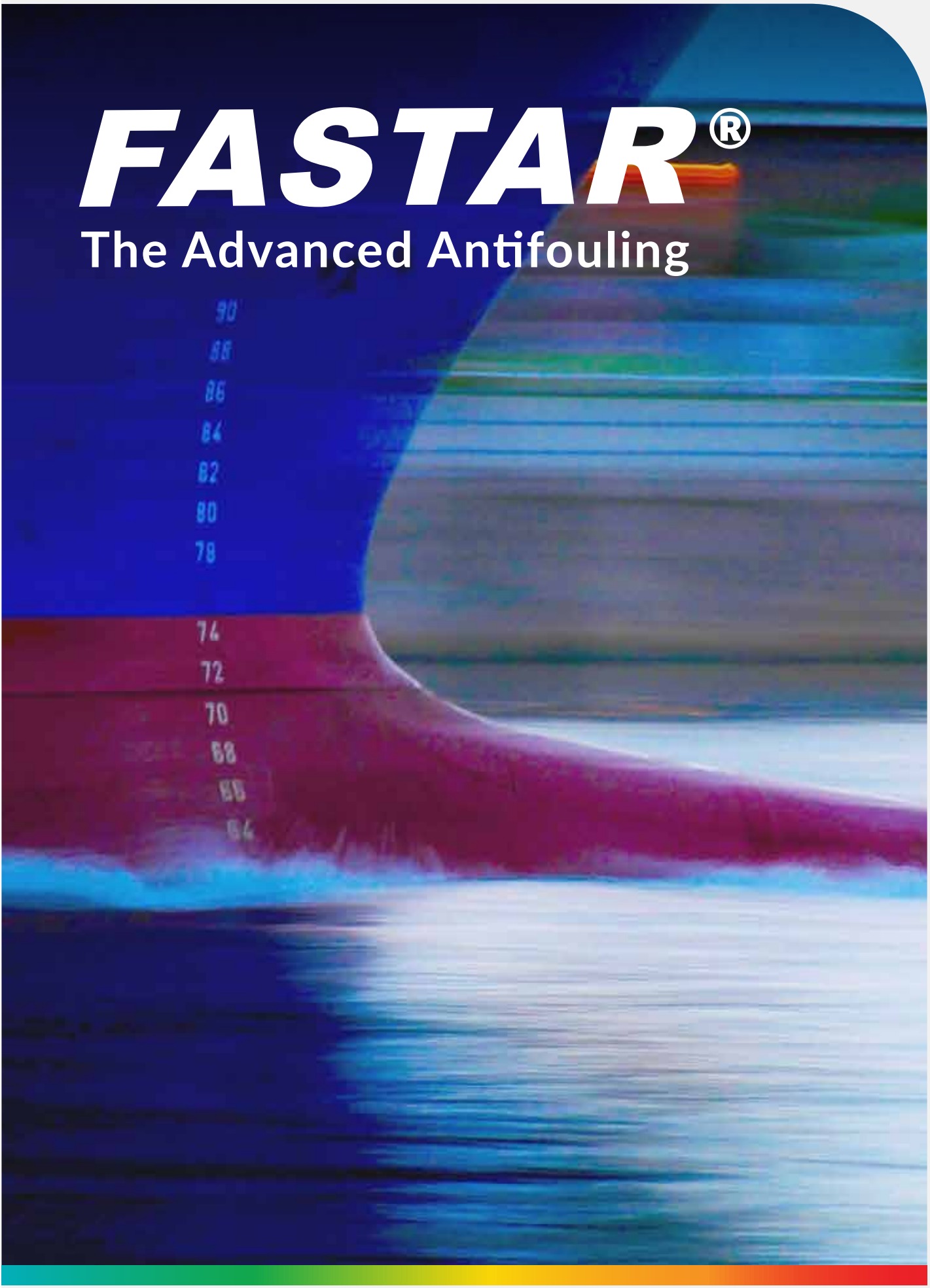
FASTAR®

The Advanced Antifouling



PRECISE · PREDICTABLE · PERFORMANCE

NIPPON PAINT MARINE

MILESTONES

1881 Nippon Paint founded and starts to manufacture marine paint products.

1911 Patents world's first antifouling paint (Patent No.20599) and starts production of antifouling systems for Japan's domestic fleet.

1927 Company renamed Nippon Paint Co., Ltd.

1952 Vinilex, an antifouling paint that uses vinyl, is introduced to the marine industry.

1973 Marine Seafront Research Centre was established in Okayama.

1978 First self-polishing copolymer antifouling paints launched.

1980 The company's marine division is rebranded Nippon Paint Marine Coatings Co., Ltd.

1990 World's first tin-free self-polishing copolymer antifouling paint ECOLOFLEX is introduced.

1997 Nippon Paint Marine's advanced anticorrosive 'self-indicating' system NOA is launched.

2003 Awarded ISO 14001 certification.

2006 Nippon Paint Marine patents its unique Hydrogel.

2008 The low friction antifouling paint LF-SEA is launched. The coating is the first to adopt Nippon Paint Marine's Hydrogel water-trapping system.

2013 The ultra-low friction antifouling paint A-LF-SEA is launched.

2017 The world's first completely biocide-free self-polishing coating AQUATERRAS is introduced.

Present Introduction of FASTAR the industry's first antifouling coating with a nanodomain structure.

FASTAR®

PRECISE · PREDICTABLE · PERFORMANCE

With the 2021 introduction of FASTAR, Nippon Paint Marine has once again pushed the boundaries of what is possible from a self-polishing copolymer antifouling paint.

Inspired by the unique microdomain structure of its biocide-free self-polishing coating, AQUATERRAS, FASTAR's game-changing nanodomain structure not only sets the benchmark high in terms of delivering precise, predictable antifouling performance, but also improves drydock efficiency, reduces application time, drydocking costs, fuel consumption and carbon emissions.

It is by precisely controlling the release of biocides that Nippon Paint Marine has been able to deliver a high-performing, low-polishing antifouling system that not only delivers unprecedented commercial benefits but also helps shipowners and operators meet emissions abatement and energy efficiency targets.

FASTAR is a radically new generation of self-polishing and self-smoothing antifouling paint that nanodomain inducing resin technology.

A TOMORROW TECHNOLOGY TODAY

FASTAR, a self-polishing copolymer antifouling paint that uses completely new hydrophilic and hydrophobic nanodomain inducing components to precisely control the release of biocides.

This new approach delivers the ultimate in fouling protection.

With FASTAR, biocide release is carefully regulated by its nanodomain structure. Its biocide delivery is more precise.

FASTAR provides a consistent 90-month performance and is less affected by any change in conditions, such as higher sea water temperatures, or a ship's operating speed.

FASTAR XI and FASTAR XII include Nippon Paint marine's proprietary Hydrogel water trapping technology, HydroSmoothXT™.

- Nanotechnology Biocide Control
- Hydrogel water trapping technology, HydroSmoothXT™ included as an option for ultra-low friction
- Maximum biocide release efficiency
- Precise polishing / optimum antifouling

- Up to 14.1% fuel savings compared to market average
- Low average speed loss down to 1.2% over 60M
- Application and drydock time reduced by as much as 37%
- Low friction
- Up to 60 idling days
- Up to 90 months dry dock interval
- Lower VOC and CO_2 emissions
- Environmentally friendly by associating with UN's Sustainable Development Goals*

SUSTAINABLE DEVELOPMENT GOALS

Nippon Paint Marine is certified to ISO 14001 environmental standards and manufactures coatings in line with UN Sustainable Development Goals

	FASTAR I	FASTAR II	FASTAR XI	FASTAR XII
Technology	Self polishing & self smoothing antifouling with hydrophilic & hydrophobic nanodomain structure			
Fuel Efficiency	8.7% Fuel Saving 3% Speed Loss over 60M service interval Low friction		14.1% Fuel Saving 1.2% Speed Loss over 60M service interval Ultra Low Friction	
Dry Dock Efficiency	Cost & time saving Reduce application & overcoating time Excellent application property in cold and warm environments			
Idling Days	Up to 60 days			
Dry Dock Interval	90 Months			
Environmentally Friendly	High volume solids (59%) Lower paint film thickness required Low CO_2 and VOC emissions			
Nano Domain Technology	Supreme Antifouling Efficacy with Controlled-Biocide-Release			
Recommended for slow steaming & tropical water	N/A	★	N/A	★
HydroSmoothXT™ (Hydrogel Water Trapping Technology)	-		★ Enhanced lower friction	
Hydrodynamic Efficiency	-		★	

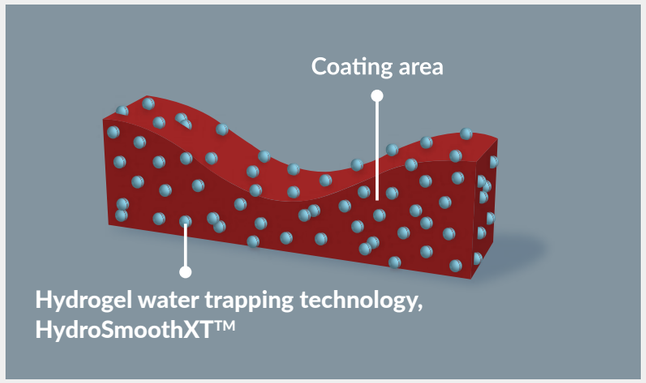
** Performance claims subject to vessel size, operating profile and correct application*

According to MARINTEK, a typical ship experiences a 5.9% speed loss over 60M, leading to a 17.7% increase in fuel consumption. FASTAR XI, validated by the ISO 19030 method, achieves 1.2% speed loss, resulting in up to 14.1% fuel savings compared to the market average speed loss.

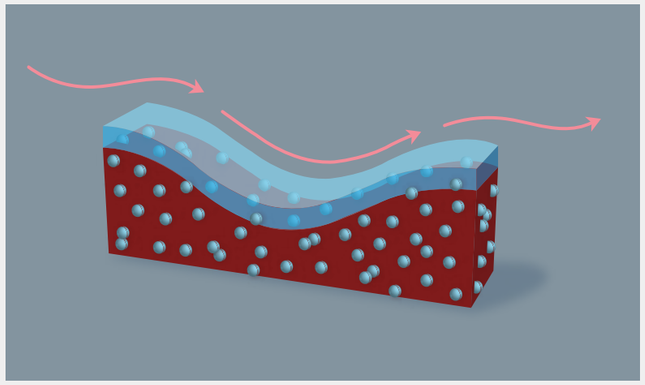
This demonstrates our advanced technology's effectiveness, providing significant cost savings and contributing to environmental sustainability by reducing greenhouse gas emissions.

Source:
Second IMO GHG study 2009, MEPC 59/INF.10, section A2.63
Market average speed loss data by MARINTEK Trond Larsen SOPRAN Report

HydroSmoothXT™

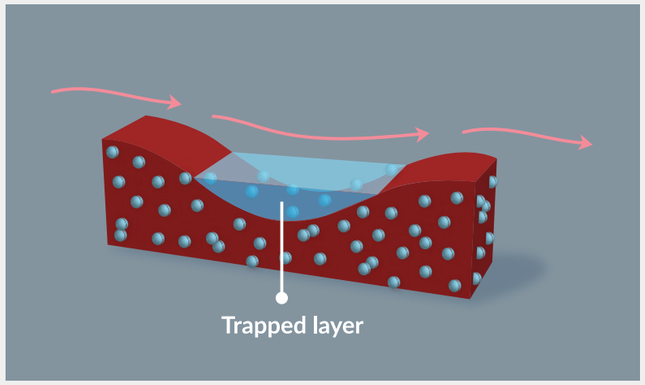


Nippon Paint Marine developed Hydrogel water trapping technology, HydroSmoothXT™ antifouling following extensive research into the skin structure of tuna fish. This was found to contain a mechanism that repels water.



HydroSmoothXT™ is a crosslinked, three-dimesional hydrophilic polymer that does not dissolve in water. It is highly absorbent yet maintains well defined structures.

HydroSmoothXT™ properties underpin several applications, especially in the biomedical and marine coatings area.



In Nippon Paint Marine antifouling products, HydroSmoothXT™ traps a microscopic layer of water on the coating's surface as the ship moves through the water.

This smooths the water flow around the hull, creating a slippery surface which significantly reduces hull-to-water friction. HydroSmoothXT™ significantly lower fuel consumption.

Nippon Paint Marine was the first to use and patent HydroSmoothXT™ in self-polishing antifouling paints creating the world's first low-friction coating LF-SEA, in 2008.

Since then, Nippon Paint Marine has applied Hydrogel-based coatings to more than 5,000 ships.

PRECISION

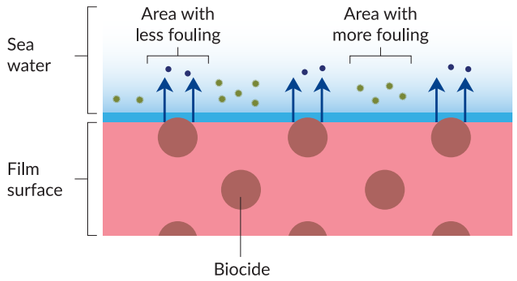
Typical antifouling performance becomes less reliable when the seawater polishing rate is low. This is not the case with FASTAR.

FASTAR's unique nano-sized hydrophilic and hydrophobic resin structure minimises the effect that seawater temperatures, vessel speeds and other external factors have on coating performance.

Nano sized hydrophilic components spread the antifouling components over a wider area, while the nano hydrophobic elements ensure the antifouling biocides are retained in the surface layer.

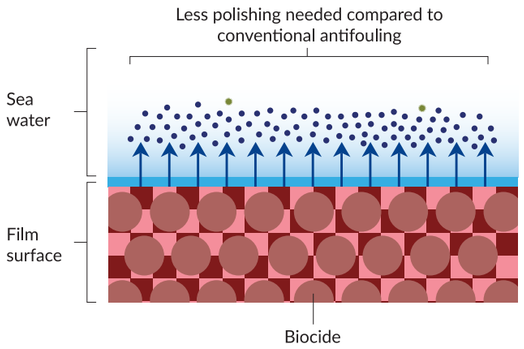
This means the release of active biocide ions are more precisely controlled, resulting in consistent antifouling performance up to 90 months from a reduced coating volume. The hull is clean for longer, even in idle periods or when slow steaming.

Conventional antifouling in operation

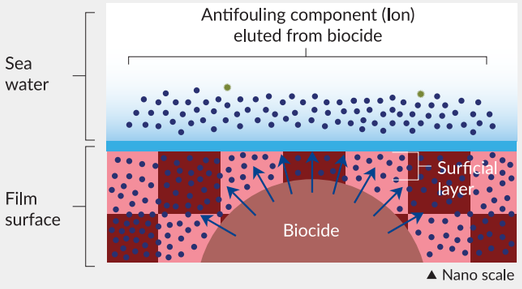


- Non-domain binders limited to control biocide release
- Uncontrolled seawater polishing results in hydrophilic surface only
- It requires more polishing to ensure better performance.
- Biocides deplete resulting in increased fouling
- Increased dry film thickness or remedial coatings are required

FASTAR antifouling in operation



- Unique hydrophobic and hydrophilic nanodomain structured binder provides polishing precision
- Controlled biocide release across the entire coated surface
- Lower dry film thickness than existing self-polishing copolymer coatings
- Hydrogel water trapping technology, HydroSmoothXT™ included as an option for greater fuel savings

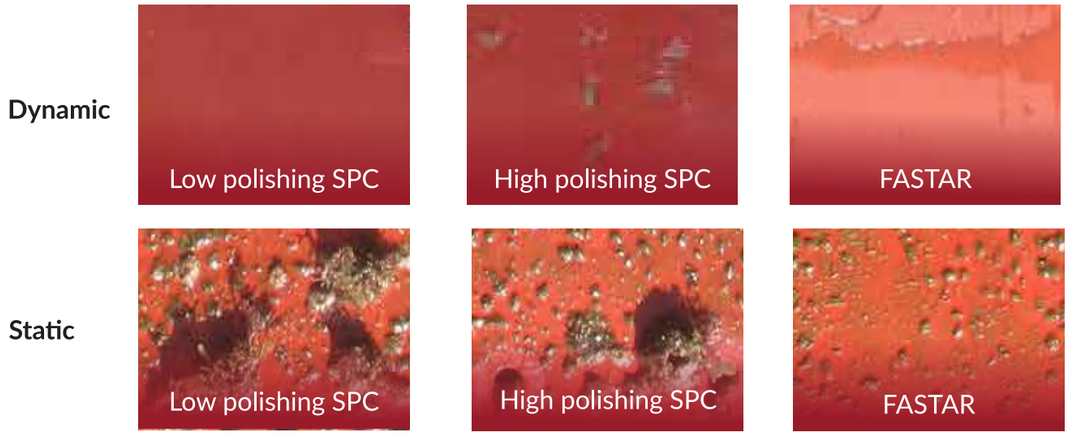


Hydrophilic domain

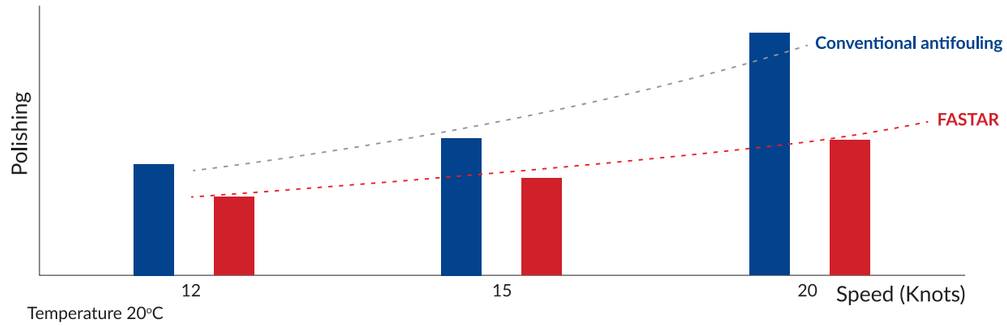
Hydrophobic domain

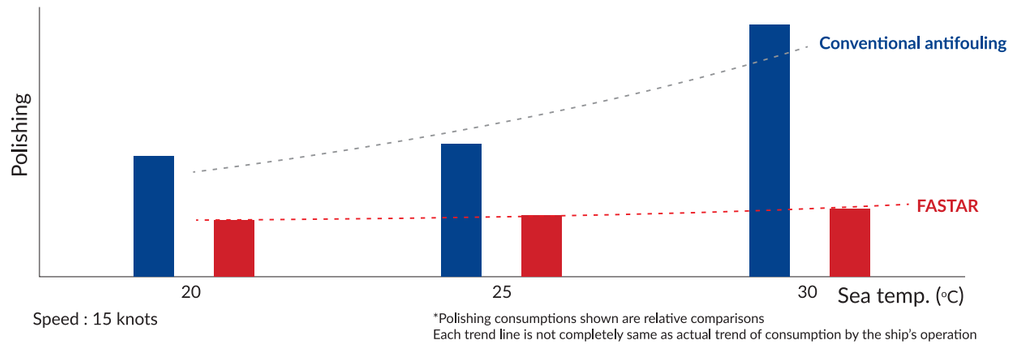
PERFORMANCE

Test patches after 12 months immersion in 75% dynamic conditions at 14 knots and in seawater temperatures of up to 30°C showed consistent polishing rates compared to conventional SPC antifouling technologies. In both cases, the FASTAR hull was free from fouling after 12 months.



Polished thickness measured by seawater temperatures (20°C, 25°C & 30°C) and increase in speed (12kts, 15kts & 20kts).





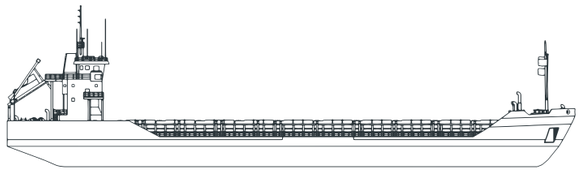
*Polishing consumptions shown are relative comparisons
Each trend line is not completely same as actual trend of consumption by the ship's operation

Conventional antifouling

FASTAR

PREDICTABILITY

FASTAR requires less paint and takes up to 37% less time to apply and dry than conventional self-polishing copolymer antifouling paints. Proven reductions in fuel consumption correlate to a corresponding reduction in carbon emissions.



For a bulk carrier with 70% activity, operating at 14kts in seawater temperatures of 24°C, a FASTAR scheme provides 60 months of service from a dry film thickness of 200µm on the vertical sides and a 120µm coat of on the flat bottom.

A conventional antifouling covering the same 2,000m2 area would require 260µm on the sides and 170µm on the flat bottom; or 775 litres of paint versus 1,038 litres.

Pos.	Area m^2	Product Name	Colour	Volume Solid %	DFT µm	Practical Coverage m^2 / Ltr	Quantity practical L
1	**1.000**	**Flat Bottom** **14 knots, activity 256 days/year, 60 months, 24°C average seawater temperature**					
1	1.000	FASTAR XI	Red Brown	59	120	3.44	291
One coat					**120**		
2	**1.000**	**Vertical Sides** **14 knots, activity 256 days/year, 60 months, 24°C average seawater temperature**					
1	1.000	FASTAR XI	Dark Brown	59	100	4.13	242
2	1.000	FASTAR XI	Red Brown	59	100	4.13	242
Two coats					**200**		

For a containership with 80% activity, operating at 18kts in seawater temperatures of 26°C, a FASTAR scheme provides 60 months of service from a dry film thickness of 260µm on the vertical sides and a 160µm coat of on the flat bottom.

A conventional antifouling covering the same 2,000m2 area would require 330µm on the sides and 220µm on the flat bottom; or 1,018 litres of paint versus 1,330 litres.

Pos.	Area m^2	Product Name	Colour	Volume Solid %	DFT µm	Practical Coverage m^2 / Ltr	Quantity practical L
1	**1.000**	**Flat Bottom** **18 knots, activity 292 days/year, 60 months, 26°C average seawater temperature**					
1	1.000	FASTAR XI	Dark Brown	59	80	5.16	194
2	1.000	FASTAR XI	Red Brown	59	80	5.16	194
One coat					**160**		
2	**1.000**	**Vertical Sides** **18 knots, activity 292 days/year, 60 months, 26°C average seawater temperature**					
1	1.000	FASTAR XI	Dark Brown	59	130	3.18	315
2	1.000	FASTAR XI	Red Brown	59	130	3.18	315
Two coats					**260**		

Nippon Paint Marine has been producing marine coatings since the 1880s and is widely regarded as a pioneer in the development hull protection and antifouling paints.

Nippon Paint Marine is certified to ISO 14001 environmental standards and manufactures coatings in line with UN Sustainable Development Goals.

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