2,000-Year-Old Computer Embodies the Genius of Ancient Greece

A shipwreck discovered by a sponge diver in the year 1900 disgorged a fantastic discovery: the rusting remains of a mechanical device that is often referred to as history’s first analog computer. Its wooden case was originally about the size of a large shoebox and contained at least 32 precision-made gears, although researchers have reason to speculate that it may have had as many as 72.

What can be understood about the gears tells scientists they correspond to Ancient Greek science – for example, theories about the motion of the moon developed by the astronomer Hipparchus. Its front dial has two concentric scales, an outer ring marked with the days of the 365-day year, and an inner dial marked with Greek Zodiac signs and divided into degrees. The calendar can move to compensate for the extra quarter day in the solar year.

Built around 100 BC, it may well represent a step in what was an evolving computing technology. Cicero, writing in the first century BC, mentions an instrument “recently constructed by our friend Poseidonius, which at each revolution reproduces the same motions of the Sun and Moon and five wandering stars (planets) as is brought about each day and night in the heavens.” He also reported that the great Archimedes had built a small mechanical planetarium and two such devices were said to have been rescued from Syracuse when it fell in 212 BC.

Known as the Antikythera Mechanism for its place of discovery – a Greek island lying between Crete and the Peloponnese – the mysterious device is displayed alongside a modern reconstruction at the National Archaeological Museum of Athens.
The Greek-controlled fleet has grown and evolved immensely in the 65 years since its rebirth. Today, ‘Greek shipping’ has developed into a global empire of entrepreneurship touching all spheres of maritime activity. The surveyors and engineers of ABS have shared in every step of that transforming expansion, building a longstanding relationship with the Greek maritime community through their close work with the owners, designers and shipyards whose collective efforts have elevated the technical and professional sophistication of this complex and ever-changing industrial sector that is so vital to the proper functioning of the modern world.

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PARSING THE PROBLEMS FACING TODAY’S SHIPOWNER

Prominent shipping man Spyros M. Polemis shares thoughts and observations on the trials, triumphs and future of the industry he has served for half a century.

PIRACY: AN ETERNAL PROBLEM

For the last three years or so, we, as an industry, have constantly urged governments to take decisive action against piracy. We have certainly come a long way, but the pirates have become more sophisticated and adapted to the situation as it developed. The Best Management Practices that the industry has adopted have certainly helped; the European Union Naval Forces, Somalia (EU NAVFOR), which was organized by the European Union, has also certainly helped, as have NATO and other navies that have sent warships to the area.

Still, the pirates have been able to increase their capabilities, have extended their area of operations more than 1,000 miles from Somalia and have also become more aggressive. Already, 60 seafarers have lost their lives in various ways, and seamen have been badly treated, tortured and shot dead in cold blood. In response, shipping companies have had no alternative but to begin using private armed guards. This was a choice of last resort; the shipowners felt that they had to do something more in order to protect their crews.

Initially, governments wavered about the use of armed guards, but more recently some politicians started to give in, and now we have a number of nations that have approved, or are about to approve, the use of armed guards. This, of course, is not a solution; it is only a

SPYROS POLEMIS is, perhaps, best known as Chairman of the International Chamber of Shipping and President of its sister organization, the International Shipping Federation. He is also chairman and managing director of Seacrest Shipping, the London-based representative of a group of shipping interests that have a maritime legacy that dates back over two centuries – the company where he recently celebrated his 50th year in the shipping industry. Here, Mr. Polemis shares observations and opinions on some of the top issues the maritime world has faced in what has been one of the most tumultuous decades in its modern history.
temporary measure in trying to protect our people. The permanent solution is to work towards establishing a proper government in Somalia itself, with powers to enforce law and order in the country.

In the meantime, the shipping industry is continuing to push governments to do more. Specifically the industry is asking governments to:

- Adopt an offensive posture against piracy in contrast to the defensive posture that has prevailed. This posture includes attacks ashore on pirate camps and infrastructure.
- Take action to release all hostages.
- Every apprehended pirate must be arrested, taken to a court of law and, if found guilty, imprisoned. No pirate that has been caught should be set free.
- Break the chain that finances piracy through legal action against the so-called investors, wherever in the world they are identified.

As to the payment of ransom, the industry is anxious to keep this avenue open, until piracy is eradicated altogether, otherwise shipping companies will have no possibility to negotiate and convince pirates to release the crew. Some governments have not quite understood this absolute necessity and have been talking about doing something regarding ransoms, even banning them all together. This would be catastrophic for the crews that are held hostage, under severe stress and unacceptable conditions, whether on board their ships or in Somalia.

As stated previously, employing security guards is, and can only be, a temporary measure. Governments must really do whatever is required to eradicate piracy altogether, and not just in Somalia. Piracy is spreading, and that is another reason why governments cannot delay, and why they can no longer afford to postpone taking decisive action.

The latest World Trade Organization projections for 2012 are not very positive, whilst global trade has probably not improved much on the levels that existed before 2008. Shipping, of course, is the servant of world trade and, just as it benefited from the boom years of the mid-2000s, its fortunes are now inextricably linked to the recent fall in the demand for its services.

It would be wrong to suggest that the industry's current problems are entirely of its own making. The behavior of the banking world and the inability of the politicians to get to grips with sovereign debt are all very well known. My personal view is that the emphasis given by Western governments to austerity programs without an accompanying aggressive strategy to promote economic growth will simply be self-defeating. We do need growth, and we need an injection of serious optimism. The last thing we need is fear about the future.

We also need to be realistic. To a large extent, many shipowners have been shielded from the full severity of the current economic crisis by the seemingly inexorable growth of China, with its apparently insatiable demand for raw materials and relentless expansion of its manufacturing capability. But even this beacon of light cannot be guaranteed.

If, as seems likely, the Eurozone goes into a full recession – or, even worse, implodes – the implications will almost certainly be global, and may well reduce demand for shipping services from China, and the other BRIC nations too. Leaving aside the impact of what may or may not happen in Europe, the continuation of China's policy of massive infrastructure expansion cannot be taken for granted – should it decide to place more emphasis on meeting the demand from its people for more domestic consumption.

ECONOMIC TURMOIL & THE FINANCIAL CRISIS

In recent years, the shipping industry has been confronted with unprecedented economic turmoil. Much of the industry is still struggling with the serious consequences of a truly massive contraction in economic activity, in which global trade is estimated to have declined by nearly 10 percent.
Moreover, although the global financial system has been seriously threatened by the crisis, with government support it has so far managed to survive and it is still intact. This is not, by any means, an insignificant achievement, and it should not be forgotten just how close to the precipice the world economy did come.

The banking crisis has now turned into a sovereign debt crisis, and the new religion of austerity may yet be the undoing of us all. When governments pumped in vast amounts of money to rescue the banks, and propped up their coffers with quantitative easing, they should also have done far more to make this conditional on maintaining lending.

Fortunately, although bankers are hardly beyond reproach amongst society as a whole, it appears to be in the banks’ own interests to support many of those shipping companies that may have had recent difficulties, although it is by no means clear how long this situation will continue, and even shipping banks may start to lose their patience with any companies in breach of their existing covenants.

The debt crisis means that banks are expected to tighten lending to the shipping industry, as they are required to improve their balance sheets and reduce debt-to-capital ratios. The majority of shipping banks are still European and are already being affected by the Euro crisis. But all shipping banks will have to comply with the stricter capital requirements of the Basel III banking rules, which are due to be phased-in over the next few years. As banks are forced to strengthen their balance sheets, this may further reduce the finance available to shipowners.

Basel III will probably exacerbate the very difficult lending conditions to which shipowners are likely to be exposed going forward. In order to meet their capital debt ratios, many banks might well wish to reduce their balance sheets by disposing of their shipping portfolios completely – even if it means doing so at a loss. New projects will require much greater equity with the possibility of even greater involvement of sovereign wealth funds or governments supporting shipping directly through soft loans.
VESSEL OVERSUPPLY 
& MARKET EFFECTS
What we also have to acknowledge is that many of the problems confronting shipping have undoubtedly been exacerbated by shipowners placing orders for far too many ships, with far too few cargoes to carry.

Current markets would appear to be demonstrating just how seriously damaging the oversupply of ships has been to shipowners’ revenues, with many now struggling to meet operating costs. In the current climate of massive uncertainty, rates are as volatile as ever. Rates for all bulk carriers, for example, are a fraction of what they were not so long ago.

However, whatever the insatiable appetite of individual owners, the biggest danger, perhaps, is the overcapacity that exists in the shipyards; a very strong commitment for market share is being displayed by the three major shipbuilding nations – China, Korea and Japan – where 90 percent of the world’s tonnage is built. Even if some shipyards appear to be going bankrupt, it is almost certain that their governments will step in to support them so that they can continue to produce ships that few people want or need (other than speculators who may be tempted by knock-down prices) or China, with its widely recognized goal of wanting to carry a much larger proportion of its cargoes – perhaps 50 percent – on board its own ships.

Although this is of little immediate comfort to those individual companies that may be struggling to survive, one consolation, at least for the moment, is that, so far, governments appear to have made a determined effort to avoid excessive use of protectionist measures.

One can understand how tempting it is to order ships now that prices for newbuildings are almost half of what they used to be; but, shipowners should refrain from placing orders, not only because there are just too many ships, but also because prices are bound to go down further.

BALLAST WATER & ASPIRATIONAL LEGISLATION
The ultimate goal of the shipping industry is simple: zero accidents, zero loss of life and zero pollution. In view of the huge liabilities involved for noncompliance, this is a matter of enlightened self-interest. It is always important to stress that shipping is a global industry requiring global rules. If major trading nations adopt rules that are at a variance to those agreed to by governments represented at the International Maritime Organization (IMO), we will have chaos.

Right now we face a particular challenge with ballast water, with some individual US States talking about treatment standards 100 times more stringent than what has been agreed at IMO and for which the equipment required simply does not exist.

Also, regrettably, at a recent IMO meeting – under pressure from the United States, or, more particularly, the US Environmental Protection Agency (EPA) – some major changes were proposed to some important draft guidelines on ballast water sampling that will be used by Port State Control inspectors and which could, potentially, be extremely problematic to shipowners if adopted by IMO. The industry made representation at the end of the IMO meeting about the direction that had been taken and, thus, the draft guidelines will now be reconsidered. However, this now
means that these sampling guidelines will not be approved until at least 2013, which, in turn, is expected to further delay the additional ratifications needed to bring the IMO Ballast Water Convention into force. This creates other problems for shipowners due to the fixed dates by which existing ships have to install the very expensive new treatment equipment required by the Convention.

I mention this particular issue in order to highlight the danger of aspirational legislation. For reasons well understood, there was huge political pressure for IMO to adopt the Convention back in 2004. But the equipment needed to comply with the new requirements, and the complex technical guidelines needed to ensure proper implementation, had not then been developed – which is why it is only now that governments are almost in a position to ratify. This is really a case of environmental aspirations being incompatible with some of the technical realities, not to speak of economic ones.

**ECAs & LOW-SULFUR FUEL**

The implementation by the United States of the new IMO low-sulfur fuel requirements in the MARPOL Convention resulted in the establishment of an Emission Control Area (ECA), along the west and east US coasts, in which ships will be required to burn fuel with a sulfur content of 1 percent this year, and just 0.1 percent in 2015.

The industry has no objection, in principle, to this dramatic regulatory change, which is consistent with the agreement reached at the IMO three years ago and which is being similarly implemented in Europe, the Baltic and the North Sea. Also, despite the very high additional costs of using distillates instead of heavy fuel oil, evidence about the effects of sulfur emissions on human health is difficult to argue against; the IMO agreement was a reasonable compromise that kept regulation of ship’s emissions within a global framework.

However, the real concern that we have about the ECAs relates to fuel availability, and whether the oil refining industry can produce the large quantities of distillate needed by 2015. It is still unclear whether or not enough low-sulfur fuel will be available for the US shipping industry, let alone the huge amount of international shipping that trades in and out of the US. In addition, if the extra costs to shipping are too high, then there is also a danger of modal shift, with many short-sea cargoes returning to the roads, which would have a negative environmental impact that might outweigh the benefits of ships switching to low-sulfur fuel.

There is certainly a growing concern about this in the Great Lakes and in Europe, although I emphasize that the industry remains committed to supporting the implementation of the IMO agreement unless governments formally decide to bring these concerns back to IMO.

The industry is trying to encourage IMO to bring forward a detailed study on fuel availability so that it might be completed before the 2015 implementation date for ECAs. We hope that we are wrong, but there is a possibility of a serious supply problem, which is a thought that seems not to have occurred to those who advocated such a relatively fast timetable for the switch.
CO2 & GREEN ARM-TWISTING
Whatever our views as individuals and citizens, it is not the place for the shipping industry to question the science of global warming, or the consensus within the international community that shipping, along with the rest of society, should play its part in reducing CO2 emissions.

Last July, IMO concluded a ground breaking agreement on technical and operational measures to reduce shipping's CO2 which has the full support of the international industry.

The reduction of emissions through reduced fuel consumption and increased efficiency is again a matter of enlightened self-interest; it is a given, and is fully compatible with the poor market conditions we are experiencing at the moment. But when we come to the debate about the so-called market-based measures (MBMs), it is important for us to be guarded and more nuanced.

Shipping companies are rightly skeptical about the introduction of MBMs. The high cost of fuel, which looks set to increase further, means that shipowners already have every incentive to reduce their emissions even more.

The industry has recently made clear that now is certainly not the time to impose additional costs on shipping that would appear to deliver little environmental benefit, even to those concerned about global warming. Many governments now see MBMs as a means of raising money from shipping as an end in itself, whether as a means of providing finance for climate change projects in developing nations – as part of the negotiations on a new global deal to replace the Kyoto Protocol – or simply as a means of raising money to go directly into government coffers. Many European governments are quite open about this and have suggested that as much as $40 billion a year might be raised from shipping. This is inequitable.

It has been made quite clear that the industry should not be regarded as a cash cow, and that extracting payments of this scale would rightly be seen by developing nations as a tax on trade and as a kind of green protectionism. The fact remains, however, that the Green Climate Fund has now been established by the United Nations (UN); and the UN will be considering sources of funding that are very likely to include shipping.

The discussions, however, are very complicated. Regardless of whether we want an MBM, if a market-based measure for shipping is developed by governments we have to be fully engaged in the process. Our principal objective must be to ensure that any measure adopted is applied on a global basis so that it does not distort competition, which means supporting the IMO as the forum in which the discussion should continue. It would be unreasonable to expect the IMO to make significant progress until the United Nations Framework Convention on Climate Change (UNFCCC) has clarified what role shipping might have in its 100-billion-dollar Green Climate Fund, which is likely to take another year or so, but if the discussion is perceived to be too slow there is a danger that the EU will be encouraged to impose regional legislation.

Talking about MBMs, it is not that we can, perhaps, take some comfort from the difficulties that the EU is currently experiencing with the European Emissions Trading Scheme (ETS),
with the implementation of its ETS for aviation, and the hostility being displayed towards this by the likes of the US and China. It is simply that ETS is not suitable for shipping. It will distort competition, it will enrich speculators and larger companies, and the money raised will not benefit the environment.

In our discussions with regulators on environmental issues, and particularly with respect to CO2, the shipping industry should be treated like a sovereign state in its own right. After all, we are frequently told that our CO2 emissions are the same as those of Germany, while the income generated from maritime transport annually is estimated to be in excess of a trillion dollars.

There is a serious point here about shipping resembling a sovereign nation, in that emissions from shipping do not lend themselves to inclusion in national CO2 reductions targets. A ship may be flagged in one country, and owned in another, while the cargo carried will be of economic benefit to a variety of different importing and exporting nations. This is why we need to maintain a special global regime for shipping.

Also, this is why the only mechanism that can apply to shipping is the levy-on-fuel type of scheme, which is flag-neutral and does not distort competition and, even more importantly, can ensure that whatever money is raised will be channeled directly to projects that will benefit the environment.

THE OCTOPUS IN THE ROOM
The European Commission has developed into something that probably no one envisaged. The Treaty of Rome planned for a Common Market; today the Commission intervenes in every walk of life and almost every aspect of the lives of European citizens. It has also sought to go further, by enacting regulations that they wish to apply to international carriers, thus impacting on issues of sovereignty.

This rather new stance is bound to create problems for all sorts of reasons, both within Europe as well as internationally.

As far as shipping is concerned, the European Commission has, for years, sought to become a member of IMO, and has demanded that its members, European Nations, speak with one voice. This issue alone could shake the very structure of IMO, because, if the EC succeeds, there will be for the first time, block voting, something which is absolutely undesirable. It will also raise other very important issues within the rest of the members of IMO and it will not ultimately be good for regulations for shipping, because what the EC decides may not be best for shipping.

IMO is quite an efficient organization in spite of its 170 members, and has the capacity to debate and pass regulations quite quickly. This has been demonstrated in the last few years by the additions to MARPOL Annex VI regarding low-sulfur fuel, by the ISPS Code, the ISM Code and others.

Also lately, as is widely known, the Commission has been threatening that, unless the IMO agrees to enact regulations for CO2 emissions, then the EU will adopt its own regional regulation.

This is not just undesirable, but it is no way to deal with such a hugely important and highly complex issue. To begin with, a regional regulation is really quite wrong for all sorts of reasons, but perhaps the most important is the fact that it will distort competition to a great extent and, ultimately, will not benefit the environment, certainly nowhere near to the degree that the Commission expects. Shipping, as a global industry, requires global rules; this is not something to be taken lightly.

IMO is working diligently and quickly on this issue, but even the UNFCCC has not yet decided which way to go. Therefore, the European Commission should allow IMO to do its work. IMO does not need to
be pressured; the IMO fully accepts the seriousness of the task and will find a proper solution.

Another issue that has escaped the public eye, perhaps deliberately by some, is the fact that the shipping industry is responsible only for 2.7 percent of global CO2 emissions. Why is the Commission pressuring IMO? Why are governments at the UNFCCC looking to raise so much money from shipping? And why are Europe and the UNFCCC not talking about the others that are responsible for the remaining 96.3 percent of CO2 emissions?

REFLECTIONS ON THE VOYAGE AHEAD
The shipping industry is a lifeline for all the people on earth, vital to their well-being, and it raises the standards of living globally by creating and spreading wealth and opportunities.

The shipping industry is so vital, so important and so big that it should have the status of a Sovereign Nation State; it should not be dictated to, it should be consulted. It should be a partner to governments, not a whipping boy.

Governments have to understand that politics have no place in decision-making about regulations concerning shipping, as they may impact safety as well as the effectiveness of the regulation.

The above need be taken very seriously by politicians. Shipping is indeed the engine of world trade. Shipping is the only means through which globalization can take place; therefore, the treatment of all issues concerning shipping requires a different approach. Changes to well-accepted practices might be counter-productive and certainly may affect many other players in the chain. What lies ahead, therefore, in terms of regulation, should be very carefully considered by politicians who should adopt a more interactive stance towards the shipping industry.

Regulators, politicians and the public demand more than ever from the shipping industry in terms of transparency, safety, pollution prevention, accountability and higher standards. Shipping has responded, as it always has, and in many respects is ahead of the game. The safety record has improved to a very large extent and so have the accident and pollution statistics. All shipping companies have embraced the ISM Code, the ISPS Code and much stricter pollution regulations, whilst governments have not played their part in terms of providing reception facilities at every port in the world.

As to the market, one has to remain optimistic that, once the extra tonnage is absorbed, better times will return. However, regulations about more environmental-friendly vessels of the future should take into account the fact that ships, by necessity, are built to last 25 years, and thus cannot change their performance by any considerable extent in the years ahead. This means that a different approach is needed. The industry has no problem in building better ships, but better ships today will not necessarily be such good ships in five years time from an environmentalist’s point of view. Also, one should not contemplate building ships to last for a shorter period because of structural safety considerations.

No one has a crystal ball, but I do hope that, in the future, governments will realize that they must re-think their strategies and be better partners to shipping. After all, the goal is the same. Higher standards of service within an already amazingly efficient shipping industry that will continue to deliver the goods that people need, safely, economically and on time.
Fighting the Fog Surrounding Shipboard Ballast Water Treatment

With the IMO declaring invasive aquatic species to be “one of the four greatest threats to the world’s oceans,” it comes as little surprise that regulators around the globe are eagerly expecting the IMO’s International Convention for the Control and Management of Ships’ Ballast Water and Sediments (the Ballast Water Management Convention) to be ratified any day now. Not so convinced are the shipping industry and most of the world’s flag States, who are grappling with an array of practical problems, technical confusion and implementation uncertainties stemming from what they see as hastily-wrought legislation, well-intentioned though it may be. Reflecting their collective reasonable doubts, ratification of the Convention has stalled at 33 States – only two of them major flags – representing just 26.5 percent of the world fleet; it needs at least 30 signatories representing at least 35 percent of the fleet to enter into force.

Adopted in 2004, the Ballast Water Management Convention requires ships to arrive in port with ballast tanks 99-percent free of living organisms and pathogens, mandating that the ballast water be cleaned or replaced through application of various treatment technologies and/or best management practices. In harm to fish and wildlife, waterways and marine infrastructure, invasive aquatic species are believed to cause billions of dollars in economic damage annually around the world – and just about everyone agrees with the Convention’s desire to prevent any more such infestations. Where they disagree is in the details.

Many maritime authorities believe the ultimate solution is to install shipboard ballast water treatment (BWT) systems, which disinfect ballast water as it is taken on; some authorities are satisfied with ballast water exchange (the replacement of ballast in mid-ocean, which relies on the saline barrier to prevent species transfer); and still other authorities – like the Port of Rotterdam – are investigating the feasibility of treating ballast water at port facilities and thereby delivering pre-treated, clean ballast water to all ships calling there.

As the regulatory climate evolves, the maritime industry is being asked to make an aggregate investment of about $74 billion in shipboard ballast water treatment. One major shipowner estimates that the cost of a BWT system could range from $1.5 million for a handysize vessel and up to $4.5 million for a VLCC, at current prices. If shipboard treatment becomes mandatory worldwide, it is believed that about 39,000 ships will need to be retrofitted with BWT systems over the next five years. Some estimates are higher, including the US Coast Guard’s estimate of 60,000 vessels, creating a $13 billion-a-year industry by 2016. At the moment, only a small fraction of the world fleet has or has contracted for shipboard BWT systems.
The US Coast Guard’s issuance of its final rule on ballast water discharge in US waters introduced a further worry for owners. Although the USCG relieved many fears by accepting the IMO D2 ballast water standard, the agency said in a written statement that it “fully intends to issue a later rule that will establish a more stringent phase-two discharge standard.” This, coupled with the elimination of an early provision in the rule that exempted vessels already fitted with BWT systems from having to re-retrofit to higher performing equipment, raised industry fears that the actual final price of regulatory peace of mind could be $74 billion times two.

Authorities pushing for shipboard BWT see the shipowners as dragging their feet. Makers of these systems don’t see the sense in taking so long to implement the inevitable. Meanwhile, many shipowners and flag Administrations are stalled in their decision-making and simply don’t know where to turn for reliable answers. A number of owners express dismay in the amount and quality of available technical information and in the squabbling over treatment standards by the world’s regulatory authorities, with many afraid that they are being asked to throw huge sums of money after shadows and smoke.

It isn’t that the maritime community does not wish to take right action, they say, but that right action in this case is not clearly defined, nor adequately supported. Most also say that the quality of data on the technologies supported by the regulators does not inspire confidence that the intended job can be done. The upshot is that even traditional, high-quality shipowners with a track record of early adoption of advanced technologies are confounded.

**One Company’s Doubt Reflects an Industry’s Dilemma**

The experience of one leading independent tanker and bulk carrier operating manager, Athens-based Andriaki Shipping Company, provides an insight into the uncertainties confronting an entire industry. Andriaki took delivery this year of a pair of suemmax crude carriers whose specifications provide space and power for, but do not include, a shipboard ballast water treatment system. It is an approach that many owners are taking.

“At the time we ordered the ships, so much was unclear about which systems could be used that even the actual power demands were unknown,” says Dimitrios Korkodilos, CEO of Andriaki. “So, we thought, let’s design for a system from which there may at least be a benefit for the ballast tanks. I refer to the well-known experiments aboard the Hellespont ULCCs, in which they used the ship’s inert gas system to inert the ballast tanks in order to prolong the life of the coatings through deoxygenation,” he explains.

Beyond the test data assisting that choice, Andriaki found surprisingly little assistance for owners facing this extremely challenging decision-making process. “We shipowners have nowhere to turn for the level of authoritative guidance we need in order to make the best ballast water treatment choices for our fleets,” Korkodilos says, pointing out that, even after an exhaustive study of the various BWT systems on offer, Andriaki could not become fully convinced as to which they would prefer when time came to choose.

“Each manufacturer naturally says that his system is best, and can offer persuasive arguments as to why. In reality, there is a lot of scientific salesmanship but nearly no service history for this equipment in this application. Even the shipyards cannot provide good guidance, because not even they are very sure about which systems are best to install,” he says.

In addition, he points to the withdrawal from the market of the Unitor BWT system as further cause for doubt. On 29 February 2012, Wilhelmsen Technical Solutions announced that it had completed a comprehensive performance verification.
program for the system and had decided to withdraw the current design, saying in a press statement that “the system, at this stage of development, will not, in our opinion, provide our customers with an effective, fully compliant solution for the varied and dynamic water conditions encountered by a vessel engaged in global trade.”

“This shows that even systems produced by respected, major manufacturers which have met with approval by the responsible authorities, may, in fact, prove unreliable in practice,” Korkodilos says. “I think this was a real blow for the whole concept of shipboard ballast water treatment. It tells us that, because the testing of these systems has been very limited, we cannot be 100-percent sure which will be most effective, or even suitable – their performance limits are not entirely clear yet.”

For Andriaki, as for many owners in the shipping fraternity, the path forward is to wait, to watch and to see what others are doing. It isn’t so much a case of dragging one’s feet, but, rather, of looking for a place to plant one’s feet squarely on the ground.

“When you see what others are putting into their newbuildings, you can discuss with them the basis for their choice; you can discuss it with the shipyard; and, if you have time, you can observe what happens during the operation of the systems. In that way, you can make an informed decision for your fleet. In this case, the timeline is far too short for that. When it comes to the question of retrofitting, the decision is even more difficult,” he says.

Owners contacted for this article indicated that retrofitting a BWT system can sometimes resemble a conversion project rather than a mere retrofit. Depending on the choice of system, a typical scenario can call for wide-scale replacement of piping systems, pumps, diesel generators and all electrical cabling, in addition to structural modification. A ship might have to spend a month in drydock to get it all done, one owner said.

“All these considerations make it very difficult to arrive at a decision with confidence that you are doing the right thing,” says Korkodilos. “Some owners are starting to order ballast treatment systems for their newbuildings, but, because of doubt and confusion surrounding this concept, very few are retrofitting. Unless something happens, I don’t see that changing before the Convention is ratified.”

One Company’s Solution may Enlighten a Path

One major shipowner has developed a methodology for going forward on shipboard ballast water treatment that may provide some illumination to those companies looking for a path through the forest. Leading tanker owner OSG made the decision-making process a global effort, reporting in its company magazine OSG Signal that it created its Ballast Water Treatment Project Team to include in the process every department, on shore and at sea, that is affected by the choice of BWT system. The team is part of OSG’s Technical Services Group, which was founded in 2009 to unite the company’s international technical offices and focus their engineering expertise on projects as they arise.

“Shipboard ballast water treatment is totally new for the industry; in this application it is not a known technology, the way oily water separation or crude oil washing are; it is a huge project that must be tackled as a team,” says Vayia Hatziyianni, a Senior Project Engineer with OSG in Athens who is Project Manager of OSG’s Ballast Water Treatment Project. She says that shipowners need to develop new competencies and capabilities to fully understand BWT systems, their operations and their impact on board and on the company. How this is done, she says, is through teamwork and exhaustive studies performed by specialists capable of assimilating the necessary knowledge and applying it to the company’s ships.

“We believed from the beginning that the owners should be the ones to work on and study this matter; that they should formulate an opinion based on the knowhow they develop through study,” Hatziyianni says. “We believe it a mistake to think that the
manufacturers alone can provide a solution, because a manufacturer does not know your fleet, your operations or your specific needs; of course, you will take a lot of data from them, but, ultimately, the work should be done by the owner. For this reason, owners should be prepared to devote some resources to the issue,” she says.

“You cannot go to a library or consult a specific organization to learn all the information that you need,” she adds. “That said, there is a lot of literature related to this issue – it’s just spread among many sources. For example, there is data on how corrosion in tanks is affected by ballast treatment, or on the efficiency of UV lamps; for each technology there is a lot of literature, because all of these methods have been applied in the potable water industry for many years. It is not an easy job; it’s very difficult to cope with all the details, but if you start from the point of view that a lot of research has to be done, you can do it,” she says.

“We began by setting criteria and decision points that we wanted to be fulfilled by our choice of BWT system,” explains Maria Sotiriou, a Chemical Engineer and OSG Environmental Officer who aided the BWT Team’s research efforts. “Then we analyzed all the systems, which at that time had been approved by IMO. Laboratory tests of equipment usually give a good indication of system performance; nearly half the data gathered was related to purely scientific matters, and the remaining part was related to engineering, commercial and installation data. Based on the criteria we set, we developed a rating system and that led us to our result” she reports. “However, the process is not as simple as the description; it involved quite a lot of study of the systems,” she says.

“Among the long list of factors figuring in the ballast water treatment decision process are: vessel type, size and configuration; available space; power requirements as compared with ship’s systems; and the vessel’s trading pattern,” she adds. “An added complication when retrofitting is having to work within the confines of an existing structure. The process might be simplified when vessels share enough characteristics – series-built ships, for example – and have similar trades, in which case one system might serve for the group.”

For this reason, Hatziyianni advises shipowners to bring into the decision-making process people with science training as well as engineers. “Scientists and engineers are both needed to make this choice,” she says. “We established a transparent decision-making tool that incorporated 23 different decision points. It is a complex process that led us to a structured outcome and a decision for our newbuildings.”

After several years’ work, OSG’s Ballast Water Treatment Project Team selected the Hyde Guardian UV-plant for installation aboard two newbuild aframax tankers with keel-laying dates in 2013. That said, Hatziyianni emphasizes the lesson is in the method, not the outcome.

“The important thing to remember is that selecting a BWT system should not be viewed as one choice to be applied across an entire fleet, or even among a particular ship type, but as a ship-specific decision. A mixed fleet with sufficient variation in space and power limitations might require an owner to install and maintain several different technologies. The system we chose was selected for a specific vessel, with a specific aim and in a specific trade,” Hatziyianni says. “For another newbuilding, or for a retrofit, our choice might be different. The important thing in all this is to prioritize your criteria and to try to make the best possible decision.”

After several years’ work, OSG’s Ballast Water Treatment Project Team selected the Hyde Guardian UV-plant for installation aboard two newbuild aframax tankers with keel-laying dates in 2013.
Shipboard Ballast Water Treatment:  
AN OPERATOR’S VIEW

By Stavros Hatzigrigoris, Managing Director, Maran Tankers Management, Inc.

The International Convention for the Control and Management of Ships’ Ballast Water and Sediments was adopted by consensus at IMO in London on 13 February 2004. As of 30 April 2012, the Convention had been ratified by 33 member Administrations (a few of them landlocked) representing approximately 26.5 percent of the world’s fleet. The Convention will enter into force one year after members representing the remaining 8.5 percent of the required 35 percent of the world fleet will ratify the Convention.

As per the current strict legal interpretation of the convention, all ships with ballast water capacity above 5,000 m³, for which the keel was laid after 1 January 2012, will have to retrofit a system after the enforcement date.

Since a large percentage of the ships that have a keel laid after 1 January 2012 have not been provided with a ballast water treatment system (BWTS), some people have expressed the opinion that, because ships cannot be stopped in the middle of the ocean at a certain date, a solution that will enable further trading will have to be sought within the IMO. Flag Administration waivers will not be sufficient to postpone the installations since port States may have a different view than the flag States.

Existing ships will have to retrofit a system during the first intermediate or special survey after their delivery anniversary date in 2016.

The situation was changed recently with the publication of the US Coast Guard’s Final Rule for “Standards for Living Organisms in Ships’ Ballast Water Discharged in US Waters,” which requires all ships with a ballast capacity above 5,000 m³, constructed after 1 December 2013 to be equipped with a BWTS. All existing ships (constructed before 1 December 2013) are required to be retrofitted with a system during their first scheduled drydocking after 1 January 2016.

One more major change is that a BWT system installed on a vessel that will discharge ballast in the US has to be finally type approved by the US Coast Guard (USCG), irrespective of any other valid Administration approvals. As an interim measure only, an IMO type-approved system could be accepted for operation if a USCG-approved system is not available. This is only for a maximum period of five years from the compliance date, after which the system will have to be approved or replaced. This means that by 31 December 2025 at the latest, all BWT systems that are to be used in US waters will have to be USCG approved.
THE TECHNOLOGIES

Ballast water treatment technologies can be divided into several categories, the main ones of which are:

PHYSICAL SEPARATION

These systems use centrifugal separation or other filtration principles. If hydrocyclonic treatment is taken as an example, it is comprised of bell-shaped hydrocyclones that push relatively large sediments and other organisms (with higher density than water) to the outer portion of the filters. The higher the velocity of water, the better is the separation. Particles lighter than water, dissolved materials, bacteria, viruses or phytoplankton cannot be removed by this technology. It could cause damage, though, to live organisms during their passage through the hydrocyclones and thus reduce their density. Such systems are usually of small capacity, which can be increased by modularizing additional units. The cleaning of the filters and the generation of bacteria within them during the idle periods is a problem that will have to be studied in detail.

HEAT TREATMENT TECHNOLOGY

The ballast water is heated to 40 to 45°C; most aquatic organisms are destroyed if maintained for a period of time in this temperature range. The system cannot be applied on bigger ships and is energy hungry.

ULTRASONIC RADIATION

This system makes use of ultraviolet (UV) light and generates intermediate oxidizing radicals for the dissociation of organic material. Although UV technology has a lot of advantages (simple operation, safe and non-toxic, organisms cannot build resistance against UV, old and tested solution etc.), normally it will require pre-treatment filtration in order to remove larger organisms and particles. It can also be rendered inefficient if the water contains heavy metal ions, oil or grease (fouling of the quartz sleeves and crystals). It will then require the use of chemical oxidizers if antioxidants are contained in the treated water. The electric power requirements are quite high.

PLASMA TECHNOLOGY

When a plasma arc is created in the water, an intensive pressure shockwave is formed. This kills the organisms in the water. The plasma technology also generates highly reactive and short-lived hydroxyl radicals, UV radiation and electric fields which further disinfect the water.

CAVITATION

The water passes through an injector shape (Venturi pipe or similar) which increases the water velocity and reduces the pressure. When the pressure reaches the vapor point of the liquid, cavitation (in which bubbles are formed and then rapidly and violently collapse) will be created, damaging and reducing very efficiently the bacteria content.

DEOXYGENATION

The absence from the water of dissolved oxygen will cause death to all aerobic living organisms. These systems remove the dissolved oxygen from the water by injecting, normally, nitrogen or another inert gas into the water. The important benefit of reducing oxygen is that, in principle, corrosion in the ballast tanks will be reduced. Inert gas and nitrogen can be produced on board by installing suitable generators. Flue gas for inerting can also be produced by dedicated inert gas generators and partly by utilizing the existing (on tankers) flue gas systems.
MAGNETIC FIELDS

The technologies of coagulation and flocculation are utilized. Magnetic flocculants are added into the ballast water, causing suspended particles like aquatic organisms and sediment to aggregate into larger flocs that are removed by use of magnets.

ULTRASONIC TECHNOLOGY

Ultrasonic devices generate high-frequency and energy waves that induce vibrations into the liquid. The physical and chemical impacts of this phenomenon (15 to 100 kHz frequency creates cavitation) destroy the micro-organisms. The process has the capability of 100-percent inactivation of larger organisms and significant reduction of bacteria and viruses.

CHEMICALS & BIOCIDES

Mainly two different types of biocides are used: oxidizing and non-oxidizing. The oxidizing biocides like ozone and the halogen family (chlorine, bromine, iodine) destroy the membrane of the cells, leading to their destruction. The most commonly used chemicals are sodium hypochlorite (NaClO), and hydrogen peroxide (H₂O₂).

Sodium hypochlorite in water completely dissociates, mainly into sodium Na⁺ and hypochlorite ClO⁻ anion, while a small portion hydrolyzes into sodium hydroxide and hypochlorous acid. A bleaching effect is caused by the oxidizing power of hypochlorous acid and hypochlorite anion. The hydrogen peroxide decomposes spontaneously and exothermically, producing oxygen and water and acts as a natural purification system. The ozone (O₃) dissolves into water where it decomposes and reacts with other chemicals to kill the living organisms.

The non-oxidizing biocides act by interfering with a vital life function, like reproduction or metabolism. The most commonly used non-oxidizing biocides are: Glutaraldehyde, a colorless non-oxidizing toxic biocide that can kill a wide variety of organisms; Menadione, a precursor of Vitamin K that is a non-corrosive and safe biocide; Acrolein, a harmful biocide that has a broad spectrum against bacteria, algae and other microorganisms as well as macro-organisms; and chlorine dioxide (ClO₂), a powerful disinfectant of water, commonly used in many public water systems to treat water. It is a strong oxidizing agent and exhibits high antimicrobial activity over a wide pH range. The risk of accelerated corrosion of ballast tanks coatings should be carefully controlled and minimized.

ELECTROCHEMICAL TECHNOLOGY

Electro-chlorination systems generate hypochlorites, which are very effective against a wide range of microorganisms. Sodium chloride (NaCl) is dissolved in water to form chlorine at the anode and sodium hydroxide at the cathode, which, once formed, recombine to form NaOCl. The NaOCl turns to hypochlorite ion and HOCI (hypochlorous acid). The initial reaction takes place in an electrolytic cell, using direct current (DC) power to provide the energy required to pass the electrolytic current through the salt water solution between the plates and drive the electrolytic reactions at the anode and cathode.
CRITICAL POINTS FOR CONSIDERATION

As is evident from the first part of this article, the installation of a BWTS is now inevitable and therefore the time has come for shipowners to discuss in a serious manner what kind of BWT system they will install in their newbuildings and, at the same time, start thinking about retrofits.

There are several parameters that have to be examined in detail prior to making a decision. Such parameters could be technical; installation; operational (including user friendliness and health and safety issues); maintenance for the system and the parts of the ship that will be affected by it; and, last but not least, financial. It is the life-time cost of the system that should be considered, not only the acquisition cost. All systems have an operational cost per unit of ballast water treated by them. For new ships it may be reasonable to assume a 20-year lifespan, whilst for existing ships all calculations will depend on the age of the ship to be retrofitted.

It will be useful to consider existing and proven shore-based technologies, but new and emerging ideas should not be overlooked.

If an owner believes that he should forget about installation at the newbuilding stage and focus on retrofitting a system, there are some basic changes that he will have to make when drafting the specs or during plan approval of his ships. Such changes should include, among others, the initial installation space for the system (pump room, engine room, steering gear room or deck store), safety considerations and capacity of diesel generators.

One of the most difficult issues that will have to be solved is the lack of experience in the operation of any of the systems that have been marketed so far. We have seen more than 60 makers trying to enter the market, and already (believe it or not) some withdrawals from it. Difficulties during commissioning have been reported (despite the small number of delivered systems and the attention paid by the makers during first-time installations) for almost all the systems that have been delivered by shipyards so far.

The BWT regulations were voted without taking due consideration for many aspects that we will be faced with during the first period of the operation of the systems and during the life time of the ships. The increase of the CO₂ footprint, the use of chemicals that may be banned at a later stage, the reliability of the systems, training issues, and health and safety problems associated with the use of the BWT systems were not discussed in detail in IMO.

The sampling procedures and the way that Port State Control will treat possible violations also have yet to be clarified.

Maran Tanker Management’s advice to owners that will buy a system (through the shipyard or on their own) is to insist on a contract that will safeguard their interests with regard to: certification by a flag State; type approval by a class society and the USCG; purchasing and disposal network for chemicals and residues resulting from the use of the system; training of the officers and the office staff; and actual testing during the sea trials and during the first months of operation after the delivery of the ships or the retrofitted systems. Other issues that will have to be considered when drafting a contract are the effects of the treatment on the ballast tanks’ coatings and other shipboard systems and the maintenance costs.
MEETING THE DISCHARGE STANDARD:

NEW US RULES FOR BALLAST WATER MANAGEMENT

The Coast Guard explains its new rule for vessels intending to discharge ballast into US waters.

The US Coast Guard (USCG) recently published a final rule that establishes a discharge standard for potentially invasive organisms contained in ship’s ballast water. The rule, titled “Standards for Living Organisms in Ships’ Ballast Water Discharged in US Waters,” was published in the Federal Register on 23 March 2012, with an effective date of 21 June 2012. The rule establishes the discharge standard and outlines Coast Guard requirements for the type-approval of ballast water management systems (BWMS). Specific provisions of the discharge standard and the implementation schedule are presented on page 19.

The US ballast water discharge standard (BWDS) identified in the final rule aligns with the IMO’s Ballast Water Management Convention adopted in 2004. The BWDS is also supported by a 2011 report by the US Environmental Protection Agency (EPA) Science Advisory Board. The EPA report concluded the BWDS specified in the final rule is the most stringent standard that vessels can practically implement and the USCG can enforce at this time.

As technologies advance and as treatment efficacies improve, the USCG will revisit the BWDS to determine if more stringent requirements are practicable and enforceable. The Coast Guard will conduct a practicability review to determine if a more stringent standard is warranted and publish the results by 1 January 2016, as required by the final rule.

WHAT TO EXPECT UNDER THE NEW RULE

Under the new rule, ballast water must be treated before discharge from most vessels operating in US waters. The rule will be phased in beginning in 2013 for newbuilds.

The USCG anticipates that more than 3,000 United States domestic vessels in various classes will be required to install an approved BWMS; specific requirements for installation vary by class. In addition, about 9,000 foreign vessels that enter US waters each year will be subject to the rule. The IMO estimates that more than 60,000 vessels worldwide will need to comply with the Ballast Water Management Convention’s discharge standard when it enters into force.

The Coast Guard’s final rule provides an implementation schedule based upon a vessel’s construction date and ballast capacity. The earliest compliance date for a vessel to have USCG approved treatment equipment installed is on delivery for vessels with a 1 December 2013 keel date. Phase-in for existing vessels will commence on 1 January 2014, and will be phased in based on a vessel’s ballast water capacity.

COAST GUARD APPROVAL OF BWMS

Implementation activities will also include the roll out of the USCG Type Approval Program for BWMS. Type approval of BWMS will require land-based and shipboard testing, engineering reviews, inspections and other efficacy assessments by a USCG-accepted independent laboratory to verify that the BWMS meets design and construction standards and achieves the USCG’s ballast water discharge standard requirements.
The USCG will approve BWMS in accordance with Title 46 of the Code of Federal Regulations (CFR) Subchapter Q, in a manner similar to other approved shipboard equipment, such as oil-water separators and marine sanitation devices. The BWMS type approval process is expected to be a similar but perhaps more complex process compared to type approval of pollution prevention equipment.

Unlike other types of USCG-approved pollution prevention equipment, where approval is for installation on US-flagged vessels only, BWMS are required to be approved for installation on US flagged vessels, as well as non-US flagged vessels operating in waters of the US.

**Availability of Independent Laboratories**

An important aspect of the type approval process will be the USCG acceptance of independent laboratories to test and evaluate BWMS efficacy based on land-based and shipboard testing. To date, the USCG has not accepted any independent laboratories to evaluate BWMS.

To be accepted as an independent laboratory, a testing facility must meet general requirements that demonstrate its financial, legal and organizational independence from those parties contracting it for analytical work. For example, the laboratory must be independent of the equipment manufacturer, must have access to an appropriate facility for carrying out the required land-based and shipboard tests, and must document that its personnel are qualified to assess design and construction requirements and to perform environmental and operational testing. Required tests may vary based on the specific BWMS considered for approval and may include reviews for intrinsically safe electrical operation, effects of vibration from or to the equipment, or other factors, such as temperature, emissions and operating parameters.

**Interim Acceptance Program for Alternate Management Systems**

The USCG recognizes there will be a delay from the effective date of the rule to its acceptance of independent laboratories and its type approvals of BWMS. To address this delay, the USCG will implement an interim program to accept the use of some BWMS that have been type-approved by other flag States. Such systems may apply for acceptance and use in US waters as alternate management systems (AMS).
AMS is intended as a bridging strategy to allow for the use of BWMS type approved by foreign administrations in accordance with the IMO Ballast Water Management Convention. The AMS must be installed and approved prior to the vessel’s compliance date and would be used in lieu of ballast water exchange until full type approval can be obtained.

Designation as an AMS is contingent on a USCG determination that the BWMS is at least as effective as ballast water exchange. To be considered for AMS designation, a BWMS must already be type approved by a foreign Administration in accordance with the Convention and relevant guidelines developed by the IMO. The test information and data from that foreign type approval process will constitute an important component of the application for acceptance as an AMS. The USCG also expects that manufacturers applying for AMS designation will use some or all of the applicable foreign test data when applying for type approval.

Use of an AMS will be allowed for up to five years after the vessel would otherwise be required to comply with the BWDS. The five-year period should provide the manufacturer or vendor with sufficient time to obtain US type approval, either using the data from the tests already completed, or by undergoing new tests designed specifically to comply with 46 CFR 162.060.

Any vessel using an AMS must comply with the terms and conditions of the EPA Vessel General Permit when operating in waters of the US. As with the process for US type approval of BWMS and other shipboard equipment, AMS determinations will include any reviews required by the National Environmental Policy Act, the Endangered Species Act, and other environmental laws.

### COMPLIANCE & ENFORCEMENT

The rule outlines requirements for designation as an AMS in 33 CFR 151.2026; for acceptance of independent laboratories in 46 CFR 162.060-40; for type approval of BWMSs in 46 CFR 162.060-10 and 162.060-12; and for extensions to vessel compliance dates in 33 CFR 151.1513 and 151.2036.

Compliance and enforcement of the BWDS will occur during routine port State and flag State vessel examinations. The USCG will enforce compliance of the BWDS by verifying Convention documents and equipment and checking recordkeeping and reporting compliance during domestic marine inspections and scheduled Port State Control Examinations.

### OUTREACH TO THE REGULATED COMMUNITY

The USCG will announce plans soon for a web-based presentation in June 2012 to provide an overview of the final rule and answer questions from participants. The USCG is also preparing industry guidance for the maritime industry to assist in complying with the final rule, and answers to Frequently Asked Questions (FAQ). These will be posted and updated periodically on the Environmental Standards Division webpage at http://www.uscg.mil/environmental_standards/. If you would like to submit questions for the FAQs, please email them to environmental_standards@uscg.mil.

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### Table 151.2035(b) Implementation schedule for approved ballast water management methods

<table>
<thead>
<tr>
<th>Vessel’s Ballast Water Capacity</th>
<th>Date Constructed</th>
<th>Vessel’s Compliance Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Vessels</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>On or After 1 Dec. 2013</td>
<td>On Delivery</td>
</tr>
<tr>
<td>Existing Vessels</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 1,500 m³</td>
<td>Before 1 Dec. 2013</td>
<td>First Scheduled Drydocking After 1 Jan. 2016</td>
</tr>
<tr>
<td>1,500 to 5,000 m³</td>
<td>Before 1 Dec. 2013</td>
<td>First Scheduled Drydocking After 1 Jan. 2014</td>
</tr>
<tr>
<td>Greater than 5,000 m³</td>
<td>Before 1 Dec. 2013</td>
<td>First Scheduled Drydocking After 1 Jan. 2016</td>
</tr>
</tbody>
</table>

Any vessel using an AMS must comply with the terms and conditions of the EPA Vessel General Permit when operating in waters of the US. As with the process for US type approval of BWMS and other shipboard equipment, AMS determinations will include any reviews required by the National Environmental Policy Act, the Endangered Species Act, and other environmental laws.
From the island of Cyprus, one man is proposing an innovative solution for the problem of invasive aquatic species, suggesting there is a profitable alternative to shipboard ballast water treatment that would satisfy evolving regulations while painlessly enlisting the shipping industry in the fight against global hunger. It isn't the first time the Eastern Mediterranean has echoed with a *vox clamantis in deserto*, but it may be the first time in a long while that the message has aspired to such universal benefit.

The proposal comes from Eddie Bucknall, Technical Director of Columbia Ship Management, a major actor on the maritime scene with over 200 ships in its care ranging from supertankers to passenger vessels. Bucknall suggests that the very serious issue of invasive aquatic species is being turned into a feel-good exercise for legislators, when instead it could be addressed in a way that makes shipping 'greener', puts a little cash in the owner's pocket and provides a sorely needed humanitarian service. The two elements of his novel proposition are to perform ballast water treatment in port-based facilities and, preferably, to have ships carry fresh water in their ballast tanks whenever possible – alternatives already allowed under the terms of the present IMO Ballast Water Management Convention. The proposal has gathered the support of a joint industry project involving Columbia Ship Management, Dutch shipbuilder Damen Shipyards, the Netherlands Government and the famously environment-oriented authorities of the Port of Rotterdam.

“I believe wholeheartedly that it is essential to stop the spread of harmful organisms, especially pathogens – but, given the uncertainties and challenges of shipboard ballast treatment technologies, I also believe the only way to ensure your ship is carrying 100-percent neutral ballast water is to either treat your saltwater ballast in port, or to take your ballast from a licensed supplier of industrial, or irrigation-quality fresh water,” Bucknall says.

The first point in his position is that there is a basic problem with mandating onboard ballast water treatment as a universal solution. Because shipboard systems are not 100-percent effective, he says, they cannot, as a group, deliver the service intended.
“The D2 standard allows less than ten viable organisms greater than 50 microns in size per cubic meter, and less than 10 viable organisms between 10 and 50 microns in size per milliliter; this means that something gets through, so there’s still a risk, however small, of another invasion,” Bucknall says. “Then, think of the many unknowns in marine biology: for every scientist I speak with who believes that current treatment technologies will perform sufficiently well, there is another who says that organisms exist whose microscopic egg or larval stage is resistant to one or more of these treatment options. Then there is the challenge of sampling while ballasting. I have been told that you would need 6,000 samples from a VLCC in order to have a scientifically representative indication of the effectiveness of your ballast water treatment system – the magnitude of a single sampling job alone is staggering.”

While a portion of the fleet may benefit from onboard ballast water treatment, the equation does not work out in favor of it as a universal solution, he says, adding that port-based treatment would be a very efficient way to handle the apparent impermanence of the D2 standard. “The United States Coast Guard has said they will accept the D2 standard, but will revisit it in a few years’ time to see about developing something better. So, now we’re talking about having an industry collectively spend $74 billion on treatment plants today and, in a few years’ time, being told to scrap them all and install something better. That is not a solution,” he says, contending that the amount in question could be spent to much better effect by the ports.

“If ballast water treatment were done in a plant in the port area, the authorities could make improvements to the standard as and when they see fit. Then, should regulators decide on a higher standard, these centralized plants could be quickly modified to provide that standard uniformly to the world fleet.”

His idea to treat ballast water in port is more than just an interesting theory; it is poised to become an interesting reality. At press time, Damen Shipyards was building a 41-meter, 980-dwt hull of its own design intended for use as the ballast water treatment barge. The hull will be delivered this fall to the Port of Rotterdam, where a treatment plant will be installed for prototype testing – if a supporter for the plant can be found to join the project. In this usage scenario, the ballast treatment barge would drive out to the ships to deliver pre-treated ballast water, similar to the way sludge barges go out to collect a vessel’s sludge discharge.

“The Convention says you cannot dump ballast water to the sea, but it doesn’t say you can’t put it onto a barge,” Bucknall explains. “You could treat the water on a barge and then recirculate it to another ship or, when it conforms to standard, pump it into the sea.”

An alternative scenario for a discharge port would be to pipe industrial water to a tanker at the single-point mooring (SPM) where it offloads cargo. Likewise at the loading port, a pipe to the SPM would take that water away, either for use by another ship or for productive service ashore.
While pre-treated saltwater ballast is a solution applicable to all ports, Bucknall would prefer the world fleet start filling its ballast tanks with fresh water, when such is available – not actual drinking water, he stresses, but clean, industrial, irrigation-quality fresh water. Columbia Ship Management (CSM) is about to put this plan into action in another joint effort with Dutch authorities and an industrial water supplier. In this case, the government will provide sponsorship to a pilot program in which the water supplier will bring water to CSM tankers bound for the Middle East.

“Our ships will be ballasted with the same clean industrial water that is used to grow vegetables in Holland,” Bucknall says. “We have a receiver for it in the Arab States, where they have a great need for fresh water. The water will first be pumped into the country’s aquifers, which are so depleted that sea is starting to invade them in some spots, and then it will be used to irrigate farmland. We hope to prove to shipowners that there is a possibility of getting paid for a ballast voyage,” he says. “Even if the net profit only partially offsets the voyage costs, that’s better than nothing – and, more importantly, it will help relieve some suffering in water-starved parts of the planet.”

There is another owner incentive in his proposal, in that long-term use of fresh water ballast could, in a sense, prolong a vessel’s structural integrity. The idea is that, in a noncorrosive fresh water environment, there will be no wastage to accelerate fatigue in the ballast tank structures. The tank internals would thus be stronger throughout the ship’s life and would, as a result, contribute less stress to the fatigue of surrounding structures. “If ballast tank integrity can be maintained throughout a ship’s life, then there will be an overall physical improvement to the ship that will make it structurally sounder, and it may even last longer,” he says.

“Many tankers discharge cargoes in areas that have plenty of fresh water and load cargoes in areas that desperately need fresh water – Western Australia, where iron and coal are sourced, or Chile and Peru, which supply copper and other minerals, come to mind,” Bucknall says. “If the bulker and tanker fleets serving those parts of the world carried irrigation-quality water on the ballast voyage, they would be doing a great good for many poor people and, in addition, wouldn’t be burning fuel with no benefit to society.”

The considerable amount of water that this exercise would involve can be sourced from groundwater supplies or by capitalizing on the vast unused output of great river systems. “There’s plenty of fresh water going into the oceans – for example, 300 miles off the mouth of the Amazon you still find fresh water,” he says. “Think of the Mississippi River: 3 knots, 180 feet deep, two miles across, and all going to the sea.”

Of course, there are many details that need to be worked out if Bucknall’s scenarios are to be made workable. For example, whether the source is groundwater or a river system, strong analysis and treatment must be available to ensure that no organisms, maladies, parasites or other contamination are being transported. To this, Bucknall says that shoreside treatment, which already protects local populations and agriculture, can readily be expanded to cover this new duty – more readily than the world fleet can be modified, at any rate. “Every port in the world has facilities for testing and analyzing drinking water,” he says. “In some place the facilities might be rudimentary, but they exist and can be built upon.”

Ultimately, Bucknall only asks that his proposal be seriously considered before the world commits itself wholesale to onboard treatment. “It is very encouraging that the Port of Rotterdam and the Dutch Government are willing to support these experiments,” he says. “This could be the start of a life-changing service for some parts of the world.”
**Presenting “Global Greece”**

ABS introduces two new specialist services designed around the evolving Greek-controlled fleet.

In his book *Voyage to the Top*, shipowner and maritime historian Dr. Matheos Los tracks the rise of Greek shipping from the dark ashes of despair following World War II to the golden hearth of prosperity that opened the new millennium. He highlights a number of contributing factors that brought the Greek-controlled fleet to the number one spot among ethnic maritime communities, including among them such personal characteristics as individuality, resourcefulness, a natural talent for the kind of business that is shipping and, of course, an innate love of the sea. One of the key elements in that rise, he noted, is an ability, common among successful owners, to spot new opportunities in markets and technologies that expanded the capabilities, the size and the scope of Greek shipping as a whole. His book was published shortly before the great boom of the mid-2000s began, but his theory has found expression in its results, the new face of Greek shipping.

“Traditionally, Greek shipping has mainly been focused on tankers and dry bulk carriers. This has now changed – permanently, I believe,” says Vassilios Kroustallis, the Greece-based ABS Regional Vice President for Eastern Europe. “Over the past few years we have seen an increase in Greek ownership of LNG carriers and containerships, and a developing interest among the owners in offshore energy activities. There are more owners with drillships and offshore service vessels,” he says.

“Greek shipping has evolved tremendously in the past decade, and ABS has evolved with it,” Kroustallis says. “We call this evolution ‘Global Greece’, meaning that the substantial capabilities of the Greece office are supported by an international network of professionals. Greek shipping may be centered in the roughly 750 shipping companies that are resident in Athens and Piraeus – which make this the biggest shipping center in the world – but it is, in reality, a global industry that needs global support. The service question today has evolved from ‘what can we do locally’ to ‘what can we do globally’ in support of the Greek maritime community.”

As he describes it, the concept of Global Greece is based on access to ABS professionals all over the world, through communications technology and personal cooperation. For example, the Greece office is in regular communication, by phone or video conference, with the various shipbuilding centers in Asia. “We bring all this experience from abroad, to an extent unmatched by any other class society here,” Kroustallis says. “We are the leading classification society in Greece today, but more importantly, we are also in position to meet the future challenges of Greek shipping. These challenges come not only from diversification of the fleets, but also from new and evolving regulations, particularly environmental issues. These will be handled by our new Environmental Team, headed by Dr. John Kokarakis,” he says.

The other new service we have introduced is the LNG Center of Greece, which is led by Raffaele Piciocchi, who was in charge of LNG shipbuilding in Asia for many years. Piciocchi is permanently based in Greece and is supported by a global network of LNG specialists around the world, for example:
Jim Gaughan, recently named ABS Chief Engineer, who has already visited ABS’ Greek clients twice since the service started up earlier this year; Patrick Janssen, the ABS Vice President of LNG in London, who came to the company after a long experience with Exmar, a major pioneering LNG player; and, of course, the ABS Gas Team led by William J. Sember in Houston, the corporate LNG Focus Group and the gas carrier teams in Korea and in China.

The LNG Center Opens its Doors
“One of the main goals of the LNG Center is to support Greek owners of gas carriers, whether LNG or LPG carriers or even compressed natural gas ships,” says Piciocchi. “There are many newcomers to the gas sector who need assistance in understanding the technologies and the operations of these kinds of ships. We provide the support network for their operations.”

The LNG Center has the flexible mission of finding answers to specific questions clients have. “If the LNG Center can resolve a problem, it will,” he says.

The main things clients need today are faster answers to questions and authoritative assistance in understanding containment technologies, cargo handling and propulsion systems, and in clarifying particular specification issues. The challenge to providing such help in a timely manner is having a qualified person to consult. In this, the LNG Center is a direct interface between shipowners and the entire ABS organization – the hub of a wheel that locates the needed expertise and routes the questions and problems there.

“This is a unique initiative among all the classification societies,” Piciocchi says. “Nowhere else do you find such an international network focused through a local center and providing assistance that is specially tailored to the needs of the individual submitting the inquiry. Each owner has his own ideas and, therefore, his own questions,” he says.

“Every specialist in the ABS organization, in any part of the world, is part of the Center’s network,” he adds. “When I need an answer to a question, I contact the right person and, if necessary, the individual comes to Greece. In other words, the staff of the LNG Center is, in a sense, all of ABS.”

Environmental Team Comes to Town
The other new service introduced through ABS Greece during the past year is the ABS Environmental Team. Led by Kokarakis, an ABS Vice President of Technology and Business Development, the service places ABS personnel experienced in environmental regulations and technologies resident in Greece, but attached – rather like the LNG Center – to the international network of ABS professionals.

“One of the main goals of the ABS LNG Center is to support Greek owners of gas carriers.
"The Environmental Team began operations by focusing on assisting clients in developing a Ship Energy Efficiency Management Plan (SEEMP)," says Kokarakis, "but it is not at all limited to that. The idea is to give support related to all environmental regulations – for example, exhaust gas scrubbers, shipboard ballast water treatment systems, low-sulfur fuels, engine emissions and energy efficiency are all encompassed in our work."

Environmental Team members have been working with clients on SEEMP development since the concept was introduced; they worked with Maran Tankers as it developed the industry’s first SEEMP and with the next two major Greek shipping companies to develop a plan, GasLog and Consolidated Marine Management (CMM). For these projects, the target was to optimize energy management within the organizations and enable them to establish and implement a truly efficient energy management system. This means that the culture of continual improvement, already used successfully to improve safety, quality and environmental practices in the maritime industry, is now applied to improving energy performance.

"We feel that the keys to addressing environmental regulations are awareness, dedication and conscious application of the principles, and we work to identify and assess practical solutions to the complex environmental problems our clients are facing," Kokarakis says. "Essentially, we provided both a second pair of eyes and a sounding board as they worked out how to describe their operations and how to fit an energy efficiency management plan to the ways they work and run their fleets. We urge clients not to buy a ready-made SEEMP template – tempting though that may be – because these kinds of plans only work when they are developed by the people who use them."

Developing a SEEMP is, he says, like developing a Safety Management System (SMS) – at least, the way the SMS should be developed, according to the philosophy of the International Safety Management (ISM) Code.

"Like ISM, the SEEMP is based on the ‘Plan, Do, Check, Act’ methodology, and should integrate fully with a company’s SMS," he says. "Like the SMS, the SEEMP is a dynamic program that is all about continuous improvement – and is part of an ever-growing group of programs that work together with the goal of improving the safety and efficiency of a company’s operations. Continuous improvement means continuous change," he explains, "which is accomplished through reinforcing right behavior and making corrective actions as necessary. It is a cumulative effect from a series of measures. So, in the case of energy efficiency, it is not one measure alone that will get you your best results, but a combination of measures; sometimes you cannot separate one measure from another because there is a connective effect between them – for example, propeller polishing and regular hull cleaning enhance each other’s effect on a vessel’s fuel efficiency."

The single most effective fuel-saving measure, he adds, is slow-steaming. In fact, Kokarakis is known in the Greek community as Mr. Slow-Steaming for his advocacy of the tactic. "If you reduce vessel speed from 14 to 13 knots, for example, you improve its fuel efficiency by about 14 percent. This is true for any size or type of vessel because it is an effect of the propeller power law," he explains.

"The Environmental Team is here to listen carefully to client concerns and respond with guidance towards the best possible solutions, helping them to comply with regulations while also remaining efficient and competitive," he adds. "Energy efficiency is not only a means of regulatory compliance; it is also a matter of better and more responsible use of resources and, ultimately, of saving money," he says.

❖
Using natural gas as fuel is not new. What is changing is the scope and scale of application as gas grows beyond its traditional role of fueling LNG carriers and its use on a limited number of small ferries during the past decade.

“Today, gas fuels a fleet of more than 380 LNG carriers, most of which burn part of their cargo as fuel, and a further fleet of some 22 smaller vessels. Still, technical and other questions remain as to the suitability of LNG fuel for specific projects,” says Sean Bond, ABS Director, Environmental Solutions Group. “As a result, concept designs and newbuilding plans must be assessed on a case-by-case basis depending on their intended operating profile, fuel availability, commercial feasibility and several other issues. As projects begin to be realized, project developers will better understand the usefulness of the concepts to their own circumstances.”

Having recognized a need not just for classification Rules and their interpretation, but also for recognized standards supporting the application and use of the technology, the industry is making progress developing standards with the International Standards Organization on LNG bunkering. On the regulatory side, the next step will be to complete the International Code of Safety for Gas-Fuelled Ships, but its completion and ratification are not expected before 2014. In the interim, class will continue to support owners, designers and shipyards as they determine what the concepts will mean to them.

Major issues include the question of LNG bunker supply and demand. LNG bunker suppliers rely on demand to develop the supply infrastructure, while operators and owners require a supply before investing in a vessel that relies on that supply. The costs of such bunkering are not necessarily known, as there is not a large existing market for small volumes of LNG to be used on gas-fueled ships. And, as emission regulations for all ships continue to tighten, the cost and availability of alternatives to ordinary heavy fuel oil, including gas, will potentially change over the coming decade.

Regarding the fuel itself, owners also need to understand both its properties and handling. LNG is a mixture, not a homogenous product. It has different compositions, which result in variable properties. The energy in each cubic meter and the methane number can impact the volume of fuel required and the way the fuel is handled as well as engine performance. Other items to consider include the power profile of the vessel and to what degree it operates below or at maximum power, an issue engine manufacturers already have under review.

To address these issues, ABS has completed joint development projects with South Korean shipyards on large vessel designs and worked with major owners, such as A.P. Moller-Maersk, on the practical implications of using gas, stored as LNG, as a fuel on the current and next generation of large containerships. There is interest in this fuel from smaller vessels as well; for example, Harvey Gulf International Marine has selected ABS as the class society for its four new dual-fuel gas-powered offshore supply vessels for operation in the Gulf of Mexico.

“For ships operating mainly in emissions control areas, gas could be a very attractive option, and here we are talking about as soon as 2015 and 2020 or 2025, depending on how the IMO judges low-sulfur fuel availability,” says Bond. “That in turn could lead to a ramping up of bunkering infrastructure, further strengthening the argument in favor of natural gas as fuel.”

Sean Bond, Director, Environmental Solutions Group, ABS
Today ABS is a worldwide organization employing more than 4,500 people, with some 200 offices in 70 countries. The size of the present company and the vast scope of its diverse activities make it difficult to believe that, just 60 years ago, ABS was a small national society with equally small global overseas ambitions.

An insight into the magnitude of the cultural change that ABS experienced between 1950 and 1980 can be gleaned from a snippet of the intake interview of Warren Anderson, who served as Principal Surveyor for the Orient from 1973 until his retirement in 1986. When he joined ABS in 1952 in the port of Los Angeles, he was interviewed by two veteran surveyors, Port Principal John Black and West Coast Principal Bill Warren.

“They said to me, ‘if you get hired for this job you’ll probably have to go on foreign assignment to Japan’; I had sailed for ten years all over the world, so that was no problem for me,” Anderson recalls. “Then they said, ‘We are the ‘Foreign Legion’ of ABS and we can tell you all about that.’ I asked where they had served. Bill Warren was first to answer. ‘I was in the (Panama) Canal Zone,’ he said. Then John Black says, quite proudly, ‘And I opened the Bureau’s office in Honolulu.’ At that point I figured I’d better keep my mouth shut. I worked with Black for three years before being sent to Japan; he was a very good man and often spoke of the Bureau in the old days and of his ‘foreign service’. I came to realize that, when they joined ABS before the war, it was just a small American company with only American clients, and the Canal Zone and Honolulu really had been considered its foreign service.”

ABS’ global expansion and transformation into the world’s second largest classification society began during World War II when the War Shipping Administration assigned ABS surveyors to follow US forces in North Africa and Italy, where they performed damage and repair surveys on the cargo carriers supporting the military. By the time the troops went home, these surveyors were concentrated in Genoa and Naples, Italy and soon opened exclusive ABS offices there.

Thanks to the Emergency Shipbuilding Program of World War II, which had succeeded in producing more cargo ships than the enemy could sink, at war’s end the United States owned more than 4,000 newly constructed merchant ships totaling 40 million gross tons. The vessels were economical to operate, had a favorable draft for ports the world over, were equipped with the most modern cargo handling equipment and deck machinery and could serve as excellent cargo carriers in any service with only minor structural alteration (most often, just removal of
armaments and gun tubs). The question of what to do with them soon sparked lively debate in Congress.

The answer was not long in coming. During the war, the US Maritime Commission and the War Shipping Administration had empaneled a planning committee to estimate probable postwar shipping requirements and to outline plans for an adequate merchant marine. Thus, two years before the Marshall Plan was announced, the Merchant Ship Sales Act of 1946 gave America’s allies the opportunity to buy surplus ships, begin restoring their merchant fleets – most of which had been destroyed during the war – and take in hand the means of importing the materials of their reconstruction.

The program began when select numbers of vessels, mostly Liberty ships and T2 tankers, were allocated to the allies who had lost nearly all their merchant ships during the war: Greece and Italy were granted 100 ships each; France received 74; Norway received 24; China got 18; and Great Britain, after some delay, received 106. The Act’s authority to sell to foreign interests expired in 1948, but for buyers in the United States, the authority continued into 1949. About half the surplus merchant fleet was sold during those three years – roughly split between domestic and foreign interests.

The program may qualify as the biggest tanker sales event in history, with 399 tankers in the T2-SE-A1 class (those equipped with diesel-electric drives), split almost evenly between US-flag and foreign operators. These were the most modern tankships of the time, and their commercial use by private shipowners and oil majors helped lay the foundation of many of today’s great crude carrier fleets. In addition to the T2s, 160 Victory ships were sold, 72 to US buyers and 98 to shipowners as far afield as Argentina, the Netherlands, Egypt, Belgium, India and Australia.

By far, Liberty ships accounted for the greatest number of vessels sold under the Merchant Ship Sales Act – 781 in total, 202 of which went into American hands. The Liberty ship silhouette soon became a familiar sight in ports around the world, as the vessels provided the springboard from which many of the great European shipping lines rebuilt their fortunes and helped rebuild their countries. The ‘ugly ducklings’ proved to be extremely durable in war and peace, with some trading into the 1990s.

Liberty Ships Spark
ABS’ Global Expansion

The selling price of a Liberty ship under the Merchant Ship Sales Act was £140,000 or $560,000 at the time. It was a real bargain – wear and tear notwithstanding – since the average cost of building a Liberty had been about $1.7 million. Owners had to pay 25 percent down in cash and could often find government assistance in raising the amount. On top of that, the US fixed the loan repayment terms at the 1946 exchange rates to protect the shipowners against fragile, inflation-ridden postwar economies.

Liberty ship sales had a particularly important impact on the maritime communities of Greece and Italy. In Italy, for example, the Lire lost over 65 percent of its value between 1946 and 1950, shrinking from 225 to 640 per US dollar. Having long-term loans fixed at 225 Lire/dollar contributed immensely to stabilizing the Italian shipowning community and allowing it to accumulate profits and start building new ships during the 1950s.

During the late 1940s and 1950s, the Liberties carried millions of tons of coal, ore, grain and fertilizer to war-ravaged Europe and Asia, permitting the shipowners to expand beyond their traditional pre-war Mediterranean and European routes. This in turn spawned an unprecedentedly dramatic sale and purchase market. By 1949, Liberty ships could command £200,000 ($800,000) and briefly sold for £700,000 ($2.8 million) during the 1956 Suez Crisis. By the end of the decade they had plummeted in value, as more modern tonnage pushed them out of the major markets.

The active Liberty ship sale and purchase market enabled owners to hook into the
international financial network. Greek shipping legend George P. Livanos once said that, “through the Liberties, Greeks were exposed to new world financing and American banks learned that shipping finance could be secure and profitable.”

Over the years, nearly all Liberty ships on the market passed through Greek hands. As the foundation on which Greeks built themselves into today’s leading shipowning nation, the Liberty ship became greatly beloved in that community. Older Greek shipowners still talk affectionately of the “Blessed 100” Liberties. Just a few years ago, some members of the Greek shipping world acquired one of the last remaining Liberty ships, rechristened it Hellas Liberty and made it into a floating museum now moored in Piraeus.

The vessels also helped shipowners modernize their operations. Italian shipping patriarch Giuseppe d’Amico, whose company Fratelli d’Amico Armatori began its postwar buildup with four Liberties and two T2 tankers, once described the Liberty ships as a “double gift” to shipowners, for the favorable financing and for the effect the vessels had on the shipping business.

“The Liberty ships were absolutely modern vessels filled with rational concepts; such ships did not exist in the mercantile world before the war,” d’Amico said. “With its simplified technology, the Liberty was an enormous advance for us. Studying the rationalized technology of the Liberties, we learned to change our ways of working and improve our methods. It was the start of the professional evolution of the Italian shipowners – and of the crews, too, from whom the ships required higher-level skills.”

The gift did not come without a few strings. Under the terms of the Merchant Ships Sales Act, any ship with a US Government mortgage had to be available for service in the event of war – a transferrable obligation that led to some solemn, memorable moments. One such moment was recounted by Italian shipping patriarch Stefano Telesio, a founder of the Genoa-based Carboflotta Group. Upon the death of his father in 1952, 21-year-old Stefano and his two brothers inherited a 2/24 share in the Liberty ship Pietro Bibolini, which required the young shipowner make a special trip to the local American Consulate.

“All owners had to declare that they would make their Liberty ships available to the US Government if needed,” Telesio recalled. “So I went to the American Consulate to stand in front of the American flag and swear on the Bible that my 2/24 of a Liberty would indeed be available. It was a very unusual moment – a small bit of our history that you don’t hear much about anymore, but still something that should not be forgotten.”

The surplus vessels released to industry, particularly the Liberty ships and T2 tankers, not only revived the merchant fleets of the world, but also propelled ABS onto the international stage. Before the war, the company’s activities had largely been confined to the United States. Arrangements with other class societies and the use of nonexclusive surveyors had provided adequate international coverage for ABS clients before the war. However, afterwards the US-built and financed tonnage dominating the world’s seaways needed service that only ABS itself could provide.

The ARTHUR M. HUDDELL was transferred to Greece in 2008 for conversion to a maritime museum, was renamed HELLAS LIBERTY and was presented to the public in its restored form in June 2010.

![George P. Livanos](image)

![Giuseppe d'Amico](image)
Under the terms of the Merchant Ship Sales Act, any ship on which the US Government held a mortgage had to be maintained in ABS class, although the new owners were free to re-flag the ship as needed. This generated such a volume of work that ABS had to establish exclusive surveyor offices in many foreign ports – the first big step in its global expansion and, consequently, its full-immersion introduction to the Greek maritime community.

As postwar recovery led to re-industrialization, a worldwide shipbuilding boom began. ABS soon opened offices to serve this growing client base in Western Europe, South America, Africa and Asia – the next big step forward in the classification society’s internationalization. ABS opened its first postwar Asia office in Yokohama in 1948, following with one in Shanghai a year later. When Nationalist leader Chiang Kai-shek fled with his forces to the island of Formosa following the Communist Revolution, an ABS surveyor was on board with the flotilla. ABS became the first classification society to establish an office in Taiwan, where it participated in the newly created Republic of China’s development as an important shipping and shipbuilding center. But the main engine of ABS’ growth in those years was Japan.

Through Shipbuilding, a Role in Japan’s Recovery

At the end of World War II, US shipbuilders chose a path that ultimately led to their own demise. Henry Kaiser, who invented the ‘flexible manufacturing system’ that rapidly mass-produced Liberty ships during the war, wanted to continue its development in American shipyards. US builders rejected the idea and returned to ‘traditional’ construction methods; within a few years, his methods were revolutionizing ship construction in the Pacific and building Japan into the world’s top shipbuilding nation.

When Kaiser quit shipbuilding, his General Superintendent, Elmer Hann, went to work at the Welding Shipyard in Norfolk, Virginia, then owned by the reclusive American billionaire industrialist Daniel K. Ludwig. Hann improved the Norfolk yard’s productivity so significantly that, when Ludwig’s company National Bulk Carriers (NBC) leased its own shipyard in Japan, he was brought over to run the operation.

Ludwig, the first builder to spot the coming need for very large tankers and ore carriers, had pushed his US shipyard to its limits by the late 1940s. He brought merchant shipbuilding to Japan when NBC secured a favorable long-term lease on the former Imperial Japanese Naval Yard in Kure, which possessed the very large, intact graving dock where the country’s World War II flagship, the Yamato, had been built. Under Hann’s control, NBC became a world-leading shipbuilder during the 1950s, producing some of the decade’s largest and most technologically advanced vessels.

Interestingly, while Ludwig often went all-out on the technology element of his ships, he was much less generous towards its human element. One maritime industry magazine of the time, reporting on a new ore carrier built by Ludwig and chartered to US Steel to service its plant on the Delaware River, observed that the vessel’s crew accommodations were ‘the most austere seen in the twentieth century’. Austerity was a key component of Hann’s approach, well in harmony with Ludwig’s famously parsimonious philosophy – so much so that the locals devised a nickname for the shipyard, and for Hann in particular as its Han-cho (head man): ‘Ke-chin-bo,’ or ‘cheapskate’.

Nearly all NBC’s ships were built to ABS class, and Kure became ABS’ main base of operations in Japan. Within a few years, NBC could routinely take vessels from keel-laying to launching in five months and, in 1958, launched history’s first 100,000-dwt ship, the ABS-classed tanker Universe Apollo. The shipyard also served as a training academy of sorts for the rising generation of Japanese shipbuilders; one of them, Dr. Hisashi Shinto, furthered the philosophy and methods employed at NBC and became a founding father of modern Japanese shipbuilding. He and his colleagues studied the Kaiser-Hann Group Technology methods and soon mastered and improved upon them.

As this knowledge spread outwards from NBC, Japan’s shipyards reached new levels of productive efficiency and became engines of prosperity that helped rebuild the country’s industrial infrastructure. In the three-year period from 1956 to 1959, for example, shipbuilding accounted for about 13 percent of all exports from Japan.
($350 million out of $2.8 billion, averaged annually). By the end of the decade Japan had passed Great Britain as the world’s number one shipbuilding nation and, by 1964, was constructing 40 percent of the world’s merchant ships.

Japan retained the title of top shipbuilding nation for more than forty years and built a succession of the world’s largest vessels, all classed by ABS:

- the first 100,000-dwt ship: *Universe Apollo* (104,520 dwt, built 1958 at NBC Kure)
- the first 200,000-dwt ship: *Idemitsu Maru* (206,106 dwt, built 1966 at IHI)
- the first 300,000-dwt ship: *Universe Ireland* (316,585 dwt, built 1968 at IHI)
- the first 400,000-dwt ship, *Globtik Tokyo* (476,025 dwt, built 1973 at IHI)

By the late 1970s, ABS had grown with the shipyards to establish a firm place in eight shipbuilding centers throughout the country. With a strong, authoritative presence in most of the yards, ABS was able to play a small but treasured role in part of the country’s restoration.

ABS was also the class society of choice when, in 1964, a Japanese shipbuilder partnered with a Scots designer and undertook the largest commercial series shipbuilding effort in history.

By the early 1960s, Liberty ships were entering the last phase of their commercial lives. Able to access virtually all ports, the standard-design vessels were well-known to owners, crews and charterers and had been the backbone of world trade since World War II. The maritime industry desired a modern replacement but did not believe mass production of ships could be done commercially. In response, a marine consultant named George T.R. Campbell developed a methodology that effectively resurrected Liberty-type series shipbuilding in a commercially viable format.

Campbell developed a standard-design vessel, which he branded *Freedom*, and worked with the IHI shipyard to optimize procurement, production and unit pricing. Through project supervision under his company GTR Campbell International (GTRC), he was then able to guarantee shipowners consistent pricing over a long string of ships – providing they did not ask for design changes or ‘extras’ or otherwise interfere with the building process. The ship design was innovative and the pricing attractive and, as a result, the Freedom became history’s best-selling ship design. IHI and its licensees built 176 Freedom series ships over the next decade – virtually all to ABS class. Altogether, Campbell built three major ship series in a 25-year period – named Freedom, Fortune and Friendship – and brought over 300 vessels into ABS class.

Series production became a fundamental component of modern shipbuilding, a development foreseen by Giroku Fujii, Managing Director of IHI, in an open letter to the maritime community written in 1965 on delivery of the first Freedom vessel, *Chian Captain*:

“Mass production of commercial ships has never been carried out, except in the case of the Liberty ships during the war, but since mass production is widely adopted in the manufacturing of transport machinery on land, there should be no reason for not adopting the idea for shipbuilding.”
Global Operations take Root and Flourish

Modern construction methods made the 1960s and 1970s golden decades for shipbuilding. New vessel types like LNG tankers, containerships and combination carriers appeared in international fleets, supporting a worldwide evolution in energy use and freight carriage; and ever-larger dry bulk and crude oil carriers supported infrastructure buildup and urban expansion in Europe and America. Newbuilding activity around the world strengthened and secured the global presence that ABS had first staked out servicing secondhand war surplus tonnage.

In Brazil, for example, ABS had a lead role in supporting a shipbuilding boom that began during the late 1960s. As in many places around the world, ABS opened its first exclusive office in Rio de Janeiro in 1948 to service Liberties, Victory ships and T2s – a tiny space for one surveyor and a secretary. When a 1963 study of South America’s shipbuilding potential led ABS to decide to beef up its Brazilian operation, Principal Surveyor Laudman J. Richoux convinced ABS Chairman and President Andrew Nielson that success in Brazil would only come through hiring locals. Among his first hires in 1964 was a young engineer named Antonio Lino Costa, who went on to become Principal Surveyor, then Country Manager.

ABS’ Hemingway Generation

As a group, the men who first brought the Bureau around the world were a unique and hardy lot. Some volunteered for service on the frontier out of a sense of adventure; some were wild characters sent out for disciplinary reasons; and some simply went out to do a job and, with their families, adapted to the challenges of a tough situation. Collectively, they left a mark of distinction on a developing world.

In a world with little regulation and no process instructions, these rugged individuals in this pioneering generation often had to make decisions alone and operate on pure initiative, sometimes under significant pressure and against great odds. Indeed, the records of their work sometimes read like excerpts from an old adventure novel: they did favors for kings – like Senior Surveyor for Bahrain Max Schaerer, who at the highest government request founded and trained the Bahraini Olympic rifle team; they saved ships – like Principal Surveyor for South Africa Henry Millard, who for eight days stood on the partially awash deck of a stranded tanker and singlehandedly led its rescue from a reef, preventing a major pollution disaster; and they helped developing nations learn the art of shipbuilding – like Hank Armstrong, Chief Surveyor and onetime Principal in Singapore and the Philippines, at whose passing the ABS world headquarters was flooded with letters from senior shipping men throughout Southeast Asia expressing gratitude to an old mentor.

From the old records, many of the senior and principal surveyors who led the field efforts in the early decades sound like characters created by Joseph Conrad or Ernest Hemingway – part entrepreneur, part salesman, part adventurer and, most importantly, part good surveyor. Many of them left behind a book’s worth of campfire tales about their exploits, and most bore their authority with a strength and dignity that forged for ABS the honorable reputation by which it is known in all corners of the world to this day.◆
and President of the ABS Europe Division. Lino Costa recently returned to Brazil and currently serves as ABS Vice President, Global Marketing.

In 1968, Richoux got an idea to translate the ABS Rules into Portuguese and enlisted the office staff in the project. He printed the book and offered free copies to universities and marine engineering students. The work not only embodied ABS' commitment to assisting the country's development, but also helped educate a generation of Brazilian maritime professionals. That year, big orders from Lloyd Brasileiro, Vale do Rio Doce and Petrobras began a building boom that resulted in Brazil's six shipyards briefly having the world's second-largest national orderbook in the late 1970s.

Under Richoux and Lino Costa, ABS grew to capture more than 75 percent of the Brazilian market, and the ABS Rio de Janeiro office actively expanded to become the headquarters for the society's operations in South America.

In 1977, ABS purchased for its world headquarters the 21-storey American Express building, a neoclassical Manhattan skyscraper that today is a city landmark. Five years later it purchased an office building in London for its regional European headquarters, and three years later after that acquired a building in Tokyo for its Asian headquarters. Now with firm roots around the world, ABS had become a truly global company, having evolved and expanded with the industry it served. It had become strong enough to weather the maritime industry depression of the 1980s and the subsequent market troubles that dragged on to the end of the century, and then to grow and transform even further.

In the four decades following World War II, ABS was carried across the world on the shoulders of an army of surveyors and their families, US and foreign nationals, who together carved out new lives in strange places while building a business in sometimes daunting isolation – there was a time in Kure, for example, when to call the United States you had to reserve a line at a national telephone office two days in advance.

In their sometimes challenging surroundings, these pioneers often formed close-knit communities that had all the characteristics of an extended family, sharing hardships and joys and, thereby, forming lifelong friendships. Those who rose to senior management brought their expatriate survival experiences back to world headquarters, where they forged a new corporate culture that managed to keep the camaraderie of a small office even as the company continued to spread across the globe. ❖
One relationship at the heart of the ABS world is its longstanding association with the Greek maritime community. This has strengthened continuously since its beginnings at the end of World War II.

The Greek shipping community made its ships available to the Allied cause during the Second World War, and its crews paid a high price for their love of liberty. At the war's end, over 2,000 Greek merchant seamen had perished fighting for freedom and the Greek merchant fleet had been reduced by two-thirds, to some 150 ships totaling about 580,000 dwt. This devastation left the future of the Greek merchant marine in doubt, until the US Merchant Ships Sales Act of 1946 put 100 surplus cargo ships – nearly all Liberty ships – in the hands of Greek shipowners who had lost tonnage during the war.

Manuel E. Kulukundis, a famed shipowner who was one of the architects of the original Liberty ship sale, as well as a buyer of many Liberties in later years, once noted that “Their successful operation helped to create the large fleets of many Greek owners. Had it not been for the help the Greek owners received from the United States with the sale of 100 Liberty ships on generous credit terms, the story would certainly have been different.”

The Greek-owned fleet soon expanded through the purchase of many more Liberty ships and other surplus tonnage. Soon, the Greek-owned fleet, which was largely split between tankers and bulk carriers, came to dominate the world of shipping. By 1980, Greek interests controlled over 4,000 ships, and the Greek maritime community could claim control of more tonnage than any other single group – a position it holds to this day.

Today, the Greek fleet continues to grow and change. In recent years, LNG carriers, container ships and offshore drilling and production equipment have been entering the Greek fleets. ABS support for the Greek community has expanded with this growth and is supplemented by comprehensive skill-building programs for industry, offered through the ABS Academy in Piraeus, which has a growing portfolio of training and education services intended to assist owners to improve the capabilities of their personnel, the quality of the fleets and the efficiency of their operations.

ABS surveyors and engineers have long been part of the growth and expansion of Greek shipping. ABS was the first foreign class society to open a technical and engineering office in Greece, and relocated its survey department headquarters for Europe from London to Piraeus in August 2009. Perhaps the best description of the relationship that exists between the Greek shipping community and ABS was given back in 1980 by Greek shipping legend George P. Livanos, who told ABS Surveyor magazine:

“Before the American Bureau of Shipping came on the scene for we Greeks, our forefathers had to deal with foreign powers that were dominating the seas in their times and resulting business relationships were severely strained. The new generation of Greeks heard these stories from their forefathers and they wanted a change. The opportunity came right after the Second World War, when ABS expanded and treated all nationalities on a completely equal basis, truly in the spirit of the Constitution of the United States.

“We were all clients of an institution that just wanted to serve the industry, and they did and continue to do so today. There were ABS surveyors who had to cope with situations never listed in any book of Rules. But they had an open mind and instinctively applied know-how, their experience, into helping solve problems on the spot, always trying to assist and not hinder their clients while also maintaining the highest level of standards. This is why ABS has so many friends in the Greek maritime community today.”

Beyond the ‘Blessed 100’

ABS’ Long Relationship with Greek Shipping

The ROBERT M. LaFOLLETTE originally launched in January 1943. The vessel was purchased in 1966 by the Olympus Agency in Piraeus.
Man is always the protagonist of all evolution. He contributes decisively to scientific and technological development, which results in the growth of world economy, and the improvement of the quality and the standard of our living.

Times change, as well as priorities. Whenever a new technology is applied, it is imperative to adapt forthwith to the new requirements for its operation, so as to ensure its safe exploitation. This adaptation requires a lot of patience, willingness, self-discipline and belief in the cause, as it may require a change of ‘culture’ and mentality.

The ability to do all that successfully – to advance, to adapt, to achieve – depends on the strength of the human element. But it is the weakness of the human element that most troubles the world of sea transportation.

In the very early 1990s we heard quite a lot about ‘the weakness of the human element’ and its relation to various accidents, not only in the field of transportation (land, sea and air) but in every field where a human being is involved. To see why and how this ‘weakness’ affects us, we have to realize that, at any given time, the behavior, skill and performance of every human being is, to a certain extent, affected by his physical and/or psychological state, which is most often due to prevailing conditions within his family and/or working environment. The consequences of this ‘weakness’ are bound to lead to wrong decisions and to wrong actions – human error – and hence to accidents.

This ‘weakness’ and its consequences cannot be eliminated altogether; we cannot control all parameters which affect the human element to the very end, but we can definitely reduce it to the minimum possible. Nevertheless, the degree of reduction of this negative effect, in order to further improve safety, also depends on the willingness and commitment of each individual to strictly comply with: the concept of planning ahead; all operating procedures and check lists; briefing/debriefing and crew coordination concepts; international rules and regulations; teamwork concepts; discipline; and correct mentality.

It is imperative to be understood that even the best professional might be affected by this ‘weakness’ unless he is always alert, meticulous and self-disciplined while performing his duties.

The most indisputable proof of the catastrophic effects of the ‘weakness’ of the human element is the latest tragic accident of the Costa Concordia and the unbelievable, unprofessional and inhuman behavior of its captain before and after the accident happened.

This ‘weakness of the human element’ was well-known at least four decades ago, and had been verified in the field of air transportation, where the appropriate standard procedures and other measures were implemented, such as rigorous initial and recurrent training, use of simulators, checklists etc. – the so-called ‘Airline Concept’.

We successfully introduced the Airline Concept into the Onassis fleet in October 1982, after four years’ preparation, and, since then, the philosophy has been adopted by the maritime industry. Very important measures were implemented by, among others, the International Maritime Organization (IMO) and the US Coast Guard, which contributed very positively in enhancing safe operations in marine transportation.

ABS first discussed ‘the weakness of the human element’ and its negative effects during its Council meeting in November 1994. I firmly believe that ABS fulfilled very efficiently the important and difficult challenge of the ‘human element’, which required – and still requires – a continuous effort to restrict this ‘weakness’ to the minimum possible level, being the only way to achieve an optimum standard of safety.

Finally, I take this unique occasion of the celebration of ABS’ 150th anniversary to congratulate the leaders of ABS during the past two decades, namely: Frank J. Iarossi, Robert D. Somerville and Christopher J. Wiernicki. Under their inspired leadership, their dedication and their high professional standards, ABS gained the trust, the recognition and the respect of the maritime industry worldwide. ❖
A human being is part of a whole, called by us the Universe, a part limited in time and space. He experiences himself, his thoughts and feelings, as something separated from the rest – a kind of optical delusion of his consciousness. This delusion is a kind of prison for us, restricting us to our personal desires and to affection for a few persons nearest us. Our task must be to free ourselves from this prison by widening our circles of compassion to embrace all living creatures and the whole of nature in its beauty.”

– Albert Einstein
1879-1955