Current problems of sea transport safety

Introduction

Taking into consideration the global character of maritime transport as well as the identified need for standardization in the processes which would lead to increased levels of safety and security, a number of International Organizations have been established aiming to create a regulatory framework for maritime transport. The most important of those is the International Maritime Organization, IMO, however it must be mentioned that there are also other associations involved in this field such as the International Labour Organization (ILO), International Organization for Standardization (ISO), Secure Trade in APEC Region (STAR), United Nations Economic Commission for Europe (UN-ECE), Container Security Initiative (CSI), Custom-Trade Partnership against Terrorism (CTPAT) and Smart and Secure Tradelanes (SST).

Maritime transport of fluids, gases, materials and other goods for trade between countries creating economic development and played important role on the process of globalization. The cost of waterborne transport is financial attractive but it has negative aspects include longer time of transportation because of limited vessels speed and time delay as a result of congestion in harbors. Because the cost of waterborne transport is the cheapest compared with air and land transport then maritime transport is the biggest actor on the trade all around the world. In the shipping, including maritime transport, there are number of players that have influence and responsibility on safety on the sea. The most important position have:

- shipbuilder, which has responsibility for construction and technical standard of vessel
- ship-owner, which decides level of technical standards of project above minimum requirements, employ crew and organize safety policy of vessel operation
- cargo-owner, which pays and presses for the transport service regarding quality, time of transport
- management company, which has responsibility for technical state of vessel and quality of crewing
- insurer, which takes the risk of crew, cargo, vessel and results of potential accidents
- classification society, which undertakes independent control on technical state of vessel on behalf of ship-owner and insurer
- local maritime administration, which controls safety standards in the harbour, port and navigation infrastructure and confirms quality of local educated crew
- flag state, which control all standards connected with maritime transport

- local ministry of sea affairs and defense, which are response for military safety (e.g. maritime piracy, fishing area, etc) and cooperation between vessels, warships and maritime authority.

Convention

There are no doubts that for achieving an acceptable safety standards of maritime transportation companies should systematically training vessels personnel, introducing new, higher technical standards of vessels and permanently checking crew routines. That policy needs funds and time so without administrative pushing none will not made it. Moreover it is strongly depend on political and economical stabilization. Each military conflict, trade collapse or economic crisis brings new higher insurance rates what changing the structure of expenditures including cutting the cost of a safety.

However it is difficult to determine an acceptable level of safety but there are no doubts that safety regimes are necessary. The milestones of conventions and maritime organization which have strong influence on safety of sea transport are presented below chronologically:

- Safety of Life at Sea (SOLAS) - 1914
- The International Maritime Organization (IMO) - 1948
- The International Association of Classification Societies (IACS) - 1966
- Tonnage Convention (TC) - 1969
- International Convention on the International Regulation for the Preventing Collisions at Sea (COLREG) - 1972
- Marine Prolusions Convention (MARPOL) - 1973
- International Convention on Standards for Training, Certification and Watchkeeping for Seafarers (STCW) - 1978
- International Convention on Maritime Search and Rescue (SAR) - 1979

The United Nations in 1948 adopted a convention establishing the International Maritime Organization (IMO) as the first ever international body devoted exclusively to maritime matters. In the 10-year period between the adoption of the convention and its entry into force in 1958, other problems related to safety but requiring slightly different emphasis had attracted international attention. One of the most important of these was the threat of marine pollution from ships, particularly pollution by oil carried in tankers. An international convention on this subject was adopted in 1954, and responsibility for administering and promoting it was assumed by IMO in January 1959. From the very beginning, the improvement of
The marine environment

All ships and vessels are exposed to the marine environment. Forces and torques acted on ships hull come from winds, seaways, currents and different types of waves. The temperature and humidity have a strong influence on seafarers behavior on sea as well. Practically winds and seaways depend on season and geographical position. Moreover winds and seaways vary randomly and using statistical method they can be divided as long-term and short-term actions. The literature on the sea environment is abundant.

The magnitude of the wind is defined by the Beaufort scale from 1806. The wind scale is grouping from 1 to 12 Bft, based on observation of the sea surface - Tab. 1. The scale starting from 1 Bft what means calm sea surface and finishing to 12 Bft what means hurricane - the sea is white with streaky foam as covered by a dense white curtain; air filled with spray; visibility very poor - de Beurs 1957 [4].

Table 1. The Beaufort scale.

<table>
<thead>
<tr>
<th>Wind force <strong>B</strong></th>
<th>Description</th>
<th>Limits of speed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>knots</td>
<td>m/s</td>
</tr>
<tr>
<td>0</td>
<td>Calm</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>Light air</td>
<td>1 - 3</td>
</tr>
<tr>
<td>2</td>
<td>Light breeze</td>
<td>4 - 6</td>
</tr>
<tr>
<td>3</td>
<td>Gentle breeze</td>
<td>7 - 10</td>
</tr>
<tr>
<td>4</td>
<td>Moderate breeze</td>
<td>11 - 16</td>
</tr>
<tr>
<td>5</td>
<td>Fresh breeze</td>
<td>17 - 21</td>
</tr>
<tr>
<td>6</td>
<td>Strong breeze</td>
<td>22 - 27</td>
</tr>
<tr>
<td>7</td>
<td>Near gale</td>
<td>28 - 33</td>
</tr>
<tr>
<td>8</td>
<td>Gale</td>
<td>34 - 40</td>
</tr>
<tr>
<td>9</td>
<td>Strong gale</td>
<td>41 - 47</td>
</tr>
<tr>
<td>10</td>
<td>Storm</td>
<td>48 - 55</td>
</tr>
<tr>
<td>11</td>
<td>Violent storm</td>
<td>56 - 63</td>
</tr>
<tr>
<td>12</td>
<td>Hurricane</td>
<td>64 and over</td>
</tr>
</tbody>
</table>

Sea surface motion often called cyclic rise and fall of the sea level is defined wave. It must keep in mind that cyclic is difficult to calculate because of sum of waves magnitude (sum of harmonics) and occurrence regular and irregular sea waves. Frequencies of waves begin from $f = 0.001 \text{ Hz (approx. L = 9 km wave)}$ to $f = 0.13 \text{ Hz (approx. L = 90 m wave)}$ [4].

Observation of waves and winds are reported from ships and fitted to the computer database in the net. Instrumental data from stations were given in different categories like annual, seasons, directions, sectors etc. For detail analysis the most extensive data collection of all types of waves was set up by The British National Physical Office and it is published for seafarers and ships designers as “Ocean Wave Statistics”.

Seagoing vehicles may be generally divided into transport and non-transport ships. Such categorization of ships is greatly...
simplified, however, it was considered by many countries. The world's marine fleet in 2007 included 34882 commercial vessels with gross tonnage of more than 1000 tons. In 2006 these ships carried 7.4 billion tons of cargo what means marine transport is the most important part of global trade. In terms of tonnage, 39% of these ships are tankers, 26% are bulk carriers, 17% container vessels and 15% were other types. These statistics do not include warships operating in the world which are more than 1300 in the 2005 (not counting small vessels such as patrol boat etc.)

**Problems of flotation and stability**

It is well known that a hull floating freely in still water experiences a downward forces acting on it due to gravity what is called weight. Since the hull is in equilibrium there must be force of the same magnitude and the same line of action as the weight but opposite it. This force is known as the buoyancy force or simply buoyancy. Theoretically everything is simple and safe so why so many vessels sink and why there are so often?

The IMO Resolution A849(20), says that the safety of seafarers and passengers and the protection of the marine environment can be enhanced by timely and accurate reports identifying the circumstances and causes of marine casualties and incidents (Fig. 1). The investigation and proper analysis of marine casualties and incidents can lead to greater awareness of casualty causation and result in remedial measures for the purpose of enhancing safety of life at sea and protection of the marine environment. It is mean that problems of flotation and stability marine vessels are still important and unsolved.

**Sea water pollutions**

Oil spilled by damaged tankers, pipelines or offshore oil rigs coats everything it touches and becomes an unwelcome but long-term part of every ecosystem it enters. When an oil slick from a large oil spill reaches the beach, the oil coats and clings to every rock and grain of sand. If the oil washes into coastal marshes, mangrove forests or other wetlands, fibrous plants and grasses absorb the oil, which can damage the plants and make the whole area unsuitable as wildlife habitat. The 2010 BP Deepwater Horizon offshore oil spill in the Gulf of Mexico, for example, occurred during prime mating and nesting season for many bird and marine species, and the long-term environmental consequences of that spill won’t be known for many years (Fig. 2). Ballast water is water carried in ships’ last tanks to improve stability, balance and trim. It is taken up or discharged when cargo is unloaded or loaded, or when a ship needs extra stability in foul weather. When ships take on ballast water, plants and animals that live in the ocean are also picked up. Discharging this ballast water releases these organisms into new areas where they can become marine pests.

Ballast water is needed to provide stability and manœuvrability during a voyage when ships are not carrying cargo, are not carrying heavy enough cargo, or require more stability due to rough seas. It is estimated that 3000-4000 million tons of untreated ballast water are discharged from ships every year in ports, as cargoes are loaded, and in coastal regions, as vessels deballast to reduce their draft and enter ports.

With the expansion of volume and density of international shipping the transfer of harmful aquatic species in ships’ ballast water tanks has become the most significant pathway of unintentional introductions of invasive alien species into marine ecosystems. As ballast water may be fresh, brackish or saline, the coastal environment, estuaries and navigable inland waters, are most at risk. The economic, social, recreational and ecological losses/costs of such invasive species are difficult to assess, as the losses of native species and environment restoration to pre-invasion quality are more difficult to determine and quantify.

A shipwreck is the remains of a ship that has wrecked, which are found either beached on land or sunken to the bottom of a body of water. Shipwrecking may be purposeful or accidental. Shipwreck law determines important legal questions regarding wrecks, perhaps the most important question being the question of ownership. Legally wrecks are divided into recreccum maris (material washed ashore after a shipwreck) and adventurum maris (material still at sea) although some legal systems treat the two categories differently, others treat them the same.

Under international maritime law, for shipwrecks of a certain age, the original owner may have lost all claim to the cargo. Anyone who finds the wreck can then file a salvage claim on it and place a lien on the vessel. The Second Geneva Convention, for the Amelioration of the Condition of Wounded, Sick and Shipwrecked Members of Armed
Forces at Sea, is one of the four treaties of the Geneva Convention. The Geneva Convention for the Amelioration of the Condition of Wounded, Sick and Shipwrecked Members of Armed Forces at Sea was first adopted in 1906, but was significantly updated and replaced by the Second Geneva Convention of 1949. The treaty is a lengthy document consisting of 63 articles.

Piracy is a basic and fundamental concern for all navies. This illegal maritime activity has a strong influence on the safety and economy of maritime transport. The maritime piracy increases maritime transport costs for number of reasons. First, the ships-owners avoid dangerous waters, second the insurance companies added water basins like Straits of Malacca, South China Sea, Coast of Somalia or Gulf of Aden to list of warzones or dangerous areas what increases costs of insurances and finally marine companies were pressed to employ very expensive security service onboard.

Pirate attacks on shipping have increased dramatically in recent years. International Maritime Bureau (IMB), Piracy Reporting Centre (PRC) reports the 2008 was a shocking year statistically. There were totally 293 hijacked of vessels and hostages what means more than any other year since the PRC began reporting on worldwide piracy statistics in 1992. The five most attacked types of vessels are container vessels, tanker chemical product, bulk carriers, general cargo vessels and tanker crude oil. What is evidently illustrated, is that chemical and product tankers show a dramatic increase in all the years and take the second place in the list in 2008. Especially German vessels are major targets, as pirates believe their owners are more willing and able to pay ransoms for the return of the crew and vessel [7].

According to the financial estimation, total costs of direct effects is about US $ 250 million. Together with additional security, insurance costs, the chance of changing trade routes and reputation damage, piracy costs the shipping industry US $ 9 billion. It is however a significant problem in respect to human safety on vessels in piracy-prone areas.

Modern maritime piracy is a serious issue nowadays. Piracy has become increasingly more violent. Besides armed robbery, hijacking the whole ship and cargo is a routine job for today’s pirates (Fig. 3). The perception that the international community has eliminated sea piracy was far from true a few years ago. Today’s pirates are trained fighters and drugged teenagers aboard speedboats, equipped with satellite phones and global positioning systems, armed with automatic weapons and rocket-propelled grenades. Modern piracy is a violent, bloody and ruthless practice [7]. Last four years the activities of the international community, international naval forces significantly reduced the success of pirates in the Gulf of Aden and the coast waters of Somalia. Such a policy is a hope and a good forecast for the marine transportation future.

Conclusions

The sea has always been a potentially hazardous and dangerous working environment. Yet, ship operators today have new factors and new pressures to contend with. The structure of the global marketplace requires that goods and materials be delivered not only to the geographical location where they are required but also within a very precise timeframe. Shipping in the 21st century is the safest and most environmentally benign form of commercial transport. Commitment to safety has long pervaded virtually all deep sea shipping operations and shipping was amongst the very first industries to adopt widely implemented international safety standards. [8].

Abstract

Maritime transport, often calling shipping trade, is one of the most international of all the world’s great industries - and one of the most dangerous. It has always been recognized that the best way of improving safety at sea is by developing international regulations that are followed by all shipping nations. Safety of sea transport can be divided on following three branches international law regulations (convention), seafarers education and training and technical development, including the fight against piracy. The paper is focused in general on main aspects of mentioned problems.

References