Some suggestions for maritime safety improvements

discussed from aviation safety references

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This is an attempt to make a comparison between safety rules, applied to Commercial Aviation, and safety rules practiced in the Marine Transport sector.

We have listed the major areas of comparison as follows:

A. Vehicle construction and function
B. Competence and certification
C. Navigational aids and precision
D. Operation and human practice
E. Involvement of Authorities and other parties

It is our intention to come up with suggestions and recommendations which, if found relevant, could be further studied and implemented as follows:

1) Introduction of the recommendation as an IMO rule or recommendation, 2) Implementation of the recommendation as a EC or a Nordic rule or recommendation, 3) Implementation of the recommendation as part of Management Classification done by a classification society, 4) Implementation of the recommendation as a Special Insurance Condition or Warrant, 5) Implementation of the recommendation as an underwriting parameter qualifying for price/deductible reduction or as a penalty if lacking

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One of the objectives of our study has been to look at past years' claims experience for larger ships, i e over 500 dwt. The basis of the statistic has been the IUMI hull statistics and the P&I statistics from the UK Club from recent years. They are both far from complete but have provisionally served as a source of information. We have observed, as others before us, that a majority, or 80%, of the marine accidents have been attributed to the human factor. However, it cannot be ruled out that also large proportions of physical losses also are attributable to a secondary human factor element aggravating technically initiated losses.

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An observation which we have made so far is that a majority of the rules, agreed upon internationally in form of IMO rules, regulations and recommendations, are applicable to the hardware, i e control and specification of ships and equipment, rather than the software; i e handling of ship, training and personal performance.

When making parallels between Aviation Safety work and Marine Safety work, it is remarkable to notice the personal freedom allowed to a ship's captain to interprete existing Marine Safety rules in comparison to the strict rules imposed upon an airline captain. It also seems as if authority involvement in the performance control is less significant in the marine than in the aviation field.

From a political point of view it seems as if the marine transport activity is leading a much more anonymous life than the aviation transportation does, perhaps because of the fact that aviation is engaged in transporting people while the marine activities are focused on the transport of goods. The IATA countries have decided to build up mandatory control centres for the air traffic, covering the whole world with duties to control, inform and save. With a few local exceptions no similar third party navigational control system exists for the marine world.

Statistics show that, with small variations, there are less people killed annually in aviation accidents than in marine accidents. A big difference between the aviation and the marine world is that the ownership of commercial airlines is known by the authorities of the registrating country. These national authorities also approve the company's organisation and its manager for technical operation. In addition it is very difficult for an airline company to change country of registration and maintain the rights to operate in a specific country. In many countries the ownership of airlines also lies in governmental hands. This is subject to rapid change in a wave of fast privatization. It is not expected that this will result in decreasing safety in the air.

The parties interested in increased marine safety are shipowners and state maritime safety authorities, ship employees, classification organisations, cargo owners, insurers, banks and financiers. The general public has to rely on a fruitful cooperation between these parties when personal transportation and the environment is concerned. We feel that the cooperation can be improved.

The party which to a great extent is paying for the claims, the insurance industry, can be split into three groups:

- the Hull insurers, about 350 direct insurers of size, worldwide
- the Cargo insurers, still more, about 1500
- the Marine Liability insurers, the P & I Clubs, only 16, covering a majority of the worldwide marine liability.

Many countries accept, in whole or in part, the classification certificates issued by the classification societies as a proof of seaworthiness in accordance with the manufacturing standards for the ship in question. Some authorities are exercising the privilege to make their own inspections. For foreign ships entering their harbours, Memorandum of Understanding on Port State Control (the MOU) is agreed upon for 15 countries in Europe and with cooperation agreements with USA, Canada and the former USSR. The MOU has as an objective to make safety and health inspections on 25% of all ships entering the harbours of the member states.

In our first evaluation of Marine Safety standards in relation to Aviation Safety standards we have come to the conclusion that, although marine and aviation are similar transport means in theory, not very much is similar in reality.

We will try to describe activities which have struck our mind as being especially

valuable and interesting to develop further and where we think that the effect of a change would improve the marine safety substantially.

We have concentrated on minimizing losses which have to do with fire onboard a ship. Statistics show that these losses are varying between severe to total. The next area of activity is to reduce groundings and improve hinder avoidance. It is suspected that difficulties in manœ uvring the ship and/or navigation errors have led to a large number of strandings and groundings. Collision losses are quite numerous and are in many cases attributable to faulty equipment, weather, darkness, poor visibility, bad planning or poor leadership. Weather accidents take a large toll of the total and major losses. In these cases we feel that the technical knowledge of a ship's limitations has to be improved. We think that obligatory periodical training for officers, obligatory training for officers on new ships, improved crew training, new practice, new calculation methods, improved instrumentation and a change of the crew's general attitude towards safety can improve the situation.

The results of our suggestions can be condensed into the following areas:

• Authorities, Owners and Insurers should demand increased involvement in the software, i e rules for human behaviour onboard and onshore.

• Nations should build up controlled marine transport areas worldwide to supervise and control the ships, with new technique, from harbour to harbour.

• Obligatory officers and crew training periodically.

• Improved loss reports, statistics and analysis.

• Cooperation between Hull, Cargo and P&I insurers in practical safety matters, new insurance conditions.

Below follows altogether 38 recommendations of improvements, with references from the commercial aviation world.

If fully implemented our recommendations will have to be seen over a sequence of many years before fully operational. They will limit current freedom of operation of ships and will to some extent lead to capital investment. The major factor to succeed and to achieve the goal of improved safety at sea is to change the human attitude about safety.

We would like you to make your own reflections upon what could be done with a relatively small effort from authorities, shipowners, officers and crew, classification associations, cargo owners, charterers and insurers. It has been done before — in the aviation industry.

Some of the most important recommendations for improvements are listed below. The recommendations are not grouped in relation to their importance to each other.

A. Vehicle construction and function

Manœuverability data normal operations

To document for every vessel: Manœ uvrability data for all speeds, normal and abnormal loading, wind, waves and current.

Manœuverability data emergency situations

To document for every vessel: Manœ uvering ability with one engine or one steering machinery inoperative for all speeds, normal and abnormal loading, wind, waves and current.

Automatic fire extinguishing equipment

Such equipment should be required in machinery room and in room with flammable liquids on all ships, 10 years or younger.

This rule will lead to automatic water sprinkler or foam release solutions coupled to automatic depressure and flow stoppage of flammable liquids. Automatic blinge pumps must operate. The main argument for automatic release is that during nights most engine rooms are unmanned for 8—12 hours. Existing manual CO_2 equipment is limited in capacity and can only be used where intoxication of personnel is not at risk. Effective firefighting has therefore been unnecessarily delayed in the past.

Automatic shut down of fuel and lubrication flow

In order not to feed the fire, it is necessary to have stoppage of machinery in fire extinguishing situations. Burst high pressure tubes counts for many severe to total engine room fires. Possible engine damages will have to be accepted.

Double CO_2 systems

Existing CO_2 systems for special object protection should be equipped with double or more extinguishing shot possibilities in order to comply with onshore industry standards.

Introduction of the Black Box

A Black Box should be installed on all ships in excess of 500 dwt. The Black Box should register speed, heading, power, rate of turn, degree of bank, time, position and track. This data will be of outmost importance in all accident analyses. All ships 10 years and younger, all tankers and passenger ships.

Requirement of a voice recorder

A voice recorder on the bridge should record all tele-communication and verbal orders at any time, 24 hour recording, 6 month storage.

Internal communication to all crew members

Requirements of an internal communication system with communication possibilities with all crew members.

Such a system would enable communication in normal operation and in emergency situations and could be combined with hearing protection for engineering room personnel. Communication to selected group of crew and between crew members should be possible.

Emergency transmitter with GPS transponder mode

A GPS Transponder System[2] gives the exact position of ship, raft or life boat in distress. Such a system would enable exact navigation for the search and rescue operation with an accuracy of 30—50 m.

B. Competence and certification

Psychological test for sea officer candidates

Candidats for machine and deck officers' work should pass a physical and psychological test with personality profile, motivation and physical ability as vital criteria in the selection of marine personnel.

Certificates with limited time validity

Certificates for deck and machine officers should have limited validity in time, max 6 months. If active duty and Periodical Training has been performed, certificates will automatically be prolonged for another 6 months. If no active service has been performed for 6 months an extended Periodical Training cession should be required.

2) GPS "Global Positioning System"

Introduction of Periodical Training for deck and machine officers

Such training should be performed onboard a ship or in simulators every 6 months and cover leadership, crew coordination, ship performance, loading configurations, navigation, laws and conventions, emergency simulations, documentation and analysis. Today no requirement for post education exists for maritime officers.

Training on new type of ship

Type training should be obligatory for all officers before being operational in their duties onboard. In the ongoing technological change of equipment, normal and emergency operations, maintenance, surveillance and testing of old or new ships, training and upgrading both in respect of the vessel as such and the handling of a ship should be required, agreed and controlled by the seaworthy authorities.

Improved medical, alcohol and drug tests

Medical control should be performed every 6 months from 50 years of age and every 12 months for others. The medical test should include alcohol and drug test and be made by specially instructed medical expertise. It is suspected that drugs and alcohol play important roles as primary and secondary cause of accidents.

Documentation of all crew members' qualification when employed onboard

Such control should encompass detailed, written instructions of duties on the job as crew member in normal and emergency situations. Ability to read and speak the official language onboard has to be documented.

C. Navigational aids and precision

Controlled routes worldwide

It is recommended that a passive control system with GPS, DGPS and GPS Transponder is introduced as obligatory on all ships over 500 dwt and on all passenger ships. The ship's route, speed and position can thereby be surveyed and controlled by others, i e control centres aided by computer assistance. Maximum navigational error could be 100 metres in open sea and 1 meter in coastal waters with the new technique. The systems should be doubled for emergency reasons.

GPS = Global Positioning System
DGPS = Differential Global Positioning System
GPS = Global Positioning System with transponder

Collision avoidance with GPS control

With the creation of obligatory GPS positioning on all ships the radar observation will be complemented with a GPS position which via a computer surveillance system can alert a warning when other ships, hinder or obstacles are in close danger.

Introduction of Minimum Equipment List

This refers to the minimum instrumentation and machinery which has to be in function for a safe journey. Speed, sight, route can be subject to Minimum Equipment List. Clear limits for operational possibility or not are defined in the Operational Handbook. Emergency systems can modify the requirements.

Route documentation should be done constantly

Route planning with detailed planned track, speed and accuracy in time has to be documented. Navigational precision 100 m at sea and 1m in coastal waters. Documentation should be saved for one year.

Weather documentation

Actual weather and forecast should by routine be documented every hour. Wave height, length and direction shall be monitored. Risk for maximum weather for the vessel shall be evaluated, headings and speed selected accordingly. Documentation should be saved for one year.

D. Operation and human practice

Education and training plan for all crew members

Along with ordinary work onboard further education and training of the ship's normal and emergency systems and operation shall be done and documented. All crew members shall have a training plan where all training cessions are documented.

Training of officers onboard, route training

Senior officers should have leadership education in order to give valuable, on the job training for young officers. Deck and machine officers should have adequate possibilities to take full responsibility for manœ uvering and orders under surveillance of the ship's captain or chief engineer. All officers should have a maritime operation management education.

Nomination of one language onboard

Nomination of one language for communication and written instructions onboard every ship. All crew members must have full command of written and spoken official language onboard ship.

Requirement of Technical Officer and Operational Officer in every shipowners fleet

The technical officer shall have full responsibility for the safe functioning of the ships, adherence with manufacturers' recommendations, classification certificates, preventive maintenance, repair and documentation.

The operational officer has full crew responsibility, surveys its competence, education, training, operational procedures, routing, navigation, safety and health. A documentation detailing all policy aspects above should be assembled in an Operational Manual for the fleet.

Introduction of Operational Manual for all ships and fleets

The Technical and Operational Officers should be responsible for the shipping company's policy, routines, rules for loading, routing, working hours, operation of ship in detail, safety appliancies, navigation precision, emergency procedures, periodical training for officers, crew training, compliance with regulations and documentation. The Operational Manual shall embrace all aspects of operation of a ship and be constantly reviewed by deck and machine officers. Relevant parts should be distributed to all crew members. Maritime Authorities should have an approved copy of each Operational Handbook.

Risk analysis

Analysis should be done periodically on all ships, their systems and crew. Risk evaluation should be done by avoidance, reduction or minimation. This can be achieved by technical or human solutions. Risk analysis should be made available in the Operational Manual.

Strict alcohol rules

Consumption of alcohol shall not be allowed for crew members on duty or members in an emergency group. Alcohol rules for the personnel in general have to be regulated so that no crew member at any time reaches a higher per mille alcohol concentration in the blood than 0,5 when the ship is at sea. Alcohol consumption in national waters should be further restricted.

Strict drug rules

Drugs should not be tolerated at all onboard ships.

Fire drills when crew is exchanged

Fire emergency drill shall be held at various potential fire/explosion locations onboard as soon as part of the machinery crew, i e primary fire fighting group, or 10 % of the remaining crew has been exchanged.

Fire drill when officers are exchanged

If deck or machinery officers are exchanged, fire emergency drill shall be carried out with both old and new officers taking part in the operation. Such operation should be evaluated by all the officers and documented.

E. Involvement of authorities and other parties

Limitation of free selection of routes

Routes should be defined along shorelines depending upon manœuvering data of ships. Ships with high level of redundancy system can be allowed closer passages to shores. Other ships have to rely upon possible tug assistance in case of manœuverability problems. Suggestion: Navigation proximity to shore only allowed if tug assistance possible 4 hours before a ship grounds if left astray for wind and current at any moment along a route, correspondingly 1 hour for ship with 2 or more propulsion machineries if one fails and manœuverability on one system is demonstrated as adequate.

Definition of alert areas

Every state can define an area outside its coast where only GPS-controlled ships with operating minimum equipment, known manœuverability or design are permitted, identifyable and controlled. Via the GPS system the control can be done anywhere in the world simultaneously. Each flag state could control each of its own ships wherever they are.

Classification of extra equipment, not part of original Class

New equipment for navigation, surveillance of loading and operation should have to be approved and agreed by the classification society before being used at sea. Today new equipment, which is not required by classification on a specific vessel, can be installed and used without annual approval, training of operator or annual tests. Examples of such equipment is autopilots, computerized loa-

ding and stability systems, digitalized sea charts, data bases for weather routing, Decca, GPS, DGPS, GPS Transponder etc.

Obligatory Incident reporting

All incidents, malfunction of equipment, near-accidents, as well as personal accidents, which occur onboard, should have to be reported and evaluated. The incident reports should be sent to the technical and operational manager who then distributes the information to the Maritime Authorities, Classification Society or manufacturer.

Accident analysis and distribution

Maritime authorities of all countries should make available and publish all accidents at sea enabling all parties concerned to make studies of past accidents, detailed per ship and per operator. Such reports can form an excellent basis for Periodical Training.

Minimum operational standards national waters

It is recommended that the Maritime Authorities prescribe the minimum manœ uverability in turn radius and speed, stoppage distance, keel and side clearances as well as navigational precision required in their inner waters to avoid collision, grounding and pollution. Also minimum weather requirement, minimum passing distances and speed in relation to other ships could be nationally defined. Here also the requirement of a double hull or equivalent, antipollution preparedness and redundancy in propulsion and stearing can be defined.

Ship Information Register

It is recommended that the Maritime Authorities or the Classification societies collect all ship data, including ownership, crew, insurer, classification, losses and repairs in a data base. This data base should be accessable to authorized interested parties.

Public safety register

Make available for the use of interested parties the survey results of the Memorandum of Understanding on Port State Control via the computer data base built up by MOU. Here technical and safety status of all inspected ships is displayed. Insurers, charterers and classification societies would all get important information for a fee.