
Maritime Environmental Ethics

A Case for Individual and Corporate Leadership

By

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Author's Biography

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Abstract

The maritime industry transports people and products around the globe binding us together in a complex network of trade and commerce. Mariners who operate ships come from diverse cultural backgrounds working far from society's oversight. Despite the benefit that ships bring to society, the potential for environmental damage is significant. Those who operate ships far from shore have the potential to discharge materials that would best be disposed of ashore. The cultural diversity, lack of direct regulatory oversight, and the pressure to meet schedules and financial requirements, cause some to commit illegal activities in the environmental aspects of their operations.

This paper addresses environmental ethics from the perspective that doing what is right, is good for business. It highlights the ultimate importance of the individual and the corporate citizen in achieving ethical leadership and emphasizes three take away points: people should make a difference, do make a difference, and people can make a difference.

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I. Introduction

A key point of environmental performance and in turn ethical behavior is that whatever we do, it's about people. People make choices and people are impacted by the choices made. Stockholders are affected by the performance of our business decisions. Beach-goers in the Bahamas are affected by the "tar-balls" from discharged bilge and cargo oil. People are affected as the food chain is contaminated by plastics taken in by the fish we consume. People are affected when the chief engineer builds a "magic pipe" to make the bilge oil disappear. People are affected when poor ship designs or maintenance schemes result in fractured tankers. People in such places as Los Angeles are affected by engine fuel particulates from ships transiting the coast and those in port. People are affected because shipping by its very nature – is a globally interconnected system of commerce.

The maritime industry has had failures in its environmental history; yet, it has started to change and must continue to change with our help. This change is good for the environment, it's good for business, and it's good for people. But it requires your full participation.

I would like to show that the way to improve our environmental performance is through a systemic change in the culture of an organization, that environmental impact is not just a random act it is often the result of a failure in navigation, technical capacity, and maintenance: human decisions. In addition to a very hazardous environment in which we operate – our failures are often the result of the culture of an organization.

Culture is something that is often an underrated and overlooked aspect of our business. Yet, it is the basis and the driver of our actions. It's both silent and subtle. It drives our decisions unconsciously. It determines who fits into the organization and who the outsider is. Culture defines who we are and what we do. It's people that make up our organizations, they crew our ships and they do good things or not based upon their personal backgrounds and national and organizational cultures. So it's up to us to create a better culture. One that continues to drive our business success in the future. Not with us dragging and kicking but with us as the leaders.

Because leadership is our heritage. Mariners have always led society to new horizons and are an instrumental element of our modern success. We sailed the world and found new lands, and peoples. We led the way and exchanged cultures. We are the backbone of modern commerce transporting 90% of the world's goods. We are the leaders! We must lead the change for more efficient and environmentally sound shipping - not - kicking and screaming into the future - but as the proactive leaders in the change effort. It must become part of our culture.

II. Pollution from Shipping

When the world's population was less numbered, pollution dumping at sea was acceptable because the environment could absorb the waste streams we discharged. But as populations around the world exploded in the 20th century, and natural materials were replaced by materials further from their natural state, the oceans can no longer naturally digest the higher concentrations and complexity of the waste. The oceans are now becoming saturated with our waste which flows into the food chain or onto our shores. For example, in Portugal, more than 90 ship incidents of pollution have been reported since 1974: twenty of them contaminated the coast line and four of them were significant pollution events [1].

In Australia, a significant ship borne pollutant is invasive species from ballast water, anchors, hull fouling, and other ship (and non-ship) related vectors. These marine pests threaten human health, economic value, and the environment [2].

In 2005, the Caribbean nations realized that ship pollution was detrimental to their well being and tourism industry on which their economic well being rests. More than 50,000 ships visit the region every year discharging invasive species in their ballast water. The Dominican Republic has 186 known alien species, Puerto Rico has 182, the Bahamas has 159, and Jamaica has 102 different non-native invasive species [3].

In Florida, we see the effect of environmental damage in various ways: reef damage is just one. There have been 12 major ship groundings on the reefs outside Port Everglades since 1993 along the three parallel reefs off it's' entrance of narrow channels, tight maneuvering lanes, and anchorages that are, unfortunately, among the reefs [4].

We continue to be haunted by the large incidents such as the Exxon Valdez which in March of 1989 struck Prince William Sound's Bligh Reef and spilled an estimated 11 million gallons of crude oil. It was one of the world's largest spills [5]. But, perhaps, the greatest impact to the environment is the incident that goes undetected: the one that does not make national news.

Certainly, the shipping industry of today releases less pollution into the environment than just a decade ago. As the world fleet grows, more ships mean more potential points of pollution. Today, shipping is directly responsible for about 5% to 10% of the acid rain that falls in coastal areas, and even more around ports where the ships enter [6].

Tankers have polluted the sea with more than 3.7 million metric tons of oil spilled around the globe from 1960 to 2002. This represents 48 significant events from explosions, fires, groundings, among others. The names are infamous: "Amoco Cadiz," "Atlantic Express," "Exxon Valdez," "Prestige," and others that are permanently imprinted upon our cultural conciseness as environmental disasters [7].

Some of the pollution cannot be avoided; but, some can be. While we operate in harsh conditions with dangerous cargos, and this won't change, we must continue to find technical and operational solutions that will reduce the risk of pollution: we must protect our environment which we should finally consider of infinite value. Perhaps, the environment should be incorporated into our financial sheets as a bottom line consideration after all, a damaged environment will eventually hurt business, even if that damage is passed on to future generations, someone will eventually pay. So, we must behave ethically today, but what does that mean?

III. Environmental Ethics

Ethics Defined

In business, one way ethics can be defined is in the way that business is conducted with respect to both those within the company and those external stakeholders inclusive of employees, governance aspects, and corporate social responsibilities [8]. While the field of ethics is broad and deep, one way it can be simplified is into a practical school of ethics considering the moral philosophy of right and wrong. Specifically, normative ethics, a practical school of ethics driving us toward a moral standard of right and wrong conduct.

In environmental ethics, we must consider the moral relationship of human beings to the environment and its non-human contents. So, what we need in our industry is a culture of

business and environmental ethics operating effectively at every level of the organization simply because such a culture will protect our company and our environment.

In our industry, it is too easy to pollute simply because our ships routinely move in and out of regulators' oversight. Since there is a lack of direct oversight, at sea, crews can if they wish, do almost anything they want to do; not because they should, not because they are allowed to, but, because they can. Those in our industry who are unscrupulous do things at sea they should not. Although, many organizations today go far above the regulations and this is admirable because those organizations have the foresight to protect themselves and the future. But many organizations are still behind the times, unfortunately, and these are the ones that need to be brought up.

In the past, polluting the ocean was acceptable: we know that. But, in recent times such accidents as the "Exxon Valdez," the "Prestige," the "Torry Canyon," and others have raised society's awareness that ship pollution must be halted. In the cruise industry, well publicized and heavily fined cases of outright pollution and investigations by the United States Department of Justice have shown the governments zero tolerance for illegal dumping and oil record book falsification.

While many companies have got it many have not. From 2002 until 2005 I served as vice-president of environmental compliance for a cruise line under probation for falsifying oil record books. I am pleased to say that we were able to change the culture and we now go above and beyond the legal requirements. We were even granted early release from probation.

But, I continue to read of polluting incidents and illegal acts as chief engineers and others are being hauled off to prison or fined. I wondered why in this day and age of instant communication this behavior continued. I mean, why risk bad publicity, a fine, or worse yet jail time? How could "we" get it and yet another executive, middle manager, superintendent, chief engineer or captain still not get it? Why do they continue to pollute? Obviously, they were aware it's illegal to discharge oil or toxic substances to the ocean. I came to the conclusion that it is not direct knowledge that makes the change - but it is the culture that drives behavior. Organizational cultures are such a strong and dominate force in shaping individual behavior that many naturally inhibit ethical behavior due to their lack of clear direction.

Some continue to pollute because their organizational culture either outright encourages environmental pollution or the culture does not have sufficient barriers in place to ensure it discourages illegal pollution. So, even today, there is still a substantial gap between the desired performance of not wanting to pollute and the actual situation taking place daily.

It became clear to me that there was a lack of practical material useful for studying ethics related to our shipping industry. This resulted in a book project that Martin Dolphin and I are putting together; the book will be based on a case study approach looking at familiar issues. The book explores the marine field and its familiar casualties that led to pollution, it also looks at positive experiences, shows what good people at good companies are doing to protect the environment, and looks at the culture of companies that drive successful change. For example, Subaru has developed a zero landfill program, American Forests works with industry to develop carbon sequestration programs, and there are others. Our hope is that the next generation of mariners, shipbuilders, designers, executives and all those that go down to the sea in ships and those who send them, will see the importance of protecting the environment.

The new paradigm that the ocean is not a vast dumping ground capable of sustaining our waste, is upon us. We now understand the environment to be a stressed system in need of

protection. But, unless we take care of it - now – future generations will hold us accountable for our misdeeds and lack of foresight.

Let's now fully turn the page of transformation and commit to an industry of design and operation that leaves a zero negative environmental impact for future generations. But, before moving to the future and the positive side, let's first review some of the negative impacts in the old paradigm.

Living in the Old Paradigm

In our old world of environmental performance: we failed, and we continue to fail. In January 2007 the United States Department of Justice announced that a ship's chief engineer and crew were sentenced for vessel pollution. A Korean vessel used hoses to bypass pollution prevention equipment. The chief engineer and second engineer were sentenced for crimes related to vessel pollution in relation to the operation of the bulk carrier vessel and sentenced to five months in prison and two months of supervised release. The second engineer was sentenced to three years of probation. The company previously pleaded guilty, and was fined \$400,000, ordered to pay \$100,000 as a community service payment, and prohibited from returning to the United States for three years for similar violations in conjunction with this case. The chief engineer pled guilty to obstruction of justice for maintaining a false oil record book and lying to the United States Coast Guard about his knowledge of the bypass hoses.

In July 2006 a container ship owner and operator paid \$3.25 million in a national marine sanctuary settlement for 15 containers lost overboard in 2004 that resulted in long-term damage to the Monterey Bay National Marine Sanctuary. Even though the vessel was traveling on rough seas from San Francisco to Los Angeles, the United States Coast Guard report revealed the containers were inappropriately loaded on board the vessel, there were faulty welds on anchor points for the containers, and there were missing D-rings from the deck of the vessel.

In July of 1999, a cruise line paid an \$18 million criminal fine and agreed to a 21 federal felony count plea agreement for dumping waste oil and hazardous chemicals. They admitted routinely dumping waste oil from its fleet of cruise ships in such environmentally sensitive areas as the inside passage of Alaska. They also pled guilty to dumping hazardous chemicals from photo processing equipment, dry cleaning shops and printing presses. They "...used our nation's waters as its dumping ground, even as it promoted itself as an environmentally 'green' company...this case will sound like a foghorn throughout the entire maritime industry..." said Attorney General, Janet Reno [9]. But did the fog horn sound loudly enough? Unfortunately, I don't think so!

Since 2001, the United States Coast Guard began a comprehensive program of boarding foreign flag-state vessels with a significant increase in the scrutiny to records and logs. This has led to vessel and crew detentions and criminal allegations and charges against vessel owners, operators, managers, officers and crew. Special focus has been placed on the use and functionality of oily water separation systems. Authorities have made it clear that jail sentences for masters and chief engineers committing pollution are likely. Such things as falsifying the oil record book and "discovery" of potential by-passing paraphernalia such as a flexible hose or suspicious fittings and piping in the engine room, will cause a grand jury investigation to begin [10]. It's unfortunate that this hard stance by regulators has to be taken. But the incidents continue in frequency. Examples in the United States include:

- Captain pleads guilty to charges related to vessel pollution [11];

- Chief engineer convicted in vessel pollution case [12];
- Captain, chief engineer, ship officers arrested in Alaska for false logs to hide pollution and witness tampering [13];
- Grand jury indicts captain and two chief engineers for witness tampering, obstruction and false records [14];
- Cruise ship engineers indicted for making false log books to conceal the dumping of waste oil [15];
- Engineers plead guilty to making false statements concealing waste oil dumping [16];
- Operator sentenced for illegal ocean dumping and three crew whistleblowers get \$1 million reward [17];
- Management sentenced for oil pollution cover-up [18];
- Company top officials plead guilty to polluting and agree to pay a \$250,000 fine and establish an environmental compliance program [19].

Compliance: The Minimum Requirement

Obviously, the pollution of the world's oceans has become a matter of increasing international concern. You would think that we would not risk jail and fines to pollute; yet, we continue to do it.

While there are other contributors to marine pollution such as land-based sources, our marine industry will continue to come under increasing pressure to stop all pollution. While we may be a smaller contributor than land-based point and non-point sources, our industry does continue to be a significant polluter with many pollutants originating from operational sources such as stern tubes, thrusters, stabilizers, cranes, etc.

Attempts to tackle the problem at an international level as early as 1920 was unsuccessful; however, the potential for oil to pollute the sea was finally recognized by the International Convention for The Prevention of Pollution of the Sea by Oil in 1954 and adopted in London. The purpose of the regulations was designed to curtail the blatant oil pollution entering the oceans.

In 1979, oil pollution from all vessels was 1.5 million metric tons per year; 257,000 were accidental; and 1,243,000 were deliberate. Compared to an estimated 3.3 million metric tons of oil from all sources including land, oil exploration, and oil production, it can be seen that ship operations contributed a significant part of pollution [20] with ships reaching a peak polluting time in 1979.

Since 1979, the amount of oil entering the sea as a result of shipping operations has declined dramatically [21]. Yet despite the improved trends a minimum standard of environmental ethics is no longer an acceptable outcome. We must drive our organizational cultures to a higher level of environmental protection – not just a minimum standard required by compliance regimes.

Moving Beyond the Minimum

As society continues to mature, it is becoming more aware of industrial impacts and there continues to be increased desire to do the right thing and to reduce impact on the environment. For example, increased environmental pressures continue to reduce exhaust emissions for shippers in Puget Sound, “The Puget Sound air emissions inventory measured air pollution

created in 2005 by oceangoing vessels among others sources and the maritime activities produced more than 1,444 gross tons of diesel particulate matter which is more than half of the studied area's total. In addition, there was another 3,109 gross tons of fine particulate matter such as dust, dirt, soot and smoke. Measurement of nitrogen and sulfur-containing compounds, volatile organic compounds and carbon monoxide were also undertaken and environmental pressures will continue to build for business organizations” [22]. Those that move beyond the minimal requirements and have visionary leadership are more likely to prosper on the slopes of changing times.

Living in the New Paradigm

Since over 90% of world trade is carried by the international shipping industry, we are not going away. Without shipping the import and export of goods on the scale necessary for the modern world would not be possible. Seaborne trade continues to expand bringing benefits for consumers across the world through low and decreasing freight costs.

Today, there are around 50,000 merchant ships trading internationally, transporting every kind of cargo. The world fleet is registered in over 150 nations, and manned by over a million seafarers of virtually every nationality. Since World War II the world fleet has grown significantly; although, the number of ships in the world's fleet grows at less than half the rate that the tonnage in the world fleet grows, partly because the average ship gets bigger every year and partly because the industry gets more efficient every year, in 1948 there were 29,340 ships representing 80,292 gross tons while in 2006 there were 91,000 ships representing 700,000 gross tons [23], the growth is phenomenal.

IV. Business Success

Environmental Ethics Promotes Successful Business

So how does a business prosper when it considers environmental ethics? Does protecting the environment and doing the right thing help in making a profit? I propose to you that it does because fines, regulations, probation plans, and wasted resources all contribute to inefficient business operations. Once, inefficiency could be tolerated – but it is no longer viable. The businesses that do survive and prosper are the ones that run efficiently and effectively by optimizing their human and physical resources.

In its simplest form, doing the right thing means following the legal requirements applicable to the businesses: it's called compliance. Compliance prevents unwanted governmental interference into the business operations. It prevents fines. It prevents jail sentences. It prevents the government from issuing the company a probation plan. Best yet, it reduces the potential that the court will appoint another management team to run the business. So at the very least, compliance must be a part of the culture. But should a business go beyond simple compliance? I think so.

Why? Because doing so raises the behavior of the organization to a higher standard. People are free to question what is right and make judgments rather than simply do what they are told they must do, i.e. simple compliance. Ethical operations raise the quality of leadership in organizations. But does ethics payoff for business? In a recent study designed to answer the

question, seven indicators were chosen to identify if ethics impacted business improvement. Those indicators include:

- Market value added
- Economic value added
- Price earnings ratio
- Return on capital employed
- Having a code of ethics
- Ratings for managing socio/ethical risks
- Being cited consistently in the annual list of most admired companies.

The sample included companies from the FTSE 350 divided into two cohorts: those with codes of ethics for five years or more and those without. The relationship between good financial performance and other indicators of corporate responsibility was positive with superior market value added for companies which referred to their ethics program in the annual report, compared with those who didn't. The study showed strong evidence that larger companies with codes of ethics out perform those companies that do not have a code. It seems, being ethical is good for business [24].

Other studies show that organizations that behave unethically are at higher risk for employee fraud which is valued at more than \$600 billion a year [25] costing employers 20% of every dollar earned. One study found that 80% of people say they buy a firm's goods or services partly on their perception of its ethics [26]; and, unethical behavior seems to harm stock price with 74% of people polled saying that their perception of a firm's honesty directly affected their decision to buy its stock. Investments in unethical firms earn abnormally negative returns for prolonged periods [27] and unethical behavior worsens the risks from scandal and it can increase the cost of civil charges. Unethical behavior results in a decline in performance of highly skilled employees with productivity drops by as much as 25% because of other workers unethical behavior in the organization [28]. Unethical behavior also seems to worsen communication in the organization and reduce the reporting of misconduct.

In a 2003, a national business ethics survey reported that 39% of employees at firms with no ethics programs reported misconduct when they saw it, 52% did so in organizations with ethical standards alone, 67% with standards and either ethics training, and 78% in firms with all three [29]. So, clearly, ethics has the potential to change the way people behave and what we want is a work force that behaves well and is motivated for business success. So yes, ethics is good for business because it changes the culture of the organization.

Culture and Its Importance

In our maritime culture, we often work with many different national cultures operating within the same organization. In cruise operations this may be as high as 60 different cultures on any one ship. And with it comes a possible 60 different interpretations of life.

The worldwide population of seafarers serving on internationally trading merchant ships is estimated to be 466,000 officers and 721,000 ratings. North America, Western Europe, Japan remains an important source for officers but growing numbers of officers are now recruited from the Far East and Eastern Europe. The majority of the shipping industry's ratings are recruited from developing countries such as the Far East and south East Asia. The Philippines and India are very significant maritime labor supply nations and the Ukraine, Croatia and Latvia have recently supplied large numbers of mariners [30].

Cultural differences are important because culture is group based with the individuals holding onto certain basic assumptions to support the validity of the group to which they belong. If someone asks us to change our way of thinking we tend to resist the change because we unconsciously do not want to be different from our group norm even if we internally believe that the change is right. This unconscious process is so powerful that it drives behavior [31]. Therefore, organizations must proactively develop their own cultures, their own norms of acceptable behavior that will not only drive compliance for business security but innovation for business success. Otherwise, the culture that is present may not be the desired one.

Since organizational culture is a complex set of basic underlying assumptions and deeply held beliefs shared by all members of the group, the culture operates at a pre-conscious level and drives the behavior of individuals in the organizational context [32]. It is very difficult to see it for what it is when you are inside the organization. And, it is much harder to change it from the inside. Thus, the use of consultants is often necessary when considering organizational change.

But it is the culture of our organizations that must be changed if we expect to succeed. We must strive to develop a high tolerance for visionary thinking and intolerance for environmental misdeeds. An important concept to overcome is the group-think phenomena in which the norm for consensus overrides the realistic appraisal of alternative courses of action. Symptoms of group-think shows itself when group members rationalize any resistance to the assumptions they have made no matter how strongly the evidence may be that contradicts their basic assumptions. Since members of the group continually behave to reinforce their assumptions, they apply direct pressure on those individuals who momentarily express doubt about any one of the group's shared views or who questions the validity of arguments supporting the alternative favored by the majority. When members who have doubts, or hold differing points of view, seek to avoid deviating from what appears to be group consensus, they tend to keep silent about misgivings and their voices are not heard. The result is that a significant part of the intelligence pool in our organizations is excluded in the decision-making process. When it occurs there appears to be an illusion of unanimity because when someone doesn't speak-up, it is assumed that he or she is in agreement with the group [33]. This is dangerous. But what can we do?

The Importance of Leadership in the Culture

Shipping managers can foster ethical behavior by being a visible role model, by communicating ethical expectations, by providing ethical training, by rewarding ethical acts and by punishing unethical ones, and by providing protective measures that will safeguard those who report wrong behavior [34]. So ethics, in general, is important to our business. But specifically, the topic of environmental ethics is extremely important because our oceans are being severely and permanently damaged. We cannot leave the earth: we must stay and we do have a duty to protect it for the next generation.

Yet, our food chain and marine eco-system are now damaged and we have, among other pollutants, a plague of plastics floating in our oceans being consumed by our food sources. Swirling masses of drifting debris called gyres pollute remote beaches and snare wildlife. Vast expanses of floating junk in our oceans are eaten by wildlife. Lego blocks, clothespins, fishing lures and other pieces of plastic perforate the stomachs, block gizzards of birds and mammals, and are killing large numbers of sea life. 500,000 albatross chicks were born in Midway Atoll in 2006, about 200,000 died, mostly from dehydration or starvation due to plastic ingestion.

The slowly rotating trash mass called the “Eastern Garbage Patch” is about twice the size of Texas and is part of the North Pacific Ocean subtropical gyre halfway between San Francisco and Hawaii. It consists of nearly 90% plastic. About four-fifths of the trash comes from land and one-fifth from ship gear and trash that is illegally dumped overboard probably to avoid the cost of proper shore side disposal. In addition, the thousands of cargo containers that fall overboard each year from container ships adds to the gyre. In one example, a ship heading from Los Angeles to Tacoma lost 33,000 blue-and-white Nike basketball shoes in 2002 and other ships lost such things as 34,000 hockey gloves, 29,000 yellow rubber ducks, and other bathtub toys! Unfortunately, this type of trash floats and moves on top of the currents for decades in any one of the more than twelve gyres that are found in our oceanic systems.

The United Nations Environment Program estimates that 46,000 pieces of plastic litter are floating on every square mile of the oceans. Although 70% will eventually sink, before it does, one-million seabirds will die from it every year, 100,000 seals will die, as well as other animals such as sea lions, whales, dolphins, and sea turtles. A piece of plastic found in an albatross stomach in 2006 bore a serial number that was traced to a WW II seaplane shot down in 1944! Unfortunately, in many areas since the 1950s there has been a tenfold increase every decade in plastic that enters the ocean: the trend is expected to continue.

Charles Moore [35] who was on his way home from the Los Angeles to Hawaii transpacific yacht race in 1997 observed trash floating by all the time. The experience changed Moore’s life, turning him from an adventurer into a self-taught scientist and environmental activist. Moore now spends his own money and some from a family foundation on tracking the plume of plastic seeking solutions [36].

Moore is a leader. But we need more leaders. Leaders who will take their business, research firms, and consultancies beyond the minimum and move from compliance to true ethical behavior. Leaders who will move their organizations toward promoting the welfare of business *and* the society which it serves. We need leaders who will make a difference, and in doing so, build long term sustainability into their organizations and into the environment for the sake of future generations *including* stockholders, employees, and community members.

V. Three Take Away Points

You Should Make a Difference

So who are those leaders, like Moore? They are the Gores of the world. They are you. Who ever has been touched enough by a changing cultural norm to see that we must do something to change the way we live. It’s you and I that can make a difference. You don’t have to be rich or a powerful position. But, you do have to be passionate. Passionate enough to protect the environment for future generations. You do have to have some knowledge about the subject. So read. Understand. And speak about the issues. Change happens because you decide to share your views with others. Change happens because you have the courage to do it. You should make a difference because you do and can make a difference.

You Do Make a Difference

Change occurs with one person at a time. So, just discuss these things with friends and colleagues. Teach others around you. Build knowledge and understanding. Build consensus and

you will certainly make a difference. People may and will say that you can't create change - but I disagree. You have the power to influence others – use it. Build better ships. Refuse to dispose of waste illegally. Engage and enable innovation that will bring our industry forward. You can make a difference

You Can Make a Difference

Perhaps all you can do is be ethical and say no to activities that negatively affect others. Perhaps you are not in a position now to make a big difference; but, perhaps you will be one day. So just do the best you can with what you have in the situation you are in. And, before we close, I want to give you a few thoughts on what others are doing. You may know about these: some were considered undoable or crazy just a few short years ago. But today they are gaining popularity out of a need to protect the environment. They are the work of visionaries: men and women who see the future and attempt to meet her needs.

Bubbles

Yoshiaki Kodama is trying to make a ship float on bubbles and move at higher speeds using less fuel. He is Director of the Advanced Maritime Transport Technology Department at Japan's National Maritime Research Institute in Tokyo. The Maritime Research Institute in the Netherlands reports that reducing the drag on a ship's hull could improve efficiency by up to 20%. There are of course problems to be encountered and overcome, but the idea of bubbles springs from improving the environment and will be good for business as well. Reduced friction improves fuel efficiency and reduces greenhouse gasses by 25% [37].

Nuclear Energy

The “N/S Savannah” was a commercial failure. But is nuclear energy in the future for commercial shipping again? Perhaps. There is a project resurrecting the idea at least. Someday fossil fuel will run out, an alternative energy source must certainly be obtained.

Sails

Several companies around the world are experimenting with wind-assisted ships to reduce fuel consumption. In "the new age of sail," ships may be pulled by a high-tech kite flying at an altitude of up to 1500 feet. German designers recently tested a prototype and estimate that a hybrid sailing ship would realize a 50% reduction in fuel consumption [38].

Zero Discharge

A cargo ship vision to run only on renewable energy was presented in 2005 with the idea to use solar power, wind energy, and hydrogen from sea water for power with zero emissions into the environment. The concept model is the “E/S Orcelle” which is a cargo ship design by Wallenius Wilhelmsen. While this is “visionary think,” and the concept is not planned to be built, the intention is to stimulate the needed technology to create such a ship within the next 20 years [39].

VI. Closing remarks

So, in closing, the maritime industry is a historic industry with deeply held traditions. We were the first truly global citizens. We were leaders and we should continue in this tradition. But this time let us lead in the exploration of ship designs and operations that will enable continued world trade while protecting the environment in which we operate.

Leadership in our companies concerning the environmental impact of our operations is for now. To prosper we must develop a culture that has zero tolerance for misdeed and a high tolerance for innovation and improved environmental performance. We must change the way we live and work if we expect do our part in improving the health of our environment. Remember, doing what is right is not just not doing what is wrong – it is doing what should be done!

While we are not the largest polluter we are a significant part and certainly have more potential to pollute than many land based organizations. You can make a difference. You do make a difference. And, you should make a difference. Thank you for participating!

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