

The Superyacht

TRUTH • OPINION KNOWLEDGE • IDEAS AND EXPERT INDUSTRY ANALYSIS



REPORT

EXPLORERS

The burgeoning phenomenon of explorer yachts and whether their description reflects their vocation.
Page 41

LORETTA ANNE

Built for a repeat owner, the third and largest yacht from Alloy Yachts to bear that name.
Page 59

RAINBOW

The hybrid engine and power system of the newest J-Class yacht that's taken years of development.
Page 91

TECHNOLOGY INNOVATION

Focusing on new ideas and future thinking affecting all sectors of the industry.
Page 100

Banishing Barnacles?

A growth industry



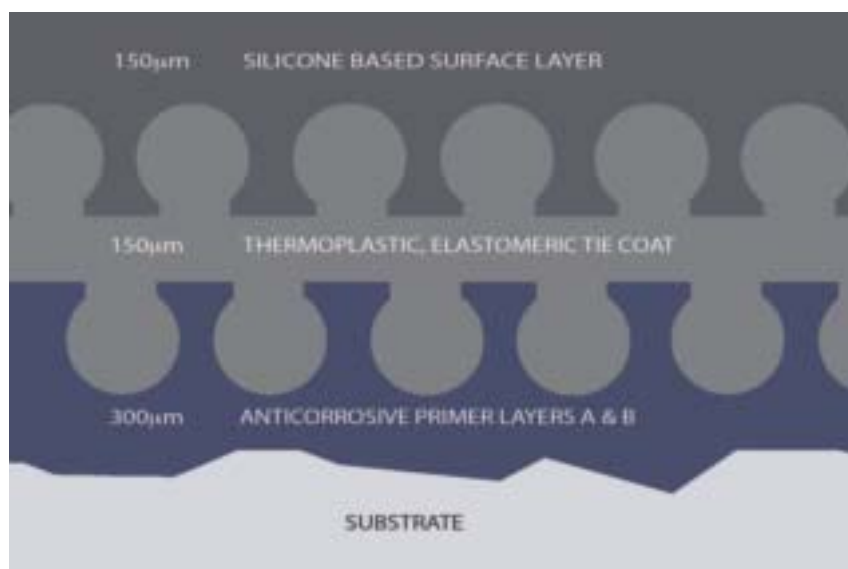
As anyone who has worked with or on superyachts will have experienced, without treatment, a slimy biofilm of bacteria and algae builds up on a hull submerged in water, attracting barnacles and other marine organisms. Disrupting the vessel's hull surface, they reduce its hydrodynamic efficiency. To maintain the same speed, a vessel's engine will have to work harder, with fuel efficiency declining and related costs increasing; otherwise it will have to sacrifice some knots. This increased work for the engine equipment has additional impact on the maintenance and wear and tear of the vessel as well as emission generation into the environment.

In the past, attempts to stave off the onslaught of the bothersome

barnacles have harnessed the effect of toxic elements, including tin. In 2003, the application of tributyltin was banned in antifouling solutions (by 2008 it was no longer permitted on vessels), and copper alternatives returned to popularity. However, there has been increasing concern from international bodies, such as the IMO, that antifouling-related copper leaching – with estimates of up to 5,000 tonnes per year – is killing non-target species and may remain within the marine food chain.

The US Navy started research into alternative antifouling solutions in the early '90s, with a focus on silicone-based top coating with regular epoxy primer bases. These are non-toxic to marine life; through a "low energy surface" they use a "physical rather

Esther Barney talks with Mega Marine Group and a captain about the silicone-based Megasil High Performance Foul Release System, a non-toxic antifouling option that could improve fuel efficiency, maintenance costs and machinery wear and tear on board.



CROSS-SECTION OF THE DUPLEX SILICONE-BASED ANTIFOULING SYSTEM.

than chemical approach and resist fouling by presenting a surface unsuitable for strong adhesion of the fouling organisms” (Morris, 1999).

Early silicone solutions had adhesion issues that prevented them from competing with the existing antifouling systems; they delaminated off the primer too easily, in effect caused by the hydrodynamic forces of the water. In particular, collisions with debris damaged the soft surface and application errors caused bubbling and fisheye to the surface. However, a Naval Research Laboratory consortium commissioned by the US Navy found that introducing new components to the silicone system and a thermoplastic, elastomeric tie coat to produce this duplex silicone layer showed improvements to other silicone fouling release systems. This system was originally called Duplex Silicone Coating System.

THE MEGASIL HIGH PERFORMANCE FOUL RELEASE SYSTEM

Mega Marine Group’s Megasil High Performance Foul Release System consists of four layers: two high-solid, anti-corrosive epoxy resin primer layers, followed by the silicone tie coat and surface coat, both dual component. These two coats differ in their chemistry and are bonded both chemically and mechanically, rather than just mechanically, to give the increased durability. The original NRL system had five layers, but adaptations were made during the ongoing development process of the system.

Application of the system takes three days and the top coats are applied with airless spray equipment. After the second layer of epoxy primer has been applied, the tie coat is sprayed on the same day, when the primer is still tacky, to ensure a mechanical bond. The final silicone coat is sprayed on the hull the next day, and within 24 hours the vessel can be placed in the water.

EMPIRICAL TEST RESULTS

The US Department of Defense’s Environmental Security Technology Certification Program (ESTCP) tested this duplex system against three competitive products over four years on US Navy and Coast Guard vessels. Properties under scrutiny were the antifouling performance, ease of application, adhesion, durability and ease of fouling removal by water jet.

The results showed the duplex system to be between 20 and 50 times more durable than the competitive silicone products (Table 1, Morris, 1999, ESTCP Coat and Performance Report PP-9502).

Peel tests, simulating the shear force of the water against the coating, were carried out to compare the duplex system’s adhesion to the primer versus other silicone treatments (see diagram opposite). The applied force was able to peel 50 per cent of the competitor’s coating from the primer, but none of the duplex system coating, reports Fujifilm.

The cost of application is higher with the duplex silicone system compared with copper-based antifouling due to the price point of the top two layers (copper-based antifouling costs around \$400/gallon compared with \$800/gallon for the silicone-based alternative). However, the lack of heavy metals means that the cost of disposal is less.

Reduced drag on a vessel has multiple effects for improving efficiency and running costs. Not only will less fuel be consumed at a certain speed, but the reduced strain on the engines will also reduce the wear and tear on the machinery over time, with obvious fiscal advantages.

PRODUCT	FORCE	RESULT	ENHANCEMENT v COMPETITOR
Competitive Product A	200g	Scratched coating	50 x
	250g	Cut thru to primer	40 x
Competitive Product B	200g	Scratched coating	50 x
	300g	Gouged coating	33 x
Competitive Product C	300g	Scratched coating	33 x
	500g	Gouged coating	20 x
Duplex system	10,000g	2 pass to cut primer Did not scratch or gouge	50 x

COMPARISON OF DURABILITY OF DUPLEX SYSTEM VERSUS COMPETITOR FOUL RELEASE SYSTEMS AVAILABLE (MORRIS, 1999).

The Naval Research Laboratory paper 'Advanced Non-Toxic Founding Release Coatings' (NRL/PU16110-99-388) estimated that the silicone-based duplex system could reduce fuel consumption by 10 to 15 per cent on Navy vessels with the environmentally benign antifouling system. The estimate for yacht fuel consumption reduction from Mega Marine Group, which supplies the duplex system to the yachting industry as Megasil, is more conservative: "up to 10 per cent".

FujiFilm Corporation acquired the commercial rights to this duplex system in 2006, through the formation of FujiFilm Hunt Smart Surfaces (FHSM), due to interest originally in the cruise and bluewater industry. FHSM offers a five-year guarantee on the system, when system and application requirements are met. At year five, touching up and applying the last surface coat extends the life of the system for another five years, reports Mega Marine Group (not approved by FujiFilm).

POTENTIAL DRAWBACKS

Due to the soft nature of the silicone coating, collisions with debris can damage the surface and will need repairing with a patch repair kit; for smaller areas of damage, this can be carried out by the crew.

Great caution needs to be taken when the coating is applied to prevent silicone contamination to other areas of the vessel as well as nearby vessels, and specially trained applicators need to be used, as they understand

the complex characteristics of the products involved.

The topcoat is currently produced in only four colours: red, black, blue and white. Creating custom colours is not currently possible, as extensive testing over six months is required for each pigment to assess whether it will change the properties of the coating. If the yacht is in very clear water then it could be possible to see the coating from above the water.

If a barnacle sits on the surface of an idle vessel for several months or more, its suction action can penetrate the top two coats to the primer, so continued monitoring and cleaning are necessary for yachts that are not moving regularly.

SUPERYACHT APPLICATION

TSR learned about the silicone-based antifouling from Captain Joseph Tress who had applied Mega Marine Group's Megasil High Performance Foul Release System to the hull of 34.75m M/Y *Abbracci* two years ago.

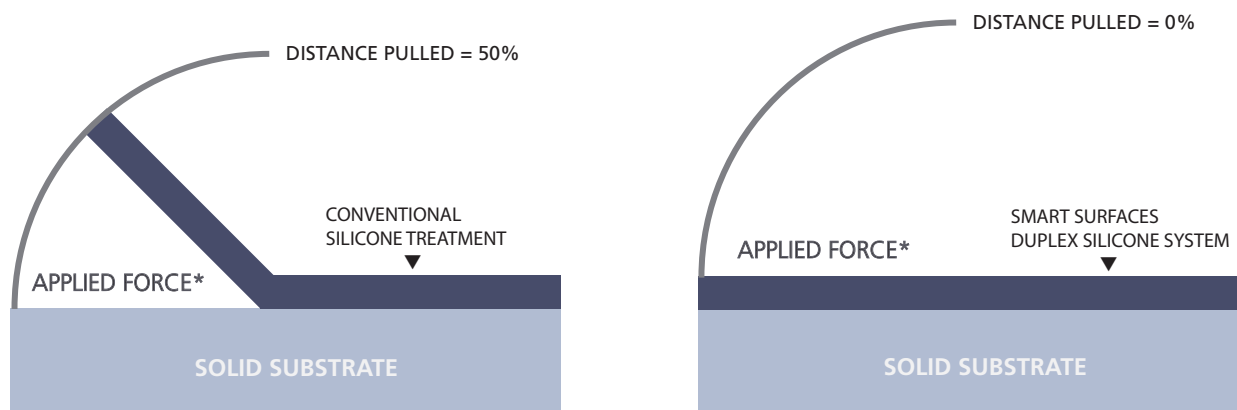
He shared how he came across the technology and how it has fared on board so far:

"I discovered this technology when we were sandblasting the hull back to the bare metal and one of the FujiFilm's certified applicators was putting the products on a cruise ship tender next to us. He showed me the sample board that had been in the water for two years, which just had a thin layer of slime that could be removed with a wipe of the finger.

"I spoke with the owner, who agreed to give it a shot. Eighteen months after the application, we hauled out the yacht for some prop work and there were a couple of areas that needed touching up from collisions with debris underwater, but other than that it was in great condition. At one point we didn't move from the dock for four months in the Bahamas and there was a little build-up of slime and organisms, but with a wipe of a terry cloth rag they were completely removed, as opposed to needing something more abrasive with other systems.

"We have seen 10 to 15 per cent less fuel burned per hour at our cruising speed of between 14 and 15 knots; from 52 gallons per hour (gph) burned, we have reduced this by around 5.2gph savings. Over 24 hours of running time, that is 124 gallons saved, which is \$400 of saving in fuel in the 24 hours. We also no longer have corrosion concerns. Before, in saltwater, we were running on 0.7mA/cm² and now we are running on 0.9mA/cm² or almost 1.0mA/cm², which is phenomenal. The wear and tear on the engines is definitely reduced, as is our running temperature.

"As far as maintenance is concerned, on a yacht of our size with normal antifouling, you are looking at about \$25,000–28,000 to lift the yacht out, put it in the shed, sandblast down to the hull, apply the primer and put on the antifouling, put the crew up in shore-based accommodation,



EFFECT OF 'SHEAR FORCE' ON DUPLEX SILICONE SYSTEM V CONVENTIONAL TREATMENT (FUJIFILM).

* APPLIED WITH EQUAL FORCE TO BOTH SILICONE TREATMENTS.

and various other expenses. Over five years, that is over \$100,000 just to lift the yacht out of the water and maintain the antifouling, which is the length of guarantee on the silicone system; of course, there will still be other reasons why the yacht might need to be hauled out during that time.

“At the time, it cost us about \$10,000 more to have this system put in over the conventional ablative antifouling, but we will save that in a year with the reduced running and maintenance costs of this system. I think that the benefits could be multiplied on a larger yacht than this, with the fuel efficiency and maintenance cost savings.” ■

Opening image: [istock.com](#)

SOURCES:

Journal of Protective Coatings and Linings, Morris, J, February 2007.

Coat and Performance Report (PP-9502), Environmental Security Technology Certification Program (US Department of Defense), 1999.

Advanced Non-Toxic Fouling Release Coatings (NRL/PU/16110-99-388), Naval Research Laboratory.

To comment on this article, email issue134@superyachtreport.com with subject: Banishing Barnacles?