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RISK CONTROL IN THE SHIPPING INDUSTRY; RELEVANT APPLICATIONS FOR THE PREVENTION OF ACCIDENTS

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INTRODUCTION

The shipping industry is in a way the first global industry. It is the link between nations and continents. The establishment of international co-operation and conventions has therefore a long history in the shipping industry.

The public, as well as others who use shipping services have the right to expect that the ship they board or which carries their cargo is safe and within the context of the voyage, seaworthy and otherwise fit for the purpose. Seafarers too have the right to expect that their ship is safe and they will not be exposed to danger or unacceptably high levels of risk.

There are many stakeholders in marine transportation safety. The industry is highly regulated with prescriptive requirements to ensure well-designed and constructed ships. Many operational procedures and training or certification requirements have been researched and mandated to ensure safe operations.

It has always been recognised that the best way of improving safety at sea is by developing international regulations that are followed by all shipping nations and from the mid 19th century onwards a number of such treaties were adopted.

In 1948 United Nations established the International Maritime Organisation (IMO). The first task was to adopt a new version of the International Convention for the Safety of Life at Sea (SOLAS), the most important of all treaties dealing with maritime safety. This was achieved in 1960 and IMO then turned its attention to such matters as facilitation of maritime traffic, load lines, and the carriage of dangerous goods.

But although safety was and remains IMO's most important responsibility, a new problem was emerging - pollution. Pollution prevention was part of IMO's original mandate but in the late 1960´s a number of tanker accidents resulted in further action being taken. As an example, recent changes to the convention will make it necessary for all new tankers to be fitted with double-hulls or a design that provides equivalent cargo protection in the event of a collision or grounding. These changes are also applied to existing tankers when they reach 25 years of age.

For certain maritime segments, the International Safety Management (ISM) Code has just come into force. For others it will enter into force soon and further insure quality of operations. State agencies i. e. Maritime Directorates, mariners, pilots, those involved with maritime control or advisement systems, as

well as operating companies, classification societies, and many others have interests in developing a practical system that contributes to better working environment and safer operations.

The shipping industry has shown that free market forces can provide efficient cheap transport and it does this through a complex web of contracts and agreements. However, as ships increase in size, cargoes become more complex and ferries run even faster, the risk of disruption following an incident become correspondingly greater.

THE INTERNATIONAL CODE FOR THE SAFE MANAGEMENT OF SHIPS AND POLLUTION PREVENTION

To understand the need for the ISM Code it is first necessary to consider the evolution of safety systems in the shipping industry. The process of regulating shipping activity has evolved primarily in response to marine disasters like the *Titanic*. The great market expansion in crude oil carriers led to new and greater risks for the pollution of the marine environment following accidents like the *Torrey Canyon, the Amoco Cadiz* and *the Exxon Valdez* founderings that gave rise to a range of pollution control measuring. More recently the ro-ro ferry disasters of the *Herald of Free Enterprise*, the *Scandinavian Star* and the *Estonia* have led to new design rules and management practices. These lessons from the past have been the only source of reference that has enabled the industry to move forward with the desire not to make the same mistakes again. It is a fact that all major disasters capture the headlines and influence public opinion. Groundings, strandings, collisions, fires and explosions have become a driving force for new legislation and the focus of safety training standards.

Having prescribed requirements to ensure that ships are loaded properly, built and equipped to meet seagoing conditions and are designed and operated in such way that environment will be protected it becomes necessary to focus on the role of people and the human element so that at all times they can safely monitor and develop the management skills to improve ship operations.

Adequate safety standards and environmental protection exists in many companies but this, by itself, is not enough. Good safety management requires a commitment through all levels of a company's hierarchy and effective communication channels between the management ashore and those on board ship are a prerequisite of safe operations.

The ISM Code aims at contributing to safer shipping and cleaner oceans by laying down requirements for a clear link between shore and sea staff of a company and for a designated person to strengthen that link. A key aspect of the ISM Code is that companies must have a verifiable safety management in place. For the system to be effectively implemented there must be a commitment from the top, responsibilities assigned and measures in place to remedy deficiencies.

The Code requires that any non-conformity is reported with its possible cause, if known. The Safety Management System shall include procedures ensuring those accidents, incidents and hazardous situations are reported to the company. The company shall have a system for recording, investigating, evaluating, reviewing and analysing reports and for taking action as appropriate.

It may be, as is sometimes said, that the ISM Code is simply a restatement of good practices that have existed over the years, but for some it harbours many new elements that must be learned. Every company in the industry will be affected by this important regulation on ship safety. The question is how to provide the insight, concepts and techniques that put an effective ISM system into place.

SAFETY MANAGEMENT SYSTEM AND QUALITY ASSURANCE

It would of course be wrong to assume that the shipping industry did not have good safety control systems in place before the ISM Code became a statuary requirement. Many shipping companies successfully operate safely and have an impeccable safety record. A number of companies have already embraced the concepts of quality assurance and the ship management companies have introduced their own code of practice based upon similar principles.

Manufacturers need their goods just in time and distributors require their outlets to be topped up on demand without the need to maintain costly stocks. The shipping industry has no option but to offer a quality service at minimum prize and to that it has to be able to manage quality effectively. A shipping company can become more competitive only if it is able to offer safe and reliable service.

There is however need for improvement both at sea and ashore, in order to meet the new code. The nature of the ISM Code will ensure that no shipping company will be able to escape the process. ISM will accentuate the positive aspects of the Safety Management System and everyone in the company can benefit from the enhancement of safe practices in ship operations. Reduced damage, improved safety consciousness, greater professionalism and improved morale are likely to bring genuine cost savings and better efficiency.

The concept of marine safety management is based on a structural and controlled approach similar to ISO 9000 standards relating to quality control systems. The reason for using the concept of quality assurance is based on the self-evident reflection that it is not possible to have a quality company, which is not safe. Good safety management is the starting point for all commercial operations involving third parties. Essentially the only major differences are that the ISO standard 9002 covers the contractual concept of the relationships between a client and a supplier and controls the quality of the expected service; while the ISM Code covers the organisation and provisions taken by the company to control safety and to prevent pollution risks.

TO REPORT ACCIDENTS, INCIDENTS AND NON-CONFORMITIES - A KEY TO RISK ASSESSMENT AND PREVENTION

The seafarer learns his profession from training and experience. Few occupations provide an unforgiving working environment as the sea and hardly a day will pass without even the most weather beaten mariner learning something beneficial. A far more easier, and safer, way to accumulate knowledge is to learn from mistakes and experience of others. We do this in a variety of ways and there are many characters forming anecdotes that are passed on in the mess on board or elsewhere in the industry.

Systematic accident prevention is a process of defining, deciding and doing. The information needed is selective and qualitative with added quantitative variables such as consequence costs and measures of severity. Actual accident prevention has to be exercised hands on, at location or in designing or constructing the physical or socio-technical conditions. It comes into existence when the preventor is supplied with the relevant information, motivation and resources.

The defining of conditions and events that is critical for the safety on board requires a reporting system that can identify accident precursors. Unsafe practices, near misses and many other problem items must be identified by the people involved with the work on board as well as with the transportation system as a whole. Regardless of the initial focus, the intent is to collaboratively develop a system that can gather, maintain, analyse, edit and distribute information on safety problems or situations. The gathering and distribution of information will permit the maritime community to take action on potential system vulnerabilities and weaknesses before a system failure and/or marine casualty occurs. Success will depend on the extent of industry's involvement in this progress, the mechanism for gathering data and developing means for effectively analysing, using and disseminating the information gleaned.

Assessing risks is a qualitative undertaking. It takes the expert opinions of those familiar with the physical and social processes exposing people to hazards. It is done with the help of experience and knowledge rather than with assumed probabilities. It is thus something which, expressed in today's computer language, lends itself to the structure of an expert system.

An expert system typically contains systematic knowledge - as provided by experts or by structured, historic performance - about a problem area that is complex, ambiguous and qualitative. The result of collected and structured expert knowledge in computerised form, for non-experts to use, has sometimes been called artificial intelligence. In fact the intelligence is quite genuine, since it is drawn from experience and conclusions of human experts. What makes it artificial is the memory of the computer and the ability of the programmers to help the user access the information in such a way that he expands his expertise through the help of others.

There are several good reasons to create an expert system for prevention on reported incident data. The accident problems are qualitative in nature, solutions require information processed with this in mind; simplistic statistics will not be of any use. The difficulties of local accident prevention can be overcome with the linking of the local field to the national or industrial overview; if tools for local assessment are structured in the same way as collected data on national or industry level, comparisons will be possible. If tools for local risk assement are implemented they could also be used for local storing of information about injuries/claims. This would improve the quality of reporting, the supervisory knowledge - if combined with the computing of quality, injury and damage-associated, uninsured costs - the incentives for prevention.

A bank of knowledge about accidents and incidents will turn into an expert system if and when the coding of the variables is done in such a way that their qualitative level is kept intact. It must be possible to ask questions about accidents, incidents and hazardous events (risks) and its observed or possible consequences and the user must be able to compare his findings with those of the system. The accident databank should yield answers that are conclusive and possible to interpret, apply and act upon by the user.

Today, it seems that all members of the maritime community are quite excited about the safety and preventive possibilities that international and/or national maritime safety reporting systems could bring to the individual mariner and/or shore worker and the industry as a whole. Many companies will soon be or have already implemented incident reporting procedures under the ISM Code. An effective national system could possible enhance compliance with the code, autonomous reporting and encouragement of confidential information sharing.

THE NATIONAL SWEDISH MARITIME SAFETY INCIDENT REPORTING SYSTEM

After the disaster in the Baltic Sea of the passenger ship *Estonia* a Swedish parliamentary committee was set up in 1994. In the year 1996 the committee put forward an "Action programme for greater maritime safety". The programme pointed out a variety of actions to be taken by the government and the shipping industry. The suggested actions and measures covered different areas like, port state control, allocation of roles and co-operation with the classification societies, implementation of the ISM-code, stability and design, fire safety, life-saving equipment and investigatory work and accident/incident reporting.

Concerning accident/incident reporting the committee is quoted as follows;

"We welcome the discussion which has been started between the National Maritime Administration and the shipping sector with a view to jointly improve the analytical process. We propose that, during an introductory phase at least, the National Maritime Administration agree to the shipping companies setting up incident reporting system in which the informant can remain anonymous. The results should be evaluated, so as to establish whether anonymity safeguards are conductive to the desirable improvement in the supportive documentation for investigation and analysis."

Accordingly the committee recognizes the need for confidentiality and release from liability prosecution for the reporting individuals and organisations. Without it, informants will be highly reluctant to provide incident reports because of fear of retribution as result of identifying information being released to investigators or by the court system through its discovery process.

The Swedish Shipowner's Association has together with the National Maritime Administration designed a system that shall be introduced at the beginning of year 1999. The project shall in three years time be tested, developed and implemented.

The goals are to reduce the frequency of marine casualties, the extent of injuries and property damage including environmental damage and to create a safer and more efficient shipping transportation system and mariner work environment.

The system would receive, analyse and disseminate information about unsafe occurrences. These non-accidents or problem events are an untapped source of data that can provide the information necessary to prevent accidents before they happen rather than wait for them to occur and then addressing prevention.

The system is to be broad enough to capture precursor safety aspects over the full spectrum of accidents, incidents and hazards. Any member of the crew that come across a safety issue that he/she feels

important to advise the rest of the maritime community, completes a report form, preferably together with the ships safety committee and the company.

The reports are forwarded to ICC, IPSO Classification & Control AB, a private consulting company in the field of safety, reliability and quality. ICC is contracted by the owners of the system, the Swedish Shipowners Association and the National Maritime Administration and enters the information into a database, analyses and distributes the information in a useful form back to the users of the information. The information will in the registration process be de-identified to ensure a confidential status to everybody that contributes to this voluntary system.

System Design

The ideal purpose of an information system on incidents is to stimulate or make prevention more effective. The actual measures of prevention are not always in par with the efforts in collecting information and designing computerized systems of information and banks of accident data. Some times it can be explained as shortcomings of the system - such as lack of validity or reliability of important data. Sometimes there are parallel motives for operating the information system - political, organizational or purely statistical - and this could explain why the result s are trivial or not applied.

The ideal use of an information system on accidents, incidents and hazardous situations is to select a certain problem, measure its severity, analyse the practical implications of the risk information available, direct technical development, organizational change or other preventive counter-measures and thus reduce or eliminate exposures to risks.

In the overall design and planning for the system many considerations have to be made during the test period. The system is to be developed and reviewed over the years and the system shall in the end be evaluated.

A strategic concept and a data-base prototype are the starting point for the project. However, the following questions, addressing essential system elements are still at this early stage of the project under consideration:

What is reported?

The ISM-code asks for accidents, incidents and non-conformities. That includes near-accidents and precursor events, causality data and hazardous situations.

To record an accident process implies a number of methodological problems. The collection of information is influenced by human reactions to and interpretations of other people's motives and unforeseen effects of interaction between men and machines. A victim reporting on his own accident will have problems in discriminating between accident and injury, between intent and actual behaviour, between causes, reasons and effects. The same is true for the witness.

The measurement and control system needed for accident prevention has to contain valid, reliable and useful information of the accident sequence. One basic problem is that these variables must be based on human memory, influenced by a number of psychological parameters.

The report should be focused on safety problems, unsafe occurrencs and critical events. Accidents, incidents and deviations (non-conformities) that are identified in the daily work or as a special activity in the safety work on board should be reported as an event, a riskscenario that can lead to a hazardous situation or has, in fact, happend (accident) and can be related to a certain consequence.

Who is reporting?

The reporter, the informant, could be anyone that experience a safety issue that he/she wants to share with the rest of the maritime community. In Swedish ships, the safety committee usally deal with the safety matters on board and the main contributions are expected to come out as a result of that committee´s ordinary work. In the company it is the responsibility of, according to the ISM-code, the designated person to verify and monitor the incident reporting activity. This designated person is the link

between those on board and the incident reporting system. For sucessful implementation and development of incentives for reporting, unions and shipowners jointly are marketing the system.

How is the form designed and forwarded?

The form must be easy to complete and also be highly flexible so as to be compatible with other reports and formats used in the company. The report should contain a free text description of the riskscenario or the accident or incident sequence, the causes, the consequences and preventive measures. It must be available in both printed and electronic form. Ample use of Internet technologies are to be employed.

Who registers and stores the information and how is it done?

The system is to be run by IPSO Classification & Control (ICC) who validate reports, de-identify the information received, manage the data-base and analyse the information. It is important that data entered into the system must be validated if useful results are to be obtained through analysis. There are many considerations for those who will be running the system. The competence of the experts must be high to ensure the quality of the data. There must be the technical capability to identify immediate problems and there must be the ability to inform and distribute reports to those who need to know.

How is the database designed?

The database must support trend analysis and lessons learned and should have the capability to do keyword searches on narrative reports. The present prototype is based upon the Microsoft Access relational database software. This prototype is to be tested and evaluated within the project. The first goal is to collect 3 000 accidents, incidents and risk scenarios.

An accident is defined as an event that has happened and has a certain observed unwanted consequence. An incident is an event that has happened and has the potential to cause an unwanted consequence and a risk is an event that can happen and can be related to a probable consequence.

A scenario, the sequence of the accident, incident or risk, is descreibed and registred in full free text. The scenario is then structured wih the help of answering to the following questions:

What was the activity of the ship? What is the activity of the ship? (risk)

- What was/is the activity of the crew involved in the event?
- Where? Location on board.
- What went wrong? (accident, incident) What goes wrong? (risk)
- How is the damage/injury inflicted

What were/are the causes?

- What were the consequences? (accident) What are the probable consequences? (risk)
- What are the suggested preventive measures?

The system supplies different lists of keywords in order to facilitates selections and make all possible kinds of cross references.

What does the output data looked like? How shall the results be presented? How shall the results be used?

Results from the system need to be reported in various fashions. Publications should include immediate safety alerts and lesson learned focused periodic reports. Each audience and distribution mechanism needs to be carefully analysed.

Most important is probably to provide a direct access to the database and the de-identified information for validation of local riskassessment.

The data from an incident reporting system must if it effectively should be used for prevention, be put in a separate data file together with internally and externally produced estimates of costs and exposures. One possible external source of complementary information is the insurance. The system should be provided with a userfriendly menu and accessible by internal/external users through terminals or modems. The user of the system should also be provided with a simple PC-program, built as a relational data-base, structured in the same way as the central incident information system.

In any medium size company there is a need for a safety monitoring system. There is an obvoius benefit to local safety work in keeping reported accidents, incidents and non-conformities on file at the company. The comparision of locally perceived risks and exposures together with the average severity of the outcome of very same risks as accidents that have taken place and are in record with the insurer, can be very useful to the determination of the relative importance of the risk, its possible consequences and to motivate intervention. Information on hazards and harmful exposures associated with particular work stations, and assements on risks in different parts of the operation of the ship, could in this way be computed and reviewed. Typically, information on lost time and uninsured costs associated wth injuries and damages are parts of such a system.

The unfolding of risk scenarios - critical incidents - will furthermore correct and adjust the supervisor´s view of the safety on board from "how it is supposed to be", towards "how it is actually done". The collection of percieved risks has the further merit that it locally yields practical and applied suggestions for solutions to risk problems.

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