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Maritime Commerce and Security: The Indian Ocean

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Contents

II. Maritime Infrastructure

III. Maritime Issues and International Security

IV Future Prospects

Appendices

1

Maritime Commerce

Setting the Scene

The first decade of the 21st century has seen both the biggest boom and the biggest bust in the history of modern shipping. Soon after the onset of the global economic and financial crisis in late 2008, the industry experienced the drying up of credit for investment in vessels and ports, the severe constriction of trade finance and letters of credit (the very heart of international maritime trade) and the collapse in trade volumes in all directions and all types of cargo, raw material and finished goods. In 2007, when the International Transport Forum convened in Leipzig, an influential senior executive of a Singapore cargo line warned that port infrastructure was lagging behind the demands of trade volumes. At that time container traffic between Asia and Europe was growing annually by 20%. At the same Forum convened two years later, Asia-Europe container volumes had dropped by an average of 20%. The Secretary-General of the Forum offered global planning figures of 4% decline for the economy, 10% decline for trade, and 20% decline for transport. Not only the scale of the declines, but the disproportion between the three measures, told the story succinctly and eloquently.[12]

A sign of the volatility of the sector is conveyed in the following developments over a short span. After its worst ever year in 2009, the container sector experienced modest recovery in the first half of 2010, only to face a slowing recovery thereafter. Yet AP Moller-Maersk, after having reported in 2009 its first loss ever in more than a century of operations, reported its most profitable year ever in 2010.[13] However, as discussed further in the book, the fortunes of a large company able to take short term belt-tightening measures is not necessarily typical of the majority of shipowners. In recent months, the market for companies that lease containers has heated up, owing to the shortage of containers caused by the slowdown in container manufactures, particularly in China, resulting from the general world trade slowdown in finished goods.

The 2009 annual Review of Maritime Transport of the United Nations Conference on Trade and Development (UNCTAD) estimated a decline in freight rates of 40% between mid-2008 and mid-2009. At the beginning of 2009, global fleet capacity had reached a peak of 1.19 billion deadweight tons, up 6.7% over January 2008, despite the downturn in trade. Whereas world container port throughput climbed 4% in 2008 to reach 506 million twenty-foot equivalents (TEU), with Chinese ports accounting for 22.6% of the world total, sharp falls were noted beginning in late 2008, even at Chinese ports.[14]

[12] "Slide in trade leaves a glut of capacity," *Financial Times,* 26 May 2009.

[13] "Maersk eyes record profit," *Financial Times,* 11 November 2010.

[14] United Nations Conference on Trade and Development, *Review of Maritime Transport,* (UNCTAD, New York and Geneva, 2009).

That shipping should be suffering such dire circumstances and anticipating a grim future as a result of global economic trends is unfortunate enough. That it should coincide with a significant trauma to the industry in the form of the epidemic of piracy against hugely valuable (and in the case of petrochemicals highly volatile and hazardous) vessels and cargoes represents a potential disaster.[15]

Ninety percent of world trade measured by weight and volume (and 80% as measured by value) is carried in seaborne commerce.[16] Globalization may be seen as a significant demand factor in the rapid expansion of maritime commerce, capacity and technology, but it has been enabled and facilitated by those developments. Increasingly sophisticated means for transporting large cargoes – such as containerization, or increasingly large vessels for specialized transport of liquid and dry cargoes in bulk – transformed the speed and efficiency of transport logistics. This made possible the development of globally distributed supply chains and production processes, and thus the efficient allocation of comparative advantage, for the production of food, other agricultural commodities, minerals and finished goods.[17] Investment in large specialized ships and in high speed cargo handling systems introduced economies of scale that made the cost per unit cheaper, even over longer distances by sea, than by land.[18]

Work on the topics covered in the present volume began with an attempt to delineate the security and governance implications of the many processes of rapid change taking place in the Indian Ocean, individually and as they affect each other.[19] Maritime commerce emerged early in the analysis as a key part of two major contemporary stories: the economics of globalization and the geo-strategic picture in the Indian Ocean. The interests and calculations of all parties – states, businesses and those who operate outside the rules (pirates, terrorists, criminals, and polluters) – are intimately linked to ships, ports and sailors. It is a truism worth repeating that the sharp rise in piracy in the Indian Ocean owes much to the rapid aggregate increase in the volume of seaborne commerce there. It also owes much to geography - much of that commerce passes through narrow straits or coastal seas, many of which are also sites of instability, armed conflict, rapid impoverishment, or traditions of extra-legal activities such as smuggling. It is also evident that the rapid development of vast port infrastructure and large vessels offers a target of opportunity for criminals of all kinds, including terrorists and pirates.

[15] The following two incidents chosen at random from dozens of others are illustrative of both the type of victim and the frequency of attacks. "Somali pirates hijack British chemical tanker," *The Guardian,* 30 December 2009; "Pirates say ransom paid for coal ship," *Financial Times,* 28 December 2009. More recent events, and the relative success of navies in fighting back, are reflected in "Marines seize ship from pirates, *The Washington Post,* 10 September 2010.

[16] Sam J. Tangredi, *Globalization and Maritime Power* (National Defense University, Washington, 2002); page xxvi.

[17] The single most comprehensive treatment of developments in the shipping business is found in Martin Stopford, *Maritime Economics,* (Routledge, 2009, 3rd Edition).

[18] The rail freight for a ton of coal from Virginia to Jacksonville Florida came to be three times the sea freight for the 10,000 miles between Virginia and Japan. Stopford, *supra,* page 39.

[19] Stimson's initial review of the environmental, governance and security dimensions was reflected in Ellen Laipson and Amit Pandya (eds.), *The Indian Ocean: Resource and Governance Challenges* (Stimson, 2009). The focus there on fisheries is particularly pronounced, and that topic is not repeated here. More recently David Michel and Amit Pandya (eds.), *Coastal Zones and Climate Change* (Stimson, 2010) deals with the security issues raised by environmental change in the maritime sphere. Those issues are not treated in the present volume, limiting consideration of environmental issues to those directly related to commercial maritime activity.

Maritime security certainly includes the world of navies, armed threats, sea lane security, and geographical chokepoints of navigation. In recent discourse, the term has also come to encompass the issues that used to be treated as "safety" issues, including the topics covered by the International Ship and Port Facility Security Code (ISPS) the Safety of Life at Sea Convention (SOLAS) as amended, various recent initiatives such as the Cargo Security Initiative to secure cargo from terrorist threats, and the Convention on Suppression of Unlawful Acts against the Safety of Maritime Navigation at Sea.[20]

In addition to such direct concerns about the safety of maritime equipment, infrastructure and personnel, there is also the fact that the vulnerability of shipping and ports to attack or subversion constitutes vulnerability for broader elements of the societies in which shipping operates. Yet candor demands an acknowledgement that there is an always latent and sometimes acute conflict of interest between the industry and the larger polity within which it exists. As governments have moved to secure cargoes and ports, elements of the industry have found the new measures to be burdensome and costly. Within a business model of decision-making – risk management – the calculation of costs and benefit will often be made by reference to an inevitably uncertain measure of risk. Governments charged with securing their territories and populations may on the other hand be more risk averse. Often they have inclined to the introduction of measures such as Long Range Identification and Tracking, which require cooperation from, and constitute added expense for, ship operators.[21]

Thus, several approaches to securing vessels against threats such as piracy have emerged simultaneously. In the absence of a clear commonality of approach, this variety of opinions may ultimately contribute to the development of clear policy. However, it is apparent there is as yet no clear policy. In the space of a month, European Community Shipowners' Association came out in favor of naval protection units on board vessels at government expense;[22] the Norwegian tanker company Odfjell considered placing armed guards on its own ships and sought official sanction from Norwegian and Singaporean authorities to arm crew and carry armed guards;[23] the senior British officer in charge of European Union anti-piracy naval operations tentatively backed a Lloyd's insurer-backed private sector patrol boat flotilla to protect merchant shipping[24] even as the British Chief of Staff of the same force warned of complications from armed guards on board merchant vessels;[25] Maersk Line, the world's largest container line, rejected the presence of armed guards on its container ships;[26]and a leading maritime lawyer warned of criminal liability under the UN Convention on the Law of the Sea (UNCLOS) if armed guards were to fire.[27]

[20] This range of issues is comprehensively and definitively addressed in Rupert Herbert-Burns, Sam Bateman and Peter Lehr (eds.), *Lloyds MIU Handbook of Maritime Security* (Taylor and Francis, 2009) and attention is not duplicated here. See also, Henry H. Willis and David S. Ortiz, *Evaluating the Security of the Global Containerized Supply Chain,* (RAND Corporation, 2004).

[21] See in Herbert-Burns et al. *supra* the chapter by Stephen M. Jones, *Implications and Effects of Maritime Security on the Operation and Management of Merchant Vessels*.

[22] *Lloyd's List,* 27 September 2010, page 2.

[23] *Safety at Sea International,* October 2010, page 15.

[24] *Lloyd's List,* 29 September 2010, page 2.

[25] *Lloyd's List,* 15 September 2010, page 4.

[26] *Lloyd's List,* 29 September 2010, page 2.

[27] *Lloyd's List,* 15 September 2010, page 4.

Overall security is also significantly affected by maritime developments that could change the competitive position and calculations of state and powerful non-state actors. Such developments include precipitous increases and decreases in freight rates, radical changes in the balance between supply and demand in shipping and port capacity, developments of vast new ports, and changes in navigation routes of particular sectors of shipping. The downturn in international trade resulting from the recent economic crisis, and the under-estimation of financial risks and the credit excesses revealed by that crisis, have struck a blow at the health and confidence of maritime commerce, sparing no sector of it.

The following example illustrates the strategic and security implications of commercial developments, and particularly precipitous change in commercial trends and expectations. Denmark's Maersk container line has, as described in more detail later, suffered substantial and unprecedented losses in its global business. The container trade was based on the pattern of large feeder ships moving to European and North American ports and then serving Latin American and African ports by "feeder" ships. As Asian trade with Latin America and Africa has recovered better than with North America or Europe, Maersk has decided to adjust its trading patterns to introduce ships more suitable for the smaller harbors and smaller cargo volumes of the former. Maersk's parent company, AP Moller-Maersk, filed a recent interim report that showed volumes on African routes rose by 12% and on Latin American routes by 18%, compared to 5% on North American and European ones.

In order to compensate for the difficulty in filling the largest ships, only recently commissioned to carry more voluminous cargos, some liner service alliances such as the New World Alliance have pooled consignments to spread the costs of a single voyage. Some container lines with diminished demand on established east-west routes have aggressively sought new types of business in ways that can also be destabilizing to established business practices. They have entered less developed markets in Asia and Africa seeking to carry non-containerized general cargo ("break-bulk") in containers. This is likely to threaten general cargo lines and smaller ports, as container vessels gravitate to ports that have the machinery to handle containers.

Such fundamental changes in trading patterns and routes could potentially alter the configuration of ports, their relative importance, the investment patterns for ports and types of vessels, and much else. This already threatens to sideline new hub ports such as Algeciras that have been developed with the old patterns in mind and have drawn substantial investment very recently. Similar reconfigurations may be anticipated in the event that the current shift of emphasis from the Suez Canal route to the Cape route develops into a long-term trend. Such important reconfigurations could alter the strategic expectations and plans built around established or planned trade routes and port infrastructure.

Case Study: Suez Canal

A compelling and important example of the current state of global maritime trade is the changing operational behavior of some shipping companies with regards to their use of the Suez Canal. The canal is a trading and geopolitical feature of considerable strategic relevance; it has also served as vital shipping short-cut since its opening in November 1869. Nevertheless, the Suez Canal Authority (SCA) is now facing a period of declining revenues as ship owners seek to reduce operating coast by sending vessels on the Europe to Asia trades round the Cape of Good Hope rather than via the canal. In a poorly timed move given the deterioration of the global economy soon thereafter, the authority raised average transit tolls by 7.1% in March 2008.

Though the SCA said it would not raise fees in 2009, the majority of shipping companies had hoped for decreases in dues. Large container ships pay up to $600,000 for a single transit of the canal.[1] Costs for owners (which are passed on to charterers) to send vessels from the Mediterranean to Asia also increased due to spikes in insurance rates[2] for those vessels transiting the Gulf of Aden and Horn of Africa, waters that have seen very serious levels of piracy and armed robbery.

Vessels choosing to transit via the canal and the Gulf of Aden are subjected to a war risk insurance premium amounting to approximately $20,000 per ship per transit in each direction, thus an additional $40,000 for a round trip for a liner service, for example. (This excludes extra costs for injury, liability and pirate ransom coverage). It has been estimated that the increased costs associated with additional war risk premiums for the 20,000 or so vessels transiting these waters each year could amount to at least $400 million.[3]

In basic terms, the revived attractiveness of the Cape route is a clear reflection of the current operational circumstances of even the largest liner operators since the accelerating decline of the global economic situation in October 2008. The ability of owners to divert services away from Suez is a result of several converging factors: the availability of spare ships; less voluminous and less frequent demand by consumers; cheaper fuel; and consolidation of cargoes by allied shipping lines. These factors have enabled shippers to lengthen voyages and benefit financially from doing so.

Though the introduction of voyages via the Cape is founded principally on commercial rationality, it is also intended as a clear demonstration to the SCA that there is a viable, indeed a more logical, alternative to the canal. Nevertheless, the economic consequences of this development for ship owners and operators are far from clear. Although they do not reflect recent additional costs of Suez passage, based on 2007 figures, total round trip costs of sailing via the canal were estimated at $25.7 billion, compared to aggregate costs for vessels routing via the Cape of Good Hope estimated at $32.2 billion: a 20.18% increase. Those estimates suggested that the re-routing of some 33% of all cargo via the Cape would amount to an additional $7.5 billion per year for 2008, 2009 and 2010, costs that would most likely be passed on to consumers.[4]

Several long-term political and strategic implications of this deserve note. The Suez Canal is Egypt's third largest source of foreign exchange, after tourism and remittances.[5] Certainly, mariners accustomed to the relatively calm sailing of the Mediterranean and Red Seas will be compelled to learn navigation through the more rigorous environment of the "roaring forties" and the challenging weather systems of the Cape of Good Hope.[6] Above all, given that the current configuration of port infrastructure and transport and logistics patterns reflect the preponderant role of Suez in trade between Europe and Asia, the reversion to the Cape route as a long-term alternative would clearly affect the commercial and geo-strategic calculations of many key players in the Indian Ocean.

[1] "Lines put new faith in Hope," *Financial Times,* 26 May 2009.
[2] *Ibid.*
[3] UNCTAD Review of Maritime Transport 2009, United Nations, New York & Geneva, 2009.
[4] UNCTAD Review of Maritime Transport 2009, United Nations, New York & Geneva, 2009.
[5] "Lines put new faith in Hope," *Financial Times,* 26 May 2009.
[6] *Ibid.*

Several key dimensions frame the relationship between commerce and maritime security.

Developments and trends driven exclusively by land-based forces can have profound effects on what goes on at sea. This effect is most pronounced in the ways that changes in the volume, scale, scope, type, and routes of maritime commerce reflect economic developments such as changes in natural resource exploitation, changes in manufacturing, entry by major trading nations into particular sectors of an economy in a foreign country, and changes (beneficial or dysfunctional) in governance, such as increased corruption or elimination of trade restrictions. Equally important are developments such as building or refurbishment of infrastructure that facilitates transportation of goods, whether rail and road links or port facilities.

The facilitation of transport by land as an alternative to sea carriage, such as Europe-Asia land routes or the building of pipelines (whether from the same source or from an alternative source of hydrocarbon energy) will also alter the shape of seaborne carriage. Sometimes, the mere establishment of refining facilities in new locations can effect radical change. Changes in nature and technology far away can also be profoundly important. The melting of the Arctic passage and the development of ice-capable vessels could alter entirely the iron necessities of Asia-Europe trade routes by providing the alternatives of the Northeast and Northwest Passages. Each of these can and will have profound effects on the calculations and prosperity of powerful state and private interests.

The ways in which Somalia-based piracy has altered the security and commercial scenes in the western Indian Ocean illustrates one type of land-based effect on the maritime space. The international community's neglect of the chronic and severe long-term insecurity and governance failures in that country has led inexorably to the current pass. That it did so in a region heavily policed by several powerful navies, and remains viable despite that naval presence, is an object lesson. It is not too far fetched to contemplate the development of similar threats emanating from Yemen or Pakistan.

An objective assessment would require acknowledgement that Somali piracy reflects developments in the maritime sphere also, as some artisanal Somali fishers have been recruited by pirate organizations upon finding themselves in unequal competition with technically sophisticated fishing fleets from advanced economies.

Developments at sea have a corresponding effect on developments on land. The ransoms extracted by Somali pirates have spawned an entire land-based industry of middlemen stretching as far as the United Arab Emirates and other global business centers. These middlemen negotiate on behalf of pirates and provide the financial and other services to allow ransom money to be paid, transferred and invested. The impact is also seen in the Somali investments that have poured into places such as Mombasa in Kenya, where local people have complained of price inflation owing to a run on real estate by Somalis seeking to invest ransom proceeds. In turn, the chronic and entrenched corruption found in the Kenyan bureaucracy, political class and business communities have provided a hospitable environment for this maritime effect landward.

Most often the interaction of developments on land and sea is mutual and inextricable. The development of container

technology and its related port handling technology, and the progressive development of integrated logistics models have over the past few decades led to immense changes in the ways that both the seaborne and the port-side dimensions of maritime commerce have been conducted. Port communities and specialist occupations that support shipping have evolved, prospered or been eclipsed as a result, and the characteristics and skills of seafaring occupations have changed markedly. Specialization and the need to keep up with rapidly evolving business models and technologies have created a great degree of instability, whether for chandlers, stevedores, engineers or sailors. Other changes in the industry that have altered the infrastructure, sociology and economics of maritime communities include the increase in size and technical sophistication of ships; changes in the structure of the industry, and financing and ownership of key sectors; specialization of vessels, such as container ships, tankers (of various specialized types), dry bulk carriers, and specialist vessels such as those devoted to large scale earthmoving and agricultural machinery; and shifts in the location of shipbuilding industries and expertise.

The Indian Ocean

The Indian Ocean is a particularly heightened and concentrated form of the global reality embodied in maritime commerce. It witnesses the transport of a very significant proportion of the world's trade. It simultaneously has a high concentration of the fastest growing economies in the world, a high concentration of the most politically unstable, governance-deficit and conflict-prone national polities, and a high degree of pre-existing international tensions, rivalries and conflicts. A greater proportion of the Indian Ocean than any other ocean is occupied by significant insular nations, some with significant populations, volumes of economic activity, global economic significance, sophisticated institutions, and influence in the community of nations.

Although it ranks only fifth out of nine regions (as classified by Lloyd's MIU in London) in terms of commercial shipping port call volume (the first three being northern Europe, the Far East and the Mediterranean/Black Sea), the Indian Ocean is an inescapably central feature of global maritime trade. More significant than the volume of intra-regional sea trade is the fact that the Indian Ocean is arguably the world's most important trading crossroads. When this is married to the reality of globally-significant deposits of primary raw materials that are vital to the world's economy – such as Bauxite, Chromite, Coal, Copper, Gold, Iron Ore, Natural Gas, Nickel, Oil, Phosphates, Titanium, Tungsten, Uranium, and Zinc – then the strategic importance of this maritime space becomes abundantly clear.

The concentration of economic activity (and the resulting high volume of seaborne commerce), the relative proximity of nations, and the environmental sensitivity of the ocean ecology in this ocean are potential change multipliers, particularly when they occur simultaneously. This presents a complex picture, encompassing the use of marine resources as well as marine space. Competition over marine resources has already given rise to inter-state competition, or conflict between non-state actors, over matters such as fishing grounds or undersea fossil fuels. Fisheries are a key part of food security and livelihoods, and fossil fuels are the key to energy security in the context of increasing demand and uncer-

tain supply. Food security, livelihoods and energy security are increasingly important determinants of security.

Recent examples of inter-state competition in the South China Sea over undersea resources are likely to be repeated in competition for resources in the Bay of Bengal between Bangladesh, Burma and India. Conflict over fisheries in the South China Sea has already had its counterpart in the coast off Somalia, where the combination of sailing skills among fishing communities and their impoverishment by outside industrialized fishers has been identified as a significant factor in the emergence of piracy. It has already become clear in the case of Somali piracy how such localized conflicts can do significant damage to the security and costs of global seaborne commerce. Other resource conflicts in the marine realm are highly likely to have similar effects on shipping.

There are also processes of rapid change in port and ship technology, and in the locus of ownership and commercial power, that have created new geographies of commercial advantage, and thus added to the anxieties of key players.

For example, the development of exceptionally large container vessels has led to the replacement of point to point cargo with a system of transshipment nodes and feeder routes. This in turn has led to the development of entirely new ports which have taken away traffic and business, and secondary benefits to local economies, from established ports. The development of large carriers of fossil fuels has led to the development of entirely new specialized terminals for these products, and given rise to new sailing routes for them.

Those routes and the terminals themselves have also added new elements to the security calculations of nations, as they constitute new points of vulnerability. For example, the establishment of the world's largest distillate refinery in Jamnagar on the western coast of India, importing crude raw materials and exporting distillates, has raised the economic stakes in an always vulnerable route from the Gulf to India, transiting the Arabian Sea parallel to the coast of Pakistan. The development of the new Chinese-funded port at Gwadar on Pakistan's coast as a terminus for the China trades has also markedly altered the geography of trade, and fed into the long-standing tensions between India and Pakistan.

The sense of vulnerability and the strategic anxieties of trade dependent nations are inevitably shaped by commercial vulnerabilities of particular economic sectors or localities, by the national shifts in ownership and market power (such as the rise in importance of Chinese shipping and shipbuilding), and by the development of new ports and infrastructure.

While the process of economic change has been rapid and radical in many regions, and affected maritime commerce in other oceans, there is no other place where it has been as substantial and significant as in the Indian Ocean. The only comparable area, in terms of the radical degree of change has been the Arctic, but the changes and future prospects in Arctic commerce are largely a result of environmental change, accompanied by improved technology for the exploitation of undersea fossil fuels. The prospect of new Arctic sea lanes of commerce has been a by-product of environmental change, rather than reflecting a fundamental and qualitative shift in the global economic significance of the Arctic littoral nations.

The economic rise of Asia in recent decades has brought the Indian Ocean's seaborne commerce in raw materials and finished goods into the center of the global economy, and Asian countries have progressively become commercial and maritime powerhouses, beginning with Japan in the 1970s, and continuing with South Korea and China to the present day.

The importance of Indian Ocean commerce is conveyed by an examination of the global trade in coal. South Africa, Indonesia and Australia between them account for more than half of the world's exports of thermal coal. China and India are the top importers. Between them, they imported 10 times as much in 2010 as they had in 2003.

A parallel to these commercial developments has led to the rise of several Asian navies, some with trans-oceanic scope and ambitions, such as India and China, and others with significant regional influence, such as Singapore, Japan and Indonesia.

Commerce across the Pacific Ocean has also experienced the effects of this burgeoning of trade as a result of the rise of Asia. Yet, in contrast to the Indian Ocean, the Pacific has fewer nodes of commerce and a dominant military presence in the form of the United States, and therefore presents a less complex picture. Moreover, the shift of weight to the Indian Ocean is palpable. Only in recent years has intra-Asian liner shipping become larger than Asia-US, Asia-Europe and trans-Atlantic liner volumes.

The Key Actors

The Indian Ocean is unique in being of equal and intense interest to commercial and military interests, littoral states and almost every significant outside power in the world.

China

Three factors make China the ubiquitous and dominant player in the Indian Ocean. First, its emergence as a global commercial maritime power and shipbuilder; second, its predominance in the Asian military balance – with its attendant build-up of its navy; and third, its skillful diplomatic strategy of economic or security partnerships (or both) with East African, insular Indian Ocean and Asian countries. It enjoys unparalleled access and influence as a result of such presence in countries as varied as Sudan, Mauritius, Sri Lanka, Pakistan, and Burma. The network of investments, raw material sources and commercial relationships that China has developed in South Africa, in Tanzania and in Sudan indicates the ways in which its economic interests depend on Indian Ocean sea lanes.

Although most of the immediate attention has focused on Chinese naval presence and activity in the seas of East Asia, the reverberations have been broader among key Indian Ocean maritime states, large and small, such as Singapore and India. The sea lanes that traverse the Indian Ocean are often components of sea lanes further east. The overall increase in the robustness of China's posture is expected to be reflected in its burgeoning posture in the Indian Ocean.

These Indian Ocean states have shared the concerns about the Chinese profile in the South China Sea expressed by the United States in the latter half of 2010, and about the increased forcefulness of Chinese positions on disputes over maritime jurisdiction in hydrocarbon-rich and fisheries-rich seas,[28] including detention of fishers who

[28] Dean Cheng, *China-Japan Confrontation at Sea: Senkaku Islands Issue Won't Go Away,* (Heritage Foundation, 24 September 2010); "Elevated Aspirations", *Financial Times,* 11 November 2010.

are nationals of other countries such as Vietnam. In some cases, the fishers detained have been nationals of states that are simultaneously in disputes with China over the South China Sea and are also significant maritime players in the Indian Ocean, such as Malaysia.

Enhanced Chinese naval operations in international waters, but in close proximity to powerful neighbors such as Japan, have been seen by Indian Ocean states as having implications for China's posture in their own neighborhood. Recent indications of Chinese aspirations to an enhanced profile in the Indian Ocean, such as unprecedented types of port visits, appear to bear out these concerns.[29] In August 2010, a hospital ship deployed in support of the Chinese anti-piracy mission in the Gulf of Aden made several port visits in the region. A Chinese naval contingent returning from the anti-piracy mission made unprecedented port visits in Burma, where China has already been deeply involved in diplomatic support to an isolated regime and in development of port infrastructure. The close proximity of Burma to vulnerable and vital sea lanes made this of deep interest to India and the states of the Malacca Straits.

India

India has long been a prominent – many would say the predominant – presence in the Indian Ocean. The Indian Ocean in turn has long figured prominently in Indian strategic perceptions and designs. India is far the most populous Indian Ocean littoral state, and increasingly the predominant economic one with increasing interests in international trade. India's coastline hosts in excess of 200 large and small ports and harbors (with many under construction or expansion). India sits athwart some of the principal sea lanes of commerce and energy security, and must confront the presence of terrorism and seaborne crime in her vicinity.

Much of India's strategic outlook reflects long-established British Indian perception, updated to respond to new circumstances. India was the lynchpin of British imperial policy, the key to the trade further east, including Australia–British interest in the Persian/Arab Gulf originally sprang from concerns about security of Indian maritime commerce. After the discovery of oil, British India and her armed forces saw to the protection of British interests in the Gulf, and Britain politically and administratively oversaw her possessions and protectorates in the Gulf from India.[30] British interests in East Africa, while driven by multiple factors, were nonetheless significantly related to seaborne trade with India. India has long evinced great interest in Mauritius, Kenya, Tanzania, and Uganda, predominantly because of close ties of migration and trade.

With its dependence on sources of oil and gas, its large expatriate populations and its increasing economic profile in the Arab nations of the Gulf, its long-standing relations with other Arab nations west and north of the Gulf, and its steady relations with Iran, India considers the Gulf to be a key part of its strategic domain. Its relations with Iran are multifaceted, including stymied attempts to enhance transmission of hydrocarbons by pipeline, commitments to enhance other trade, and the partnership in developing Iran's Chahbahar port, as well as several road and rail links between that port and Central Asia.

[29] "Navy flexes its muscle on the high seas," *Financial Times*, 27 October 2010.

[30] James Onley, *Britain and the Gulf Shaikhdoms, 1820-1971: the Politics of Protection,* (Center for International and Regional Studies, Georgetown University School of Foreign Service, Qatar, 2009).

India's increasing interests in sources of raw materials in Africa, and its increasing investment in African agriculture, make East Africa a key to India's international posture. For the past decade and more India has simultaneously pursued a "look east" policy to enhance its trade and investment links with Southeast Asia.

India and China

It is apparent that Indian maritime interests span the Indian Ocean and are growing as the Indian economy develops in size, sophistication and global connections. The same is true of Chinese maritime presence there. At that level of commerce, in a setting where the Indian Ocean marketplace is in any case crowded, this need not pose any complications. Indeed, Indian trade with China is growing and is increasingly important to India. This trade includes major elements of strategic infrastructure such as power generating equipment, and India-China trade is expected to surpass $60 billion in 2010, making China India's largest trade partner.[31]

However, disentangling the strands of commerce and security can be difficult. As we see in the anti-piracy patrols in the western Indian Ocean, and saw earlier in efforts to defeat piracy in and near the Straits of Malacca, or in the longer-standing US presence in the Gulf, navies are often deployed in support of commercial interests and commercial shipping. However, the larger context that shapes India's perceptions of the significance of the Chinese military posture in the Indian Ocean transcends security of commerce. India is wary of China's long and close relationship with Pakistan, and considers this a trespass on India's strategic sphere. The display of recent Chinese aggressiveness has exacerbated India's long-standing and volatile border disputes with China on the eastern and western ends of the Himalayas. Concerns over Chinese construction of railways in the Tibetan plateau and across the Himalaya-Karakoram, and about Chinese control and use of the Tibetan headwaters of India's major river systems also color Indian strategic perceptions. These historical tensions and strategic rivalry in military affairs between India and China frame and sharpen the ambivalence about maritime presence, military or strategically commercial, that might otherwise be understood as mutually beneficial.

It might seem natural that Chinese naval patrols would police sea lanes that are vital to Chinese interests, or that a burgeoning Chinese economy would lead China to invest for purely commercial reasons in port development on Pakistan's coast, or in Sri Lanka, or in Mauritius or on the coast of Burma. In the context of strategic rivalry and tension, those same port developments can begin to look like encirclement.[32] The emergence of a discussion in the Chinese national security discourse (such as on the part of retired Admiral Yin Zhuo, and Chinese Navy Military Academy researcher senior Colonel Li Jie) on the topic of a prospective Chinese Navy base to support anti-piracy operations in the western Indian Ocean, adds to such nervousness despite the disavowal by the Chinese Defense Ministry of any such plans.[33]

Since the 1970s, Indian policy has articulated a suspicion of the military presence of outsiders in the Indian Ocean. India sought to insulate her sphere of influence from the militarization brought about by US-Soviet naval rivalry. India proposed,

[31] "Reliance orders $10bn of Chinese generators," *Financial Times*, 29 October 2010.

[32] "China irks India by building ports in South Asia," *International Herald Tribune,* 16 February 2010.

[33] "China rules out overseas naval base now," *China-Wire,* 1 January 2010.

with the support of the Non-Aligned Movement (NAM) but also largely as a reflection of her own strategic interests, that the Indian Ocean be declared a "Zone of Peace." The suspicion that Indians show today about Chinese funded port development at Hambantota in Sri Lanka reprises the suspicion shown a generation ago toward perceived US plans to establish a naval presence there. Even at greater distance from Indian shores, the establishment of the US base on Diego Garcia occasioned high anxiety and intense diplomacy on India's part.

Other Nations

Inevitably, given the multiplicity of commercial interests that traverse the Indian Ocean today, there is now a greater sense of all round acceptance of a plethora of security actors on the high seas. However, in recent years, the security interests of major outside nations in the Indian Ocean have contended with the desire of littoral nations to be dominant players in their own neighborhood. The development of cooperation between Indonesia, Malaysia and Singapore to eradicate piracy against merchant vessels owed much to concerns that, in the absence of such local cooperation, the Japanese and US navies were seeking a larger role in the naval security of the Malacca Straits than deemed comfortable by the nations bordering it.

The Indian Ocean is unique among the world's oceans in the multiplicity of non-littoral nations or "outsiders" which articulate legitimate security interests closely related to their interests in seaborne trade; claims considered generally valid by all the players present. These include most major economies and militaries of the world. The navies of the United States, China and many European nations, as well as commercial shipping from Russia, China and smaller European nations such as Denmark and Norway, constitute a significant presence here.

Other significant presences in both the Indian Ocean and the global maritime industries are corporations based in a handful of European countries, especially Greece, Norway and Denmark. What is notable is the absence, in a list of the emerging commercial powerhouses on the oceans, of commercial interests based in many of the largest trading nations of the world, including the United States and Britain. That absence as well as the decline in the proportion of tonnage registered there is a measure of the decline of their control over the means of their own trade.

A perfect free trade model would suggest anxiety about this is not justified. The very idea of a global economy is that each nation or economic unit exercises its comparative advantage to the optimal benefit of all. Surely, one might argue, as long as a truly free market in seaborne transport is available to all, who owns the means of transport is not a matter of national interest. The high seas are in any case a common resource, equally open and available to navigation. The means of maritime transport are merely a component of a global supply chain. Commercial incentives and transactions should render the locus of ownership of any piece of that component irrelevant.

The ownership of significant volumes of shipping by Europeans, whose primary interest in the Indian Ocean is in freedom of navigation to ply their trade, may pose little threat of abuse of market power. By contrast, dominant positions in the infrastructure of maritime commerce, especially shipbuilding, may at least provoke anxieties, particularly if capacity is seen to be lost permanently.

Yet it would be a mistake to think that this multiplicity of governments, littoral states and outsiders, numerous as it is, exclusively defines the future of the Indian Ocean and its commerce. Private parties – including major multinational shipping and fishing industries, and local communities and their economic interests – as varied as subsistence or artisanal fisheries, coastal trade, and ancillary activities to local ports, will also be significant players.

Equally important and powerful actors in maritime security and commerce will have differential interests in maritime space and the framework that formally or practically governs its use. These variations of interest will reflect the scale of a particular nation's involvement in maritime commerce and its particular characteristics, such as its function in the overall industry and the sectors of particular concern. Singapore, a powerhouse in the Asian and the global maritime business, has interests driven largely by its status as the world's busiest port (with activities ancillary to that, such as fitting and repair of ships), a major refiner of petrochemicals, and as a major financial and management center for the industry. It services the infrastructure of seaborne commerce, and does so efficiently and as a major player. In contrast, India's posture will reflect the interests of a user of the infrastructure of maritime commerce, increasingly dependent for its economic development on imports of energy, raw materials, machinery and finished products, and on exports of raw materials and finished products.

Finally, quite apart from the important and powerful actors – large or small, private parties or governments – the interests of smaller nations in the Indian Ocean should be acknowledged. Even where these are not significant to maritime commerce, their interests in and claims to the maritime realm can have consequences for the former. This volume does not deal with the questions and disputes about undersea mineral and hydrocarbon resources, but the case of Bangladesh's disputes with India and Burma over territorial seas offers an instructive case study of the relationship between the two.[34]

Bangladesh, with compelling food security interests in fishing, and equally compelling energy security interests in the substantial offshore hydrocarbon deposits in the Bay of Bengal (as well as economically valuable poly-metallic nodules), is engaged in this dispute with its two neighbors under circumstances where there is a strong likelihood of failure. Whatever may be the outcome as to maritime territorial jurisdiction or undersea resources, for a trade dependent country such as Bangladesh, the extent to which its neighbors will constrict its proximate maritime jurisdiction bears on its commercial interests.

[34] For a useful overview of the issues, see Abu Syed Muhammad Belal, *Maritime Boundary of Bangladesh: Is Our Sea Lost?* (Bangladesh Institute of Peace and Security Studies, 2009).

Elements of Instability in Maritime Commerce

The global economic and financial crisis that began in 2008 brought attention to the many vulnerabilities and instabilities inherent in maritime commerce. Because it resulted in the inter-related phenomena of diminished consumer demand in the west, slowdown of production of finished goods in Asia, diminished demand for raw materials bound for or originating in Asia, and a fall in trade volumes in all directions and all sectors, its impact on Indian Ocean seaborne commerce and ancillary industries was immediate and profound.

The global economic downturn has resulted in a serious depression for maritime trade. Shipping markets have been hit very hard by the collapse in global trade flows and also the sharp decrease in the availability of trade finance as banks have collapsed or been forced to dramatically rein in financing. Volumes of traded bulk commodities went down sharply, container volume declined by 10% in 2009, and vast quantities of shipping tonnage were laid up in anchorages around the world.

The impact was all the more marked because the Indian Ocean seaborne trades had, until the downturn, been the scene of prodigious growth. This expansive growth was accompanied by a spate of investment in the global shipping industry and massive infrastructure expansion in many of the Indian Ocean coastal states. The limitless appetite in China for raw materials and energy supplies to feed its role as the workshop of the world reflected a generalized demand for shipping capacity from established Asian economies such as Japan, South Korea, Malaysia, and Singapore, and burgeoning ones such as Indonesia, Vietnam and India.

The steep increase in investment for the first seven years of the first decade of the 21st century resulted in substantial financial exposure of all sectors of the maritime industry and maritime trades. The simultaneity of this financial exposure and the fall in demand, rates and revenues (discussed in detail below), revealed quite starkly the underlying vulnerabilities of Indian Ocean maritime commerce. Also readily apparent were the fragility of the planning assumptions that had driven investment and development in the industry, and of government policy of important Indian Ocean nations. For example, freight rates dropped precipitously in 2008-2009, in some sectors as much as 90%. Whereas rates have recovered somewhat since, such volatile changes in the business worked to the advantage of the heavily capitalized enterprises that could more easily absorb short term shocks - large multinational corporations or state-supported Asian ones. Today, by some estimates, capacity outstrips demand for shipping by a ratio of 2 to 1.

Viewed in global terms in 2009, world shipping markets for all trades – bulk, general cargo, liner services (container) and liquid bulk – were likely to face stern difficulties for at least two years through to the second half of 2011 as excess shipping capacity far exceeded demand for conveyance. This depressed rates and placed heavy burdens upon shipping companies, which were nonetheless compelled to honor new vessel delivery agreements for which they have little business. Owners have been unwilling or unable to cancel orders for new-builds, despite the obvious oversupply in the market, as at the very least they would have had to forfeit deposits placed to the large yards in South Korea, Japan and more recently, China. Even as late as the end of 2007, ship owners had placed orders for too many new vessels on the tail-end of the five-year boom in maritime trade that started in the early part of the decade.

As a broad indication of the scale of the downturn, charter rates for Capesized bulk carriers, which are the high-capacity workhorses for the conveyance of coal and iron ore, had reached almost $300,000 per day in mid-2008; however, by December 2008 they had plummeted to a mere $3,000 per day. In terms of liquid bulk trade, the downturn was also being felt in the crude oil tanker market, where charter rates have also slumped, despite this sector of maritime trade being rather more balanced than the dry bulk or container trades. In mid-2009, oil consumption had settled to approximately the same levels as those recorded between 2000 and 2004; even though the global fleet of very large carriers of crude oil (VLCCs) had increased from 430 to 530. In the container shipping sector, owners were confronted with plummeting demand as demand for transport of finished and semi-finished manufactured goods collapsed towards the end of 2008. As with the dry and liquid bulk trades, container shipping is now confronted with serious overcapacity, which for a while forced some companies

Case Study: Dry Bulk

The Baltic Dry Exchange Index (BDI) is a numerical value calculated daily by the Baltic Exchange in London. Essentially, it is a compound calculation of the cost of carrying dry bulk cargoes of various sizes by sea. In assessing the 26 main routes for the time and voyage charter business, the BDI is calculated by taking a canvass of what it costs to book and carry cargoes of various raw materials and commodities, and creating a mean value of charters for Capesize, Panamax, Supramax and Handysize vessels. The BDI is used as a fundamental barometer of the state of global trade (and by extension as one indicator of macro economic activity) because it measures the demand for shipping *vis-a-vis* the supply of bulk carriers available to meet that demand. Put another way, it reveals the supply/demand balance of trade of raw materials in the global economy; raw materials essential to the production of finished goods.

In May 2008, the BDI reached its highest level since its introduction in 1985 – 11,793 points. Six months later, in December 2008, it had fallen by a staggering 94% to only 663 points; the lowest since 1986. It appeared to recover somewhat in 2009 from a low of 866 in January up to more than 2000 in March, suffered a dip again subsequently and then recovered to 3800 by July.[1] By November 2009 it rose to 4381, still nowhere near its high point but nonetheless an indication of a return to activity. The change in the structure of market expectations is reflected in the language of the headline that reported this – "Baltic at a peak as bids rise for Capesize vessels."[2] [3]

[1] "Commodity Shipping Index Advances the Most Since at Least 1985," *Bloomberg*, http://www.bloomberg.com/apps/news?pid=newsarchive&sid=ah6n4sxikADs&refer=news.

[2] *Financial Times,* 18 November 2009.

[3] A qualification of the generalized picture of gloom and a downward spiral, though this may not necessarily detract from the larger concern about long-term crisis in the industry, is that the industry has developed certain buffering tools against such instability, such as the use of freight derivatives as hedge against exposure to freight costs.

Case Study: Container Cargo

In the worst downturn in container shipping's history of longer than half a century, Maersk, the operator of the world's largest container fleet, suffered its first loss ever in its 105 years of existence in 2009.[1] Hanjin Line, the South Korean firm, lost more than a billion dollars in 2009.[2] Although Maersk's decline in traffic was substantially smaller than in the sector as a whole, there were indications that this was because it was able to offer competitive terms and tolerate smaller margins in ways that reflected its huge market share. Smaller companies were less fortunate. The extent of Maersk's exposure to the market's downturn was brought on by precisely its exuberance at the top of the market, when it sought a dominant position in the container sector. In 2005, it paid a substantial premium in a €2.3 billion deal for the Anglo-Dutch container line P&O Nedlloyd, the acquisition of which made its fleet twice the size of the second largest fleet in the world.[3] If further confirmation were needed of the heady optimism about the future of container shipping just before the collapse of the global markets, the conference system to coordinate among owners to control capacity was abolished on October 17, 2008.

Also at the height of the market, Maersk ordered and received delivery of the fastest ever container vessels, designed to speed goods from Chinese sources, which fell victim immediately to the steep rise in fuel prices and the slump in container demand. These ships went directly to storage rather than service, laid up in Loch Striven in Scotland, as Maersk itself went to slow steaming (reducing average speeds from 20 knots to 14) in an effort to save on fuel costs, even at the expense of speed.[4] Although these vessels have more recently been brought into service again, an indication of a revival of demand, the overall prospect remains uncertain, in light of the acknowledged surplus of growth in ship capacity over growth in demand for container shipping.[5]

[1] "Maersk sinks into loss for first time," *Financial Times,* 5 March 2010.

[2] Clarkson Research Services Limited, *Container Intelligence Monthly,* December 2009.

[3] "Maersk battles to contain losses," *Financial Times,* 5 May 2010.

[4] "Slump leaves cargo ships in the doldrums," *Financial Times,* 23 February 2010.

[5] "Maersk sinks into loss for first time," *Financial Times,* 5 March 2010.

to only seek charges that in some cases only cover bunkering and port call costs.

In the highly changeable and dynamic interplay of commerce and security outlined above, the uncertainties occasioned by the steep decline in the maritime business environment added an additional element of change, uncertainty and complexity, and therefore of potential anxiety in the inter-related economic and strategic expectations of key players in the Indian Ocean scene. That the downturn came in the wake of a robust expansion and optimism in the Indian Ocean trades only added to its capacity to destabilize.

It is important to recognize signs of revival in certain sectors and shipping trades, though these leave the industry far short of its recent glory days, and revivals in the past two to three years have often been temporary and too easily reversed. Thus, the revival in demand for Capesize ships noted above was reversed less than a year later, as they fell from a peak of $60,000 per day in mid-May 2010 to $23,000 per day in early July. Above all this reflected a larger than expected slowdown in Chinese demand for coal and iron ore as the steel industry in that country drew on substantial reserve stocks and Chinese steel demand also slackened. Similarly, rates for VLCCs went from $75,000 per

day in early June 2010 to $20,000 per day on one route in early July.[35]

Senior industry insiders noted that the reasons for the tanker market having held up relatively well earlier in 2010 was the adoption of extraordinary measures such as slowing of deliveries of newly built vessels and the use of vessels for storing oil, which had withdrawn surplus capacity and allowed freight rates to be maintained at relatively high levels.[36]

[35] "Bulk shipping groups fear fall in profitability," *Financial Times,* 6 July 2010.

[36] *Ibid.*

Case Study: Tankers

As a result of both the tough shipping market and the tough financial market related to it, consolidation is predicted among oil tanker fleets. The result seems to favor large operators, in this instance those that can raise capital on public markets. Declining demand and over-supply of ships has hit tanker profitability sharply, though this sector at least remains profitable. Overseas Shipholding Group, the second largest global company in numbers of vessels owned, reported a 2009 profit down 78%, while Frontline, the industry leader, revealed a drop in net profit of 85%. Consolidation as a result of economic difficulties compounds a trend already in place by virtue of the major oil companies' preference for large operators, as growing environmental concerns and regulations, and the related reputational considerations, have led them to prefer larger, safer, more reputable operators.[1]

As with other sectors of the shipping industry, the decline in demand for crude and products has been reflected in not only the large quantity of tanker tonnage being laid up around the world but also the drop in the numbers of new tankers being delivered to owners. During the second half of 2009, a total of 358 tankers over 10,000 dwt (amounting to a total of some 31 million dwt) were scheduled to be delivered from the yards; however, many of these vessels were delayed into 2010. The value of a new VLCC dropped owing to the drop in charter rates. According to Simpson Spence and Young, a renowned London-based brokerage, 20% of the tanker tonnage that had been projected to enter the market during 2009 will not be delivered to owners as originally scheduled.[2]

When the crude prices started to drop towards the end of July 2008 (having reached an historic peak of $147.27 on July 11, 2008), onshore storage capacity in the major producers began to be exhausted, despite reduced field production rates. This resulted in major producers, notably Iran in the early period, storing unsold crude in VLCCs and ULCCs in anchorages near the major terminals in the Persian Gulf. Initially, the crude being stored 'on-the-water' tended to be the heavier, sour crudes which are less desirable in the market as few of the major refineries are sufficiently configured for refining these varieties. However, by early 2009 this trend had expanded to lighter grades as buyers dried up around the world and prices slumped. According to data compiled by London-based Lloyd's MIU's APEX service, by April 2009, over 35 VLCCs and Suezmax tankers had been chartered as short-term storage facilities as traders stored low-priced crude to benefit from market *contango*. Oil price *contango* occurs when the current price is lower than the future price, and it is more economically advantageous for traders to hold on to acquired crude and sell it later despite the daily storage/charter fees. By January 2009, the amount of oil stored at sea climbed to the highest levels in at least two decades. However, as demand started to increase in mid-2009, the number of VLCCs being used for storage declined.[3]

[1] "Wave of oil tanker deals predicted," *Financial Times,* 4 March 2010.

[2] www.lloydslist.com, 30 March 2009.

[3] www.lloydslist.com, 26 June 2009.

Such extraordinary measures have been found across all sectors of shipping. For example, the South Korean government has offered distressed firms the option of selling their ships to a government agency and then leasing them back, thus displacing the capital costs.[37]

Inherent Instability of Maritime Commerce

Although the exuberance in the maritime economy seen in recent decades may momentarily have obscured this, the sea is and always has been an insecure environment for commerce, and maritime commerce has clearly understood that. Literature and history are replete with reminders that maritime trade is vulnerable to the perils of nature and variations in national law and commercial practice. Most sea traders leave the protection of their sovereigns and their laws as well as the physical safety of the land. They have historically rendered themselves vulnerable to sharp dealing in foreign markets, attacks by pirates and destruction or loss of cargo by storms or running aground.

That the high seas have always been treated by law and the practice of nations as a type of no man's land, *mare incognita*, has long meant that there is a higher degree of risk understood by most actors. There have of course been periods when a particular nation's naval predominance has allowed for the imposition of a type of order, whether the Royal Navy's *Pax Brittanica* in the Indian and Atlantic Oceans during the 19th century or the US Navy's predominance in the Pacific in the 20th. There has also been a *de facto* common law and commercial practice, originating mostly in the United Kingdom, which has come to govern commercial transactions.

The profitability of the maritime sector has in fact been closely related to the degree of risk. The common expression "his ship has come in" reflects both high uncertainty and great potential profitability. It comes as no surprise that misfortune in one quarter can constitute fortune in a competitor. Following the Deepwater Horizon spill in the Gulf of Mexico and the subsequent US moratorium on drilling, oil tanker trades experienced an upsurge in business.[38] An executive of a US tanker operator said, "Shipping usually benefits from bad news, be it spills, storms or conflicts." In the current maritime business, cross-ownership of sectors often acts to hedge risks, as has the cross ownership by John Fredriksen, the Norwegian described as "the world's most influential shipowner"[39] of drilling rigs and oil tankers. The close relationship between risk and profitability is also reflected in Mr. Fredriksen's response to the current crisis in the industry, specifically his recent turn away from his characteristic willingness to back hunches on short term spot charter markets and toward safer (and less profitable) long-term charters.

Other elements of instability in the industry include the practice of registering vessels under so-called "flags of convenience" in states that have little connection to the vessel or its owners or users. The most popular of such registries are weak states that are content to gain the revenue from registration without imposing many (if any) regulatory requirements. They are also entirely lacking in the capacity to provide diplomatic representation or military protection to their vessels. Whereas

[37] "Hanjin prepares raids form its Gibraltar Strait terminal," *Financial Times,* 19 July 2010.

[38] "Oil tankers find silver lining in spill," *Financial Times*, 15 June 2010.

[39] *Ibid.*

this might have been tolerable in a context where the actual location of a vessel or fleet would agree to provide representation or protection to vessels nominally registered elsewhere, owing to the influence of owners, this is less the case today. The highly cosmopolitan nature of the maritime business has introduced ambiguity about the national identity and locus of any given enterprise.

The overall pace and scale of change in the industry, which we have already referred to, is also a source of potential instability. The recent collision between two vessels at the entrance of Mumbai harbor, which closed the port for a week, offers an acute example of how the growth in infrastructure and human capacity has failed to keep pace with the growth of marine traffic, and of the potentially serious commercial consequences of such a discrepancy.[40]

Many insiders of ports and shipping as well as students and other informed observers of the sector note that key elements of it have been characterized by long-term mismanagement. They note that the financial exposure of investments is partly at least a reflection of poor policies such as the availability of subsidies, or of tax advantages such as those available to German "KG" investors clubs. The latter attracted investors with little knowledge of the sector, or little appetite for the risk involved, whose principal interest was in the tax advantages. Some have faulted the lending practices of German banks to these consortia. Others have noted the many environmentally unsustainable practices considered necessary to keep on the growth trajectory required to sustain increasing scales of investment. These include dredging of ever deeper harbors and channels and rivers.

[40] *Lloyd's List,* 8 September 2010, page 1.

Characteristics and Importance of the Shipping Industry

The symbiotic relationship between developments in maritime commerce in the Indian Ocean and elsewhere, owing both to the entire global economy's substantial dependence on Indian Ocean trade and to the far-flung and globally integrated structure of the maritime industry, has been noted previously in this analysis. An overview of global developments in maritime transport and trade is therefore a useful tool for understanding trends particular to the Indian Ocean. Each of these developments has transformed the trade patterns, the economic agility and the nature of maritime commerce in the Indian Ocean.

One of the defining, even unique, features of the shipping trade is the lag time between capital investment and deployment of capacity. Ships take several years to build, and because the order books of shipyards are often full, ships are ordered three to four years ahead of the expected date of entry into service.

What makes the business difficult for investors is its cyclical nature. Because it is difficult to predict the scale of growth in trade, and therefore demand for ships, some anomaly between supply and demand in either direction is normal. In a stable market this need not occasion much concern. Investment in future capacity constitutes prudent preparation for the market. In an expanding market, deliveries cannot keep pace with orders and the problem is one of insufficient supply of vessels. This presents a boon to revenues of ship owners and ship builders. However, when there is a downturn in maritime trade, such as we have witnessed in recent years, there can

be a serious problem of excess capacity and excess orders. The decline in trade volumes on the scale seen recently has led to a decline in freight revenues, a decline in the valuation of vessels – with attendant over-exposure on mortgages, and a crisis in the shipbuilding markets, as owners had difficulty financing vessels on order, or sought to slow or cancel deliveries. Decline in trade volumes has also posed a problem for the investment and planning processes of shipyards, which also must plan well ahead for production of vessels.

Ship finance is also *sui generis* in the world of finance. Less than 1% of investment in ships is raised through equity markets. The distinctness of ship finance has been dictated by several factors. The principal ones are the cyclical nature of the shipping business and the volatility of markets, the highly mobile nature of very expensive assets, their vulnerability to natural events or political risks, and the lag times for entry into service of large capital assets. Several innovative and distinctive forms of finance have arisen in shipping. The so-called "KG" clubs in Germany, which have developed as a tax vehicle for general (i.e non-maritime) investors, prefer simple ships such as container vessels trading established routes. Islamic finance shares risks and rewards among investors.

During the recent downturn in global shipping, ship finance of all kinds,whether debt or equity, conventional or innovative, has been highly constrained. In the first three quarters of 2009, relatively few syndicated shipping loans (a total of $25 billion) were made anywhere; almost none by US or European banks, and mostly by Japanese banks. The majority of bankers appear to be pre-occupied with the work-out of existing debt under the highly challenging overhang in supply of vessels described above, rather than having appetite for new lending.[41] Indeed, the effects of the crisis in ship finance have been felt more generally in the health of the banking sector as a whole. One example of massive difficulty in this respect are the fortunes of the German HSH Nordbank, one of the largest providers of shipping finance. Having financed huge numbers of ship orders during the boom, particularly to KG funds, it now finds the assets worth as little as a half of the amounts lent against them.[42] Of course, such difficulties for banks specializing in ship finance presage continuing problems in the availability of finance in the future.

Because ships are so expensive, the revenue from freight and the residual value of ships assumes great importance. The retirement of ships and their scrapping has engendered an often controversial "ship-breaking" industry, concentrated almost entirely in the Indian Ocean region.

Development of port infrastructure has also expanded exponentially in recent decades, to serve the long-term expansion of trade and the simultaneous increases in vessel size, in sizes of cargo, and in the sophistication of cargo handling technologies. Much of this port development has occurred in the Indian Ocean region, unsurprisingly in view of its importance to global trade. In many instances entirely new ports have been developed or are planned on sites that were hitherto little more than fishing harbors or artisanal ports, such as Gwadar in Pakistan or Lamu in Kenya. The boom in port construction has compounded the capital intensity of an already capital intensive

[41] This discussion of ship finance draws on conversations with John M. Doviak, Director of the Cambridge Academy of Transport.

[42] "HSH Nordbank told to oust chief," *Financial Times,* 10 November 2010.

sector. In the recent downturn, this has also exposed ports to financial "overhang."

The business of shipping freight has long been a highly competitive one. Despite the presence of several large ship-owning corporations with significant strength in one or more sectors, such as Maersk in containers, there has long been no predominant force, and no monopoly in any part of the industry. Unfortunately, in this respect it suffers from a disadvantage in its dealings with major customers in important sectors, such as major oil companies and steel mills which enjoy significant market power.

In the context of an expanding market, this inequality was of little significance, and between 1947 and 2004 the costs of transport remained stable. This allowed for efficient planning by customers (importers and exporters) for the future costs of carriage of goods, and by carriers for their investments and technical innovation.

Costs of transportation remained stable as the volume of seaborne merchandise grew exponentially. Between 1960 and 2005, seaborne trade in oil, gas and related products grew by a factor of 4, iron ore by a factor of more than 6, coal by a factor greater than 12, and grain and bauxite/alumina each by a factor of 4. In the 30 years from 1975 to 2005, seaborne trade in iron and steel grew by a factor of 5. With some variations, rates of growth of this order are seen in almost every commodity or good that had been traded in the contemporary global market.[43]

Just as the liner and tramp systems for international navigation had been innovations in maritime practice that revolutionized international commerce in the 19th and early 20th centuries, so the development of bulk and container transport in the 20th century transformed the economics of seaborne commerce. These developments also entailed an exponential increase in the capital intensity of an already highly capitalized industry, owing to the increased scale of the hardware of shipping and ports, which in turn enabled exponential increases in the speed and volumes of trade per voyage. These developments of course have made possible a vast expansion of global trade.

Since the 1950s, highly specialized vessels have transformed the face of maritime commerce. Today distinct vessel types transport finished goods in containers, chemicals, petroleum, liquefied gases, forest products, wheeled vehicles, large scale earthmoving and agricultural machinery, refrigerated cargoes, mineral ores and grain. New areas of specialization in vessel types include those that service offshore drilling installations, and ice-capable vessels for Arctic navigation.

The growth in size and technological sophistication has also inevitably created a two tier system of those port facilities capable of handling the new vessel sizes and volumes of trade, and those limited by financial, political or physical factors. This in turn, along with the changing economic profiles of countries in world trade, has redrawn trade routes and networks. For example, some intermediate ports have lost importance, while entirely new complexes have been developed for transshipment. The hub and spoke system has assumed large importance as a result of the need of large vessels to unload cargoes at specialized transshipment ports. There has been a substantial overall increase in the depths of harbors, the sizes of terminals, and the sizes of cargo parcels.

[43] Martin Stopford, *Maritime Economics,* (Routledge, 2009, 3rd Edition), page 24.

For much of the first half of the 20th century an average tanker of respectable size was 12,500 dwt. A tanker double this size was built during World War II, and a fleet of 16,500 dwt tankers was introduced during that period. By 1959, the largest tanker afloat was seven times as large, and the first VLCC in 1966 was almost double that at 209,413 dwt. In 1968 the largest tanker was 326,585 dwt, and by 1980, 555,843 dwt. Stopford estimates that the increase in ship size probably reduced shipping costs by an astonishing 75%.[44]

This massive multiplication of size was mirrored in other types of vessel. Although as early as the 1920s dry bulk vessels of around 24,000 dwt were in service, most bulk cargo until the 1950s was carried in ships of 10,000 to 12,000 dwt. By the 1970s, ships of 200,000 dwt were in service, and 300,000 dwt by the 1980s.[45] Changes in the sizes of vessels were accompanied by technical improvements in efficiency. During the 1980s, fuel efficiency of diesel engines improved by 25%. Hull designs allowed the use of as much as 30% less steel weight in some types of ships, and better coatings improved the smoothness of hulls underwater and the longevity of tank structures.[46]

The increase in scale in maritime transport and infrastructure required an exponential growth in the size of the investments necessary. The segmentation of the shipping market by ship type and cargo led to less flexibility and therefore greater reliance on the specialized industry shipper. Since the investments were great, costs had to be controlled, and there was thus a move to shipping registries in countries other than the actual base of shipping lines and vessels ("flags of convenience").

The increase in size and specialization of vessels was accompanied by, and in some cases resulted from, a high degree of automation in both port handling and navigation. That same automation, with its diminished reliance on labor of various types, also segregated the industry, and contributed to its relative invisibility to landlubbers.

Today, the global regulatory regime for shipping is uneven, having been developed haphazardly according to opportunities that presented themselves. There is a substantial body of rules governing safety and pollution at sea, agreed under the aegis of the International Maritime Organization (IMO), a specialized agency of the United Nations, but relatively few formal rules governing commercial practice. The latter are governed by contractual transactions that generally follow customary practice, but with little official sanction, national or international. Many authoritative observers note that even on the matters where it has acted the IMO has often followed the national leaders in international practice rather than led the development of an international consensus.

Rise of Asia

The developments described above in the shipping industry coincided with profound changes in the global political economy occasioned by the waning of the European empires. Liner shipping was an imperially based system, especially so in the patterns of its routes. Large enterprises based in and identified with one or another of the imperial powers, notably but not exclusively Britain, served interlocking commercial and political interests in

[44] Stopford, *supra,* page 40.
[45] *Ibid.*
[46] *Ibid.*

a collection of territories bound together by political identity and preferential trade. With the decline of empire, and the rise of more free trade in the late twentieth century, the ownership structure of the industry changed from dominant marquee names to smaller independent operators.

Those observing the industry today see the wheel turning full circle with the rise of new shipping and port super-corporations, many identified with and even owned by new forces in world politics and trade. We see this especially in the new Chinese profile in maritime commerce. It is also visible in the cases of smaller powers such Singapore and various nations of the Gulf, all of which have established profiles disproportionate to their size. Each of this last group has in almost all cases traded on the advantages of geography, using long-term investment strategies to leverage their natural advantages of strategic access to sea lanes into prominent roles in the global maritime economy.

The Chinese posture in the Indian Ocean today presents the most exact contemporary reflection of the old imperial pattern, with the aggressive pursuit of interlocking interests in access to raw materials, political influence in source countries, funding and building of vast new port capacities in locations that are strategic in both commercial and political terms, as well as in China, the simultaneous development of vast merchant and military fleets, and establishment of a vast shipbuilding industry.[47]

The limitless appetite in China for raw materials and energy supplies to feed its role as the workshop of the world is but one reflection of a generalized demand for shipping capacity from established Asian economies such as Japan, South Korea, Malaysia, and Singapore, and burgeoning ones such as Indonesia, Vietnam and India. The World Bank's *World Development Indicators* for 2008 indicate that the percentage of East Asian GDP credited to seaborne trade is 87%, having almost doubled in less than two decades. Whereas a good proportion of this trade has been trans-Pacific, the impact on the Indian Ocean has nonetheless been substantial, as raw materials imported from Africa, and energy from the Middle East have been factors in the exports of all these economies across the Indian Ocean or the Pacific.

The story of Asia's importance to global shipping is not of recent provenance. It stretches back decades, long before awareness of the decline of western economic might had taken hold. Japan generated 80% of the growth of the deep sea cargo trade between 1965 and 1972. By the early 1970s Japan was building half of the ships built in the world, and Japanese controlled the world's largest merchant fleet. This was followed by a similar set of developments that accompanied Korea's rise as simultaneously a manufacturing and trading power.

[47] Citing various sources, Geoffrey Till, *Asia Rising and the Maritime Decline of the West,* (RSIS Working Paper 205, S. Rajaratnam School of International Studies, 2010) on page five notes that today 90% of the world's ship containers are manufactured in China, that China is the third largest shipbuilding nation in the world, after Korea and Japan, and that Shanghai is the world's busiest cargo port. He also notes the rise of China Ocean Shipping Company and China Shipping container lines as the sixth and eighth largest shipping companies in the world.

In each instance, this rise was accompanied by significant state support for steel, for shipbuilding, for shipping companies, and for automobile manufactures. This is a model that we now see at work in the rise of China.

Although India is not as significant in the global shipping industry as China, Korea or Japan, its growing role in global trade and its location makes it an important player in maritime commerce, which in turn has assumed a greater importance in the hierarchy of Indian national interests. In marked contrast to its traditional image as a protected, autarchic and globally non-competitive economy, India has evinced a degree of global integration that would have surprised even its first round of reformers in the 1990s, led by then-Finance Minister, now Prime Minister, Manmohan Singh.[48]

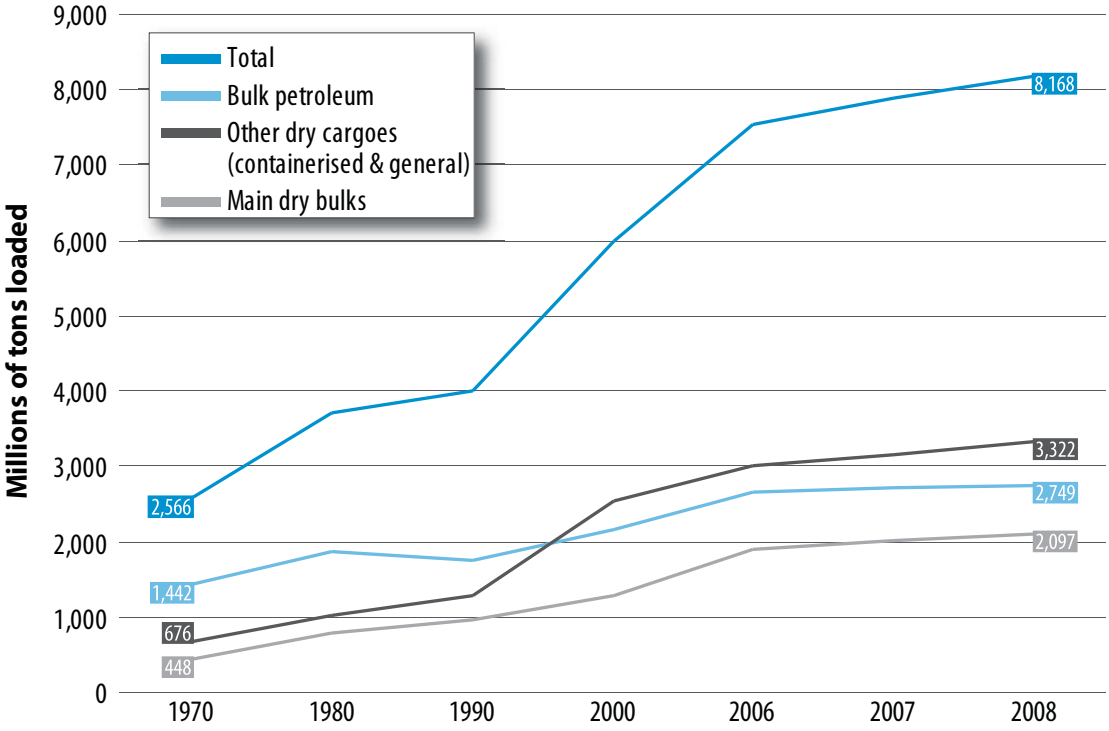
[48] Tariffs and other import restrictions have declined sharply. Foreign direct investment (FDI) and other inflow of foreign capital have been significantly eased. The ratio of trade to Gross Domestic Product has increased. Exports of goods and capital have assumed greater significance for economic growth (Mattoo and Subramanian, "India and Bretton Woods II," *Economic and Political Weekly,* 8 November 2008, page 64). Of course information technology services remain most significant, but also significant for India's posture in trade are its skill-intensive manufactured goods exports (Kochar, K, U Kumar, R Rajan, A Subramanian and I Tokatlidis, "India's Pattern of Development: What Happened, What Follows?" (*Journal of Monetary Economics,* 53(5), 981-1019). Also significant is the fact that unlike China's and Russia's, little of India's FDI has been in the natural resource sector, and much has gone not to developing and resource-rich countries but rather to developed economies (Mattoo and Subramanian, *supra*, pages 64, 65).

Global Trade and Maritime Commerce

Trends in Global Trade

The scale of the decline in global sea trade in a macro sense may be better understood by being placed in the context of long-term trends in the industry and of annual trade data. The World Trade Organization (WTO) has highlighted that aggregate monthly trade volumes of both developed and developing countries have been falling since September 2008. Within the shipping and port sectors the speed with which the decline has spread geographically and by sector has been due to the chronic shortage of trade finance and investment. The WTO assessed that volume of total world exports by sea fell by 10% by the end of 2009; the first drop

Growth of Global Maritime Trade from 1970-2008 (Selected Years)



	1970	1980	1990	2000	2006	2007	2008
Bulk	1,442	1,871	1,755	2,163	2,648	2,705	2,749
Main dry	448	796	968	1,288	1,888	2,013	2,097
Other	676	1,037	1,285	2,533	3,009	3,164	3,322
Total	2,566	3,704	4,008	5,984	7,545	7,882	8,168

Source: UNCTAD Review of Maritime Transport 2009

of this kind since 1982 and the largest fall since World War II. This is all the more telling when seen in the context of the general upward trending of international maritime trade from the 1970s. The table and graph on the previous page shows the growth in trade across the primary trades during selected years from 1970 to 2008.

As a result of the dramatic decline in demand for finished goods (particularly from the OECD countries), in conjunction with a fall in industrial production and concomitant fall in energy demand, the decline in sea traded volumes has affected all shipping sectors –dry bulk, liquid bulk and containerized cargo. Containerized trade, which accounts for some 16% of all sea trade in loaded volume, recorded the sharpest fall of all sectors, and remained depressed at the beginning of 2010. Overall, global seaborne trade fell more than 1% in 2009.

Since the early years of the previous decade, as a result in the steady increase in worldwide economic activity amongst the OECD countries and particularly the BRIC group, especially China and India, global trade by sea expanded discernibly. This significant increase in activity fuelled revenue and an appetite for both foreign and domestic investment in shipping company expansion, shipbuilding and port development and expansion. Freight rates were also driven steadily upwards. However, sharp economic reversals were quickly mirrored by shipping industry decline. The following graphs and tables offer an overall picture of the macro-economic context.

The graph and accompanying table on the following page, depicting changing GDP growth of selected major G20 economies, is included to illustrate the general decline in global economic activity from 2006 to 2008, despite the increase among the BRIC grouping in 2007. However, the graph's most potent value is in showing the scale of the collective economic contraction from 2008 to 2009; with an average growth of negative 2.44%. The decline in global maritime trade and across virtually every sector of the shipping industry is as a result of the macro economic situation shown on the previous page.

Cargo Flows Along Three Main Maritime Trading Routes, 2007-2008

(Millions of TEUs and Percentage Change)

Year	Asia to USA	Asia to Europe	Europe to USA
2007	15,247,955	17,236,936	4,464,206
2008	14,527,722	16,740,642	4,343,506
% Change	-4.70%	-2.90%	-2.70%

Source: Containerisation International

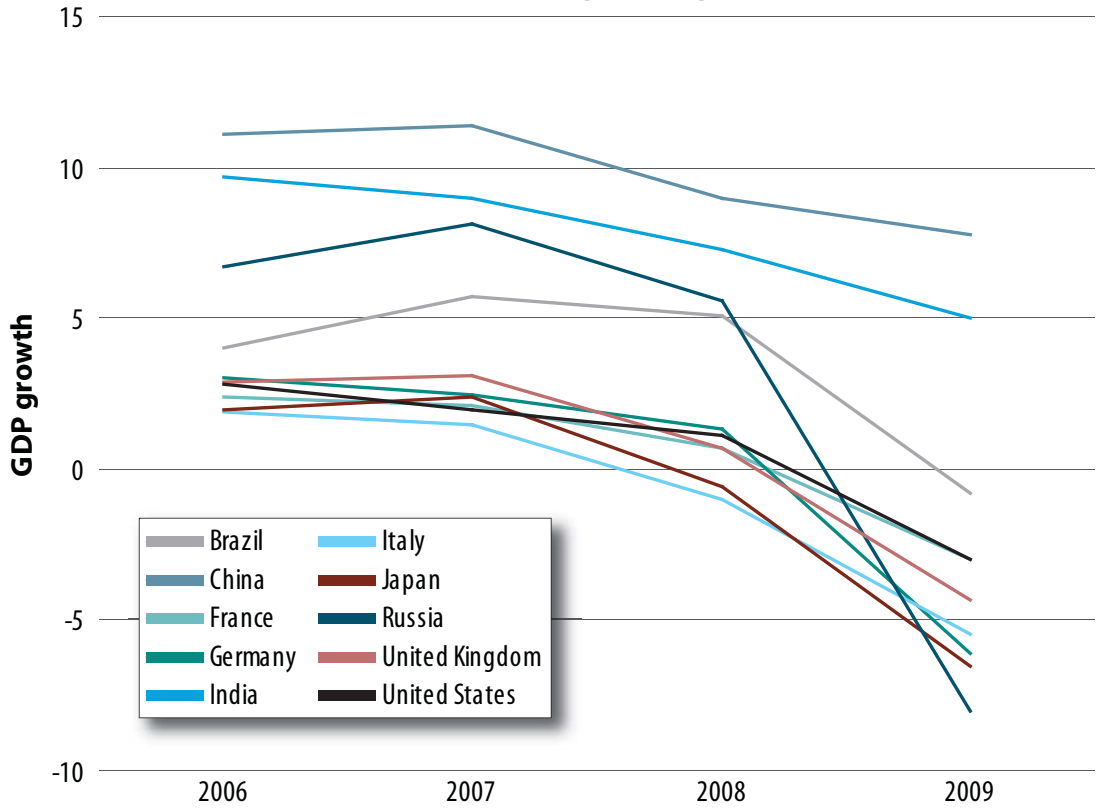
Most significantly, the table above illustrates the fall in demand for finished goods made in Asia (principally in China) from the United States and the major economies in Europe. The biggest fall is in trans-Pacific liner trade between China and Japan to the United States.

The figure on page 39 shows a largely healthy and logical symmetry between demand and supply of shipping from 2002 through until 2007. Thereafter there is a sharp divergence as demand falls rapidly during 2008 and 2009. This problem was compounded by the fact that although supply of shipping fell slightly from 2007, the overall volume of container vessels available for charter was supported by the delivery of newly completed ships that had been ordered prior to 2007.

The Geography of Raw Materials

An understanding of the location of raw materials and mineral deposits within

Economic Growth of Selected Major G20 Economies, 2006-2009
(Annual Percentage Change)

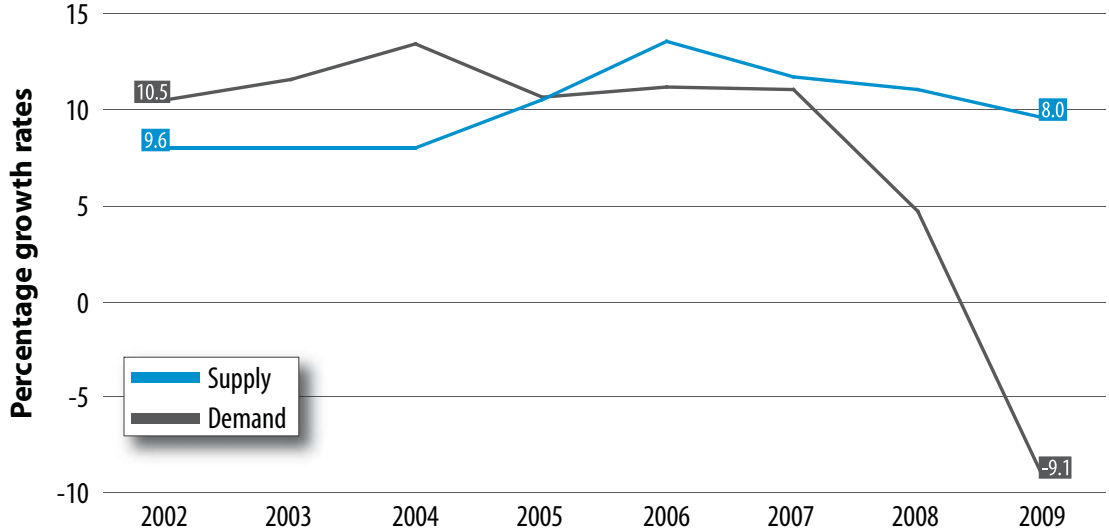


	2006	2007	2008	2009
Brazil	4.00	5.70	5.10	-0.80
China	11.10	11.40	9.00	7.80
France	2.40	2.10	0.70	-3.00
Germany	3.00	2.50	1.30	-6.10
India	9.70	9.00	7.30	5.00
Italy	1.90	1.50	-1.00	-5.50
Japan	2.00	2.40	-0.60	-6.50
Russia	6.70	8.10	5.60	-8.00
UK	2.90	3.10	0.70	-4.30
US	2.80	2.00	1.10	-3.00

Source: UNCTAD Review of Maritime Transport 2009

the Indian Ocean region helps to form the geo-strategic picture of the region by establishing the locations and typologies of strategically vital materials such as petroleum, uranium, titanium, iron ore and bauxite – all of which are vital for industrial production. It reveals what countries have available help to generate exports and GDP. It contributes significantly to building of the maritime trading linkages and patterns within and through the region. The tables in Appendices III, IV and V provide details on where materials are located, and on the export origins and import destinations for them.

Growth of Demand and Supply in Container Shipping, 2002-2009
(Annual Percentage Growth Rates)



	2002	2003	2004	2005	2006	2007	2008	2009
Supply	8.00	8.00	8.00	10.50	13.60	11.70	11.00	9.60
Demand	10.50	11.60	13.40	10.60	11.20	11.00	4.70	-9.10

Source: UNCTAD Review of Maritime Transport 2009

In terms of value, exports from the region are dominated by crude oil, LNG, product fuels and distillates, and petrochemicals. Other important exports in terms of volume and value include: machinery and equipment (including electronics), re-exported manufactured goods, coal, iron ore, timber, gold, alumina, wheat, and transport equipment. The most important exporting countries in the Indian Ocean region are Saudi Arabia, Singapore, the United Arab Emirates, Malaysia, Australia, Thailand, India, Indonesia, Iran, Kuwait, South Africa, Iraq and Qatar.

The table on imports in Appendix V reveals a comprehensive spectrum of raw materials, petroleum, foodstuffs, building materials and manufactured goods being routinely imported by states within the Indian Ocean region. Volumes and goods reflect a country's population size, wealth, industrialization and dependency (particularly for the small island states and East African countries). The most significant importing and transshipment countries within the Indian Ocean region are: India, Singapore, Australia, Thailand, Malaysia, United Arab Emirates, Indonesia, Saudi Arabia, South Africa, Iran, Israel and Egypt.

In terms of value, the majority of states in the Indian Ocean region are net importers. They include Australia, Bangladesh, Comoros, Djibouti, East Timor, Egypt, Eritrea, India, Indonesia, Israel, Jordan, Kenya, Madagascar, Maldives, Mauritius, Mozambique, Pakistan, Seychelles, Singapore, Somalia, South Africa, Sri Lanka, Tanzania, Thailand and Yemen. Net exporters in the Indian Ocean region are Bahrain, Iran, Iraq, Kuwait, Malaysia, Myanmar, Oman, Qatar, Saudi Arabia, Sudan and the United Arab Emirates.

The Major Indian Ocean Trades

Seaborne trade consists of "bulk cargo" or "general cargo."

General cargo comprises seven distinct categories – loose cargo, containerized cargo, pallets and flats, pre-slung, liquid, refrigerated, and wheeled cargo (Roll-on/Roll-off or Ro-Ro). On the other side of the general cargo sector, the "liner shipping industry" is organized so that smaller, individual cargo consignments are aggregated and transported by a common carrier. This methodology is central to the modern concept of containerized sea transport, and is the dominant mode of transporting semi-processed and finished goods. The liner trade is comprised of three main vessel types – multipurpose vessels (often referred to as general cargo vessels), container ships and Ro-Ro vessels.

The bulk cargo category includes liquid bulk, dry bulk and specialist bulk. The bulk shipping industry is configured to providing specific types of vessel to lift cargoes according to a single vessel/single cargo formula. Four main vessel types service the bulk trades – tankers, bulk carriers, combined carriers and specialist bulk carriers.

The majority of bulk cargoes are formed around the raw material (bulk commodities) trades such as iron ore, petroleum, grains and coal. The primary categories of bulk cargo are:

- Liquid bulk;
- Dry bulk (comprising the *'five major bulks'* – iron ore, grains, coal, phosphates and bauxite; and *minor bulks* – cement, chemicals, finished steel products, gypsum, non-ferrous metal ores, salt, sugar and wood chip);
- Specialist bulk cargoes (liquefied gases, refrigerated cargoes and motor vehicles.)

The form and geography of the bulk trade naturally enough reflects the nexus between industrial manufacturing centers and sources of supply. Industrial centers fabricating steel, aluminum and fertilizers require regular supplies of commodities such as iron ore, coal, bauxite and phosphates, which are usually sourced far from centers of production.

Within the Indian Ocean, sources of raw materials or commodities and the centers of industrial production are linked by chains of tankers, bulk carriers and specialist bulk carriers (such as LNG carriers). Some of the world's most important bulk trades originate from conspicuous sources of vital raw materials and commodities.

Dry Bulk

Owing to their volume, the five major bulk trades – iron ore, grain and soy, coal, phosphate rock and bauxite, and alumina – are the major component of the global dry bulk carrier market. The major sources of these commodities and raw materials within the Indian Ocean region are both revealing as strategic commodity concentrations in this space and as source-points for the bulk carrier movements within and through the Indian Ocean. In terms of amount, 50% of major bulk trade consists of material for the steel industry—coal and iron ore. The steel industry also accounts for an estimated 40% of the minor bulk trades.[49]

It is also readily apparent how vital and strategic these commodities are for the very sinews of modern societies. Iron ore and coal are the components of steel, and thus the building blocks of industrial

[49] John M. Doviak, Cambridge Academy of Transport, Interview, 20 October 2009.

production and modern infrastructure. Phosphates are the essential material for fabrication of fertilizers, and thus along with the trade in grain describe the basis of food security. The key countries where the vital raw materials and commodities are found in the region are seen in the adjacent chart.

Liquid Bulk

Bulk petroleum oils, petrochemicals and liquefied gases constitute the most voluminous and vital sector of bulk shipping in the region. The figures to the right provide an overview of the major liquid bulk movements (crude oil, product fuels, distillates and petrochemicals, and, liquefied natural gas (LNG) and liquefied petroleum gas (LPG)) within and across the Indian Ocean.

Petrochemical Terminals and Trades

The major strategic refiners are also important exporters of products, distillates and petrochemicals to large markets outside of the Indian Ocean region, namely China, European states, and to a lesser extent, the United States. This is another important reason why those extra-regional advanced industrial countries have a strategic interest in ensuring the security and free-flow of sea lanes of communication (SLOCs) for important products as well as crude oil. Indeed, given the shifting of emphasis of future refining capacity growth to the Middle East and Asia, petroleum product flows from the Indian Ocean region will take on increasing importance over crude trade for many of the world's larger consumers.

In order to appreciate the significance of the changes in the refining industry and oil products trade in the Indian Ocean re-

By Country

Australia	iron ore, coal, bauxite and alumina, grain
India	iron ore, coal, bauxite and alumina
South Africa	iron ore, coal, grain, phosphates
Indonesia	coal
Iran	iron ore
Madagascar	bauxite and alumina
Malaysia	bauxite and alumina
Egypt, Iraq, Jordan, Sri Lanka, Tanzania	phosphates

By Commodity

Iron Ore	Coal	Bauxite and Alumina	Phosphates	Grain
India	Indonesia	Australia	Iraq	Australia
South Africa	India	India	Jordan	South Africa
Iran	South Africa	Indonesia	South Africa	
		Madagascar	Sri Lanka	
		Malaysia	Tanzania	

Crude Oil Movements

Exporting countries

The most important are Iran, Iraq, Kuwait, Saudi Arabia and the United Arab Emirates.

Also Australia, Egypt, Indonesia, Malaysia, Oman, Qatar, Sudan, and Yemen

→ **Importers within the Indian Ocean**

The most important are Australia, India, Singapore and South Africa.

Also Bangladesh, Egypt, Indonesia, Kenya, Madagascar, Malaysia, and Sri Lanka

→ **Importers outside the Indian Ocean**

Belgium, Canada, China, France, Greece, Ireland, Italy, Japan, Malaysia, Netherlands, New Zealand, North Korea, Philippines, Portugal, South Korea, Spain, Taiwan, Thailand, United Kingdom and the United States

Refined Petroleum Products (LPG, Gasoline, Diesel, Jet-A, Kerosene, Distillates and Petrochemicals)

Exporting countries

The most important are India, Saudi Arabia, Singapore, Kuwait, United Arab Emirates, Qatar, Bahrain and Djibouti.

Also Iran, Indonesia, Australia, Egypt, Malaysia, Pakistan, and South Africa

→ **Importing countries**

All 36 countries within the Indian Ocean region are importers of refined products of various products and quantities

Liquefied Natural Gas (LNG) Movements

Exporting countries:

Australia, Egypt Indonesia, Malaysia, Oman, Qatar, the United Arab Emirates and Yemen (from late 2009)

→ **Importing within the Indian Ocean**

India

→ **Importers outside the Indian Ocean**

Belgium, China, Japan, Portugal, South Korea, Spain, Taiwan, the United Kingdom and the United States

gion to the wider maritime trading picture for bulk liquids, it is necessary to briefly consider some systemic developments in an historical context. Until the 1950s, the two main oil trading routes were from the refineries in Venezuela and the Caribbean to the United States and from the Middle East to Western Europe. The former was dominated by products movements, while the latter was mostly crude. During the process of re-nationalization of the oil industries in the Middle East in the 1960s, the oil crises of the late 1960s and the 1970s, and as petroleum became more important to the economies of Western Europe, the latter states began to radically expand Europe's refining capacity in tandem with reducing its dependence on Middle-East supplied crude. In this way, Europe became largely self-sufficient in oil products.

Following the oil crises of the 1970s, the major producing counties in the Persian Gulf became interested and able (following the massive spike in oil revenues) to build refineries at the sources of crude supply. Moreover, as the larger Asian economies began to expand in the 1980s and 1990s, the refineries in the Persian Gulf became important suppliers to those Asian countries that did not have major refining capabilities of their own. At this time, Singapore also evolved into the most important regional refining hub for Southwest Asia. Most recently, at the beginning of the 21st century, as China's and India's economies accelerated, those two countries have been adding significantly to their refining capacities and interests. In the case of China, it is expanding its own domestic capacity and looking for opportunities to invest in new refineries or upgrades to existing sites in the Middle East, while India has now turned itself into the largest and most important refined product exporter in and to the Indian Ocean region.

Saudi Arabia, having also recognized the need to expand its capacity to refine the increasing volumes of its heavier, sour crude oils (that constitute the emphasis of its currently expanding crude oil production), is also greatly increasing its export capacity not only to the Indian Ocean region but also to European markets. New refining technology applied at the new Indian refineries at Jamnagar, and Saudi Arabia's new and expanded facilities at Jubail and Yanbu are able to refine heavy, sour oils to the extent that even they meet the very stringent gasoline and diesel-derived emission requirements. The importance of the major products refiners and exporters in the Indian Ocean region has taken on global as well as regional significance. Furthermore, they have also developed considerable products storage capabilities at the major refining sites, which merely serve to enhance the strategic importance of these nodes, principally at Jamnagar, Singapore, Jubail, Ras Tanura, and Mina Al Ahmadi in Kuwait.

Because of the country's location at the junction of the Indian and Pacific Oceans, amidst the seas that link Australasia with Southeast Asia, and at the narrowest point of the Malacca Straits that divide the vast Indonesian archipelago from the southern tip of the Asian landmass, Singapore is one of the most strategically significant features of the Indo-Pacific maritime realm. The country's geo-economic and geo-strategic significance was shaped in history. In 1819, the British East India Company established a trading post on the island, which was used thereafter as a strategic trading node along the spice route. Singapore would later become one of the most important commercial and

military centers of the British Empire, and the nucleus of British geopolitical power in Southeast Asia. Following independence, the government has used its location to swell its geopolitical and economic importance. Today, Singapore remains the world's most important single waypoint in the maritime conveyance of crude. In 2002, the continuous stream of VLCCs transiting Singapore from the Indian Ocean before turning northeast into the South China Sea en route to China, Japan and South Korea equated to over 11 million barrels of oil passing through the straits each day (some 32% of total global oil trade). By EIA estimates, this volume could reach 24 million barrels of oil per day (37% of the global oil trade).[50]

Aside from its considerable refining capacity (examined below), Singapore's

Major Refineries

Nominal Production Ranking	Country	Nominal Refining Capacity (bbl/d)
Super	India	3,136,850
	Saudi Arabia	2,175,000
	Iran	1,515,000
Large-volume	Singapore	1,348,000
	Indonesia	1,056,800
	Kuwait	940,000
	Australia	844,500
	Egypt	747,000
	Malaysia	722,000
Moderate	UAE	561,300
	Qatar	543,000
	Pakistan	503,000
	South Africa	494,500
	Bahrain	267,000
Low-volume	Djibouti	250,000
	Oman	201,000
	Sudan	181,700
	Yemen	130,000
	Kenya	90,000
	Jordan	65,000
	Myanmar	56,000
	Bangladesh	33,000

Case Study: Singapore: Location, Security and Energy

Singapore sits on the busiest straits in the world, is the world's premier port, and witnesses the transit of substantial portions of the energy requirements of the economies of China, South Korea, Taiwan, and Japan. Singapore has established itself as a power in the ancillary professions and businesses of maritime trade. What is also notable is the way in which geography has become part of Singapore's key role as the essential refiner in Asia, and the third largest in the world. Singapore is arguably the best example in the world of the confluence of petroleum processing, transport and geographical location.

This depends on five key factors: Singapore's strategic location; the scale of its tanker discharging and loading terminals; its massive refining capacity; its oil storage capacity; and region-wide tanker distribution networks for distillates and petrochemicals. It is the prototypical strategic petroleum processing and conveyance gateway. In 2004, the government made clear its plans to maintain and boost its status with storage expansions and studies into the development of turning the country into an LNG hub to complement its oil processing, trading and distribution capacity. Currently, with over 70 production and storage companies, Jurong Island is now recognized as one of the world's major oil and petrochemical hubs, and the site of one of the world's top three refining centers, after Rotterdam and Houston. Singapore is also the world's third largest oil trading center, after New York and London.[1]

[1] Alexander's Gas and Oil Connections, http://www.gasandoil.com/goc/history/welcome.html.

[50] Michael Richardson, Institute of Southeast Asian Studies, for the *Straits Times*, 4 June 2007, http://www.iseas.edu.sg/viewpoint/mr4jun07.pdf.

Case Study: The Geography of Liquefied Natural Gas: Singapore and Qatar

Singapore

As a result of the downturn, the Singaporean government has taken financial control over the development of the country's first LNG re-gasification terminal as the credit crunch delays its completion until 2013. The terminal was being developed by a consortium between Singapore's PowerGas and GDF Suez. However, financing issues and lower demand for gas meant the consortium was unable to develop the $1 billion terminal on a commercial basis by the agreed date of 2012. The terminal is planned to have 3 million tons of LNG annual capacity, with the potential for a second phase project to increase this capacity to 6 million tons. The terminal is intended both to diversify the city state's own energy sources, and also to initiate Singapore's long-held plan to function as a regional gas trading hub. Singapore is strategically very well placed to become a major player in the LNG trade in Asia due to its geographical location and its existing status as an oil trading hub.[1]

Qatar

Qatar has now established itself as the world's largest LNG exporter and its liquefied petroleum gas output is also rising rapidly, with the country due to become the world's second largest LPG exporter by 2012 when output reaches 14 million tons per year. The world's largest exporter remains the UAE. Sea-transported gas cargo volumes will grow on average by 7.8% per annum over the next five years. Most of this is founded on the development of new LNG trains and with commensurate gains in LPG line production — most notably from the Qatargas-4 and RasGas-3 projects. Qatar's gas-indexed shipping lines have been investing heavily in new carriers in anticipation of higher exports once the current recession eases.

Qatar Gas Transport (Nakilat) and Qatar Shipping have invested in a series of very large gas carriers. With the new deliveries, Qatar Shipping's fleet will total nine LNG carriers, six LPG carriers, four product tankers and one crude oil tanker by next year. Nakilat expects to have a 100%-owned fleet of 25 new LNG ships — 14 Q-Max and 11 Q-Flex — operational by 2012. These 25 vessels, along with 29 jointly-owned ships, are part of a 54 vessel fleet currently being built by Korean shipyards. Nakilat received the first of its 14 Q-Max LNG carriers on order in July 2009 from Samsung Heavy Industries' yard. Qatar is also looking to build up its energy and transportation infrastructure links to neighboring countries. The $3.5 billion Dolphin pipe line linking Qatar to Abu Dhabi is now being developed by Occidental and Total. Rail links to Bahrain and the Saudi Arabian border are also planned.

[1] www.lloydslist.com, 2 July 2009.

virtually unparalleled status as the most important petroleum hub in Asia is derived from its deep-water loading and discharging terminals for VLCCs and product tankers, and also from its vast storage capacity. Singapore's refining capacity requires that its relationship with producer countries in the Persian Gulf and the Arabian Peninsula must be consummate and durable; and that the sea lanes of communication (SLOCs) across the Indian Ocean must be secure. This explains its openness to the presence of all navies.

Developments in Key Indian Ocean Trades

Dry Bulk

Charter rates for bulk carriers saw their lowest levels in 20 years in 2009, on low demand for the 'big five' – iron ore, grains,

coal, phosphates, and bauxite. Some modest volume increases in the second and third quarters of 2009 were due to a rise in iron ore and coal imports to China (largely from Australia), and prevented a complete sweep of bankruptcies in the bulk carrier sector. However, many observers assessed that these shipments were arranged more by ore traders rather than by actual customers and were being stockpiled, which indicated that restocking of cheaply-priced ore might cease as demand from Chinese steelmakers remained weak. Thus the seeming relief may actually be short-lived. In real terms, global trade in dry bulk commodities, mainly iron ore and coal, has diminished by 15-20% since September 2008. Recent increases in demand for iron ore have been noted in an increase in prices, but it is unclear how much effect this will have on demand for shipping.

Liquid Bulk

As a clear indicator of the general rule that the tanker market is somewhat more resilient, flexible and dynamic in the short-term, unlike the dry bulk and container sectors, the overall prospects for the crude and product tanker trades were not as bleak as they are for the other markets. The main reasons for the resilience of the tanker sectors are the large volumes of oil that must be carried routinely over long distances (Persian Gulf to Southeast and East Asia), a smaller new tanker order-book compared to other sectors such as the container market, and the steady retirement of old and single-hulled VLCCs.

In July 2009, the International Energy Agency (IEA) stated that it expected exports from the Persian Gulf and Arabian Peninsula would face a gradual return to growth, and that it could take up to five years for volumes to return to 2008 levels. History reveals that any predictions regarding crude export volumes are routinely revised and often wrong; nevertheless, the struggle to achieve the correct balance between anticipated demand, supply and available tankers in the global market will remain problematic. The IEA has forecast that crude trading should rise by 1.5% annually through to 2014. It predicts a rebound in volumes of crude oil shipped around the world over the next five years, with West and North African exports rising most rapidly. It further forecasts less crude being exported from Latin America and Russia. In terms of the global tanker market, demand for VLCCs in particular is likely to return only gradually.

The reason for the sharp declines in exports from the Middle East has been due to production costs implemented by OPEC in order to control prices in response to lower global consumption. The IEA expects that the strongest growth in oil imports will be seen in China as new refineries are built and domestic consumption rises. However, Japanese imports of crude registered the steepest decline in petroleum imports in the last five years, an indication of weakness in demand for refined products and distillates in the Japanese domestic market.

Notwithstanding the decline in aggregate demand for crude, products and LNG in Japan, the government has been formulating a project to increase the volume of crude imported from the Persian Gulf in order to fill the country's onshore strategic reserve base. Japanese importers have negotiated a deal with the Abu Dhabi National Oil Company to import additional volumes of oil from the Emirates. The additional imports would be used to bolster Japan's strategic reserve at a time when

the government was observing China expand its own reserves.[51]

Liquefied Natural Gas and Liquefied Petroleum Gas (LNG and LPG)

Typically, the liquefied gas trades have been comparatively resilient in the face of economic slumps, particularly LNG, the majority of which is conveyed as part of long-term contracts with structured delivery schedules and volumes, although, in recent years, a spot market has been developing for surplus cargoes. Nevertheless, such is the severity of the current crisis that LPG and LNG trades have also been noticeably affected.

By January 2009, petroleum output amongst the major OPEC producers in the Persian Gulf was substantially reduced, in keeping with commensurately suppressed demand and low prices, which resulted in a surplus of liquid petroleum very large gas carriers (VLGCs) lying idle. Freight rates were depressed to the level that they were below running costs. There are currently some 163 VLGCs in the global fleet.

Though less serious, there was a similarly depressed market for LNG carriers: by early in 2009, there were as many as 25 of the operational fleet of 287 idle, including eight new Q-Flex[52] vessels and two Q-Max[53] vessels that have been in lay-up off Khor Fakkan in the northern Gulf of Oman, some for as long as seven months.[54]

In the first half of 2009, the depressed state of the LNG trade was due in no small part to the sharp reduction in LNG requirements by the world's largest importer – Japan. In May 2009, Japan's Ministry of Finance announced that the country imported 19% less LNG, down to 4.3 million tons, because of a drop in power demand and a slowdown in industrial output. This was accompanied by big declines in imports of LPG.

By mid-2009, the number of LNG carriers without charters had increased to 60 (some 20% of the global fleet of 320 vessels). Despite a sharp fall in demand, the continued high levels of natural gas production, particularly in Qatar, resulted in traded volumes falling to 12-year lows. However, because the majority of LNG carriers are contracted for up to 20 years at rates that are agreed at fixed levels for the duration of the contract, owners continued to enjoy the best earnings in the bulk shipping business. Nevertheless, as mentioned above, some of the world's newest and most expensive LNG carriers have been mostly idle, as they were constructed and delivered for delayed LNG production projects that have yet to come on-stream. If the new Qatari

[51] www.lloydslist.com, 29 June 2009.

[52] The Q-Flex LNG carrier, with a capacity of between 210,000 m3 and 216,000 m3, is the world's second largest type of LNG carrier type. It has a capacity about 1.5 times that of conventional LNG carriers.

[53] The Q-Max is the largest type of LNG carrier in the world. The name Q-Max, "Q" stands for Qatar and "Max" for the maximum size of ship able to dock at the LNG terminals in Qatar. It has a capacity of 266,000 cubic meters. The Q-Flex and the even larger Q-Max are a new generation of LNG mega-ships. The Q-Max has 80% more capacity than conventional LNG carriers with about 40% lower energy requirements due to the economies of scale created by their size and the efficiency of the engines. Q-Max LNG carriers are unique and purpose built for Nakilat and allow for more efficient transport of Qatar's natural gas to markets throughout the world.

[54] www.lloydslist.com, 20 January 2009.

projects are delayed, the VLGC market will remain depressed, and some owners may be forced to scrap vessels early.

Liner (Container) Shipping

The volume and frequency of the conveyance of containerized goods is an important indicator (indeed one of the best signs) of the level of demand for manufactured goods around the world, particularly items such as machinery, electronic goods, clothing, luxury goods, furniture, appliances, and clothing.

When container volumes (numbers of 20-foot equivalent units (TEUs) and 40-foot equivalent units (FEUs)) between Asia and Europe and between Asia and North America surged by almost 20% per year from 2002 to 2007 and vessels were sailing at full capacity, the major shipping lines, such as Maersk, MSC, Hapag-Lloyd, NYK, CMA-CGM and Cosco, ordered large numbers of vessels, particularly the largest variety of post-Panamax vessels (molded breadth of >32.31m), so as to meet what was expected to be many years of continuing expansion in trade.

This unchecked surge in orders for the latest generation of mega container vessels (those with capacities of 12,000 to 13,000 TEUs) has become the primary reason why container companies are likely to face several years where the size of their fleets far outstrips demand for their services. Even after it becomes clear what vessel cancellations are prudent despite the forfeit penalties, the vessels due to be delivered simply between 2009 to 2012 represent 49% of the existing global capacity. Given that this massive surplus is not going to be absorbed for some time to come, it is likely that only the largest liner firms with more robust cash-flows and diversified trading portfolios (including bulk liquid capability), such as Maersk, will be able to survive. Essentially, the longer the recession, the more firms will go bankrupt; particularly the small- to medium-sized fleets.

The volumes handled by most container ship operators in the first quarter of 2009 were running between 15% and 30% lower than in the first quarter of 2008, leading to the cutting and merging of many services.[55] Maersk reported losses of $555 million in the first quarter of 2009 alone and also predicted that the company could be facing its first ever full-year loss in earnings in its 105-year history, an outcome that did in fact occur. In April 2009, China's two largest shipping companies, Cosco and China Shipping, reported revenues that were less than 50% of the same period in the first quarter of 2008. Singapore's Neptune Orient Lines, which operates APL, the world's seventh largest container ship fleet, also announced major net losses in early 2009 of $245 million compared to net profits of $121 million for the same period in 2008. Hapag-Lloyd, the world's sixth largest carrier, reported losses of $302 million in the first quarter of 2009.

One of the biggest issues that the economic crisis precipitated for the big Asian and European carriers has been the status of the largest vessels, which have twice the capacity of the most modern ships of only 10 years ago. These ships were designed and justified on the basis that when fully laden they would be more cost effective than operating two or more smaller vessels servicing the same routes. The largest lines are hoping that these larger vessels

[55] "Lines put new faith in Hope," *Financial Times,* 26 May 2009.

will enable them to survive the downturn. To this end, the large liner service alliances, such as the New World Alliance, are cutting back on their individual services and pooling consignments on the largest vessels to spread costs.

The sharp decrease in container volumes being shipped along the traditional east-west/west-east oceanic routings linking Europe and Asia has forced liner shipping companies to explore other areas of business to help them survive. Some have sought new business by converting non-containerized general cargo and ship this form of break-bulk in containers instead. This process has long been completed in the advanced industrialized countries, but not in the less developed parts of Asia and Africa. This could well result in the evolution of more container ship services (particularly those with vessels that have smaller drafts and their own loading gear) servicing smaller ports along the east coast of Africa, India and Southeast Asia. That in turn could result in the displacement of some general cargo vessel trades by container vessels that gather consignments in sequence from multiple ports and deposit these at one of the major hub ports in the Indian Ocean, such as Singapore, Jakarta, Colombo, Jebel Ali, Salala and Djibouti.

Refined Petroleum Product/Distillate Trade

Refined products are shipped in specialized tankers, which are configured to carry several different products in a single hull. The refining process results in three different categories: light distillates, middle distillates and heavy distillates and residue. The following table shows the make-up of the different levels.

Distillate Level	Product
Light	Liquid petroleum gas (LPG)
	Gasoline (also known as petrol)
	Naphtha
Middle	Kerosene and jet aircraft fuels: Jet A, Jet A-1, Jet B and JP-4, JP-5 and JP-8 (military variants)
	Diesel fuel
Heavy and Residium	Fuel oils
	Lubricating oils
	Paraffin wax
	Asphalt and Tar
	Petroleum coke

The trading of oil products, distillates and petrochemicals is very different from that of crude both operationally and in terms of movement patterns. Furthermore, the products' trade by sea has a distinct and rather complex economic structure, which derives from the fact that products and distillates are carried by ship for three distinct reasons: refinery location, product type balancing trades and deficit trading

- Refinery location: If a major refinery is located at or near an important net source of crude oil, or if it is sited at a strategic location along the trade route and distills a surplus, then products will be shipped from here to final market destinations. Many of the major refineries built or under development in the Indian Ocean region are designed specifically as export refineries.
- Product type balancing trades: The types of products (including distillates and petrochemicals) refined at a given facility will not necessarily fit the requirements of the market in the host state or region. Thus, a country with refining capabilities (but with an aggregate net import profile) will export certain products that it does not require at all or in the volumes that it produces, and will import others that it does need or does not produce.

- Deficit trading is the classic reflection of supply and demand. Those countries with limited or no refining capacity may have a domestic market that outstrips its ability to produce or expand its national output. Also, countries with a domestic requirement that is too small to support a refining capability of its own (or the export terminal infrastructure that would enable it to function as a regional products supply node) will be net importers. This is mostly the case for island states with small populations or coastal states with smaller populations. Deficit trading is reflected most clearly in the requirements and trade of diesel, Jet-A and particularly gasoline.

Existing refining capacity in the Indian Ocean region is dominated by the high-capacity, export-orientated facilities in the Persian Gulf and Arabian Peninsula and increasingly by India.

The product importing countries in the Indian Ocean region with no domestic refining capabilities are the Comoros, East Timor, Eritrea, Madagascar, the Maldives, Mauritius, Mozambique, the Seychelles, Somalia, Sri Lanka and Tanzania.

The large-scale importing countries that have varying levels of nominal refining capability (which are part of balancing trade flow system) but have a need for certain products (including often sizable volumes of gasoline, diesel and Jet-A) are Indonesia, Australia, Egypt, Malaysia, Pakistan, South Africa, Oman, Sudan, Yemen, Kenya, Jordan, Myanmar and Bangladesh.

The major exporters in the Indian Ocean region, which are thus explicitly vital strategic refining nodes, remain India, Saudi Arabia and Singapore. Though Iran is classed in the super producer category in terms of aggregate nominal daily production, the country is actually a net importer of refined products (particularly gasoline) due to insufficient refining capacity needed to meet soaring domestic demand; a problem that is compounded by the reality of faltering refining infrastructure that cannot be maintained sufficiently due to the international sanctions that prohibit the country importing the vital spare parts and technology needed.

Important second-tier exporters are Kuwait, the UAE, Qatar, Bahrain and Djibouti.

Significant Expansion Projects at the Hub/ Primary Refineries in the Indian Ocean Region

India

Until Reliance Industries' project to expand the country's refining capacity in Gujarat State, India's refining capabilities were largely configured for refining products and distillates for the country's own market and national requirements. However, the completion of the massive new Reliance Industries refinery at Jamnagar in Gujarat in 1999, which has a production capacity of 660,000 barrels per day, marked a significant change in direction for India's petroleum industry. Jamnagar has essentially given the country the ability to begin large-scale product exports to the entire Indian Ocean region, and beyond into the Western Hemisphere and also to other parts of Asia and the African continent.

The latest phase of the Jamnagar project – a second refinery on the same industrial site that has the capacity to produce 580,000 barrels per day – started production in January 2009, some three months

ahead of schedule. The combined output at Jamnagar now stands at 1,240,000 bpd, making it the largest single-site refinery in the world. As it stands, much of the first facility's output is orientated for export, while all of the second facility's capacity is given over to export. The aim at the new refinery is to turn the lowest-quality, and thus cheapest, crude feedstock into top-quality fuels suitable for even the most regulated markets. Only around 30 of the 660 refineries currently operating in the world can achieve this.

In March 2007, the government-owned Indian Oil Corp revealed its plans to invest around Rs250 billion ($5.7 billion) to build a 15 million tons/year (307,500 bbl/day) refinery complex at Ennore in Tamil Nadu state. The complex, which would consist of a refinery, a naphtha cracker and an aromatics unit, would cater mainly for the export market. A refinery of the same size is also due to come on stream in Paradip in Orissa by 2011. The Ennore facility is due be completed by 2015-16.

Since 2000, India's oil market has boomed in all respects – domestic products demand, refinery capacity, crude imports and product exports have all increased markedly, which is changing maritime trade patterns for oil, resulting in more short-haul crude cargoes from the Persian Gulf and an increasing number of product exports to the Far East from India rather than the Gulf and the Arabian Peninsula.

In addition to Jamnagar, India currently has 17 refineries, which give the country an aggregate nominal refining capacity of over 3.1 million bbl/d.

Saudi Arabia

Saudi Arabia, which already has major operational refining facilities in Jeddah, Jubail, Rabigh, Ras Tanura, Riyadh, and Yanbu (two facilities) with an aggregate nominal output of over 2.1 million bbl/d, has advanced joint-venture projects to boost this capacity by another 800,000 bbl/d with the addition of two new major refineries at Yanbu and Jubail, each with a 400,000 bbl/d capacity. The new refinery at Yanbu is a joint venture between Saudi Aramco and ConocoPhillips, while the facility under construction at Jubail is jointly owned by Saudi Aramco and Total of France. The two installations are the centerpieces of a plan to boost the kingdom's refining capacity to 3.4 million bbl/d over the next five years, with the remainder coming from planned expansion projects at existing facilities at Ras Tanura and Yanbu. These are currently on hold. The Saudi Aramco/ConocoPhillips facility is due to be completed by 2011. Total had originally intended to begin commercial operations at the new Jubail 400,000-barrel-a-day refinery by the end of 2012; however, in May 2009, it announced that it would postpone the start-up date to March 2013.

On the basis that the Kingdom's refining capacity will reach almost 3 million barrels per day by 2013, this will maintain Saudi Arabia's position as the second largest refiner in the Indian Ocean region, and certainly the largest exporter. The country will thus have added significantly to its two products exporting centers – one on the Red Sea and the other in the Persian Gulf. While this will not radically alter the movement pattern of products from these two maritime spaces, it will likely significantly increase the export flow rate,

particularly for low-sulphur gasoline and motor diesel.

Singapore

Singapore is arguably the best example in the world of the confluence of petroleum processing, transport and geographical location. Simply put, it is the most vital petroleum hub in Asia, and the third largest in the world. This status is derived from five key factors: its strategic location; the scale of its tanker discharging and loading terminals; its massive refining capacity; its oil storage capacity; and region-wide tanker distribution network for distillates and petrochemicals. It is the prototypical strategic petroleum processing and conveyance gateway.

In 2004, the government made clear its plans to maintain and boost its status with storage expansions and studies into the development of evolving the country into an LNG hub to complement its oil processing, trading and distribution capacity. Currently, with over 70 production and storage companies, Jurong Island is now recognized as one of the world's major oil and petrochemical hubs, and the site of one of the world's top three refining centers, after Rotterdam and Houston. Singapore is also the world's third largest oil trading center, after New York and London.[56]

In 2002, the continuous stream of VLCCs transiting Singapore from the Indian Ocean before turning northeast into the South China Sea en route to China, Japan and South Korea equated to over 11 million barrels of oil passing through the straits each day (some 32% of total global oil trade). By EIA estimates, this volume could reach 24 million barrels of oil per day (37% of the global oil trade).[57]

Aside from its considerable refining capacity (examined below), Singapore's virtually unparalleled status as the most important petroleum hub in Asia is derived from its deep-water loading and discharging terminals for VLCCs and product tankers, and also from its vast storage capacity. The three major oil refineries hold 88 million barrels of combined storage capacity (88% of the country's total). Singapore's independent storage operators have a further 24.4 million barrels of capacity.[58] There are several projects underway to expand this; however, the most significant is the construction of the new joint Hin Leong/PetroChina *Universal Terminal* on Jurong Island. In November 2007, the 2.3 million cubic meter capacity *Universal Terminal*, now acknowledged as the largest commercial oil storage terminal in Asia, received its first test cargoes: fuel oil from a VLCC; and, several cargoes of middle distillates (including gas oil and Jet-A) from smaller aframax and other product tankers. The terminal became fully operational in 2008. The project is one of several that will boost the country's oil storage capacity by approximately 4 million cubic meters (an additional 67%) by the end of 2008.[59]

Singapore had a total crude oil refining through-put capacity of approximately 1.3 million barrels per day (bbl/d). The country's three refineries are ExxonMobil's Jurong/Pulau Ayer Chawan facility (605,000 bbl/d); Royal Dutch Shell's Pulau Bukom

[56] Alexander's Gas and Oil Connections, http://www.gasandoil.com/goc/history/welcome.html.

[57] Michael Richardson, Institute of Southeast Asian Studies, for the *Straits Times*, 4 June 2007, http://www.iseas.edu.sg/viewpoint/mr4jun07.pdf.

[58] US Energy Information Agency, http://www.eia.doe.gov/emeu/cabs/Singapore/Oil.html.

[59] "S'pore Universal Terminal Tests First Oil Tanker," Reuters, 5 November 2007, http://uk.reuters.com/articlePrint?articleId=UKSP24431420071105.

complex (458,000 bbl/d); and the Singapore Petroleum Company's (SPC) Pulau Merlimau refinery (273,600 bbl/d).[60]

Iran

Iran has a long history of refining capability. For many years the refining complex at Abadan was one of the largest in the world and exported a broad spectrum of distillates throughout the region and the wider Indian Ocean region. The country's nine refineries, which are all owned and operated by the National Iranian Oil company (NIOC), are located at Abadan, Arak, Bandar Abbas, Isfahan, Kermanshah, Lavan, Shiraz, Tabriz, and Tehran. Between them, the facilities have a combined nominal output of 1.515 million bbl/d. However, this figure is currently deemed to be greatly reduced given the inability of the NIOC to maintain full operational capacity at several facilities due to a lack of spare parts and investment, a problem stemming from the ongoing sanctions ranged against the country. The most conspicuous manifestation of this problem has been Iran's inability to produce sufficient quantities of diesel and particularly gasoline for its domestic requirements, which has resulted in large-scale imports of these middle distillates from both exporters within the Persian Gulf and from India.

In 2007, the government embarked upon a large-scale project to re-constitute and expand the country's refining capacity to meet both domestic needs and to improve its options for expanding its export capability. However, in the face of sanctions and continued ambivalence among many of the leading international contractors for this highly specialized development (such as those located in Japan, South Korea and western Europe) due to the political and commercial risks associated with doing business in Iran, progress has been slow. In fundamental terms, Iran will be unable to fully re-constitute its once impressive refining sector unless sanctions are rescinded to a large degree or unless it relies heavily on Russian and/or Chinese assistance in this regard.

Other Significant Facilities: Kuwait, UAE, Qatar, Bahrain and Djibouti

Within the Indian Ocean region there are a number of second-tier coastal refineries that in aggregate terms contribute large volumes of refined products to the region. The most important of these facilities are located in Kuwait, the United Arab Emirates, Qatar, Bahrain, and Djibouti.

Kuwait has a nominal total refining capacity of 940,000 bbl/d, which is derived from three coastal facilities located at Mina Al-Ahmadi, Shuaiba and Mina Abdullah. All of the refineries are operated by the Kuwait National Petroleum Company. In March 2009, the government abandoned plans to build a new 630,000 bbl/d refinery, for which contracts had previously been awarded to several South Korean and Japanese firms in May 2008.[61] Had the facility been built, it would have made Kuwait one of the leading producers in the Middle East, and would have bolstered the country's ability to dominate market share in the northern Gulf and supply Iraq and particularly Iran with more sizable parcels of middle distillates.

The UAE has a nominal total capacity of some 561,300 bbl/d, which is produced by four facilities – Al-Ruwais (Abu Dhabi

[60] *Ibid.*

[61] Oil and Gas Journal Special Report, http://www.ogj.com/index/article-display.articles.oil-gas-journal.volume-107.issue-47.processing.special-report_global.QP129867.dcmp=rss.page=1.html.

Oil Refining Company-ADORC), Umm Al-Narr (ADORC), Jebel Ali (Emirates National Oil Company-ENOC) and Hamriyah Sharjah (Sharjah Oil). What is interesting about the UAE in this regard is that its refining capacity is modest compared with its crude output. Moreover, given its direct coastal access to the Gulf of Oman (Arabian Sea) and the fairly straightforward ability to connect the country's oil production infrastructure with the coast, this would seem to have been a good industrial opportunity for the country. However, it has always faced somewhat overbearing competition from Saudi Arabia in this regard. Nevertheless, in February 2008, the Abu Dhabi Oil Refining Company (TAKREER), announced its plans to build a new 417,000 bbl/d refinery that would be located at Ruwais approximately 240 km from Abu Dhabi City, which would be completed by 2013 and would almost double the emirate's current installed refining capacity of around 485,000 bpd.[62]

Qatar's two operational refineries – Um Said and Ras Laffan – produce some 293,000 bbl/d of refined products. Um Said is wholly state owned, while the facility at Ras Laffan (in keeping with the vast array of foreign participation in this predominantly LNG production center) has a very international ownership complexion with stakeholders from several Qatari and international companies including Qatar Petroleum, ExxonMobil, Total, Idemitsu, Cosmo, Mitsui and Marubeni. Tenders for the new AL-Shahene Refinery (which will be located at Mesaieed Industrial City) have been delayed as of late 2009; however, the facility is due to be completed by 2013, and when fully operational will almost double the country's refining output by adding another 250,000 bbl/d of distillate production capacity, with emphasis on diesel oil, gasoline, Jet A and Jet A-1.[63]

The Bahrain Petroleum Company (Bapco) Sitrah refinery in Bahrain, which produces some 267,000 bbl/d of distillates for Persian Gulf and Indian Ocean region regional markets, is one of the largest refineries in the Middle East. The oldest facility of its kind in the GCC, it has been an important producer and exporter for dependent countries in Africa and Asia since 1968. Bapco completed a thorough upgrade of the refinery in 2007, which enabled it to produce low-sulphur diesel and unleaded gasoline to ensure the facility's competitiveness in the far more stringent market for transportation fuels. The facility draws one sixth of its feedstock from Bahraini crude wells and the remainder from Saudi-supplied crude.[64] The refinery is complemented by a storage farm for over 14 million barrels of crude and distillates and marine loading terminal.[65]

Djibouti's ideal strategic location between the Red Sea and the Gulf of Aden, its relative proximity to the oil fields on the Arabian Peninsula, and the fact that it sits astride one of the most important maritime trade routes in the world, renders its Doraleh oil refinery (which has a nominal output capacity of 250,000 bbl/d) one of the most important facilities of its kind on the African continent. It is a vital supplier for refined products for dependent states in the Horn of Africa, both inland and coastal. The refinery's importance is further amplified by the nearby oil storage and terminal facilities that service a

[62] "Abu Dhabi to build new refinery," Thaindian News, 25 February 2008, http://www.thaindian.com/newsportal/world-news/abu-dhabi-to-build-new-refinery_10020998.html.

[63] Pumps and Systems, www.pump-zone.com/global-news.

[64] www.hydrocarbons-technology.com.

[65] The Bahrain Petroleum Company Overview, www.naukri.com/gpw/bapco/index.htm.

growing regional trade in refined products heading in-land and along the coast to neighboring states.

Shipping and the Environment

The radical environmental changes that have revealed themselves in the Indian Ocean region,[66] along with their secondary effects such as natural disasters, have substantial implications for the future of the shipping industry. Shipping is the victim of environmental change that it has had little role in causing.[67] For example, the prospect of significant sea level rise seriously threatens port infrastructure. It is also itself the cause of environmental change with victims elsewhere, often among fishers and other coastal communities and subsistence economies, when projects to dredge channels to accommodate larger vessels threaten local habitats, natural environments, ecologies, and livelihoods.

The natural environments of many Indian Ocean coastal locations have been fundamentally altered to accommodate the large port developments that we have discussed above. Even greater changes are planned, whether in the form of a massive port at Lamu in Kenya, a UNESCO World Heritage site and a fragile ecosystem, or a proposal to dredge the Palk Straits between India and Sri Lanka to permit large vessels to sail between the two countries rather than having to sail around the southern coast of Sri Lanka. Questions are increasingly raised about the environmental sustainability of what is necessary to keep shipping on a growth trajectory, such as dredging ever deeper in harbors and channels. Other questions have arisen such as those about the future of ship scrapping, already a sensitive part of the very sensitive economic structure of fleet sizes. Given the externalized environmental costs of shipbreaking on beaches such as Alang in India, or in other sensitive and food producing coastal ecologies such as the coast of Bangladesh, questions arise about whether the current cost structure should be sustained at such environmental cost.

Climate change and its secondary effects have also become matters of concern to the industry, which will undoubtedly suffer its effects in the form of extreme weather events. At the same time the global community is increasingly turning its attention to pulling maritime transport within the ambit of the various approaches that are under discussion for mitigating carbon emissions.[68] Thus shipping has come face to face with the economic impacts of environmental mitigation measures, and their effects on the longstanding shipping economics, through requirements for vessel design, for instance.

Today, the shipping industry carries more than 90% of world trade at a fraction of the environmental damage and cost of any other mode of commercial transport. Although the shipping industry has relatively good environmental credentials, there will be always room for improvement in reducing operational and accidental pollution. Environmental consideration becomes significant in almost every aspect of the shipping business—from

[66] See Ellen Laipson and Amit Pandya (eds.), *The Indian Ocean: Resource and Governance Challenges,* (Stimson, 2009) and David Michel and Amit Pandya (eds.), *Coastal Zones and Climate Change,* (Stimson, 2010).

[67] Though there have been no vulnerability studies as yet.

[68] See for example, United Nations, *Report of the Secretary General's High-level Advisory Group on Climate Change Financing,* 5 November 2010, pages 28-29; and "UN wants taxes to fund climate change fight" *Financial Times,* 7 November 2010.

ship design, construction, operation, and final disposal of ships.

Greenhouse Gas Emissions

On a per ton, per mile basis, shipping is the most environmentally friendly and energy-efficient common means of transport. According to the International Maritime Organization (IMO), maritime transport only accounts for 10% of the transport sector emissions while carrying as much as 90% of world trade by volume. Road transport by contrast accounts for as much as three-fourths of the transport sector emissions. Still, emissions from the shipping industry in aggregate terms are significant, and contributed 3.5% of all global emissions in 2008.

Over the year leading up to the Copenhagen Summit of the United Nations Framework Convention on Climate Change (UNFCCC), COP15 in December 2009, there was extensive discussion about the shipping industry's responsibility in dealing with climate change. Shipping greenhouse gas emissions were being considered for inclusion in the new emissions reduction targets to be negotiated in Copenhagen, and shipping companies had expressed their commitment to playing their part. Shipping and aviation emissions are exempt from the international regulatory framework set in the Kyoto Protocol.

In an address at COP 15, Efthimios E. Mitropoulos, Secretary-General of IMO explained that "our work on climate change contains three distinct components: technical measures that will mainly be applied to new ships; operational measures for all ships–new and existing; and market-based reduction measures to provide emission-cutting incentives–all of which, when fully implemented, will deliver the required GHG emission reductions from ships engaged in international trade. Indeed, a study on GHG emissions from ships conducted by IMO this year forecasts that, through the technical measures developed by the Organization, a relative emission reduction of 15% to 30% is possible depending on ship type and size, while, through the operational measures, a further 20% reduction on a ton mile basis is possible and would be cost-effective even with the current fuel prices."

The Copenhagen Accord that came out of the conference in December, however, was silent on the treatment of international shipping in CO2 emission reductions. Shipowners regretted lack of direction from the Accord. The International Chamber of Shipping (ICS), the principal international trade association for the merchant shipping industry, expressed dissatisfaction with the Accord saying, "UNFCCC has been unable to agree a clear mandate for the industry's regulator, the United Nation's International Maritime Organization (IMO), on how to build upon the considerable work already undertaken by IMO on a package of technical, operational and economic measures for reducing shipping's emissions on a *global* basis—a mandate strongly advocated by the shipping industry."[69]

Shipping, as a uniquely international industry, can only work efficiently when operating within a global regulatory framework that applies equally to all ships regardless of flag. The Baltic and International Maritime Organization (BIMCO), the world's largest private shipping organization, has also noted that the scheme that is introduced should be "both global and flag-neutral, and that

[69] ICS Press Release, 21 December 2009, http://www.marisec.org/news/pressrel.htm#21 December 2009.

proceeds from carbon trading, tax levy, or whatever else implemented should be earmarked for projects that will reduce emissions, rather than finance other political initiatives."[70]

In the absence of a global package agreed by IMO, there is a risk that some countries will develop unilateral measures to regulate CO2 shipping emissions at a national or regional level. Pressures to accelerate the regulatory process have emerged from the European Union, which has suggested that in the absence of an IMO-driven program, it will seek to impose a regional solution, most likely involving an Emission Trading Scheme that will apply to all ships calling at EU ports. The ICS fears that such developments may result in serious market distortions and be far less effective in ensuring the reduction of CO2 emissions by the global shipping sector as a whole.

Even without a global agreement, the shipping industry has been developing new technologies and ship design and adopting technical and operational measures to curb emissions. Rather than burdening the industry with added cost, adopting such measures can actually be profitable. For instance, speed reduction, new engine technology and ship design can help increase fuel efficiency, and therefore reduce shipping costs as well greenhouse gas emissions. Some shipping companies have adopted the speed reduction approach to cut their operating costs during the 2008 record rise in oil and bunker prices.

Denmark's AP Moller-Maersk, the world's largest container ship operator and supply vessel operator, has made climate change mitigation a part of its business strategy. It claims that the less fuel they use, the less CO2 they emit and so environmental initiatives often go hand in hand with financial benefits. The company is committed to enhancing energy efficiency through innovation and operational improvements, and investing in new ship design and low carbon technologies.

Alternative fuel such as natural gas, solar, wind, and nuclear power are now being considered by the shipping industry but there are considerable challenges associated with each. Liquefied natural gas can be used as an alternative clean fuel but it requires three times the storage space of liquid fuels. Nuclear propulsion is technically feasible but is likely to have social opposition and the cost of building necessary infrastructure will be high. The use of biofuels for shipping is currently seen as uneconomic, and there is uncertainty about the sustainable availability of crops. Solar power may help meet some ancillary requirements such as lighting on board ships but is not powerful enough to provide primary propulsion power.[71]

Japan's NYK Line, in collaboration with Garroni Progetti S.r.l., an Italian ship design company, and Elomatic Marine, a Finish consulting company, is developing a future concept container ship called "NYK Super Eco-ship 2030" aimed at achieving a 69% CO2 reduction in marine transportation. The ship will have two main features to achieve this goal: first, reduction in the propulsion required for driving the ship by reducing the ship weight and friction resistance; and second, combined use of LNG-fueled fuel cells, solar power and wind power for propulsion power. The ship will use

[70] The Baltic and International Maritime Council (BIMCO), *Reflections 2009*, page 7.

[71] IMO News, 2009 Issue 3, page 26.

new technologies which are theoretically feasible but not yet commercialized.[72]

Other International Regulatory Developments

IMO has recently made significant progress in developing international shipping regulations for environmental protection. In October 2008, IMO formally adopted radical revisions to Annex VI of MARPOL (International Convention for the Prevention of Pollution from Ships) stating that sulfur oxide (SOx) emissions will be progressively reduced globally to 0.5% by 2020, and in sensitive coastal areas to 0.1% by 2015. Progressive reductions in nitrogen oxide (NOx) emissions from marine engines were also agreed. Moreover, substantive progress was made recently with regard to developing technical and operational measures to address such emissions, including the development of an Energy Efficiency Design Index (EEDI) for new ships, an Energy Efficiency Operational Index (EEOD) suitable for all ships, and a voluntary code on best practice in energy efficient ship operations for the whole shipping industry.

Oil Pollution

Between the *Torrey Canyon* and the *Exxon Valdez* the world became aware of the very serious potential environmental consequences of the transport of petroleum by sea. Oil pollution is therefore the emblematic environmental issue in maritime commerce.

Accidental and operational oil spills from ships have been a major environmental concern for decades but have been steadily reduced over time with the introduction and enforcement of various legal instruments and safety measures such as double-hulling of tankers. For the maritime sector in developing countries it remains a serious concern, and many are currently building capacity to prevent and respond to oil pollution.

According to the International Tanker Owners Pollution Federation Limited, most spills from tankers result from routine operations such as loading, discharging and bunkering which normally occur in ports or at oil terminals. Accidental causes such as collisions and groundings generally give rise to much larger spills, with at least 84% of such incidents involving spillage in excess of 700 tons.[73]

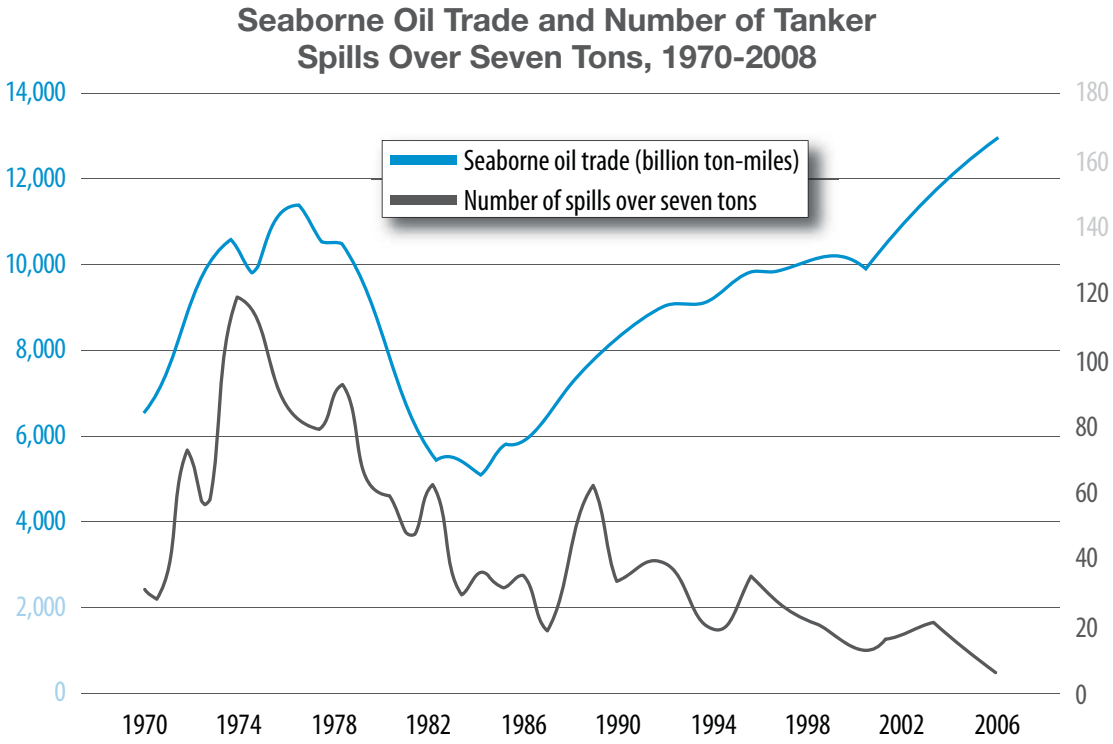
According to a United Nations Environment Programme (UNEP) report from 2008, oil inputs and spills to the seas have been reduced by 63% compared to the mid-1980s. Oil spills from tanker accidents have declined by 75%, from tanker operations by 90%, and from industrial discharges by some 90%.[74] Although there has been a steady increase in oil trade since the 1980s, there has been a downward trend in oil spills.

Despite visible improvements over time, oil spills are still a significant issue and not only pollute the sea in general, but are hazardous to human health, kill birds, marine mammals and fish, and destroy coastal habitats. Species affected by toxic oil include coral reefs and plankton which serve as home to sea organisms. Seabirds that dive into the sea for food or congregate on the sea surface are particularly vulnerable to floating oil. The impact of an oil spill can depend on a number of

[72] "NYK Super Eco Ship 2030," NYK Line Website, http://www.nyk.com/english/csr/envi/ecoship.htm.

[73] International Tanker Owners Pollution Federation Limited Website, Accessed 28 May 2009, http://www.itopf.com/information-services/data-and-statistics/statistics/index.html.

[74] United Nations Environment Programme (UNEP), *In Dead Water – Merging of Climate Change with Pollution, Over-harvest, and Infestations in the World's Fishing Grounds*, February 2008, page 44.



Source: Fernresearch, 2007,
http://www.itopf.com/information-services/data-and-statistics/statistics/index.html

factors including the type and amount of spilled oil, the physical, biological and economic characteristics of the affected area, weather conditions, and the effectiveness of clean-up response.[75]

The International Maritime Organization made addressing oil pollution a high priority since 1967 when the Torrey Canyon tanker ran aground while entering the English Channel and spilled her entire cargo of 120,000 tons of crude oil into the sea. It was the biggest oil spill disaster ever recorded up to that time. IMO's MARPOL is the main international convention on marine environment pollution by ships from operational or accidental causes. It is a combination of the initial Convention adopted in November 1973, the MARPOL Protocol of 1978 adopted following a series of tanker accidents in 1976-77, and a number of further amendments. Since the measures have been put in place, oil spills from accidents and routine tank cleaning operations have been significantly reduced.

Improved ship design from single-hull to double-hulled tankers has helped reduce oil spills. A double hull is a design which surrounds cargo tanks with a second internal plate at a sufficient distance (generally 1.5-2 meters) from the external plate and safeguards the tanks from damage in a collision, reducing the risk of oil pollution. IMO introduced amendments to MARPOL to include the provision on double hulls in the early 1990s. The phase-out schedule originally stated in the 1992 amendment was accelerated and other measures were added following the *Erika* disaster in December 1999 off

[75] International Tanker Owners Pollution Federation Limited Website, http://www.itopf.com/marine-spills/effects/environmental-impact/index.html.

the coast of Brittany, France and the *Prestige* disaster in November 2002 off the Galician coast in northwestern Spain. The revised MARPOL Annex I *Regulations for the Prevention of Pollution by Oil* was adopted in October 2004 and entered into force in January 2007.

Other key measures include the following:

- Regular training workshops to improve regional capacity on oil spill preparedness and response;
- Ensuring good ship maintenance and inspection;
- Recruiting competent and experienced crew;
- Using better navigational equipment;
- Utilizing airborne surveillance to monitor and prevent ships from making illegal discharges.

Ballast Water

According to UNCTAD estimates, international shipping moves around three to four billion tons of ballast water each year.[76] Shipping ballast water provides an inadvertent mechanism for the transfer and dispersal of alien species and pathogens, including harmful bacteria, toxic dinoflagellates, seaweeds, mollusks, starfish, crabs, and fish. Non-indigenous and invasive species pose a significant threat to biodiversity in coastal waters because they often have no natural predators and may out-compete native species for food in their new environment.[77] Invasive species not only pose a threat to fisheries but also human health through shellfish poisoning and even cholera outbreaks.[78]

IMO has recognized shipping ballast water as a serious international pollutant and is currently developing a set of draft regulations for potential use in future international shipping operations. These guidelines will require ships to undertake appropriate management or treatment operations to minimize risks involving ballast water.

The International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM Convention) adopted in 2004 addresses the issue of transfer of non-indigenous aquatic invasive species in ballast water with a performance standard for ballast water treatment technology.[79] The ratification process of the Convention, however, has been slow, and it will not enter into force until 12 months after ratification by 30 states representing 35% of the world merchant tonnage. As of October 31, 2009, only 18 states, representing about 15% of world merchant shipping tonnage, had ratified the Convention.

Marine Litter

According to the United Nations Environment Programme (UNEP), some eight million items of marine litter including plastics, ropes, fishing nets, and cargo-associated wastes, are estimated to enter the sea every day. About five million of these items are thrown overboard or are lost from ships.[80] Cargo ships are estimated to create about 60 kg of waste per day.[81] UNEP also estimates that over 46,000 pieces of litter are on the surface of every square mile of ocean.[82]

Marine litter is harmful in that it could entangle and be ingested by marine life—it is a serious

[76] UNCTAD, 2008.

[77] United States Environmental Protection Agency, http://www.epa.gov/owow/invasive_species/factsheet.html.

[78] Earthdive, http://www.earthdive.com/site/news/newsdetail.asp?id=541.

[79] World Shipping Council, http://www.worldshipping.org/iss_11b.html.

[80] UNEP, *Op. cit.,* page 54.

[81] *Ibid.*

[82] UNEP, http://www.unep.org/regionalseas/publications/reports/RSRS/pdfs/rsrs178.pdf, pages 28-29.

cause of mortality for seabirds, marine mammals and fish.[83] Marine litter also provides transport for invasive alien species across the ocean.[84] A report released jointly by UNEP and the Food and Agriculture Organization (FAO) in May 2009 claimed that the world's fish stocks are seriously threatened by the growing presence of lost and discarded fishing gear that now make up about 10% of all marine litter.[85] The study found that large amounts of fishing gear lost or abandoned at sea has resulted in "ghost fishing," trapping and killing fish, seabirds and marine mammals. Moreover, discarded fishing equipment poses a serious hazard to ships, creating navigation problems and accidents.[86]

Lack of adequate reception facilities or their high usage costs tempt many ships to ignore MARPOL and dump their litter over board, especially in the high seas.[87] Annex V of MARPOL, which regulates the disposal of garbage from all vessels, is currently undergoing review by the IMO to address the issue.[88] There is a concern that a revision of MARPOL Annex V may leave shipping in a difficult position, with inadequate facilities for their reception in ports.

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83 *Ibid.*

84 *Ibid.*

85 UNEP and FAO, *Abandoned, Lost, or Otherwise Discarded Fishing Gear,* 2009, http://www.unep.org/regionalseas/publications/reports/RSRS/pdfs/rsrs178.pdf.

86 *Ibid.*

87 *Ibid.*

88 "Marine stocks hurt by abandoned fishing gear, finds UN study," 6 May 2009, UN News Center, http://www.un.org/apps/news/story.asp?NewsID=30714&Cr=fao&Cr1=fish.