ECOSPEED®

SHIP HULL PERFORMANCE TECHNOLOGY

Contents

Total Protection

The rudder of M/V Elisabeth Russ before Ecospeed was applied in 2004, showing heavy cavitation damage.

The rudder of M/V Elisabeth Russ in drydock in 2011. No further cavitation damage has occurred in the intervening 7 years.

Ships have been sailing for up to nine years (and counting) with Ecospeed without having to replace the coating on their rudders or having to opt for important and costly steel repairs.

Ecospeed can be applied on a rudder at a very low cost, especially compared with the large drydock costs. It will give a rudder supreme protection against cavitation and corrosion damage for the rest of the vessel's service life.

Ecospeed is a really fast and easy way of keeping a rudder's performance at maximum efficiency at all times.

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A Brighter, Greener Offshore Future

The importance of choosing the right hull coating system and maintenance regimen for vessels in the offshore oil and gas industry

By Steven Ferry

While the shipping industry as a whole is experiencing a slump in terms of newbuilds, one maritime sector is bucking that trend: the offshore exploration and drilling industry.

The world's demand for energy continues to rise and is now on a collision course with the stark reality that known oil reserves are dwindling, with most onshore oil reserves now mapped and being tapped.

The world's demand for energy continues to rise while known oil reserves are dwindling.

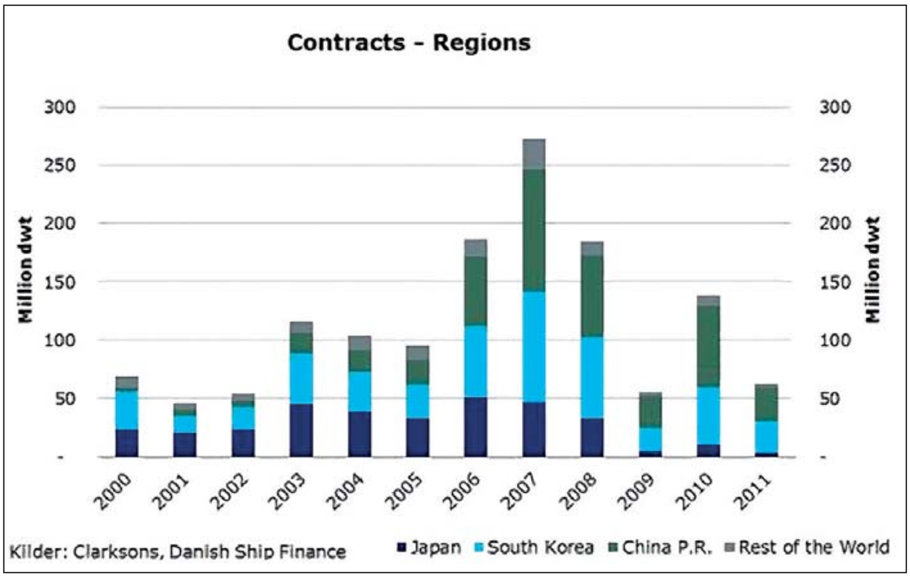
Not that the oil and gas industry has not seen this coming. It has long realized that the energy future lies offshore, under the oceans of the world which comprise close to 71% of the Earth's surface. In fact, they have been working on technology to siphon the oil lying beneath increasingly deep waters since the first tentative steps were taken in the shallow bayous of Louisiana during 1940. Oil fields in shallower waters were tapped over the intervening years, to the point where it became imperative that the challenges of deep-water drilling be met and overcome.

Ratifying the oil and gas industry's outlook and approach, the greatest oil discovery in the last decade was made offshore.

And that is why the offshore drilling industry is a shining light in the maritime sector: capital outlays and discoveries, production and profits are all healthy. One area where significant improvements still can be made is in the mitigation of the lost production from, and high costs of maintenance of these rigs, ships and equipment, working as they are so remotely and in generally very challenging environments.

Let's look at some specifics.

General shipping new-builds are off, with 40% of dry bulk orders post-poned in 2011, and 2012 and 2013 orders falling to an estimated 43 million dry weight tons each year.

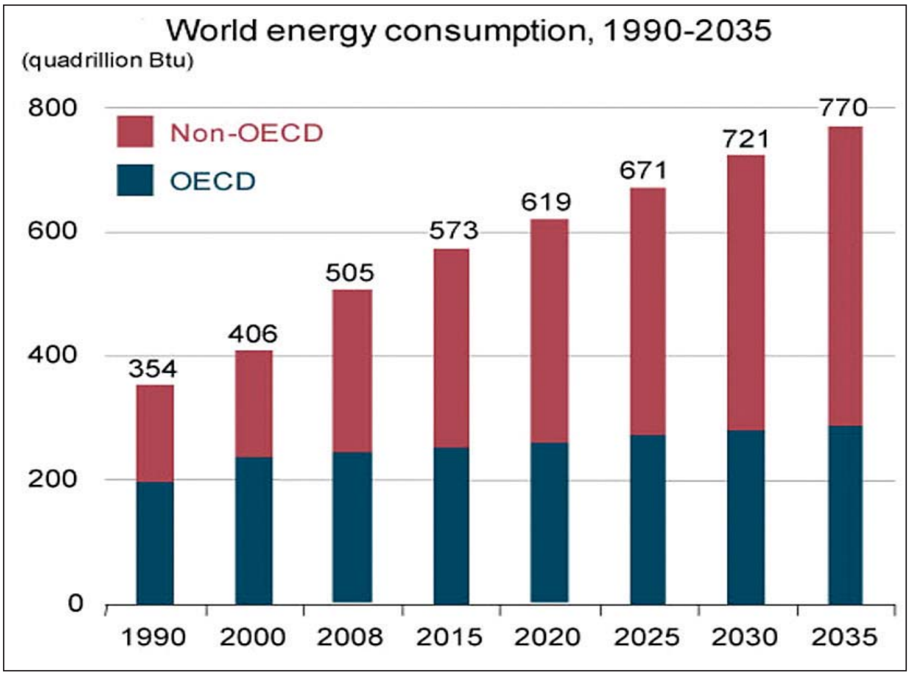


Projected Energy Consumption

It is projected that world energy consumption (the majority of which is oil based) will grow by 53 percent from 2008 to 2035, and is projected to rise from 505 quadrillion British thermal units (Btu) in 2008 to 619 quadrillion Btu in 2020 and 770 quadrillion Btu in 2035 (see chart below).[1]

Much of the growth in energy consumption occurs in countries outside the Organization for Economic Cooperation and Development (non-OECD nations), where demand is driven by strong long-term economic growth. Projected energy use in non-OECD nations will increase 85% by 2035, compared with an increase of 18% for the OECD economies.

On-site maintenance of offshore related units can be very expensive as they are generally located in very challenging environments.



U.S. domestic oil production peaked in 1970, while global oil production initially fell from a high point in 2005 but has since rebounded. 2011 figures show slightly higher levels of production than in 2005, and are considered the new peak.[2]

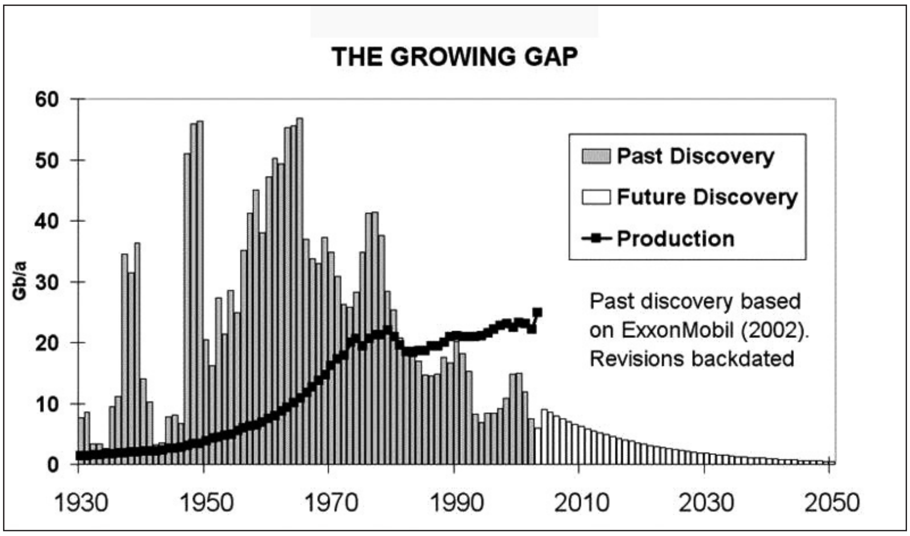
The Growing Gap

Absent deepwater finds, the prediction is for new discoveries of oil to be near zero by 2050—see chart below.[3]

Or, put another way:

Resources, Peak Oil

Peak oil is the point at which the maximum rate of petroleum extraction is reached, and after which the rate of production is expected to enter terminal decline.



"All the easy oil and gas in the world has pretty much been found. Now comes the harder work in finding and producing oil from more challenging environments and work areas." *William J. Cummings, Exxon-Mobil*

New Discoveries

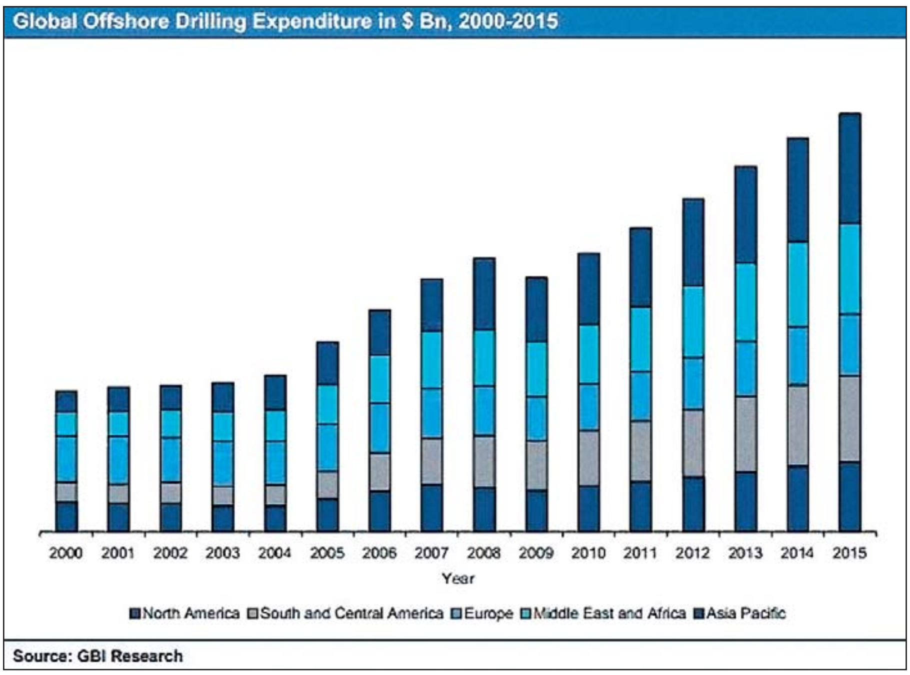
Tupi, a huge underwater oil field, was discovered by Brazil in 2008 and represented the world's largest oil find since the discovery of a 12-billion-barrel field in Kazakhstan in 2000.[4] The new deepwater field is estimated to hold the equivalent of 5-8 billion barrels of light crude oil, and created a buzz among the world's largest oil companies—all of which had struggled to find global-scale projects worthy of their investment.

Because the migration to offshore exploration and production will only gain momentum, the demand for vessels and rigs will also continue to rise.

The Offshore Future

Since offshore exploration and production began over 70 years ago in Louisiana, advancements in seismic and drilling technologies have seen the offshore industry developing fields in all parts of the globe and in ever-deeper waters, with a concomitant and steady increase in oil production. Currently, approximately 30% of all the world's oil and gas comes from offshore units, and this share is expected to continue to increase.[5] Just two years after the 2010 Deepwater Horizon spill and subsequent moratorium, deep-water drilling has regained its momentum in the Gulf of Mexico and is, once again, spreading around the world.

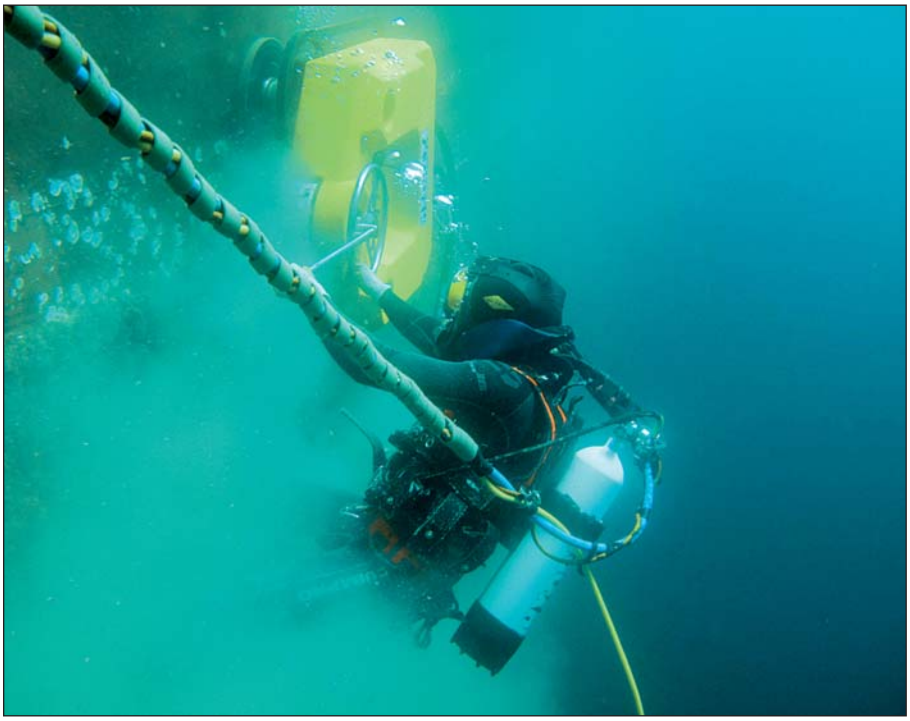
In fact, BP and other oil companies are now intensifying their exploration and production in the Gulf, which will soon surpass the levels attained before the accident. The reason for the resumption of such drilling is the inescapable and continuing high demand for energy.[6]



Arctic Exploration

When Royal Dutch Shell sank five wells off Alaska recently, it was the first drilling in U.S. Arctic waters in decades. And encouraged by high commodity prices and shrinking sea ice, not only oil exploration, but the cruise and fishing industries as well, among others, are gearing up to tap the Arctic's riches, previously inaccessible because of the year-round ice. Also, shrinking summer Arctic ice is opening new, and shorter shipping lanes, an open invitation to general shipping to chart Arctic courses.

The U.S. Geological Survey estimates that nearly 13% of the world's undiscovered oil reserves, and 30% of its undiscovered gas reserves, are to be found north of the Arctic Circle. That's 90 billion barrels of oil and 1,670 trillion cubic feet of natural gas. And these estimates don't include so-called unconventional oil and gas deposits, such as



A large vessel can accumulate as much as 5,000 tons of fouling in a couple of years, which must be cleaned to permit inspection.

hydrocarbons found in shale rock, or methane hydrates on the sea floor.[7]

While Arctic oil exploration is more challenging technically than any other environment, continuing high oil prices and advances in technology combine to fan the petroleum industry's interest in the region, with countries such as Canada, Russia, Norway, and Denmark (Greenland), whose northern areas all extend into the Arctic, being likely targets for future exploration.

Vessels and Rigs

It is clear that the migration to offshore exploration and production that has already begun will only gain momentum. It is also clear that, as it does, the demand for vessels and rigs will also continue to rise.

However, an unfortunate reality with these developments is that the farther from shore—such as into the Arctic (or Antarctic)—exploration and production takes oil companies, the farther vessels and rigs will find themselves from drydock for cleaning and servicing as needed—meaning significant downtime and lost production.

Clean Hulls

Keeping a ship's hull free of even a small degree of accumulated fouling (slime) and ensuring that the coating is in good, smooth condition can save about 20% of fuel consumption;[8] while a heavily fouled hull can require as much as 80% more power to propel the vessel at the same speed.[9] In other words, it is very good business, both economically and environmentally, to ensure that hulls of both oil-exploration service vessels and tankers are kept as smooth as possible.

Keeping the hulls of exploratory vessels and rigs clean makes business sense as well, but for a different reason. Since these are stationary vessels, kept in place by thrusters or tethers, the fouling problem is not one of increased hull friction, but one of increased hull weight as a result of heavy biofouling. This fouling not only reduces the deck loads commensurately, but, over time, will also have a damaging effect on the hull itself.

Stationary vessels are open invitations to both micro and macro fouling, especially considering that conventional biocidal antifoulants require flowing water to work. These factors allow stationary vessels to accumulate fouling to almost hard-to-believe levels in a relatively short time.

In fact, a large vessel can accumulate as much as 5,000 tons of fouling in a couple of years, which will, if not addressed, not only have a detrimental effect on the hull itself, but will also reduce the vessels' effective deck loads.

It is also well worth noting that in order for a vessel to be approved for underwater inspection in lieu of drydock (UWILD) by the classification societies, the hull must be sufficiently clean to permit inspection by divers under the supervision of a classification society inspector.

A Harmful Solution

In the latter part of the 20th century, the marine industry solved this age-old problem with new tin-based antifouling paints, such as tributyltin (TBT).

However, while TBT was found effective in preventing fouling, it was soon also found to be extremely toxic and harmful to the marine environment. As a result, it was not long before tin was banned, and it finally ceased to be used in antifouling paints in 2008.

Post-TBT

The most frequent replacement for TBT-based products has been those anti-foulant paints that leach copper and other biocides into the water to kill the marine life fouling the hull.

While these anti-foulants work for a while, they do not last long and require frequent reapplication in drydock. Neither can such paints be cleaned in the water without causing heavy pollution and without reducing their useful life. Also, since biocidal antifouling coatings need to move through water to work, on stationary vessels such as drillships these coatings are largely ineffective.

Biocidal antifouling paint problems have been compounded recently by research findings that show existing heavy-metal-based antifoulings have the potential of worsening rather than preventing invasions of non-indigenous (alien) aquatic species, as these become tolerant of the copper and other biocides in the coatings.

Hence, a good, long-term solution for cleaning hulls rules out paints that have a leaching function or other such active ingredients.

Also, since such leaching antifouling paints require a water flow to work, they are rendered virtually impotent when it comes to stationary vessels, as they form a leached layer that clings to the surface of the hull and prevents further biocides from leaching out, in effect sealing the biocides in and making the hull a perfect target for both micro- and macrofouling.

A Working Solution

How would a possible solution to this problem look?

It would be a hard hull-coating, free of active ingredients. This coating would be as inert and long-lasting as possible, and would provide excellent hull protection. It would also be easy to keep clean of fouling.

The ideal coating would also improve in smoothness and performance over time.

Stationary vessels are open invitations to both micro and macro fouling, especially considering that conventional biocidal antifoulants require flowing water to work.

A coating known as Surface Treated Composite (STC) answers all aspects of the problem when properly applied and maintained. It combines a hard, durable, non-toxic hull coating with advanced in-water hull cleaning technology. It is wholly environmentally safe, and it can save shipowners and operators millions of dollars annually in operational costs.

Such STC coatings also ease the much dreaded drydock curse by permitting vessels to be cleaned and maintained in-situ by divers using special equipment.

The Drydock Curse

The highest single expenditure for any shipowner in maintaining a ship, after delivery of the vessel from the builder, is the cost of drydocking.[10]

Today, due to the globally stalled economy, shipowners and operators run on tighter budgets and margins, meaning the costs of hull protection and maintenance must be balanced carefully against fuel savings.

Docking is expensive, difficult to schedule, and disrupts the vessel’s operations for a protracted period of time, especially when sailing from the Arctic or Antarctic for a suitable port.

When it comes to stationary drill vessels, drydocking grows even more complex and time-consuming. Since many such vessels are equipped with non-retractable sub thrusters that must be removed before entering drydock, such a project can involve as many as 16 thrusters to be removed, transferred to barges and transported ashore, while the rig, using its remaining tailshaft propulsion, makes its own way to drydock.

Once drydock is complete, this scenario reverses and all the thrusters have to be restored and recommissioned. From start to finish, drydock service for a drilling vessel can take as long as 60 days: a substantial loss of day rates.

Drydock Frequency

A vessel should not need to see drydock more frequently than is required to keep it in class. The primary reason more frequent drydockings are necessary is unchecked fouling build-up, something a properly applied and maintained STC coating can circumvent.

Designed to last the life of the hull, and cleanable offshore, an STC-coated vessel would only have to drydock in accordance with class requirement, never for coating repair, replacement or cleaning.

As oil exploration and production expands to the Polar regions, the STC coating anticipates and solves another problem: the Polar environment.

Designed to last the life of the hull, and cleanable offshore, an STC-coated vessel would never have to dock for coating repair, replacement or cleaning.

The Polar Code

Environmentally, there are a number of aspects that make the Polar regions particularly sensitive to pollution and environmental damage. The Polar regions are more pristine than more-populated and -traveled waters. The emission of toxic heavy metals and biocides, the atmospheric pollution resulting from the burning of extra fuel to overcome hull friction, and invading alien species can easily cause greater havoc than they would in less pristine areas.

Recognizing this, the International Maritime Organization (IMO) is debating a strong, uniform code to be enforced throughout the Polar regions to bring about safe-and-sound maritime operations for all.

The points such a Polar Code will most likely include are:

- A ban on the use of toxic antifouling systems that leach biocides or emit other highly toxic substances into the water
- Measures to reduce atmospheric pollution from GHG, black carbon and other emissions
- A cleaning regime ensuring that ships sailing in polar waters are cleaned of biofouling before voyaging into these areas in order to prevent the invasion of non-indigenous species.

Supporting this is the current IMO Report (DE 56/25) to the Maritime Safety Committee, dated 28 February 2012, which, among other things, references the following recommendation:

10.17.4 — The Polar Code should include a provision to ensure that hard and inert AFS coatings, suitable for ice operations and certified to be resistant to ice, should be used when there is any risk of hull contact with ice, since these coatings are generally non-toxic, more suitable for such operations, more economically viable, and environmentally less impactful.

Icy Waters

As any icebreaker operator will confirm, ice is not good for a hull's coating. In fact, few if any elements will destroy even the sturdiest of conventional coatings more rapidly than ice-laden waters.

The optimum coating solutions must withstand this element as well, which is exactly what the glass-reinforced surface treated composite (STC) coating delivers on.

In fact, an STC coating meets all the ideals above, including satisfying environmental requirements: European authorities have certified STC products to be completely non-toxic and harmless to the environment.

The STC system combines a glass reinforced coating and regular in-water cleaning to keep ship hulls operating at maximum performance and other underwater surfaces free of fouling. Such a coating is applied once, either on a new-build or in drydock when a ship's hull needs repainting, and lasts the lifetime of the vessel with only minor touch-ups (typically less than 1% of the whole surface per drydocking), and is guaranteed for ten years.

Initial application of an STC coating is comparable in cost to other high quality underwater hull paint but it is easier than others to apply in that it requires only two coats on bare metal with a three-hour drying time between coats, and extended maximum overspray time. It is simultaneously conditioned and cleaned underwater, resulting in a progressively smoother surface over time.

With an STC coating in place, regular in-water cleaning can be done in-situ with no ill effect on coating or the environment.

Through regular inspection of the ship hull and in-water cleaning of slime build-up, the ship is then kept at optimum performance. In fact, the coating improves with regular underwater cleaning, skin friction reducing with each cleaning. In-water cleaning of the largest vessels can be accomplished in 12 hours and can usually be carried out without adversely interrupting a ship's operations.

Maximizing the Offshore Exploration Boom

Oil is providing favorable winds for the maritime industry in the rough seas of the current world economy. The industry can enjoy even greater profits by charting a better course to manage fouling and unnecessary drydocking—all the while meeting increasingly stringent environmental requirements in increasingly hostile environments.

That course would include the application of a high-quality STC coating to all new-build offshore vessels before launch, or the replacement of inadequate or inappropriate coatings with such an STC at the next dry-docking opportunity.

With such an STC coating in place, regular in-water cleaning through the life of the vessel or rig will then eliminate the need for repainting and its requisite and costly spell in dry-dock, since this can be done in-situ with no ill effect on coating or the environment. ■

1 http://www.eia.gov/forecasts/ieo/index.cfm and http://www.eia.gov/forecasts/ieo/index.cfm
2 http://en.wikipedia.org/wiki/Peak_oil
3 Ibid.
4 http://www.nytimes.com/2008/01/11/business/worldbusiness/11iht-oil.1.9147825.html?pagewanted=all
5 http://www.modec.com/about/industry/oil_gas.html
6 http://topics.nytimes.com/top/reference/timestopics/subjects/o/offshore_drilling_and_exploration/index.html
7 http://money.cnn.com/2012/07/17/news/economy/Arctic-oil/index.htm
8 http://www.shiphullperformance.org/getPaperPDF/3.pdf
9 http://www.usna.edu/naoe/people/SCHULTZ%20PAPERS/Biofouling%202007.pdf
10 http://www.imarserv.com/dry-dock-management.php

The Reference on non-toxic hull coatings published and available

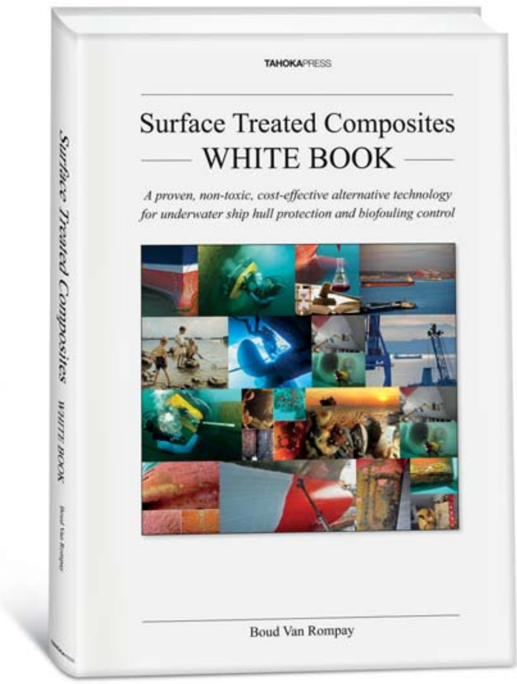
As announced in previous issues of our magazine, a new book, *Surface Treated Composites White Book – A proven, non-toxic, cost-effective alternative technology for underwater ship hull protection and biofouling control*, by Boud Van Rompay has been published by Tahoka Press and is available for purchase online at TahokaPress.com.

The *Surface Treated Composites White Book* is a complete reference on hard, non-toxic hull coating systems and in-water cleaning. It covers all related issues including the environmental hazards of biocidal coatings and the cost-effectiveness of surface treated composite hard coatings combined with routine in-water cleaning. The information in this book can save shipowners and operators between 8 and 40% of their current fuel bill while giving them an environmentally benign way to protect their ships' hulls and keep them smooth and free of fouling.

The Book

The Surface Treated Composites White Book is a description of a better, alternative, non-toxic, cost-effective, environmentally safe technology for protecting the underwater hulls of ships and keeping them free of biofouling. "Alternative" because it takes a 180° opposite vector to the generally used, conventional systems of painting the underwater hulls of ships with highly toxic heavy metals and biocides as a means of protecting the hulls and keeping them clean. "Better" because its standard application can reduce the cost of maritime transport significantly while greatly lowering the environmental impact of shipping.

This alternative technology begins with the premises that the marine environment should be kept clean and free of toxic chemicals which pollute the water and contaminate the sediment, that shipping should be able to operate and expand without harming or destroying the very environment on which it operates, that there is a non-toxic answer and that that answer is also the most economical way to sail.



The Surface Treated Composites White Book is essential reading for anyone who has any connection with protecting the underwater hulls of ships, who is responsible for operating ships economically, for reducing the impact of shipping on the environment. Shipowners, ship operators, officers, naval architects, ship builders, the IMO, government officials responsible for maintaining a sustainable marine environment, officials in charge of navies and government owned and operated fleets, NGOs, shipyard operators, anyone who has any interest in or responsibility for the efficient and ecologically sound operation of ships and shipping.

The book is the result of 40 years of research, development, study and practical application and experience added to the wealth of information on the subject which has been researched and recorded by caring and intelligent minds around the world.

The book's Table of Contents is published in full here:

1. Introduction

2. Current Practices
It is easy to simply continue using the conventional methods for the protection of ships' hulls and the control of biofouling which currently prevail broadly. But are these methods the best available, and are they sustainable?

3. Drivers of Change
What are the factors which are currently driving change in the shipping industry with regard to ship hull coating and protection, biofouling control, hull maintenance and cleaning? What pressures –

economic, regulatory, environmental – do shipowners/ operators face today with regard to the underwater ship hull?

4. The Fuel Penalty

Hull roughness and biofouling can add 25 - 40% or more to a ship's fuel bill under existing normal hull protection and fouling management general practices, costing an estimated $70 billion in wasted fuel worldwide with corresponding unnecessary atmospheric pollution.

5. Underwater Hull Related Environmental Concerns

The underwater hull of a ship interfaces directly with the marine environment, and its protection and the handling of fouling also has an indirect effect on the degree of atmospheric pollution caused by the ship. The methods chosen for hull protection and maintenance and biofouling control greatly influence this environmental impact.

6. Regulatory Aspects

Legislation and regulations concerning hull coating systems, their chemical content and emissions, application, underwater cleaning, biofouling control and other related issues vary from country to country and state to state. Some are international in scope such as those agreed at IMO level. In general this regulation is increasing in scope and restrictions.

7. Hull Coating Systems Compared

The main types of underwater ship hull coating systems in use have already been outlined and described briefly in Chapter 2. This chapter provides a comparison of each major coating system in light of the subjects covered in Chapters 3 - 6.

8. A Better, Viable Alternative

Having examined existing practices and concerns regarding underwater ship hull protection and fouling control and noted the shortcomings and issues, and compared the various coatings available, the next logical step is to describe the best available technology and practices in detail.

9. In-water Ship Hull Cleaning

In-water cleaning is an important part of current best available practices concerning ship hull fouling control, but for it to work without damage to the hull coating or the marine environment, circumstances, conditions and methods must be right.

10. Propeller Cleaning

Propeller roughness has been shown to increase fuel consumption by 5 - 15%. Correct propeller maintenance is probably the lowest expenditure, highest return on investment measure that can be taken to improve fuel efficiency and reduce fuel costs and atmospheric emissions. Frequent cleaning can be particularly efficient and environmentally benign.

11. Rudder Protection

Rudders are particularly prone to cavitation damage. There is a specific coating that can prevent this phenomenon, saving shipowners a great deal of money and trouble.

12. Case Studies

"All the proof of a pudding is in the eating." William Camden, 1605.

13. Conclusion

Resources

Glossary

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The Author

Boud Van Rompay is the Founder and CEO of Hydrex, an international underwater technology company which delivers advanced underwater repairs and maintenance. Mr. Van Rompay began his career as a diver and acquired extensive experience with underwater technologies. He is also an inventor with a long string of patents to his name. One of these patents is for Surface Treated Composite (STC) underwater hull coating system which he researched and developed as an answer to the very serious marine pollution which he witnessed and quickly traced to the toxic antifouling coatings in use on ships and boats generally. Seeing that a non-toxic solution was urgently needed, he set out to develop one. That system and its success are fully documented in this book, with all the theoretical and practical knowledge to put it into full effect. Mr. Van Rompay sees every ship that gets off the toxic bandwagon and adopts an environmentally safe approach to hull protection and fouling control as one step closer to a clean, pollution free marine environment – his goal.

You can order copies of the book and/or download a free preview which includes the first two chapters, by visiting

www.tahokapress.com

This book could save you huge sums of money and, perhaps more importantly, help avoid the catastrophic environmental damage caused by biocidal antifouling coating systems. ■

TAHOKAPRESS

Condition after years of use

Ecospeed after sailing in the ice for two years. The ice belt, with clearly visible damage, had not been coated with Ecospeed along with the underwater hull. This has now been remedied to prevent similar damage from reoccurring.

Ecospeed is an environmentally safe underwater ship hull coating system which provides the vessel with long-term protection and dramatically improves the ship's performance. The coating gives a very thorough and lasting defense against cavitation and corrosion damage for a ship hull's entire service life.

It provides the underwater vessel with an impenetrable protective layer while its flexibility enables absorption of the forces that are produced by cavitation. This prevents the damage normally caused by this phenomenon. Without proper protection against cavitation and the resulting erosion and corrosion damage, the financial consequences can be severe.

Ecospeed comes with a 10 year guarantee and is expected to last the lifetime of the vessel. This is in strong contrast to traditional antifouling paints where a new application is necessary during each drydocking. With an Ecospeed application no repaint will be needed. At most, minor touch-ups will be needed. Planning the maintenance of the vessel therefore becomes much easier.

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