A Vessel Traffic System Analysis for the Korea/Tsushima Strait

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1. Introduction

The Korea/Tsushima Strait separates the southeastern coast of the Republic of Korea (ROK) from the northwestern coast of Kyushu Island and the southwestern coast of Honshu Island, Japan, connecting the Sea of Japan/East Sea with the East China Sea. The principal users of the Strait include Korea, Japan, Russia, China, and the United States. The Strait is about 151 miles long, bisected into an Eastern Channel and a Western Channel by the Tsushima Islands. The narrowest part of the Western Channel is 23.2 miles in width; the widest part is 26.6 miles. In the Eastern Channel, the narrowest part is about 25 miles between the southern tip of the Tsushima Islands and the northwestern coast of Kyushu Island.

Neither Japan nor the ROK enforce a 12-mile territorial sea in the Straits. The shipping lanes to the east and west of Tsushima Islands are therefore high seas governed by the conventional and customary international law that applies to the high seas. Both the ROK and Japan have ratified the United Nations Convention on the Law of the Sea (UNCLOS). Both Japan and the ROK depend heavily upon ocean shipping and oil imports for their growing economies and fisheries are one of the major sources of protein for their peoples. These two important interests tend to interfere with one another in the waters of the Korea/Tsushima Strait.

2. Current Vessel Traffic Situation in the Korea/Tsushima Strait

2.1. Western Channel: Currents, Winds and Weather

Between Cheju Do and Pusan the coastal currents are primarily tidal and vary in speed and direction depending on the bottom topography and the time of day. In the Western Channel ten miles off Pusan the surface current flows in a general NE direction and averages a little over one knot. Between Pusan and Ulsan the current in the Western Channel (the Taehan Current) flows NE parallel to the coast. In winter the current is weak, but in spring its strength increases. The Sailing Directions for this area[1] note that deep water occurs close to shore along this coast and caution transiting vessels to stay in waters deeper than 200 meters at night or in foggy weather. Off the Tsushima Islands there are tidal currents that shift north and south depending on whether the tide is ebbing or flowing. However, tidal currents are not felt beyond a distance of five miles off shore. Outside this distance the current flows north.

Off the western coast of the Tsushima Islands strong NW winds prevail during the winter and raise heavy seas. In some parts of Tsushima, a peculiar cold wind known as "Kankeburi" causes thick fog on the sea. SW winds generally prevail during the summer. Northerly or NE winds prevail during September and October, and in September strong winds may hinder navigation near the eastern coast of Tsushima. In the northern part of the Western Channel NW winds prevail from October to May, from June to July SE winds prevail, and during August and September NE winds are predominant. Gales sometimes accompany SE or NE winds in late August and typhoons may occur in late summer and early fall.

2.2. Western Channel: Coastal Traffic

There is considerable coastal traffic in the Western Channel, including both container and 400-500 dry weight metric ton LPG and tanker traffic. The ocean-going tanker industry considers the Korean coastal traffic undisciplined.[2] In particular there is concern about the container ships that operate on tight schedules and don’t always obey the rules of the road.[3] Most of coastal traffic stays within six miles of the shore. The major destinations are the ports of Yosu, Pusan, and Ulsan. The following information on these ports was taken from the applicable Sailing Directions.[4]

Yosu is a major commercial port, fishing port, and an important rail terminus, and has been developed as a subsidiary port to Pusan. There are six major terminals in Yosu: 1) a dry cargo harbor, 2) the Honam Refinery and crude oil wharf, 3) the Honam Oil Refinery and refined product wharf, 4) an advanced material pier, 5) an energy terminal, and 6) the Kwangyang Steel Mill. A Deep Water (DW) Route has been established in the Gulf of Yosu. There are fish havens in close proximity to this route. No. 1 Anchor Berth, a circle with a 0.6 radius, can accommodate VLCCs greater than 70,000 GRT. No. 2 Anchor Berth, a circle with a 0.4 mile radius, can accommodate other vessels greater than 70,000 GRT.

Pusan, one of Korea’s principal ports, is divided into a North Harbor used by large vessels over 55,000 dwt, and a shallow South Harbor, 4 to 9m deep, used by coastal vessels. The North Inner Harbor depths range from 5 to 13m. It has 8 piers for container and bulk cargo and one T-head oil pier. There are four anchorage areas as well as a quarantine anchorage. Fishing nets are laid on either side of the fairway through the North Outer Harbor from September to March. A Traffic Separation Scheme (TSS) has been established in the approaches to Pusan Harbor. The scheme has not been adopted as yet by the International Maritime Organization (IMO); however, the local authorities apply Rule 10 of the Convention on the International Regulations for Preventing Collisions at Sea (COLREGS).[5]

The port of Ulsan has a refinery, 2-3 oil terminals and can take a mix of container and tanker vessels. The approach to Ulsan Harbor is deep and clear of danger. At the entrance and the central part of the harbor depths range from 10 to 20m. There are submarine pipeline berths at Imodco Oil Terminal. A maximum size of 325,000 dwt vessels can be berthed. There is a general anchorage area about 12m deep, but S winds raise a heavy swell. Unfortunately some fifty ships may be directed to anchor in the same small area and there is a 2.5 knot current running in the small anchorage. The tanker industry says there is a need for a couple of major buoys to anchor large vessels further out.[6] In addition Ulsan pilots have a reputation of going too fast into port and anchoring vessels too close. They apparently assume that all the vessels in the anchorage will swing the same way when the tidal currents shift, which unfortunately doesn't always happen. Adjoining vessels need as a separation distance the minimum swinging circle of both ships, plus a safety factor. Fishing stakes, partly obstructing navigation, are found from September to March in any part of the harbor. They can be found near the entrance and along the coast outside the bay at any time. In general, the tanker industry feels that Korean port management and pilot skills need to improve and warns their ships to take extreme caution when going to Korean ports.[7]

2.3. Western Channel: Fishing Industries and Fishing Fleet Activities

An increasing number of fishing industries and fleets are operating in the offshore areas and around the coasts of Korea and fishing operations are performed throughout the year. The Sailing Directions[8] caution that offshore fishing operations are frequently encountered. Fish havens, marine farms, fixed net fishing and squid fishing operations may be found in areas where they constitute a hazard to navigation. Fish havens may be located on the surface, on the sea bed, or suspended below the surface at distances within five miles of the coasts. Deep water marine farms may be found as far as 30 miles offshore and are usually attended by service vessels.[9] Fixed net fishing sets may be extended up to five miles off shore. The nets are set in designated areas marked on navigation charts. Newly established fixed nets are considered hazardous to navigation and are published in weekly Notices to Mariners in the ROK or via an announcement through the Radio Navigation Warnings System.

Boats up to 100 tons conduct fishing operations throughout the year in the Straits and up into the Sea of Japan. Fishing is done by pair trawling: two trawls are towed in tandem using fine mesh nets. The trawlers use very bright lights at night. Tanker captains report that they can't see the boat for the light. Japanese trawlers utilize the services of a guard boat with a green revolving light that stays between transiting vessels and the trawlers. There is generally one guard boat per 25-30 fishing vessels The tanker industry thinks the guard boat system is a good system.[10]However, the fish-attracting lights from the trawlers may not be in conformity with the lights specified in COLREGS.[11] Fishing vessels are considered by the tanker industry to be the main hindrance for large transiting vessels.[12] There is active fishing all across the Straits, including in the main north-south navigation lanes. On February 11, 1998 a South Korean fishing boat sank after colliding with a nuclear-powered U.S. submarine in the Western Channel south of Pusan. The submarine, part of the U.S. 7th Fleet, was not damaged and proceeded to the naval port of Chinhae with the rescued fishermen.[13]

2.4. Eastern Channel: Currents, Winds, and Weather

The Tsushima Current, a branch of the warm Kuroshio ocean current, flows in the Eastern Channel in a NE direction. Combined with tidal currents the velocity can be considerable. In the northern part of the Eastern Channel off the southwestern tip of Honshu, the winds are generally from the W in December and January, shifting N and E in spring and summer due to local conditions that combine to push the SE monsoon to the north and east. In the southern part of the Eastern Channel off the northwestern coast of Kyushu winter cold fronts can produce NW winds and heavy seas.

Summer fog creates poor visibility.

2.5. Eastern Channel: Coastal and Cross Traffic

Japanese coastal vessels range up to 140,000 dwt. The Japanese fleet is considered well disciplined by the tanker industry.[14] There is a considerable amount traffic approaching and emerging from the Kanmon Kaikyo Strait, which leads to the Inland Sea, as well as the ports of Kanmon Ko and the port of Hakata in Fukuoka Bay. These ports are the source and destination of a major amount of bulk carrier cross traffic to and from the ROK as well as transiting bulk carriers to and from destinations such as Taiwan.[15] (Table 1). In addition, the high speed, well-lit coastal ferries plying the Eastern Channel also confuse tanker navigation.

Kitakyushu Shi, one of Japan's largest industrial complexes, is located on the northwest tip of Kyushu Island along the Kanmon Kaikyo Strait. The Port of Kanmon Ko occupies the major part of Kanmon Kaikyo and is divided into a number of districts, including the ports of Wakamatsu Ko, Kokura Ko and Moji Ko, that service the Kitakyushu complex. Port Regulations Law applies and, except with permission of the Port Captain, vessels may not approach within 30m of a tanker loading inflammable materials, nor within 50m of a tanker loaded with LNG.

The Port of Hakata occupies the greater part of Fukuoka Bay. The entrance to the Bay is divided into three channels by a number of islands, but only the eastern most is recommended for large vessels. N winds send heavy seas into the Bay and there can be strong NW winds during the winter. The port of Hakata maintains a pier for the sole use of vessels discharging LPG. When such a vessel is moored or mooring alongside the pier, no other vessel may approach within a distance of 45.7 m. Three lighted buoys, each exhibiting a red light, mark the restricted area.

2.6. North-South Shipping Lane Traffic

With the increase in trade and development in northeast Asia the volume of oil and number of tankers carrying oil, LNG, and LPG is increasing. The larger northbound ships use the Eastern Channel to take advantage of northbound Tsushima current. The following data for 1996 was compiled by the Japanese government from Lloyd's data for the Northwest Pacific (NOWPAP) meeting in Toyama, Japan in 1997.[16] An estimated 7,387 vessels of all types completed 75,293 voyages through the Strait. Vessels in service for over 20 years made up 26.4% of the total number of voyages. Vessels less than 10,000 G/T made up 67.6% of the total. Tankers made up 14.5% of the total vessel traffic and 12.7% total voyages, with 1,069 tankers making 9,597 voyages. Tankers made an average of 9 voyages per year. Very large tankers, 100,000 G/T and above, made 389 voyages (4.1% of total voyages)[17]; tankers between 10,000 and 100,000 G/T made up 31.5% of the voyages; tankers less than 10,000 G/T made up 64.4% of the voyages. Tankers over 20 years old made up 14.6% of all the voyages. The total number of tanker voyages to Russia was 116. Russia does not operate many vessels, but they tend to be older, although some taken from the former State of Yugoslavia are relatively modern.[18] Age and the accompanying deterioration and weakening of ships' structures is a major contributor to casualties. Between 1975 and 1985 the mean age of vessels lost at sea was 18-19 years of age.[19]Size, on the other hand, has not been found to be related to pollution from casualties.[20]

2.7. Current Traffic Management Situation

There is no active vessel traffic control system in the high seas portion of the Strait at the present time. Current traffic management beyond the jurisdiction of port authorities is entirely voluntary and passive, with rocks, shoals, and other stationary hazards to navigation appropriately marked and/or lighted. There are lighthouses on the north and south ends of the Tsushima Islands and on the

northwest coast of Iki-shima island in the Eastern Channel. The tanker industry considers the navigation aids in the Strait adequate in the age of Global Positioning Systems (GPS).[21] The installation of an Electronic Chart Display Information System (ECDIS) can improve a ship's ability to navigate in ports and coastal areas. The system uses a computer to reassemble all the data to determine the actual location of a ship and to plot courses on a display screen. ECDIS depends on the differential GPS for its accuracy and can be made more effective by integrating it with radar and producing a radar display on a sea chart. However, the accuracy of hydrographic data from which the charts are prepared is one of the main concerns with ECDIS.[22] IMO international performance standards for electronic charts are pending.

The Japan Maritime Safety Agency is the government agency primarily responsible for coastal and offshore maritime safety. The Agency currently maintains a computerized Maritime Safety Information System, including a ship reporting system. The reporting system compiles and manages information on the positions of participating ships, the movement of foreign fishing boats and marine research ships, and weather and sea conditions. A vessel traffic information system provides information and controls vessel traffic, particularly in Tokyo Bay, Ise Bay and the Seto Inland Sea.[23] Japan is also linked to the Global Maritime Distress and Safety System, a satellite-aided global system for communications between land-based facilities and ocean going vessels.

The typhoon warning system is a major concern when late summer typhoons move through area. Although Japan provides excellent forecast and surface information, the Korea Radio Navigation Warning System has a reputation of generally giving only 12 hour notice of an approaching typhoon. Transiting tankers need at least 24 hour notice. It generally takes them about 16 hours to get through the dicey part of Straits at their normal speed of 12-14 knots, although speed depends on visibility and fishing vessel activity. In the presence of active fishing vessels, tanker speed drops down to a 10-11 knot maneuvering speed in order to be able to alter course to avoid fishing vessels. Large tankers normally put a guard ring on their radar (safety ring on warships) to detect potentially threatening traffic. Penetration of the ring sends off an alarm and alerts the watchkeeper. The set distance varies with traffic: 14-15 miles in open ocean, 2-3 miles in high density traffic.

2.8. Mineral Development in the Strait

The Japan - ROK continental shelf boundary in the Strait runs down a median line in the Western Channel. In 1970, for purposes of exploiting oil and natural gas on its continental shelf, the ROK government designated seven mining blocks (areas in the ocean) as development zones. Three of the blocks partially overlapped the shelf areas claimed by Japan, including Block 6 in the western part of the Strait. However, the ROK-Japan continental shelf dispute focused mainly on Blocks 5 and 7, located in a large area southeast of Cheju-Do beyond the entrance to the Strait. In 1974 the two states signed a joint development agreement that made Block 7 a "joint development zone". The agreement went into effect in 1978.

The ROK is looking into exploiting the oil and gas resources in the Strait itself. In 1987 the ROK began to drill an exploratory well in Block 6 about 120 km east of Pusan and located a natural gas reservoir. Japan has made exploratory attempts for oil and gas in the offshore waters west of Honshu and Kyushu and around Tsushima. There are also coal deposits in the Eastern Channel. However, as long as drilling and mining obstructions are properly marked, oil, gas and mineral development in the Strait and in the Joint Development Zone, which extends along the continental shelf to the east and southeast of Cheju Island in the main shipping channels leading to the Strait, is expected to have minimal impact on transiting vessels.[24] To date "[t]here has been no shipping problem caused by oil exploration in the Strait or approaches to the Straits."[25]

2.9. Current Oil Pollution Emergency Response

A major oil spill anywhere in the Strait has the capacity to spread widely and severely damage valuable fisheries. (Fig. 1). Tugs are available at Yosu, Pusan, and Ulsan. The Sailing Directions do not mention the availability of tugs at Kanmon Ko and Hakata; but it is assumed that they are available. However, stand-by tugs are expensive and in the last ten years there has not been any major pollution incident that has damaged resources along the coast of the ROK from tankers transiting the Strait, although there have been some minor cases of pollution caused by ships coming into Korean ports.[26]

On January 2, 1997 a 25-year-old Russian tanker broke apart in heavy storms and spilled more that 30,000 bbl of heavy fuel oil along the western coast of Honshu, threatening 15 nuclear power plants and several coastal fisheries. The main part of the ship sank, but the broken bow section drifted for five days before running aground. The cargo was destined for power stations on Russia's Kamchatka peninsula. Tugs and helicopters were deployed and Russia ultimately contributed four vessels to the clean up effort. The cleanup response was slow and hampered by high waves and poor visibility. Within two weeks an oil slick had spread along 450 km of coastline, however, the wave action also helped to disperse the pollution and minimize the damage to fisheries.

On July 2, 1997 a single hulled 259,000 dwt, Panamanian-registered, Japanese-operated supertanker transporting 1.9 million bbl of crude from the U.A.E. ran aground on a reef in Tokyo Bay. The accident was apparently due to pilot error in dealing with two fishing vessels, but luckily the resultant spill was minimal and contained. As a result of these mishaps the Japanese government is moving to toughen regulations governing oil tankers.[27] In particular, Japan is looking to strengthening provisions for adequate inspection of hull integrity and seaworthiness by both flag states and port states, and strengthening measures to deal with vessels that pass in the vicinity of a coastal state but do not enter its ports.[28] Japan also feels there is a need to review regulations on the construction of tankers carrying heavy oil, which are currently less restrictive than those pertaining to crude oil tankers.[29]

In 1990 the IMO concluded the International Convention on Oil Pollution Preparedness, Response and Co-Operation,[30] which mandates that parties require ships flying their flags to have oil pollution emergency plans on board, and ship masters, port authorities, and observing aircraft to report any discharge, or probable discharge of oil. Parties are also required to establish a national oil pollution response system, including a response plan, equipment, and trained personnel. The Convention also mandates that the parties cooperate in the event of a spill, and cooperate in training, preparation, research, and technical development. At the first meeting of the UNEP/IMO Northwest Pacific Action Plan (NOWPAP) Forum on Marine Pollution Preparedness and Response in July 1997 in Toyama, Japan, forum participants exchanged information on marine pollution preparedness and response and began developing a regional contingency plan, including a regional environmental sensitivity map, and a memorandum of understanding among the NOWPAP States. Japan informed participants that it was short on equipment and materials applicable to offshore operation and highly viscous spills, but that it was working on this problem. Japan also stated its view that "Japanese law cannot apply the oil spill incident of a foreign country's vessel which occurs outside the Japanese territorial water, except for notification based on MARPOL and measures based on the Intervention Convention."[31]

Under Article 8 and Protocol 1 of the 1973/1978 International Convention for the Prevention of Pollution from Ships (MARPOL)[32], the captain of a ship is required to report to the coastal state if there is any risk of an accident leading to a pollution incident. The 1969/1973 Intervention Conventions[33] established the right of coastal states to take measures on the high seas "necessary to prevent, mitigate or eliminate grave and imminent danger to their coastline or related interests from pollution or threat of pollution of the sea by oil and substances other than oil following upon a

maritime casualty or acts related to such a casualty, which may reasonably be expected to result in major harmful consequences.[34] Since the Intervention Conventions were adopted before the designation of Exclusive Economic Zones (EEZs) in the United Nations Convention on the Law of the Sea (UNCLOS)[35], "high seas" for purposes of these conventions pertains to all seas beyond the territorial seas. In the territorial sea, the coastal state has sovereign power to 1) designate environmental protected areas, 2) designate and control navigation routes for safety purposes and 3) prohibit discharge. If a foreign vessel is found to be posing a risk of violating international pollution regulations or accidental pollution in the territorial sea, the coastal state may require the vessel to observe special precautionary measures established by international agreement, or confine passage to specified sea lanes.[36]

In addition, several provisions of UNCLOS also give port and coastal states power to take actions to protect their environments from vessel source pollution (articles 21-23, 211, 218-221). UNCLOS and the regime of IMO conventions acknowledge that coastal straits states have the power to enact legislation and regulations not only for navigational safety and traffic in territorial waters, but for conservation of fisheries and for pollution control or prevention of environmental damage, such as that posed by oil spills from supertankers. Strait states and user states are also urged to seek cooperative measures for safety aids (UNCLOS article 43). It is important to recall, however, that many of the problems currently complicating straits management and threatening the resources of the straits states, such as aging substandard vessels, inexperienced crews, convoluted ownership arrangements, and huge increases in tanker size and traffic volume were not fully anticipated nor discussed in any detail during the conference that produced UNCLOS. The ROK ratified UNCLOS on January 29, 1996; Japan ratified it on June 20, 1996.

2.10. Operational Discharge

The 1990 GSAMP report estimates 46% of total oil input to seas originates from shipping, including accidental spills; however the U.S. Academy of Sciences also reported in 1990 that of the 568,800 tons of oil discharged annually, only a fifth of it came from accidents.[37] The remaining eighty percent came from operational discharges. Since the total amount of vessel discharge in 1977 was 257,000 tons, this represents more than a doubling of oil input into the sea from shipping in a little more than a decade. Although no vessel discharge is permitted near areas designated as environmentally sensitive by the IMO, a continuing increase in the amount of operational discharge may lead to an increased demand for new areas to be so designated, particularly productive fishing grounds in busy straits, so it is in the shipping industry’s interest to find a way to minimize operational discharges, particularly from rogue bulk carriers. In addition many ports need to either construct discharge reception facilities or expand and improve the ones they have.

The ROK is also very concerned about oil pollution along its coasts. Their Marine Pollution Prevention Act (MMPA), amended in 1991 to conform to the standards of MARPOL, focuses on pollution prevention and control from vessels, offshore structures, and ocean dumping. In 1992 the government assigned oil spills and clean-up operations to the Maritime and Port Administration. One of the ROKs most difficult problems in dealing with pollution control stemmed from the fragmentation of administrative authority into several separate agencies and poor coordination between them.[38]

In an effort to solve that problem the Korean government established, on August 8, 1996, the Ministry of Maritime Affairs and Fisheries (MOMAF), merging the Maritime and Ports Administration, the Fisheries Administration, the Maritime Police Administration, and seven other marine-related authorities. MOMAF is in the course of developing and implementing six policy goals: 1) expand global maritime economic territory and strengthen management capability; 2) apply world-class technology to ocean science and industry, and encourage responsible use of the world’s

oceans; 3) strengthen national sea power through the dramatic reduction of logistics costs; 4) diversify the fishing industry and establish economically vital fishing villages; 5) maintain safe and clean seas; and 6) promote among citizens a new and abiding awareness regarding the ocean.[39] Included in the implementation of these goals is the further development of the port of Pusan, the construction of a port "information superhighway" similar to the port of Singapore, and the formulation of a comprehensive sea-traffic safety system. MOMAF is also devising measures for dealing with oil pollution disasters, including amending the Marine Pollution Prevention Act. The MMPA amendments include the establishment of the Private Sector Oil Pollution Prevention and Responses Association whose main tasks include the prevention of oil spills, the storing and leasing out of oil spill response ships, the provision of equipment and materials, the installation and operation of oil reception facilities, research and technology development in oil-spill response and education and training of oil spill response teams. The establishment of the Association was triggered by the spill of 5,000 tons of crude oil by the Sea Prince off Korean shores in July 1995.[40]

2.11. Oil Pollution Compensation

Oil pollution compensation is covered by a number of international conventions, including the 1969/92 Convention on Civil Liability for Oil Pollution Damage,[41] the 1971/92 Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage (Fund Convention),[42] and, when it comes into force, the 1996 Convention on Liability and Compensation for Damage in Connection with the Carriage of Hazardous and Noxious Substances by Sea (HNS Convention).[43] HNS is a freestanding convention that, when in force, will provide a uniform legal regime to provide compensation to a person or a State that has suffered damages in connection with the carriage of hazardous and noxious substances at sea. The Convention imposes strict liability on the owners of vessels for any damage arising from the carriage of hazardous and noxious substances at sea, which are defined broadly to include more than 6,000 bulk and packaged substances, including oils and noxious liquid substances carried in bulk and listed in Annexes I and II of MARPOL. Radioactive materials and materials that are hazardous in bulk, such as coal and wood chips, are excluded. Damages are also defined broadly: 1) loss of life and personal injury, 2) property damage outside the ship, 3) damage to the environment, and 4) costs of preventive measures. Shipowners can avoid liability if they can prove that the harm arose from war, third parties, and/or government negligence. Governments, for example, have a duty to maintain navigational aides. (See also SOLAS, SCTW, and MARPOL.) The HNS Convention covers environmental damage caused to coastal states' territory, including the territorial sea and the EEZ. The Convention places limits on shipowner liability based on ship tonnage. Shipowners must maintain insurance or other financial guarantees sufficient to cover liabilities established under the HNS. Compensation for damage above the shipowner limit can be obtained from an HNS Fund. The Convention was adopted by acclamation by more than 70 States.

The 1989 International Convention on Salvage (Salvage Convention) governs assistance to vessels in danger and recognizes the right to reward for all salvage operations having a useful result.[44] There are also voluntary plans covering shipowners and cargo owners whereby compensation for pollution damage and clean-up costs is available following oil spills from tankers, such as the Tanker Owners Voluntary Agreement Concerning Liability for Oil Pollution (TOVALOP) and the Contract Regarding a Supplement to Tanker Liability for Oil Pollution (CRISTAL). Substantial revisions of these plans went into effect in 1987 with enhanced limits and updated terms. The ROK's Compensation Act for Damage from Oil Pollution has also been amended to increase the liability of shipowners responsible for oil spills, increase the amount of compensation payable, establish a damage area encompassing the entire 200-mile EEZ and include precautionary costs to be borne by international compensation funds.[45]

3. Traffic Control Schemes - The Options

Maritime Traffic Control (MTC) has active and passive forms. Active MTC broadly defined includes any involvement with ships' navigation by a person not on board a ship (i.e. maritime traffic controllers) and includes vessel traffic service systems. Passive systems include traffic separation systems.

3.1. Vessel Traffic Service Systems

Vessel Traffic Service (VTS) systems utilize a combination of non intrusive surveillance measures, including a tracking system using radar, satellite surveillance, GPS transponders, weather sensors, ship reporting requirements, and a monitoring person on shore. Radar images superimposed on electronic charts show a vessel's position relative to navigational boundaries and hazards. Transponders release both a range and a bearing at low cost. The Donaldson report recommended a global transponder system and the IMO is currently considering the potential benefits of a transponder requirement. INMARSAT maintains geostationary communication satellites for maritime use. Vessel reporting systems require ships to report in; navigation information is then relayed back to them and other vessels in the area. By monitoring and disseminating information on vessel movements VTS systems reduce the risk of collisions and groundings. "Typically, personnel at the centres receive regular reports from vessels on their locations and intentions (through voice communication systems which are often complemented by radar systems), synthesize and disseminate traffic information and advisories to other vessels."[46]

VTS systems are widely used in ports and approaches to ports, such as Pusan, for example. They have been compared to air traffic control (ATC) centers. Both aim at reducing congestion and preventing craft from coming too close to one another, which permits them to proceed at higher speeds. However, the ATC emphasis is more on information than traffic control.[47] ATC focuses on procedural control, including scheduling and to a lessor extent instructions to pilots, who are primarily aided by Instrument Landing Systems (ILS) that have replaced the "see and avoid" rules governing shipping. ATC directs traffic only in controlled airspace and any aircraft wanting to fly in such space must comply with the directions of the air traffic controller. ATC is also concerned with equipment requirements. While most airspace is uncontrolled, no aircraft is allowed to fly in or near clouds unless it is properly equipped for it, even in uncontrolled air space. This is in contrast to marine navigation where poorly equipped smaller coastal vessels are permitted to proceed almost anywhere in any conditions.[48]

There are commercial companies that develop, produce and install complete VTS systems to monitor ports, harbors and waterways.[49] VTS systems, using dual X-band radar, remote VHF direction finders, communication systems, and sophisticated computer software, can produce an integrated display of sensor data, and can coordinate navigational information, traffic control, hazardous material data, and enforcement functions. They are able to interact with ships and shipping agents, port authorities, piloting services, weather services, search and rescue, pollution control and response efforts, defense agencies, and so on. (Fig. 2). The advantages of VTS include 1) warning of collision risk much sooner, 2) monitoring fishing vessels, and 3) monitoring traffic separation systems (TSS). When in the autonomous mode, they can supply ships with position, course and speed information.

In Japan maritime traffic controllers are employed by the private sector. There are existing VTS systems that currently link ports, plan and track ships' routes, provide laser-guided docking approach systems and in the future will be available to provide environmental monitoring and spill detection.

3.2. Traffic Separation Systems

Traffic Separation Systems (TSS) are passive systems analogous to establishing one-way lanes in congested shipping corridors. Rule 10 of COLREGS specifies the IMO rules for vessels navigating within a TSS. They include rule 10(i), which specifies that a "vessel engaged in fishing shall not impede the passage of any vessel following a traffic lane." Large vessels actually don't need a very wide lane, a corridor two miles wide in each direction will suffice. The manager of a major oil tanker company that sends 10 to 15 100,000-metric-ton tankers through the Korea/Tsushima Strait considers the fishing trawlers that are actively pair trawling in the shipping lanes to be the major cross traffic problem and recommends a traffic separation scheme as a solution, with the northbound tankers confined to a 2-mile wide corridor east of the Tsushima Islands, and the south-bound tankers confined to a 2-mile wide corridor west of Tsushima, accompanied by a prohibition on all active fishing within the corridor. Coastal traffic could go both ways. Cross traffic should proceed at right angles, should be equipped with transponders and directed by a marine traffic controller. In addition, he recommends the installation of radar on the north and south ends of the Tsushima Islands, actively monitored by a person for enforcement purposes. However, this opinion is not shared by some Korean experts who think that "[c]urrent and projected vessel traffic through and across the Straits can be managed without any additional traffic management measures."[50] However, it is at least one expert's view that "Korea would not have any concern about the freedom of navigation even in the case that a more restrictive vessel traffic management regime would be introduced."[51]

The 1929/1974 International Convention for Promoting Safety of Life at Sea (SOLAS)[52] is the primary convention regulating vessel seaworthiness, navigation requirements, and traffic management schemes. For example, under SOLAS Protocol of 1978, Chapter I, Part B, Regulation 6 vessels over 10 years of age are subject to more frequent and thorough inspections by port states. Chapter V covers navigation. Resolution MSC.43(64), adopted on 9 December 1994 specifies the guidelines and criteria for ship reporting systems. On 16 May 1995 the IMO adopted Resolution MSC.46(65) amending SOLAS Chapter V, which addresses mandatory ships' routing and ship reporting systems. Regulation V/8 establishes general provisions governing ships' routing systems. The purpose of routing systems is to improve safety of navigation in crowded and restricted areas. The 1995 amendments recognized the need to reduce the risk of pollution by ships colliding or grounding in or near environmentally sensitive areas and added provisions permitting mandatory routing systems. The precise objectives of any routing system depend upon the particular hazardous circumstances; however, the conditions in the Korea/Tsushima Strait would permit a routing system under SOLAS. In 1989 the IMO adopted comprehensive principles and reporting procedures for ship-related incidents involving potential pollutants.[53]

3.3. Additional Options

Human error is still considered to be a major cause of shipping accidents. The Donaldson Report attributed some 60-80% of all maritime accidents at least in part to human error.[54] The 1978 IMO Convention on Standards of Training, Certificates and Watchkeeping (STCW) set standards for competency, hours of work and manning of vessels.[55] The 1995 STCW amendments, which are now in force, represent virtually a complete rewriting of the Convention. In 1991 the IMO adopted their revised Guidelines on Management for Safe Operation of Ships for Pollution Prevention. While it is acknowledged that the best way to minimize human error is through training crews, pilots, and port authorities, freight rates are generally too low in the highly competitive shipping industry to support major training programs. It has been suggested that insurance companies should plough back some of their profits into training programs since they will be the ultimate beneficiaries of those programs. In any case insurance rates could and should be used as an incentive so that the safe

operator gets a major break in premiums.

4. Feasibility of a Traffic Separation Scheme

There are several TSS systems currently in place in international straits, for example, in the Dover Strait, the Turkish Straits, and the Phillips Channel in the Singapore Strait.

4.1. The Strait of Dover

According to the tanker industry the Dover Strait TSS works extremely well and should be used as a model for other systems. In 1964 the Maritime Safety Committee of what became the IMO decided to introduce traffic separation schemes in congested straits, beginning with the Strait of Dover. When the TSS came into operation on a voluntary basis in 1967, it was the first in the world. The Dover scheme has been refined and made compulsory in the intervening years[56] and the tanker industry thinks it works.[57] Most of the following information about the TSS in the Dover Strait is from Anderson, 1992:[58] "Under the terms of the traffic scheme, the main route into the North Sea runs on the French side, and the route from the North Sea to the Atlantic runs on the English side. Between them there is a separation zone, which has a crossing "gate" opposite Dover for the ferries, and in which fishing is prohibited. Cross traffic is required to cross the lanes as nearly as possible at right angles to the flow of traffic. Extensive pilotage assistance is available on both sides and there is full radar surveillance from the Dover coastguard and the Cap Gris Nez Traffic Centre. There are inshore traffic zones on both sides of the Strait for use by smaller vessels as well as deep draft routes within the main lanes." Underkeel clearance requirements over the years has been increased from 4 to 11m. The British and French have signed an agreement establishing a territorial sea boundary down the middle of the Strait.

There is a voluntary ship reporting system for loaded oil and chemical tankers and gas carriers over 1,600 GRT. A Channel Navigation Information Service uses radar in order to monitor the TSS, warn vessels of dangers, broadcast traffic situation reports and other navigation information, and record evidence of violations. France, Belgium and the Netherlands have national reporting systems. France requires all vessels carrying hydrocarbons or other dangerous cargoes and intending to enter French territorial waters, even if they are not calling at a French port, to transmit details of the voyage and cargo. Belgium and the Netherlands have compulsory reporting systems for all vessels bound for ports in northern Belgium and the Scheldt Estuary. Since 1978 the French government has enforced a rule that larger oil tankers must navigate at least 7 nautical miles from their channel coast because of the time it takes for a salvage tug to reach a stricken vessel.

4.2. The Turkish Straits: the Bosporus and the Dardanelles

The Bosporus is one of the main sea routes for crude oil exports from Russia. It is 30 km long, between 550 and 3000 m wide, and has strong, unpredictable currents. The Bosporus links the Black Sea with the Sea of Marmara and bisects the City of Istanbul. The Dardanelles link the Sea of Marmara with the Aegean Sea. The Dardanelles are about 65 km long, 1300 m wide at the narrowest point and there are strong currents. The entire length of the Turkish Straits, including the Sea of Marmara, is 160 nautical miles. The IMO estimates 45,000 ships use both straits each year and traffic is increasing. Passenger ferries make frequent crossings and the Straits are heavily fished. There were 157 collisions in the Bosporus between 1988 and 1992. On March 13, 1994 a Cypriot registered 130,000 dwt oil tanker, the *Nassia*, and a Cypriot-registered freighter collided in the Black Sea entrance to the Bosporus Strait. The accident was caused by pilot error. The tanker, a single hulled vessel built in 1976 loaded with 98,500 metric tons of crude oil, caught fire and shut down the Bosporus for six days, but escaping oil was viewed as a minimal impact spill by Lloyd’s of London. On October 18, 1994 the tanker *Luba*, with 6,643 tons of phosphoric acid, grounded while

transiting the Straits; on November 19, 1994 a Maltese-flagged freighter, the *Martin*, collided with a car ferry off Istanbul; on March 25, 1995 a Chinese bulk carrier collided with a Turkish ship, the *Barbaros Oktay*, in the Bosporus.

The 1936 Treaty of Montreux has historically governed navigation in the Bosporus and the Dardanelles, collectively known as the Turkish Straits and by virtue of article 35(c) of UNCLOS still does.[59] The 1936 Treaty pledged complete freedom of passage and navigation by day and night, and specified that merchant ships passing right through the Straits ('transiting vessels') could not be subject to any 'formalities', except for sanitary controls for which dues could be collected and the levying of dues for such services as pilotage and towage. To facilitate the collecting of such dues the treaty permits the Turkish government to require transiting vessels to report their identity, flag, tonnage, destination and last port of call to the Turkish authorities and require all vessels to stop at designated areas near the entrances to the Straits. The 1936 Treaty places limits on the size, type, armament and numbers of such warships that have freedom of passage through the Straits (Articles 10-18). Warships of the non littoral states of the Black Sea have only limited access in respect of total tonnage in time of peace. The warships of the Black Sea littoral states have greater rights, but are limited to transiting only during daylight hours and may be subject to notification requirements and restrictions on the lengths of their stays in the Black Sea.

In March 1994 the Turkish government announced that in order to reduce the chance of vessels carrying hazardous cargoes colliding in the Straits it was proposing to the IMO Safety Committee the addition of five traffic separation schemes in the Straits and also proposed the following draft Rules, which had been incorporated into its national legislation and were scheduled to go into effect on 1 July 1994: 1) large vessels with dangerous cargoes, including oil tankers 150m or more in length, can transit the Straits only one at a time, 2) the passage of vessels with a draft of 10m or more are limited to daylight hours, 3) the entry of deep draft vessels when currents of 6 knots or more are present is prohibited, 4) when visibility is less than 1 nautical mile, large vessels and those carrying dangerous cargoes will not be allowed into the straits, 5) vessel "health" inspections will be required at entrances to the Straits, and 6) the passage of vessels more than 200m long or with a draft of more than 15m "…is neither desirable nor advisable."[60] Such vessels must traverse the Straits only in daytime with a prescribed number of tugs. A request for passage must be sent to Turkey's maritime administration before the transit is scheduled. The Straits may be closed to other maritime traffic during transit of a large vessel. The Draft Rules also included regulations governing vessel discharges, the use of pilots, speed limits, minimum distances between vessels while navigating and information that must be reported to the traffic control station, including special advance reporting requirements for vessels carrying hazardous cargo. All civilian nuclear-powered vessels, vessels carrying nuclear cargo or waste, and vessels carrying dangerous or noxious cargo and waste (including oil) must obtain pre-passage permission from Turkish authorities.

Russian found Turkey's Draft Rules inconsistent with the Treaty of Montreux and unacceptable. As a practical matter Russia expressed concern that the regulations were likely to cause increased congestion at the entrances to the Straits. Russia also suggested that it would be better if Turkey would update its navigational radar system in the Straits rather than insisting that all merchant vessels employ pilots.[61] Since the 1936 Treaty does not authorize additional traffic regulations for safety of navigation or for environmental protection purposes, it has been argued that only Articles 41 and 42 of UNCLOS and the 1972 COLREGS govern navigation in the Straits.[62] However, in the more than half century since the 1936 Treaty was negotiated technology has changed. In the age of supertankers and cargoes of highly volatile and highly toxic materials the provisions and assumptions of the 1936 Treaty of Montreux need to be rethought.

In May 1994 the IMO Maritime Safety Committee amended Turkey's proposed Draft Rules and

adopted, subject to confirmation by the IMO Assembly, a set of "Rules and Regulations on Navigation through the Strait of Istanbul, the Strait of Canakkale and the Marmara Sea". They entered into force on 24 November 1994 when they were adopted by the IMO along with the five proposed traffic separation schemes. There are two rules on ship routing and towing and four recommendations on ship reporting and navigation information, pilotage, daylight transit, and anchorage. Under Rule 1.1 vessels "shall exercise full diligence and regard for the requirements of the traffic separation schemes (TSSs)." Under Rule 1.2 a vessel "not able to comply with the requirements of the [TSS]" must give early warning to the appropriate ship reporting/VTS station. Under Rule 1.3 Turkey may then "temporarily suspend two way traffic and regulate one-way traffic to maintain a safe distance between vessels." Vessels are "strongly" recommended to participate in the Turkish ship reporting system, "strongly advised" to report information about their vessel and its cargo before transiting the Straits, "recommended" to keep VHF radio watch and make use of the ship reporting information services, and "strongly recommended" to use a pilot. Vessels that "have a maximum draught of 15 m or more and vessels over 200 m in overall length are advised to navigate the Straits in daylight."

There are no special recommendations for vessels carrying hazardous cargoes. On 21 June 1994 Turkey amended its national regulations to bring them more into conformity with the IMO Rules and Regulations; however, they are not identical, and remain a source of some irritation to Russia. Turkey’s view is that they conform to international law because the right of free passage is naturally limited by the concept of safe passage.[63] Turkey cited the 1989 Basel Hazardous Wastes Convention[64] as legal authority for the promulgation of regulations governing the movement of hazardous wastes through its territorial seas. Since the passage of its controversial regulations Turkey has closed the Bosporus to shipping traffic several times to ensure the safe passage of large tankers.[65]

4.3. The Malacca and Singapore Straits

Connecting the Indian Ocean with the South China Sea and the Pacific Ocean, the Malacca and Singapore Straits pass through the territorial waters of Thailand, Malaysia, Indonesia and Singapore. Combined, the Straits are approximately 600 miles long, with a minimum width of 3 miles near Singapore Island. Minimum fairway depth can vary: in the Phillips Channel where there is a TSS it is less than 23 m. Although the Straits comprise a major international shipping corridor, the shallow depth limits fully-loaded tankers to about 200,000-225,000 deadweight tons (62-72 foot draft) to allow a 3.5 m bottom clearance. Larger ships are prohibited from transiting the Straits and must offload part of their cargo and send it by separate ship through the shallow southern portion of the Malacca Strait and the Singapore Strait or follow an alternative route through the Sunda and Lombok Straits.

From both an economic and a military standpoint the Straits of Malacca and Singapore constitute a strategically important choke point.[66] Most of the crude oil from the Middle East must pass through these Straits to reach East Asia and the other Pacific rim nations. It is estimated that an oil tanker enters the Straits every 2-1/2 hours. Approximately eighty percent of Japan's crude oil (200 million tons) is shipped from the Middle East through the Straits. Estimates of the total number of ships transiting the Straits vary. Japan estimates that some 60,000 ships of all sizes pass through the Malacca and Singapore straits each year, of which one third are very large crude containers (VLCCs). In 1993 Malaysia placed the number at almost 100,000, more than double the number transiting during the previous decade.[67]

During the past decade, the average annual rate of increase in shipping traffic through the Straits was 7.8 per cent. Singapore is already one of the largest container ports and perhaps the largest bunkering port in the world. Between 1982 and 1993 the total number of vessels exceeding 75 GRT

arriving at the port of Singapore almost tripled, to 92,655 vessels, with a volume of 624 million GRT. The resulting congestion creates massive traffic and pollution problems, which impact upon and are aggravated by coastal state development. Further development of oil and tin in the Straits also threatens to complicate navigation.

Several incidents of grounding and near grounding of vessels have strengthened arguments for introducing some form of mandatory reporting for ships, adding more traffic separation schemes and routing systems, and increasing underkeel clearance requirements. In June 1992 the U.S. Navy destroyer *Ingersoll* collided with a Singapore merchant ship. In July 1992 two supertankers collided. In August 1992 an ocean-going Taiwan trawler hit the Singapore-based Royal Pacific cruise ship, sinking the liner and killing nine. In September 1992 the tanker *Nagasaki Spirit* with part cargo of 40,000 tons of crude oil on board collided with the container vessel *Ocean Blessing*in the Malacca Strait and caught fire. Forty three people died and approximately 13,000 tons of oil spilled into the strait, polluting about 65 miles of coastline along the Sumatran coast. In January 1993, the supertanker *Maersk Navigator* of Denmark and the tanker *Sanko Honour* of Japan collided at the mouth of the Malacca Strait, resulting in another mammoth oil spill. The most recent incident occurred on 6 September 1997. A super tanker rammed into an Indian registered cargo ship in the Strait of Malacca when thick smoke from forest fires obscured visibility. The cargo ship broke in two and sank with a loss of 29 lives. The was no oil spilled from the tanker.

A safe shipping channel in these Straits is critical to ensure a continuous, regular and reliable supply of energy to East Asian states such as Japan and Korea. From a military perspective, the Straits are indispensable links between the Indian and Pacific Oceans and key passage routes for the rapid deployment of operational vessels such as aircraft carriers. Yet navigation aids in the Straits need to be upgraded and additional obstructions need to be charted. Only Singapore runs a VTS within the Port of Singapore. The threat of yet another major oil spill in the Straits is prompting Malaysia, Indonesia and Singapore to consider increasing control over tanker movements. The Japan Shipowners Association has established a "tanker safety special committee" to develop high-definition ship-installed radars and vessels with better maneuverability, as well as to explore establishing sea lanes and regulating the passage of large tankers through the Malacca Strait. To relieve future tanker congestion the States of Malaysia and Thailand are embarking on a project to send Middle East oil by pipeline across the narrow neck of the Malay peninsula (Isthmus of Kra).

Accidents and discharges from ships in the heavily-used Straits are also creating severe pollution problems for the coastal areas bordering the Straits. Pollution from transiting ships are negatively impacting on fisheries, sensitive marine ecosystems, human health and tourism. The Strait of Malacca is the principle source of marine fish production for Malaysia, production that was spared devastation from the Nagasaki Spirit collision by a lucky change in the wind. However, North Sumatran fishermen were not so lucky and expressed their intention to seek $2.4 billion in compensation from the owners of the *Nagasaki Spirit*. Indonesia announced its intention to file a claim of up to $60 million under two shipping conventions. The spill also threatened a national park and a wildlife sanctuary in Thailand.

Prospects for a regional contingency plan, drawing also upon existing industry arrangements, have been enhanced by the development of the ASEAN Oil Spill Response Action Plan (OSRAP). In addition, Indonesia has drafted a National Marine Oil Spill Contingency Plan and the new Malaysian Contingency Plan, combining government and industry effort, covers all waters claimed by Malaysia in the Malacca Straits and South China Sea. Japan has pledged to cooperate with ASEAN to install crude oil recovery equipment and help build oil pollution defense facilities in Asia's vital waterways.

4.4. The IMO and the Enforcement Process

The main objectives of the International Maritime Organization (IMO) are the promotion of safety and the protection of the marine environment. The IMO has concluded some 30 global conventions and hundreds of resolutions that amplify and clarify the provisions of those conventions. A state becomes a member of the IMO by becoming a party to the IMO convention and is then bound by its provisions. The IMO is also a forum in which maritime nations meet to discuss maritime matters of concern. The IMO places considerable emphasis on the newly revised Guidelines on Management for the Safe Operation of Ships and for Pollution Prevention, which set forth responsibilities of companies operating ships and emphasize that companies should adopt and implement strict policies on safety and environmental protection. An increasingly important feature of IMO work is encouraging cooperation between government and industry, at regional and global levels, particularly with respect to prevention and cooperation in combating pollution. However, when it comes to taking action on specific requests by individual members the IMO has often been criticized as being glacially slow to act. As a result, States frequently implement vessel traffic control measures while their applications are still pending before the IMO Maritime Safety Committee. Once a TSS is adopted by the IMO it becomes official and it goes on every chart.

IMO member states are obligated to enforce IMO rules vis-a-vis their own flag vessels, but they frequently enforce them against other States' flag vessels under several international law provisions that permit port state control over vessels for the purpose of protecting their marine environment. In the UK, a non complying vessel may be seized and its captain's license or certificate of competency may be revoked or suspended; he may even face a tribunal.[68] UK and French naval vessels have arrested ships in the Dover Strait that do not comply with the TSS, as happened recently when a trawler headed the wrong way down the TSS. However, in 1993 only 30% of the 994 ships that violated the Dover Strait TSS rules were identified and of these one half were French-flagged fishing vessels. In addition, fines are generally low. Satellites and UK aircraft also monitor the Dover Strait for vessel discharges. Warships, however, are generally exempt from many IMO rules.

4.5. The Flag of Convenience Problem

Under international law the flag state has the responsibility of ensuring that flag vessels are seaworthy and that their operation conforms to generally accepted international regulation, procedures and practice. Duties of the flag state are spelled out in article 94 of UNCLOS. However, States willing to register ships under a flag of convenience generally are not parties to the some thirty IMO conventions that regulate the financial, safety, labor and environmental practices of the international shipping industry and may have little interest in enforcing the provisions of those conventions. Currently the open registry fleet comprises approximately 50 percent of world shipping. Flags of convenience are controversial for many reasons, most notably because of a series of oil tanker accidents involving flag of convenience vessels. A recent example is the Liberian-registered tanker *Braer* that foundered off the coast of Scotland on January 5, 1993, spilling 25 million gallons of crude oil. The infamous ships *Amoco Cadiz*and *Torrey Canyon* were also Liberian-registered tankers. Courts and critics blame these accidents on sub-standard vessels and poorly trained crews. In 1979 the flag-of-convenience ships had a casualty rate of 0.93 percent of total gross registered tons while the rest of the world showed a 0.28 casualty rate. Although statistics show that tanker accidents declined in the 1980s, there are signs that this record is reversing, primarily due to aging fleets and cost-cutting measures by owners.[69]

Because of the inadequacy of flag state enforcement, and because ship activities can significantly and negatively impact upon port and coastal states, conventional and customary international law permits concurrent jurisdiction over vessels in a number of instances. At present coastal states have the right to adopt laws and regulations regarding the activities of ships passing through their territorial seas to promote safety of navigation, regulation of maritime traffic, prevention of

pollution, conservation of resources, and infringement of custom, fiscal, immigration, and sanitary laws. Port states have jurisdiction to inspect vessels voluntarily in their ports in order to determine if they are in compliance with international standards for vessel construction, equipment, training, and certification. The 1982 Paris Memorandum of Understanding on Port State Control suggests a possible joint approach that might be modified for adoption on a wider scale or in other regions. Under this informal treaty regime, fourteen European states apply a uniform procedure for inspecting ships within their region, enforcing international shipping standards and exchanging information. In 1990 the average detention rate for substandard vessels in Paris MOU ports was 4.5%; only 10% of all detentions in MOU ports were oil tankers.[70]

4.6. The IMO and Mandatory Ship Reporting

The increasing need for navigation safety and pollution information and prevention, as well as several recent incidents of near-grounding of vessels, have also strengthened arguments for introducing some form of mandatory reporting for ships. In 1989 the IMO adopted some recommended principles and guidelines for voluntary ship reporting systems and requirements to promote uniform reporting standards.[71] Under the current international legal regime, some legal scholars consider mandatory reporting requirements legal for ships entering territorial or internal waters and as a condition for ships entering EEZs and bound for a port or internal waters of a member state, provided reporting measures are published and provided to the IMO. Mandatory reporting is not considered permissible for transiting ships exercising innocent passage and not bound for a national port unless the IMO rules or standards change or a new convention is enacted or existing conventions are amended (i.e. SOLAS, MARPOL). SOLAS Regulation V/8-1, in force 1 January 1996, allows for mandatory ships reporting systems to be adopted and implemented in accordance with IMO guidelines to protect the marine environment.

At present there does not appear to be any significant political or military opposition to adding a VTS system that includes a ship reporting requirement to the Korea/Tsushima Strait. The applicable conventions give warships an exemption from reporting requirements and other rules as well, depending on whether it is peacetime or wartime. In the event of conflict it is expected that navies will do what they will and any VTS restrictions will be irrelevant. Navies could be useful in enforcing a VTS system, however. Under article 236 of UNCLOS military and government-owned vessels in non commercial service enjoy immunity from port and coastal state jurisdiction in all circumstances, although flag states must ensure that their warships act in a manner consistent with the UNCLOS provisions on the environment.

5. Potential Conflicts in the Korea/Tsushima Strait

5.1. Fishery Relations

Japan, the ROK and China maintain important reciprocal fishery relations. Because both the ROK and China have not established a 200-mile exclusive fishery zone, Japan can fish anywhere in the Sea of Japan and the Yellow Sea outside of the 12 mile territorial seas of those states. In exchange Japan does not apply its 200-mile fishery zone law west of 135 deg E.

Fishery disputes have long been a part of Japan/ROK diplomatic negotiations and the allocation of limited fish resources have frequently strained relations.[72] The Korean government’s 1952 Presidential Proclamation of Sovereignty over the Adjacent Seas (the Peace Line or Rhee Line) was primarily intended to provide protective measures against Japanese fishing in Korean waters. The Japan/ROK Fisheries Agreement, first negotiated in the 1960s, defines fishing areas and governs fishing activities in the Strait. Each State has established a 12 nautical mile wide exclusive fishing zone around its territory in the Strait. (Fig. 3). The Korean exclusive zone is surrounded by a joint

regulatory zone, within which fishing conditions for both States are controlled as to the number and size of boats, types of gear, quantity of catch, and fishing periods. Within the joint regulatory zone trawlers of more than 50 tons were not allowed to operate east of 158 deg E and mackerel fishing from boats of less than 60 tons was restricted to a zone south of 35 deg 30' NNE and south of 33 deg 30' NNW of Cheju-Do. A joint fishery resources research zone was also defined.

In addition to the fisheries agreement, Japan and the ROK established a separate domestic, self-regulatory scheme for their fishermen operating in each other's coastal waters beyond the joint regulatory zone in 1983. The scheme covers the Japanese trawl and purse seine fisheries operating along the Korean coast and the Korean trawl, squid jigging, and pot fishing along the Japanese coast. Both Japanese and Korean fleets fish in the same offshore waters north of Kyushu in the Eastern Channel, and this has caused a number of disputes over charges of too many vessels, damaged gear, and interference. On 10 September 1986 Japan's Maritime Safety Agency arrested three Korean fishermen for alleged illegal fishing in Japan's territorial waters in the Strait. In 1987 Japan and the ROK renegotiated some of the terms of the voluntary agreement. The new terms, effective until December 1991, reduced the numbers of vessels of both fleets in certain disputed areas. In addition, the ROK agreed to observe the trawl and squid-angling fishing prohibition zones in the offshore areas of Japan.

The ratification of UNCLOS and its EEZ regime by Japan and the ROK in July 1996 created new boundary disputes over certain small islands, including a dispute between Japan and the ROK over the sovereignty of Takeshima/Tokdo Island (Liancourt Rocks on the charts) in the Sea of Japan/East Sea. Apparently both nations would like its EEZ resources, both living and non living; however, this dispute does not interfere with traffic passing through the Strait, which is many miles to the south. Since ratification the two governments have been unsuccessfully attempting to negotiate a new fishery agreement based on the provisions of UNCLOS. In January 1998, Japan notified the ROK of its intention to terminate the 30-year-old Japan-ROK Fishery Agreement, which will remain in effect one year after notification. In response the ROK reportedly notified the Japanese Ministry of Foreign Affairs that the voluntary restraints that it imposed on eight Korean fishing vessels to prevent them from fishing in restricted waters around Hokkaido have been suspended. Negotiations over a new fisheries agreement are expected to resume in April 1998.

In Japan, conflict between fisheries activities and other uses of sea areas is also a continuing problem. According to national law, local governments may establish local rules and ordinances regulating ocean and coastal use and a permit from the prefecture governor is necessary if exclusive use of a particular portion of sea area is required. Such permits apply only to sea areas that have no specific legal designation either by the Port and Harbour Law, the Fishing Port Law or the Shoreline Law.[73] In Japan, existing fishing rights, such as the Right of Set Nets, the Right of Particular Sea Areas and the Common Right of Fishing Operations are considered exclusive rights and almost all of the coastal areas of Japan are covered by such rights.[74] In some instances compensation must be paid as a condition of using certain sea areas where fisheries rights exist, even though there may be no real economic damage caused by the project.

5.2. Energy Demands of East Asia[75]

Despite recent monetary setbacks, the East Asian region is expected to continue to host some of the world's fastest growing economies. During 1965-1989 the region's energy consumption grew by more than twice the rate of global consumption. The total primary energy demand in the Asia Pacific area is expected to increase from 2.35 billion TOE to 4.09 billion TOE in 2010 compared to an increase in the world total from 8 billion TOE to 11.8 billion TOE for the same period.[76] Among the East and Southeast Asian states, Japan ranks first in refining capacity at 4.866 mb/d; China second at 2,867 mb/d, South Korea third at 1.244 mb/d; and Singapore fourth at 1.170 mb/d.[77] Much of the

gas produced in the region, particularly in Southeast Asia, has been exported as LNG to Japan, South Korea, and Taiwan. Gas accounts for 11% of Japan's primary energy consumption and the demand for gas in Japan, South Korea and China is expected to grow. It already outpaces the growth in demand for oil.

More than 98% of Japan's oil consumption relies on imports, of which the biggest supplier is the Middle East. Most of the ROK's oil also comes from the Middle East. Oil demand is expected to grow by an average of 3.8% to reach 806 million bbl by 2000. Korean gas demand is expected to reach 15mt/y in 2000 compared with 6.5 mt/y in 1995. 90% of its LNG imports come from Indonesia, 10% from Malaysia. North Korea has substantial production and reserves of coal. It imports 75% of its oil from China, 25% from the Middle East.[78]

For the foreseeable future, the Middle East will continue to be the main oil supplier for East Asia. Exploration of the continental shelf resources of the East China Sea region and the Sea of Japan/East Sea are only just beginning and the amount that can ultimately be recovered is uncertain. Projects are under consideration to bring gas from Eastern Siberia and Central Asia across China into Northeast Asia. The main pipe line would run from Turkmenistan to the east coast of China and then extend to Japan via Korea.[79] Currently Japan has 50 nuclear reactors, satisfying one third of its electricity needs. The ROK has 9 reactors meeting 40% of its needs, and is expected to have approximately 23 reactors by 2006; however, nuclear power development continues to be plagued with the problem of safe nuclear waste disposal. It is anticipated that sea lane access for energy products will continue to be a primary security concern in the foreseeable future.

5.3. Other Security Considerations

The Korea/Tsushima Strait is also the concern of policy makers because of its importance as a vital sea lane of communication (SLOC). Vessels sailing south from the east coast of the ROK, the west coast of Japan, and the Russian port of Vladivostok must first transit through the Strait. With the end of the cold war, the security climate in East Asia has much improved; however, other situations threaten to destabilize the region. The situation in North Korea remains uncertain and volatile, the People's Republic of China periodically flexes its muscles in the Taiwan Strait and the South China Sea, and there is always the potential for a wide range of low level threats, including terrorism, piracy, and the illegal trade in narcotics, endangered species, and people. In short, the maritime security environment in East Asia has become much more complicated. With these threats and with the growth of regional navies and potential disputes over offshore and scarce resources, there portends to be an increase in the number of incidents and a corresponding threat to the security of East Asian SLOCs. However, despite the perennial concern about the impact of a potential drawdown of U.S. forces in the region, Japan has the resources to protect waters within a perimeter of 1,000 miles from Honshu Island, and probably beyond.[80] In addition the ROK is developing and upgrading their naval capability.[81] Furthermore there is also a regionally based, "potentially formidable maritime strike capability provided primarily by aircraft and surface ships equipped with anti-ship missiles"[82] that could be mobilized to defend and keep open the Strait should any regional conflict threaten to close it.

The North Korean navy is divided into east and west coast fleets, with the east coast fleet headquartered at Toejo Dong and with major bases at Najin and Wonsan. The DPRK navy has many more, but smaller, older vessels than the ROK (DPRK: 500 naval vessels totaling 68,000 tons; ROK: 140 vessels totaling 99,000 tons). Most of North Korea's ships are less than 200 tons; however, they could and have been used for coastal and infiltration operations. North Korea also has a number of high speed warships, including guided missile patrol boats equipped with the anti ship missiles and torpedo boats.[83] North Korea's attack submarine inventory includes 4 Soviet Whiskey, 4 Chinese Romeo, and 16 North Korean-built Romeo submarines. The Romeos are well equipped, have

improved sonar capability, and can carry 18 torpedoes or 36 mines, which could be used to block the Strait if it was in North Korea's interest to do so.[84]North Korea, with 75% of its oil needs provided by China and a large domestic supply of coal, is not heavily dependent upon the Korea/Tsushima SLOC.

However, at present it appears that political and economic change will come gradually in North Korea. There are some cracks in the stony North Korean facade: a recent foreign delegation, including a U.S. congressman, was given access to parts of North Korea heretofore off limits to visitors and an air services MOU between governments is about to be signed that will permit aircraft to fly over North Korea to reach destinations in Russia. The reunification of North and South Korea itself, if and when it comes, could actually be a destabilizing event because the advent of a larger and more powerful united Korea is expected to cause uneasiness in both China and Japan. However, it is felt by some experts that the most fundamentally destabilizing event that could occur would be a major conflict between China and Taiwan in which the U.S. intervened.[85] Such an event would threaten the security of the Korean peninsula and Japan, and dramatically affect economic growth and development in all of East and Southeast Asia. A united Korea could play either a balancing or a buffer role in such an event.

6. Conclusion

In conclusion, there are contending interests-fishing, shipping, exploration, security, freedom of navigation-in use of the Korea/Tsushima Strait between the various countries that most use the Strait (the Koreas, Japan, Russia, China, and the United States). These interests tend to interfere with each other. In this paper, shipping interests, particularly those related to marine transport of oil, were examined in relation to the other interests. One method for reconciling some of the conflicts between shipping and other interests is with a maritime traffic control (MTC) scheme. There is currently no active MTC scheme in the Strait. MTC schemes include active Vessel Traffic Service (VTS) systems and passive Traffic Separation Systems (TSS). A VTS system does not seem appropriate for the Korea/Tsushima Strait at this time because of its cost and complexity. However, a TSS would be appropriate. There are many examples around the world of successful TSSs, the most notable of which is the Dover Straits. A TSS could possibly alleviate potential conflicts of interest in the Strait. It could increase transparency even while regional navies grow; it could dampen the possibility of low level threats such as piracy; and it could enhance confidence-building in the region.

In addition, a TSS in the Korea/Tsushima Strait may prevent a catastrophic oil spill. Economic growth in Northeast Asia is expected to continue in the foreseeable future, and tanker traffic is expected to increase along with it. The energy needs of the ROK increased 20% per year in the last two years and expanding harbor facilities are not keeping up with demand. Yasu and Ulsan harbors are apparently bulging. Russian and Chinese use of the Strait has somewhat increased, although not significantly, but this may change. Although there have not been any major oil pollution incidents as a result of the interaction between transiting tankers and the fishing fleets, it may be only a matter of time before such an event occurs. It makes sense for the governments whose interests are affected by activities in the Strait to engage in a cooperative dialogue on devising a TSS for the Strait, and to earmark funds that would otherwise be expended on cleaning up future oil spills on furthering this cooperative effort.

Endnotes

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3. *Id*.

4. *Sailing Directions*, *supra* note 1.

5. The Convention on the International Regulations for Preventing Collisions at Sea (COLREGS). Done at London 20 October 1972; entered into force 15 July 1977. 28 U.S.T. 3459, T.I.A.S. No. 8587, 1050 U.N.T.S. 16. COLREGS is a body of rules accepted by most maritime nations. They are binding rules that are supposed to be followed closely. Lights and shapes must be displayed as set out in the rules in order to convey information about the type of vessel, her direction, and the nature of her movement. The Steering and Sailing Rules specify the required manner of navigation when two vessels are approaching each other head to head, overtaking, crossing, or proceeding in a narrow channel or fairway. The Steering and Sailing Rules are applied on a case by case basis according to the circumstances of the situation. There is no general rule that vessels must navigate on any particular course. There are also rules governing the use of radar equipment, the sound and light signals required to warn of a course alteration, the sounds required in restricted visibility situations, and general standards of good seamanship.

6. Whittaker, *supra* note 2.

7. COLREGS, *supra* note 3.

8. *Sailing Directions*, *supra* note 1, Pub.157, Sectors 1 and 2; Sailing Directions: Japan, Vol. II, Pub. 159, Sixth Edition, 1995, Sectors 3, 4, 5, and 11. Prepared and published by the Defense Mapping Agency, Bethesda, MD.

9. *Sailing Directions*, *supra* note 1, Sector 1, p. 3.

10. Whittaker, *supra* note 2.

11. COLREGS, *supra* note 5.

12. Whittaker, *supra* note 2.

13. *The Honolulu Advertiser*, February 12, 1998, at A2.

14. *Id*.

15. In 1990 alone bulk carriers were being lost at sea at the rate of one per three weeks. Most of the sinkings were a result of poor maintenance and old age. In May 1995 the IMO met to discuss measures to reduce the frequency of bulk carrier sinkings.

16. Report on a Recent Case of Marine Pollution Emergency and Response Submitted by Japan, NOWPAP, First Meeting, Toyama, Japan, July 23-25,1997.

17. Whittaker, *supra* note 2. A good percentage of this total can be attributed to Teekay Shipping (Canada) Ltd. who operates a uniform fleet of 100,000 metric ton tankers than makes approximately 10 to 15 transits per month through the Strait.

18. Vadim Chelikov, An Arctic Bridge for the Russian North, *Moscow News*, February 4, 1994, n5 p8(1). Russia cannot build a merchant navy under the terms of the START treaty and therefore plans to create an underwater merchant fleet. Malakhit, a St. Petersburg marine engineering firm, has

started a project to convert old naval submarines into tankers and cargo carriers.

19. Michael A.Titz, 1989. Port State Control Versus Marine Environmental Pollution. *Marit. Pol. Mgmt.*, Vol 16:3, 189-211, 192.

20. *Id*. at 193.

21. Whittaker, *supra* note 2.

22. Dave Dooling, 1994. Navigating Close to Shore, *IEEE Spectrum*, Vol 31 n 12 at 24(8).

23. Tsuneo Akaha, 1995. Japan's Ocean Policy in the Post-Cold War Era: Balancing Developmental and Environmental Needs, Domestic and International Interests, in *The Role of the Oceans in the 21st Century*, eds. Seoung-Yong Hong, Edward L. Miles, Choon-ho Park. Proceedings of the 27th Annual conference of the Law of the Sea Institute, Seoul, Korea, 1993. Published by LSI, Honolulu. 81-115, 112.

24. Whittaker, *supra* note 2.

25. Chi Young Pak, infra note 79, pers. com, November 20, 1997.

26. *Id*.

27. *The Oil and Gas Journal*, July 7, 1997, Vol 95:27, 2(1).

28. NOWPAP Japan Report, *supra* note 16.

29. *Id*.

30. International Convention on Oil Pollution Preparedness, Response and Co-Operation. Done at London, 30 November 1990. 30 I.L.M. 733 (1991). Annex.

31. NOWPAP Japan Report, *supra* note 16.

32. International Convention for the Prevention of Pollution from Ships (MARPOL). Done at London 2 Nov 1973. IMO Doc. MP/CONF/AP.35 (1973), 12 I.L.M. 1319 (1973); Protocol of 1978 Relating to the International Convention for the Prevention of Pollution from Ships, 1973. Annexes I-V. Done at London, 17 February 1978; entered into force, 2 October 1983. 1341 U.N.T.S. 3, 17 I.L.M. 546 (1978).

33. International Convention on the Intervention in the High Seas (Intervention Convention) (1969 for oil, extended to other substances in 1973). Done at London 2 November 1973; entered into force 30 March 1983. T.I.A.S. 10561. Annex and Protocol. Done at Brussels, 29 Nov 1969; entered into force, 6 May 1975. 970 U.N.T.S. 211, 26 U.S.T 765, T.I.A.S. No. 8068, 9 I.L.M. 25 (1986).

34. IMO Resolution A.648. Adopted on 19 October 1989.

35. United Nations Convention on the Law of the Sea (UNCLOS), Annexes. Done at Montego Bay, 10 December 1982; entered into force 16 November 1994. U.N. Doc. A/CONF.62/122, 21 I.L.M. 1261 (1982).

36. *Id*. Articles 22(2) and 23; IMO Res. A578(14).

37. *IMO News* 4 (1990), 16; Y. Sasamura, 1993. Prevention and Control of Marine Pollution from

Ships, in *The Marine Environment and Sustainable Development: Law, Policy, and Science*, eds. Alastair Couper and Edgar Gold. Proceedings of the 25th Annual Conference of the Law of the Sea Institute Malmo, Sweden, 1991. Published by LSI, Honolulu, 306-324.

38. Seoung-Yong Hong, 1995. Marine Policy in the Republic of Korea, in *The Role of the Oceans in the 21st Century*, eds. Seoung-Yong Hong, Edward L. Miles, Choon-ho Park. Proceedings of the 27th Annual conference of the Law of the Sea Institute, Seoul, Korea, 1993. Published by LSI, Honolulu, 23-55.

39. Seoung-Yong Hong and Young-Tae Chang, 1997. Integrated Coastal Management and the Advent of New Ocean Governance in Korea: Strategies for Increasing the Probability of Success. *Intl. J. Marine & Coastal Law*, Vol 12:2, 141-161.

40. *Id*. at 159.

41. International Convention on Civil Liability for Oil Pollution Damage, Annex and Protocols. Done at Brussels, 29 Nov 1969; entered into force, 19 June 1975. 973 U.N.T.S. 3, 9 I.L.M. 45 (1970). Protocol of 1984 to Amend the Civil Liability Convention. Done at London, 25 May 1984. IMO Doc. LEG/CONF6/66.

42. International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage (Fund Convention), Annex and Protocols. Done at Brussels, 18 December 1971; entered into force, 16 October 1978. 1971 U.N.J.Y.B. 103. Protocol to the 1971 Fund Convention. Done at London, 19 November 1976; entered into force, 8 April 1981. 16 I.L.M. 621 (1977). Protocol to Amend the Fund Convention. Concluded at London, 25 May 1984. IMO Doc. LEG/CONF 6/67.

43. Final Act with the International Convention on Liability and Compensation for Damage in Connection with the Carriage of Hazardous and Noxious Substances by Sea. Done at London, 3 May 1996; Protocol done at London, 2 May 1996. 35 I.L.M. 1406 (1996).

44. International Convention on Salvage. Done at London 28 April 1989; entered into force 14 July 1996. Japan and the ROK are not parties.

45. Hong, *supra*, note 39 at 159.

46. Tony K. S. Quon, 1992. Risk Analysis of Vessel Traffic Systems. *Marit. Pol. Mgmt*, Vol 19:4, 319-336, 319.

47. The use of commercial airspace is governed by the International Air Services Transit Agreement of 1944 and the International Civil Aviation Convention. The Agreement and Convention provide for a mandatory international air traffic control system.

48. *See* A.G. Corbet, 1995, Navigation Management: Post-Donaldson, *Marine Policy*, Vol 19:6, 477-486, for a detailed comparison of MCT and ATC.

49. Lockheed Martin Ocean, Radar & Sensor Systems (OR&SS) recently contracted with the PRC to produce a vessel traffic control system for the Qiongzhou Channel, the strategic strait separating Hainan Island from the mainland of southern China.

50. Chi Young Pak, *supra* note 25.

51. *Id*.

52. International Convention for the Safety of Life at sea (SOLAS). Done at London 1 November 1974; entered into force 25 May 1980. 32 U.S.T. 47; T.I.A.S. 9700. Protocol of 1978. Done at London 17 February 1978; entered into force 1 May 1981. 32 U.S.T. 5577; T.I.A.S. 10009.

53. General Principles for Ship Reporting Systems and Ship Reporting Requirements, Including Guidelines for Reporting Incidents Involving Dangerous Goods, Harmful Substances and/or Marine Pollutants. IMO Resolution A.648(16) Adopted on 19 October 1989.

54. Lynda M. Warren and Mark W. Wallace, 1994. The Donaldson Inquiry and Its Relevance to Particularly Sensitive Sea Areas, *Int'l. Journ. of Marine & Coastal Law*, Vol 9:4, 523-534, 526, note 14.

55. International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW). Done at London 7 July 1978. UKTS 50 (1984), Cmnd. 9266; entered into force 28 April 1984. 1995 amendments to STCW, 1978 entered into force on 1 February 1997.

56. The 1972 COLREGS made traffic schemes compulsory and Rule 10 of these Regulations applies fully to the Strait of Dover.

57. Whittaker, *supra* note 2.

58. David Anderson, 1992. The Strait of Dover and the Southern North Sea - Some Recent Legal Developments, *Int. J. of Estuarine and Coastal Law*, Vol 7:2, 85-98, 86.

59. Convention Regarding the Regime of Straits (Treaty of Montreux). Done in Montreux, 20 July 1936; entered into force 9 November 1936. 173 L.N.T.S. 213, 31 *Am. J. Intl. L.* Supp. 1 (1937).

60. Maritime Traffic Regulations for the Turkish Straits and the Marmara Region, 11 January 1994.

61. John Barham, Turks Call for Radar Bids, *Financial Times*, November 25, 1994. The Turkish maritime agency announced that it had invited nine international companies to submit bids for the construction of a radar and communications system in the Straits.

62. G. Plant. 1996. Navigation regime in the Turkish Straits for Merchant Ships in Peacetime.*Marine Policy*, Vol 20:1, 15-27, 16. Rule 1(a) of the 1972 COLREGS provides: 'These Rules shall apply to all vessels upon the high seas and in all waters connected therewith navigable by seagoing vessels.' The 1972 COLREGS were amended in 1981, 1987, 1989, and 1993.

63. Hugh Pope, New Shipping Rules Bring Turkey into Conflict with Russia, Neighbors, *L.A. Times*, July 2, 1994, at A17. For a complete discussion of the legal controversy see Plant, *supra*note 67.

64. Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and Their Disposal, (with Annexes). Done at Basel, 22 March 1989. Entered into force, 5 May 1992. 28 I.L.M. 657 (1989).

65. Comment (S.A. Scharfenberg). 1996. Regulating Traffic Flow in the Turkish Straits: a Test for Modern International Law. *Emory Intl. L.* Rev. Vol 10:1, 333-395.

66. *See e.g.* John H. Noer, 1996. *Chokepoints: Maritime Economic Concerns in Southeast Asia*, National Defense University Press, Washington, DC.

67. Malacca Strait: Issues and Challenges, *The MIMA Bulletin* (1994), Vol 1:1, 3-4.

68. Whittaker, *supra* note 2.

69. The International Law Commission has recommended that a "genuine link" must exist between the ship and the registering state before a vessel may fly the flag of that state. Although the 1958 Geneva Convention on the High Seas (559 UNTS 285; 17 UST 138; TIAS 5969; in force 30 September 1962), requires a "genuine link" between the state and the ship (article 5), it makes no determination as to what constitutes such a link. UNCLOS did not resolve the controversy. The United Nations Conference on Trade and Development (UNCTAD) has assumed a leading role on the reflagging issue and in 1986 organized the United Nations Conference on Conditions for the Registration of Ships. The result was the adoption of the 1986 Convention on Conditions for Registration of Ships (Done at Geneva, 7 February 1986; 26 I.L.M. 1229 (1987)), wherein the participating states attempted to define "genuine link" by including the phrase "key economic links". The convention, however, avoids further specifics, lacks mandatory language, permits considerable latitude in interpretation and obscures issues of marine pollution, safety and the role of the port state. The main emphasis is on flag state rights and responsibilities, which for the most part are identical to those provided in the 1958 High Seas Convention and UNCLOS and which fail to provide for alternatives when the flag state chooses to ignore or is unable to meet its obligations.

70. Patricia W. Bierne and Alan E. Boyle, *International Law and the Environment*, Clarendon Press. Oxford, (1993), p. 271.

71. IMO Res. A.648(16).

72. Chi Young Pak, *International Straits of the World: The Korean Straits*. Martinus Nijhoff, London 1988.

73. Hiroyuki Nakahara, 1997. Recent Issues on Coastal Management in Japan, *Intl. Journ. Marine & Coastal Law*. Vol 12:12, 163-179, 174.

74. *Id*. at 176.

75. The information on energy and energy demand in East Asia included in this paper are information predating the financial crisis that hit Asia in 1997.

76. Ji Guoxing, 1996. Energy Security Cooperation in the Asia Pacific, *Korean Journal of Defense Analysis*, Vol VIII:2, 269-295, 271.

77. *Id*. at 275.

78. *Id*. at 281.

79. *Id*. at 285.

80. Dalchoong Kim, 1995. Post-cold War Strategic Environment and SLOC Security in the Western Pacific, in *The Role of the Oceans in the 21st Century*, eds. Seoung-Yong Hong, Edward L. Miles, Choon-ho Park. Proceedings of the 27th Annual conference of the Law of the Sea Institute, Seoul, Korea, 1993. Published by LSI, Honolulu. 676-683.

81. Paul H. Kreisberg, 1996, "Threat Environment for a United Korea: 2010", *Korean Journal of Defense Analysis*, Vol 8:1, 77-109, 88. The ROK plans to build additional destroyers, frigates and submarines and is interested in acquiring Aegis air defense capabilities at sea, as well as acquire small aircraft carriers in the next decade or so.

82. Dalchoong Kim, *supra* note 87, at 680.

83. Young-Tai Jeung and Sung-Hee Yoo, 1996. North Korea's Suspicious Arms Buildup and Military Threats for Regime Security, *Korea and World Affairs*, Vol 20:4, 637-653.

84. Kreisberg, *supra* note 87, at 79.

85. *Id*. at 86.
