Tiny monsters, giant threats

Individual zebra mussels are about the size of a fingernail. They attach to almost anything, are too small to be seen in their early stages (how they get transported by pleasure craft and clothes that ‘look clean’) and are very difficult to destroy.

Thought to have reached North America in the ballast tanks of oceangoing ships via the St. Lawrence Seaway, zebra mussels were first seen in Lake St. Claire (between Michigan and Canada) in 1988; today they pollute waters from Massachusetts to California and Canada to Texas, costing North America over $138 billion per year, according to some estimates. They are presently a growing threat in England. Research into how to defeat this invader is making slow progress.

The zebra mussel is one of several thousand known aquatic invasive species in the world. Many have been transported in ballast water, giving rise to regional and international anti-invasive species legislation, such as the Ballast Water Treatment Convention. An article on some of the equipment used in the fight against this bio-pollution begins on page 2.
COVER:

Now that’s engine work. Dwarfed by the mammoth crankshaft they are installing, workers at Portugal’s Lisnave Shipyard call to mind ants attacking a picnic discard. Founded 50 years ago to service the world supertanker fleet, Lisnave has long been one of the maritime industry’s most highly regarded repair yards. Much of this issue of Surveyor looks at organizations with anniversary years to celebrate.

FEATURES:

2 Ballast Tank Bug Killers
Ballast water treatment systems help industry face the long standing problem of shipborne bio-invasion.

12 Tightening the Net for Three Decades
The New Inspection Regime is the latest advance in the Paris MOU’s 30-year fight to eliminate substandard shipping.

18 Looking Forward with Lisnave
The CEO of famed repair yard Lisnave shares some thoughts with Surveyor on the future of ship repair.

25 Small Yard, Big Heritage
Lisbon’s NavalRocha shipyard is a living piece of Portugal’s industrial history.

26 A Day in the Life of a Flag
For 20 years, the IPTM has kept close watch on the safety and quality of vessels flying the Portuguese flag.

30 ABS@150: A Legacy of Leadership in Regulatory Development
Through collective efforts, classification societies help IMO develop international regulations.

36 Viewpoint: Reflections on 30 Years of Port State Control
Richard Schiferli, Paris MOU Secretary General

Editor’s Note:
The photo used on the cover of the Fall 2011 edition of Surveyor was attributed to the wrong source. The photo shows a Hydrex diver using the Hydrex® Typhoon™ MC 311 hull cleaning machine to remove the fouling from a major cruise ship as part of routine hull maintenance on a non-toxic hull coating. The Typhoon series of machines is part of Hydrex’s Ecospeed® non-toxic hull coating and cleaning system. Photo copyright 2007, Hydrex nv.

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Ballast Tank Bug Killers

Ballast water treatment systems help industry face the long standing problem of shipborne bio-invasion.

The ballast tanks of the world’s merchant fleet annually carry an estimated three to five billion tons of water from place to place around the globe and, according to the International Maritime Organization (IMO), take some 7,000 different aquatic animal and plant species along for the ride. These unwilling passengers are often invisible to the unaided eye, but have the potential to wreak great environmental damage. Most marine species, even large fish or creatures that attach to a rock or the seabed and never move again, pass through a ‘planktonic’ (microscopic and floating) stage of development in which they can easily be sucked up a ship’s intake pipe and dropped into its ballast tank. The majority of these tiny abductees do not live through the ensuing voyage, and most that do find themselves discharged into an unfriendly environment whose assorted dangers soon put an end to their adventure. Of the few that survive, some establish a reproductive population that finds a place in the local food chain while others, in the worst cases, multiply in pestilent proportions.

Such bio-pollution has changed entire ecosystems around the world. For example, back-and-forth infestation has made the waters of Sydney, Hong Kong and Honolulu harbors nearly interchangeable in terms of biodiversity. In the United States, rivers and lakes are under attack by several high-profile pests – such as the ‘jumping’ Asian carp and the evil-looking Chinese snakehead – and the ever-expanding menace of the country’s best-known ballast-borne invader, the zebra mussel. A native of the Black Sea, the zebra mussel is now found in the waters of 29 states and the Great Lakes region, where it has caused an estimated $7 billion in damage over the past two decades. In the Black Sea, meanwhile, nature is suffering from an invasion of the North American comb jellyfish, which has depleted plankton stocks to such an extent that it has been identified as a contributing factor in the collapse of several commercial fisheries.

The seabed communities of Southern Australia are fighting incursions of Asian kelp, while the native flora and fauna of the Wadden Sea, an intertidal zone shared by Germany, Holland and Denmark, are struggling against foreign sea grasses and the sea walnut even as the local blue mussel population is under attack from the Pacific mussel. Worse yet, the ballast-borne pollution threat extends into the arena of public health. Ships taking on ballast in contaminated waters are suspected of transporting infectious diseases and pathogens like the E.coli bacteria.
Ballast-assisted bio-invasion has been known as a problem for more than a century, but became a matter of international concern in the late 1980s when a number of nations began reporting large-scale infestations. Damage caused by zebra mussel infestation of the Great Lakes spurred the movement that led to President George H.W. Bush signing the US Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990. The Act established the US Coast Guard as the nation’s ballast water authority and mandated a regional ballast water management (BWM) plan for the Great Lakes. In 1993 this led to mandatory BWM requirements for the Lakes, including the first legislation to require that ships discharge freshwater ballast at sea and replace it with seawater – the procedure that has since become known as ballast water exchange (BWE). In 1996 Congress enacted the National Invasive Species Act, which led through several stages to mandates in 2004 requiring ballast water exchange for all ships calling on US ports.

International anti-invasive species efforts first took shape in 1991, when Resolution 50(31) from IMO’s Marine Environment Protection Committee (MEPC) presented guidelines on preventing the introduction of unwanted organisms and pathogens from ships’ ballast water and sediment discharges. This started the regulatory development and negotiation process that led to two IMO resolutions and, ultimately, to the IMO Assembly adopting the International Convention for the Control and Management of Ships’ Ballast Water and Sediments (the Ballast Water Management Convention) in 2004.

NEW STANDARDS CALL FOR NEW SOLUTIONS

For now, ballast water exchange is the standard method of ballast water management. There are certain challenges to BWE, among them structural and operational risks associated with discharge and intake of ballast water on the open ocean, and difficulties for ships in coastwise service to get to the deep ocean areas needed for effective exchange. The Ballast Water Management Convention notes these and requires in Regulation B-3 that all ships install ballast water treatment (BWT) systems, and verify their performance according to limits on numbers of living organisms per volume of ballast discharge, as specified in Regulation D-2:

- less than 10 viable organism per m³ > 50µ in minimum dimension
- less than 10 viable organisms per ml < 50µ and > 10µ in minimum dimension

and less than the following concentrations of indicator microbes:
- toxicogenic vibrio cholera, less than 1 colony forming unit (cfu) per 100 ml, or less than 1 cfu per 1 gram zooplankton samples
- Escherichia coli, less than 250 cfu per 100 ml; and intestinal enterococci, less than 100 cfu per 100 ml

Since 2008, various flag Administrations have tested and granted type approval to (as this issue went to press) 18 BWT systems capable of meeting these discharge standards.

Invasive Marine Species Pathways & Origins

- From NW Atlantic
- From NE Atlantic
- From Asia

Major Areas with Invasive Marine Species

- > 250
- 150 - 250
- < 150

Number of Invasive Alien Species
IMO, meanwhile, has developed a list of 14 guidelines to clarify the Convention’s requirements for approval of ballast water management systems. For many flag States, however, several important implementation issues remain to be resolved, particularly regarding the sampling and testing of ballast water and enforcement of the regulations – all areas of concern for the port State inspectors whose job it will be to verify that BWT systems are functioning as required.

In the US, regulatory deliberations over BWT were still ongoing as this issue went to press, but leaning toward establishment of a single Federal standard along the lines of the D-2 requirements.

“The big question for many authorities is, how can ballast water treatment systems be tested to see if they’re working properly?” says Matt Granitto, Product Manager for Ballast Water Treatment Systems at Pittsburgh, Pennsylvania-based Hyde Marine. Its system, the Hyde Guardian, uses filtration and ultraviolet light to treat ballast tank water.

**Testing the Question**

“Even though BWT technologies have been developed from the wastewater treatment sector, the applications are very different; with wastewater, there’s a kind of litmus test that can determine whether a treatment system is operating effectively. The ballast water rules, on the other hand, define a certain quantity of organisms per ton of water,” Granitto points out. “In order to be scientifically rigorous, you need very large samples in triplicate and a scientific team to determine if the organisms contained in those samples are alive, dead or rendered harmless, which means verification and enforcement becomes a very involved process,” he explains.

“The framers of the BWM Convention knew of the difficulties in verification and devised a rigorous land-based testing standard (the G-8 Guideline for obtaining type approval for BWT systems) with conditions that are far worse than any you’d expect to see in real life,” he adds. “Thus, if you can show that your system satisfies the parameters of the land-based tests, it should be suitable for treating ballast water on a vessel.”

Granitto adds, going forward, all BWT systems will be required to have a data logging system. The idea is that the Port State Control officer, by examining the log book, will be able to conclude that the system is operating properly.

“Verification standards are still a challenge for many authorities,” says Peter McNulty, President of Los Angeles, California-based N.E.I. Treatment Systems, which manufactures the Venturi Oxygen Stripping™ (VOS) ballast water treatment. “It might be that
verification standards are developed for each type of treatment system. So, for example, it is known that if you use ultraviolet light bulbs at a certain power and a certain wavelength, you will always meet the IMO D-2 standard. I would then claim to the port States that all you have to do is look at the records – downloaded to the control panel, etc – of the amount of power delivered to the UV lights and use that to determine if the system is performing to the IMO regulation. That should be good enough. For our system, it would be a test of residual dissolved oxygen. We recommend to port State authorities, for verification of treatment, dipping the tanks with the dissolved oxygen meter that we provide with each system.”

“Ultimately, authorities will have to have scientifically defensible evidence should they want to levy fines or sanctions on an operator,” says Granitto. “Right now, the scientific community is pretty well united in the stance that you can’t get defensible data for standards that go significantly beyond the IMO requirements.”

Many issues surrounding the BWM Convention started playing out about two years ago, as the signatures to the instrument began to amass and concerns arose in the industry that, even if the D-2 standard is clear and achievable, reliable methodologies for the compliance regime remain to be established. For example, the Paris Memorandum of Understanding (Paris MOU) on Port State Control (PSC), which represents 27 European flag Administrations, currently has BWM under review and a task force in place to draft guidance for its PSC officers. Their progress, says the MOU, depends on developments at IMO. At IMO, meanwhile, concerns over enforcement remain a sticking point for many potential signatories, and one of several important ongoing discussions that are keeping the BWM Convention from moving forward at anything but a glacial pace.
The BWM Convention will enter into force one year after ratification by at least 30 nations representing at least 35 percent of the world fleet. The list reached 30 signatories in September 2011, when Mongolia and Palau came on board, but, as this issue went to press, represented over 26 percent of the world fleet. The exact date the Convention will attain critical mass has been a subject of much speculation over the past few years, but the general expectation seems to be that most Administrations will resolve their issues during 2012 and, thus, have the Convention in force sometime during 2013.

"Many shipbuilding contracts require compliance with US Coast Guard rules, since such a large percentage of the world’s ships trade to the United States," says McNulty. "For this reason, we think that a US rule will be pretty close to a de facto global standard. So, it’s likely that one of the things holding up the Convention is that many flag Administrations are waiting to see what legislation finally comes out of the US.”

When the BWM Convention does become international law, it will require most ships at sea today to retrofit BWT systems, following a schedule based on ballast capacity and date of build. The result, according to some estimates, will be an ordering rush that could exceed 10,000 BWT systems per year between now and 2021.

In anticipation of that order rush, a growing number of shipowners are joining the ranks of the early adopters and are beginning to order vessels equipped with BWT systems; others are hedging their bets by ordering vessels ready for retrofit, with space allotted for a BWT system and the supporting piping and electrical systems pre-installed, but without any treatment equipment.

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The retrofit costs of a BWT system will far exceed its new construction costs,” says McNulty. “We are now starting to see momentum building among forward-looking owners, who are preparing for the future by installing BWT systems today.”

Shipyards, too, are taking a forward-looking approach by studying the available treatment technologies with an eye to deciding which systems they will incorporate in their standard designs of tomorrow – a decision that could strongly affect the fate of some of the systems now struggling for a place in the emerging BWT market.
GENTLEMEN, START YOUR ENGINES

Ballast water treatment systems are currently divided under three broad rubrics of type: ‘mechanical’, which includes filtration, cyclonic separation and electromechanical separation equipment; ‘chemical’, which includes biocides (mostly chlorine compounds) and electrolytic chlorination equipment; and ‘physical’, which includes ultraviolet light (like the Hyde Guardian) and cavitation and deoxygenation equipment (like N.E.I.’s VOS system).

Industry is still sorting through the wide range of BWT technologies that these three families cover. For now, potential purchasers have to base their decisions on a database comprising a few systems in service, a lot of academic and laboratory test information, and some clear differentiating factors like installation and operation costs, the physical size of the equipment and, perhaps most important, system flow rate.

Flow rate makes the tanker sector the biggest market for BWT system manufacturers in terms of revenue. Large tankers have ballast flow rates ranging to 6,000 m³/hr and beyond. Some of the largest ore carriers go even further, with ballast pumping capacities in the 9,000 m³/hr range to balance the loading rates at major ore terminals. Systems of this size can run upwards of $2 million and, with 600 VLCCs currently in service, represent a sizeable potential income stream.

Though lucrative, the big BWT systems are not the meat of the ballast water treatment market. The size of a BWT system is not related to the size of the ship, but the rate at which its cargo moves on and off. Large cruise ships, for example, ballast frequently to adjust trim for passenger comfort but do so at relatively low flow rates, and so only need ‘small’ BWT systems. Likewise, because containers don’t move on or off a ship very quickly, even the largest containernships do not ballast at very high rates, having ballast water treatment needs of some 500-700 m³/hr. Thus, the biggest market for BWT is found in the more numerous vessels needing only modest-size systems. Altogether, the BWT manufacturers see the 5,100 containerships and 21,000 general cargo ships currently at sea as their largest potential markets. The BWT orderbook is still too small to indicate a discernable buying trend and service experience is still too short to start whittling down the field, so how those promising markets will one day divide remains a subject of speculation.

“One of the challenges in ballast water treatment is that not all systems are suited to all applications,” says Granitto. “For example, chlorination systems are not suited to coastal carriers/short sea shipping because they require 24 to 48 hours of contact to be effective, and ships in coastal trades ballast and deballast every four or six hours. In some cases, UV technology may demand more power than a ship can provide. As time goes on, it will be interesting to see which technologies lend themselves better to which applications,” he says.

“Ballast water equipment suppliers have been spending money for a long time, so most feel that it’s about time they started seeing activity in the market. As such, many are entertaining orders from all sizes and types of vessels during this early stage of the business – we’re delivering systems to all types and sizes of vessels, from small passenger to large tankers. We are ramping up production and engineering to meet the coming market, but it is difficult to predict what market segments will be our strongest,” Granitto adds. “Each supplier will probably find a niche where their technology is the best match for a specific ship type or service.”

When the Hyde Guardian received its type approval from the United Kingdom in 2009, there were only five other approved competing BWT systems. Even today, only 18 or so manufacturers have received type approval from a flag Administration, although dozens more are working through the approval process. This small but growing supply sector will be severely strained when it is suddenly hit with the 10,000 units/year that have been forecast – but, still, it is a challenge that the manufacturers are preparing to take on.

“With the tremendous earnings potential in BWT, several big players have jumped into the market – for example, Alfa Laval, Siemens, Wartsila and – by acquiring Hyde Marine – Calgon Carbon,” says Granitto. “Even so, there is still plenty of opportunity in BWT for companies that have a good technology and quality equipment to offer.”
The Venturi Oxygen Stripping™ (VOS) system makes use of the Venturi effect to kill organisms that have accidentally been introduced into a ship’s ballast tank, by removing oxygen from the ballast water and drawing it into an inert gas.

The Venturi effect describes what happens when a liquid flowing in a tube enters a section of the tube that becomes narrow. As the fluid passes through the constricted part, its velocity increases – like what happens to the water flow when you partially close the end of a garden hose with your thumb. This increase in velocity is accompanied by a decrease in fluid pressure, which results from the natural tendency of all systems to seek energy equilibrium. When the pressure inside the tube is lower than the pressure outside, a hole in the narrow section will not cause the liquid to spray out into the atmosphere, but will instead draw the atmosphere inside the tube.

This makes the Venturi effect very useful to industrial mixing and dispersal applications, such as: carburetors, which use the effect to draw gasoline into an engine’s air intake flow; sandblasters, which use it to mix sand with a high-speed air stream; inspirators that mix fuel gas with air in gas-fired backyard grills; and aerators that draw oxygen into fermentation vats for the brewing of beer. Since 2002, the Venturi effect has been employed in the VOS ballast water treatment system, which is manufactured by Los Angeles, California-based N.E.I. Treatment Systems.

In the VOS system, a Venturi injector is installed in the ballast water intake pipe, with its narrow section connected to a gas line running from what N.E.I. calls a stripping gas generator. Similar to the inert gas (IG) generators used to neutralize the explosive atmosphere in a tanker’s cargo space, the N.E.I.-designed unit produces a gas that is very low in oxygen content.

“The stripping gas generator resembles an inert gas generator but is very different,” says N.E.I. President Peter McNulty. “The oxygen levels produced by standard IG systems can vary quite a bit and still satisfy the explosion-proofing requirement; ours is a much higher-specification device,” he explains. “Like the others, it burns diesel fuel to make inert gas; unlike them, it does not create soot and the oxygen concentration is very carefully controlled.”

The Venturi injector draws the gas into the ballast water stream, creating numerous, champagne-like bubbles. Here the force of nature is again put to work. Because the bubbles contain a lower oxygen concentration than the ballast water, oxygen molecules are physically compelled to seek equilibrium by migrating from the water into the bubbles. When the bubbles rise to the surface inside the ballast tank and burst, the freed oxygen is vented out as the tanks fill with treated water. According to N.E.I., this stripping process removes 95 percent of all ballast water oxygen – 100 percent removal being possible but unadvisable, since an oxygen-free environment can encourage growth of sulfur-producing bacteria.

N.E.I. supplies handheld dissolved oxygen (DO) meters with each VOS system, to give shipboard personnel and PSC officers an easy way to verify that the oxygen content in the ballast water is at sufficiently low levels. The
The company also suggests a second method of monitoring system performance.

“We don’t actually need to measure the DO because we can calculate it,” says McNulty. “Since VOS is purely a physical process, it is totally predictable. At a given water flow rate and gas concentration, we know exactly what will happen to the ballast water – so system performance can also be verified based on a reading of equipment operation logs.”

One important initial design goal for N.E.I. was to minimize the VOS system’s impact on the host vessel’s energy efficiency. Since then, the rising price of fuel has pressured the company to lower system energy demands even further.

“We are close to a revision to our standard design, which will cut the running cost of our treatment system by 25 to 75 percent, depending on the application,” says McNulty. “Most of the time it yields a 75 percent decrease in fuel consumption, by making use of boiler flue gas in combination with the existing system. We’re not dropping any of the existing components but are adding some components that can draw boiler flue gas through the system and into the ballast tanks in a class-approved manner.”

“Reductions of 25 to 50 percent are proven; the remaining 25 percent comes from the realization that we have been very conservative in our standard design,” he says. “We have a way of configuring our treatment system to use 50 percent less fuel during the water treatment stage – for many water conditions around the world, a lot less of that gas is needed.”

Founded in 1997, N.E.I. Treatment Systems began as a consulting engineering firm in wastewater treatment for the energy industry. The company began developing the idea of using Venturi injectors to deoxygenate ballast water in 2002 and today has transitioned completely to ballast water treatment. In 2003, the VOS system was selected for testing and evaluation under US Government grant programs administered by the National Oceanic and Atmospheric Administration (NOAA) and the Maritime Administration (MARAD).

Brought into the Great Lakes Ballast Technology Demonstration Program, VOS was tested for biological effectiveness by the Chesapeake Biological Laboratory (CBL) of the University of Maryland Center for Environmental Science, with shipboard trials conducted by CBL and the Marine Invasions Research Laboratory of the Smithsonian Environmental Research Center. Later, corrosion testing in the laboratories of BMT Fleet Technology Ltd confirmed N.E.I.’s expectations that a collateral effect of deoxygenation would be reduced ballast tank corrosion.

Testing coated and uncoated plates in four tank conditions – submerged, humid, ‘buried’ and splash zones – BMT concluded that long-term corrosion rates in deoxygenated seawater were 20 percent lower in the buried condition, 38 percent lower in the splash zone, 78 percent lower in humid environments and about equal in the submerged state. It was also noted that deterioration and creep of coal tar epoxy and standard epoxy coatings improved slightly in deoxygenated water.

After three years in development, the VOS system received type approval in 2007, with ABS performing the classification technical review on behalf of the Liberian Register. Subsequently, the system has been type-approved by the Marshall Islands, Panama, Malta and the Netherlands.
As a maritime company originally based in Cleveland, Ohio, Hyde Marine has long been familiar with the problems that the zebra mussel has caused in the waterways of the Great Lakes. The company teamed with the University of Michigan in 1996 on studies of BWT technologies for ships operating in the Great Lakes/St. Lawrence Seaway system and in 1997 was selected as engineering contractor for the Great Lakes Ballast Technology Demonstration Project, one of the first BWT research programs in North America.

“The question the Federal Government wanted to answer in 1996 was whether it was possible to filter harmful organisms out of ballast water. We were able to prove that filtration plus ultraviolet (UV) radiation was a viable approach and, when Hyde decided to manufacture its own BWT system, that became our approach,” says Matt Granitto, Product Manager of BWT systems for Hyde.

In 1996 he was engineering manager for the company that provided UV systems to the Ballast Technology Demonstration Project.

Hyde developed its first BWT system in 2000 and, over the next three years, installed experimental systems aboard three cruise ships, a containership and a chemical carrier. In 2003, the company installed on board a cruise ship the first of the systems that are sold today under the name Hyde Guardian®. That installation contributed to the technology receiving type approval from the UK flag Administration and becoming the first BWT system accepted by the US Coast Guard’s Shipboard Technology Evaluation Program (STEP).

Available in flow rates from 60 to 6,000 m³/hr, the Guardian plugs into a ship’s ballast system piping. Incoming water is first passed through filtration equipment and then through UV treatment reactors before heading to the ballast tank. The filters contain stacked nylon disks mounted

**Light of Doom**

Ultraviolet radiation is emerging as a popular means of purging ballast spaces of unwanted passengers.
under spring compression on a piston spine. When they are compressed, the diagonal grooves on the disk faces, which run in opposite directions on top and bottom, intersect to create a three-dimensional filter matrix. When ballast water flows between the disks, the channels and intersections capture the contaminants. Any biological material that escapes this stage is irradiated with UV light. During deballasting the filters are bypassed and the water passes through the UV treatment reactors on the way out, to maximize kill level.

The system’s design allows the UV equipment to be installed vertically or horizontally with equal effect, which, says Granitto, gives the company a sometimes critical flexibility in retrofitting systems into tight machinery spaces. For him, one of the most interesting parts of the installation process comes at the end, when it’s time to train the crew. What surprises trainees the most, he says, is finding that, despite the seemingly exotic technology, they have a fairly simple system on their hands.

“Overall, we say that training and maintenance during commissioning for a system below 1,500 m³/hr takes anywhere from two to four hours, depending on how technically competent the staff is and how much they want to know,” he says.

“We started designing the system from the point-of-view that, since there are few to no spare crew hours aboard a merchant ship, it should need as little maintenance as possible,” says Granitto. “The system we have longest in operation, which is the one we used for our type approval testing in 2008, has needed only routine inspection since it was installed eight years ago. We have had remarkable success on the first one; but even so, our general guideline is that, typically, you might spend four to six hours per year on inspection,” he says. “There’s no preventive maintenance needed because there are few moving parts – but we do suggest you pull off the covers and look at the filters once every six months.”

“The filtration system is just media filtration – yes, stacked disks are a somewhat unfamiliar medium, but in essence they are analogous to a bed of sand,” he adds. “The UV system is the most complicated part of it all, but, in the end, it’s just lights in a pipe – people think I over-simplify when I describe it that way, but, after all, that is what it is; it’s lights in a pipe. They’re special bulbs with special positioning, they don’t run off standard current and they have a special power supply, but, in the end, there’s nothing magical about them. Likewise, the maintenance is straightforward. Typically, the idea of dealing with a UV system intimidates most ships’ personnel at first; but once you walk them through it they just look at you with a surprised expression when they realize how really simple it is to operate.”

Hyde has also used its UV technology to disinfect ship’s drinking water on board and to provide the final disinfection stage in onboard wastewater treatment systems.

Hyde Marine was acquired by Calgon Carbon in 2010, but, prior to that, the road to finding financing for the technology was a bumpy one. “In the beginning, it was hard to get investors to take seriously the idea that a $25-billion industry would just appear in response to proposed regulation,” says Granitto. “But it seems to be finally happening, and there are companies that have been around a long time, that are now seeing the market arrive.

“Hyde is now part of Calgon Carbon, a leading supplier of UV technology that also has experience with regulatory-driven markets,” he recounts. “When they acquired us they knew they had something good, and they are investing in people and facilities to position Hyde to meet the coming demand.”

Winter 2012 • Surveyor | 11
Tightening the Net for Three Decades

The New Inspection Regime is the latest advance in the Paris MOU’s 30-year fight to eliminate substandard shipping.

Port State Control (PSC) data is such a common reference today, such basic source data in so many of the maritime industry’s safety and quality regimes, that it is difficult to imagine the shipping world without it. Yet, the idea that port States could coordinate inspection efforts so as to better the quality of international shipping was strangely new just 30 years ago.

Today, PSC inspection is the means by which maritime authorities check visiting foreign ships to verify that they comply with international regulations on safety, pollution prevention and seafarers’ living and working conditions. The information from these inspections is taken throughout the world as the raw data of quality, not only for the ship, but also for the authorities and organizations standing behind its certificates.

A ship’s history with Port State Controls, particularly in nonconformities with industry standards, deviations from international law and, most importantly, detentions in port, can dramatically affect its chances of securing a desirable charter, of obtaining favorable insurance rates, of commanding a good price on the secondhand market and, in some cases, even of being welcome in the area.

As a concept of united, regional forces policing maritime safety, Port State Control dates back to 1982, when a group of 14 European nations signed an agreement under which they would harmonize their ship inspection efforts. The event that sparked their commitment to action was the sinking of the tanker *Amoco Cadiz*, which ran aground on the Portsall Rocks off the coast of Brittany, France in March 1978 and spilled 1.6 million barrels of oil over some 200 miles of coastline. Earlier that year, these nations had considered a united effort to audit the living and working conditions on board visiting ships according to guidelines from the International Labor Organization (ILO). The oil spill prompted them to focus on vessel safety and pollution, to which end they ultimately signed the Paris Memorandum of Understanding on Port State Control, coordinating their ship inspectorates under the regional authority that today is known as the Paris MOU.

The stated mission of the Paris MOU is “to eliminate the operation of sub-standard ships through a harmonized system of Port State Control.”
To this end, more than 24,000 inspections take place annually aboard foreign ships in Paris MOU ports to assess compliance with international safety, security and environmental standards and that their crews have adequate living and working conditions. Because the port State can detain a ship for deficiencies in these areas, PSC is often described as the coastal State’s last defense against substandard shipping, the maritime industry’s ultimate safety net, or the ‘sharp teeth’ of international regulations.

Detention isn’t the only weapon in the MOU’s arsenal. There is also the ‘name and shame’ approach that has proven increasingly successful over the past 20 years. In 1993, the Paris MOU published its first list summarizing flag State performance to date, basing the flags’ rating on the performance of their fleets in PSC inspections; in 1994, it began publishing quarterly detention lists, which became monthly detention lists in 1998; in 1999 the Paris MOU began its famous Caught in the Net campaign, one of the few maritime industry initiatives picked up and praised by press and public alike. In 2000, the Paris MOU began publishing annual White, Grey and Black lists of current flag State performance.

The Caught in the Net campaign was highly successful but helped develop a public perception, difficult to dispel, that ‘substandard’ means ‘two steps from disintegration’. With few egregiously-abused ships around these days, some ask why the Paris MOU still talks about a ‘threat’ from substandard shipping.

“Substandard simply means ‘below minimum standards,’ explains Paris MOU Secretary General Richard Schiferli. “Those standards are laid down in the international conventions agreed upon at the International Maritime Organization (IMO) and ILO. Speaking strictly, then, a ship operating below those minimum standards is substandard,” he says, but hastens to add that, as a practical matter, the substandard ship problem refers to a higher level of deviation from the norm. “When a ship has deficiencies serious enough to be detained, we consider it to be substandard,” he explains.

These differences aren’t limited to physical issues. “A ship can be considered ‘unseaworthy’ if, for instance, the crew is poorly trained or otherwise unable to perform critical functions on board,” says Schiferli. “You might have a new ship, but, if the crew can’t pass an operations drill or demonstrate competence in safety procedures, you would still have an unseaworthy ship.”

Success has made the Paris MOU a model for maritime Administrations around the world grappling with the problem of substandard shipping. Today, eight other regional MOUs build on the Paris MOU example: the Tokyo MOU (for the Pacific Ocean); the Acuerdo de Viña del Mar (South and Central America); the Caribbean MOU; the Mediterranean MOU; the Indian Ocean MOU; the Abuja MOU (for West and Central Atlantic Africa); the Black Sea MOU; and the Riyadh MOU (for the Persian Gulf).

Headquartered in the Hague, the Paris MOU is the vehicle through which the European Union shares PSC efforts with Canada, Croatia, Iceland, Norway, the Russian Federation and Slovenia. Currently, the 27 members of the Paris MOU look after the waters of the European coast and the entire North Atlantic Basin from North America to Europe.

The executive body of the Paris MOU, the Port State Control Committee, meets annually in member cities to determine policy, direct the organization’s efforts, coordinate activities with other regional MOUs and confer with regulatory bodies. Since its start-up, the Paris MOU has granted observer status at these meetings to the IMO, the ILO and US Coast Guard.
Second Spill Sparks Strong Response

Two decades after one tanker incident sparked the formation of the Paris MOU, another sparked its transformation. In late 1999, the single-hull oil tanker *Erika* sunk and spilled 20,000 tons of oil that polluted some 400 km of French coastline. The incident ignited outrage against substandard ships that produced three sweeping suites of new maritime legislation for Europe. Just over a year after the sinking, the *Erika I* package introduced tighter maritime safety controls and called for the removal of single-hulled tankers from European waters. In 2002, the *Erika II* package created the European Maritime Safety Agency (EMSA), which has become another global force against substandard shipping and a strong aid and supporter of the Paris MOU.

Regarding Port State Control, *Erika I* amended EC Directive 95/21 to control entry of ships into European Union ports, specifying, among other things, that ships over 15 years old with more than two detentions in the previous two years be denied entry and that, as ships get older, they be subjected to increasing levels of inspection. The Committee of the Paris MOU announced it would follow by undertaking a concentrated inspection campaign targeting oil tankers over 15 years of age and over 3,000 gt for structural and operational safety. Since then, concentrated inspection campaigns on various ship types or inspection themes have become annual events in the Paris MOU region.

Widening its focus to account for the role of the flag State in the existence of substandard shipping, the Committee also announced that targeting ships for PSC inspections would also consider the performance of the flag State. Accordingly, in 2000 the Paris MOU began issuing the White, Black and Grey lists of flag State performance that have since become high-profile emblems of pride – or shame – for maritime Administrations around the world. Acknowledging the role played by Recognized Organizations (classification societies which have been recognized by flag States to carry out statutory surveys on their behalf) in the substandard shipping problem, the organization announced at the time that, henceforth, statistics on the performance of Recognized Organizations would also be included in its annual report.

Under the White, Grey and Black lists, individual flag State Administrations are ranked according to how their ships have performed in Port State Control within a period of three years. The Grey list shows flag States that have accumulated detentions corresponding to the average within the Paris MOU region. Flag States on the White list have significantly fewer detentions than the average, and Black-list flag States have significantly more detentions than average. The latest lists, published in June 2011, report on a total of 84 flags: 18 on the Black list, 24 on the Grey list and 42 on the White list.

The Black list is divided into four categories of risk (very high, high, medium-to-high and medium), a ranking that helps inspectors determine a ship’s place on the inspection line when it comes to port. Ships flying Black- and Grey-list flags are liable for being banned from the region after multiple detentions.

Still, the relationship between the Paris MOU and the flag States of the world is not as adversarial as all that activism might imply, and as once might have been the case. It has improved markedly since 2006, when the Paris MOU obtained official Inter-Governmental Organization status at the IMO. A delegation from the Paris MOU participated in the 18th session of the IMO Subcommittee on Flag State Implementation in 2010.

“Where IMO is an organization of flag States, the various MOUs are organizations of port States,” explains Richard Schiferli. “With some of the flags on our Black list we have, let’s say, a different relationship than we do with some of the flags on our White list. So, while some flags don’t enjoy seeing our PSC officers coming on board, other flags, which know that they have their act well together, have absolutely no problem with them,” he adds.
“Overall, since the Paris MOU and other MOUs now participate in meetings at the IMO, we have a better dialogue and understanding with the flags, even ones that are not doing so well. My offer to those flag States is, let’s have a look at what you’re doing and maybe we can help improve your performance,” Schiferli says. “In some cases that has been very successful, one example being the Panamanian flag. Panama was on our Black list for a number of years and, of course, they didn’t like us very much and we were upset at how they were doing their work. Then we began a dialogue. I’ve been to Panama and visited their Administration. We studied their issues and, within a couple of years’ time, they moved up to our Grey list and last year made our White list. So it is possible to improve a flag’s performance.”

**The New Inspection Regime**

The Paris MOU Committee adopted its New Inspection Regime (NIR) in May 2009. Developed in parallel with the EU’s Third Maritime Safety Package, the NIR is a significant departure from past practice, declaring that all ships calling on Paris MOU ports must be inspected, even if they only rarely visit. A risk profile would be established for each ship based on type, age, flag, company history and PSC detainment record. The risk profile would help determine how often a ship would be inspected. The NIR also specified that substandard ships will be subject to a mandatory minimum ban period, with repeat offenders facing a permanent ban.

The NIR, which entered into force on 1 January 2011, uses risk analysis to reward quality shipping operators and reprimand substandard ones. The brain performing these calculations is the new Thetis Information System. Managed and hosted by EMSA, which led the task force behind the NIR, Thetis will also be the source of new ship performance data streams that will be posted on the Paris MOU website at www.parismou.org.

Risk, in one sense or another, always figured in the MOU’s targeting of ships for inspection. The NIR approach puts a finer point on the practice, using a number of factors to categorize ships as low, standard or high-risk vessels, using daily updated

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**Thetis: the brain behind the New Inspection Regime**

Risk assessment figures high in the Paris MOU’s New Inspection Regime. Salient elements of the risk calculation include: the ship’s inspection history, type and age; its flag State performance, coming largely from ship inspection records and the Voluntary IMO Member State Audit Scheme; the performance rating of its Recognized Organizations; and ISM performance of its management company.

The brain performing these calculations is the new Thetis Information System. Managed and hosted by EMSA, the organization that led the Paris MOU task force that developed the NIR, Thetis calculates ship risk profiles daily, taking account of the latest inspection information. The result, says the Paris MOU, will reward responsible shipping and penalize the scofflaws:

- **Low-risk ships** will, in principle, not be subjected to PSC inspection for at least 24 months from the last inspection, with a maximum inspection-free period of 36 months.
- **Standard-risk ships** will be subject to an inspection interval of between 10 and 12 months.
- **High-risk ships** will face more stringent ‘expanded inspections’ every six months. These in-depth expanded inspections include risk items which will be inspected every time, including operational drills. Thetis will help guide PSC inspectors through this more complicated targeting procedure, and act as a central archive for storing inspection results that will generate a comprehensive overview of all inspected vessels.
calculations of ‘Ship Risk Profile’ and Company Performance. Calculating tools for these figures are available on the Paris MOU website.

“We want to focus our attention and resources on those ships that need our attention: the high-risk ships,” says Schiferli. “They will be inspected every six months and, at each interval, will get what we call an ‘expanded inspection’. Older ships of certain types, like passenger ships, tankers, bulk carriers and gas carriers, will also get expanded inspections. We don’t just look at the paperwork and do a couple of spot checks any more; we have, let’s say, a fixed inspection program, including one or more safety drills, that the inspector needs to complete.”

The NIR contains a number of significant departures from past practice, one of which factors the International Safety Management (ISM) Code into a vessel’s risk assessment.

“One significant difference with the previous system of targeting and inspection is in our risk calculation, which now includes the ISM performance of the management company,” says Schiferli. “We believe the Safety Management System (SMS) on board is so important that, if inspectors find a major flaw in the SMS, the deficiency counts as five points in the company performance calculation; by comparison, a regular deficiency – say, a pump not working or a watertight door leaking – only gets one point. We assessed ISM performance under the old regime too, but back then it only counted as one point,” he notes. “From now on, ships under a poorly performing management company will never be considered low-risk.”

The Paris MOU also ranks the differing performance of Recognized Organizations, or classification societies, and figures them too in the new ship risk profile. Ship type is also a factor, through the inherent risk in certain trades – a tanker, for example, poses an environmental risk that a small general dry cargo ship does not.

The NIR will also enhance the output of one of the highest-profile tools the Paris MOU uses to monitor the state of shipping: the concentrated inspection campaign (CIC). CICs have been held annually in the Paris MOU region since 1997 (on ILO working and living conditions). These in-depth inspections use a special questionnaire that focuses on a particular area of international regulation, with the aim of gathering information on, and enforcing, compliance. Prepared by a panel of experts, each campaign identifies specific items within the focus area for inspection. For example, the 2002 CIC focused on Standards of Training, Certification and Watchkeeping (STCW) compliance, the 2004 on ILO standards, and the 2005 on radio communications and distress systems.

Some CICs have been joint efforts with other regional MOUs. Its longest such collaboration has been with the Tokyo MOU, the second largest in the PSC community, with which it has also held joint ministerial conferences. The two organizations conducted their first CIC, focusing on ISM, in 2007. This was followed by a CIC on lifeboat launching appliances in 2009, tanker damage stability in 2010 and structural safety and the Load Line Convention in 2011. Recently, they announced a joint CIC on fire safety systems scheduled for 2012. Lately, other MOUs have been joining in, with seven regions taking part in the 2011 effort.

In seeking to recognize risk mitigation as well as risk, the NIR appears to be winning friends among owners that have long lamented the unfair commercial advantages of irresponsible operation. Schiferli says that the industry’s reaction to the NIR has, so far, been favorable.

“When we developed the NIR we wanted to be sure to reward ships for good performance,” Schiferli says. “Now, high-risk ships get more attention and low-risk ships get less attention – low-risk ships can have extended inspection intervals of up to 36 months. That’s a big benefit for shipowners running a good operation.
“Further, just as good performance is rewarded with long inspection intervals, bad performance is also ‘rewarded’ with more frequent and more thorough inspections,” he adds. “At the same time, sanctions for poor performance have also changed. Now, ships flying a flag on the Black and Grey lists, if they get detained multiple times within a certain period, run the risk of being banned from all Paris MOU ports for a minimum period. If they get banned more times, this period is extended until they are never again allowed back.”

Collectively, the intensified inspections, enhanced penalties, extensive risk assessment and sophisticated system for data analysis and dissemination in the New Inspection Regime may make the single greatest advance in the Paris MOU’s 30-year war on substandard shipping.

“Many conferences have tried to sort out shipping’s problems and, while they come up with different solutions, they always have one answer in common,” says Schiferli. “That answer is: when others fail, Port State Control will step in.”

Port State Control in the EU’s Third Maritime Safety Package

The third maritime safety package was adopted by the European Parliament on 11 March 2009. With the adoption of the first two legislative packages on maritime safety (the so-called Erika I and II packages), the EU delivered a strong message that substandard shipping would no longer be tolerated. The third maritime safety package was developed in 2005 and, when adopted in 2009, sought to benefit those operators that respect safety standards by increasing pressure on substandard ships and their owners. The objective was to reward the better ships with fewer inspections and penalize the riskier with more frequent and more thorough inspections.

To this end the legislation proposed extensive reforms to make Port State Controls more efficient. The previous inspection target requiring 25 percent of all ships entering EU ports was replaced by a collective target for Europe to check all ships calling on EU ports, including those that only rarely visit or make stopovers at anchorages. The frequency of the inspections now depends on ship risk profiles, determined by ship type, age and flag, the management company’s past performance and the number of times the ship has been detained. High-risk ships will be inspected every six months, average-risk ships every 12 months, and low-risk ships every three years.

By guaranteeing that all ships are inspected, the new arrangements are expected to make it much harder for substandard ships to slip through the net.

The legislation also improved the regime for banning substandard ships, extending it to include all ship types. The ban is stricter than before, with the regulations stipulating a minimum ban period for initial offenders and an absolute ban for repeat offenders.

Supporting this, the Paris MOU will publish a Black list of companies operating substandard ships. These operators will find their ships inspected more frequently than others, with a consequently greater risk of being absolutely banned from European waters.
Portugal’s Lisnave Shipyard was formally founded 50 years ago, as the great golden era of tanker evolution was just getting underway. Its fate has been tied to the ebb and flow of that sector ever since.

The year was 1961. During the previous decade, postwar recovery had turned into expansion and the tanker trades boomed with the new industrial revolutions that energized Europe and America. Their engines of prosperity demanded an ever-increasing flow of coal and oil, calling forth the biggest ships in the world to bring these fuels of their development. Soon known as supertankers, these large crude carriers served as mobile pipelines linking oil producers in the East and consumers in the West, with Portugal standing right at the crossroads of their major trade routes.

The big ships passing Portugal’s shores spelled opportunity for the Companhia União Fabril (CUF) Group, an industrial combine run by the Mello family that was leasing a small shipyard in downtown Lisbon on the north bank of the Tagus River. In 1961, CUF established a new company named Lisnave and began construction of a shipyard for it across the river in Margueira, with the idea of catching at least some of the maintenance and repair that this growing fleet of workhorses would need.

For some time, the tanker sector rewarded this vision handsomely. Once the economic superiority of very large crude carriers became apparent, tankers grew to sizes that were once unimaginable even to the most way-out visionaries – and at a barely believable pace. In 1963, the biggest ship in the world was a 130,000-dwt tanker. Five years earlier, the
first ship of 100,000 dwt capacity had been delivered. Ten years later, ships of 469,000 dwt were in service and designs for 500,000-dwt vessels were seeking classification approval. Where industry experts once debated whether ships of 100,000 dwt made any sense at all, they now sang harmoniously that the one million deadweight ton tanker was as inevitable as the dawn. The world tanker fleet blossomed and Lisnave flowered with it.

The shipyard responded to the revolution in tanker size by building the world’s first one-million-deadweight ton graving dock. Named the Alfredo da Silva Dock, the unique structure symbolized the industry’s optimism and the yard’s technology leadership.

During these prosperous years the shipyard grew in power and prestige, at its height employing several thousand people at the Margueira facility. As a company it became a technology icon in Portugal and one of the country’s leading training institutions. Today, continuing this tradition, the company remains a premier provider of training services for the nation, having invested €6 million (approximately $7.8 million) over the last three years teaching industrial skills to the next generation of Portugal’s workforce.

Lisnave’s fortunes rose high on the tanker tide, and receded with it, too, after the crude carrier market collapsed following the second oil crisis of 1982. For most of the next two decades the tanker sector suffered and Lisnave struggled to stay afloat. In 1999, bankruptcy seemed imminent. At the end of the following year, Lisnave left Lisbon for a larger workplace on a manmade island in the Sado River Estuary of the Mitrena Peninsula, about 45 km south of Lisbon near the town of Setúbal. Lisnave took over the Mitrena location from the Setenave Shipyard, built in the 1970s by Lisnave shareholders, and gave it an extensive renovation and upgrade. Covering 1.5 million m², the new facility offered the ailing repairer not only more space, but also better access to the Atlantic and a chance to begin the new millennium with a fresh start.

The renovation of the Mitrena facility cost $80 million, about $35 million of which was spent on building a new propeller repair shop, a waste and water treatment facility and a variety of system upgrades, including the replacement of 15 km of piping and 50 km of electrical lines. The remaining $45 million was devoted to producing a dramatic innovation in ship docking technology: the Hydrolift.
Laid out rather like a bird’s foot, the three Hydrolift docks, each measuring 280 meters long and 36.75 meters across, radiate out from a shared entry basin. A system of electric winches hauls vessels through the entry basin and into the docks. Once a ship is inside the basin, which is open to the sea, the main gate is closed and the gate of the destination dock is opened. Four massive pumps, each capable of moving 46,500 tons of water per hour, then raise the water level so that the ship can be hauled into the repair bay. Once the ship is in position, the gate is closed and the water allowed to flow out under the force of gravity.

The above-ground graving docks do require very stout walls as well as a very solid foundation beneath the vessel, but pay back construction costs through savings in time and logistics. For example, steel plate and large equipment can be driven straight from the warehouse to the ship, and work crews can get to their jobs without losing time in stairwells. Other advantages of the ground-level work area include a reduction in the use of lifting equipment, a healthier atmosphere for workers with better air circulation, and enhanced protection of the environment by preventing drydock residual water from contacting the river.

The Hydrolift was also designed to accommodate natural water circulation in the surrounding area, which lets fish migrate normally and helps keep the nearby wetland from becoming stagnant. This is critical to the yard’s environmental status, as the shipyard stands near the Arrábida Nature Park and the Sado Estuary Nature Preserve. The shipyard points to the continued presence of delicate fauna – such as herons and flamingos – thriving in the 30,000-hectare parklands as proof that shipyard work and environmental protection are not mutually exclusive activities.

Shortly after establishing itself at Mitrena, circumstance proved the renovation investment to have been very well spent. In 2002, tanker freight rates began climbing to levels not seen in many years. For example, a suemmax tanker that could get $20,000/day in 2002 was earning $40,000/day in 2003, then $70,000/day in 2004 and $105,000/day in 2005. At these rates, shipowners found that the costs to a ship deviating from its charter to make repairs far outweighed any difference in shipyard price. Yards to the East, despite cheaper labor costs, could not entice ships from the lucrative Atlantic routes and, for several years, impatient vessels crowded the waters outside Linsave just like in the old days. But, also like in the old days, when the tanker
market dropped at the end of 2009, the crowds disappeared and the yard was back to fighting for work.

“What attracts clients to Lisnave is the assurance that their ship will be attended by experienced workers who have a long track record of high-quality work,” says Lisnave CEO Frederico Spranger. “Of course, we would like very much to have more steel work, and we do get it from time to time – if, say, there is an accident in this area, we benefit from our position – but if a ship has 200-plus tons of steel to replace, the owners typically try to take it east.”

Today, the majority of ships coming to Lisnave do so for piping, mechanical, electrical and other precision work. To cope with the market’s ups and downs, Lisnave employs an average of about 2,000 people including around 500 on its own payroll supported by a variety of subcontractors. The yard also cooperates with other builders by letting them use parts of its large facility, as was done in the recent Windfloat wind power project. The hull of the floating wind turbine was assembled in Lisnave graving dock by construction outfit MPG.

That said, talking about large employment rolls and big steel replacement jobs as the measure of a yard’s vitality is emblematic of an outdated way of thinking about ship repair, Spranger says. As the quality and environmental protection movements cast increasingly larger shadows over the regulatory landscape, the industry’s concept of the ship repairer’s role will acquire a new dimension along the lines of protective services. “The maritime mentality must modernize, and along with that needs to jettison its type-casting of the ship repair yard as the maritime equivalent of an automobile body shop,” he says.

The Hydrolift was also designed to accommodate natural water circulation in the surrounding area, which lets fish migrate normally and helps keep the nearby wetland from becoming stagnant.
Modernize the Mind of Shipping

Traditional concepts of ship repair are too limited, says Spranger, because ship structures and their needs have evolved beyond them. Growing requirements from regulators are bringing new work to repair yards – ballast water treatment system retrofits, for example – and may also bring them opportunity to take a new role in supporting the shipboard demands of an ever-widening regulatory landscape. The first step in that evolution is reexamining the concept of ship repair.

“In normal mass production, there is a low cost to the item produced and, with that, a certain rejection rate. In shipbuilding you cannot have a ‘rejection rate’, so when a building defect is found by the class surveyor or owner’s representative, it must be fixed. The term ‘repair’ is used to describe that, and the whole concept of repair has become exactly that: fixing problems,” Spranger explains. “But you cannot apply that concept to the overall ship if the problem you have is related to design – applying the limited concept to the general is a complete mistake.”

Modern ship design, then, must be accompanied by a modern approach to care and maintenance. “In the past, ships were so robustly built that there was no concern about corrosion. Today, calculating ability is so accurate that we are able to design a ship with no corrosion margin in the steel at all. The responsibility that comes with that capability is to have stronger safety and quality controls in place – as we see happening,” he explains. “Today, corrosion is such an extremely important issue in the life of a ship that classification societies are even starting to enter the field of corrosion protection. That’s just one example of how regulatory control over ships is growing. New regulations, such as those controlling emissions, requiring use of certain fuels and mandating ballast water...
treatment, all represent a certain amount of work coming for repair yards. But that is not the end,” he says.

It isn’t only about the ships, he says, but also about who works on them. When the revolution comes, then, the shipyard sector too will stand for some weeding out. With the success of the New Inspection Regime of the Paris MOU on Port State Control – particularly its long-awaited rewards for commitment to quality operation – an analogous system for repair yards might not be too far off. For the playing field to be swept that clean, however, Spranger says authorities must first recognize repair yards as industrial units and treat them accordingly.

“We ship repairers provide an industrial service and should be recognized as quality industrial companies,” Spranger says. “Today you see quite a number of shipyards that are ISO 9000 certified, but also many that are not. I believe it would be reasonable to have laws that mandate ship repairs be done only by ISO-certified yards. That is not presently required by any authority and, as a result, you find many companies without accreditation selling ship repair services all over the world.”

Taking the quest for quality a quixotic step further, he raises the idea of a radical turn to the builder-user relationship, based on the workings of the aviation industry.

“When an airplane has an accident, the builder is immediately called in to consult, to help sort out what went wrong. When something happens to a ship, you never see the builder near the thing. Some people point to the deeper involvement of airplane manufacturers with airplanes and say that ship quality would be improved by extending the shipbuilder’s guarantee period. That’s a mistake – it’s not a question of extended guarantees, but of the way the system works,” he says. “Airplanes don’t
have a long builder’s guarantee period, but in aviation the owner is forced to follow specific maintenance guidelines. In other words, the maker is allowed to interfere with the user’s maintenance plan.”

While the maritime world may never be ready for such an extreme, some radical thinking is needed to shake out the cobwebs and bring on the kind of quality regime that a modern, globally important industry must have, he says. Such a reformation would need political support, and the quest for that has, so far, not exactly been fruitful.

“The EU has no shipyard policy and doesn’t care to have one; the Community of European Shipyards Association has struggled with this for a long time,” Spranger says. “By comparison, in aeronautics there is policy not only to fight for market share, but even to beat the Americans. The lobbies against change in the maritime industry are too strong and the United Nations, which should be able to resolve these higher problems of the world, cannot. There is only one force that can make these changes happen: public opinion.

“Shipping lags very far behind other transport industries in terms of regulatory and quality controls,” he says. “I believe the public will wake up one day, sometime in the future, and then public opinion will drive political demand for much deeper control on ship quality and force the entire system to change.”

Even if the revolution is long in coming, Spranger says it is merely a question of time – at least some of the prerequisite actions from regulators, growth in public awareness and dismantling of crippling traditions have begun. The repairers are ready, he says; the rest of the system just has to catch up.

“The maritime industry is old-fashioned in many ways and needs to catch up with the world it serves,” Spranger concludes. “Some areas, like design, are very modern, but many are still operating with a mentality from the time of Lloyd’s Tavern.”

From left: the sad-looking vessel is set to rest on keel blocks in the shipyard’s big graving dock; the bow area is staged; the damaged sections are removed; the new steel is put in place; and the whole thing is primed and painted and ready to sail out with a proud new face.
Just across the street from the ABS office in downtown Lisbon is a small shipyard with a grand heritage. Named NavalRocha, it is a working monument whose every stone, brick and floorboard is a silent witness to Portugal’s industrial history. NavalRocha began as a foundry and mechanical workshop in the late 1800s. In the early 20th century the facility took on yacht repairs and, as the Rocha do Conde de Óbidos Shipyard, built a reputation for small vessel expertise. The yard was bought in 1937 by an industrial combine, the Companhia União Fabril (CUF) Group, to service its fleet of cargo ships. CUF founded the Lisnave shipyard across the river in 1961 and, while the big yard gained fame servicing the largest ships in the world, its parent kept busy on smaller ones.

For years dedicated to small container and passenger vessels, dredgers, barges and other short-sea service vessels, NavalRocha is today looking to build a niche repairing offshore support vessels (OSVs) working in West Africa and North Europe.

“There are very few repair facilities for West African OSVs on the continent, and Portugal is just a few days’ sailing away,” says António Meneses, NavalRocha’s Senior Project Manager. “Our yard is just 20 minutes from Lisbon’s international airport, which gives us a close link to equipment suppliers throughout Europe and the world, meaning all possible vessel spare parts can be quickly obtained.”

Owned 45 percent by the Portuguese Government, 35 percent by a private investor and 20 percent by Lisnave, NavalRocha has 28 direct employees supported by a varying number of subcontractors. The yard currently operates two graving docks, with lengths of 173.5 and 104 meters, and a 140-m repair pier. Despite the modern equipment, whispers of the past still emanate from every corner of the facility, from the tugboat-sized stone graving docks dating to the yard’s earliest days – well-tended but not currently used – to the headquarters building, which was once CUF’s steel lofting department.

Francisco Roque, ABS Senior Principal Surveyor for Portugal, characterizes NavalRocha as having the characteristics of both a friendly, local facility and an international shipyard. “I have worked in NavalRocha as both an ABS surveyor and as a ship superintendent, and I must say that they have always done very good work, with a family-like approach and customer satisfaction as the objective. Many of the staff are former longtime Lisnave employees who bring a great amount of experience to the job. From my work there, I would say that, if you have an OSV with a problem and need a shipyard that can be creative with solutions, this is an excellent place to bring it.”
A Day in the Life of a Flag

For 20 years, the IPTM has kept close watch on the safety and quality of vessels flying the Portuguese flag.

The first offshore energy project installed in Portuguese waters is not an oil or gas drilling platform – although one of each is coming in 2012 – but an innovative attempt to expand the limits of offshore wind technology. That project, named Windfloat, mounts a wind turbine on a three-column floating structure that outwardly recalls the hull of an old-style triangular offshore drilling rig. A demonstration unit, moored offshore Aguçadoura in northern Portugal in October 2011, has been closely watched by energy authorities around the world since its first kilowatts started streaming ashore in December. For the Portuguese Institute for Ports and Shipping (IPTM), the country's maritime Administration, the Windfloat experiment has provided a glimpse into what may be the start of an offshore energy revolution.

In 2011, two major energy company consortia completed extensive deepwater seismic studies offshore central and southern Portugal, where they plan to begin exploration drilling during 2012. An oil project led by Brazilian national oil company Petrobras and a gas project led by Spanish State-owned Repsol will be the first deepwater exploration efforts offshore Portugal, and represent the first significant interest in Portugal's offshore reserves in over a decade.

The Windfloat flies the Portuguese flag and has as port of registry in a northern town, Povoa do Varzim, which will be the site of its support base. Accordingly, the IPTM flagged the unit as it would an offshore platform: ABS attended fabrication and construction, and the IPTM certified the unit with reference to the ABS Rules for Building and Classing Mobile Offshore Drilling Units and Portuguese national safety rules regarding, lifesaving equipment, vessel mooring, safety performance and emergency procedures.

"We had little prior experience with offshore energy projects, so it was very interesting for us to work with ABS as they followed the project from design to installation," says José Maciel, Director of IPTM's Maritime Safety Division. "There are drilling rigs flying the Portuguese flag, but the experience of certifying units for such activities is still quite new for us."

Currently, a small fleet of offshore equipment flies the Portuguese flag: two column-stabilized drilling units, three self-elevating drilling units and one offshore supply vessel, the majority owned by Italian energy construction giant Saipem and classed by ABS. The units fly the Portuguese flag under the Madeira Register of Shipping (MAR), in which the IPTM has an oversight administrative role. Headquartered on the island of Madeira, an Autonomous Region of Portugal, MAR is the country's international ship register. IPTM is represented on the board of MAR, including a representative on the technical commission that approves
vessels for acceptance. In this way, says Maciel, the IPTM maintains close control regarding safety matters and statutory issues of the vessels.

“Ships under the MAR fly the Portuguese flag; we have two registers, but one flag and one maritime Administration,” says Maciel. “This close relationship is of the utmost importance for Portugal to be positioned on the White list of the Paris MOU on Port State Control.”

With 160 vessels flying the Portuguese flag through MAR and a little more than a dozen vessels under the conventional register, the performance of MAR vessels drives Portugal’s rating by the Paris MOU.

“The advantages MAR offers shipowners are, primarily, a favorable tax structure and crewing requirements. For example, only half the crew, including officers, need be from an EU country,” says Maciel. “Owners like to work with the MAR not because they expect ‘flexibility’ or that difficult things will not be done; they work with MAR because they get a first-class European flag at a lower cost. Maybe one of the most important things is that the register doesn’t play games – each party knows what’s expected of them and in turn knows what to expect of the other.”

Active Role at IMO Essential

Although the sea has been an integral part of the Portuguese culture for over 800 years, it was only in the late 1800s that the country established a special governmental agency to look after its ports collectively. This agency, the Directorate General of Ports, was merged with the Directorate General of Shipping and Maritime Transport in 1992 to form the present IPTM organization. Today IPTM represents Portugal in international regulatory fora, oversees planning and administration for the country’s maritime sector and assists the government in setting national policy for ports, shipping, navigation and maritime safety.

The most important international-level work performed by the organization is at the IMO. Among the most important issues currently before the IMO Assembly that the IPTM closely follows is that of piracy and the long-running question of whether merchant ships should be armed. “If we speak of arming the crew, we must admit that very little is known about how nonmilitary crews might respond if a pirate attack becomes a firefight. On top of that, we know nothing about the behavior of normal civilians in such high-stress situations,” he notes.

“The basic problem is that no one knows how non-professionals will behave in an emergency and we shouldn’t take the chance of arming them to find out,” Maciel says. “Navy vessels are staffed by military personnel trained to use arms. A merchant ship is staffed with civilians, who, at best, are not as well trained in the use of arms,” he explains. “In an emergency, people who are not well trained might misuse their weapons, might fire too soon,

The WINDFLOAT structure was recently deployed off the coast of Agucadoura, Portugal.
for example, or otherwise cause an accident on board that would just make matters worse. So, if we speak of organizations offering armed guard services, we must proceed with caution. For the moment, we believe IMO should continue to develop guidelines for companies on the subject, but we are not in favor of having armed merchant ships.”

After piracy, Maciel says the two most important issues for the IPTM at IMO concern vessel emissions and the voluntary IMO Member State Audit Scheme, the plan by which maritime Administrations are subject to external audit under the auspices of IMO, with regard to their implementation of IMO Conventions relevant to Safety of Life at Sea and environmental protection. Portugal favors the scheme and supports the use of flag State audit data in the Paris MOU’s ship risk assessments.

“The New Inspection Regime, which is assigning vessels a risk-based priority for PSC inspection, is placing strong emphasis on the flag State audit scheme by including it in the Ship Risk Calculation. One of the elements in the formula is whether the flag State of the vessel has been audited. The flag audit scheme is a very good idea that will help raise the quality of the world fleet,” he says. The Portuguese flag has not yet been audited.

IPTM has under its umbrella both the flag Administration and Port State Control. This brings to the relationship between the two organizations a somewhat collegial atmosphere in which issues are tacked through cooperation rather than contention, says Maciel, who is a former PSC officer. Similarly, many of his colleagues have previously worked together in one or the other organization. The natural tendency of that connection, he says, is that the two groups work together and help each other improve in their specific roles in the chain of maritime safety.

“IPTM has the flag State and Port State Control under one roof, and we work together on the same issues. Port State Controls have a positive force in global maritime safety, with a different focus than the flag States have,” Maciel says. “They are the police and, as such, have a very important impact on improving flag State actions. We have learned a lot from our PSC colleagues.”

Focus on the Human Element

One point on which Maciel is adamant is that, no matter what is the hot topic of the moment, the human element must have a central place at IMO deliberations. With such longstanding problems as watchstander fatigue and burdensome administrative duties now compounded by diminishing career lengths and a consequent reduction in collective experience on board, the human element is one subject requiring nonstop vigilance from the flag State.

“The evidence points to the human element as the source for most errors, but most of the answers have been to improve technology, in one way or another. Technology is continuously improving; when you want
to update equipment, you buy it; but you cannot upgrade education and training in the labor force so easily. It takes time. At IMO we need to lower the speed of this continuous improvement in technical regulation and focus on what the accident investigations tell us: that 80 percent of accidents are still caused by human error, and the nature of that 80 percent has changed,” says Maciel.

“Ships’ crews are, increasingly, being drawn from places with little real merchant marine culture – you need to have had at least a generation or two at sea to have that,” Maciel explains. “On top of that, with people leaving the sea after just a few years to make use of their maritime training ashore, there are fewer experienced people on board for these newcomers to look to for support. This puts maritime safety in a continuous state of risk, which has to be addressed through training and education.”

Seafarer responsibilities have long been a subject of industry scrutiny, and he praises the International Labor Organization's Maritime Labor Convention (ILO MLC) for raising seafarer rights to the same level of attention.

“The MLC puts together many important documents that the ILO has drafted over the years to protect seafarers’ rights,” says Maciel. “The impact on maritime safety of the human condition on board cannot be underestimated.”

This brings up a poignant recollection that puts a human face on what, for many, is an abstract subject. “I visit a lot of ships and, after some time has passed, I remember only a few things about each one,” he says, “but there is one I have never forgotten. It was a small ship in the European coastal trades. There were just four men on board: the captain, the engineer and a crewman at the bow and at the stern – all of different nationalities, all very tired and all very alone. The captain said to me, ‘the thing I miss most of all is someone to speak with in my language.’ I think of that captain and his crew when we discuss the MLC and its attempts to protect the rights of seafarers to decent conditions.

“Much less has been done for the individual on board than for the machinery,” he adds. “Whatever happens in terms of technological progress, the human element – the well-being of the man in the machine, so to speak – must remain the primary focus of flag and port State alike.”

Hunting for Another Kind of Buried Treasure Offshore Portugal

Portugal is not known for offshore energy reserves, but that may change if several new projects turn out successfully.

The offshore project getting the most attention lately has been an alternative project, the Windfloat wind energy experiment, which installed a demonstration unit in northern waters that began producing electricity in December 2011.

Traditional oil and gas sources are also making a showing, and some pretty big energy producers have taken notice. Portugal launched bidding for 14 offshore blocks in 2002, drawing interest in the frontier areas of its deepwater basins, which lie beyond the continental shelf in the west and south. Projects led by two national oil companies, Brazil’s Petrobras and Spain’s Repsol, are set to begin exploration drilling in 2012.

The Petrobras-led consortium will drill for oil off the coast of Peniche, approximately 100 km north of Lisbon. Petrobras operates four deepwater blocks in Peniche covering 12,000 km² at water depths between 200 and 3,000 meters. The Repsol-led project will drill for gas offshore Algarve, in a 6,000-km² area that extends the company’s activity across the entire Iberian southern coast.

In July 2011, the European Union proposed a draft resolution on new rules under which oil companies will be held liable for any environmental damage. The guidelines call for stricter health and safety rules and asks for further transparency in operations, safety and from third-party regulators. Put forth by the Committee of Industry, Research and Energy, the proposal will need approval from the 27 member States and the EU Parliament. For Portugal, it has yet to be determined whether the changing regulatory climate and the heightened activity offshore will require creation of a special offshore safety authority.

Over the past 50 years, about 25 exploratory wells have been drilled in Portuguese waters. The area has been the subject of extensive seismic studies since the 1970s, the most recent of which were completed two years ago for Petrobras.

“In one of our meetings with Petrobras I asked if there really is oil and gas down there," recalls José Maciel, Director of the Maritime Safety Office of the Portuguese flag Administration, IPTM. "They said, we hope so; we have all this technology that looks into the earth and tells us things, but until we see the oil coming up to the surface we don’t really know."
ABS@150: A Legacy of Leadership in Regulatory Development

Through collective efforts, classification societies help IMO develop international regulations.

When the International Maritime Organization (IMO) meets for regulatory debate, its delegates often turn to experts from the world’s classification societies for technical advice. Through these experienced individuals, class societies leave an imprint on developing international maritime regulations that, in itself, is one of the most vital components of the world’s maritime safety regime. Working together at IMO, classification societies combine their accumulated expertise to provide the voice of technical reason in the legislative debates through which international regulations are created.

This involvement in IMO’s regulatory process dates to the creation of their professional organization, the International Association of Classification Societies (IACS), over 40 years ago.

The first IACS-like pooling of classification society expertise occurred in 1938, when ABS and six other societies began gathering informally with the intent of developing a degree of harmony among their Rules. These meetings came about following a request written into the 1930 Load Line Convention, asking classification societies to work on “securing as much uniformity as possible in the application of the standards of strength on which freeboard is based.” The request was repeated in the 1966 Load Line Convention and led directly to the creation of IACS.

Regulation 1 of the 1966 Load Line Convention instructs that, when applying Load Line requirements, if a vessel complies with the Rules of a classification society, the flag State can conclude that it has sufficient strength to be compatible with the requirements of the Load Line Convention. The reasoning is that, because ship strength and stability are intrinsically linked, complying with a class society’s strength Rules and statutory stability requirements provide the fundamental basis for ship safety on which the IMO conventions build. Recognizing that, at the time, the classification societies still promulgated their...
own standards, which in some matters differed significantly, regulators again called on them to harmonize their strength requirements. This request led to the formal establishment of IACS in 1968.

When IMO granted IACS non-governmental organization (NGO) with Observer status in 1969, the technical experts of the world’s class societies gained a place as authoritative advisors to the international regulatory process. Over the ensuing four decades, classification societies have provided an independent voice of technical expertise and reality in IMO’s regulatory debates, bringing to the table important feedback derived from their verification of compliance services as ROs.

**Influencing the Regulatory Process**

Classification societies participate at IMO collectively through IACS or individually as advisors to national delegations. For example, several flag States, including the United States (through the US Coast Guard), regularly invite ABS to provide advisors to their IMO delegations. Most often, classification societies provide input to regulatory development through their collaborative work in IACS, with their people chairing or otherwise participating in the IACS groups that develop submissions to IMO, or by contributing to the various groups and committees that develop IACS Unified Interpretations of the international Conventions for consideration by the IMO member States.

The cooperative nature of the IACS work means that no society can claim to have championed a particular cause and singlehandedly achieved a goal at IMO. They can, however, rightly claim a leadership role in the resolution of issues through the direct participation of individual volunteers in the IACS delegations that attend the meetings and go into the IMO drafting groups where the actual regulatory texts are developed.

The organization’s interpretive role is extremely important. Because regulations form in a crucible of politics, debate and compromise, regulatory text can end up containing vague expressions that are sometimes open to widely varying interpretations when the individual ROs – whose job is to conduct the design reviews and statutory surveys through which the flag States verify that the ships flying their flag adhere to the requirements of these regulations – attempt to apply them to ships. When differing interpretations lead to implementation conflicts, the matter is usually brought before IACS, primarily the IACS Statutory Panel, and is frequently resolved through the development of IACS Unified Interpretations (UIs).

Since interpretation of convention regulations is the prerogative of the flag States (and not their ROs), IACS UIs are submitted to the IMO with the advice to all flag States that IACS societies will apply the UI when acting on behalf of the flag States that authorize them as ROs – unless a flag State instructs its ROs otherwise. Subsequently, IMO committees or sub-committees formally review the IACS UI and may agree with it modify it or ask IACS to undertake further work to modify the UI. In many cases, these UIs are subsequently used in the further updating/amending of the related regulations. As a result, the regulations themselves become progressively clearer and better developed through this feedback process based on real application experience.

Even texts that are not so vague can be problematic. The many agendas in play at IMO, and their need to compromise so as to reach agreement on regulatory text, often produce a working atmosphere in which, essentially, the practical details and difficulties of implementation may not be – or cannot be – fully anticipated at the time of adoption. As proposals progress along the path of development, IACS informs the IMO membership of their technical implications, advises on implementation and, through its Expert Groups and Panels, goes through the often painstaking process of turning regulatory concepts into technical instructions. This part of the process, which is critical to a convention’s ability to achieve the goals of its framers, can become a very complex, long-term endeavor requiring the collective labors of hundreds of classification society engineers and surveyors.

Collaborating in these ways, the IACS member societies have contributed significantly to bringing many of the regulatory goals of IMO to practical fruition. One notable past example of that work is development of the Enhanced Survey Program (ESP). In 1992, IMO followed the US Oil Pollution Act of 1990 by amending MARPOL with a mandate that oil tankers would henceforth be built with double-hulls. The convention also mandated that existing single-hull tankers be subjected to a more rigorous scope of periodic surveys in the lead
up to their mandatory phase-out. The IACS Working Party on Surveys, Reporting and Certification, under the chairmanship of Gus Bourneuf, at the time Assistant Chief Surveyor of ABS, responded to this instruction by developing the ESP. By the following year, enhanced surveys were being performed on single hull oil tankers and bulk carriers in shipyards around the world.

One major set of issues confronting the IMO membership today concerns emissions of ‘greenhouse gases’. The relevant regulations have been adopted and are scheduled to enter into force, but, because their adoption was somewhat contentious and done under heavy time pressures, the new regulations have left some very significant and complex technical issues yet to be developed before the regulations enter into force. Two IACS groups, the Expert Group on the Environment, currently chaired by Ah Kuan Seah (ABS Vice President, Environmental Solutions), and an IACS/Industry Joint Working Group have undertaken to find technical solutions and standards to some of these technical issues for submission to IMO, aimed at achieving uniform and consistent application of these major new regulations in practice.

Another major IACS project, relating to effective implementation of recently adopted IMO ‘goal-based regulations’, is the harmonization and updating of the IACS Common Structural Rules (CSR) for oil tankers and bulk carriers. IMO’s development of ‘goal-based standards’ for the structural design, construction and maintenance of these ship types, which set ‘functional requirements’ that classification society Rules will be required to meet, can be seen as the fruition of the original IMO request for harmonized structural Rule requirements that brought IACS together in the first place. Led by the IACS Hull Panel, currently chaired by Gary Horn (Director of the ABS IACS Hull Panel team), the collective effort seeks to fulfill that vision and harmonize the various CSR requirements – which are not yet entirely common – and update them to comply with IMO’s goal-based standards.

**Direct Impact through Individual Efforts**

Classification societies also make a direct, individual impact on regulatory development. One example of such a contribution is a project that ABS executed on behalf of the US Coast Guard. In 1983, the Coast Guard commissioned ABS to prepare a report that integrated into a single document all US load line regulations and policies, all ABS and IACS interpretations of load line regulation, all IMO circulars and the International Convention on Load Lines. The report was prepared over the course of two years by senior hull engineer Jim Graf (today ABS Vice President, Business Planning and Analysis) and became the Coast Guard’s Load Line Technical Manual, officially published in 1990. Soon after publication, the Coast Guard submitted the Manual to IMO as an information document reflecting accepted US practice and interpretations of the Load Line Convention. With no other similar documents available, particularly any carrying the endorsement of a major maritime nation, the Manual became an important reference work used by the industry and regulators alike for two decades. Updated in 2011, the Load Line Technical Manual continues to be a unique and valuable international reference work.

Another example of a direct class impact on regulation is the work led some years ago by Greg Shark (today Director of Regulatory Affairs for ABS) and Dr. Hsien-Yun Jan on mobile offshore drilling unit (MODU) stability. After the 1980 disaster aboard the drilling rig Alexander Kielland, the Norwegian Government...
proposed to IMO more onerous stability standards that required a major increase in minimum metacentric height (GM) and in upper hull buoyancy for semisubmersible rigs to ensure that they would not capsize in the event of major damage. It was estimated that, in some instances, the proposal would reduce deck load capacity by about 5,000 tons.

Industry was interested in confirming its belief that an intact semisubmersible MODU already possessed significant amounts of stability margin, and in finding an alternative practical approach to improved stability criteria that would achieve the same objectives without the large loss of deck load capacity. Because of ABS’ long leadership in classing MODUs, the classification society was approached by industry to assess semisubmersible MODU stability from a first principles perspective in order to determine if the proposed increase in stability was warranted and, if so, develop a rational, technically-based solution. In a three-year joint industry project led by ABS, advanced non-linear motion techniques were used to develop new dynamic stability criteria for semisubmersible MODUs. The results showed that the proposed increase in GM was not necessary; they were used to develop dynamic stability criteria that were submitted to IMO and, ultimately, became part of IMO’s MODU stability criteria. The criteria were also incorporated into the ABS MODU Rules as alternative stability criteria.

A fundamental contribution to the competent and uniform enforcement of statutory regulations was made in 1993, when IMO adopted an extensive set of minimum requirements (Assembly Resolution A.739(18)) that organizations must fulfill in order to be authorized as ROs by flag States – as well as recommendatory guidance to flag States on the appointment, coordination and oversight of their ROs. Much of the initial drafting of what became A.739(18) was done by Ed Reilly, an ABS Director who, in 1992, was appointed as IACS’ Permanent Representative to IMO. Through Reilly’s tireless work at the IMO on behalf of IACS, these very progressive requirements were adopted and subsequently made mandatory by IMO through an amendment to the SOLAS Convention.

Developing these minimum requirements for ROs (subsequently augmented by training and qualification requirements for RO engineers and surveyors in IMO Assembly Resolution A.789(19), adopted in 1995) became necessary as an ever greater portion of the world’s merchant fleet began dropping the flags of traditional maritime nations in favor of the lower-cost operations possible under the flag Authorities of open ship registers, while the number of organizations seeking to act as ROs for those flags grew rapidly. Until that time, the relationships between the major classification societies and their home governments, and those governments’ recognition and use of classification Rules in conjunction with international regulations and national requirements, had been, essentially, a matter of maritime tradition. This is based on an historical understanding that classification Rules provide the basic technical foundation for ship structures and essential engineering systems upon which national and international regulations build.

As a result, compliance with classification Rules, although understood to be a prerequisite for compliance with IMO conventions by many flag States, was not explicitly stated as such in the IMO conventions themselves (other than in the limited manner in the Load Line Convention, as previously mentioned).

Starting with SOLAS, the major international conventions have been amended to require that, in addition to complying with the convention’s requirements, vessels are also required to comply with the requirements for structural strength and essential engineering services of a classification society recognized as an RO by the flag State. This has helped re-establish the essential, complementary relationship of classification Rule requirements and international convention regulations in providing a comprehensive framework for ship safety and pollution prevention.

The IACS member classification societies, through the collective efforts of their numerous technical experts, have for over four decades been strong partners of the world’s maritime Administrations in the regulatory arena. As ABS surveys a landscape of many milestones in its 150 years of service to maritime safety, standing high among them is the work of the dedicated individuals who have brought it a place of leadership in the global effort to develop and implement rational, practical and critical international regulations for the protection of life, property and the natural environment at sea.
The load line on a ship’s side indicates its allowed freeboard – the minimum distance the side of the laden ship is to project from the water– for various weather and water conditions around the world, which is calculated according to the specifications in the International Convention on Load Lines (ICLL). It can be said that the conditions of assignment of load lines are as important as the freeboard itself, because the assigning authority must be satisfied as to the ship’s watertight and weathertight integrity, structural strength and stability.

In 1983, the US Coast Guard (USCG) commissioned ABS to prepare a report summarizing ABS’ years of evaluation experience regarding the ICLL, including techniques used and interpretations made on behalf of the USCG as the United States’ Load Line Assigning Authority. The single author of that report, senior engineer Jim Graf (today ABS Vice President, Business Planning and Analysis), wrote it during nights and weekends over the following two years.

It was the dawn of the era of personal computing, and the new technology allowed the young engineer to tackle the two-year project from home rather than through late hours in the confines of the office. The conditions under which it was produced reflect society’s transition into the digital age: A modem linked Graf to USCG headquarters in Washington for collaboration and information exchange and the text was drafted in Microsoft Word 1.0 on an IBM XT computer (which cost $6,600 and had far less memory than a current mobile telephone), but all diagrams and sketches were hand-drawn in pen and ink on vellum.
The USCG published the resulting document in 1990 as its *Load Line Technical Manual*, describing it as “setting forth the technical procedures for evaluating, calculating and assigning ICLL load lines, using USCG and ABS policies where the Convention leaves certain requirements ‘to the satisfaction of the Administration’ or is open to interpretation.” That tells the work’s function but does not indicate the far-reaching impact the document has had on the maritime world.

Soon after publication, the USCG submitted the *Load Line Technical Manual* to IMO as an information document reflecting accepted US practice and interpretations of the ILLC. With no other similar documents available, particularly any carrying the endorsement of a major maritime nation, the Manual has been used by interested parties on an international level for many years.

“The *Load Line Technical Manual* is a unique document,” says Tom Gruber, who worked with the ABS Load Line Group from 1988 to 2009. Today he is Senior Principal Engineer with ABS’ Naval Engineering department in Washington, DC. “It explains in practical terms and understandable language how to apply Load Line regulations,” he says. “It isn’t only something the USCG and ABS use; surveyors and engineers do use it, but so do naval architects and shipowners – all over the world. I can’t even count how many copies I have given away over the years, nor how many of my own copies have fallen apart with use.”

In July 2010, the USCG approached ABS to revise the manual, so that it would reflect the evolution of load line policies, and of the industry itself, that had occurred since it was first published. These evolutions included new vessel types, new IACS interpretations, USCG acceptance of equivalent solutions proposed over the years, and, most importantly, amendments to the ILLC that entered into force in 2000 and 2005. The engineer assigned to the project was Tom Gruber, who, by good fortune and out of professional interest, had brought Graf’s original Word files and vellum drawings to Washington after a 1997 visit to ABS’ World Trade Center headquarters. The original drawings were scanned and are now a part of the new electronic document.

Based on his two decades’ experience in the Load Line Group and feedback from ABS field surveyors, clients and the ABS Ship and Offshore Engineering departments, Gruber worked with his civilian USCG counterpart, Tom Jordan, to complete the revisions and submit the updated document to the USCG in October 2011 for final review and issuance.

“The manual that Jim wrote is, by far, the best reference document I have used in the 23-plus years I have been with ABS,” says Gruber. “This sentiment has been echoed not only by the engineers and surveyors who work with it, but also by our external clients. While it is ‘officially’ a document about USCG policies, the manual is used worldwide.”

Tom Gruber, Senior Principal Engineer, ABS
The Paris MOU has been doing Port State Control since 1982 and, sometimes, people ask me if we have really made any progress in the fight against substandard shipping in those 30 years. To this I say that conditions in the industry are much better than they used to be, but also that we are not ‘there’ yet. If we stopped doing Port State Control at this moment, the risk is very high that the industry would slide back into a safety situation very much like what it had in the early 1980s.

In our first decade of operation, the detention percentages were not very high – not because ships were better, but because we were not very good at catching the bad ones and because our inspection system was not very advanced. Between about 1990 and 2000, as we became better at inspecting and catching the bad ships, detention percentages slowly increased to about 10 percent. Today, even though we are inspecting more stringently and are better than ever at selecting the ships that need our attention, the detention percentage of ships in Paris MOU ports has dropped to just over 3 percent. That’s a sign that the system is working.

That improvement comes not only from what we are doing, but also from the more global approach that other MOU regions are now taking toward dealing with substandard shipping. It is becoming harder for bad ships that leave our region to operate somewhere else – that is the key. One challenge for the Paris MOU today is to give assistance to other regions so that they too can improve and start doing as we are doing, with the same level of effectiveness.

The overall picture of ship quality in today’s maritime industry is very good, and the majority of shipping companies run a very good operation. These good operators will get rewards and encouragement to continue their good practices under our New Inspection Regime. But the reputation of the shipping industry is shaped less by the large number of responsible operators than by the much smaller number of companies and individuals for whom responsible operation is not part of the business plan. For 30 years, the Paris MOU has been dedicated to finding the substandard ships that such operators put to sea, and to forcing them to improve or get out of the business.

The common perception is that ‘substandard ship’ means ‘rustbucket’ – a ship that’s falling apart. The concept is larger than that. For us, a substandard ship is one whose deficiencies are serious enough to cause it to be detained in port. A ship can be unseaworthy if, for instance, the crew is unable to perform critical functions on board. The vessel itself may be fine, but if, for example, the crew can’t adhere to safety procedures or can’t manage to do operational drills, you still have an unseaworthy ship.

The fight against substandard shipping is a long and complex one. It isn’t just shady operators that keep bad ships at sea. Those ships couldn’t sail without a compliant flag State and a classification society looking the other way as it hands out certificates. That is why we say that the chain of responsibility only starts with the shipowner; it then links to the Master and crew on board, then to the flag State, and then to the classification society – and why there are still a number of weak links in the chain.

As long as there are poorly performing flag States supporting poorly performing operators, as long as there are classification societies issuing certificates to ships they haven’t seen, as long as bad ships can find friendly bankers, insurers and charterers, our work will not be done. It would be nice if the maritime industry would take care of its own, but, as history shows, hoping for that is rather like hoping for a world that doesn’t need policemen. That said, the industry is much better off than it was 30 years ago and, while we haven’t eliminated substandard shipping completely, we are definitely heading in the right direction.◆

Reflections on 30 Years of Port State Control
Richard Schiferli, Secretary General, Paris MOU
"Oars alone can never prevail
To reach the distant coast;
The breath of Heaven
must swell the sail
Or all the toil is lost."

–William Cowper (1731-1800)

*Human Frailty*