Catalogue NO. NPMC-081-E2

100 years

NIPPON PAINT'S ANTI-FOULING


Ultra Fuel Oil Saving A/F

# A-LF-Sea

Advanced Low Friction Coating

## Advanced Formula

Verified fuel-saving
Reduced $CO_2$ emissions
Biomimetic Technology

2019
Japan's Environment Minister's Award
for Global Warming Prevention Activities

We can Save the Earth
Minister of the Environment

NIPPON PAINT MARINE

# A-LF-Sea provides more fuel saving effect.

2007 2008 2009 2010 2011 2012 2013 (year) Current

**4%**
**Fuel saving type**

Version currently in use **LF-Sea**

eco products awards 2010

Co-development with
Osaka University and
Kobe University

KOBE UNIVERSITY OSAKA UNIVERSITY

**10%**
**Fuel saving type**

Advanced version **A-LF-Sea**

Support project by Japanese Government (MLIT*)

Co-study with ClassNK ClassNK R&D PROJECT

Co-monitored with MOL

## Project Background

**A-LF-Sea** is advanced version of Nippon Paint's successful low friction antifouling paint LF-Sea. This highly sophisticated self-polishing technology has been developed and refined together with ClassNK and MOL with support from the Japanese government (MLIT*).
By enhancing LF-Sea's verified technology and combining it into Nippon Paint's copper silyl acrylate copolymer, the new product delivers an improved synthetic biomimetic water trapping function. Combined with a unique super-smooth anticorrosive system developed from our automotive coatings and the new system drastically reduces ship's frictional resistance. Reduction of ship's frictional footprints in this way will translate into 10%** fuel savings and an equivalent reduction in $CO_2$ emissions.

*MLIT:Ministry of land, infrastructure, transport and tourism

**Percentages quoted compare the power saving benefit of the system to a clean SPC A/F in good condition at the same point in the vessel's docking cycle

## FEATURES

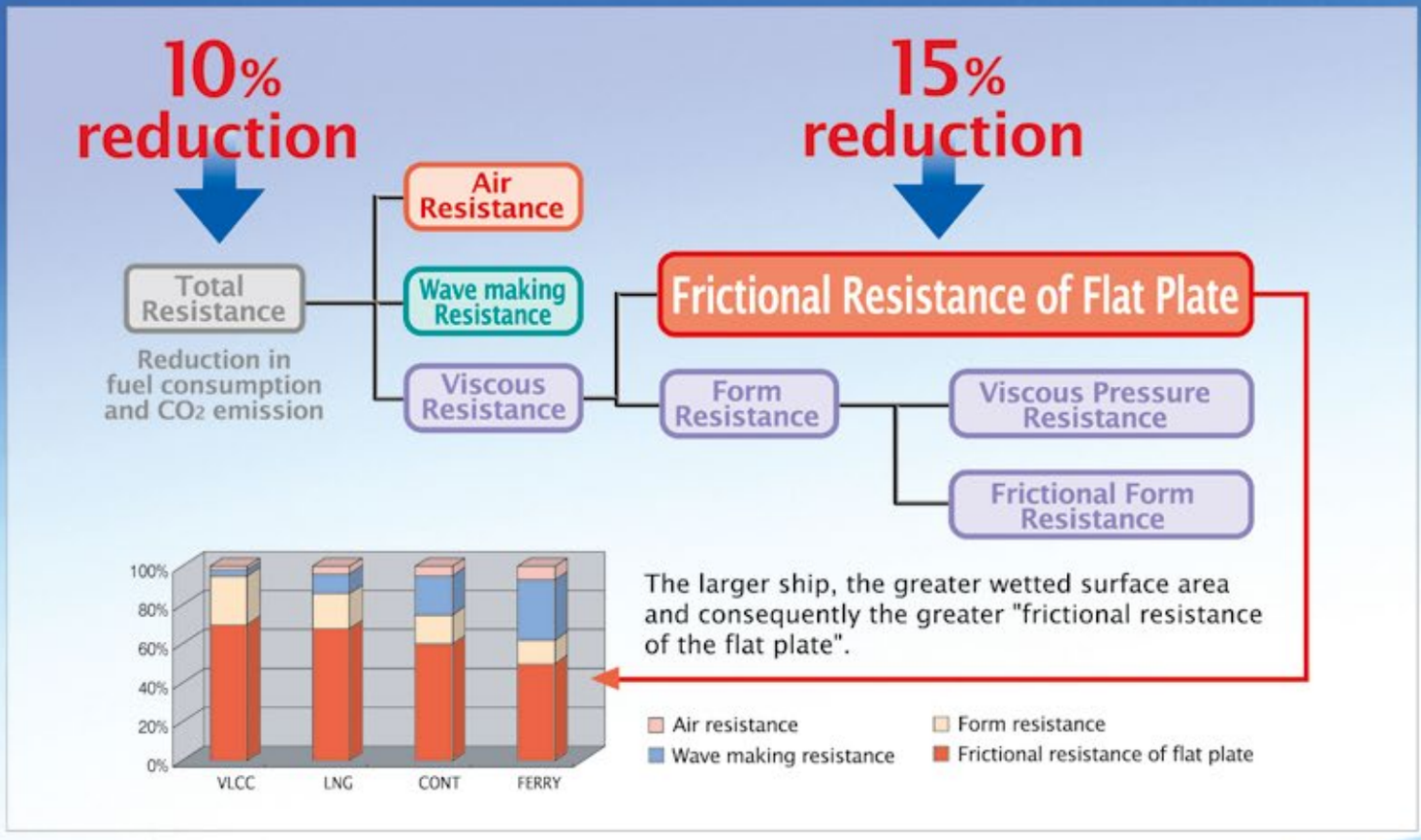
- Antifouling with copper silyl acrylate copolymer (support for 5 year specification)
- Extra-low friction & Advanced fuel-saving Antifouling
- Water trapping technology
- Rheological control adopted to A/C system
- Cost effective and easy budget management
- Direct application over existing antifouling without performing a full blasting
- Applicable using standard painting practice and equipment

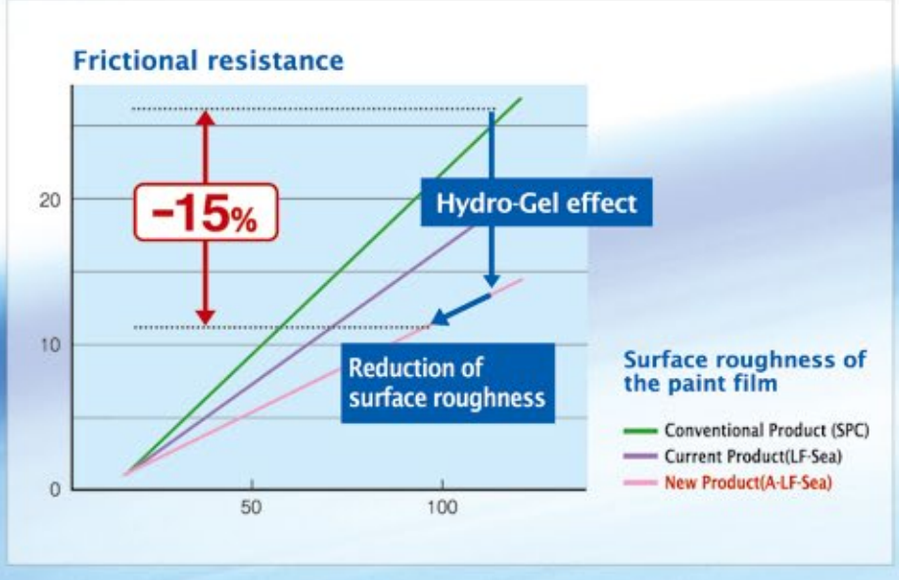
## MERITS

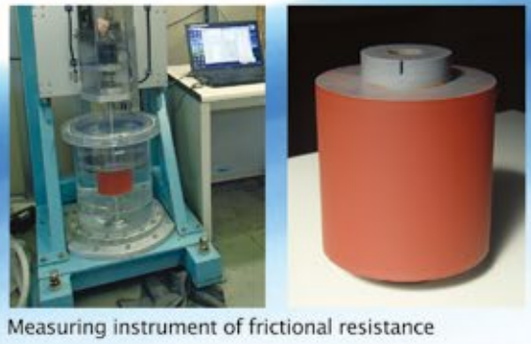
- Around 10% fuel saving
- Cost reduction of D/D and painting process mentioned above
- Contribution to environmental conservation by reduction in $CO_2$ emissions with low fuel consumption



## Reduction of Frictional Resistance



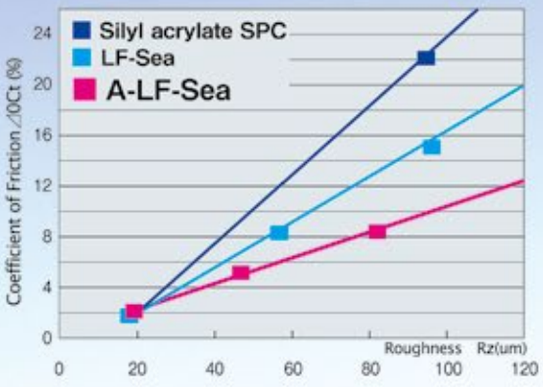



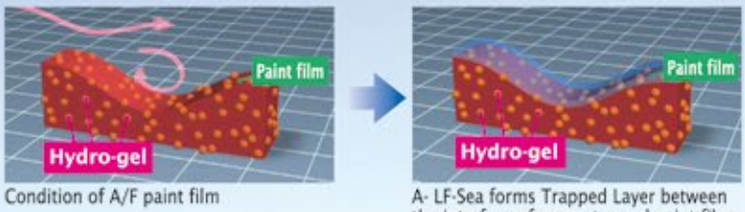
Measuring instrument of frictional resistance

15% reduction in the frictional resistance of coating will translate into a 10% corresponding lowering of the ship's total resistance, leading to an equivalent reduction in fuel consumption and $CO_2$ emissions.

## Water Trapping Technology

Enhanced water trapping function incorporated into excellent copper silyl acrylate and improved biomimetic technology.

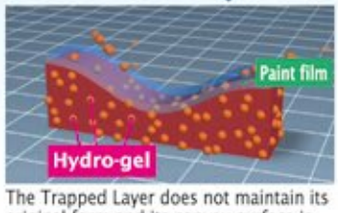


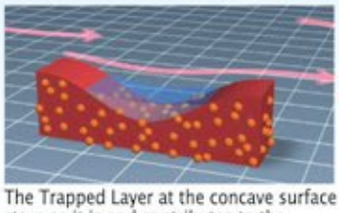

Condition of A/F paint film



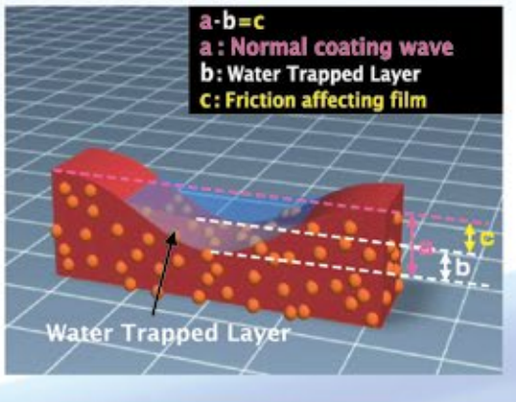

A- LF-Sea forms Trapped Layer between the interface of sea water and paint film with new technology.

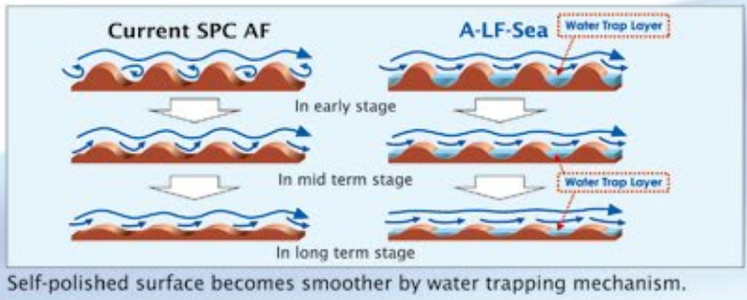



The Trapped Layer does not maintain its original form and its convex surface is removed by adjacent water flow.



The Trapped Layer at the concave surface stays as it is and contributes to the reduction of the frictional resistance.

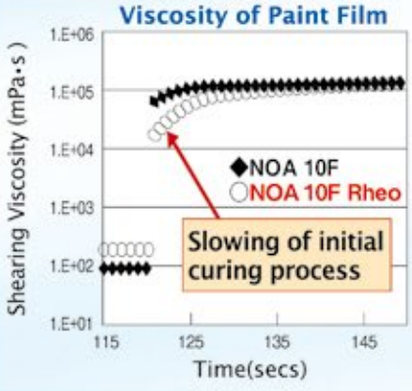


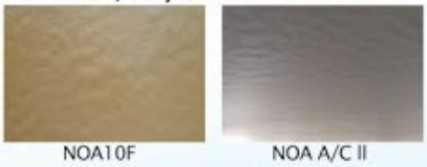

Self-polished surface becomes smoother by water trapping mechanism.

## Rheology Control Technology

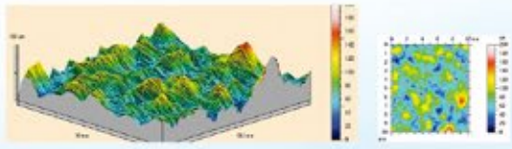
The anticorrosive within the A-LF-Sea system uses special rheology control technology. This was developed from Nippon Paint's experience in the automotive industry and has now been transferred to marine coatings. The resulting super-smooth coating assists in further reducing frictional resistance.




Current A/C system "NOA" series

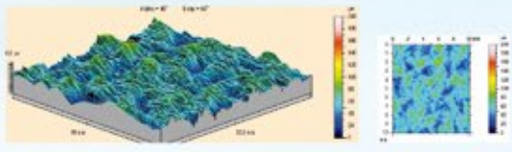


NOA10F NOA A/C II



Advanced A/C "NOA Rheo" series

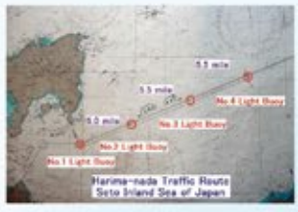
NOA10F Rheo NOA A/CII Rheo



## Performance in service (FUKAE MARU Kobe University)

| Year | A/F Paint | No. of sample | Test period | AV.Speed (Annual) | FOC between fixed points | | Fuel saving effect |
|---|---|---|---|---|---|---|---|
| | | | | | | Speed Corrected | |
| | | | | Knt | L | L | % |
| 2010 | SPC A/F | 24 | Feb.10- Jan.11 | 12.41 | 242.0 | 242.0 | Std. |
| 2011 | LF-Sea | 19 | Feb.11- Jan.12 | 12.51 | 235.2 | 231.5 | 4.4% |
| 2012 | A-LF-Sea | 19 | Feb.12- Jan.13 | 12.49 | 226.7 | 223.8 | 7.5% |

} (Only A/F)




•Controllable pitch propeller (CPP) : 305 rpm
•Propeller angle of forward swept wing 18.0

### Painting scheme

| | LF-Sea | A-LF-Sea system |
|---|---|---|
| | A/F | A/C + A/F |
| Newbuilding | 4 % | 10 % |
| M&R -1 Full Blasting | 4 % | 10 % |
| M&R -2 Spot Blast | 4 % | 7~8 % (Only A/F) |

## A/F Performance LF-Sea

*VLCC *299,990DWT
*30 months

*General cargo container
*56,816DWT *30 months

*BC *87,996DWT
*30 months

*PCC *18,500DWT
*37 months

*PCC *59,637GT
*24 months

*Deep sea skipjack fishing ship
*483GT *13 months

## Product line

| Product | Type of Ship |
|---|---|
| A-LF-Sea 150 | Ocean-going ships |
| A-LF-Sea 250 | Specific ocean-going ships |
| A-LF-Sea 600 | Coastal ships |

NIPPON PAINT started research and development of antifouling paints early on and got antifouling paint for patent in 1911. And then NIPPON PAINT succeeded in providng Japan's first domestic antifouling paints.
(Quoted : 100th anniversary of foundation of NIPPON PAINT)

## 2019
## Japan's Environment Minister's Award for Global Warming Prevention Activities


Nippon Paint Marine Coatings received the 2019 Environment Minister's Award for Global Warming Prevention Activity in the Countermeasure Technology Advanced Introduction Category for its work on the theme of "Reduction of fuel consumption and $CO_2$ emissions by dissemination of low-friction bottom paint."

In our award-winning effort, we developed a water trapping technology that enables a reduction in water flow resistance, as world first. The technology, developed by focusing attention on the body structure of tuna, which swim very fast, and obtaining a hint from the tuna's outer body, has achieved significant reductions in fuel consumption in ship operations. Our efforts to help curb global warming by disseminating products using this technology was highly praised, leading to this award.

We aim to become a company that delivers state-of-the-art environment- friendly products across the world, and to continue being a company that contributes to the global environment through bottom paints and offers new value.

NIPPON PAINT MARINE
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