STIMSON

Maritime Commerce and Security:
The Indian Ocean

Amit A. Pandya and
Rupert Herbert-Burns with
Junko Kobayashi

February 2011

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Preface

Globalization – or global economic integration – is among the handful of organizing principles for contemporary international relations. It has assumed a status as an analytical and explanatory tool on a par with traditional considerations such as geo-strategic location, national military power, size and natural resource endowment of territories, level of industrial development and human elements such as demography, educational endowment and culture.

Maritime commerce is now, and for almost all of modern history has been, the key to global trade and therefore to globalization. Indeed, we may trace the roots of modern globalization to the onset of the age of European maritime discovery half a millennium ago. Yet seaborne commerce remains a decidedly neglected dimension of the discourse on international relations.

The present work looks at the Indian Ocean as an increasingly vital maritime space. It looks at the maritime agenda from an economic and shipping perspective, but also factors in issues of security, from the safety of ships and their crews, to the larger security concerns of littoral states and major powers for whom the sea is a lifeline for prosperity and growth. We have organized this study, which we hope will serve as a useful reference document to diverse audiences, into three broad categories: Maritime Commerce, Maritime Infrastructure and Maritime Issues and International Security.

In addition to extensive research in the trade and academic press, this volume is based on field visits and interviews with scholars, government officials, and regulators, mariners, port officials and business executives in several sectors of the shipping industry. The authors visited ports and other maritime institutions in Singapore, Malaysia, Indonesia, India, Bangladesh, Pakistan, the United Arab Emirates, Egypt, Tanzania, Kenya and Mauritius.

Stimson's work on the Indian Ocean region began as part of a project conducted between 2007 and 2010 entitled Regional Voices: Transnational Challenges. That project sought to delineate and describe, from a multi-disciplinary perspective, the emerging security trends and challenges (environmental, economic, demographic, institutional, and in the realm of ideas) in the countries of Southeast Asia, South Asia, the Middle East and East Africa – in other words, most of the countries of the Indian Ocean littoral.

We saw developments in the maritime sphere – in resources, environment, governance, and security – as critical to the broader regional security environment; in a region of rapid economic growth, of shifting balances in economic and military power, and of emerging strategic competition. The first part of the work related to the Indian Ocean was embodied in *The Indian Ocean: Resource and Governance Challenges,* (Stimson 2009). It was followed by *Coastal Zones and Climate Change* (Stimson 2010), focused on the environmental dimensions of the Indian Ocean.

I am deeply grateful to Amit Pandya, currently serving in the US government, for his leadership of this project. He directed the Regional Voices program for three productive years, and co-authored this impressive study as a labor of love after his Stimson work was completed. Rupert Herbert-Burns, based in the UK, is a man of many maritime talents, based on his considerable experience in the Royal Navy, as a consultant to the maritime industry, and as a writer and analyst on maritime issues. Stimson has benefitted greatly from his contributions to our work on maritime issues, which will continue in 2011. Lastly, Junko Kobayashi, a Research Associate at Stimson from 2007 to 2009, provided important research assistance and was the principal author of the ports and environmental sections of the report.

Sincerely,

Ellen Laipson
February 2011

President and CEO
The Stimson Center

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Abbreviations and Acronyms

AIS	Automatic Identification System
APEC	Asia-Pacific Economic Cooperation
AQ	Al Qaeda
AQAP	Al Qaeda in the Arabian Peninsula
AQI	Al Qaeda in Iraq
ASEAN	Association of Southeast Asian Nations
AU	African Union
BCI	Baltic Exchange Capesize Index
BDI	Baltic Exchange Dry Index
Bpd	Barrels per Day
BRIC	Brazil, Russian Federation, India and China
Btm	Billion Ton Miles
C4I	Command, Control, Communications, Computers and Intelligence
CENTCOM	US Central Command
CINC	Commander-in-Chief
CJTF-HOA	US Combined Joint Task Force-Horn of Africa
CO2	Carbon Dioxide
CTF	Combined Task Force
DWT	Deadweight Tonnage
EIA	Energy Information Agency (US Department of Energy)
EiS	Eye in the Sky
EU	European Union
FEU	40-foot Equivalent Unit
FPSO	Floating Production and Storage Unit
FSO	Floating Storage Unit
GCC	Gulf Cooperation Council
GDP	Gross Domestic Product

GRT	Gross Registered Tonnage
GT	Gross Tonnage
ICC	International Chamber of Commerce
ICS	International Chamber of Shipping
ILO	International Labour Organization
IMB	International Maritime Bureau
IMO	International Maritime Organization
IPCC	Intergovernmental Panel on Climate Change
IRTC	Internationally Recognized Transit Corridor
IPSP	International Port Security Program
ISPS	International Ship and Port Facility Security Code
IWAS	Irregular Warfare at Sea
JWC	Joint War Committee
LMA	Lloyd's Market Association
LNG	Liquefied Natural Gas
LOA	Length Overall
LPG	Liquefied Petroleum Gas
LRIT	Long Range Information and Tracking
LSCI	Liner Shipping Connectivity Index
LTTE	Liberation Tigers of Tamil Eelam
MARLO	US Maritime Liaison Office (Bahrain)
Mbd	Million Barrels per Day
MDA	Maritime Domain Awareness
MNC	Multinational Corporation
MSC	Maritime Safety Committee (IMO)
MSC(HOA)	Maritime Security Center (Horn of Africa)
MSO	Maritime Security Operations
NATO	North Atlantic Treaty Organization
OBO	Ore/Bulk/Oil Carrier
OECD	Organization for Economic Cooperation and Development
PRC	Peoples Republic of China
PSI	Proliferation Security Initiative
RN	Royal Navy

Ro-Ro	Roll-on/Roll-off
RPG	Rocket Propelled Grenade
SCA	Suez Canal Authority
SIDS	Small Island Developing States
SLOC	Sea Lanes of Communication
SOLAS	Safety of Life at Sea Convention
STCW	Standards of Training, Certification and Watchkeeping for Seafarers
SUA	Convention for the Suppression of Unlawful Acts Against the Safety of Maritime Navigation
TCO	Transnational Crime Organization
TEU	20-foot Equivalent Unit
TNC	Transnational Corporation
TOC	Transnational Organized Crime
UAE	United Arab Emirates
UAV	Unmanned Aerial Vehicle
UHF	Ultra High Frequency
UIC	Union of Islamic Courts
UKMTO	UK Maritime Trade Organization
ULCC	Ultra Large Crude Carrier
UNCLOS	United Nations Convention of the Law of the Sea
UNCTAD	United Nations Conference on Trade and Development
UNFCCC	United Nations Framework Convention on Climate Change
US	United States
USCG	United States Coast Guard
USN	United States Navy
VBSS	Vessel Board Search and Seizure
VHF	Very High Frequency
VLCC	Very Large Crude Carrier
VLGC	Very Large Gas Carrier
VLOC	Very Large Ore Carrier
WBIED	Water-borne Improvised Explosive Device
WCO	World Customs Organization
WTO	World Trade Organization

Glossary

Armed robbery at sea:	An act of armed crime against a vessel and her crew inside territorial waters that may include theft of stores, cash and personal belongings, assault, kidnapping and seizure of the vessel.
Asymmetric warfare:	Armed conflict between belligerents whose relative military strength and tactical approach differs significantly, with the effect that the nominally weaker side will attempt to offset this inferiority by exploiting the vulnerabilities of the militarily stronger side.
Ballast:	Any weight (usually water) used to improve the stability of a vessel (usually when steaming with reduced or no cargo), or to change the trim or draft of a vessel.
Baltic Exchange:	The world's only independent source of maritime market information for the trading and settlement of physical and derivative shipping contracts. Members are responsible for a large proportion of all global dry cargo and tanker fixtures as well as the sale and purchase of merchant vessels.
Break-bulk:	Cargo that is conveyed as individual packages/parcels.
Bulk carrier (Bulker):	A vessel that conveys cargo (usually dry) in bulk form, such as iron ore or coal.
Bunkering:	The act of a vessel taking propulsion fuel onboard.
Classification society:	A non-governmental organization that certifies a vessel's seaworthiness and construction standards.
Combined task force:	A multinational coalition naval task force formed to address a shared maritime security problem or common foe.
Container rates:	Rate or charge for transporting a whole container (TEUS or FEU).
Container terminal:	Ship/shore interface with several different types and sizes of lifting equipment such as gantry cranes and straddle lifters, and gate/reception facilities for processing ground transportation.

Deadweight tonnage:	The total weight that a ship can carry, including cargo, bunkers, water, stores, and crew.
Demurrage:	A charge levied on cargo for delayed receipt of a container held in facilities/location at which the line incurs a consequential cost.
Dispatch:	Premium payment made for reducing the time a vessel must spend in port loading/discharging cargo.
Draft:	Depth of a vessel below the waterline (surface of the water).
Feeder vessels:	Small, short sea vessels (usually small container vessels or general cargo vessels) that transport cargo from local/regional ports to larger transhipment ports (load centres) from where it is shipped on much larger vessels to distant locations.
Freeboard:	Vertical distance from the waterline to the top of the weather deck.
Freight all kinds:	Also referred to as FAK, it is the standard rate, regardless of commodities, loaded into a container.
Freight rates:	Prices or rates charged for carriage of goods by sea.
General cargo vessel:	Multi-purpose vessels, designed to handle and stow a variety of freight. This may include forest products, manufactured goods, heavy equipment, vehicles, machinery, bagged goods, steel and food products, and containers.
Handymax bulk carrier:	35,000 – 54,999 DWT
Handysize bulk carrier:	10,000 – 34,999 DWT
Intermodal:	Conveyance system that encompasses different modes of transport (ship/road/rail) with minimal disruption to speed and flow of goods during transition process.
International Maritime Organization:	Specialised, self-governing agency that is part of the UN. Its role is to develop and maintain a comprehensive regulatory framework for shipping, including: safety, environmental concerns, legal matters, technical co-operation and maritime security.
ISPS Code:	An amendment to the SOLAS Convention on minimum security arrangements for ships, ports and government agencies. It prescribes responsibilities to governments, shipping companies, shipboard personnel, and port/facility personnel to "detect security threats and take preventative measures against security incidents affecting ships or port facilities used in international trade."

Large capesize bulk carrier:	150,000 DWT +
Liner service:	An ocean common carrier service (usually on panamax and post-panamax container ships) that operates on an established route, which has published, fixed sailing times and published tariffs.
Maritime security operations (MSO):	A term referring to the actions of naval forces to combat maritime terrorism and other illegal activities, such as smuggling, hijacking, piracy, and human trafficking.
Maritime terrorism:	A variant of terrorism that takes place within the maritime realm – at sea, onboard ships, against ships, within ports, on offshore infrastructure, and inland water ways and riverine areas. As with its terrestrial cousin, its objective is the application of violence for political aims. Piracy, which is perpetrated for financial gain, is NOT maritime terrorism.
MARPOL:	An IMO convention for the prevention of pollution by shipping.
Naval escort:	A warship, usually a of corvette, frigate or destroyer size, which is tasked with actively protecting merchant vessels (either solo or in convoy). Originally, in a wartime context of protecting convoys, these ships were employed primarily for anti-submarine warfare in wartime. In the contemporary context of MSO, naval escorts offer protection in the form of rapid reaction to a piracy attack, but are not usually engaged in continuously escorting groups of ships.
Panamax bulk carrier:	55,000 – 84,999 DWT/breadth <3231 m
Panamax container ship:	Breadth <32.31 m (no length restrictions)
Piracy:	As defined by UNCLOS, "piracy is any illegal act of violence or detention, or any act of depredation, committed for private ends…on the high seas (in international waters) against another ship…,or against persons on board such a ship in a place outside the jurisdiction of any state."
Post-Panamax container ship:	Breadth >32.31 m (no length restrictions)
Post-Panamax crane:	A gantry crane capable of servicing container ships of breadths greater than the Panamax-sized vessels (usually up to 17 TEUs across)
Q-Flex:	A membrane-type LNG carrier with a cargo capacity of between 210,000 m3 and 216,000 m3
Q-Max:	The largest LNG carrier class in the world. The name Q-Max refers to (Q) Qatar Max - the maximum size of ship able to dock at Ras Laffan terminal in Qatar. The Q-Max has a cargo capacity of 266,000 cubic meters.

Reefer:	Shorthand term referring to refrigerated vessels or cargoes.
Ro/Ro:	Roll-on/Roll-off vessels or cargoes.
Sea lanes of communication (SLOCs):	The primary maritime routes between ports and regions and/or seas areas that are used for commercial sea trade, logistics supply and naval forces.
Small capsize bulk carrier:	80,000 – 149,999 DWT
SOLAS:	The Safety of Life at Sea Convention is an IMO convention that specifically addresses the safe operation, practices of merchant ships, including the fitting and operation of relevant equipment such as life boats, emergency communications, and fire fighting.
String/loop:	The fleet or grouping of container vessels required to provide a required TEUS/FEU capacity and service frequency along a specific route, such as Europe to Asia.
SUA convention:	UN(IMO) protocol governing measures to prevent unlawful acts which threaten the safety of ships and the security of their passengers and crew from dangers of piracy, armed robbery and other unlawful acts. The main purpose of the convention is to ensure that appropriate action is taken against persons committing unlawful acts against ships. These include: the seizure of ships by force; acts of violence against persons on board ships; and, the placing of devices on board a ship which are likely to destroy or damage it. The convention obliges governments either to extradite or prosecute alleged offenders.
Suezmax tanker:	125,000 – 199,999 DWT
Tramp shipping:	A shipping service wherein the shippers contract to transport cargo in shipload consignments between ports designated by the charterer.
Transshipment port:	Very large hub ports that function to aggregate/consolidate cargo (usually containerised) from a number of smaller regional ports for onward shipment to distant markets/ports in high-volume liner services.
ULCC:	Ultra Large Crude Carriers of 350,000 DWT +
VLCC:	Very Large Crude Carriers of 200,000 – 349,999

Maritime Commerce and Security

Maritime commerce in the Indian Ocean is a particularly important component of global maritime trade: in volume, in the key resources and manufactured goods that it moves, and in the steadily expanding significance of the national economies that dominate its trade. These include East Asian economies, Indian Ocean littoral states, and those such as Europe, dependent on the Indian Ocean maritime trade. Even the United States and its American neighbors, most of whose trade with Asia traverses the Pacific, remain dependent on Indian Ocean trade by virtue of the dependence of their East Asian trade partners on sources of raw material transported across the Indian Ocean from East Africa, the Gulf, South Asia, or Australia. The Indian Ocean is where the greatest and most rapid change has been registered in maritime commerce, including investment in ports and vessels, and the emergence of entirely new maritime commercial powers such as Singapore, the United Arab Emirates, Qatar, and Saudi Arabia.

The economic shocks and uncertainties that registered throughout the world in the past two and a half years, especially the downturn in trade volumes, have seriously damaged commerce in the Indian Ocean and worldwide. Maritime commerce has been affected disproportionately. Despite the recovery in global trade volumes later in 2010[1], the shipping industry has failed to share in the extent of the recovery. Notwithstanding exceptions such as the reactivation of superfast Maersk line container ships that had been laid up at anchor, the placing of orders by Maersk for 10 huge container ships as large as aircraft carriers from Korea's Daewoo shipyards[2], or the government subsidized purchase of tankers in the Gulf, the shipping industry remains mired in uncertainty, weakness and overcapacity. Just days after announcing its order, Maersk warned that the post-crisis recovery of container shippping is already slowing, noting that fleet expansion was outstripping growth in demand to move goods.[3]

Some bare figures tell the tale most succinctly.

- In the course of 2009, port traffic in Singapore and Shanghai, the world's largest container ports, fell by 13.5% and 11% respectively.[4] During the same year, the global container fleet's carrying capacity increased by 5.7%.[5]

[1] "World Trade back at 2008 levels," *Financial Times*, 24 February 2011. CPB Netherlands Bureau for Economic Policy Analysis calculated a 15.1% increase in 2010 following a 13% contraction in 2009.
[2] "Maersk orders 10 huge container ships," *Wall Street Journal*, 22 February 2011.
[3] "Container shipping recovery slows, says Maersk," *Financial Times*, 24 February 2011.
[4] *Containerization International – News,* 12 January 2010.
[5] *Containerization International – Online,* 15 January 2010.

- In 2007, 535 container ships were ordered built. In 2008, 208 ships were ordered. In 2009, there were 2.[6]
- During 2009, container freight rates declined by one third and dry bulk rates by a half (at one time dipping to 10% of their pre-crisis levels).

The economic crisis' disproportionate impact on shipping reflects the excessively ambitious expectations and calculations of the industry – for example in ordering more vessels than necessary – and the particular characteristics and time-frames of investment decisions in the industry. These sources of weakness, instability, change and uncertainty in the industry also could lead to larger instability in the political and strategic environment.

Much of the modern international system appears to turn on issues of trading relationships and the control of and access to key raw materials. The size and shape of investments made by governments and businesses in merchant vessels, ports and navies reflects the centrality of these interests. The massive size of these investments raises the stakes. Precipitous and unpredictable changes of the sort that have afflicted shipping in the past two years cause uncertainties for all key actors, and thus challenge their planning assumptions and threaten to change their positions of relative commercial/strategic advantage. Adjustments that the industry is forced to make to accommodate the new reality, such as changes in routes for commercial or security reasons, can affect the advantages of ports and countries that rely on maritime traffic and may have invested in anticipation of steady increases in volume. This is likely to make states nervous for a variety of reasons.

[6] Clarkson Research Service Limited, *Container Intelligence Monthly,* January 2010.

Security and commerce have long been linked. At the dawn of the age of European global dominance, navies ceased to be platforms for artillery ancillary to armies and became tools for the protection of trading vessels and the policing of sea lanes. In the contemporary Indian Ocean, the close relationship between commerce and security has already manifested itself in a variety of forms. Piracy now reaches increasingly farther from the Horn of Africa and the Gulf of Aden into the deep ocean. Naval task forces involving a dozen nations have had mixed success in protecting these vital lifelines of commerce. A few years ago a concerted effort by the navies of the three littoral states – Singapore, Malaysia and Indonesia – and those of Japan and the US were necessary to beat back piracy in the Malacca and Singapore Straits, the busiest sea lanes in the world. Singapore's robust security posture in large part reflects its importance as a commercial and maritime nation. The Chinese Navy's presence in the Indian Ocean and Chinese commercial investments in port infrastructure have been perceived by India as an integrated source of strategic threat, and have occasioned a strategic rivalry between the two Asian giants.

Purpose of the Current Volume

There is no dearth of attention, from policymakers and commentators, paid to the broad theme of emerging security threats and challenges in the maritime sphere. The most casual perusal of news sources and of the output of policy research institutions reveals an acute interest in issues such as piracy on the high seas. There is also a substantial body of research and analysis devoted to strategic rivalry among established and emerging military powers,

particularly in the Indian Ocean. Perhaps of slightly more specialized interest, but still part of general discourse, are issues such as measures to secure ports and cargoes against terrorism and other crimes. These have attracted the attention of first rate scholars, analysts and commentators.[7]

On occasion, geographers or military sailors concern themselves with some dimension of it. The work of maritime economists is of great interest to a specialist community among trade economists,[8] and thus developments and trends in maritime commerce occasionally make their way into trade and international economic policy discourse in a limited fashion. What is rare among policymakers and analysts is a systematic awareness of the commercial maritime world in its own terms.

The current volume offers those outside the business, particularly strategic analysts, security policymakers and students of the politics of the region, a description and analysis of those commercial developments and trends in the world of shipping and ports that bear upon their work. The necessity for making this connection was demonstrated in interviews by the authors. For example, senior officers and policymakers of naval military forces acknowledge their lack of understanding of the *arcana* of marine insurance and the risk analysis it is based on. Insurers are only moderately more aware of the implications of bilateral and multilateral security policy for their business. Often there is an inchoate sense on both sides that commercial and security imperatives are at cross-purposes. Such mutual incomprehension is detrimental to both sets of interests.[9]

The goal is to provide the general reader, interested in the diplomatic, economic, development, or cultural dimensions of this part of the world, with a description and analysis of those aspects of maritime business which should be better understood by all. This is an overview of the field for the lay reader. It is not an exhaustive treatment of any of the elements it describes. It does attempt to cover many of the principal elements of maritime business, and to briefly describe their characteristics and their significance for broader political developments.

The trends described within demonstrate a source of instability born of the economic and technological characteristics of maritime commerce in general, and particularly under the conditions generated by recent developments in the technology and in the structure of the business. They constitute a significant source of instability in economies and therefore in the societies of affected nations. The very changeability of maritime commerce

[7] Almost too voluminous to list comprehensively, this literature includes such work as Peter Chalk, *The Maritime Dimension of International Security* (Rand, 2005); Rupert Herbert-Burns, Sam Bateman and Peter Lehr (eds.), *Lloyds MIU Handbook of Maritime Security* (Taylor and Francis, 2009); and Sam J. Tangredi, *Globalization and Maritime Power* (National Defense University, Washington, 2002); as well as the excellent work produced at the S. Rajaratnam School of International Studies in Singapore by Sam Bateman and Joshua Ho, and by Geoffrey Till at the UK Joint Services Command and Staff College.

[8] See for example the following: Hilde Meersman, Eddy Van de Voorde, and Thierry Vanelslander (eds.), *Future Challenges for the Port and Shipping Sector,* (Informa, 2009); Gordon Wilmsmeier, Jan Hoffmann and Ricardo Sanchez, "The Impact of Port Characteristics on International Maritime Transportation Costs" in Kevin Cullinane and Wayne Talley (eds.), *Port Economics* (Research in Transportation Economics Volume 16, Elsevier, 2006); and Jan Hoffmann, *Asian Countries' Specialization in Different Maritime Businesses: Challenges and Opportunities Arising from the Process of Concentration in Shipping,* Paper presented to IPSC, Karachi, May 2004. See also International Association of Maritime Economists, *IAME News,* (Quarterly).

[9] For an excellent review of the issues in marine insurance raised by the recent spate of piracy, see Joshua Ho, *Marine War Risk Insurance: Should the Government be Involved?* (Institute of Defense and Strategic Studies, Nanyang Technological University, Singapore, 10 March 2006).

can generate political insecurities, and therefore risky behavior, in the calculations of key actors, particularly big winners and losers in the process of economic change.

Maritime commerce is often opaque and incomprehensible to those unfamiliar with it, and the industry feels neglected and misunderstood by outsiders. To some extent this is perhaps the result of the invisibility of the sector. Despite the critical importance of seaborne commerce to the global economy, and therefore its great bearing on the livelihoods and lifestyles of substantial portions of humanity, its operations are routinely witnessed only by those carrying them out at sea or at ports, or in maritime business enterprises. The provision of services to maritime commerce such as insurance, financing, legal counsel, labor recruitment, design, and architecture are all highly specialized aspects of their respective professions. They are expressed in arcane terms and governed by highly distinct considerations.

Even within many cities that host significant ports, the consciousness of most inhabitants – those outside shipping related occupations – is hardly affected by the maritime sector. Nations with significant commercial maritime interests, even those with powerful military naval forces, often find political and policy discourse oblivious of maritime concerns, or at best restricted to specialist agencies and public officials. With rare exceptions (Singapore comes to mind), officials responsible for regulating or promoting maritime commerce find that their area of responsibility is not valued by government or citizenry, and that they do not enjoy the prestige of officials of equivalent rank in other areas of policy. This can have serious consequences for the interests of nations with significant maritime interests such as India—dependent on substantial seaborne trade, with an immense coastline, whose security interests have an important maritime dimension.

Established seafaring cultures in particular locations have declined substantially in the recent decades. Well into the twentieth century, the maritime commerce of major seafaring nations, such as the US and the UK, and of lesser maritime nations, was manned and sustained by the seagoing and navigation skills, and the technologies, developed and propagated between generations by traditional coastal cultures of seafaring livelihood. Activities such as fishing and coastal trade, in addition to international trade, contributed symbiotically to such cultures. These cultures enjoyed a distinct presence and recognition within their national cultures.

While certain coastal and insular nations still evince this link between traditional seafaring and participation in international maritime commerce (the disproportionate presence of Filipino and Sri Lankan sailors in the contemporary globalized merchant fleets of the world comes to mind) these have essentially become specialized and closeted aspects of the consciousness of their own nations.

It is essential that the general public understand better the predicament and particular considerations of an industry that is central to the global economy, and to other developments in international affairs that increasingly exercise policymakers.

Where the authors discuss the implications of trends in maritime commerce specifically for the Indian Ocean, those trends are for the most part global in scope. It could hardly be otherwise. The shipping industry is perhaps the most global of all industries, both in its reach and scope and

in its highly cosmopolitan character with respect to flags of registration, ownership patterns, and recruitment of crews. The industry's own structure manifests the far-flung supply chains and specialization characteristic of globalization in general. Most shipbuilding occurs in a handful of nations. Shipbuilders in particular countries specialize in particular types of ship. A small handful of nations specialize in repair and maintenance, and a handful of countries specialize in shipbreaking. Danes, Greeks and Norwegians are disproportionately represented among ship owners. Marine insurance, maritime law and ship-brokerage are dominated by United Kingdom entities.

Developments in the global maritime industry taking place quite outside the Indian Ocean, such as the state of supply and demand in types of ships, types of freight, and the behavior of investors and lenders can have implications for the trade, ports, workforces, and national economies of the Indian Ocean littoral. Conversely, developments in the maritime industry in the Indian Ocean, and other political or strategic factors that bear upon it, can significantly affect nations and economies far away, given the high and increasing proportion of global economic activity that is related to nations located on the Indian Ocean, or those such as China with significant presence in its maritime commerce.

The Geographical Contours

Geography is where commercial activity and strategic interests intersect. Witness the strategic energy devoted for decades to the Suez and Panama Canals and the extent to which the large geo-strategic calculations and actions of global military powers such as the United States and the United Kingdom were devoted to their protection. Geography both facilitates and constrains maritime commerce. An examination of the Persian/Arab Gulf or the Gulf of Aden/Horn of Africa illustrates this exactly. The locations to be accessed for purposes of trade are reached through narrow navigable waterways, which in themselves constrain navigation routes, while the shores of such waterways are crowded with contending nations and forces, to say nothing of geo-morphological perils. The patterns of trade routes are determined in large part by the locations of the points of trade, but they in turn are facilitated, threatened or simply constrained by the nature of the

Case Study: The Straits of Malacca and Singapore

These straits have often been considered the busiest and most crowded in the world, and the most susceptible to collision or other accidents, as well as the possibility of a terrorist incident. As a result, the littoral states – Indonesia, Malaysia and Singapore – have adopted a Cooperative Mechanism on Safety of Navigation and Environmental Protection for the Straits under the UN Convention on the Law of the Sea, and instituted joint traffic monitoring and information mechanisms. However, there is a high degree of variance in the available planning information and models.

In 2007, for example, a study by the Japanese Ministry of Land, Infrastructure and Transport and the Nippon Foundation projected 141,000 vessels by 2020. In mid-June 2009, a study by the Maritime Institute of Malaysia assessed the maximum capacity of the Malacca Strait at 122,640 vessels, and that this number would be reached in 2024.

In October 2009, the Maritime and Port Authority of Singapore presented to the 34th Tripartite Technical Experts Group (TTEG) a study indicating that in 2007, 257,000 vessels moved through the Singapore Strait, the narrowest point of the Straits of Malacca and Singapore, based on reports to the Singapore maritime authorities. The study concluded that a doubling of the traffic was sustainable, with enhanced technologies and traffic management measures.

coasts, channels or waters they must traverse—peopled, exploited, policed, patrolled, or otherwise used by nations and groups with varying interests. Geography, the description and analysis of distribution in space, is clearly as essential as economics to an understanding of maritime commerce itself and of its relationship to the strategic postures of key players.

With a total surface area of 73,556,000 square kilometers (28,400,000 square miles), the Indian Ocean is the third largest of the world's oceans. It comprises some 20% of the total water surface area of the planet. The average depth of the ocean is 3,890 meters (12,760 ft), and its deepest point is in the Java Trench (or Sunda Trench), which has a maximum depth of 7,725 meters (25,340 ft).

The parameters of the study are bounded in the north by the Indian subcontinent; to the west and northwest by the east African coast and Arabian Peninsula respectively; to the east by Thailand, the Malay Peninsula, Indonesia, the Sunda Islands, and Australia; and, to the south by the oceanic margin with the Southern Ocean at latitude 60° S. The western extremity of the Indian Ocean is delineated from the Atlantic Ocean at the 20°E meridian running south from Cape Agulhas in South Africa to 60°S latitude. The eastern extremity is from the Pacific Ocean at its eastern-most extremity at the 147°E meridian, running south from South East Cape on Tasmania to 60°S latitude. The northernmost extent of the Indian Ocean is the Iranian port of Bandar Imam Khomeini (Bandar Shahpour) at latitude 30° 25' N in the Persian Gulf.[10]

[10] Lloyd's Maritime Atlas of World Ports and Shipping Places (London: Lloyd's Marine Intelligence Unit, 2005).

This global view illustrates the terrestrial and maritime boundaries of the Indian Ocean, and also shows the access spaces and chokepoints. The three largest access spaces are south of the equator: between the southern extent of the African continent and Antarctica, between the southern extent of Australasia and Antarctica, and via the Timor Sea, which separates the Indonesian Archipelago and Australia. North of the equator, the Indian Ocean is accessed via two major chokepoints: in the northeast at Bab el Mandab (which straddles the Red Sea and the Arabian Sea), and in the east via the Strait of Malacca.

Coastal States and Associated Littorals

The Indian Ocean comprises a diverse collection of 36 states, which between them have 35.39% of the world's population, but generate only 10.003% of global GDP.[11]

The states within the Indian Ocean region include: Australia, Bahrain, Bangladesh, Comoros, Djibouti, East Timor, Egypt, Eritrea, India, Indonesia, Iran, Iraq, Israel, Jordan, Kenya, Kuwait, Madagascar, Malaysia, Maldives, Mauritius, Mozambique, Myanmar, Oman, Pakistan, Qatar, Saudi Arabia, Seychelles, Singapore, Somalia, South Africa, Sri Lanka, Sudan, Tanzania, Thailand, United Arab Emirates, and Yemen. All these states combined have 38.13% of the world's total coastline, which is dominated in order by Indonesia, Australia, India, Madagascar,

[11] World Bank 2008 data and national and UN data sets.

Case Study: Sethusamudram – Dredging the Palk Straits

When the Government of India announced its intention to proceed with a major project to deepen the channel between India and Sri Lanka to allow larger vessels to navigate it, it encountered multifaceted opposition. The Government of Sri Lanka objected on the grounds of security and environmental concerns. Fishers in both countries objected to the likely devastation of fisheries. Indian advocates of environmental protection objected on the grounds that it would alter the ecosystem and destroy natural barriers to storm surges. Devout Hindus objected on the grounds that the project would destroy a causeway described in the scripture Ramayana as having been constructed for the benefit of the divine Rama's army to complete the defeat of the forces of evil ensconced in Lanka.

In many respects, this case encapsulates almost all of the issues raised by significant infrastructure projects around the Indian Ocean. Primary among them are environmental considerations. The oceans, and particularly coastal zones, are particularly delicate ecosystems, and therefore highly vulnerable. Other elements include the ways in which significant alterations of nature also alter the geopolitical baseline expectations and calculations of nations. What is also notable in this case is the similarity it bears to the case of the proposed port development at Lamu in Kenya. In both cases, concerns about environmental impact are closely joined to concerns about destruction of cultural and historical heritage.

There is no disagreement that dredging would have to be continuous if the channel is to be maintained at navigable depth. Such dredging, along with the impact of substantial traffic in large vessels, including their emissions, would alter the sub-surface geology, the currents and tides, and the aquatic life and livelihoods based on it.

What is curious is the limited utility of a project that is likely to create such radical changes. The justification offered for the project was that it will shorten the sailing time of ships passing between India's west and east coasts. Upon closer examination, it appears that the enlarged channel will remain un-navigable by the largest ships, which will have to continue to sail around Sri Lanka. The financial calculus is also highly dubious: high tolls for passage would reduce the benefit of using the route, whereas low tolls would be unlikely to recoup the considerable capital and ongoing expenses of the project. Were the proposed channel like the Suez or Panama canals – a substantial saving of sailing distance – the calculus could be favorable. The marginal benefit of not sailing around Sri Lanka appears less so. In recognition of this, the appointment of an expert panel headed by Nobel laureate R.K. Pachauri appears to have slowed implementation of the proposal.

Malaysia, Thailand, Somalia, South Africa and Saudi Arabia.

Owing to the economic benefits that derive from access to sea transport and trade, including fisheries, tourism and recreation, population settlements within virtually all countries of the world that have maritime access are often more concentrated in the coastal areas than the interior. Given the significant proportion of the world's population that lives within the Indian Ocean region, and the fact that the region has almost 40% of the globe's total coastline, the significance of the Indian Ocean is profound.

Vulnerable Passages and Chokepoints

The geography of the Indian Ocean presents a higher number of straits, passages and other "chokepoints" than any other. These constitute a significant constraint on trade in the Indian Ocean, owing to the limits on the types of ships that can physically navigate them, the influence of particular countries that may be exercised to the disadvantage of ships from one or another nation, and because of the existence of geo-political tensions born of physical proximity or competing interests in freedom of navigation.

The major chokepoints in the Indian Ocean include: Bab el Mandeb, the Strait of Hormuz, the Strait of Malacca, the Suez Canal and the Lombok Strait.

1

Maritime Commerce

Introduction

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]

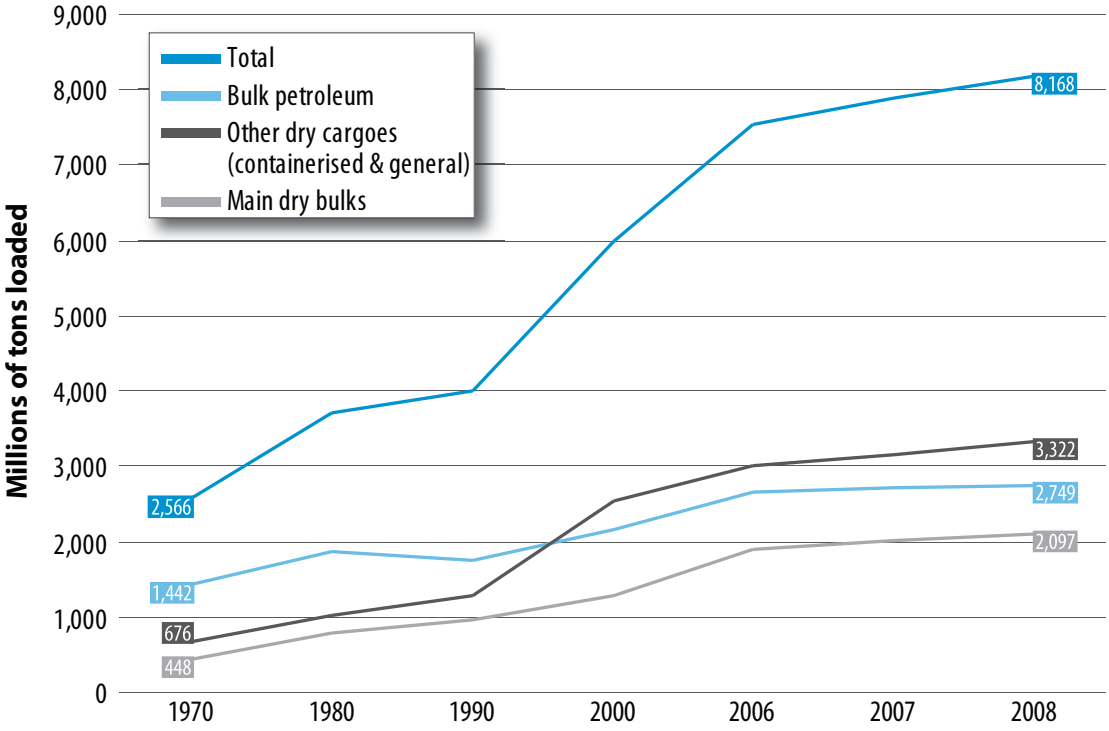
[48] Tariffs and other import restrictions have declined sharply. Foreign direct investment (FDI) and other inflow of foreign capital have been significantly eased. The ratio of trade to Gross Domestic Product has increased. Exports of goods and capital have assumed greater significance for economic 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

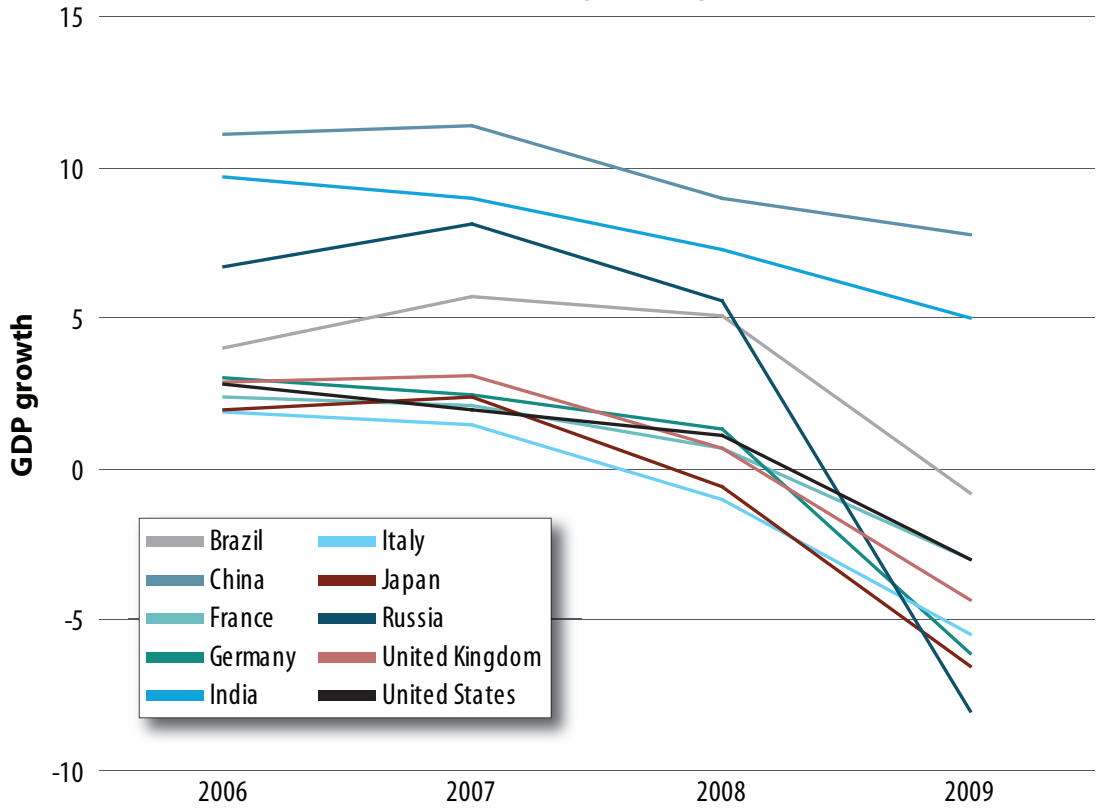
Most significantly, the table above illustrates the fall in demand for finished goods made in Asia (principally in China) from the United States and the major economies in Europe. The biggest fall is in trans-Pacific liner trade between China and Japan to the United States.

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)

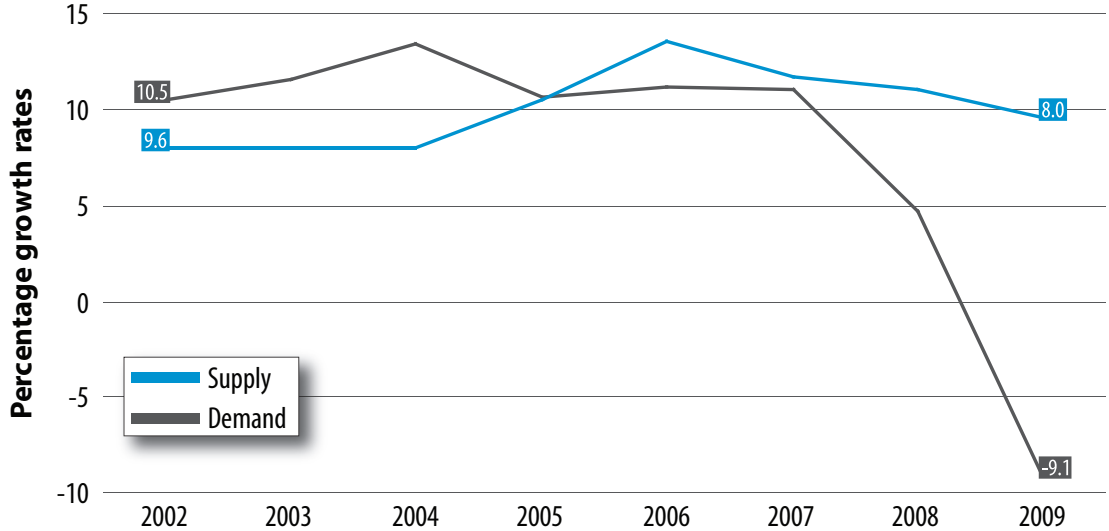


	2006	2007	2008	2009
Brazil	4.00	5.70	5.10	-0.80
China	11.10	11.40	9.00	7.80
France	2.40	2.10	0.70	-3.00
Germany	3.00	2.50	1.30	-6.10
India	9.70	9.00	7.30	5.00
Italy	1.90	1.50	-1.00	-5.50
Japan	2.00	2.40	-0.60	-6.50
Russia	6.70	8.10	5.60	-8.00
UK	2.90	3.10	0.70	-4.30
US	2.80	2.00	1.10	-3.00

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]

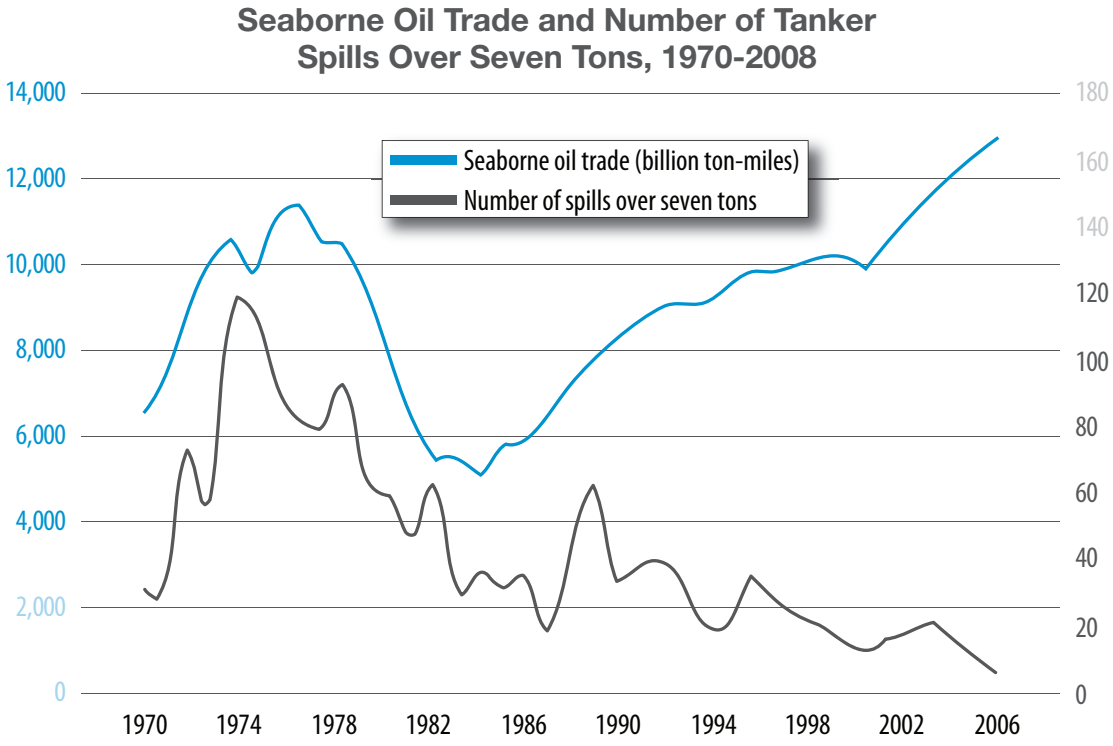
According to a United Nations Environment Programme (UNEP) report from 2008, oil inputs and spills to the seas have been reduced by 63% compared to the mid-1980s. Oil spills from tanker accidents have declined by 75%, from tanker operations by 90%, and from industrial discharges by some 90%.[74] Although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

Maritime Infrastructure and Labor

2

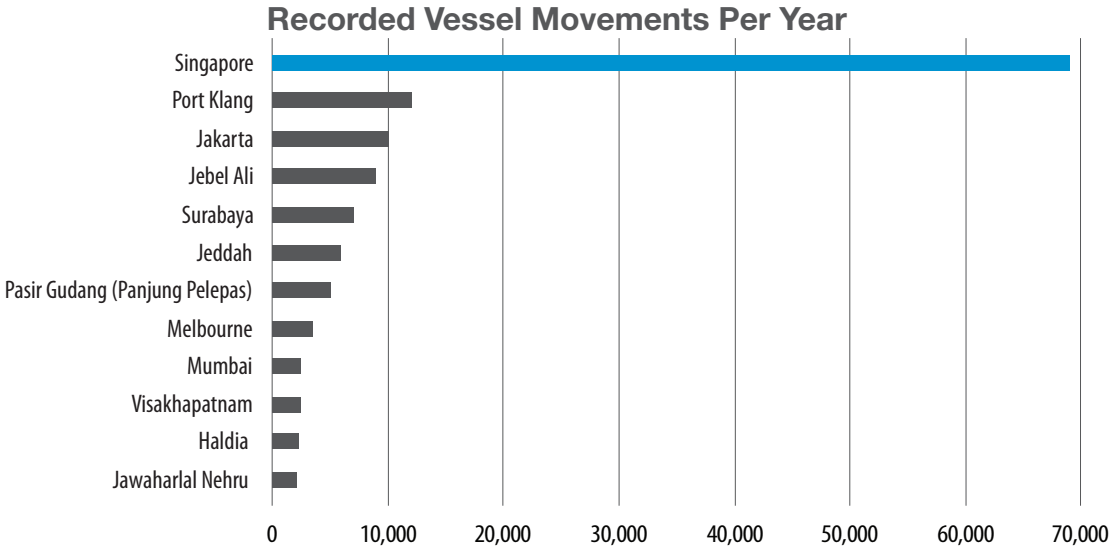
Major Ports and Terminals

The large-scale and rapid processes of change in maritime commerce described hitherto have given rise to significant changes in the industries that constitute the essential components of shipping, notably shipbuilding, shipbreaking (recycling) and ports. They have given rise to equally substantial changes in the workforces of international shipping. Yet further changes will need to take place, particularly in the area of labor, if maritime commerce is to continue to serve effectively, and improve its responsiveness to, the global economy. In some areas such as shipbreaking, the collateral costs of the industry will need greater attention from policymakers struggling to respond to the current realities of the shipping business and to integrate it into its larger social and political context.

Ports and Terminals

A list of important ports and terminals (measured by numbers of vessel calls) in the Indian Ocean is found in Appendix I. Often, ports of secondary importance in terms of vessel calls need to be considered because they are significant for particular cargoes or commodities.

The countries with ports that have the most significant trading/shipping activity profiles (including those that handle large volumes of passing traffic, such as Egypt and Singapore) are Australia,



Source: Lloyd's MIU

Egypt, India, Indonesia, Malaysia, Saudi Arabia, Singapore, and the United Arab Emirates. Second-tier countries important to trade in one particular commodity or with significant general levels of trading shipping activity are Bangladesh, Iran, Iraq, Kuwait, Oman, Pakistan, Qatar, South Africa and Sri Lanka.

It is apparent that the vast majority of activity is located in Asia rather than Africa. This is commensurate with numbers of ports; foreign direct investment (FDI) in the commercial maritime sectors; port and terminal infrastructure development and handling capacity; country sizes, populations and export/import volume requirements.

The graph of vessel movements at the 12 principal ports in the region on the previous page indicates the clear dominance of Southeast Asia, the prominence of the Arab/Persian Gulf, and the significance of Indian ports, which may be expected to grow if current trends of Indian economic growth are sustained.

These ports constitute the primary nodes of maritime trading activity in the Indian Ocean region, and in many respects determine the pattern of major oceanic shipping links within the Indian Ocean. The clear difference between Singapore and the other ports is stark. These nodes also act as magnets for investment in infrastructure by major port terminal operating companies and shipping lines.

Ports

The location of ports has, along with the patterns of sea lanes, long been one of the essential elements of the geography of strategic power in the maritime realm. Changes in the relative importance of ports, caused by shifting of trade patterns or by the availability of superior natural or technical facilities elsewhere, has often caused profound changes to the relative importance of coastal nations. For example, less than half a century ago, the Yemeni port of Aden enjoyed great importance as a lynchpin of the Indian Ocean trades. Today, despite the continuing importance of the sea lanes along which it sits, it is decidedly marginal. This is not only because it is in a highly unstable country, but also because its infrastructure is uncompetitive and it has been eclipsed by massive new ports along the Arab coast of the Gulf which were mere coastal villages a few decades ago.

With the increasing importance of trade in petrochemicals in the global economy, and the entry of significant numbers of additional suppliers and consumers into the global market for these, the location of terminals for the export of crude oil and liquefied natural gas, and for the refining of them and export of refined products has also assumed a large strategic significance.

Where these ports and terminals are located determines the precise contours of sea lanes, their volumes of traffic and relative importance, and thus assumes an all-important role in the strategic calculations of the concerned coastal states. Most port developments reflect commercial imperatives, but some such as Chinese investments in Hambantota and Gwadar in South Asia and Lamu in Africa may also be perceived by the principal or other nations as political and strategic.

The rapid increase in the volume and complexity of maritime trade in the Indian Ocean, accompanied by the increase in technical sophistication of vessels and ports, has also resulted in rapid development of land-based infrastructure, at ports and in the form of land transport connections. This has had, and will have, environmental consequences, particularly serious in inherently fragile coastal ecosystems, [89] as well as affecting the political and occupational sociology of localities where ports are situated.

Substantial capital is also required to finance development of infrastructure, in order to serve the imperative for ports, governments and local maritime enterprises and export (and import) dependent sectors to remain competitive. Owing to the paucity of investment capital available in many Indian Ocean littoral states, and because the global economy has internationalized ownership and investment patterns

[89] See generally, David Michel and Amit Pandya (eds.), *Coastal Zones and Climate Change*, (Stimson, 2010).

for all economic activity, the development of port and related infrastructure has offered opportunities for foreign entry into what was traditionally sensitive strategic infrastructure. Increasingly, new ports or expansions of existing ones are financed either by foreign sovereign or quasi-sovereign capital, often Chinese, Singaporean or Emirati, or by foreign corporations based in the Indian Ocean or in Europe. In some instances ownership, and in other instances control of ports, is expatriated.

Among the significant expansions that are underway are those at Dubai, Bahrain, Djibouti, Karachi, Mumbai and Mombasa. Among the new port developments that have potential significance as strategic game-changers are the following:

- The deep water port of Ehoala at the southern tip of Madagascar, which opened in mid-2009. Eighty percent of the $270 million project was funded by Rio Tinto, the global mining firm, and 20% by the government as part of a World Bank supported regional project.
- The proposed development of a major new port at Lamu in northern Kenya, which would dwarf the major port of Mombasa.
- Gwadar in Balochistan on the western coast of Pakistan.
- Hambantota in southern Sri Lanka, to add to the port capacity available in Colombo and Trincomalee.

The potential strategic significance of port developments may be understood by reference to the existing expansion of Djibouti and the proposed establishment of a massive and entirely new port at Lamu. Each will seek to reconfigure the relationship of hinterlands to oceanic trade by establishing new and enhanced points of egress for the region of Ethiopia and southern Sudan. This clearly has the potential to affect and be affected by the jockeying over the political order in southern Sudan and over control of hydrocarbon resources there, as well as providing a means of export for the agricultural production of foreign owned land in Ethiopia. Quite evident also is the close proximity of these ports to some of the most dangerous sea lanes in the world. Whether enhanced trade through such ports is abnormally vulnerable, or it is secured by significant military presence and activity, it clearly in either case bears closely upon security calculations of investors, exporters, importers, ship owners, and insurers.

China is now increasingly the leading player in the Indian Ocean in the ports and shipping sector, particularly in Eastern Africa. For African countries, China's role is huge as an importer of raw materials and a supplier of goods. It is also significant as an investor in infrastructure—ports, airports, roads, and railways. China has poured as much as $40 billion into the Africa region over the past decade, most of it in the form of bilateral and project financing aimed at maximizing trade relations. It has been reported that China is strengthening its position in Africa by providing $10 billion in low-cost loans for ports and other infrastructure over the next few years.[90] It is investing billions of dollars to expand the airport and build other infrastructure in Mauritius.

One characteristic that distinguishes ports from other sectors of the global economy, including shipping, is their hard and fast geographical constraints. An investment made in a particular port is not fungible in the least, unlike the use of petroleum tank-

[90] "Beijing to lend $10Bn in Africa," *Fairplay Daily News*, 10 November 2009.

ers as storage devices. Thus, the stakes are much higher in the competition for business between ports, and in the consequences of unanticipated changes to their significance as a result of changes in patterns of trade.

Port Development Trends[91]

Over the past year, the global economic crisis led to a significant decline in cargo volumes and revenue at many ports. Dealing with congestion, keeping up with new information technology and equipment, improving port services, port security, environmental protection, and regional cooperation remain key challenges for emerging ports. To a large extent, opportunities and challenges for port development go hand in hand with developments in the shipping industry including ship design. For instance, ports have had to expand and acquire bigger and more sophisticated equipment to accommodate increasingly large and gearless containerships.

A longer term problem in some parts of the Indian Ocean has been congestion. This began with the rapid growth of container traffic in the 1980s and 1990s, as the effects of containerization of cargo reached all parts of the global maritime trading system, including ports that were patently unprepared for it. Congestion can be reduced through improving efficiency of port operations, and this is where investment in infrastructure, including information technology can be significant. Customized software and networks help to make port operations more standardized, cost-efficient, transparent, safe, customer-friendly and substantially improve cargo handling turnaround times. The application of IT also can enhance connectivity with road and rail transport networks to also improve efficiency of cargo handling.

An issue of great concern in the past decade has been threats to security and safety. This work does not discuss at any length the issues raised in supply chain and port security. This area has been intensively addressed by policymakers and analysts since at least the attacks of September 2001 on the United States.[92] It is sufficient for our purposes to note that the administrative and logistical challenges of implementing measures to secure cargo from terrorist threats, and the expenses involved in improving security, have burdened the lower end ports of the Indian Ocean and governments of poorer countries. This has placed a premium on the ability of these ports and governments to attract outside expertise and investment. In a trading system where integrated logistics are essential to the speed of transshipment upon which suppliers, shippers, consignees, and retailers all depend, the additional delays, expenses and risks constitute significant additional burdens for port operations.[93]

The International Ship and Port Facility Security Code (ISPS Code) was formulat-

[91] For a useful general introduction to the factors that determine the direction of port development see Hilde Meersman, Eddy Van de Voorde and Thierry Vanelslander, "Scenarios and Strategies for the Port and Shipping Sector", in Hilde Meersman, Eddy Van de Voorde and Thierry Vanelslander (eds.), *Future Challenges for the Port and Shipping Sector,* (Informa, 2009).

[92] Henry H. Willis and David S. Ortiz, *Evaluating the Security of the Global Containerized Supply Chain,* (RAND Corporation, 2004).

[93] *Maritime Security: ISPS Code Implementation, Costs and Related Financing,* (United Nations Conference on Trade and Development, 2007). The cost estimates for implementation of new ISPS requirements are entirely speculative, ranging between start-up figures of $3,000 and $35.5 million per port, and annual figures of between $1,000 and $19 million per port. "Ports pay billions for security," *Ports and Harbors,* May 2007.

ed by the International Maritime Organization in response to the perceived threats to ships and ports in the wake of the 2001 terrorist attacks against the US. The Code provides a comprehensive set of measures to enhance the security of ship and port facilities, and there are now 148 parties to it. When port authorities in Tanzania, Kenya and Mauritius were asked about port security, they claimed that they are fully compliant with the Code, but the question is how effective security really is beyond formal compliance with prescribed procedures. In the field of maritime and supply-chain security, there are ongoing efforts to implement and refine relevant legal instruments and standards.

Privatization and Public-Private Partnerships

Governments in many countries traditionally regarded ports as national strategic assets that should be publicly controlled. But over the past two decades, there has been an increasing trend towards privatization of port ownership, management, and operations for existing public ports and new ones. There is also a growing separation of the roles of port authority and port operator. Port authority is increasingly focusing on policy and regulatory roles while private port operators and service providers are taking over a range of port-related services.

The trend of privatization has been driven by the high cost of port modernization, and the requirements of efficiency, sophisticated technology, expertise and innovation. According to the United Nations Conference on Trade and Development (UNCTAD), 42% of world container throughput passed through state-owned terminals in 1993 but this figure was down to 19% by 2006. While the overall volumes for state-owned terminals since 1996 have remained the same, privately owned terminals have been growing rapidly.[94] Most of the top 100 container ports today have some form of private participation.

Leading lines such as Maersk and APL have expanded into managing container port operations at various locations, taking advantage of their expertise in the container trade. Port Tanjung Pelepas in Malaysia is 30% owned by the shipping line Maersk Sealand.

Although privatization is not a new trend, it remains highly significant in the ports of the Indian Ocean. For instance, the Indian Government recently launched public-private partnership initiatives to develop port logistics and increase capacity to address the doubling of port traffic over the past decade. Kenyan government policy now is to enhance public-private partnership (PPP).

Global Port Operators

The process of privatization and deregulation has led to the rise of the top five global port operators—DP World, PSA International, Hutchinson Port Holdings (HPH), APM Terminals, and COSCO. (See Appendix II for a detailed description of the principal global port operators.) The emergence of these global operators through a spate of mergers and acquisitions brought many opportunities for developing economies, including sharing of expertise in management and operational techniques, infrastructure planning, international finance, and new equipment tested in other locations. These global port developers and operators are likely to dominate future port development.

[94] UNCTAD, "Globalization of port logistics," 2008, page 4.

It is apparent that, for all the benefits of capital and expertise that the involvement in port operations of these industry giants can have, the emerging pattern of ownership structures among port operators can potentially have deleterious effects. It can be anti-competitive in reducing the options and choices of ports and governments. To the extent that many of these companies are also either state or parastatal enterprises, questions arise over sovereign control of what is clearly a highly strategic infrastructure asset.

Impact on Ports of Global Economic Downturn

As a result of the global economic crisis and major downturn in international trade, ports faced a sharp fall in volumes and revenue in 2008-2009. Singapore, the world's busiest transshipment hub had throughput for the first quarter of 2009 of 6.02 million TEU, down 17.9% from the same period a year earlier. Dubai's Jebel Ali port was also particularly affected by the downturn because of its status as the Gulf's main transshipment hub. Ports that mainly handle transshipment business are in a weak position when it comes to an economic downturn because shipping lines can easily switch between transshipment ports or change their routes to cut out transshipment. African ports were also hit, though less so than in more developed parts of the world. Tanzania's central bank announced that cargo shipped through the country's Dar-es-Salaam port fell 25% in the first half of 2009.

The following four biggest global port operators—Hong Kong's Hutchinson Ports, Singapore's PSA, Denmark's APM Terminals and Dubai's DP World—cut costs, laid off staff, delayed or cancelled new construction projects, and improved terminal efficiency. DP World faced a 10% decline in consolidated volumes across its portfolio of 49 terminals.

Mohammed Sharaf, Chief Executive of DP World, and others in the industry believe the downturn could prove ultimately healthy for operators if it helps them to learn to control costs better.[95] The crisis became an opportunity to revisit port and shipping management and operation strategies. The crisis also led banks to significantly tighten port financing in terms of both debt finance and capital for new project developments or acquisitions, and place greater emphasis on risk assessment. As securing finance from traditional sources has become more challenging, financial resources may increasingly come from alternative sources such as infrastructure funds and private equity.

Environmental Considerations

The environmental impacts of the construction and operations of ports are important because they can threaten the social consensus and therefore the stability upon which ports depend. Environmental changes occurring for other reasons can have significant impact on the physical infrastructure and natural features such as channels upon which the operations of ports depend. In a world marked by pervasive and rapid changes, impacts on ports can arise from the environmental consequences of exploitation of marine resources, while the impacts of port related changes such as dredging of channels or modification of tides and currents can

[95] "Ports face crisis as volumes fall," *Financial Times*, 26 November 2009.

have far reaching effects on livelihoods from fisheries or tourism.[96]

The major Green Port international conference that has been taking place annually since 2005 is a sign of the growing importance of environmental issues to ports. Attended by numerous stakeholders (including port operators, regulatory bodies, and local government officials) across the globe, such an event allows for training and sharing of expertise in port environmental issues such as environmental regulations, port technology and renewable energy.[97] Governments and port developers have reason to take environmental issues seriously. Port infrastructure and maritime logistics are likely to be adversely affected by changes in coastal ecologies and currents, high temperatures, sea level rise, floods, inundations, and extreme weather events. This is already in evidence. Cyclones have caused damage to ports in parts of the world such as Bangladesh. Floods during cyclonic weather conditions have caused major disruptions to container terminal operations in Mauritius, which led the port authority to recently construct a concrete wall along the terminal to prevent this recurring problem. Hydrologists of the Tanzania Ports Authority have noted that it has become increasingly difficult to calculate tidal movements important to the calling in of shipping vessels. That port authority is now in the process of conducting a climate change impact assessment.

Port infrastructure development may in itself cause considerable damage to the environment. Environmental impact assessments are often conducted negligently in developing countries, and, even if not, can only anticipate problems that will arise to a limited extent. Dredging activities at ports have caused damage to mangrove forests in Kenya, as they have disturbed the delicate balance between freshwater and seawater necessary for the survival of mangroves. Environmentalists recently opposed a port expansion project in Tanga in northern Tanzania because it would endanger a very rare species of fossil-like fish that resides there.

The Dhamra Port project at Bhadrak in Orissa, India has recently attracted considerable attention because of its proximity to vulnerable Olive Ridley turtle nesting and mating grounds at Gahirmatha beaches,[98] and to India's second largest mangrove forest at Bhitarkanika. The port, under joint development by Tata Steel and L&T, an Indian conglomerate, had been the subject of an environmental impact assessment. This assessment has been widely criticized by scientists, politicians, non-governmental advocacy organizations, and individual signatories.[99]

Transshipment Patterns in the Indian Ocean Region

The transshipment of containerized cargoes and the evolution of regional port hubs for this purpose has been one of the most noticeable and important developments in modern trade by sea, and this phenomenon is well represented in the Indian Ocean where several strategically vital facilities have evolved during the last

[96] See David Michel and Amit Pandya (eds.), *Coastal Zones and Climate Change* (Stimson, 2010). Though not a discussion of ports, the essays in this volume address many of the key environmental change processes that should be considered by port developers.

[97] See more detail at GreenPort website, www.greenport.net.

[98] IUCN Press Statement, "Vulnerable Olive Ridley turtles find diverse support in Orissa, India," 3 March 2009.

[99] "Tata sues Greenpeace over 'damaging' turtle game," *The Guardian,* 27 July 2010.

two decades. The tables and charts that follow reveal the relative importance of the various transshipment hubs around the Indian Ocean, which can be seen relative to one another in terms of total containers handled per year.

The list of ports was compiled from the American Association of Port Authorities (AAPA) ranking of the world's largest container ports. Of the 125 ports listed in the AAPA ranking, 22 are located in the Indian Ocean. There are four categories of ports in the table above based upon cargo handling capacity.

It is clear that Singapore accounts for almost 33% of all the volume handled throughout the entire Indian Ocean; it processes more containers than the next four ports combined – Jebel Ali (UAE), Port Kelang (Malaysia), Tanjung Pelepas (Malaysia) and Jawaharlal Nehru (India). Viewed at a state level, Singapore, Malaysia and the UAE handle almost 65% of all the containerized trade in the Indian Ocean, which in geopolitical terms means that the two primary container trading synapses in the Indian Ocean region are the Persian Gulf and the Malacca Straits.

Major Transshipment Hub Ports

Rank	Port	Country	TEUs	% of Total
1	Singapore	Singapore	27,935,500	32.71
2	Jebel Ali	UAE	10,653,026	12.47
3	Port Kelang	Malaysia	7,118,714	8.34
4	Tanjung Pelepas	Malaysia	5,500,000	6.44
5	Jawaharlal Nehru	India	4,059,843	4.75
6	Tanjung Priok	Indonesia	3,689,783	4.32
7	Colombo	Sri Lanka	3,381,693	3.96
8	Jeddah	Saudi Arabia	3,067,563	3.59
9	Salalah	Oman	2,639,000	3.09
10	Durban	South Africa	2,511,704	2.94
11	Melbourne	Australia	2,256,603	2.64
12	Sharjah / Khor Fakkan	UAE	2,173,867	2.55
13	Bandar Abbas	Iran	1,686,335	1.97
14	Karachi	Pakistan	1,431,530	1.68
15	Madras	India	1,128,000	1.32
16	Dammam	Saudi Arabia	1,087,395	1.27
17	Chittagong	Bangladesh	958,020	1.12
18	Johor	Malaysia	927,284	1.09
19	Penang	Malaysia	925,991	1.08
20	Chennai	India	886,000	1.04
21	Port Mohammead Bin Quasim	Pakistan	716,158	0.84
22	Mundra	India	671,000	0.79

Source: American Association of Port Authorities

Transshipment Traffic by Country

Country	% of Total
Singapore	32.71
Malaysia	16.95
UAE	15.02
India	7.9
Saudi Arabia	4.87
Indonesia	4.32
Sri Lanka	3.96
Oman	3.09
South Africa	2.94
Australia	2.64
Pakistan	2.51
Iran	1.97
Bangladesh	1.12

Source: American Association of Port Authorities

Regional Trends

Ports in Southeast Asia and the Persian/Arab Gulf now lead the industry in terms of increased efficiency and highest productivity. In the Indian Ocean region, the busiest ports are in Singapore, Malaysia, Dubai, and India.

In Southeast Asia, the major features are the port of Singapore's predominance as a global port; the ancillary industries that it has also taken leadership in, including professional and other services to shipping, and petroleum refining; the secondary benefits it has spawned as far away as Indonesia in development of services

Case Study: Lamu

A major port is planned in Lamu, 300 kilometers north of Mombasa. A railway link to Southern Sudan and Ethiopia is also to be constructed. Lamu Port is envisaged to be twice the size of Mombasa, with a deeper draft able to accommodate bigger vessels. China's role as the lead investor in Lamu will have significant economic and strategic implications. Lamu Port is intended to provide direct access to Southern Sudan. The prospect raises several difficult issues.

The port will offer state of the art facilities for direct trade between Southern Sudan and the ocean. This will alter the geopolitical configurations, and will almost certainly be a significant factor in the strategic positioning of the principal Sudanese interests around the independence of Southern Sudan. Such direct access to Southern Sudan's oil, and direct access for Southern Sudan to an autonomous source of supply through Kenya, will also inevitably alter the diplomatic and commercial calculations of politically powerful actors including governments of permanent members of the UN Security Council and their corporate citizens. The prospects of such adjustment are suggested by the alacrity with which major oil companies have reacted to the certainty of Southern Sudan's independence. The key parties of interest in any realignment of oil pipeline and trade routes are Indian Ocean states. The international consortium that controls the three oil producing blocks that straddle the new border between North and South Sudan, (the Greater Nile Petroleum Operating Company) consists of China's state oil company CNPC (40%), a private Malaysian company, Petronas Carigali (30%) and India's ONGC Videsh (25%).[1]

A complicating element of the strategic picture is Lamu's proximity to Somalia, and therefore its susceptibility to piracy. The development of roads and railways to connect the port to its hinterland, as well as pipelines, refineries and an airport, will be a substantial undertaking demanding huge capital investments and substantial periods of time. So will the dredging and construction of extra-deep berths for supertankers. Given the high commercial and geo-political stakes, one may anticipate significant competition for infrastructure development opportunities and control. It is also not clear how major investors will secure such large investments in such an insecure environment, and what implications this is likely to have for the prospects of military activity and competition between states and non-state armed groups.

There is also a substantial controversy about the environmental damage and the damage to cultural heritage likely to result from the development of a major port at Lamu. Lamu is a World Heritage site recognized by the United Nations Educational, Scientific and Cultural Organization. Its pristine natural environment, including mangrove forests, and its live historical and cultural heritage of the traditional Swahili culture of the Arab-African East African coast have made it a significant tourist destination and source of revenue.

The impact on the environment will also have implications beyond the damage to tourism. Dredging and pollution from future maritime traffic will alter the environment substantially. Fisheries, an essential part of local livelihoods, will certainly be damaged, and the promise of replacement jobs in the port is considered unrealistic for a local population that has had little exposure to modern machinery or skills related to modern economic activity.

[1] "Sudan investors wary of tricky oil divide," *Financial Times*, 8 February 2011.

such as ship repair and maintenance; and Malaysia's ports aspiring to find comparative advantage to compete with Singapore. Overarching all this is the massive amount of maritime trade and almost limitless potential port business that passes through this region, and the sensitivity of its ports to marine accidents, maritime terrorism and other crimes.

The primary driver of port development in South Asia has been India's prodigious economic and external trade growth. Almost as important are Sri Lanka's attempts to carve out a niche as a serious port center, and Pakistan's aspirations to become a landfall and point of maritime egress for the trade links between the Gulf and Central Asia, and the Gulf and China's interior. In each of the latter instances, the presence of Chinese capital has been a source of irritation in India's relations with those countries. The development of the Pakistani port of Gwadar astride India's sea lanes to its energy supplies in the Gulf has been an additional source of tension.

Port developments in the Middle East have been a study in contrasts. The ports of the Gulf have experienced prodigious growth and investment, corresponding to the huge increase in imports of finished consumer and capital goods to support the rapid development in infrastructure and general economic growth of the Arabian Peninsula. There has also been substantial expansion and improvement in the facilities for petrochemical trade, as vessels for that have increased in size and technical sophistication. In Yemen and Egypt, the development of ports has been less dynamic. Because the strategic environment of the Gulf and the Middle East has always been volatile, it has also long benefitted from a series of strategic understandings and a bevy of military presences, and thus presents the fewest uncertainties either arising from, or affecting port development.

In most respects, East Africa is the laggard in the recent dynamic development of ports and seaborne commerce in the Indian Ocean. Nonetheless, the imperatives currently at work are likely to feed substantial development there. It has been noted previously the extent to which large Asian economies are growing increasingly dependent on trade with East Africa, particularly the supply of raw materials or food supplies. Chinese and Indian dependence on hydrocarbons from Sudan, Indian investment in farmland and agricultural products in Ethiopia, similar Saudi Arabian investment in Sudan, aborted South Korean efforts to acquire farmland in Madagascar, and the fast maturing and complex links between China's economy and South Africa's, all suggest that economic imperatives for port upgrading are at work. Investments from the Gulf, China and Singapore confirm this expectation.

Major Regional Developments in Ports

Southeast Asia

Singapore

The Port of Singapore retains its position as the world's busiest container port by far, responsible for almost seven times the cargo handled compared to the next busiest, Port Klang in Malaysia. At the center of a web of shipping routes, Singapore is connected to more than 600 ports in over 120 countries and handles some 140,000 vessel calls annually. Singapore operates the most technically advanced and efficient shipbuilding and ship-repair facilities in all of Southeast Asia. It also serves as Asia's largest, and the world's

third-largest, petrochemical refiner, and as a top global player in the offshore and marine engineering industry.

The Port of Singapore is one of the few ports in the world still entirely owned by its national government, through a state corporation. Singapore capitalizes on its strategic location, sophisticated facilities, highly trained officials, and strength as an international business and financial hub. It continues to invest in new infrastructure, facilities and cutting edge information technology (IT) systems.

Singapore's strengths as a port draw on the country's role as a "full service" maritime economy, which provides the full range of services to maritime and ancillary corporations locating there and to vessels calling there. Singapore's many institutions include the Maritime and Port Authority of Singapore (MPA), Singapore Maritime Foundation (SMF), the Association of Singapore Marine Industries (ASMI), and the Singapore Maritime Academy. It is also home to a wealth of world-class maritime services in shipping, law, finance, brokerage, insurance, and training. Singapore is also the choice venue for the headquarters and representative offices of international maritime organizations and associations such as the Baltic Exchange, Asian Shipowners' Forum, International Bunker Industry Association, International Association of Independent Tanker Owners, and the Baltic and International Maritime Council. Increasingly, the country and the port are assuming the characteristics long associated with the United Kingdom's dominance of the global business. This has allowed Singapore to emerge as the maritime capital at least of the Indian Ocean, and possibly of the world.

The Port of Singapore was among the worst hit by the global economic crisis. Demand for ships fell significantly as trade volumes contracted in double-digits. Its throughput for the first quarter of 2009 was 6.02 million TEU, down 17.9% from the same period a year earlier. In its 2009 budget initiatives, the government rolled out measures in response to the global crisis. This included the measure to reduce port dues starting in April 2009 by 20% for smaller harbor craft operating in Singapore, and by 10% for larger, oceangoing ships docking in Singapore for less than ten days in the course of a year.[100]

Malaysia

China Shipping, China's biggest shipping company recently relocated its hub from Singapore to Port Klang. More major shipping lines are expected to shift their operations to Malaysian ports in response to the latter's strong marketing strategies.

The two areas in which Malaysia could surpass Singapore are integrated logistics and niche marketing. Unlike Singapore, Malaysia has ample hinterland for setting up warehouses, factories and mills near a port to ensure quick turnaround time for cargo. It has also undertaken a strong strategy to dominate the distribution and production of *halal* (Islam-compliant) food and to establish a global *halal* hub.

As a modern Muslim country with an open economy and developed infrastructure, Malaysia's *halal* hub could appeal to the Middle East and other Muslim markets. In the past several years, the Malaysian government has taken a number of measures to ensure its comparative advantage in the *halal* food trade. These include establishing a *halal* Standard, MS1500:2004, an ISO-compliant standard which provides

[100] Singapore Nautilus, 3Q 2009 Issue 8, page 36.

practical guidelines for the food industry on production, preparation, handling and storage. The government has also established the biggest *halal* cold storage facility in Asia at Westport.[101]

Malaysia is home to Port Klang, the largest port in the country located in the state of Selangor and one of the busiest ports in the Indian Ocean. It is connected with more than 120 countries and over 500 ports worldwide. Port Klang is served by three major gateways, Southpoint (8 berths), North Port (18 berths), and Westports (22 berths). Southpoint (formerly known as Southport) is the oldest part of Port Klang, managed by the Malayan Railway Administration. Two of its berths are designed specially to handle palm oil shipment. Much of the shipping activity has moved to the newer and bigger Westports and North Port that are privately owned.

In 2009, with a dredging project that cost over US$28 million, the south channel of Port Klang was deepened from 15.5 to 16.5 meters and widened from 365 to 500 meters. The widening of the channel will enable the largest super post Panamax container vessels with drafts exceeding 15 meters to safely pass through.[102] In June 2009, Hanjin Shipping, South Korea's largest carrier and one of the top 10 customers of Westports, began to offer direct service between Southeast Asia and the US from the port.

Another emerging port in Malaysia is Tanjung Pelepas in Johor which opened in 2000, and is already one of the busiest ports in the Indian Ocean. The shipping line Maersk Sealand owns 30% of the port. Tanjun Pelepas has attempted to compete with Singapore as a transshipment port, as compared with Port Klang, a gateway port and main national load center. Singapore has in the last few years lost business to Tanjung Pelepas owing to the latter's lower rates, but Singapore has responded by offering a rebate on shipping costs and other incentives.

South Asia

India

India currently has a dozen major ports and about two hundred minor ports along its coasts. Many of these ports are undergoing expansion and modernization and new ones are being built along with the country's rapid economic development and increase in trade.

The Government of India aims to increase the cargo handling capacity of major ports twofold to reach 1.5 billion metric tons by the year 2012. This will be achieved by investment of around $25 billion through public-private partnerships (PPP).[103] In September 2009, India's Ministry of Shipping committed about $4 billion to 28 port investment projects throughout the country over 2009-2010.[104]

The government dominated India's maritime activity in the past, but it is now encouraging the private sector to take the lead in port development activities and operations. At many major ports, international port operators have been invited to submit competitive bid for BOT terminals on a revenue share basis. This

[101] Stephen Ng, "Transforming Malaysia ports into a regional hub," *Malaysian Business*, 16 November 2008.

[102] "Port Klang dredging to finish by December," *Cargo News Asia*, 7 September 2009, http://www.cargonewsasia.com/secured/article.aspx?article=20550.

[103] "Ports," Public Private Partnerships in India, Ministry of Finance, Government of India website.

[104] "India commits $4bn to 2009-10 port investment," 30 September 2009.

has attracted foreign companies, such as Dubai Ports International (at Cochin and Vishakhapatnam), Maersk (at JNPT and Mumbai) and P&O Ports, (at JNPT, Mumbai and Chennai), and PSA Singapore (at Tuticorin). Minor ports are also being developed by domestic and international private investors.

India faces other challenges including improving communications systems and trade facilitation measures, hiring and training of officers where there is currently a shortage, and enhancing road and rail connectivity to ports.

Pakistan

Pakistan's sole international port has been Karachi. The country's maritime trade is now facing a monumental change as a result of the development of a huge new port at Gwadar on the Balochistan coast. Considered by many to be an important gateway to Central Asia, and an emerging shipping hub for traffic from the Straits of Hormuz to East and Southeast Asia, Gwadar raises many questions. These include its location in a politically volatile province marked by armed insurgency, and the absence of supporting land-based infrastructure including rail and road transportation, whereas Pakistan's land transportation routes are all focused on Karachi. The combination of massive Chinese investment in the port's development and its location astride the sea lanes that carry India's energy supplies from the Gulf add a strategic edge.

The Government of Pakistan provided very limited funding for the development of Gwadar port, the majority of which came from China. Under the terms of the agreement of 2002, Beijing provided $198 million and Islamabad provided $50 million to construct Phase I of the port, which was completed in June 2006. Gwadar Port is now operated by Singapore's PSA which won a competitive bid. The concessions awarded to PSA included a 40 year lease agreement for operating and managing Gwadar Port; fixed share of revenues: 9% from cargo operations and marine services and 15% from Gwadar Free Zone business; and exemption from corporate tax for 20 years.

The ambition is for Gwadar to become a major domestic and regional port like Karachi, providing Pakistan with increased trade and strategic importance. But tensions between the Government of Pakistan, the provincial government, and the people of Balochistan are likely to remain a critical issue. That said, its competitor in Pakistan, Karachi, is also increasingly vulnerable to violence and instability.

Bangladesh

Chittagong Port, which handles around 90% of the country's international trade, has experienced substantial growth in the past 15 years. The rapid increase in Bangladesh's external trade and resulting container traffic volume has created considerable congestion, and the port's operational space has become insufficient. Moreover, Bangladesh has another set of challenges including inadequate customs procedures and the lack of a comprehensive transport network of roads, railways, and inland waterways. In 2009, the World Bank offered aid to develop Chittagong and Mongla in Bangladesh as transshipment ports with the condition that the Government of Bangladesh opens them up for regionalization.[105]

[105] "Bangladesh offered ports aid," *Daily News*, 2 June 2009.

Sri Lanka

Colombo Port recorded its highest ever annual cargo throughput in 2008. The total cargo handled at Colombo was about 30.9 million tons, an increase of 6.7% over the previous year. The government has taken measures to expand the port with the construction of breakwaters and dredging to 18 meters. The total cost of this expansion project, which began in April 2008, is $345 million.

Also significant is the large port construction projected for Hambantota, President Rajapakse's home village, with substantial Chinese investment and technical support. This raises both the issue of Indian sensitivities that was discussed earlier and the question of whether the project is commercially viable given Sri Lanka's existing port capacity and anticipated demand.

Middle East

The global economic downturn challenged plans for the ports in the Gulf region, many of which had aggressively expanded capacity in recent years. Because much of the Gulf's investment, such as purchases of specialist (mostly petrochemical) vessels, were driven by sovereign considerations including national pride and a desire for national control by parastatal corporations, the exposure was all the greater, but the willingness of sovereign bodies to stand behind the investments was also substantially greater.

The volume of goods passing through the ports of the six main Gulf states rose from 15 million TEUs in 2004 to 24 million TEUs in 2008. This growth prompted total investments in regional ports of $38.2 billion up to 2008. Expansions are planned in Saudi Arabia, Dubai and Oman, and new facilities are planned throughout the region, including Qatar's New Doha port, Kuwait's Bubiyan Island port and Abu Dhabi's Khalifa Port. While the Gulf's ports fared better than most other regions, the economic crisis has caused cargo volumes to drop. Surplus capacity will lead many port owners and investors to review their expansion projects for the upcoming years. Many port projects are likely to be delayed or scaled down with the decline of trade volumes. [106]

In January 2009, there were 47 international shipping companies providing regular services to Egyptian container ports with about 400 ships. Egypt benefits from its geographical position and from the Suez Canal, which forms part of the world's busiest shipping route. To keep up with demand, several terminals have been recently developed by private sector investors for shipping lines that redistribute cargo to other Mediterranean and African destinations.

East Africa

One of the key challenges for the ports of East Africa has been congestion. Africa's share of global traffic is only 3.3% but it records some of the highest container "dwell" time (time before release of cargo). In some ports, a dwell time of up to 20 days has been recorded instead of a desirable 3 days. (Singapore's dwell time is less than a day).[107] The sharp increase in containerized traffic has not been met with equal expansion of port facilities and rise in operational capacity. The problems contributing to congestion include inadequate container yard and technology capacity, shortage of trained service providers, slow cargo tracking and customs clearing process, and poor road and rail transportation networks.

[106] Robin Wigglesworth, "Port projects put on hold in storm," 7 September 2009.
[107] PMAESA, *Our Ports*, 2008 Vol. 4, page 10.

Port congestion in Tanzania's largest port of Dar-es-Salaam and Kenya's main seaport of Mombasa has significantly improved in the past two years. According to the shipping company PIL, the turnaround time in Mombasa is now 3-4 days as opposed to two weeks. A number of factors contributed to this development including new communications technology and improvement in the customs clearing process. But the port authorities in Tanzania and Kenya, as well as shipping companies, believe the most significant factor was the recent adoption of Inland Container Deports (ICDs) and Cargo Freight Stations (CFSs) which are facilities located near ports that are used to temporarily store containers carried under customs control. The service, which has been outsourced to private companies, has helped decongest the ports by moving cargo and customs related activities away from the port area.

Despite the global downturn, many ports in the region are still showing strong growth, with the top performers being the resource-rich countries. Africa is leaning towards business with the fast growing Asian economies rather than with Europe, where it formerly had closer ties. Statistics reveal that there has been a marked increase of container traffic from the Far East to Africa in general, and especially from China. Trade between China and Africa increased to $55 billion in 2007, almost double the amount recorded in 2005.[108] Again, the significant increase in ties between South Africa and China is a prominent factor in the development of trade volumes at ports on the eastern coast of Africa.

Like other regions, there is a trend in East Africa toward increasing privatization and public-private partnerships. Talks are underway to privatize parts of the Kenya Ports Authority and the Cargo Handling Corporation in Mauritius, which handles all the cargo at Port Louis. Both are currently solely owned and managed by government.

Development of intermodal transport has also picked up in East Africa. Roads are being expanded and new ones being paved with aid from foreign donors. Whereas the railroads of Tanzania and Kenya had at one time been the landward backbone of the ports of Mombasa in Kenya and Dar-es-Salam in Tanzania, after years of neglect they now only carry 4% of cargo on land in Kenya and Tanzania. If they were operational, the transport of cargo would be much more cost-effective and less damaging to roads. There is also a need for new equipment such as cranes compatible with new types of vessels and difficulty with cargo tracking.

Kenya

The Port of Mombasa, Kenya's main seaport and the largest on the East African coast, is currently undergoing expansion. Mombasa handles the bulk of Kenya's foreign trade, and the growing trade needs of landlocked Uganda, Rwanda, Democratic Republic of Congo, Burundi, and Southern Sudan, and to some extent, Ethiopia and Somalia.

In December 2007, the Kenya Ports Authority (KPA) signed a loan agreement worth $235 million with the Japan Bank for International Cooperation (JBIC) for development of the Mombasa Port. These funds are being used to expand the existing container handling facilities, to construct a second container terminal to accommodate the present and expected traffic growth, and to deepen the channel.

[108] PMAESA, *Our Ports*, 2008 Vol.5, page 48.

There are also plans to rehabilitate and expand Kenya's rail network to connect to the neighboring countries of Burundi, Democratic Republic of the Congo, and Rwanda. Transportation charges can be reduced significantly if an efficient rail service becomes operational. These developments could help Mombasa retain its competitiveness against other ports in the region.

Djibouti

Djibouti Port is strategically located at the crossroads of three continents—Europe, Asia and Africa, and next to one of the busiest sea routes. It has a natural hinterland in Ethiopia, Uganda, Burundi, Rwanda, and potentially Sudan. The Port of Djibouti is the only port linked to Ethiopia by rail and road, and it is the most centrally situated port in the Common Market for Eastern and Southern Africa (COMESA), a market with a population of around 400 million. However, traffic to and from Djibouti suffers from its proximity to the pirate-afflicted sea lanes.

Dubai Ports World took over the management of Djibouti Port in May 2000 to develop modern facilities, provide an efficient and reliable service, and promote the port's capabilities. Djibouti has experienced strong growth in container traffic in the past several years, in line with the economic growth of the region. To keep up with the future demand, DP World invested in the construction of the $400 million Doraleh Container Terminal which opened in February 2009. This world-class facility has a capacity of 1.2 million TEU per year, and is equipped with six superpost-Panamax ship-to-shore cranes.

Mauritius

A sign of the development of Indian Ocean trade has been the emergence of Port Louis in Mauritius as part of the commercial strategic picture. To some extent, the emerging importance of this port, isolated on an island in the ocean also reflects a conscious strategy of positioning it as the economically, legally and politically stable base and entry point for Asian (particularly Chinese) investment in Africa. Located at the crossroads of trade routes between Europe, Asia, Africa, and Australia, Mauritius has experienced continuous economic development with growth averaging 5.7% annually over the past two decades. The country's only seaport, Port Louis, handles about 99% of the total volume of external trade and contributes more than 2% to the country's GDP. The vision of the Mauritius Ports Authority (MPA) is to develop Port Louis into a regional maritime, logistics, and business hub. The port has recently undergone major structural reforms and upgrades with modern port facilities that are able to offer world class port services. Transshipment activity in Port Louis is growing fast since an agreement was signed with Maersk Sealand, MOL, MSC, and P&O Nedlloyd. Transshipment container volume rose from 36,000 TEU in 2002 to 93,000 TEU in 2006, and to 107,000 TEU in 2009. [109]

[109] Mauritius Ports Authority, Port Trade Statistics, CY 2009, http://www.mauport.com/downloads/statistics/Calendar%20Statistics%202009.pdf.

Shipbuilding, Shipbreaking and Marine Technology

Shipbuilding

The maritime trade of the Indian Ocean depends almost entirely on vessels built in yards outside the Indian Ocean region, and owned by parties outside it. However, the three leading shipbuilding nations in the world, South Korea, China and Japan, are themselves substantially dependent on the Indian Ocean trade.

The downturn in freight demand, added to the surplus of vessels ordered during the period of dynamic growth, has resulted in a serious crisis for shipbuilders. Shipping companies in all sectors have felt obliged to attempt to stretch out periods for delivery of their orders, for reasons both of a drying up of financing and the fact that new vessels are mostly surplus to requirements. As it is, new tonnage on order represents an additional 53% of the existing market. And though we deal in detail with the scrapping of ships below in the discussion of the shipbreaking industry, we should note for now that the extent of scrapping, the incentives for retirement of ships, and the limits on demand for vessel scrap, all at present constitute the great imponderables in determining exactly how great is the surplus of vessels in service today.

As of mid-2009, there was a large surplus of new-builds waiting to be delivered, which are equivalent to 70% of the existing bulk carrier fleet, 42% of the global container tonnage and 30% of the world's total tanker fleet. From mid-2003 until mid-2008, owners around the world benefited from an accelerating macro economic boom, particularly as trade expanded with the emerging economies of Brazil, Russia, India, and China. Greek owners in particular embarked on a large-scale new vessel ordering program from the major Asian builders to meet what was perceived to be the continuance of a long-term upswing in maritime trade demand.

The price of a very large crude carrier (VLCC), which ranged between $150 and $160 million four years ago, now ranges between $85 and $90 million. Many in the industry question whether shipbuilders can make a profit at this price.[110] With such radical variables at work in the economics of the industry, fundamental questions present themselves about who builds ships, where they are built, the expected quality and life cycle of vessels, and what types of shipping companies are able to maintain sufficient capacity to respond to market demand without being over-extended during downturns. The preponderant expectation is that the advantage will be with highly capitalized or state supported enterprises, or those willing to offer lower prices even at lower quality and reliability.

What is certain is that the decline in the value of vessels, reflecting the decline in

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

freight rates that can be commanded by its owner, has had an effect on the finance of vessels. Lenders have been overexposed on loans for what is by its nature a huge capital investment.[111] While the general expectation is that financing will not be required in any significant quantity for new orders, many banks are committed to release funds according to a schedule for vessels already ordered and under construction. Their difficulties in finding the funds to do so has serious implications for shipbuilders and those they employ as well as owners. In such a climate, those able to access or dispose of ready cash, such as state-subsidized enterprises or those willing to defer maximum profitability,[112] are likelier to establish dominance in their respective market, whether builders or carriers, in preparation for the recovery when that comes about.[113]

Because bulk ships are the easiest to build, container vessels a little more complicated, and cruise ships the most complicated of all, there is a danger that financially straitened shipyards will crowd the easier sectors, flooding capacity there, whereas other sectors will experience shortage of building capacity.

An additional source of stress for the economics of shipbuilding is the prospect of new emissions limits coming into force for shipping. Although the timing, structure and extent of any international (or national) standards regime remain uncertain, there is an overall expectation in the industry that some standards will be imposed, and that it will add to the capital costs of vessels.

Owing largely to its association with the production of warships, and because of the strategic and nationalistic approach to seaborne trade adopted during the period of mercantilism, shipbuilding has historically attracted a high degree of political involvement and patronage, and public investment. Not only did the European imperial powers and notably Britain adopt such an approach, but the same was the case for prewar Japan, which emerged as the next generation power in the industry, along with Brazil in the 1970s. Today, the leading shipbuilding nations South Korea and China evince a similar state involvement in the industry.

Among the nations with smaller output of ships are several European producers such as Croatia or Russia, often occupying a niche in specialist vessels such as ice-capable ships, ferries, cruise ships, or vehicle and farm equipment carriers. Some of the older shipbuilding powers such as Germany also continue with smaller amounts of production, though their future appears to be highly uncertain. In any case, for purposes of impact on the Indian Ocean maritime industry, their significance is almost nil. However, smaller nations in the Gulf, for example, are at present playing a strategic role in the health of the worldwide shipbuilding industry. They are doing so by making strategic decisions to order new ships despite the glut in the market, owing to the desire of proprietary state elites to control their commerce.

Three countries dominate the world's shipbuilding industry – South Korea, China and Japan. Among the three, Japan enjoys a deserved reputation as a "high-

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

[112] "Fair and fleet-footed in the world of Japanese shipping", *Financial Times,* 9 November 2010 offers a glimpse of a company willing to purchase ships it would have chartered in order to protect small ship owners.

[113] For a succinct overview of ship financing, see Costas Th. Grammenos, "Developments and Issues in Shipping Finance", in Hilde Meersman, Eddy Van de Voorde and Thierry Vanelslander (eds.), *Future Challenges for the Port and Shipping Sector,* (Informa, 2009).

tech" manufacturer of technically sophisticated and high quality vessels, China as a labor-intensive producer of vessels that enjoy a reputation in the shipping business for uncertain quality of product, and South Korea as intermediate.

An eloquent indicator of the volatile competition between major shipbuilding nations, and especially of China's prodigious growth, is found in comparing today's market shares with those of less than a decade ago. Only South Korea's position has remained stable, at 34% of global production share. In 2001, Japan produced 32% of the world's ships. Today it produces 18%. China's share in the same period grew from 6% to 38%. Europe's share fell from 22% to 7%.[114]

Despite the quality advantage they enjoy, some of the largest Japanese shipbuilders have recently expressed alarm at the erosion of their competitive position owing to the high value of its currency relative to those of China and Korea, and the government subsidies offered to national shipbuilders by those governments. The prospect of closures or mergers of major Japanese shipyards has led to a call for concerted action. While in the short run the long lead times between orders and delivery have meant that Japanese yards have work for the present, the slump in global demand following 2008 has yet to be felt. This presents another factor of volatility in an industry requiring huge investments and substantial waiting periods for return on investment. An equally significant factor is the high differential in labor costs between Japan and China.[115]

The irony of all this is that Japan's own emergence as a shipbuilding power in the mid-twentieth century, and her rout of European shipbuilders, owed almost everything to the advantage she enjoyed through her low labor costs and cheap currency. Japanese shipbuilders hvae sought to weather the current challenges through a combination of maintaining the loyalty of their domestic customers in what remains a powerful shipping industry and trading sector, and by introducing technical and design innovations. These include sculpting of ships, hull design and reduction of wind resistance for optimal fuel efficiency.[116]

Many orders were placed with emerging yards in China, which by 2008 had become the world's second largest builder after South Korea. Many of these new ship-building yards on the country's east coast industrial areas were financed with ship owners' large down-payments; some based on contracts for vessel deliveries stretching to 2013. The Greeks have borrowed extensively to finance fleet expansions. However, in the current market hundreds of these vessels that are still under construction have been losing value apace as existing vessel supply far outstrips demand. In June 2009, announcements by brokers stated that ship values had dropped by a mean of 20%, and were projected to continue falling.

In early 2009, China's COSCO line announced its intention to postpone or cancel outright its massive portfolio of newbuilds. However, there was speculation that the Chinese government would persuade COSCO and Sinotrans to support the new Chinese yards by buying up orders cancelled by other owners around the

[114] "Proud shipbuilders fight to survive," *Financial Times*, 8 February 2011.

[115] "Shipyards call for action on Seoul over won," *Financial Times*, 8 February 2011

[116] "Japanese yards claim innvoative edge over Asian rivals," *Financial Times*, 8 February 2011.

world. This was an indicator of the Chinese state's determination to maintain its shipbuilding industry as a strategic asset for the future. Nevertheless, some 40% of new ships on order from Chinese yards in 2008 were not delivered, and many orders were accepted from financially vulnerable owners that have since cancelled, which has meant that many of the new yards may lapse into bankruptcy and others may never be established.

It was noted above that the reputation of the Chinese shipyards is for lower quality products. It is by no means the case that the quality concerns about Chinese-made vessels will affect buying habits in the long-term. The current straitened market makes price competitiveness more significant. Moreover, the financial back-up offered by the government, including financing for shipyards and for vessel purchasers, acts to neutralize the quality differential. Finally, the current quality issues with Chinese vessels reflect a relatively new industry, with the attendant issues of quality assurance, skills, innovation and experience. If the Chinese industry continues to develop, these may be expected to ameliorate.[117]

Most important with respect to the Chinese profile are the twin factors of state support available to the shipbuilding industry and the Chinese national interest in maintaining a robust industry. China depends on shipping for the export of its goods more than any other economy. Thus, Shanghai shipyards recorded a 50% increase in the value of exports in 2009, and China has become a force in shipping finance.[118]

In South Korea, the world's most prolific builder, the major firms in order of magnitude are Hyundai Heavy Industries, Samsung Heavy Industries and Daewoo Shipbuilding and Marine Engineering. The three shipbuilders dominate the market in the areas of high-value-added vessels, such as container vessels, liquefied natural gas carriers and crude oil tankers. Many of these builders are now facing uncertain times as ordered vessels are completed and delivered, some orders are cancelled despite the financial penalties, and the placing of new orders has waned.

The top three South Korean yards accumulated only $1.2 billion worth of new orders during the first half of 2009. This was in stark contrast to the aggregate value of $34.1 billion for the same period in the proceeding year announced in July 2008. Currently the order-books at the South Korean yards are still in the three-year range, and the major builders have stated that they are likely to deny new orders until the macro economic sentiment improves, despite their own serious cash-flow problems. With the global order-book for new vessels being stretched farther into the next decade, due to likely delays in production and delivery schedules, the continued burden of current ship deliveries into a market already imbalanced will likely hamper the prospects for new orders beyond 2013.[119]

Of the Indian Ocean littoral nations, India offers the greatest prospect of developing a robust shipbuilding industry in the future. The Shipyards Association of India has given recent signs of its intention to position the country as a significant player in the shipbuilding industry.[120]

[117] Geoffrey Till, *Asia Rising and the Maritime Decline of the West,* RSIS Working Paper No. 205 (S. Rajaratnam School of International Studies, Nanyang Technological University, Singapore, 2010).

[118] Jan Hoffman, *Shipping out of the Economic Crisis*, 2010, unpublished.

[119] www.lloydslist.com.

[120] *Seatrade*, June 2010, page 117.

Important boosts to the shipbuilding industry, and at least a hedge against the uncertainty of traditional shipbuilding, are likely to be provided by opportunities in specialist vessel production for novel types of economic activity. The prospects of a substantial increase in Arctic navigation are discussed elsewhere in this book. The stronger hulls and ice-breaking capacities required to do that would increase demand for such specialist ships. Even more significant as a present reality is the huge increase in deep sea petrochemical exploration, seen significantly off the western coast of Australia and the eastern coast of Brazil. Petrobras's requirements for Brazil's "pre-salt" fields suggests the sheer scale of the opportunity presented for specialist shipbuilding. These include 28 drilling ships (equal to a third of the present global fleet of such ships), 146 supply ships and 72 large tankers.[121] The technical specialization at issue is conveyed by the conversion of oil tankers into production platforms and the need for underwater wells. It is estimated that the fleet of new ships to be procured by Petrobras will be bigger than all but the largest navies of the world.[122]

Shipbreaking[123]

Shipbreaking[124], which is now largely concentrated on the shores of Bangladesh and India, involves dismantling obsolete ships for scrapping or disposal. This is a rare shipping-related business that has prospered as a result of the global economic crisis. As maritime transport and shipbuilding companies have suffered, there has been an over-supply of vessels. These have consequently been turned over to shipbreaking yards faster than in previous times. New ship designs have also made older models obsolete, a trend that has contributed to the shipbreaking industry's vitality. However, it is not in the least clear that this rate of scrapping will make a significant dent in the substantial over-supply of vessels in the global merchant fleet. While a record of 180 mostly smaller ships were sold for scrap in 2009, this constituted only 2.5% of the existing fleet, while the order book for new builds stood at 36%.[125]

The world's most significant shipbreaking facilities, with a few exceptions in Turkey and China, are found almost entirely on the Indian Ocean. The focus of this low-end and low-tech industry is South Asia, where the largest facilities are found in Bangladesh (Chittagong), India (principally in Gujarat, with smaller sites in Maharashtra, Kerala and Andhra Pradesh), and Pakistan (near Karachi). There is an emerging ship scrapping industry in the Philippines but it is significantly smaller in scale.

The term "facility" is used to describe the locations of shipbreaking because the South Asian locations are highly informal, and it would be misleading to describe them as "yards" or any term that might connote an industrial, port-like or constructed facility. Unlike the Turkish yards, or the new and high-tech Chinese dry docks devoted to shipbreaking, the South Asian fa-

[121] "Petrobras plans to double Brazil oil production," *Financial Times*, 4 February 2011.

[122] "Challenges of the deep set to transform the industry," *Financial Times*, 14 February 2011.

[123] Research for this section in the trade press has been supplemented by field visits to shipbreaking locations and by interviews with Chandra Bhushan of the Center for Science and Environment in New Delhi and with Professor Gopal Krishna of Jawaharlal Nehru University in New Delhi, Convener of the Indian Platform on Ship Breaking (IPOS).

[124] Shipbreaking is also referred to as ship demolition, ship dismantling, ship scrapping, ship decommissioning, or ship recycling.

[125] Clarkson Research Service Limited, *Container Intelligence Monthly,* January 2010.

cilities carry on their activities on beached ships with rudimentary tools and almost no safety gear. These activities have posed environmental and safety hazards to the local inhabitants as well as occupational hazards to the workers. Workers suffer exceptionally high rates of death or dismemberment, and local marine and land environments have been polluted by toxic materials from ships that have damaged fisheries, agriculture and coastal ecologies. The situation has led to shipbreaking yards being monitored by human rights NGOs, and to courts prohibiting or monitoring shipbreaking activities.

China had also possessed this type of low-tech industry, but it had lost business to the lower cost South Asian scrappers. China's turn toward a more sophisticated form of ship dismantlement offers a glimpse of a future in which there is not only amelioration of the environmental and occupational hazards long characteristic of the industry, but where in an environmentally conscious world China might carve out a niche in an industry that will be rendered increasingly important as a result of the global oversupply of vessels and the need to retire more of them.

The IMO adopted the International Convention for the Safe and Environmentally Sound Recycling of Ships in May 2009. The Convention, which covers the design, construction, operation, and preparation of ships for recycling, aims to ensure that ship recycling is carried out in a way that does not pose unnecessary risks to human health and safety and the environment. Ships to be sent for recycling will be required to carry an inventory of hazardous material such as asbestos and heavy metals.

Although the Convention was developed with input from IMO member States, relevant industry organizations, the International Labour Organization, and parties to the Basel Convention (on international transport of toxic substances), the likelihood of its being effective is uncertain. Controversies over the onus of responsibility have led to its rejection by both environmental groups and ship breakers. The Basel Convention imposes upon vessel owners the duty to ensure and certify that a vessel complies with the prohibition against international transportation of toxic substances. The IMO convention is thus perceived by environmental groups and ship breakers as weakening Basel by placing the onus on ship breakers to detoxify the vessels they dismantle. Given the dominance among ship owners of a handful of nationalities, such as Greeks and Norwegians, the sentiment among opponents of the IMO Convention is that it is international only in name, and intended to weaken a proven and truly international regime governing toxic wastes. However, what the Convention does add is explicit recognition of, and protection for, the welfare of workers engaged in the manual and highly hazardous work of ship dismantling.

Regardless of the merits of the arguments about the relative value of one or another international instrument, what has been apparent for a long time is that it is national policies in the countries where shipbreaking occurs that are all important. This consists of equal parts political will and government capacity. A vivid example may be found in the bureaucratic confusion and obfuscation that has surrounded the arrival of allegedly toxic vessels in India for dismantling at Alang in Gujarat state. In 2006, following disagreements among various bodies with partial responsibility, the Supreme Court of India stepped in to order that the 27,000 ton former French warship *Clemenceau* return to France after it had sailed to India, owing to the presence of as-

bestos, lead, mercury, and other toxins on board.[126] Less successful was opposition to the arrival of two ships from North Korea which also contained toxic materials.

In October 2009, the US ship *Platinum II*, said to contain substantial amounts of polychlorinated biphenyl (PCB) and asbestos, arrived in Indian waters for dismantling at Alang. The ship was the object of an EPA fine of $518,000 for violation of a judicial settlement order under the US Toxic Substances Control Act. Nonetheless, it availed itself of a gap in US jurisdiction, between the EPA's regulation of toxic substances and the Maritime Administration's authority to interdict its physical transportation out of US waters.[127] In a telling example of methods used in the international scrapping industry, the owners sailed the ship out of US waters on the pretext that it was in use rather than *en route* to scrapping. A series of registrations under "flag of convenience" registries, uninterested in Basel Convention requirements, facilitated its transportation to India.

It met similar bureaucratic complexity at the Indian end. A desk review by the Gujarat Maritime Board, the Gujarat Pollution Control Board and the Indian Customs cleared the vessel for entry to Indian waters. However, the Indian Ministry of Environment and Forests and the Indian Ministry of Steel (which coordinates the inter-ministerial group on shipbreaking) sought further details. Under pressure, the Gujarat Pollution Control Board admitted that the ship was in violation of the Basel Convention.[128]

Whereas in this instance the public pressure from the Indian Platform on Ship Breaking (IPOS) resulted in a victory for the opponents of toxic imports and environmental hazards in the shipbreaking industry, the trend has been in the opposite direction. The inherently elusive and mobile nature of shipping, even at its best, and the regulatory, jurisdictional and bureaucratic complexity at the Indian end,[129] have resulted in a situation where 300 toxic vessels have arrived since 1998 at Alang, and are in various stages of decomposition, having had their steel and other reusable material extracted.

Bangladesh, unlike India, possesses no reserves of iron ore. It is therefore difficult for the Bangladeshi Department of Environment to act forcefully to regulate its environmental or occupational hazards. The twin considerations that militate against forceful regulation are Bangladesh's economic reliance on secondary iron and steel and the political power and influence of shipbreaking and secondary steel firms. In early 2000, courts in Bangladesh indicated a desire to forcefully regulate the industry but came up against the paucity of legislation, formal regulation or administrative enforcement capacity for such purposes.

As a result, though Alang in India has been the object of significantly greater criticism and attention than has Chittagong, the latter presents a far more alarming picture. In the case of India, coverage by an active and critical press and mobilization by civil society environmental and human welfare organizations, along with a relatively

[126] "In the Dock Again," *Times of India,* 14 October 2009.

[127] "Radioactive ship anchors at Alang," *Times of India,* 14 October 2009; "Toxic ship: Center will not go by Guj word," *Times of India,* 15 October 2009.

[128] "Now, Gujarat panel admits ship toxic," *Times of India,* 17 October 2009.

[129] The sharing of jurisdiction among the Ministries of Defence, Environment and Forests, Steel and Shipping, and the Coast Guard, Customs and marine police evinces the classic case of simultaneous bureaucratic duplication and gaps in coverage, as well as incentives to pass on burdensome responsibilities.

independent judiciary, has meant that conditions for the local environment and for local workers have at least been publicly aired in the media since 1998, and the Supreme Court has monitored conditions since 1995, even if improvements have been insignificant.

To some extent, this reflects the relative lack of importance of recycled steel for India. Nonetheless, businesses built on recycling of iron and steel and on the manufacture of products from recycled iron and steel remain important in the local economy in Alang's nearby towns of Bhavnagar and Shihor, and more broadly in the economy of Gujarat. Certainly, the owners of these enterprises are politically and socially powerful. The clout of the shipbreaking industry in India is reflected in the level of its legal representation, in the person of the Supreme Court advocate who is also the spokesman for the ruling Congress Party.

There have also been credible reports of local activists – those protesting the effects of toxic shipbreaking on local fisheries and farm productivity – being silenced by intimidation and violence, and of the emergence of criminal enterprises ancillary to the industry. The introduction of criminality into the industry has raised concerns about security vulnerabilities on India's coasts. As criminal syndicates have, in the past, provided vectors for threats such as terrorism, there is a concern at the security implications of the combination of criminal influence and lax regulation on shore and the prospects of vessels being vectors of contraband and terrorism (through innocent passage at intermediate ports for example).

Marine Technology

It comes as no surprise that, as in all businesses, those who manage the shipping industry are generalist managers skilled in finance, accounting, logistics, and corporate management, rather than technical experts in the equipment technology of their industry. Managing technological innovation in the industry will require refinement of coordination between managers and architects and engineers.

Technical innovation in the design of ships is outstripping ancillary technologies such as cargo handling equipment at ports. Much of this innovation was introduced in order to respond to what was expected to be a steady increase for the foreseeable future in volume of traffic. Gantry cranes at many ports originally designed for ships with thirteen container wide loads are unequal to the container ships that the Danish company Maersk has brought into service that now have twenty-two container wide loads. It is estimated that one thousand containers can be unloaded by one crane in a twenty-four hour period. In order to speed up the process in a time of burgeoning demand and volume, innovations were introduced in the industry, such as at the Port of Hamburg in Germany, where the capacity was designed and installed for two cranes to work side by side. However, such ambitious schemes have stalled because of the economic crisis, and Hamburg remains unique in possessing this capacity.

The specialist technical needs of container lines have led them to invest in appropriate port infrastructure and equipment, and innovation in vessel designs and technology has continued with the expectation that port capacity can be made to follow. This assumption is now questionable given overcapacity and unsustainable levels of investment and debt.

One of the principal features of design and technological innovation expected in the future is that various regulatory requirements – current items such as double hulling of tankers and prospective items such as lower carbon emissions – will dictate innovation as much as will commercial efficiency, competitiveness and advantage.

This can in the short-run lead to significant challenges for the industry. The limits in certain areas on sulphur levels in marine fuels have resulted in engine damage to several vessels, leading to a rise in insurance claims.[130] A group of prominent shipbuilders, owners and classification societies recently called on the Marine Environment Protection Committee of the IMO to consider the potential safety hazards for vessels in rough seas as a result of the introduction of a proposed energy efficiency design index.[131] Similar concerns have arisen about the impact of measures taken for economic reasons such as slow steaming of vessels to save fuel. There remains a concern that slow steaming may in fact have deleterious effects on engines.[132]

It is widely anticipated that, because required innovations such as double hulling will add to the expense of ships, other changes will need to be introduced, for example a move back to smaller tankers or slower voyages in order to compensate for the greater capital and fuel expenses caused by double-hulling. Owing to the longer investment and construction horizons of the industry, changes in investment direction are as slow and cumbersome as turning around a super-tanker at sea. The question that then arises is whether this acts as an additional trauma to a system already stressed by the financial overhang and vessel overcapacity described earlier, or whether there will be opportunity to address some of the problems caused by excess capacity.

At the same time, the sheer inventiveness of marine architects, engineers and designers has also offered the prospect of innovations that, if financially sustainable, can introduce new sources of cost efficiency. For example, innovations in hydrodynamic design allow longer vessels to sail faster with current levels of power and fuel use.

There is a plethora of new ideas and experimental technologies that has resulted from the economic and environmental changes that the industry has experienced. These include serious consideration of ships powered by liquefied natural gas (LNG)[133] and anticipated reductions in the permissible levels of sulphur in ships fuel.[134] For some competitively disadvantaged and suffering shipbuilding industries such as Europe, technological innovation for "green" shipbuilding is seen as a means of recovery.[135] Among factors thought to contribute to the need for innovation in design are new requirements for improved crew conditions.[136]

130 *Lloyd's List,* 15 September 2010, page 7.
131 *Lloyd's List,* 7 September 2010.
132 *Tradewinds,* 3 September 2010, page 33; *Tradewinds,* 10 September 2010, page 14.
133 *Tradewinds,* 3 September 2010, pages 29-30; *Lloyd's List,* 7 September 2010, page 2; *Fairplay,* 23 September 2010, page 24.
134 *Tradewinds,* 3 September 2010, pages 30-31.
135 *Lloyd's List,* 8 September 2010, page 3.
136 *Lloyd's List,* 15 September 2010, page 2.

The Workforce

Seafarers

Following World War II, parallel to the "flagging out" of western-owned ships to flags of convenience, the composition of most of the world's merchant marine crew shifted from being predominantly citizens of developed countries to citizens of developing countries. As a result, remuneration has depended upon the nationality of a sailor. More recently, pay differentials have been narrowing, though differences still exist between regions.

The crew composition of the worldwide merchant fleets today reflects a very important role for mariners from the Indian Ocean region. Officers in the global fleets are drawn predominantly from a handful of countries, including India, Sri Lanka, Ukraine, and Russia, and hands are drawn also from a few countries including the Philippines, India, Sri Lanka, Bulgaria, and Russia. The precise national composition of crews depends on the types of vessels at issue and the rates to be earned, as crew will be chosen according to the cost of wages and technical skills required. The standard practice in the industry is to have only two or three nationalities on board a particular voyage, except in the case of cruise ships, whose crew are significantly more diverse.

Chinese mariners are a substantial presence in the global seagoing workforce, but are almost entirely absorbed into the very substantial and rapidly growing Chinese merchant fleet. Each nationality of mariner brings a distinct set of characteristics that has bearing on long-term workforce development. Filipino mariners are considered very skilled, disciplined and dedicated, but approach their maritime careers as a means of earning a sufficient stake to invest in landward livelihoods. They are therefore expected to retire earlier than mariners of other nationalities.

Seafarers have suffered from a serious decline in employment opportunity resulting from the recent declines in volume of maritime traffic, and from the laying up of ships for petroleum storage or because new deliveries of liners are surplus to requirements (as in the case of Maersk's super-fast new container vessels). The latter for instance, which would ordinarily be manned by a full complement of 120, required only 10 while laid up. This has placed an additional strain on an occupation already under strain. In periods of enforced unemployment, skill sets atrophy in an occupation where the match between extant skills and requirements is already tenuous owing to rapid technological change.

The increase in technological sophistication of ships has been accompanied by a failure to give serious attention to the requisite training of crew. For much of the period since the predominance of steam navigation, the workforce has been di-

vided broadly into officers responsible for navigation, engineers, generalist hands, and service personnel. Whereas officers had technical skill in navigation or engineering, this was as much articulation of skill sets as prevailed. In the face of the recent rapid and sophisticated innovation of technology, the need has arisen for an exponential increase in these skill sets, and the need to recruit personnel with far greater degrees of technical education. Increasingly, the navigation and operations systems of ships are computerized, and require specialist aptitude, understanding and training.

A recent analysis in the trade press makes an eloquent plea for technical design and innovation to be crew-centered. In an article entitled "Factoring in the human element in the design of ships," Peter Holloway notes,

> In factoring in the human element in the design of ships, a designer must understand how those responsible for managing the cargo systems and operating the vessel at sea go about their business, in what conditions and over what period of time. The human element is known to cause in excess of 80% of ship casualties and this often is a result of complacency and reliance on electronic systems. Injuries to personnel are often caused by awkwardly placed, poorly designed and difficult to maintain equipment where the ergonomics of the as-built layout failed to consider how the equipment might be operated.[137]

The liquefied natural gas (LNG) fleet has grown quite dramatically in a very short period. Owners of LNG and chemical tankers (both highly technical and specialized types of vessels) today find themselves routinely short of qualified crew. The risks of their being manned by unqualified crew are quite clear, given their vulnerability to the volatility of their cargoes and the unpredictable natural environment of the Indian Ocean.

There has also been a failure to give serious attention to remuneration and conditions (especially accommodations) of the crew who are responsible for the safe operation of these very valuable assets under highly adverse circumstances in the face of natural hazards and human threats. The conditions of crew have recently drawn public attention as a consequence of vessels being hijacked by pirates. The recent economic downturn in shipping trade also resulted in crews of less reputable companies being stranded far from home as ship operators were forced to cancel voyages.

Retention of crew has become more problematic, particularly as the dangers from piracy, terrorism and crime have become more pervasive. This affects mariners not only as general victims of such events. Increasingly, masters of vessels are choosing to retire to landward occupations (albeit related to the industry) owing to the significantly greater pressure on them from powerful and sophisticated criminal enterprises to collude in criminal activities including freight theft and fraud.

Another significant recent trend has been the downsizing of numbers of crew on any given vessel or voyage. To some extent this has merely been a reflection of the automation of ships, and the extent to which fewer "hands" (and minds) are required for even significantly larger ships. That said, some in the industry express concerns about the safety implications of very small crews, and the absence of redundancies in the event of crew disability.

A related concern arises from the atrophy of certain skills as a result of technological improvements. As engine makers im-

[137] *The International Maritime Human Element Bulletin,* September 2010, page 7.

prove their online support services, shipboard engineers find themselves getting less onboard hands-on experience. While this has little effect on normal operation of a ship, there is concern that engineers that have little experience of repairs at sea will be unable to evince the necessary skills in an emergency at sea.[138]

The health of crew has long been an issue, but growing general awareness of global health issues has drawn heightened attention to medical issues on board ships and at ports. Although it is standard practice that crew members receive a health screening before being hired and shipping out, the screening systems have not been effective because of the pervasive corruption in certification of good health and because of the onset of symptoms after departure. The impact of health problems on crew welfare has been accompanied by the economic consequences for owners of diversions of ships owing to health issues among crew. Defects in screening of crew members have also undercut the effectiveness of drug and alcohol screening, with consequences for safety of ship operations.

There are several indications of an emerging recognition in the industry of the need to improve the status of crew.

The standard-setting "classification societies" for ships have begun to also look at the manning of ships in order to ensure that the user of a ship has a transparent understanding not only of the physical and mechanical characteristics of the ship but also of the adequacy of the crew arrangements. The major oil companies have been quite definitive about the requirements for senior officers on both their proprietary and their charter ships. For example, they require a specified minimum length of experience on tankers to ensure that the requirements of tanker navigation are adequately understood by them.

The International Maritime Organization (IMO) has also in recent years begun a thorough review of current and prospective models, systems and structures for the crewing of ships. Among the models that the IMO has broached is a less hierarchical one, which is predictably highly controversial in the very conservative culture of the shipping industry. Accompanying this has been a growing recognition within the industry of the need to provide career development paths, for example by moving past the traditional and highly hierarchical structure of officers and men to allow the transition from seafaring to management.

A concrete and present initiative taken by the IMO is the Maritime Labour Convention (MLC) of 2006.[139] This brings almost all of the existing maritime labor instruments under a single one. It consolidates and updates 68 Conventions and Recommendations of the International Labour Organization (ILO), adopted since 1920. Adopted by a vote of 314 to 0 with 4 abstentions, the MLC will enter into force 12 months after ratification by 30 members with a total of 33% of world gross tonnage of ships. Nine countries have ratified to date, and the tonnage requirement has already been met owing to the largest flag of convenience states having ratified, such as Panama and Liberia.

The MLC sets out seafarer's rights to decent conditions of work on a wide range of subjects, and aims to be globally applicable, uniformly enforced, and easily

[138] *Fairplay,* 16 September 2010, page 26.

[139] The United States has not ratified this, but has undertaken review by the Technical Advisory Panel on International Labor Standards (TAPILS) of the President's Committee on the ILO to examine whether the Convention should be submitted for ratification.

understood and updated. Within the IMO governance framework, MLC is intended to be the "fourth pillar", joining the core IMO conventions on Safety of Life at Sea, Standards of Training, Certification and Watch-keeping and Prevention of Pollution from Ships.

The MLC is not the first important IMO instrument to address seafaring, as the existing International Convention on Standards of Training, Certification and Watch-keeping suggests. It is however, the first to address conditions of work, and the assumption into the IMO governance framework of matters, previously the purview of the ILO, suggests that the questions of seafarer welfare and morale are now considered important as aspects of the commercial practice of the shipping industry.

The MLC defines "seafarer" as any person employed or engaged or working in any capacity on board a ship covered by the Convention. In practical effect this means all ships involved in international trade and many in coastal trade.[140] It covers minimum requirements for seafarers to work on ships, permissible conditions of employment, accommodation, recreational facilities, food and catering, health protection, medical care, welfare, social security protection, compliance, and enforcement.

The intersection of issues of security and maritime workforce is reflected in the ILO Convention (Number 185) concerning Seafarers' Identity Documents, adopted in 2003 and entered into force in 2005.[141] Given the high mobility of seafarers, and the heightened security concern following the attacks of September 11, 2001, the Convention sought to provide for standardized documents and a uniform system for monitoring of security threats. The purpose was to ensure, through such prophylactic measures, that seafarers would not become virtual prisoners on their ships but would be able to go on shore leave in ports of call and in destination ports, and would be able to await transfer of ships or more freely transit to repatriation or onward transport to their next assignments.

A distinguishing feature of the seafarer's life is separation from family, community of origin, culture, and national society and polity. This is so not only for the duration of a given voyage, but more systemically over the course of a career it loosens bonds of affection and belonging. Seafarers can often find themselves at the end of a career psychologically isolated and even at times divorced from traditional structures of social welfare support.

Some of the most constructive and progressive initiatives on behalf of seafarers have come from mariners' unions and from civil society groups. The National Union of Seafarers of India for example provides an old people's home and a hospital for its members. It also reflects recognition of the specialized education and training needs of seafarers by operating a seafaring academy in Goa.[142] The Port Management Association of Eastern and Southern Africa (PMAESA) has supported efforts to prevent and respond to the spread of HIV/AIDS among seafarers, through research, training and provision of treatment and counseling.

[140] The exemption applies to vessels smaller than 200 gross tons that do not sail on international voyages.

[141] The United States has also not ratified this. Consideration has been held up by the potential inconsistency between the Convention and the requirements of US immigration law enforcement.

[142] Interview with Dr. R. Krishna Murthy, independent labor adviser, Mumbai, India, 2 August 2010.

An example of civil society initiative is the organization Women in the Maritime Sector of Eastern and Southern Africa (WOMESA), devoted to enhancing the role of women in the maritime sector in December 2007. With its headquarters in Mombasa in Kenya, WOMESA has been recognized and supported by the International Maritime Organization in support of its own commitments to the development of women under the rubric of the United Nations Millennium Development Goals (MDG).

Other initiatives to upgrade the skills and qualifications, and therefore the livelihoods, of seafarers have come from government or industry-initiated academies, such as the Singapore Maritime Academy, the Colombo International Nautical and Engineering College and the Mercantile Seamen's Training Institute in Sri Lanka.[143] One may understand easily the importance of training to the efficiency of the industry. What is often missed is the extent to which the welfare of seafarers is also served by training for modern seafaring. The extent to which a seafarer has higher skills is the extent to which s/he can command decent wages and be able to benefit from competition between employers for labor.[144] The downturn in the industry has placed pressure on labor costs.

Labor at Docks and Ports

A neglected element of the total picture relating to the rapid economic and technological changes in maritime commerce is that of labor in ports and docks. We may observe at the outset that ports have often been locations of militancy, sometimes the cutting edge of militant labor organizing and in many countries the most unionized of all sectors. The dockworkers in Aden formed the backbone of the independence and Marxist movements in British Yemen. The dock workers of India are among the most highly unionized. In the past, organized labor in the port of Mombasa was a force to be reckoned with. All point to the self-confidence that dock workers, stevedores and others evidenced in the past.

The vast technological changes in cargo handling at ports has reduced the importance of semi-skilled workers in ports, placed a premium on smaller numbers of more technically proficient workers, and given rise to unprecedented challenges. Rapid technological innovation in crane and other onshore and onboard loading and unloading technology have given rise to safety hazards.[145]

An enumeration of the key challenges of ports (other than investment and port design) emphasizes the importance and the weaknesses of human resource issues in the ports sector. Operation of information technology for amelioration of port congestion, operation of highly sophisticated and capital intensive cargo handling equipment, port support services, provision of port security, compliance with new port security requirements, and interface with vessels that are undergoing rapid evolution in design and technology: all these require trained and skilled workers, many in societies that currently suffer from serious systemic crises in their education systems and their systems for vocational training.

India is a case in point. Her burgeoning trade and the increasing emphasis placed on the private sector have contributed to the development of entire ports that are privately owned and operated. At these and older established government run ports, the technology has changed radi-

143 "Looking ahead," *Seatrade,* June 2010, page 111

144 *Ibid.*

145 *Lloyd's List,* 7 September 2010, page 4.

cally. Unions are powerful in this sector. India now finds herself faced with the challenge of adequately training sufficient numbers of new dock workers, upgrading the skills of existing ones, and addressing the unprecedented and vast challenges of occupational safety and health posed by rapid development in technology.

However, private enterprise remains partially aware of this need, or unwilling or unable to finance such training, while government has not accorded priority to it. The Ministry of Labor and the National Safety Council lack the skills and the resources to grapple with these issues,[146] and they remain part of India's larger crisis of insufficient trained labor to staff her growing economy.

The initial reference to the historical militancy of dock workers suggests that this issue requires urgent attention. In the absence of systematic initiatives to grapple with the labor skills and safety issues posed by a fast changing port environment, there is a real possibility of labor discontent turning to labor unrest. The consequences would be serious of anti-state forces exploiting that in a strategically essential and vulnerable sector.[147]

A Note on the Fisheries Sector

Although fisheries are not considered in the present work, it is important to note that those who work on board fishing vessels experience many of the same challenges as mariners in general. Technology in fishing has changed rapidly on large corporate fishing vessels, and this has raised many of the issues of skills and occupational hazards identified in our discussion of seafarers. Asia accounts for 80% of world fisheries, and much of this is conducted in the Indian Ocean, even by East Asian nations with substantial access to the South China Sea and the Sea of Japan. One hundred and fifty thousand fishers work on 2,500 vessels larger than 1,000 tons, many the size of cargo ships. Five million or more fishers work on vessels smaller than 100 tons, four million work on open-decked ships with engines, and five million on open boats without engines.

Fishing is an essential part of food security, for nations and for local communities. As they navigate the same oceanic realm as maritime commerce, the welfare and activities of fishers have bearing on the variety of issues that we have identified as relevant to the security of maritime commerce. Competition between local (artisanal) fishers and mechanized fleets has given rise to serious security threats including Somali piracy, while declining coastal fish stocks, declining in part because of environmental changes caused by maritime commerce, have forced fishers further out to sea and closer to sea lanes. Certainly, fish is one of the commodities traded worldwide on specialized refrigerated vessels. The ILO Convention Concerning Work in the Fishing Sector (Convention 188) was adopted in 2007 to regulate basic working conditions for commercial fishers, excluding only subsistence and recreational fishing.[148]

[146] Interviews with senior officials at the National Safety Council of India, and the Directorate General at the Indian Ministry of Labour and Employment responsible for occupational safety and health (DG/FASLI).

[147] We should at this point note the significant attention also devoted to security measures at ports, and the recognition that the role of dockworkers in that is key. This is reflected in the joint adoption of an IMO/ILO Code of Practice for workers at ports.

[148] International Labour Conference, *Convention Concerning Work in the Fishing Sector, Convention 188; and Recommendation Concerning Work in the Fishing Sector, Recommendation 199;* See also International Labour Organization, *Decent Working Conditions, Safety and Social Protection: Work in Fishing,* 2007.

Maritime Issues and International Security

3

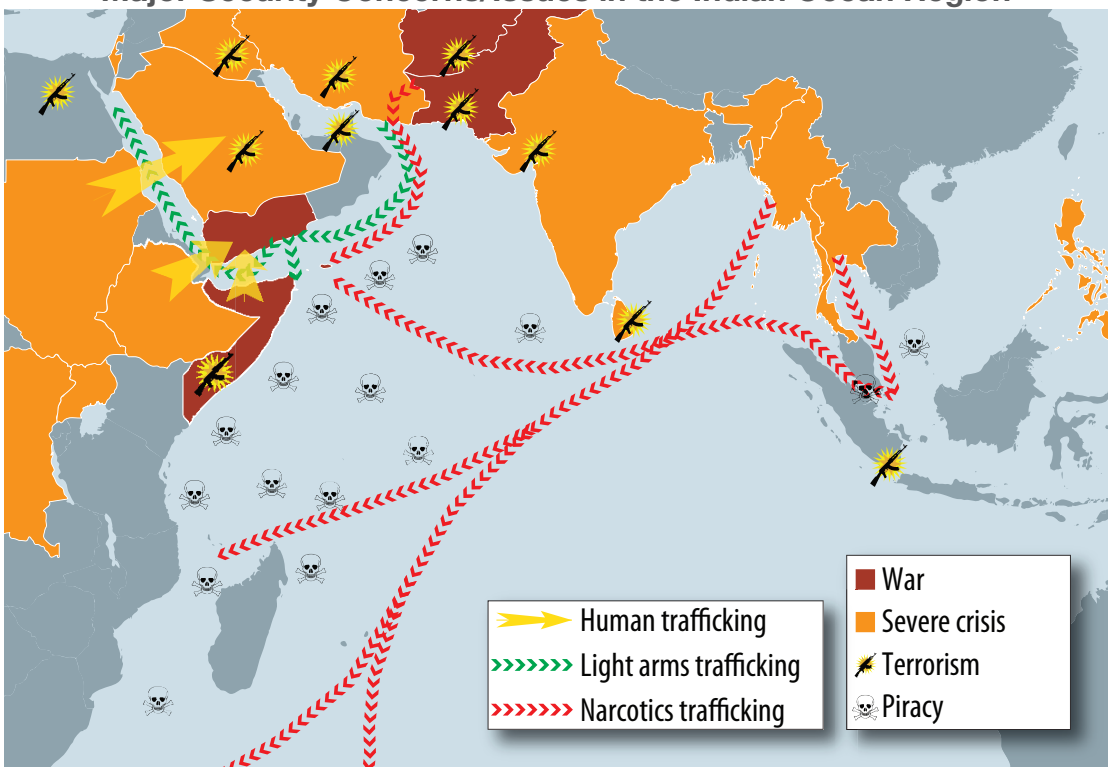
Security

Security Policy and Maritime Commerce

In an ocean as important as the Indian Ocean, the security of trading vessels is wholly contingent upon the concomitant security of the sea lanes of communication (SLOCs), littorals and ports that are essential to their operations. The added significance of the Persian Gulf and Arabian Peninsula as the world's single-most important source of petroleum merely serves to amplify this. Yet the threats to security in the Indian Ocean region (both at sea and within numerous countries that border the region) are as diverse as they are endemic. Over a total surface area of 73,556,000 square kilometers (28,400,000 square miles), it is possible to impose only limited security for trade and commerce in the Indian Ocean, even in its most threatened sub-regions.

Since the massive increase in global trade and petroleum flows from the 1960s onwards, the growth of Asian economies from the 1980s and the constant geopolitical turbulence in the Middle East and Per-

Major Security Concerns/Issues in the Indian Ocean Region



sian Gulf since 1968, the Indian Ocean has become increasingly pivotal in the strategic calculus of outside economic and/or political major powers. Furthermore, the discernable acceleration of India and China's economic growth and influence at the beginning of the 21st century, has, unsurprisingly, been matched by their drive to expand their military presence and power projection capabilities to ensure the integrity of the SLOCs that are every bit as essential to their own national security as they are for other powers that rely on trade from and through this space.

Additional factors that have forced themselves on the attention of those concerned with the security of maritime commerce include security threats in the form of trafficking of illicit drugs, people and weapons, and the more recent surge in piracy and armed robbery at sea.

The map on the preceding page and tables on the following page summarize the most important security threats and concerns in the Indian Ocean region. What becomes immediately apparent is that the scale of the problems and the diversity of the types of threat, not only their nature but also their location, can only be addressed through wide-scale cooperation. The multilateral approach to the conduct of maritime security in the Indian Ocean region, involving small states, regional powers, and extra-regional major powers, is a recurrent theme throughout this analysis.

The table on page 100 is revealing as an overview of the troublingly large number of security challenges and concerns facing this region of the world. Several are endemic, most notably trafficking of a diverse range of contraband. The findings can be summarized in the following way:

- Countries of greatest overall concern are marked in red – Pakistan, Somalia and Yemen;
- 19% of the countries in the region are experiencing varying degrees of involvement in armed conflict;
- 31% of countries have varying degrees of terrorist threat to their country and some are bases for major terrorist groupings, such as AQAP in Yemen;
- 33% of countries are threatened by piracy in adjacent international waters or armed robbery at sea inside their own territorial waters;
- 39% of countries in the Indian Ocean region have governments that exhibit some degree of political risk, while several have serious domestic socio-political instability, such as in Pakistan, Yemen and Somalia;
- 53% of all countries still have persistent maritime territorial disputes with neighboring states; and
- 56% of all countries in the region are threatened by the endemic problem of illicit trafficking of arms, narcotics or people, either as sources, conduits or as destinations. This is the single largest security problem for the region, and one of the most problematic to limit, much less prevent.

The table on page 101 captures the pressing security concerns and issues facing both governments inside the region and several key stakeholder governments outside the region that have key strategic interests in and around the Indian Ocean. The table reveals key areas, vital bordering states, security issues, germane strategic issues, and international military presence and deployments. Key areas of concern remain the need to keep critical trading SLOCs and chokepoints secure and free

Security Concern/Issue Summary for the Indian Ocean Region 2009/2010

Country	War/Armed Conflict	Terrorism	Maritime Trafficking (Drugs/Weapons/ People)	Piracy and Armed Robbery at Sea	Political Risk or Internal Instability	Maritime Territorial Disputes
Australia						X
Bahrain						
Bangladesh			X	X	X	X
Comoros						X
Djibouti			X			
East Timor					X	X
Egypt		X	X			X
Eritrea			X			
India		X	X	X		X
Indonesia		X		X		X
Iran		X	X		X	X
Iraq	X	X			X	X
Israel	X	X			X	
Jordan						
Kenya			X	X	X	
Kuwait						X
Madagascar			X			X
Malaysia				X		X
Maldives						
Mauritius			X			X
Mozambique			X		X	
Myanmar			X		X	X
Oman			X	X		
Pakistan	X	X	X		X	X
Qatar						
Saudi Arabia	X	X	X			X
Seychelles				X		X
Singapore				X		X
Somalia	X	X	X	X	X	
South Africa						
Sri Lanka		X			X	
Sudan	X		X		X	
Tanzania			X	X		
Thailand			X	X	X	
UAE			X			X
Yemen	X	X	X	X	X	

Sources: AON Political Risk Services, CIA World Fact Book, IMB, SIPRI, Risk Intelligence

from armed threat or blockade. The latter objective, the presence of aforementioned threats such as trafficking and piracy, and the latent risk of a maritime terrorist threat in certain areas are reflected in the levels of naval presence, most notably the presence of CTF-150, CTF-151, Standing NATO Maritime Group (SNMG) 1 or 2, the EU's ATALANTA force, or various elements of the US 5th Fleet. From a US perspective, this space is clearly the responsibility of CENTCOM; however, it would be fair to point out that notwithstanding the wide array of maritime-related and based threats,

Security Threats and Concerns Within Sea Areas

Sea Area	Bordering States of Concern	Security Concerns	Strategic/Geopolitical Concerns	Naval/Military Presence
Red Sea	Egypt, Israel, Saudi Arabia, Sudan and Yemen	Trafficking of illicit drugs, weapons and people; piracy and armed robbery at sea; terrorism; insurgency and civil conflict	Critical conduit for east-west trade, movement of petroleum; transit for naval forces between Atlantic and Indian Ocean	NATO ATALANTA CTF-150 CTF-151 U.S. 5th Fleet Other navies: Egypt, Israel, Saudi Arabia
Arabian Sea	Pakistan, Somalia and Yemen	Trafficking of illicit drugs, weapons and people; piracy and armed robbery at sea; terrorism; insurgency and civil conflict	Critical crossroads for east-west trade, movement of petroleum; deployment of naval forces for maritime security operations (MSO), power projection and SLOC protection	NATO ATALANTA CTF-150 CTF-151 Other: Russia, China, Iran, India, Pakistan, Saudi Arabia, Malaysia and Singapore
Persian Gulf	Iran, Iraq and Saudi Arabia	Trafficking of illicit drugs and people; terrorism; insurgency and civil conflict in Iraq; potential threat from Iran	Critical access and conduit for petroleum; access for protective naval forces for MSO, power projection and SLOC protection	U.S. 5th Fleet CTF-IM CTF-152 Iran
Bay of Bengal	Bangladesh, Myanmar and Thailand	Trafficking of illicit drugs; piracy and armed robbery at sea	Critical access to petroleum-producing littoral areas; access for naval forces for power projection; SLOC protection and disaster relief	India China Thailand Myanmar Malaysia
Suez Canal	Egypt	Trafficking of illicit drugs and weapons	Critical conduit for east-west trade; movement of petroleum; and transit for naval forces between Atlantic Basin and Indian Ocean	NATO ATALANTA CTF-150 CTF-151 U.S. 5th Fleet Russia Regional navies: Egypt and Israel
Bab el Mandab	Yemen	Trafficking of illicit drugs, weapons and people; terrorism; insurgency and civil conflict	Critical conduit for east-west trade, movement of petroleum; transit for naval forces between Atlantic and Indian Oceans	NATO ATALANTA CTF-150 CTF-151 U.S. 5th Fleet Saudi Arabia Russia
Straits of Hormuz	Iran	Trafficking of illicit drugs and people	Critical conduit for petroleum, access for naval forces for MSO, power projection and SLOC protection	U.S. 5th Fleet CTF-IM CTF-152 Saudi Arabia Iran
Strait of Malacca	Indonesia	Trafficking of illicit drugs and weapons; piracy and armed robbery at sea	Critical conduit for east-west trade; movement of petroleum; transit for naval forces for MSO, power projection, SLOC protection and disaster relief	U.S. 7th Fleet China Singapore Australia Malaysia Indonesia Royal Navy

the main focus of CENTCOM's kinetic effort remains on land, most obviously in Afghanistan and Iraq.

The Indian Ocean space has a broad spectrum of extant security realities and potential concerns. This is to be expected, and for all practical purposes, accepted by those actors that use or exist within this realm for trading, commercial and strategic reasons. These include:

- Criminal concerns: Illicit trafficking (narcotics, people and arms), piracy and armed robbery at sea, and terrorism;
- Insurgent and/or terrorist activity within complex or weak and/or failing or failed states;
- Geopolitics, conflict and security in the Persian (Arabian) Gulf.

Crime and Terrorism

The northern Indian Ocean sees substantial illicit trafficking of narcotics, small arms, light weapons, ammunition and explosives (SA/LW/AE), and people. The area of concern comprises the Arabian Sea (which includes the Gulf of Oman, the Gulf of Aden and the waters off the Horn of Africa), the south section of the Persian Gulf, specifically the Straits of Hormuz and the waters between the south-western corner of Iran and the Gulf coast of the United Arab Emirates (UAE). Whether as sources, conduits or destinations, the area of concern also encompasses coastal areas of Iran, Oman, Pakistan, Saudi Arabia, Somalia, the UAE and Yemen.

The Arabian Sea has a long history as a crossroads for smuggling among the countries of the Indian subcontinent, the Middle East and East Africa. Smuggling of narcotics, alcohol, weapons, ammunition, and other contraband is common within, and through, this maritime space. A principal maritime smuggling route extends from Iran and Pakistan to Europe and Africa through the Gulf of Oman (with the navigational track typically following the Omani coast), along the Yemeni coast in the Gulf of Aden and then northwards into the Red Sea via Bab el Mandab and then on towards the Suez Canal. This routing has also been referred colloquially by the US Navy as the "Hash Highway."

Recently, the Omani government has stepped up surveillance operations in the littorals off Oman, covering not only its major ports of Port Sultan Qaboos and Salalah but also to support interdiction efforts against traffickers using Dhows and fast boats bound for ports such as Sohar and smaller landing areas on Oman's northeast facing coast. The land borders between Oman and the UAE remain porous as a trafficking route for transshipped narcotics, while the northern border areas of Yemen are a persistent transit area for illegal substances and small arms being smuggled into Saudi Arabia. This sparsely-populated area is also known as a crossing area for migrants and trafficked persons moving between Yemen and Saudi Arabia.

There is a commonality of methods, and in some instances means (institutional and financial networks, personnel and vessels) between criminality and terrorism, and also with piracy. A detailed account of opiates trade from Afghanistan and Pakistan is found in Appendix VII.

In the aftermath of the attacks by AQ maritime cells on the USS Cole in Aden in 2000 and the VLCC Limburg off the coast of Yemen in 2002, and the Al Qaeda in Iraq (AQI) attacks against the Iraqi oil terminals in April 2004, coalition partners have been concerned by the prospect of follow-on attacks by AQ and AQI against shipping and petroleum infrastructure in

the Arabian Sea and Persian Gulf. Terrorist attacks of this kind have not occurred since 2004. While the threat of maritime terrorism in these regions, and the maritime capability of terrorists in the Middle East, has at times been exaggerated, prudence demands that coalition navies, merchant crews and oil industry personnel remain vigilant to the possibility of a maritime terrorist attack. The reason for such caution is concern over the potential environmentally destructive consequences of a successful attack upon a laden VLCC or oil terminal, as much as its political consequences.

Currently, the maritime effect of insurgent-related conflict in the region presents more of an immediate concern for maritime security even if the effects have been to date rather less dramatic than focused terrorist attacks against vessels and/or terminals. The conflict between Yemen's government forces and the Shiite Houthi insurgents in the mountainous northwest of the country, on the border with Saudi Arabia, have given rise to an increase in the trafficking of arms to Yemen. In October and November of 2009, Saudi naval forces were forced to implement an effective blockade of Yemen's Red Sea coast in an effort to interdict arms supplies from Eritrea and Iran bound for the insurgents in Yemen. Several violent clashes between smuggling vessels and Saudi warships resulted. While the incidents were limited in number and geographically confined to the southern reaches of the Red Sea, the potential effect of a prolonged insurgency upon maritime security in the region is clear. While it may not threaten international shipping unduly, an increase in maritime counter-trafficking and counter operations could divert resources and attention away from other vital maritime security operations missions, such as ongoing counter-piracy operations. This concern would be exacerbated if the civil conflict inside Somalia sent large numbers of refugees fleeing across the Gulf of Aden, or if the war prompted an increase in the illicit trafficking of arms from Yemen to the Horn of Africa.

Case Study: Security of India's Coasts[1]

India suffered perhaps the greatest blow ever inflicted by seaborne terrorism on November 26, 2008 when a handful of Pakistanis conducted a commando raid on central Mumbai, in which 170 people were killed.

In addition to approximately 200 ports of varying sizes, India's 7,600 kilometer coastline offers a plethora of small landfalls, coves and harbors. Its Exclusive Economic Zone (EEZ) of two million square kilometers and its territorial waters present a proliferation of fishing and coastal trade, with at any given time thousands of craft at sea. Like the preponderant part of India's economy, her coastal economy is dominated by the so-called "informal" economy, unregulated, economically marginal, and small scale.

The challenge of maintaining domain awareness and control of this space, and of policing it, has long bedeviled Indian authorities. In the early 1990s, gangs based in Mumbai and the Gulf that had dominated smuggling and trafficking into western India were associated with terrorist attacks on the Bombay stock exchange. The author's conversations with Indian security officials – police and intelligence – at the state and national levels before the attacks on Mumbai suggested a widespread awareness of high vulnerability along India's coasts.

The centralized communication and monitoring systems that would be required appear to have received little serious planning consideration, though they form part of general discourse about this vulnerability. Certainly serious planning has not been in evidence for the high capital costs of establishing a comprehensive infrastructure that would include the necessary number of coastal radar and other monitoring stations at the necessary distances, as well as the costs of equipping the thousands of artisanal coastal craft with transponders.

As is often the case in security vulnerabilities of this kind in developing countries with scarce public resources, there is a complex sociology that compounds the problem. Most significant at the level of state preparedness is the hapless failure to coordinate among various security institutions. Analysis by Indian security experts on the terrorist attacks in Mumbai in 2008 suggests that there was a signal failure to communicate and coordinate among the Navy, the Coast Guard, and marine units of the state police. Equally damaging was the hoarding of intelligence and the lack of timeliness in its dissemination.

Experience since the Mumbai attacks has revealed an institutional lassitude reflected in a reluctance to diagnose the institutional source of vulnerability and to ameliorate it. Given that the attacks were of national significance, and that intelligence institutions and security forces of the central as well as state governments were brought to bear (and implicated in the failure) it is remarkable that the central government has yet to convene a formal independent inquiry. The inquiry convened by the state government of Maharashtra, which could only look at the portion of the picture under state jurisdiction – namely the police – had its report permanently embargoed and closed to public disclosure.

This bodes ill for current attempts to improve coordination between the Indian Navy, the Coast Guard and the police, despite brave accounts of interceptor vessels commissioned, the Navy spreading awareness in coastal communities, and clear demarcation of responsibilities for the Navy, Coast Guard and police.

Coastal vulnerability has both a system-wide and a local dimension. The system-wide dimension is the pervasive corruption of bureaucrats and police that

[1] This discussion draws on interviews over a period of two years with dozens of active duty and retired senior Indian police and intelligence officials in Kerala, Maharashtra, Gujarat and Delhi, and active duty and retired Indian Navy officers. See also "Coastal Security Gets Pride of Place," *The Asian Age*, 1 July 2009.

offers an entrée to terrorists. The localized may be understood by reference to the cases of the western coastal states of Kerala and Gujarat.

Like the seas off Somalia a few years ago, Kerala today suffers from violent confrontation between mechanized and artisanal fishers. This provides an enabling environment for the entry of terrorists and other criminals, including organized crime syndicates. It also distracts scarce police resources and personnel from other law enforcement into the necessity of policing these confrontations. Compounding the picture is the partisan political angle brought to this by the significant influence enjoyed by fishers in Kerala's Communist Party.

Police in Kerala have been increasingly worried about the vulnerability of their coasts. They have been concerned about the convergence of such conflict, the failure to effectively patrol the coasts, the simultaneous injection of criminality and militant ideology into the state as a result of the extensive nexus to the Gulf owing to the large population of Keralites there, and the geographical feature of the "backwaters" which offer topographical cover for potential terrorists and criminals.

Gujarat offers a distinct but equally telling indication of the vulnerability of India's coasts. Its contiguity to Pakistan and Pakistani territorial waters, the historical maritime smuggling routes connecting it to Pakistan, Iran and the Gulf, and the fact that its territorial waters were the launching pad for the final stage of the terrorist attacks on Mumbai in 2008, heighten Gujarat's sense of vulnerability. That Gujarat is also the site of the massive distillates refinery at Jamnagar, a global source of supply, suggests the seriousness of this. The vulnerable security of Gujarat has already dealt a serious blow in the form of a substantial decline in coastal trade off Gujarat.

The attacks on Mumbai also revealed the vulnerability of the substantial financial, industrial, nuclear, and commercial infrastructures at risk in the northwestern coasts of India. Whether it is facilities such as nuclear reactors of Maharashtra or the Jamnagar refinery, the question that arises is how highly influential business interests will seek to protect their facilities from such risk. At present, business appears to rely on private provision for security. However, in the absence of more complete domain awareness, involving law enforcement, intelligence and the Navy, the risks of terrorist attack remain high. Certainly the Pakistani terrorists who attacked Mumbai targeted symbols of India's prosperity and of her connection to the global culture and economy.

Piracy and Armed Robbery at Sea

For historical perspective, it is important to remember that the roots of a modern system of armed peace in the Persian/Arab Gulf and Oman lay in British concern with piracy emanating from the Gulf sheikhdoms. The modern sovereign state system in the western Gulf/eastern Arabia is based on the "Trucial States"[149] established by an outside power to create a security system to protect British shipping on the Indian trades.

A marked difference today is that the capacity or willingness of the states where vessels are owned to protect them has diminished considerably. Whereas in the past the country of ownership would have also been the vessel's flag state, that is hardly ever the case today. The high likelihood today is that a large, sophisticated, well-funded vessel is registered in a "flag of convenience" state that has poor capacity to offer sovereign protection. Indeed, it is precisely state weakness (to regulate) that has recommended these "flags of convenience."[150]

Whereas in the past there would have been a uniformity of interest and goals between private commercial interests and the perceived public interest in maintenance of order, today we find a significant divergence. In an environment in which commercial shipping and its freight customers are vulnerable to huge financial losses, physical damage or ransoms as a result of piracy, there appears to be little unanimity between ship owners, freight customers, and governments, or even among different types of ship owners.

As a result, naval forces of a dozen nations or more have undertaken substantial burdens in the form of financial expenses and distraction from other military missions in order to police commercial sea lanes and deter attacks against commercial shipping. This represents an aggregation of interests and effort within a community of nations, most of them from outside the Indian Ocean, with a strong collective interest in the security and costs of seaborne commerce.

[149] 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).

[150] In the interests of fairness we should however note that at least one small and weak state that hosts a substantial ship registry, the Marshall Islands, has shown serious attention to the threats to its shipping in the Gulf of Aden. Although not able to dispose of military force, it has been forceful in pursuing prosecution of Somali pirates in Kenya. *Tradewinds,* 17 September 2010, page 54.

One may ascribe this global aggregation and dissociation from any particular national polity to, among other factors, the passing of maritime consciousness and activity integrated into the national consciousness of seagoing nations. This has been replaced by a globally integrated industry of interest largely to specialist insiders. Moreover, the fact is that vessels at sea belong physically to an inherently transnational realm and are invisible to national consciousness in any given country. They rise to national consciousness only when they dock, or when landward interests such as commodities traders or insurers are put at risk as a result of events such as pirate attacks.

It has been difficult to reach consensus among the key players on means that shipping could undertake to reduce its vulnerability. Whereas many ships have agreed to sail in convoy or to use relatively secure routes, others have found it too costly to do so. There has been little consensus on the precise shipboard measures to be adopted. Some security experts and governments have proposed armed guards, while ship owners and crew have often believed these to be insufficient for protection, yet provocative to attackers and therefore likely to increase danger to vessels and crew. Companies with substantial financial reserves or good insurance cover have considered it more cost-effective to pay pirates ransoms for the release of vessels. In either case, smaller, poorly capitalized vessels and companies have been unable to contemplate ransoms or adequate security. Among the crews of many smaller companies and vessels which invest little in training, there is a serious lack of awareness of the most elementary self-protection measures, such as how to prevent boarding.[151]

In sum, there is no agreed set of protocols and best practices. For example, the Automatic Identification Systems (AIS), or other means of information access for ships as well as their owners or naval patrols, and communication among vessels, may offer some degree of prevention or protection. Unfortunately, such systems are accessible certainly to pirates on captured ships. In any case, as their revenues have grown, pirates have substantially redressed their technological disadvantage *vis-à-vis* ship owners and navies or coast guards.

With respect to piracy, the general impression is of a cast of characters that is unsure of the plot or the script. Navies and task forces, which have certainly improved coordination among themselves, nonetheless are in the posture of policing an impossibly large area of ocean, and running to catch up. The industry's attempts to systematically address its own vulnerability also have a long way to go to be effective. Vessel Classification Societies and insurers do increasingly disseminate information about vessel vulnerability or risk respectively, but the knowledge of insurers is limited, and the structure of hazard and cover relative to piracy is in a state of confusion. Hull insurers want to unload piracy cover to war risk insurers. At the same time, there are *lacunae* in pi-

[151] There are significant disagreements in the industry and between industry and governments on measures to be adopted. For a very useful overview of armed guards on merchant vessels see Sam Bateman, *Riding Shotgun: Armed Security Guards onboard Merchant Ships,* (S. Rajaratnam School of International Studies, Nanyang Technological University, Singapore, 5 March 2010). For an excellent review of the issues in marine insurance raised by the recent spate of piracy, see Joshua Ho, *Marine War Risk Insurance: Should the Government be Involved?* (Institute of Defense and Strategic Studies, Nanyang Technological University, Singapore, 10 March 2006).

racy coverage, which omits ransom cover as well as personal kidnap.

The landward effects of piracy, for example in the influx of pirate revenue into real estate markets in Mombasa, have been previously noted. Whenever such an influx of cash is accompanied by the burgeoning of large-scale infrastructure as seen in port developments such as Lamu, we may anticipate the "business" opportunities for pirate revenue will potentially compromise the security of ports and vessels, at least against criminality if not worse. That this is not a paranoid fantasy is indicated by the very sophisticated networks of lawyers, negotiators and financiers that have been acting for pirate interests in ransom negotiations.

The current high importance to maritime commerce of piracy was reflected in the IMO Council's 104th session (June 7 to 11, 2010) approving a proposal by IMO Secretary-General Efthimios Mitropoulos that the theme of next year's World Maritime Day should be "Piracy: Orchestrating the Response." Several features of this declaration deserve note or emphasis. Secretary-General Mitropoulos observed that this is an endemic problem, not only off the Horn of Africa but in other parts of the world, and that it has resisted many and varied efforts at containment. He called for the international maritime community to secure the release of hostages; strengthen protection of persons, ships and cargoes; ensure compliance with adopted measures; promote cooperation among states; and build the capacity of states to deter, interdict and bring perpetrators to justice.[152] As significant as the bare elements of this policy statement are, the details that elaborate their meaning, and the subtleties of phrasing, capture the divergent if not conflicting interests of governments and commerce.

A heartening emphasis is that the statements both on release of hostages and on strengthened protection of persons reflect a concern with the welfare of seafarers, including explicit reference to the need for provision of care for victims of attack, kidnap and hijacking. The concluding language of the statement subtly notes the debate between industry and governments about their respective responsibilities and the allocation of costs. It refers to IMO not only "intensifying its efforts to meet the challenges of eradicating the scourge of piracy worldwide but, more importantly, to orchestrate the right response, among all concerned, to achieve the set objectives." (emphasis added)

The reference under the heading of strengthening state capacity to the specific need for enhancing safety of life at sea and maritime law enforcement points up the scale of the challenge, given that the principal state in question, Somalia, barely has any functioning government at all. Therefore, despite the accurate and progressive analysis reflected in the reference here to the need to protect maritime resources (recognition of the roots of Somali piracy in conflicts over fisheries), the statement does explicitly recognize the Somali challenge, only to impotently acknowledge what the international community has for two decades failed to settle, namely that Somali stability is the key.

The IMO's official position reflects a sense of crisis and a call for decisive action from all parts of the industry, despite the fact that the industry itself has been unable to settle upon a clear course of action that it prefers. Some 92,000 signatories joined a petition against Somali

[152] IMO release, *IMO to focus on piracy response in 2011 WMD theme,* June 2010.

piracy from ship owners and trade unions to the IMO Secretary-General.[153] Simultaneously, the Asian Shipowners Forum called for stronger action against piracy in the South China Sea.

Historical and Geographical Perspective

Piracy and armed robbery at sea occur in many parts of the Indian Ocean, and in some areas the problem continues to deepen. Indeed, piracy in the western Indian Ocean, specifically occurrences in the Gulf of Aden and off the Horn of Africa, now far outstrip occurrences anywhere else in the world. Before concentrating on the latter concern specifically, a brief overview of the wider problem in recent years is warranted, not only to lend perspective on the geographical scope of this persistent crime and the responses ranged against it, but also to establish points of reference for potential future areas of increased concern.

International Maritime Bureau (IMB) records from 2003 to 2009 reveal that incidents of piracy and armed robbery in the Indian Ocean region have occurred in the sea areas and territorial waters listed in the table below. In this report, for the purposes of definitional clarity, Armed Robbery at Sea are those cases of violent crime against vessels and crew (including vessel seizure and crew kidnapping) that occur inside the territorial waters of a sovereign state, and as such fall into the security responsibility and jurisdiction of that state. Acts of piracy, on the other hand, are those cases of violent crime against vessels and crew (including vessel seizure and crew kidnapping) that occur on the high seas in international waters.

Armed Robbery at Sea and Piracy in Territorial Waters 2005–2009

Armed Robbery at Sea		Piracy in Sea Areas
Bangladesh	Myanmar (Burma)	Andaman Sea
Egypt	Oman	Arabian Sea
Eritrea	Saudi Arabia	Bay of Bengal
India	Seychelles	Gulf of Aden
Indonesia	Somalia	Malacca Straits
Iran	South Africa	Persian Gulf
Iraq	Sri Lanka	Red Sea
Kenya	Tanzania	Singapore Straits
Madagascar	Thailand	
Malaysia	United Arab Emirates	
Mozambique	Yemen	

Source: *IMB Piracy & Armed Robbery Against Ships Annual Report 2008 & 2009*

Ports in the Indian Ocean Region with Three or More Reported Incidents During 2009

Country	Port	No. of Reported Incidents of Armed Robbery
Bangladesh	Chittagong	17
Tanzania	Dar es Salaam	5
Malaysia	Sandakan	4
India	Kakinada	3
	Kochin	3
Indonesia	Balongan	3
	Belawan	3

Source: IMB 2009 Annual Piracy Report

Of all the *reported* piracy and armed robbery at sea incidents recorded world-wide by the IMB from 2003 to 2008, 66.34% of these occurred within the Indian Ocean region, a little over two-thirds. Just over 82% of the reported incidents between 2003 and 2008 occurred in the following territorial waters and sea areas in order of magnitude: Indonesia, Bangladesh, the Gulf of Aden, Somalia, the Malacca Straits and India. In 2009, the piracy and armed robbery at sea problem was again centered in the north-western and north-central parts of the Indian Ocean. By the end of 2009, the IMB had recorded 406 incidents[154] worldwide, a 28% increase

[153] *Lloyd's List,* 23 September 2010, page 2.

[154] ICC International Maritime Bureau, *Piracy and Armed Robbery Against Ships Annual Report,* 2009.

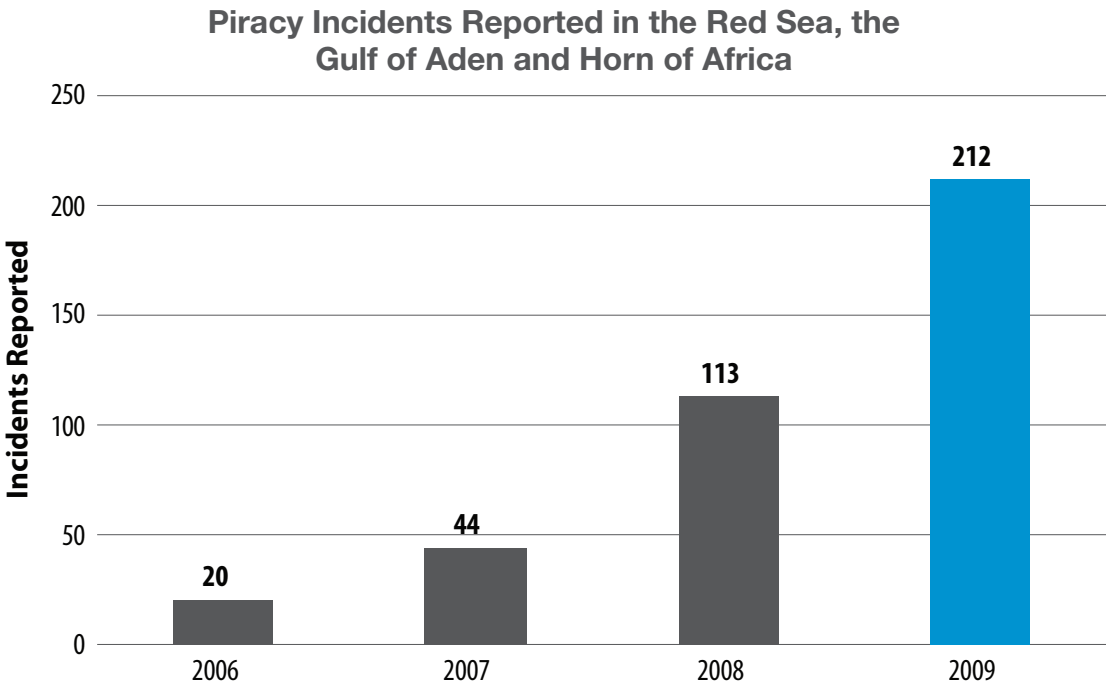
over 2008. Of these, 295 incidents[155] were recorded as occurring in the Indian Ocean region, which amounts to 73% of all incidents reported world-wide – almost three-quarters. The problem has also affected vessels at ports, anchorages and inroads in the Indian Ocean region, which is shown in the table on the previous page. Confronting the threat of attacks in ports is the sole responsibility of the security forces of the sovereign state concerned.

Until 2006, the area of greatest concern was the Malacca Straits, the Singapore Straits and the territorial waters of Indonesia and Malaysia. Incidents in and around the Mouth of the Ganges and Bangladesh have also been a persistent concern throughout this period. However, it has been the sharp rise in incidents in the Gulf of Aden, off the Horn of Africa (specifically the Somali coast), and more recently, the kidnap-for-ransom attacks occurring deeper into the Arabian Sea and mid/northern Indian Ocean since 2008, that is currently of greatest concern to the international community. Overall, however, it can quickly be seen that during the last five years, the Indian Ocean region remains, by a wide margin, the maritime area of greatest concern with regards to piracy and armed robbery at sea.

Piracy in the Gulf of Aden and off the Horn of Africa

Any piracy or armed robbery at sea (in its contemporary manifestation) is a product of outright or comparative terrestrial lawlessness and inadequate security on and near the coast of a given state or territory, combined with proximate shipping lanes and high numbers of transiting (or calling) vessels, which essentially become targets of opportunity if not adequately prepared and/or protected. In the case of Somalia, which is now arguably the world's pre-

[155] *Ibid.*



Source: IMB Piracy & Armed Robbery against Ships Annual Report 2009

eminent and most enduring failed state, the pre-requisites for chronic levels of piracy and armed robbery of ships are without equal anywhere in the world. [Currently, only Nigeria comes close to having similarly favorable conditions for piracy and armed robbery, and high levels of attacks.] Indeed, the scale of the problem confronting the international shipping community and the regional states has resulted in the formation of the largest international naval effort since the Tanker War in the late 1980s to help protect shipping in the region. The graph on the previous page gives a clear indication as to the change in the situation during the period 2006 to 2008.

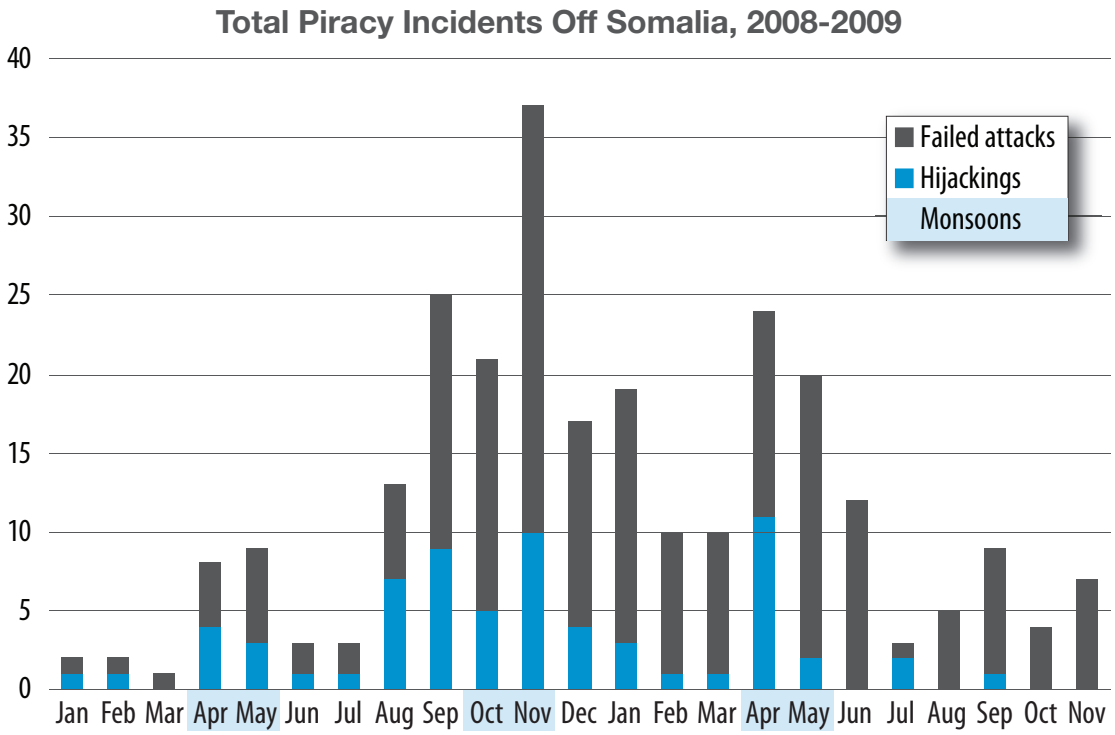
The drastic rise in incidents of piracy in the Gulf of Aden in 2008 stemmed from five principal factors:

- Merchant shipping steaming north/south in the Somali Basin had begun to heed piracy warnings from the IMB, and started to navigate beyond 200 nautical miles from the coast, thereby making them less attractive as targets;
- The escorting of World Food Programme (WFP) vessels bound for Somalia and Kenya had the desired deterrent effect of halting attacks against these vessels in the Somali Basin, and also provided an added measure of 'perceived' protection for other *unescorted* shipping in this area – this prompted pirates to concentrate their efforts on easier targets in the Gulf of Aden;
- The deteriorating security situation ashore in Puntland enabled pirates far greater freedom of operation in the Gulf of Aden, and an opportunity for pirate gang leaders to offer greater pay and rewards to those that participated;
- The sheer volume and geographic density of available shipping in the Gulf of Aden from which to select 'targets of opportunity' as compared to the comparative paucity of targets in the Somali Basin;
- As it became increasingly obvious that there were great financial gains to be had from the kidnap and ransom formula, this fact merely served to fuel the enthusiasm for more pirates to put to sea to collect their share.[156]

Pirates operating from bases in Somaliland are rare (with the exception of the Sanag region). The majority of pirates are based in Puntland, with Eyl having emerged as a major pirate base of operations from 2007. The town of Garad is now also a notable launch point for attacks, and a holding area for captured vessels and kidnapped crews. Ras Aser and Haifun also continue to be used as bases, but to a lesser extent.[157] Independent piracy researchers have identified some 50 groups routinely operating from bases in Puntland. However, there are acknowledged variations in skill sets and levels of at-sea experience.

Piracy tactics improved during 2009, with the more experienced teams using coastal fishing fleets for cover and deception, carrying out attacks under cover of darkness, extending the effectiveness of the skiff/mother-ship operations to the extent that attacks into deep-ocean against lone vessels in the shipping lanes are becoming common; and carrying out assaults against faster, higher freeboard vessels, such as container and Ro-Ro vessels. Several of the vessels seized in 2009 have been 'recycled' and used as mother ships for deep-ocean work, such as the Yemeni fishing vessels, *Farei*

156 *Risk Intelligence* – www.marisk.dk.
157 *Ibid.*



Source: Risk Intelligence

Ali Afraaf. Reports indicate that a local coastguard has been formed in Puntland and that a 'formal' coastguard is in the process of being established. However, given endemic corruption within the security apparatus within Puntland, the legitimacy and reliability of these units remains highly questionable. The UN-sponsored Special Protection Units (SPU), that have been hired by transiting vessels are deemed more reliable as a means of protective escort in Puntland's coastal areas.

The graph above shows the levels and trends in attacks from the beginning of 2008 to the end of 2009. Though the changes are not all attributable to any single factor, the monsoon transition phases in the Indian Ocean have been identified as favorable to pirate operations due to the reduced sea states. The onset of the monsoon transition periods (the intervals between the summer and winter monsoons) result in a moderation of the prevailing winds, which has the effect of reducing the sea states (wave height) in the northern Indian Ocean. From mid- to late-December, the weather is dominated by the winter monsoon (also known as the North-East Monsoon or Retreating Monsoon). At the end of the transition period in November, the northern land mass of the subcontinent cools off rapidly and the air pressure builds over northern India. This results in colder winds sweeping down from the Himalayas towards the warmer air and lower pressure of Indian Ocean, resulting in high north-easterly winds and increased sea-states. These are generally unfavorable conditions for piracy activity in small open boats and small mother ships.

Deep Ocean Attacks

Though piracy and armed robbery at sea in the north-central regions of the Arabian Sea are certainly not occurring at the levels seen in the Gulf of Aden and Horn of Africa, there has been a worrying increase in the number of incidents reported far offshore and in northern coastal areas starting in 2009. There are growing concerns surrounding the regularity with which pirates are attacking deeper into the western and north-central Indian Ocean along the north-easterly/south-westerly shipping lanes, and more recently as far to the north-east as the Omani littoral and midway between Oman and the western Indian state of Gujarat. In mid- and late-2009, attacks were reported as far as longitude 67°E. On April 6, 2009, the bulk carrier MV Shanghai Venture was attacked in position 15° 13' N 067° 15' N (approximately 1,110 nautical miles north-east from the town of Eyl on the north-eastern Somali coast). The latter attack by Somali pirates operating from a mother ship occurred only 420 nautical miles from the Indian coast. More recently, the attack on the large oil tanker *Irene SL*, carrying oil from Kuwait to the United States, suggested an increase in the capacities of Somalia-based pirates.The hijack of an extremely large vessel with a cargo worth $200 million so far out at sea demonstrated the pirates' adaptation to the prophylactic measures shipowners had taken in the Gulf of Aden region. In the first two months of 2011, 10 vessels had been seized in the Indian Ocean or Arabian Sea, compared to three in the same period of 2010, only one of them outside the Gulf of Aden.[158] This development has led to naval coalition directives recommending that merchant vessels keep at least 600 nautical miles off Somalia's eastern coast; however, independent risk experts are recommending that vessels steaming from the Persian Gulf and Subcontinent bound for the south-western Indian Ocean should stay east of longitude 62°E.

As an added complication to the safety of merchant ships in the western and central parts of the Indian Ocean, there have been an increasing number of attacks in the shipping lanes between the Seychelles and Mombasa and Dar-es-Salaam. Until March 2009, attacks in the central and southern parts of Somalia were much reduced, due in no small part to the increasing control of Islamists in these territories, such as the Alliance for the Re-Liberation of Somalia-Djibouti (ARS-D)'s increasing influence in Haradhere and Hobiyo. However, from March 2009 as ARS-D were involved in increased factional/clan fighting in Mogadishu, which required varying levels of withdrawal of fighters from Hobiyo and Haradere, pirate teams were given a freer hand in restarting their activities, including long-range operations offshore and further to the south off the Seychelles, Kenya and northern Tanzania.

Typical Pirate/Armed Robbery Attack Modus Operandi

The typical attack happens during hours of low light during dawn or dusk, with the majority occurring at dawn. However, increasingly some attacks are also occurring at night when there are clear skies and a sufficiently full moon phase. Attackers use small open skiffs, which are capable of speeds up to 25 knots. These craft can operate directly from the shore, although increasingly they are being deployed from a larger mother-ship (usually a fishing boat or motorized dhow). The mother ships

[158] "Ill wind for navies as pirates extend their reach," *Financial Times*, 15 February 2011.

provide logistical support, and the better-equipped vessels use radar and AIS to assist in target location and identification for the small attacking skiffs. Two or more skiffs are used in the attack, trailing the target vessel and then approaching from astern/quarters. Pirates are generally armed with assault rifles (AK-47) and grenade launchers (RPG-7). Ladders and/or grappling lines are used in gaining access to the vessel's upper deck. Slow, low-freeboard vessels – such as chemical and product tankers, small general cargo vessels, fishing boats, tugs and offshore support vessels, laden bulk carriers, and even VLCCs – are more vulnerable to attack. Routinely, pirates are also firing at the vessel's bridge/wheelhouse in order to intimidate the master to slow or stop the vessel to facilitate easier boarding, otherwise referred to as 'fire-for-effect.' Once pirates have successfully boarded and taken control of the vessel and crew, they proceed to a safe haven controlled by a pirate syndicate off the east coast of Somalia while a ransom is negotiated and delivered. The vessel, cargo and crew are considered by the pirates to be a valuable asset, and it is not in their best interests to damage the vessel and/or cargo, or harm the crew.

International Anti-Piracy Responses and Coordination

In the wake of the steadily increasing numbers of attacks against ships in the Gulf of Aden/Horn of Africa region since the beginning of 2008, and more expressly the number of vessels that have been successfully hijacked, the international community has responded robustly in the form of large-scale deployment of warships to patrol the Gulf of Aden and the Somali Basin. Indeed, since the initial French naval operations to escort World Food Program-chartered vessels conveying food aid to Somalia in November 2007, and the presence of Combined Task Force 150 (CTF-150) warships in the Gulf of Aden conducting maritime security operations (MSO), naval operations have developed significantly.

On November 20, 2008, the UN Security Council adopted a resolution that called for those states having the capability to do so to deploy warships and aircraft to the effected region to actively combat the threat of piracy the Gulf of Aden and Horn of Africa. The resolution also acknowledged the existing efforts of the EU and NATO in this regard. On December 17, the adoption of UN Security Council Resolution 1851 enabled the implementation of tougher measures; allowing for the occupation of land and sea spaces in pursuit of pirates. These resolutions essentially gave full legitimacy to the various naval formations tasked with anti-piracy operations to take a far more determined approach to ensuring the security of merchant vessels operating in this dangerous part of the Indian Ocean. Though not deployed at the same time, and with varying sized numbers of ships, the following formations have been active in patrolling the waters in the southern Red Sea, the Gulf of Aden and the Somali Basin: Combined Task Force-150 (CTF-150); Combined Task Force-151 (CTF-151); EUNAVFOR [Operation Atalanta]; and NATO's Standing Naval Maritime Groups 1 & 2 (SNMG 1 & 2).

CTF-150, though nominally a formation dedicated to counter-terrorist operations as part of Operation Enduring Freedom, has been regularly active in counter-piracy roles since 2007. With its logistics base in Djibouti, it has been comprised variously of

warships from Australia, Canada, Denmark, France, Germany, Italy, the Netherlands, New Zealand, Pakistan, Portugal, Singapore, Spain, Turkey, the UK and the US.

CTF-151, established in January 2008 by the US 5th Fleet headquarters in Bahrain, was intended specifically to address the problem of piracy off Somalia. The formation is centered on US naval and marine assets with contributions variously from many of the countries that have comprised CTF-150.

Headquartered at Northwood in the UK, Operation Atalanta was initiated by the EU a the end of 2008 as a direct result of the passing of UN Security Council resolutions calling on the international community to confront the problem of piracy off Somali head-on. Its function is to deter and prevent acts of piracy and armed robbery off the coast of Somalia. Though initially intended as a 12-month operation to last during 2009, its mandate has been extended until the end of 2010. As of the end of 2009, the force comprised 12 frigates, a submarine and three maritime patrol aircraft from Belgium, France, Germany, Greece, Italy, the Netherlands, Norway, Sweden and Ukraine.

Aside from those countries already noted above that are or have been part of the aforementioned formations, warships from China, India, Iran, Japan, Malaysia, Russia, Saudi Arabia, South Korea and Yemen have and continue to be deployed to the region on anti-piracy operations. The coordination of efforts between the various formations and other countries with warships patrolling in the western Indian Ocean are managed through monthly Shared Awareness and De-confliction meetings, which were initiated to try to get the best aggregate effect of all of the various assets in the region, and to cover as much of the vast maritime space that is currently under threat from Somali pirates.

Arguably the most successful manifestation of the international effort to combat the threat of piracy and armed robbery at sea in the north-western and north-central Indian Ocean has been the establishment and patrolling of the Internationally-Recognized Transit Corridor (IRTC) in the Gulf of Aden. Established by the Maritime Security Center (Horn of Africa) (MSC (HOA)) in February 2009, the IRTC is a ship-routing corridor in the Gulf of Aden that is patrolled by groups of coalition warships such as the EUNAVFOR or NATO's SNMG 1 or CTF-151 in order to safeguard the merchant vessels from piracy attack. Vessels transit the corridor in groups according to their maximum sea speed. Since its establishment, successful hijackings of vessels have fallen in the Gulf of Aden. From another point of view, the success of the IRTC is somewhat of a pyrrhic one, as the patrolling of these waters has merely forced the pirates to concentrate their efforts in areas that are not as thoroughly patrolled by warships, and where lone merchant ships are thus far more susceptible to a successful hijacking, such as in the Somali Basin and northern-central Indian Ocean. Successful attacks in these waters have escalated since the establishment of the IRTC. The inability of international efforts to maintain sufficient naval presence in this huge maritime space has been partially offset by the introduction of maritime patrols by aircraft and UAVs based out of the Seychelles.

The United States, India and China in the Indian Ocean

The United States

The United States has a high degree of military presence in the Indian Ocean region, particularly in the northern Indian Ocean (Persian Gulf, Arabian Sea and Red Sea). The US maintained a strong presence in this space throughout the Cold War, and particularly since large quantities of crude began to be imported from the Persian Gulf in the mid-1970s. This presence continues and is a direct reflection of the country's current strategic and security interests in the region.

In terms of strategic futures, the US forces in the Indian Ocean region are likely to be primarily concerned with the following issues/missions: ensuring security and freedom of navigation in the Persian Gulf and the Gulf of Oman; support of allied governments in the region (particularly in the Persian Gulf); the security of shipping in the major east-west and northwest-southeast SLOCs linking the Suez Canal, the Persian Gulf and the Malacca Straits; and the monitoring of Chinese and Indian geostrategic posture and military presence in the Indian Ocean region. The first three of these are extant and well known. However, the fourth is more embryonic in terms of its regional strategic development, but is likely to become of increasing importance to the US strategic calculus and posture in this new decade as India and particularly China deploy grouped naval forces in greater numbers in the Indian Ocean more frequently and on a permanent basis, with the necessary attending logistical support (replenishment-at-sea). China is likely to look for permanent logistical bases in the northern Indian Ocean to support this posture, bases that will be located in a maritime space long dominated by the US. However, despite occasional alarmist stories and projections in the media that suggest that confrontation between India and China in the Indian Ocean will become increasingly likely as their respective military presence expands, naval conflict between the two developing major powers is not necessarily inevitable, nor is the exact form of such putative conflict determinable.

Nevertheless, for any major power with global interests, vigilance concerning spaces that are of vital interest to national economic integrity and prosperity is simply prudent policy. In order to ensure that the first three primary objectives within the Indian Ocean region are achieved, especially the security of the vital SLOCs highlighted above, CENTCOM will likely be increasingly concerned with monitoring the force levels of both countries, particularly expeditionary deployments of China. This will be achieved through continued high-profile presence in the northern Indian Ocean by the US Navy, diplomatic engagement with India and monitoring of the People's Liberation Army Navy (PLA(N)) expansion and its power-projection capacity during this de-

cade. The most significant feature of this expansion will be the development of China's naval organic airpower, nuclear powered attack submarines, forward basing, and replenishment at sea capabilities.

China and India

While conflict at sea between China and India is certainly not inevitable, both governments are wary of each others naval expansion programs. Realist observers in India adhere to the notion of a "string of pearls" strategy on the part of the Chinese to surround India by financing port developments in neighboring states, and view this in conjunction with the clear purpose of China's development of a 'blue water' naval capability as a means for Beijing to protect its strategic interests in the region, principally its expanding trade and commercial links with mineral and petroleum-rich African states and its major sources of crude in the Persian Gulf—Saudi Arabia and Iran. China remains wary of India's naval build-up, particularly the expansion of its aircraft carrier numbers, and its closer ties with the United States, which has also included closer cooperation on nuclear technology and arms sales.

Regardless of the actual level of perceived intention and/or coherence of the 'String of Pearls' model, the fact that their respective economic security is underpinned by the free-flow of trade (particularly petroleum) through the Indian Ocean means that these expanding powers have a clear interest in projecting naval power into the Indian Ocean to safeguard their interests, specifically the security of the SLOCs that connect the Persian Gulf with their most important petroleum terminals.

Chinese Naval Expansion

The Peoples Liberation Army (Navy) is concentrating on the development of its major surface combatant fleet and the ability to deploy these capital ships at long range with the necessary replenishment vessels. Modernization is characterized by the acquisition of advanced Sovremenny class destroyers and Kilo class submarines, coupled with domestic production of modern Lanzhou class destroyers and Yuan class submarines. Chinese naval technology has improved with Russian assistance over the years. However, its domestic capabilities in this regard have been advancing, including better fire-control systems, stealth technology and C4I.

The modern type 052B, 052C and 051C destroyers are now equipped with long range air defense missiles, and the Sovremenny class is fitted with supersonic antiship missiles. New nuclear powered attack (Type 093) and ballistic missile submarines (Type 094) are emerging, and conventional attack submarines, such as the Kilo and Yuan are in service. Though currently unconfirmed by the PLA, independent reports indicate that an aircraft carrier program, centered on the conversion of the *Varyag* at a shipyard in Dalian, appears well advanced. It remains to be seen whether the former Admiral Kuznetsov class aircraft carrier will actually become an operational feature of the PLA(N) fleet. If it were, such a vessel would radically alter the PLA(N)'s maritime power projection capability.

It is the aforementioned assets that China requires and would look to use as part of a strategy to protect its sea lanes of communication and spheres of trading interest in Africa and the Middle East. A clear demonstration to the international community of China's determination to protect its interests was Beijing's deployment of two destroyers, *Haikou* and *Wu-*

han, and a support vessel in December 2008. The vessels deployed from Hainan along with some 80 special operations troops.[159] This was the first deployment of Chinese warships this far from the Chinese mainland in modern times. In October 2009, the guided missile frigates *FFG-525 Ma'anshan* and *FFG-526 Wenzhou*, became the fourth such task group to be sent from China to assist in the international counter-piracy mission off the Horn of Africa. The new warships joined the supply ship, *Qiandaohu*, which has been on task in the region since July 2009.[160]

Indian Naval Expansion

Often eclipsed by reporting on Chinese naval building programs and ambitions, the Indian navy's expansion project is well developed and increasing in scope. By 2020, India will be able to deploy three large aircraft carriers: the currently in-service 28,700-ton VSTOL carrier, *INS Viraat* (ex *HMS Hermes*), the 44,570-ton Kiev class aircraft carrier, Admiral Gorshkov (*INS Vikramaditya*), which is due to be delivered by 2012 (the vessel is far behind schedule and over cost but should be fully operational about 2015); and an Indian-built 40,000-ton *Vikrant* class aircraft carrier, which is due to be completed by 2018. The navy is also procuring advanced aircraft to support fleet operations, including MiG-29K multi-role aircraft and Ka-31 airborne early warning helicopters.[161]

In addition to the 169 vessels currently in service, some 39 new vessels are on order or under construction. In 2007, the former US amphibious ship *Trenton (LPD 14)* was transferred to India from the US Navy. The next-generation, Kolkata class guided missile destroyers are expected to be commissioned starting in 2012 along with six Advanced Talwar and Shivalik class frigates that are also scheduled for delivery by 2012. Six French-built Scorpene conventional attack submarines are under construction in at the Mazagon Dockyard in Mumbai, and three Akula class attack submarines are on order from Russia. The Shipbuilding Center (SBC) at Vishakapatnam is currently developing a new SSBN class of which three are planned. During a briefing on the future Indian navy in August 2008, Admiral Sureesh Mehta stated that: "By 2022 the Indian navy will have a fleet of 160-plus ships, three aircraft carriers and 400 aircraft of different types. Extensive satellite surveillance and networking will be there."[162]

In a clear demonstration of the navy's mobilization capability, during the 2004 Indian Ocean earthquake crisis, the Indian Navy deployed 27 ships and over 5,000 Naval personnel in disaster relief operations, in what became one of the largest relief mobilizations that the Indian Navy has undertaken. Naval ships were able to start large-scale operations within 12 hours from the time of the tsunami; it was the first navy to reach the affected areas. Since October 2008, India has deployed warships to the Gulf of Aden and the Somali basin to assist in the ongoing anti-piracy effort. Indian vessels have been active in preventing piracy attacks and arresting Somali pirates, even inside Somali territorial waters.

[159] "China Sends Three Warships to the Gulf of Aden," *Welt Online*, 26 December 2008, http://www.welt.de/english-news/article2932289/China-sends-three-warships-to-the-Gulf-of-Aden.html.

[160] "China's new naval flotilla sets sail for Gulf of Aden while merchant vessel still held by pirates," *People's Daily Online*, 31 October 2009, http://english.people.com.cn/90001/90776/90883/6799586.html

[161] "India's Navy Expanding Rapidly," Military.com, 9 June, 2008, http://www.military.com/forums/0,15240,169493,00.html.

[162] "Indian Navy fleet to grow to 160-plus by 2022," *Thaindian News,* 9 August 2008, http://www.thaindian.com/newsportal/business/indian-navy-fleet-to-grow-to-160-plus-by-2022_10081924.html.

Case Study: Arms and Human Trafficking in the Gulf of Aden and Southern Red Sea

Smuggling via the Red Sea is widespread and persistent for several reasons:

- The Red Sea is the shortest and most utilized maritime conduit between the sources of opiate production in Central Asia and the major markets in Europe;
- Despite the presence of fairly large numbers of coalition warships on anti-piracy and counter-terrorism operations in the wider Arabian Sea, regional maritime security forces and interdiction capabilities from Oman and Yemen are limited, as are the mechanisms for adequate regional maritime security force co-ordination;
- The existence of several fragile, poorly-secured states with ongoing insurgencies and/or terrorist presence means that fairly frequent weaponry and ammunition re-supply shipments are inevitable, most of which comes from Yemen;
- The very high levels of shipping that pass through the Red Sea, added to the large volume of cross-traffic in the Gulf of Aden, means that not only are there numerous means of conveyance for contraband but also there is far too much traffic for regional forces and coalition warships to ever hope to inspect and board.

Stowaways and human trafficking across the Red Sea is ongoing, most often on dhows and smaller general cargo vessels. The general flow is from west to east, with Sudan and Saudi Arabia being two of the major sender and receiver countries. There have been several instances of small, overloaded vessels carrying trafficked persons capsizing in the Red Sea with inevitably tragic results.

Weaponry channeled through Yemeni ports is reported to be supplying terrorists and militants in Sudan, Somalia, the Palestinian territories, Eritrea, and Saudi Arabia.[1] UN investigations have determined that Yemen is the primary source of arms and ammunition bound for Somalia, which has supposedly been under an arms embargo since 1992. Arms smuggling by sea from Yemen also intersects with piracy and human trafficking across the Red Sea and the Gulf of Aden. Yemen's extensive boundaries pose a considerable challenge to limiting the flow of weapons into and out of the country. Indeed, there have been reports from Yemeni media of small arms, light weapons and ammunition being trafficked to Yemen by organized crime syndicates from as far away as Serbia, Slovakia, Montenegro, Croatia, and Kosovo, shipping the weapons from various Adriatic ports.[2]

[1] "The UPI reports on Yemen's weapon's trafficking," Armies of Liberation, 15 November 2005, http://armiesofliberation.com/archives/2005/11/15/the-upi-reports-on-yemens-weapon-trafficking/.

[2] *Ibid.*

Future Prospects

4

Future Prospects

The complex and very concrete set of issues covered in this volume cannot be easily summarized or expressed in neat policy formulations. This study is intended to provide useful, practical information about how global commerce transits the Indian Ocean, and to provide some new thinking about the nexus between trade and economic interests – the global system – on the one hand, and the enduring and evolving security concerns of states on the other.

What Can Change, What Cannot

Patterns of vessel trade across the ocean will be shaped by some largely immutable factors, such as great circle and rhumb line navigational tracks, which are based on maximizing economic efficiencies (bunkers consumption and ton/mile calculations that are an integral part of charter party formulation), and to a lesser extent by established variances in seasonal weather at sea (such as monsoon patterns and typhoons).

The configuration of sea lanes (SLOCs) will occasionally be altered by mariners in the event of major interstate wars or local maritime security concerns if the threat to vessels is such that re-routing away from economically-based navigational norms is the only way to mitigate risks. This has happened in the past when the Egyptians closed the Suez Canal from 1967 to 1975 as a result of Arab-Israeli wars, forcing trade around Cape Agulhas, and has also occurred more recently in the wake of increased piracy activity off the Horn of Africa. However, these changes are not permanent. What is likely to evolve with regards to SLOCs in the Indian Ocean region is the volume of certain types of trade along them. These developments will have a discernable bearing on the security interest placed upon these SLOCs and any associated chokepoints by China and India especially.

The most likely determinants of the future of Indian Ocean trade are likely to be the following:

Evolution of Energy and Container Traffic

- India, Saudi Arabia and Singapore will remain the three most important refining countries in the Indian Ocean region for refined product distribution. Jamnagar on the west coast of India will continue to attract increasing shares of heavy, sour crude oils from the Persian Gulf, principally from Saudi Arabia and Iran, and its low sulphur diesel and high quality gasoline will be exported as far away as north-western Europe and the United States.
- In Saudi Arabia, the refineries at Jeddah, Jubail, Rabigh, Ras Tanura, and Yanbu

will continue to play a major role in the supply of distillates to eastern Africa, the Middle East and the Mediterranean. This will boost the significance of the Suez Canal as a major conduit and potential chokepoint for increasing amounts of refined fuels and distillates from the Indian Ocean region to the Atlantic Basin.

- Singapore will remain the pre-eminent refined product supplier and petroleum storage facility supply Southeast Asia, though it will lose some market share to Jamnagar. All of this combined will render the Arabian Sea and the Red Sea the most important refined petroleum products crossroads in the Indian Ocean region, and one of the most important in the world alongside the Caribbean and Gulf of Mexico in the Western Hemisphere and the South China Sea in South East Asia.
- Chinese imports of crude from the Persian Gulf, principally from Saudi Arabia and Iran, and increasingly from Iraq will grow. This will also be characterized by greater numbers of Chinese-flagged VLCCs along the SLOC to and exiting from the Strait of Hormuz.
- The number of VLCCs carrying heavy/sour crudes from Saudi Arabia and Iran to north-western India will increase.
- The volume of product tankers carrying Indian exports of refined petroleum products and distillates from the north-western Indian coast to Africa (specifically: Kenya, Tanzania, Madagascar, Mozambique and South Africa) and along the Arabian Sea/Red Sea SLOC (for products bound for the Mediterranean and north-western Europe) will grow.
- The number of container vessels and, to a lesser extent general cargo vessels, along the Arabian Sea/Red Sea SLOC lifting Indian manufactured exports bound for Atlantic Basin will grow.
- The volume of east to west liner (container) trade through the northern Indian Ocean as a result in increasing Chinese dominance of manufacturing of finished goods bound for Europe and the Atlantic Basin will grow.
- As Chinese commercial involvement in all parts of Africa that have vital raw materials increases over the next two decades or so, there will be a commensurate increase in the volume of shipping (bulk, tanker and container) along the three main trans-oceanic SLOCs that connect the Malacca Straits and the Lombok Straits with the Gulf of Aden, central east Africa and Cape Agulhas.

Systemic Factors

- The following developments could affect the security perceptions and anxieties of Indian Ocean states and the commercial perceptions and concerns of key players in the shipping industry: the growth in Chinese shipbuilding capacity; its growing involvement in development of port infrastructure; and the growing role of Chinese financial institutions in ship and port financing.
- The establishment of land bridges as integral parts of important trade patterns could alter the importance of certain ocean routes and affect the value of investments made in those. One example is the route slated for completion in 2014 between Jeddah, Riyadh and Damman. More significant would be establishment of a Eurasian land bridge, such as that between

Xiangtang and Hamburg. This would allow transport over 10,000 kilometers in 17 days, one-third quicker than by sea. Though more expensive; it would still be 25% cheaper than by air.

- Potential political instability located around these land bridges might complicate the already complex internal security calculations of regimes or the strategic behavior of regional and global powers in already volatile environments.
- If fuel prices continue to rise, it is possible that the long-distance transportation of raw materials and finished products will diminish in favor of a search for sources closer to home.
- If demand for container traffic remains weak and bunker (fuel) costs remain high or increase, the industry could see significant change in areas such as the size of vessels used for particular routes, the length of routes and the ways that those routes are configured, more partnership with customers (shippers) and less arms length dealing, and the slow steaming of vessels.
- There will likely be an increase in the age and pace at which ships will be scrapped. In that sense, the global crisis of 2008 may have been an opportunity for appropriate modernization of fleets.
- One uncertain element in the ship supply picture is the extent to which there is a technological revolution in the making that could make current new builds prematurely obsolete. On the other hand, the huge capital investments made in vessels could act to inhibit innovation in design. To the extent that some designs are for the purpose of lowering carbon emissions or cost savings through greater fuel efficiency, this would be unfortunate.
- The 2008 crisis may have been a blessing in disguise for a shipping industry frenetically hurtling toward an unsustainable growth in capacity and investment. The future remains uncertain.

Looking Ahead: Security and Commerce

Today, the link between the flag of registry of vessels and the nationality of their owners is arbitrary. At the same time, nowhere else has the collective interest of the global community been greater. This is reflected in the intense international cooperation on the perilous sea lanes of the northwest Indian Ocean. The predominance of European, US, Indian, and Chinese naval forces, an exact correspondence to the actual parties in commercial interest, tells all.

While Asian states are engaged in a significant increase in naval capacity, the implications of this for the security of maritime commerce are not clear. Asia already spends more on defense than Europe. Reliable estimates suggest that naval spending in the Asia-Pacific will move past Europe by 2030. China is the most significant in this respect, having increased naval spending fourfold between 1995 and 2005. However, most of the increase in Asian naval capability will be in sophisticated capabilities such as anti-submarine, anti-air, ballistic missile defense and naval strategic defense forces. Seventy percent of the increases in spending will be for submarines, destroyers, frigates and amphibious warfare vessels. A mere 7% will be for auxiliaries, OPVs and patrol craft.[163] It is questionable whether this is

[163] Geoffrey Till, *Asia Rising and the Maritime Decline of the West,* (RSIS Working Paper 205, S. Rajaratnam School of International Studies, 2010), page 6.

responsive to the requirements to be generated by seaborne commerce in the Indian Ocean.

- It is clear that much will depend on the commercial and security intentions and actions of China, and on the evolving strategic balance or imbalance between India and China. One very important factor in this could be the prospects for, and consequences of, increased trade between India and China.
- Many recent developments in the Indian Ocean have been the consequences of the size and shape of China's growth in the world economy; the trend is likely to endure. Yet if Chinese growth were to slow down over the coming decades, as forecast by the Asian Development Bank,[164] this would significantly affect trends in Indian Ocean trade.
- The consequences of developments in India, and the evolution of her role in the global economy, will be almost as important as China. Whereas at present her principal significance has been as an importer of energy and exporter of refined petroleum products and raw materials such as iron ore and coal, her future is highly likely to include substantial exports of finished products.
- Another uncertainty is whether the prodigious growth of China, India and Asia as a whole will be sustainable environmentally or economically.

Other uncertainties also could change the shape and nature of the future of the Indian Ocean. For example, were Russia and the former Soviet Central Asian nations to emerge as more substantial suppliers of China's energy needs, China's reliance on the sea lanes and chokepoints in the Indian Ocean could diminish substantially. History also suggests that the security preoccupations – today's piracy and terrorism, as compared to communism of a generation past – can give way to new threats and priorities that profoundly affect how states judge the challenges and opportunities of the commerce and security dynamics in the Indian Ocean.

[164] *Asian Development Outlook 2010 Update*, (Asian Development Bank, 2010).

Appendices

Appendix I: Major Ports and Terminals

Secondary ports [denoted with an asterisk] are listed if they are significant in some way for the cargo or commodity. The countries that are shaded in grey constitute those with ports that have the most significant trading/shipping activity profiles (including those that handle large volumes of passing traffic, such as Egypt and Singapore).

Countries marked in bold black type are those second-tier countries with significant levels of trading shipping activity. What is immediately apparent is that the vast majority of activity is located in Asia rather than Africa. This is commensurate with numbers of ports, FDI in the commercial maritime sectors, port and terminal infrastructure development and handling capacity, country sizes, populations and export/import volume requirements.

Country	Recorded Vessel Calls Major Ports/Terminals 2008	Major Ports and Terminals
Australia (Asia)	11,437	Melbourne, Fremantle, Dampier, Darwin, Adelaide, Devonport, Geelong, Burnie, Bunbury, Portland, Esperance, Hastings, Geraldton, Albany, Port Lincoln, Broome
Bahrain		Mina Sulman* and Sitra*
Bangladesh (Asia)	2,208	Chittagong and Mongla
Comoros		Moroni
Djibouti	902	Djibouti
East Timor		Dili, (Kupang: in the Indonesian part of the island of Timor)*
Egypt (Africa)	11,628 (Includes passing movements for Suez Canal)	Adabiya, Ain Sukhna Terminal (Sumed Pipeline), Sokhna
Eritrea		Assab and Massawa
India (Asia)	23,760	Mumbai, Visakhapatnam, Haldia, Jawaharlal Nehru, Paradip, Chennai (Madras), New Tuticorin, Kandla, New Mangalore, Pipavav, Kolkata (Calcutta), Kochi (Cochin), Kakinada, Mormugao, Mundra, Jamnagar
Indonesia (Asia)	32,815	Jakarta, Surabaya, Belawan, Panjang, Merak, Semarang, Cilacap, Gresik, Teluk Bayur, Banten, Palembang, Jambi (Telanaipura), Kupang, Probolinggo
Iran (Asia)	3,504	Sirri Island, Bandar Abbas, Kharg Island, Bandar Imam Khomeini, Bandar Mahshahr, Abadan
Iraq (Asia)	2,128	Umm Qasr and Al Basrah Terminal (ABOT)
Israel	104	Eilat
Jordan	1,270	Aqaba
Kenya	1,013	Mombassa
Kuwait (Asia)	2,649	Shuwaikh, Mina al Ahmadi, Shuaiba
Madagascar	441	Toamasina
Malaysia (Asia)	21,088	Port Klang, Pasir Gudang (Panjung Pelepas), Penang (Pinang), Lumut
Maldives	587	Male*
Mauritius		Port Louis
Mozambique	1,227	Maputo, Beria, Nacala
Myanmar	833	Yangon
Oman (Asia)	3,310	Port Sultan Qaboos (Mina Qaboos), Salalah, Sohar, Qalhat Terminal
Pakistan (Asia)	3,412	Karachi, Port Mohammad Bin Qasim, Gwadar
Qatar (Asia)	5,169	Ras Laffan and Mesaieed (Umm Said)
Saudi Arabia (Asia)	12,594	Rabigh, Jeddah, Jubail/King Fahd Port(Persian Gulf), Dammam, Ras Tanura, Yanbu/King Fahd (Red Sea), Juaymah Terminal
Seychelles		Port Victoria
Singapore (Asia)	70,944 (Includes passing movements for Malacca/ Singapore Straits)	Singapore and Pulau Bukom
Somalia	311	Berbera and Mogadiscio*
South Africa (Africa)	7,150	Durban, Richards Bay, Port Elizabeth, East London
Sri Lanka (Asia)	4,467	Colombo
Sudan	1,027	Port Sudan and Suakin (Swakin)
Tanzania	2,097	Dar es Salaam, Mtwara, Tanga
Thailand	332	Phuket
United Arab Emirates (Asia)	23,196	Jebel Ali, Khor Fakkan, Fujairah, Abu Dhabi (Mina Zayed), Dubai (Mina Rashid), Mina Saqr, Sharjah (Mina Khalid), Ruwais, Ajman, Jebel Dhannah (Jabal az Zannah) Terminal, Hamriyah, Das Island
Yemen (Asia)	2,659	Aden, Hodeidah (Al Hudaydah), Mukalla, Mokha

Source: Lloyd's MIU

Appendix II: Major Port Operators

From a technical standpoint, a port authority or a shipping/logistics company is responsible for (or contracts to) process cargo through a port. They may be state-owned (particularly for port authorities) or private entities.

Operations involve managing the movement of cargo between vessels, trucks and freight trains and optimizing the flow of goods through customs. In a more detailed sense, this involves managing and upgrading loading and unloading facilities (gantry cranes), berths, waterways, roads, storage facilities, communication equipment, computer systems and workforces. The operator also manages safety and port security.

The world's largest port operators in terms of total cargo tonnage handled are:

- Hutchison Port Holdings (Hong Kong, People's Republic of China)
- PSA International (Singapore)
- Dubai Ports World (Dubai, United Arab Emirates)
- A.P. Møller Container Terminals (The Hague, Netherlands)
- COSCO (Beijing, People's Republic of China)

All of these multinational companies (MNCs) have important operations in the Indian Ocean region, some of which are considerable, particularly DP World and Hutchison Port Holdings. In order to give a comprehensive capture of the state of port operations in the in Indian Ocean region, each of these companies will be examined in turn, and in three main ways: geographical footprints within the Indian Ocean region (in accordance with the major port listings presented earlier); current operational status; and latest developments within the context of the current economic crisis.

Hutchison Port Holdings

Operational Status in the Indian Ocean region

Hutchison Port Holdings (HPH) is the world's leading port investor, developer and operator with interests in 49 ports in 25 countries throughout Asia, the Middle East, Africa, Europe, the Americas and Australasia. In 2008, the HPH Group handled a combined throughput of 67.6 million TEUS worldwide.

Aside from DP World, HPH has the most diverse geographical coverage in the Indian Ocean region, with container terminal operations in East Africa, the Gulf, the Arabian Sea, the Bay of Bengal, and Southeast Asia.

Latest Developments

General Financial Matters

In August 2009, HPH announced a 35% fall in net profits, which was a reflection of an 8% decline in the number of TEUs

being handled through its terminals during the fist half of 2009 as compared to the same period in 2008. Net profits were down to HK$4.4bn ($567.7m) compared to HK$6.8bn in the first half of 2008, while total revenues fell 21%. However, HPH has stated that the severe reduction in global maritime trade volumes that characterized the fourth quarter of 2008 and first quarter of 2009 had begun to bottom out during the summer of 2009. The main contributors to the division's decline were reduced port operations in Hong Kong and the mainland. However, throughput fell 15% in total at its other operations in Indonesia, Malaysia, Oman, Pakistan, and Saudi Arabia.

At the end of the first half of 2008, HPH revealed it had suffered a 63% drop in net profit for the first half of 2008. The company earned a net profit of HK$10.7 billion ($1.4 billion), representing the 63% fall on the interim result in 2007 noted above. During 2007, Hutchison's port business contributed HK$19.6 billion (14% of total revenues). The ports and related services division had grown steadily at a rate of 4% overall to 32.8 million TEUs during 2007.

Hutchison Port Holdings: Terminal/Facility Locations

Country	Location/City	Facilities
Indonesia	Jakarta	Jakarta International Container Terminal (JICT) Koja Terminal (KOJA)
Malaysia	Port Klang	Westports Malaysia (KMT)
Myanmar	Yangon	Myanmar International Terminals Thilawa (MITT)
Oman	Sohar	Oman International Container Terminal (OICT)
Pakistan	Karachi	Karachi International Container Terminal (KICT) Karachi New Port Container Terminals (KNP)
Saudi Arabia	Dammam	International Ports Services, Dammam, Saudi Arabia (IPS)
Tanzania	Dar es Salaam	Tanzania International Container Terminal Services (TICTS)

Source: Hutchison Port Holdings - www.hph.com

Oman

In May 2009, despite the persistent downturn in global maritime trade, HPH's Oman International Container Terminal (OICT) at Sohar announced that it is planning to increase its TEUS throughput by between two to three times the volumes it processed in 2008. [OICT is a joint venture between HPH, the Government of Oman, Steinweg of the Netherlands, and some Omani and UAE investors.] OICT, which has two berths, intends to expand throughput on the basis of increased Omani exports from Sohar and Muscat, and by taking on increased regional transshipment business from the UAE, Iran and perhaps Pakistan.

OICT is ambitiously targeting to secure over a 25% share in the country's total imports and exports exchange during 2009 and into 2010. In the summer of 2009, talks were underway to initiate closing Muscat's Port Sultan Qaboos container terminal and convert it into a cruise terminal by 2013, which would essentially provide OICT with a secondary boost from the transfer of this container traffic from Muscat to Sohar.

Saudi Arabia

HPH's port terminal at Dammam has positioned itself to take on the role of a growing transshipment facility for the upper half of the Persian Gulf. This has be made possible following extensive investment that has enabled the installation of additional cargo-handling equipment, and the dredging of the main berths as well as the port's access navigation channel; all of which will enable container vessels in excess of 8,500 TEUs to use the port. In March 2009, Maersk initiated its service linking

China with Dammam, with the first call of an 8,900 TEUs-capacity S-Class vessel – the largest container ship ever to call at a port in this part of the Gulf. Usually these very large 'motherships' have discharged upper-Gulf containers at Jebel Ali for onward distribution by smaller feeder container vessels. Dammam's King Abdul Aziz Port (International Port Services) is a joint venture between HPH and a subsidiary of the Al Blagha Holding Group, based in Riyadh.

Dammam is Saudi Arabia's port for break-bulk imports and exports. It is also fast becoming an important transshipment hub for the upper Persian Gulf, as highlighted earlier. Now the larger container vessels ('motherships') call at Jebel Ali on the inbound call, having loaded containers for the Europe to Middle East market as well as local export cargo. These vessels (such as the S-Class) then sail further up the Gulf to Dammam with the right mix of Saudi Arabian import freight and also commercially-feasible transshipment goods for Kuwait, Iraq and Iran.

From Dammam, the transshipment-designated TEUs and FEUs will be transported by the main carriers' own Gulf feeder vessels, or use the existing dense network of general cargo, Ro-Ro feeder-vessels that connect the smaller ports of the upper Gulf and with Dammam. The Saudi facility currently has an annual handling capacity of 1.8m TEUs; however, discussions between HPH and the port authority regarding a second phase development to increase capacity to 3m TEUs per year are currently under way.

Pakistan

Pakistan's government has started processing bids received by international and domestic port operators to construct and operate the country's first deepwater container port, to be developed at a cost of $1.1 billion at Keamari Groyne, which is a short distance from the main Karachi port, which is operated by HPH.

A key facility at the new 'Pakistan Deepwater Container Port' (PDCP) will be a 4 million TEUs capacity terminal that will be built in three phases on the public-private partnership model. It will be developed according to a 25-year build, operate, transfer lease scheme. Bids to tender for this proposed facility will be extended in the latter stages of 2009 or early 2010.

Karachi port currently has two container terminals: the state-owned 'Pakistan International Container Terminal' and, the Hutchison-managed 'Karachi International Container Terminal'. While HPH has been given the initial mandate to develop the new port, PDCP has attracted bids from DP World and Sharjah-based Gulftainer.

PSA International

Operational Status in the Indian Ocean region

PSA International Pte Ltd is the second largest port operator in the world, with its flagship operations centered on its PSA Singapore Terminals - PSA HNN and PSA Marine. In total, PSA operates 28 port projects in 16 countries across Asia, Europe and the Americas. It has a nominal global cargo-handling capacity of 111 million TEUs, and owns 66 kilometers of quay length.

The company's non-Singapore operations are focused in the Sub-continent, with five container terminal operations on both India's Arabian Sea and Bay of Bengal coasts, and a new facility at Pakistan's

new deepwater port at Gwadar. Gwadar is very significant as a port as it gives Pakistan a vital transshipment capability close to the Gulf of Oman and the Persian Gulf, and because it has been funded with considerable Chinese investment, which also gives them inherent access rights to the port, potentially also for its warships. (See strategic assessments for these waters in the next major section of this report).

PSA's Singapore operation is the world's largest container transshipment port. It processes approximately 20% of the world's total TEUs/FEU transshipment throughput, which amounts to some 6% of total global container throughput. The port services a network of 200 shipping lines that connect 600 ports in 123 countries around the world. PSA has developed several in-house port/terminal-related IT systems and cargo-handling equipment, including: Computer Integrated Terminal Operating System (CITOS); Portnet; Flow-Through Gate; and, Remote-controlled Overhead Bridge Cranes.

PSA International: Terminal/Facility Locations

Country	Location/City	Facilities
India	Chennai	Chennai International Terminals
	Hazira	PSA Hazira International Terminal
	Kandla	Kandla Conterminal Terminal
	Kolkata	Kolkata Container Terminal
	Tuticorin	Tuticorin Container Terminal
Pakistan	Gwadar	PSA International Terminal
Singapore	Singapore	Brani Container Terminal Keppel Container Terminal Pasir Panjang Container Terminal Tanjong Pagar Container Terminal

Source: PSA – www.internationalpsa.com

Latest Developments

In August 2009, PSA reported that despite the ongoing slump in global maritime trade (principally in the container and break-bulk sectors), TEUs/FEU throughput at its Asian terminals from July onwards had started to rise, reversing a trend in the first half of 2009 when throughput fell in aggregate terms. During the downturn, PSA has been using the time to train up badly needed new personnel, including crane operators.

The company is also continuing its project to expand the new Pasir Panjang terminal, which will add 20 million TEUs per year of capacity over the next 10 years through to 2019. Construction of nine full-sized super post-Panamax berths is under way, with the eventual project plan calling for all 16 berths to be ready by 2018. In early 2008, it had been projected that the new facilities would be needed as soon as possible; however, in the current climate, this urgency has receded. SA is moving forward with its plans for a new Ro-Ro terminal that will function as an integrated logistics center for vehicle shipments at three berths at Pasir Panjang.

COSCO

Operational Status in the Indian Ocean region

The COSCO-PSA Terminal Private Limited is a joint venture between the Cosoco Group and PSA Corporation Limited, with Cosoco holding a 49% equity interest in it. The terminal is comprised of two berths within the larger Pasir Panjang Terminal in the port of Singapore in two phases. The terminal has a capacity of 1,000,000 TEUs. The sale of equity stakes and operational control over a terminal in Singapore to a foreign entity marked a reversal of PSA's longstanding policy not to relin-

quish control over its port infrastructure to outside shipping interests.[165]

The Panjang Terminal is located 7 kilometers west of PSA's other main container terminals at Keppel Harbor. This evolving S$7 billion terminal represents a major expansion of PSA's container facilities in Singapore. When fully completed in 2009, it is expected to raise the country's container handling capacity by a further 18 million TEUs per year. The terminal is one of the largest expansions of container processing infrastructure anywhere in the world, and part of a strategic drive by the Singaporean government to maintain the country's position as one of the primary transshipment hubs in the Indo-Pacific maritime realm.

Latest Developments

In April 2009, Cosco Pacific reported a 34.1% reduction in net profits during the first quarter of 2009; a loss attributed to a significant reduction in the throughput volume of TEUs handled at its terminals. The company reported that container volumes had dropped 8% to nearly 9.6 million TEUs, down from 10.4 million TEUs in 2008. Notably, the company's vice-chairman and managing director, Xu Minjie, revealed that the largest drop was at the Cosco-PSA terminal in Singapore where container volumes fell 51.6%.[166]

COSCO: Terminal/Facility Locations

Country	Location/City	Facilities
Singapore	Singapore	COSCO-PSA Terminal Private Limited

Source: Cosco Pacific Ltd - www.coscopac.com

[165] Cosco Pacific Limited, Press Release, 4 March 2005 http://www.cosco.com.hk/en/download/files/pacE20050310.pdf.

[166] http://www.lloydslist.com.

In January 2009, throughput in the fourth quarter of 2008 was recorded as having increased by only 7.7%, and sharp negative growth was recorded in some of its major facilities in December. The company's Singapore facilities, Cosco-PSA Terminal Private, recorded a 25.4% fall in volume in December.[167]

DP World

Operational Status in the Indian Ocean region

DP World has the most geographically diverse and prolific operations of all the major port operators in the Indian Ocean region, with major operations in the southeastern Indian Ocean around Australia, the Red Sea, the southeast coast of Africa, the Persian Gulf, the Arabian Sea and the Bay of Bengal. Aside from its flagship operations in the UAE, principally in Dubai, DP World has significant holdings in India and Australia.

Headquartered in Dubai, DP World, which was formed in September 2005, is a leading marine terminal operator, which provides a wide range of cargo handling services; its core activities worldwide and within the Indian Ocean region are container terminal operations. Initially, the company was focused on the UAE ports of Rashid and Jebel Ali, and DPI (Dubai Ports International), which was set up to grow the company internationally. The rapid growth of DP World in the past four years has been fuelled largely by acquisitions around the world.

DP World's flagship port, Jebel Ali in Dubai, has been voted the "Best Seaport in the Middle East" for 14 consecutive years. DP world was the first global marine ter-

[167] *Ibid.*

minal operator to achieve ISO 28000 certification for its security management standards. [The ISO 28000 standard establishes mechanisms and processes to address security vulnerabilities at strategic and operational levels, as well as establish preventive action plans]. Jebel Ali is arguably the most critical single maritime transshipment facility in the Middle East and perhaps also the Indian Ocean.

In 2008, DP World handled more than 46.8 million TEUs across its portfolio from the Americas to Asia; this represents an increase of 8% from volumes achieved in 2007.

Latest Developments

In October 2009, DP World reported that trade through its terminals indicated signs of stability in the container trade; however, the company also expects that the final months of 2009 to remain challenging in Asia, Africa and in the wider maritime trading realm. Goods throughput volumes through DP World-owned terminals during the first three quarters of 2009 were down 8% on the corresponding period for 2008. In the third quarter of 2009, container volumes handled in the UAE were in line with 2008 levels. In August, ports in the UAE handled just over one million TEUs, and it was assessed that this reflected the continued resilience of point-to-point and transshipment trade in the Middle East, Indian subcontinent and African regions despite an aggregate fall in global TEUs volumes during 2009.[168]

In July 2009, DP World's chief executive, Mohammed Sharaf, characterized the first six months of 2009 as, "the most challenging operating environment our industry (seaborne trade) has ever known."[169] In the first half of 2009, DP World reported a 10% fall in consolidated container volumes across its 49 terminals worldwide. From January to June, the company's home base of UAE alone reported a 7% fall in container volumes.

Notwithstanding the company's concerns regarding falls in cargo and concomitant reduction in profits across all its major operations, DP World continued to honor

DP World: Terminal/Facility Locations

Country	Location/City	Facilities
Australia	Adelaide	DP World Adelaide
	Fremantle	DP World Fremantle
	Melbourne	DP World Melbourne
Djibouti	Djibouti	Doraleh Container Terminal - under development Port of Djibouti
Egypt	Sokhna	DP World Sokhna
India	Chennai	Chennai Container Terminal (CCT)
	Kochin	India Gateway Terminal (Formerly the Rajiv Gandhi Container Terminal)
	Kulpi	
	Mundra	Mundra International Container Terminal(MICT)
	Nhava Sheva	Nhava Sheva International container Terminal (NSICT)
	Visakhapatnam	Visakha Container Terminal Pvt Ltd (VCTPL)
Mozambique	Maputo	Maputo Container Terminal [Mozambique International Port Services (MIPS)]
Pakistan	Port Qasim	DP World Karachi
Saudi Arabia	Jeddah	Jeddah Seaport
United Arab Emirates	Abu Dhabi	Abu Dhabi Terminals (Mina Zayed)
	Dubai	Jebel Ali Port Port Rashid
	Fujairah	Fujairah Port

Source: DP World – www.dpworld.com

[168] http://www.lloydslist.com.

[169] Lloyd's List Daily Commercial News, http://www.lloydslistdcn.com.au/archive/2009/july/31/dp-world-cost-cuts-to-cushion-results-decline.

selected outstanding deals for port infrastructure upgrades. In September 2009, DP World took delivery of three new super-post-Panamax cranes at its Jeddah South Container Terminal on Saudi Arabia's Red Sea coast. The addition of these cranes, which have a 65 ton lift capacity, to Jeddah's seven container berths will greatly increase vessel turnaround times for large vessels using Jeddah as a Red Sea transshipment node. Jeddah was clearly seen as an important upgrade project; in March 2009, DP World announced that it was deferring 50% of its port capacity expansion plans.[170]

A.P. Møller Container Terminals

Operational Status in the Indian Ocean region

Regional Overview

In mid-2009, the head of APM's Africa and Middle East regional division announced that APM's port investment projects (in terms of capital injection) will remain modest in the short-term due to the downturn. However, APM also maintained that developing countries located in this region should view APM as an investment and operations partner for the future. The company raised concerns in 2009 that the port infrastructure in parts of this geographical division remains very inadequate for the needs of the future.

Delays to processing vessels, in terms of port access, berths and cargo-turn-around times remains a critical issue in many developing nations in the Indian Ocean region, where adequate port infrastructure still does not meet demand, or does not exist at all. Many ports in the region do not have sufficiently-dredged berths and port access channels to accommodate even moderately-sized vessels, and certainly not the larger post-Panamax ships.

APM has argued that without investment in port expansion programs for some of the more important trading states and potential transshipment nodes in the region, these aspiring countries will not benefit from the economic boost that such major port facilities can bestow. APM Terminals invested approximately three quarters of a billion dollars in capital port and transportation projects, in both industrialized and developing nations during 2008.

Bahrain

In February 2009, APM gained its operational control license for its new terminal at Khalifa Bin Salman Port. The official handover enabled the company to complete work and equipment testing and finalize staff training at the new port.

APM's initial investment in the new facility was over $62 million, which enabled the installation of four post-Panamax cranes with an outreach of 18 stacks. The port will have an initial capacity of approximately 1.1 million TEUs per annum, with the ability to expand up to approximately 2.5 million TEUs per year.

Full port operations began in April, and vessels have been berthing and discharging cargoes since the middle of that month. The new, purpose-built facility has enabled APM to develop agreements with the large carriers to use Bahrain as another strategic hub in the Persian Gulf.

Khalifa Bin Salman is being positioned as an alternative to Jebel Ali and Dammam as a hub for upper Persian Gulf cargoes.

[170] http://www.lloydslist.com.

Latest Developments

In November 2009, APM Terminals reported that it was maintaining levels of tariffs and payment terms for its terminal services, despite the significant fall in container volumes worldwide during 2009. The company does not expect a trade volume upturn into the early months of 2010 across its worldwide operations. However, in looking at its operations in a more geographically segmented way, APM estimated that the worst hit container markets are North America (down 25%), Eastern Europe (down 29%) and northern Europe (down 13%). In comparison, its operations in Bahrain, India, Indonesia, Jordan and Oman were benefiting from more resilient maritime trade in the Middle East, the Sub-continent and Southeast Asia. Nevertheless, in comparison to the rest of the AP Moller-Maersk Group, which reported that full losses for 2009 will be close to $1 billion, APM Terminals was faring fairly well. For its standalone terminal business, year-to-date volumes of TEUs handled by APM Terminals was down 9% in 2008, though this was better than a global container market fall of 15%. The company is using this period of downturn and terminal capacity slack to get infrastructure improvements in place, cargo-handling equipment maintained, and expand training of port employees. APMT has announced that it has no plans to mothball any of its terminals, but is not proceeding with any previously planned new terminal building projects.

A.P. Møller Container Terminals: Terminal/Facility Locations

Country	Location/City	Facilities
Bahrain	Mina Salman/Khalifa Bin Salaman Port (KBSP)	Bahrain Gateway Terminal
India	Pipavav	APM Terminals
	Mumbai	Jawaharlal Nehru Port
Indonesia	Tanjung Pelepas	Port of Tanjung Pelepas (PTP)
Jordan	Aqaba	Aqaba Container Terminal (ACT)
Oman	Salalah	Port of Salalah

Source: APM Terminals - www.apmterminals.com

Appendices III-V: Raw Materials and Minerals for Manufacturing and Export

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

Raw Materials and Minerals for Manufacturing and Export

Country	Raw Materials and Minerals
Australia	Bauxite, Coal, Iron Ore, Copper, Tin, Gold, Silver, Uranium, Nickel, Tungsten, Lead, Zinc, Diamonds, Natural Gas, Petroleum
Bahrain	Oil, Natural Gas
Bangladesh	Natural Gas, Timber, Coal
Comoros	-
Djibouti	Gold, Granite, Limestone, Salt, Diatomite, Gypsum, Pumice, Petroleum
East Timor	Gold, Petroleum, Natural Gas, Manganese
Egypt	Petroleum, Natural Gas, Iron Ore, Phosphates, Manganese, Limestone, Gypsum, Lead, Zinc
Eritrea	Gold, Potash, Zinc, Copper, Salt, possibly Oil And Natural Gas
India	Coal, Iron Ore, Manganese, Bauxite, Titanium Ore, Chromite, Natural Gas, Diamonds, Petroleum, Limestone
Indonesia	Petroleum, Tin, Natural Gas, Nickel, Timber, Bauxite, Copper, Coal, Gold, Silver, Rubber
Iran	Petroleum, Natural Gas, Coal, Chromium, Copper, Iron Ore, Lead, Manganese, Zinc, Sulfur
Iraq	Petroleum, Natural Gas, Phosphates, Sulfur
Israel	Timber, Potash, Copper Ore, Natural Gas, Phosphate Rock, Magnesium Bromide
Jordan	Phosphates, Potash, Shale Oil
Kenya	Limestone, Salt, Zinc, Diatomite, Gypsum
Kuwait	Petroleum and Natural Gas
Madagascar	Graphite, Chromite, Coal, Bauxite, Salt, Quartz, Tar Sands
Malaysia	Tin, Petroleum, Timber, Copper, Iron Ore, Natural Gas, Bauxite
Maldives	-
Mauritius	-
Mozambique	Coal, Titanium, Natural Gas, Tantalum, Graphite
Myanmar	Petroleum, Timber, Tin, Antimony, Zinc, Copper, Tungsten, Lead, Coal, Limestone, Precious Stones, Natural Gas
Oman	Petroleum, Copper, Limestone, Chromium, Gypsum, Natural Gas
Pakistan	Natural Gas, Petroleum, Coal, Iron Ore, Copper, Salt, Limestone
Qatar	Petroleum and Natural Gas
Saudi Arabia	Petroleum, Natural Gas, Iron Ore, Gold, Copper
Seychelles	-
Singapore	-
Somalia	Uranium, Iron Ore, Tin, Gypsum, Bauxite, Copper, Salt, Natural Gas, Oil
South Africa	Gold, Chromium, Antimony, Coal, Iron Ore, Manganese, Nickel, Phosphates, Tin, Uranium, Diamonds, Platinum, Copper, Vanadium, Salt, Natural Gas
Sri Lanka	Limestone, Graphite, Mineral Sands, Gems, Phosphates
Sudan	Petroleum, Iron Ore, Copper, Chromium Ore, Zinc, Tungsten, Mica, Silver, Gold
Tanzania	Tin, Phosphates, Iron Ore, Coal, Diamonds, Gemstones, Gold, Natural Gas, Nickel
Thailand	Tin, Rubber, Natural Gas, Tungsten, Tantalum, Timber, Lead, Gypsum, Lignite, Fluorite
United Arab Emirates	Petroleum and Natural Gas
Yemen	Petroleum, Rock Salt, Marble, Coal, Gold, Lead, Nickel, Copper

Source: CIA World Factbook 2008

Appendix IV
Exports of Indian Ocean Countries

Exports of Indian Ocean Countries

Country	% of Regional Total	Major Exports
Saudi Arabia	13.73	Crude oil, LPG, Petrochemicals, Distillates, Gasoline, Jet Fuel, Diesel
Singapore	10.41	Machinery and equipment (including electronics), Pharmaceuticals, Petrochemicals, Distillates, Gasoline, Jet Fuel, Diesel
United Arab Emirates	9.17	Crude Oil, Natural Gas, LNG, Transshipped (re-exported) Manufactured Goods
Malaysia	8.64	Electronic Equipment, Petroleum and LNG, Timber and Wood Products, Palm Oil, Rubber, Chemicals
Australia	7.89	LNG, Coal, Iron Ore, Gold, Meat, Alumina, Wheat, Machinery, Transport Equipment
Thailand	7.88	Rice, Rubber, Automobiles, Computers, Electrical Appliances
India	7.75	Petroleum Products, Petrochemicals, Tea, Engineering Goods
Indonesia	6.04	Crude Oil, Natural Gas, LNG, Electrical Appliances, Rubber
Iran	4.69	Crude Oil, Natural Gas, Petrochemicals
Kuwait	4.21	Crude Oil, Distillates, Product Fuels, Fertilizers
South Africa	3.59	Gold, Diamonds, Platinum, Other Metals and Minerals, Machinery and Equipment
Iraq	2.92	Crude Oil and Livestock
Qatar	2.76	LNG, Petroleum Products, Fertilizers, Steel
Israel	2.39	Machinery and Equipment, Cut Diamonds, Agricultural Products, Chemicals
Oman	1.49	Petroleum, LNG, Re-exports, Metals
Egypt	1.47	Crude Oil and Petroleum Products, LNG, Natural Gas, Cotton, Chemicals
Pakistan	0.91	Rice and Chemicals
Bahrain	0.85	Petroleum and Petroleum Products and Aluminum
Bangladesh	0.62	-
Sudan	0.60	Oil and Petroleum Products, Cotton, Livestock, Sugar
Yemen	0.41	Crude Oil and Coffee
Sri Lanka	0.36	Tea, Diamonds, Rubber
Jordan	0.29	Fertilizers, Potash, Phosphates, Pharmaceuticals
Myanmar	0.27	Natural Gas and Rice
Kenya	0.22	Tea, Coffee, Petroleum Products, Cement
Mozambique	0.12	Aluminum, Sugar, Timber
Tanzania	0.11	Gold, Coffee, Manufactures, Cotton
Mauritius	0.10	Sugar
Madagascar	0.06	Coffee, Sugar, Chromite, Petroleum Products
Seychelles	0.02	Petroleum Products (re-exports)
Djibouti	0.02	Re-exports
Somalia	0.01	Livestock
Maldives	0.01	-
Comoros	0.0014	-
Eritrea	0.0006	Livestock and Food
East Timor	0.0004	Coffee (note: potential for oil exports)

Source: CIA World Factbook 2008

Appendix V
Imports of Indian Ocean Countries

Imports of Indian Ocean Countries

Country	% of Regional Total	Major Imports
India	14.91	Crude Oil, Machinery, Gems, Fertilizer, Chemicals
Singapore	11.38	Machinery and Equipment, Mineral Fuels, Chemicals, Foodstuffs, Consumer Goods, Crude Oil
Australia	9.71	Machinery and Transport Equipment, Computers and Office Machines, Telecommunication Equipment and Parts, Crude Oil and Petroleum Products
Thailand	9.28	Capital Goods, Intermediate Goods and Raw Materials, Consumer Goods, Crude Oil, Fuels
Malaysia	8.10	Electronics, Machinery, Petroleum Products, Plastics, Vehicles, Iron and Steel Products, Chemicals
United Arab Emirates	7.32	Machinery and Transport Equipment, Chemicals, Food
Indonesia	6.68	Machinery and Equipment, Chemicals, Fuels, Food
Saudi Arabia	4.79	Machinery and Equipment, Food, Chemicals, Motor Vehicles, Textiles
South Africa	4.51	Machinery and Equipment, Chemicals, Petroleum Products, Scientific Instruments, Food, Crude Oil
Iran	3.52	Industrial Raw Materials and Intermediate Goods, Capital Goods, Food and other Consumer Goods, Technical Services
Israel	3.24	Raw Materials, Military Equipment, Investment Goods, Rough Diamonds, Fuels, Grain, Consumer Goods, Crude Oil
Egypt	2.93	Machinery and Equipment, Food, Chemicals, Wood Products, Fuels, Crude Oil
Iraq	2.26	Food, Medicine, Manufactured Goods
Pakistan	1.84	Crude Oil, Petroleum Products, Machinery, Plastics, Transportation Equipment, Edible Oils, Paper and Paperboard, Iron and Steel, Tea
Kuwait	1.38	Food, Construction Materials, Vehicles and Parts, Clothing
Qatar	1.29	Machinery and Transport Equipment, Food, Chemicals
Bangladesh	1.05	Machinery and Equipment, Chemicals, Iron and Steel, Textiles, Food, Crude Oil, Petroleum Products, Cement
Jordan	0.81	Petroleum Products, Machinery, Transport Equipment, Iron, Cereals
Bahrain	0.81	Crude Oil, Machinery, Chemicals, Food
Sri Lanka	0.73	Textile Fabrics, Mineral Products, Petroleum Products, Food, Machinery and Transportation Equipment
Oman	0.69	Machinery and Transportation Equipment, Manufactured Goods, Food, Livestock, Lubricants
Kenya	0.56	Machinery and Transportation Equipment, Petroleum Products, Motor Vehicles, Iron and Steel, Resins and Plastics
Yemen	0.48	Food and Live Animals, Machinery and Equipment, Chemicals
Sudan	0.40	Food, Manufactured Goods, Refinery and Transportation Equipment, Medicines and Chemicals, Textiles, Wheat
Tanzania	0.31	Consumer Goods, Machinery and Transportation Equipment, Industrial Raw Materials, Crude Oil
Mauritius	0.23	Manufactured Goods, Capital Equipment, Food, Petroleum Products, Chemicals
Myanmar	0.19	Fabric, Petroleum Products, Fertilizer, Plastics, Machinery and Transportation Equipment, Cement, Construction Materials, Crude Oil, Food Products, Edible Oil
Mozambique	0.17	Machinery and Equipment, Vehicles, Petroleum Products, Chemicals, Metal Products, Food, Textiles
Madagascar	0.13	Capital Goods, Petroleum Products, Consumer Goods, Food
Djibouti	0.08	Food, Beverage, Transport Equipment, Chemicals, Petroleum Products
Maldives	0.07	Petroleum Products, Ships, Food, Clothing, Intermediate and Capital Goods
Seychelles	0.05	Machinery and Equipment, Food, Petroleum Products, Chemicals
Somalia	0.04	Manufactured Goods, Petroleum Products, Food, Construction Materials, Clothing
Eritrea	0.03	Machinery, Petroleum Products, Food, Manufactured Goods
East Timor	0.01	Food, Gasoline, Kerosene, Machinery
Comoros	0.01	Rice and other Food, Consumer Goods, Petroleum Products, Cement, Transport Equipment

Source: CIA World Factbook 2008

Appendix VI: Regional Multilateral Organizations

All of the organizations on the next page comprise prominent states located in the Indian Ocean region; however, only one – the Indian Ocean Rim Association for Regional Cooperation – is specifically set up to address matters in the Indian Ocean, but its focus is trade rather than broader socio-political or socio-economic issues. While all of the remaining bodies address issues that *can* have an impact on the use and status of the Indian Ocean, none are explicitly dedicated to doing so, as can be clearly noted from their wider membership outside the Indian Ocean region (not shown), their titles and the objectives statements. Countries in bold type constitute those that are most significant by virtue of GDP, GNP, aggregate export value, aggregate import value, population and length of coastline. In political, economic and maritime trading terms, these are among the most influential states within and using the Indian Ocean. This influence is not necessarily reflected in military power or security capacity.

Regional Multilateral Organizations

Regional Organisation	Member States from within Indian Ocean region and their Objectives and Purpose
African Union (AU)	Comoros, Djibouti, **Egypt**, Eritrea, Kenya, Mauritius, Mozambique, Seychelles, Somalia, **South Africa**, Sudan, Tanzania To accelerate political and socio-economic integration of the continent…to achieve peace and security; and, the promotion of democratic institutions, good governance and human rights.
Arab League (AL)	Bahrain, Djibouti, **Egypt**, **Iran**, Iraq, Jordan, Kuwait, Oman, Qatar, **Saudi Arabia**, Sudan, **United Arab Emirates**, Yemen Draw closer relations between member states and co-ordinate collaboration between them, to safeguard their independence and sovereignty…
Asia Cooperation Dialogue (ACD)	Bahrain, **Bangladesh**, **India**, **Indonesia**, **Iran**, Kuwait, **Malaysia**, Myanmar, Oman, **Pakistan**, Qatar, **Saudi Arabia**, **Singapore**, Sri Lanka, **Thailand**, **United Arab Emirates** Formed to promote Asian cooperation at a continental level.
Asia-Pacific Economic Cooperation (APEC)	**Australia**, **Indonesia**, **Malaysia**, **Singapore**, **Thailand** Facilitate cooperation on regional trade, and enhance economic growth and prosperity in the region.
Association of Southeast Asian Nations (ASEAN)	**Indonesia**, **Malaysia**, Myanmar, **Singapore**, **Thailand** Accelerate economic growth, social progress, cultural development and facilitate the protection of the peace and stability in the region
Colombo Plan (CP)	**Australia**, **Bangladesh**, **India**, **Indonesia**, **Iran**, **Malaysia**, Maldives, Myanmar, **Pakistan**, **Singapore**, Sri Lanka, **Thailand** To strengthen economic and social development of member countries, with an emphasis on human resources development.
Gulf Cooperation Council (GCC)	Bahrain, Kuwait, Oman, Qatar, **Saudi Arabia**, **United Arab Emirates** Formulates similar regulations for, and fosters cooperation in, economies, finance, trade, customs and legislation.
Indian Ocean Rim Association for Regional Cooperation (IOR-ARC)	**Australia**, **Bangladesh**, **India**, **Indonesia**, **Iran**, Kenya, Madagascar, **Malaysia**, Mauritius, Mozambique, Oman, Seychelles, **Singapore**, **South Africa**, Sri Lanka, Tanzania, **Thailand**, **United Arab Emirates**, Yemen Disseminates information on trade and investment in order to assist the region's business in order to better understand impediments to trade and investment.
South Asian Association for Regional Cooperation (SAARC)	**Bangladesh**, **India**, Maldives, **Pakistan**, Sri Lanka To promote the welfare of the peoples of South Asia and to improve their quality of life; to accelerate economic growth and social progress.

Sources: Websites of the respective organizations

Appendix VII: Opiates from Afghanistan and Pakistan Bound for Europe

Phase One: Land Trafficking Corridors Leading to the Coast

Opiates enter Iran overland from Pakistan and Afghanistan by camel, donkey or truck caravans (or a combination of various aforementioned means); they are most often organized and protected by armed Baluch tribesmen. Once inside Iran, large shipments are either concealed within trucks or broken down into smaller consignments. The Iranian town of Zahedan remains the major hub for the trafficking of opiates in southern Iran, from which consignments move northwards to Turkey or in a southerly and south-westerly direction to the coast. Foreign trafficking syndicates operate in and from Iran, including African-led organized criminal groups that have shipped consignments bound for Europe via east African ports. Most local traffickers in Iran, which tend to be well-armed, operate in large armed convoys on Iran's eastern border, and they will fight if challenged.

Opium from Kandahar and Helmand reaches the Persian Gulf, Gulf of Oman or the Makran coast for onwards sea transport via one of several routes:

- **Afghanistan to Pakistan:** Heroin as well as opium consignments are moved to Pakistan via the North West Frontier Province (NWFP) and Balochistan province in the south via Quetta, Panjgur and Turbat, and then on to Gwadar on the Makran coast.[171] Significant quantities of opiates go through Balochistan to be exported via ports of the Pakistani coast, which is over 700 kilometers long.
- **Afghanistan to Pakistan to Iran:** Opiates are moved to Pakistan via the NWFP and Balochistan via Quetta. From Quetta, they are transported on to Zahedan in Iran via the border town of Taftan. From Zahedan, consignments can either be transported southwest to Iran's Persian Gulf coast to the port of Bandar Abbas, or south to Char Bahar on the Gulf of Oman. It is from the smaller ports that dhows and fast boats are likely to be favored over larger coastal and short sea general cargo vessels that may be unable to get in close to shore due to their draft.
- **Afghanistan to Iran:** Opiates can also be smuggled directly to Iran via one of the relatively new roads between Delaram and Zahedan, and Gereshk and Zahedan.[172] From Zahedan, consignments not destined for the northern route to Turkey follow one of two of the southern routes to the coast as listed in No. 2 above.

[171] Jane's Intelligence Review, http://www.geopium.org/JIR3.htm.

[172] "New route links Afghanistan to sea, via Iran," *San Francisco Chronicle*, 18 February 2009, http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2009/02/17/MNGF15RGMK.DTL.

Balochistan thus functions as the crossroads for the trafficking of Afghani and Pakistani opiates. Aside from road routes, the more rugged routes are also plied by caravans of camels, crossing the deserts of Afghanistan, Pakistan and Iran, particularly at night. Groups of traffickers have been known to relay one another: from Afghanistan to Panjgur in Pakistan, then on to Turbat and eventually on to Mand, Pasni or Gwadar on the coast. Dalbandin, in northern Balochistan near the Afghan-Pakistan border, is also a major regional trafficking node for consignments from Afghanistan that are bound for the Makran coast or westwards to Iran.[173] Despite its continued interdiction efforts, Iranian security authorities have estimated that 65% of the trafficking in Afghan opiates goes through its territory.

Phase Two: Sea Transport from Iran and/or Pakistan to the UAE, Oman and Yemen

Iran to the UAE:

The UAE is a prominent transshipment destination for narcotics, and small loads of opiates are smuggled across the Persian Gulf to be placed in containerized cargo shipments bound for Europe, Africa, and to a lesser extent the US. Hashish also moves extensively along this route. In October 2008, 610 kilograms of opium and 150 kilograms of hashish were seized from a vessel steaming from Iran to the UAE across the Straits of Hormuz. In December 2008, Iran also seized 250 kilograms of hashish in Bushehr province that was bound for Qatar.

Consignments of opium and heroin that have been routed through Iran leave via a number of ports and on different kinds of vessels. The main port of *Bandar Abbas* is a major exit point for large consignments that are shipped to Europe via the UAE. Illicit consignments of arms bound for the Levant have also been routinely exported via Bandar Abbas, including the recent parcels of arms that were discovered on the Cypriot-flagged Ro-Ro vessel *M/V Monchegorsk*, by US Navy forces in the northern Red Sea in April 2009.

Commercial shipping linkages: Iranian-flagged general cargo vessels sailing from southern Iran are the most numerous group of general cargo vessels (35-40%) calling at Dubai, and constitute one of the main sea trading linkages across the Straits of Hormuz aside from the dhow traffic. There are also regular commercial connections from Bushire and Khorramshahr. Iranian-flagged container vessels and a small number of Ro-Ro vessels also connect Bandar Abbas with ports in the UAE, the Red Sea and the Mediterranean. A smaller number of general cargo vessels have services between Bandar Abbas and Sharjah. Iranian-flagged container vessels and general cargo vessels calling at Jebel Ali tend to link Bushire and particularly Khorramshahr; although a limited number of container vessels also have services lining Jebel Ali, Bandar Abbas and Karachi.

Essentially, any narcotics being transshipped through the UAE from Bandar Abbas on general cargo vessels, rather than Dhows and/or fast boat, are more likely to enter via Dubai and, to a lesser extent, via Sharjah.

The itinerant dhow traffic (which is ideal for small consignments of narcotics, and less likely to be routinely and systematically checked by customs inspectors) that connects southern Iran (Bandar Abbas, Chah Bahar and Jask) and the UAE across the Straits of Hormuz is significant and perpetual.

[173] *Ibid.*

Iran to Oman:

Opiates trafficked via southern Iran are also shipped to Oman for onward shipment to Europe (although in smaller quantities than the UAE), or moved overland to Dubai for containerized transshipment by sea. Aside from regular barge services linking Bandar Abbas with Sohar, most general cargo from Iran to Oman is conveyed on Ro-Ro services between Bandar Abbas and Port Sultan Qaboos across the Gulf of Oman. Opiates, and increasingly hashish, are also being trafficked through the Straits of Hormuz and/or across the Gulf of Oman from Iran and Pakistan to Oman via dhow or fast boat. However, the volumes involved are less than that being moved to the UAE.

Pakistan to the UAE, Oman and Yemen

As highlighted above, Pakistan remains a major transit country for opiates and hashish being trafficked along the southern route to Europe and Africa. Precursor chemicals also move through Pakistani ports in the opposite direction to raw opium or processed heroin bound for Europe. These chemicals are intended for the heroin processing labs (both fixed and mobile) in neighboring Afghanistan; still the world's largest producer of opium poppy. Pakistan is also a major narcotics producing country in its own right, with cultivation of poppy still being conducted on well over 1,000 hectares of arable land. It is currently estimated that 36% of illicit opiates exported from Afghanistan transit Pakistan en route to Iran, Western Europe, the Middle East, the Arabian Peninsula, Africa and East Asia.[174]

Precursor chemicals (such as acetic anhydride) bound for Afghanistan and Pakistan are smuggled in to the country largely from the UAE, South Korea and India, generally in mislabeled containers. Ecstasy, buprenorphine and other psychotropic drugs are smuggled into Pakistan from India, the UAE and Europe, and small amounts of cocaine are also smuggled into Pakistan by West African crime syndicates.[175]

As indicated above, opiates and hashish from Afghanistan are trafficked to the Makran coast ports through Balochistan. There are regular and continuous general cargo and feeder-sized container ship services linking Pakistan's main ports of Karachi and Port Mohammed Bin Qassam with Jebel Ali, Dubai and Salalah in the UAE, and to Port Sultan Qaboos and Salalah in Oman. Vessels bound for Yemen from Pakistan link the Makran ports with Hodeidah and Aden (though not all are direct).

Security authorities in the Port of Aden, in co-operation with customs authorities of the Free Zone, seized a large quantity of drugs coming from an Arab country in late 2008. The drugs were concealed in steel boxes welded to the bottom of a large electrical bread oven, which was being transported inside an FEU container. Police and customs officials at Aden have reportedly detected many drug shipments during 2008.

Smaller consignments of drugs are also smuggled in dhows from Pakistan to Yemen, Oman, Saudi Arabia and the UAE via the Arabian Sea. Approximately 40 metric tons of hashish were seized in the spring of 2008 by law enforcement on the Makran coast, in cooperation with Combined Task Force 150 (CTF-150) in the Persian Gulf. Also that year, Royal Navy

[174] US Department of State, http://www.state.gov/p/inl/rls/nrcrpt/2009/vol1/116523.htm.

[175] *Ibid.*

warships seized some 30 tons of hashish, cocaine, opiates and amphetamines discovered on dhows during the first half of 2008[176]; much of this was seized in the northern Arabian Gulf.

[176] "Navy crews seize tonnes of drugs," *BBC News*, 13 July 2008, http://news.bbc.co.uk/1/hi/england/devon/7503916.stm.

Appendix VIII: Geographical Contours

Vulnerable Passages—"Chokepoints"

Chokepoint	Geographical Features
Suez Canal	Connecting the Atlantic and the Indian oceans (via the Mediterranean Sea and the Red Sea), the Suez Canal has a total length of 162 km (87 nautical miles). The Suez Canal extends from Port Said on Egypt's Mediterranean coast southwards to Port Tewfik on the Gulf of Suez. The canal's widest point is the Great Bitter Lake (although in practical terms only the eastern side of the lake is used by transiting and anchored vessels); however, the canal is only 133 meters wide at its current nominal maximum depth of 22.5 meters. There are no restrictions on the length of vessel that can transit the canal as the radius of the curves in the canal at Ras El Ish, El Ballah, Ismailia, El Kabrit, Geneffe and Port Tewfik enable sufficient manoeuvring for even the largest ships. Due to the configuration of the canal's dredged cross-section, the maximum permitted breadth of vessels is 70.1 meters and the maximum draft allowed is 17.68 meters.
Bal el Mandab	Bab el-Mandab (the 'Gate of Tears') links the Red Sea and the Arabian Sea, and is one of the narrowest divides between the African and Asian continents aside from the Suez Canal. The island of Perim divides the strait into two distinct channels: the eastern channel - Bab Iskender (Alexander's Strait), is 3 km (1.6 nautical miles) wide and 30 m deep; the western channel - Dact-el-Mayun, is 25 km (13.5 nautical miles) and has a depth of 310 meters. It is the latter channel, thus, that is the primary shipping conduit.
Strait of Hormuz	The Strait of Hormuz connects the Gulf of Oman/Arabian Sea and the Persian Gulf. The Strait is bounded in the north by Iran and by Oman to the south (Musandam Peninsula). At its narrowest point, the Strait is 54 km (29 nautical miles) wide. It is the only sea passage to the Indian Ocean for the countries that bound the Persian Gulf. Vessels moving through the Strait follow a Traffic Separation Scheme (TSS), which is 10 km (5.4 nautical miles) wide: comprising two two-mile (3 km)-wide traffic lanes - one inbound/westward and one outbound/eastward, which are separated by a two-mile (3 km) wide separation median. The inbound lane is the northerly of the two, which runs nearer the Iranian side of the Strait.
Straits of Malacca and Singapore	The Straits of Malacca and Singapore, commonly but inaccurately referred to as "the Strait of Malacca" constitute the entirety of this chokepoint. The Strait of Malacca is an 805 km (435 nautical miles) stretch of water between the Malaysian Peninsula and the Indonesian island of Sumatra. It is the primary shipping route linking the Indian Ocean and the Pacific Ocean. At its widest point, the strait is approximately 330 km (180 nautical miles) between the island of Sabang off Aceh (Sumatra) and the island of Phuket (Thailand). However, at the Phillips Channel, which separates Singapore and Indonesia (island of Pulau Batam), the Strait narrows to only 2.8 km (1.5 nautical miles) wide - one of the narrowest of the world's strategic chokepoints. The strait is not deep enough at its shallowest point - 25 meters (82 feet) - to permit some of the largest vessels to use it such as the largest laden VLCCs, ULCCs and bulk carriers. A ship that exceeds Malaccamax dimensions will typically use the Lombok Strait.
Lombok Strait	The Lombok Strait, located between the islands of Bali and Lombok in the Indonesian archipelago, connects the Indian Ocean with the Java Sea. [Though technically in the Indian Ocean, the Java Sea is contiguous with the Pacific Ocean to the northwest (via the South China Sea) and to the northeast (via the Makassar Strait).] Its narrowest point is at its southern (Indian Ocean) access, where it is only 18 km (9.7 nautical miles) across; however, it widens progressively to 40km (21.6 nautical miles) wide at its northern opening. The strait is some 60 km (32.4 nautical miles) in length. Given that it is some 250 meters deep, vessels from Europe, Africa and the Middle East bound for China and Japan that draw too much water to pass through Malacca use the Lombok Strait. [Note: In the very unlikely event of any form of closure of the Malacca Strait due to a security incident, the Lombok Strait would become the primary maritime linking corridor between the two oceans, and would add to transit times and bunker costs for vital shipments of crude oil, bulk commodities, LNG and manufactured goods moving between east and west.]

Regional Seas and Maritime Areas

Primary Sea Area	Sub-Sea Areas/ Maritime Spaces	Geographical Features
Red Sea	Gulf of Suez Gulf of Aqaba Suez Canal*	The Red Sea is a 2,250 km (1,216 nautical miles) long salt water inlet of the Indian Ocean, running along a NW-SE axis. Accessed and constrained by the Suez Canal in the north and Bab el Mandab in the south, and functioning as it does as a critical navigational conduit between the Atlantic and the Indian Ocean, the Red Sea is a geographical feature of inescapable importance to the Indian Ocean, to the maritime trade between Europe and Asia and the strategic movement of warships and expeditionary military forces. There are vital oil and gas fields in the Gulf of Suez, which are heavily exploited by Egypt. The Gulf of Aqaba is the only maritime trading access for Jordan, and the Strait of Tiran remains a potential bottle-neck for Israeli shipping and naval forces. It is bordered by: Djibouti, Egypt, Eritrea, Israel, Jordan, Saudi Arabia, Sudan and Yemen
Mozambique Channel		A 1,600 km (864 nm) stretch of water between the island state of Madagascar and Mozambique. The channel, which is between 460 and 950 km (248 to 513 nm) wide, constitutes an important corridor for shipping from the Americas bound for the Sub-continent, and crude oil shipments from the Persian Gulf bound for the Atlantic Basin that cannot transit via the Suez Canal. It is bordered by: the Comoros, the French territories of Bassas da India, Europa Island, GlorIndian Ocean regiono Islands, Juan de Nova Island and Mayotte, Madagascar and Mozambique
Persian Gulf	Strait of Hormuz* Shatt al Arab	A 989 km (534 nm) inland sea at the northernmost extent of the Indian Ocean that is connected to the Gulf of Oman in the southeast via the Strait of Hormuz. Its north-western end is marked by the Shatt al-Arab (which carries the waters of the Euphrates and the Tigris). The Iranian coast dominates its north-eastern margin, while Saudi Arabia and the UAE dominate the opposite shore. The gulf is about 56 km (30 nm) wide at its narrowest extent. Overall, the Gulf is very shallow, with an average depth of 50 meters, and a maximum of 90 meters. A significant proportion of the seabed geology contains enormous quantities of petroleum, which have been extensively exploited by the riparian states. Overall, the Persian Gulf and its coastal areas constitute the world's largest single source of crude oil. The Al-Safaniya field, in the Saudi Arabian littoral, is the world's largest offshore oilfield. Notably, the Gulf also contains the largest single natural gas field on earth - the North Field/South Pars, which is shared by Iran and Qatar. The Gulf is bordered by Bahrain, Iran, Iraq, Kuwait, Qatar, Saudi Arabia and the United Arab Emirates.
Arabian Sea	Gulf of Aden Gulf of Oman Bab el Mandab* Laccadive Sea	A region of the Indian Ocean bounded in the east by India, in the north by Pakistan and Iran, to the west by the Arabian Peninsula, and in the south by a line that extends between Cape Guardafui on the north-east point of Somalia and the south-western coast of Sri Lanka. The Arabian Sea has a surface area of some 3,862,000 sq km (1,491,130 sq miles). The sea has two vital sub-regions - the Gulf of Aden in the west, and the Gulf of Oman to the northwest. The Arabian Sea is the principal Indian Ocean trading cross-roads, which connects Europe (via the Red Sea) with the Sub-Continent and Southeast Asia and Northeast Asia (via the Malacca Straits). It is bordered by: Djibouti, India, Maldives, Oman, Pakistan, Somalia, Sri Lanka and Yemen
Bay of Bengal	Andaman Sea	The Bay of Bengal, which occupies an area of 2,172,000 km^2, forms the north-eastern part of the Indian Ocean. It is bordered by India and Sri Lanka to the West, Bangladesh to the North, and Myanmar and the Andaman and Nicobar Islands to the East. Its southern boundary is essentially a line from the southern tip of Sri Lanka to the northernmost tip of Sumatra in Indonesia. Aside from its strategic importance to India and China in particular, the Bay of Bengal also boasts sizable deposits of petroleum with offshore plays in the Krishna Basin, the Burma Basin and off Sittwe in Myanmar (a growing source of natural gas hotly competed over by India and China).

**Chokepoints (see table above)*

Author Biographies

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