

DESIGNING USABLE SHIPS

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SUMMARY

This paper provides an overview of IMO activities relating to the role of the human element in the design, safety and operation of ships with the emphasis on what the naval architect could and should be doing.

1. INTRODUCTION

Let us begin by addressing the question “what is a usable ship?”

First we should try to identify the users. A non-exhaustive list is given below:

- Owners/operators
- Shippers/cargo owners
- Passengers
- Masters and crew
- Society

Another question then arises “do the users have a common understanding of what is a usable ship?”

- Owners/operators want a ship that is easy to maintain and operate, inexpensive, safe, etc.
- Shippers/cargo owners does not want any harm to caused to the cargo and they also want the cargo to reach its destination, i.e. the ship should be safe.
- Passengers are looking for a comfortable, exciting and safe ship.
- Masters and crew wishes a ship that is easy to operate, comfortable and also safe in the broadest sense of the word and certainly with respect to the working environment.
- Society wants environmentally friendly as well as safe ships.

It seems from the foregoing that the only real common concept is “safe”. However, safe might not be given the same meaning by all the users. Society would probably tend to view safe as “no disasters” while the crew would look at a safe ship as one that not only keeps floating but also is not inviting small personal accidents such as slips and falls.

So – it seems to me – the question to be addressed by naval architects and others would be: “how do you build a ship that is, at the same time, cheap, safe, comfortable, easy to maintain, easy to operate and environmentally friendly?”

IMO issues rules and regulations, which must be complied with, relating to certain structural issues, equipment to be carried on board as well as operational

issues. IMO also develops a number of guidance documents to supplement the mandatory instruments.

The International Labour Organization (ILO) also issues relevant conventions and recommendations, e.g. pertaining to crew accommodation.

Classification societies issue detailed technical rules and regulations. They are also moving more and more into operational issues.

National maritime administrations are responsible for ‘filling out’ the international instruments developed by IMO and ILO. In this respect, many administrations simply accept the Unified Interpretations developed by IACS.

But do all these rules, regulations and recommendations solve the problem we have been facing for years and still is facing, i.e. the ‘usable’ ship?

2. WHAT IS THE ROLE OF IMO?

2.1 THE TRADITIONAL ROLE OF IMO

Traditionally IMO has been seen as a predominantly technical organization when it comes to addressing maritime safety and protection of the marine environment. This would appear to be reinforced by the names of most of the sub-committees established by the Maritime Safety Committee (MSC) and the Marine Environment Protection Committee (MEPC):

- Bulk Liquid and Gases (BLG)
- Radiocommunications and Search and Rescue (COMSAR)
- Design and Equipment (DE)
- Carriage of Dangerous Goods, Solid Cargoes and Containers (DSC)
- Fire Protection (FP)
- Safety of Navigation (NAV)
- Stability, Load Lines and Fishing Vessel Safety (SLF)

Two other sub-committees, however, seem to be of a different nature:

- Standards of Training and Watchkeeping (STW)
- Flag State Implementation (FSI)

2.2 HUMAN ELEMENT IN IMO

It is obvious that the STW Sub-Committee deals with the human element in relation to maritime education and training as well as watchkeeping issues. The FSI Sub-Committee deals with issues related to the implementation of IMO instruments by Member States in their roles as flag, coastal and port States. It also deals with casualty investigation and analyses and in this respect not only structural issues and equipment, but also operational and other human element related issues.

What might be less obvious is that all the more “technical” sub-committees in reality also deals with the human element. For example is the BLG Sub-Committee dealing with work environmental aspects of tanker operation. The NAV Sub-Committee is addressing the issue of manning as well as a number of other human element related issues. And the list could go on.

The Long-term Work Plan of the Organization (up to 2010), as contained in resolution A.943(23), includes, *inter alia*, two high-priority items:

- Role of the human element in the prevention of maritime casualties and accidents
- Promotion and maintenance of a safety culture and security consciousness

In the Strategic Plan for the Organization (for the six-year period 2004 to 2010), as contained in resolution A.944(23), the following will be found:

“IMO will take the lead in enhancing the quality of shipping by, *inter alia*, ensuring that all stakeholders understand and accept their responsibilities regarding safe, secure and environmentally sound shipping by developing a ‘chain of responsibility’ concept among them; and identifying, correlating and evaluating the factors, including human interaction on board ships, that influence safety and security culture, and developing practical and effective mechanisms to address them.”

One of the principles stated in the Human Element Vision, Principles and Goals for the Organization, as contained in resolution A.947(23), is that the human element is a complex, multi-dimensional issue that affects maritime safety, security and marine environmental protection. It involves the entire spectrum of human activities performed by ships’ crews, shore-based management, regulatory bodies, recognized organizations, shipyards, legislators and other relevant parties, all of whom need to co-operate to address human element issues effectively. Another principle is that consideration of human element matters should aim at decreasing the possibility of human and organizational error as far as possible.

The former Secretary-General of IMO W. A. O’Neil once said:

“As we look for areas where we can make further gains, I think we would have to sum them up in one word: people. We live in a world in which technology is becoming more and more important. Our own industry is changing as fast as or faster than any other. And yet the paradox is that these changes are making us realise more clearly than ever before that people are the key to any real efforts to improve safety and prevent pollution. But not just any people: they have to be people who are trained, skilled and motivated. We need to probe deeper and learn more about the reasons why seafarers make mistakes. We really do need to make safety part of shipping’s culture. We need to apply such ideas as formal safety assessment and adopt programmes like ‘prevention through people’.”

2.3 HISTORICAL BACKGROUND

2.3(a) Joint MSC/MEPC Working Group

A Joint Working Group on the Role of the Human Element in Maritime Casualties was established in 1991 by IMO’s Maritime Safety Committee (MSC 59) and Marine Environment Protection Committee (MEPC 31). The Group, which was subsequently renamed the Joint MSC/MEPC Working Group on the Human Element, has met during all subsequent sessions of the MSC and also during MEPC 37 in September 1995.

During the Group’s first years of work it concentrated primarily on matters related to safety management, port State control on operational requirements and development of a common structure for shipboard emergency plans. The practical results of this work were:

- resolution A.741(18) – the ISM Code;
- a new chapter IX of the SOLAS Convention making the ISM Code mandatory;
- resolution A. 788(19) – Guidelines on implementation of the International Safety Management (ISM) Code by Administrations;
- resolution A.742(18) – Procedures for the control of operational requirements related to the safety of ships and pollution prevention (now part of the amalgamated Procedures for port State control contained in resolution A.787(19));
- new regulation XI/4 of the SOLAS Convention providing the legal framework for control of operational requirements; and
- resolution A. 852(20) – Guidelines for a structure of an integrated system of contingency planning for shipboard emergencies.

In addition to the very specific tasks outlined above the Group also looked at the current situation with regard to the role of the human element in relation to the work of IMO in general. This look resulted in a set of instructions issued by MSC 69 in May 1998 (and the MEPC) to all Sub-Committees, containing the following points:

“Each Sub-Committee is instructed to:

- review the adequacy of requirements and recommendations for equipment and operating manuals and operational guidelines on board ships;
- consider the simplification and standardization of terminology in operating manuals and symbols and signs used on board ships;
- identify words and phrases used in IMO instruments relating to human performance criteria and determination of the extent to which they can be more specifically defined;
- give appropriate consideration to a list of questions on subjects relating to human factors; and
- report to the Committees on their progress.”

The Sub-Committee on Flag State Implementation (FSI) was instructed to develop a commonly agreed marine human element taxonomy with definitions for human elements related to casualties in connection with its work on casualty investigation.

As a general strategy it was decided to conduct work on two different levels:

Level one by identifying what had already been done with regard to the human element within IMO;

by identifying actions with regard to the human element which are relevant for the work of the Group within the industry and within other relevant international organizations (e.g. ILO and WHO), which have already been taken or are being undertaken; and

by undertaking possible follow-up actions.

Level two by determining more systematic, methodical and comprehensive ways of dealing with human element matters in the future.

It was also decided, as far as practicable and possible, to conduct the work on both levels simultaneously, bearing in mind that this would be an ongoing process over a long period of time.

The work is extremely complex and involves scientific and practical knowledge and experience. It will therefore be necessary to try and define a frame of reference and to use a commonly agreed terminology in order to obtain practically useful results. A list of common human element terms is given in MSC/Circ. 813/MEPC/Circ. 330.

MSC 75 in May 2002 identified a need for updating the instructions to the sub-committees relating to the human element taking into account the experience gained since the original instructions were issued at MSC 69. The Committee instructed all sub-committees to continue to take into consideration appropriate human element-related matters in the course of their work, particularly when:

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| “1 | reviewing the adequacy of requirements and recommendations for equipment and operating manuals on board ships, including the simplification and standardization of terminology. In this respect, when developing new or amending existing performance standards, careful consideration should be given to including recommendations on: |
| 1 | user-friendliness; |
| 2 | safety of use of the equipment; |
| 3 | harmonization of essential safety features of the equipment; and |
| 4 | the need for clear, easily understandable and updated operating and technical manuals and drawings; |
| .2 | reviewing the adequacy of requirements and recommendations for operational guidelines on board ships, in particular with respect to them being easily understandable; |
| .3 | continuing the simplification and standardization of symbols and signs used on board ships; and |
| .4 | identifying words and phrases used in IMO instruments such as “adequate”, “sufficient”, “to the satisfaction of the Administration”, etc. and determine the extent to which they can be more specifically defined.” |

2.3(b) Fatigue

The question of fatigue has also been considered within IMO in co-operation with ILO. A definition of fatigue as contained in MSC/Circ.813/MEPC/Circ.330 was agreed by MSC 71 in May 1999. The definition is as follows:

“A reduction in physical and/or mental capability as the result of physical, mental or emotional exertion which may impair nearly all physical abilities including strength, speed, reaction time, co-ordination, decision making or balance.”

A correspondence group developed practical guidance on fatigue to all parties who may effect the fatigue issue, and this guidance was adopted by MSC 74 as MSC/Circ. 1014 (Guidance on fatigue mitigation and management). The philosophy behind the development of the guidance was not to develop new information but rather assemble what already exists, in a useful format, for transmission to those parties who have a direct impact on ship safety.

The outline of the information is related to the potential dangers associated with fatigue and ultimately the effect on the health and safety of the personnel working on board ships. The guidelines contain information on the symptoms and causes of fatigue, and addresses solutions to combat fatigue to improve the associated health problems and help prevent a fatigue related accident occurring.

The guidelines are composed of modules each devoted to an interested party. The modules are as follows:

Module 1	Fatigue
Module 2	Fatigue and the Rating
Module 3	Fatigue and the Ship’s Officer
Module 4	Fatigue and the Master
Module 5	Fatigue and the Training Institution and Management Personnel in charge of Training
Module 6	Shipboard Fatigue and the Owner/Operator/Manager
Module 7	Shipboard Fatigue and the Naval Architect
Module 8	Fatigue and the Maritime Pilot
Module 9	Fatigue and Tugboat Personnel
Appendix	Fatigue related documentation.

In Module 7 the following is stated:

“Reducing shipboard fatigue will require orchestrated action by many groups, including flag States, shipowners and operators. Naval architects and ship designers make their unique contribution by improving the design of shipboard conditions.”

MSC 75 in May 2002 considered the issue of education and training for fatigue prevention, mitigation and management to be very important and of some urgency. It instructed the STW Sub-Committee to consider mandatory education and training requirements in this respect for all relevant parties and all types of ships.

2.3(c) Resolution A.947(23) – Human element vision, principles and goals for the Organization

In November 1997 the IMO Assembly adopted resolution A.850(20) which set out the IMO “policy” with regard to the role of the human element within the Organization.

The vision is stated as follows: “to significantly enhance maritime safety and the quality of the marine environment by addressing human element issues to improve performance.”

A revised Assembly resolution was approved by MSC 77 in May 2003 and adopted by the 23rd session of the Assembly in November/December 2003 as resolution A.947(23).

2.3(d) Safety Culture

In resolution A. 792(19) the IMO Assembly recommended Governments and international organizations concerned to initiate work with the aim of establishing a safety culture in and around passenger ships under their flag addressing all persons working professionally in or in relation to such ships, irrespective of whether or not their work is covered by relevant instruments developed by IMO.

MSC 75 in May 2002 agreed that, in order to promote a maritime safety culture and environmental conscience, within the provision of resolution A. 900(21) on Objectives of the Organization in the 2000s, on all ships as well as ashore, so that all aspects of safety, in its broadest sense, are addressed within the shipping industry, it was necessary to revise resolution A. 792(19) to include all types of ships, and noted the development by the Joint Working Group of a preliminary draft Assembly resolution for further consideration and finalization at MSC 77, following MEPC’s concurrent action. The Joint Working Group was not reconvened during MSC 77, but it reconvened during MSC 78 in May 2004. Owing to other pressing work, the revision of resolution A.792(19) was deferred until the next meeting of the Group, which is scheduled to take place during MEPC 53 in July 2005.

2.3(e) Reporting on near misses

MSC 74 in May/June 2001 considered the issue of reporting near misses and how to promote a no-blame culture and issued MSC/Circ. 1015 in which it invited Member Governments to:

- “1 review their regulatory and safety regime with a view to encouraging the reporting of near misses without fear of reprisal or punitive action;
- .2 urge companies operating ships under their flags not to penalize persons reporting near misses; and
- .3 urge companies operating ships under their flags to implement procedures by which persons should only report near misses to the designated person(s) and the designated person(s) should only pass on such reports in an anonymous form.”

2.3(f) Human Element Analysing Process (HEAP)

The HEAP is a practical tool, designed to address the human element, to be used for consideration of maritime safety and environmental protection issues at IMO. The flowchart is provided in accordance with goal (a) in resolution A. 850(20) on Human element vision, principles and goals which states: “to have in place a structured approach for proper consideration of human element issues for use in the development of regulations and guidelines by all Committees and Sub-Committees”. The steps outlined in the flowchart list a series of questions that should be considered to appropriately address the human element in the regulatory development process.

This is a method developed in IMO (by the Joint Working Group on the Human Element) for IMO and should be seen as a practical and non-scientific checklist to assist regulators in ensuring that human element aspects related to the ship and its equipment, the master and the crew, training, management ashore and on board, and work environment conditions have been taken into consideration when introducing or amending IMO instruments.

HEAP is broad in application and not to be seen as any kind of replacement for a Formal Safety Assessment (FSA) study.

2.3(g) Strategic Plan for the Human Element

At MSC 78 the Group developed a working document, including a preliminary list of possible items to be included in an action plan, which would serve as a basis for the development of a strategic plan to address the human element as well as an accompanying action plan. This work will be continued at the next meeting of the Group, which is scheduled to take place during MEPC 53 in July 2005.

The Group also considered the issue of how to implement and enforce the provisions of SOLAS regulation V/15 based on an IACS Unified Interpretation

as well as a submission from the United Kingdom on the results of an EU project “ATOMOS IV”, which addressed this issue. In this respect the Group welcomed the IACS UI as a valuable first step in that it addresses the issue up until the ship is delivered, i.e. questions of hardware and its ergonomic aspects. In the future further consideration will have to be given to the question of addressing the operational aspects of the regulation. Here could the results of ATOMOS IV be very valuable.

3. IMO INSTRUMENTS

3.1 BINDING INSTRUMENTS

As you are no doubt aware IMO adopts a number of binding international rules and regulations in the form of conventions and protocols to conventions. Furthermore, a number of originally recommendatory instruments in the form of codes has been made mandatory by direct reference in a convention. Examples of this are the High-Speed Craft (HSC) Codes, which were made mandatory through chapter X of the SOLAS Convention.

Another example is the International Safety Management (ISM) Code, which was made mandatory through chapter IX of SOLAS.

3.2 NON-BINDING INSTRUMENTS

Supplementing the mandatory instruments IMO has issued a large number of recommendatory instruments in the form of resolutions and circulars.

Examples of some of these instruments are listed below:

- Resolution A.760(18) – Symbols related to life-saving appliances and arrangements
- Resolution A.792(19) – Safety culture in and around passenger ships
- Resolution A.830(19) – Code on alarms and indicators
- MSC/Circ.735 – Recommendations for the design and operation of passenger ships to respond to elderly and disabled persons’ needs
- MSC/Circ.834 – Guidelines for engine-room layout, design and arrangement
- MSC/Circ.846 – Guidelines on human element considerations for the design and management of emergency escape arrangements on passenger ships
- MSC/Circ.982 – Guidelines on ergonomic criteria for bridge equipment and layout
- MSC/Circ.1014 – Guidance on fatigue mitigation and management
- MSC/Circ.1070 – Ship design, construction, repair and maintenance
- MSC/Circ.1091 – Issue to be considered when introducing new technology on board ship

to mention but a few.

4. CONCLUSIONS

In the introduction the question was asked whether it is possible to build a 'usable' ship, taking full account of all user requirements/wishes, and whether the plethora of rules, regulations and recommendations helps in solving the problem.

My conclusion is that they do indeed help, at least to a certain extent, but they do not in themselves solve the problem. The professional knowledge and skill of the designers and builders of ships is of paramount importance in order for us to get ships that are really 'usable'.

You will have noted that IMO has issued guidance on bridge ergonomics, engine-room layout, fatigue mitigation and management, and a lot of other issues, but you will not find any guidance on general ergonomic matters. This issue is now on the agenda of IMO and in the future you will hear more about the results of that work.

Simple things, like making sure that surfaces are non-slip; ladders and staircases do not invite slips, trips and falls; work areas are sufficiently lighted and arranged in such a way that accidents cannot occur; avoidance of noise and vibrations; crews' accommodation spaces including indoor climate and layout; etc., play a very important role for the persons on board and should be addressed at the design stage as well as during construction and operation of the ship. There is a wealth of information available from other industries on human factors and ergonomics, why not use it?

Finally, please use your common sense when designing a ship. This would and should certainly include consulting the people who are actually going to spend a lot of their time on board – the seafarers. And by this I do not only mean the master!

5. DISCLAIMER

The views given in this paper is solely those of the author and should not in any way be construed as representing the official views of IMO or the Danish Maritime Authority.

6. AUTHOR'S BIOGRAPHY

Jørgen Rasmussen holds the current position of Chief Ship Surveyor at the Danish Maritime Authority. He is also Chairman of the IMO Joint MSC/MEPC Working Group on the Human Element.