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## CHAPTER 2

### Psychosocial risks of the seafarers

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**Résumé:** *Il n'est pas aisé de définir la notion de risques psycho-sociaux au travail, d'envisager des critères, des indicateurs, la reconnaissance juridique de cette réalité sociale. A bord des navires, le principe de prévention, l'évaluation des risques, la formation et l'information, la surveillance de la santé, s'imposent, y compris concernant les risques psychosociaux. Leur incidence sur la sécurité maritime et la sécurité du travail ne peut être négligée, notamment la fatigue en matière de veille à la passerelle. Beaucoup d'analyses des abordages, incidents et naufrages mettent l'accent sur le «facteur humain», mettant en lumière des formations insuffisantes, des effectifs réduits, des gens de mer fatigués, s'ils ne sont pas épuisés. L'automatisation des passerelles et de la propulsion nécessite une vigilance renforcée ; l'intensification du travail se développe à bord, comme à terre. Le capitaine et les officiers sont soumis à des contraintes multiples et à des responsabilités pesantes. Les conditions de vie à bord et les conditions d'emploi nécessitent la prise en compte des gens de mer en escale et à bord. Ce concept ancien est d'une grande modernité. De nombreux facteurs interviennent et peuvent donner lieu à des mesures parcellaires; la formation des officiers au management, la limitation de la multiculturalité des équipages, la limitation de la durée des embarquements trop longs, le respect des repos à bord et des congés sont des éléments fondamentaux, pouvant relever d'une gestion sociale de qualité de la part des principaux armements.*





## 1. DEFINITION OF PSYCHOSOCIAL RISK

Psychosocial risks are an increasingly visible reality at work and arise directly from the conditions in which it is carried out, whether of environmental origin, that is, relating to physical, chemical or biological agents, or related to the undertaking of tasks, organisation, methods, procedures, work contents and interpersonal relationships. These risks may negatively affect the worker's physical and mental health and the undertaking of his or her work with the risks this implies, not only for the worker but also for those directly or indirectly affected by the activity carried out.

Following this same line and as well as the above conditions, the Joint ILO-WHO Committee (1984) referred to the workers' properties, their culture, needs and personal situations outside work<sup>1</sup>. These elements are very important considerations for seafarers because of the special features of their work and the conditions in which it is carried out.

This chapter covers the on-board psychosocial risks from two different, but at the same time complementary, perspectives. Firstly, we study how these questions are regulated in Spanish and international legislation from a theoretical and legal point of view. Secondly we offer a more practical or field view of the matter by analysing how the various psychosocial risk parameters affect crews' on-board life, health and safety.

## 2. ON-BOARD PSYCHOSOCIAL RISK IN SPANISH AND INTERNATIONAL LEGISLATION

### 2.1. PREVENTIVE PRINCIPLE

In assessing occupational risks, it is necessary to «prepare and apply, as relevant, practical directives for researching the human factor in maritime accidents and incidents»<sup>2</sup> to adopt the necessary preventive measures so that potential risks do not appear and result in an occupational accident.

The various occupational tasks on a ship involve specific risks arising from life on board. On-board work involves shift work interrupted by the arrival at or departure

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1) Joint ILO-WHO Committee on occupational medicine, Geneva, 1984 and Technical prevention standard number 926, on psychosocial factors: Assessment method. INSHT (National Occupational Health and Safety Institute).

2) International Maritime Organisation (1999): Resolution A.884 (21) Amendments to the Code for the investigation of maritime casualties and incidents (Resolution A.849 (20)).

from port or by the nature of the activities undertaken there as well as long periods on board, which over time can have harmful consequences for the health of the workers in this sector/field.

A constant in studies on prevention matters in general and on the maritime sector/field in particular is that the references and research have been centred on occupational safety with the consequent study, above all technical, of the design of the ship's machinery, technical innovations, projects, construction, maintenance, operations and equipment<sup>3</sup>.

However, as is clear in research into maritime accidents in the last 30 years, reality shows us that the human factor is one of the causes or at least is present in them and, therefore, is a reality that must not be forgotten<sup>4</sup>.

## 2.2. RISKS ASSESSMENT

Risks assessment is a basic part of prevention and an obligation of employers precisely to detect all the risks that may appear in a specific occupational activity (article. 16 LPRL)<sup>5</sup>.

All risks in an occupational sector must be assessed with an initial assessment to declare the opening or start of a health and safety action programme, taking into account the nature of the activity as well as the special risks to which certain workers may be subjected, as is the case here.

The assessment must be updated when there are modifications to the working conditions and an incidental assessment made when accidents or harm to health have occurred. This type of assessment is necessary because if its result makes it so advisable, the employer must carry out periodic controls of the working conditions to detect potentially dangerous situations. If the results show that there are risks with a probability of occurring, the employer must adopt the necessary corrective measures to achieve a higher level of protection.

It is important to note there is a certain principle of free choice in the specific assessment method or procedure for undertaking the assessment. This is very important from the moment at which the production activity has special features and

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3) International Maritime Organisation (IMO) (1993): Resolution A.742 (18) Procedures for the control of operational requirements related to the safety of ships and pollution prevention.

4) Smith, A. (2007): *Adequate crewing and seafarers' fatigue: The international perspective*, Centre for Occupational and Health Psychology, Cardiff University.

5) Law 31/1995, on the prevention of occupational risks, 8 November 1995, transposing Council Framework Directive 89/391/CEE of 12 June 1989, relating to workers' occupational health and safety.



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therefore a specific control of risks, specifically, of how to prevent and assess them, as understood by the Supreme Court at the time<sup>6</sup>.

The risks assessment set by the system based on the general principle of prevention is carried out to detect any risks to prevent instead of repair them. In this sense, questions relating to the human factor have gained in importance, such that this has become a priority for its leading role in the prevention of maritime casualties.

In this sense, the International Maritime Organisation has pronounced on and requested the Maritime Safety Committee and the Marine Environment Protection Committee to pay special attention to the psychosocial risks that may arise from activities at sea such as fatigue, communication, culture, experience, health, understanding of the situation, tension, conditions and work organisation<sup>7</sup>.

With regard to the subject under study, the parameters for assessing the risks arising from the human factor involve a series of multidisciplinary questions because of the complex activity that affects maritime safety, maritime protection and the protection of the marine environment. The group directly affected will be the ships' crews, those responsible for management ashore, the regulatory organisations, the recognised organisations, the shipyards, the legislators and other interested parties because they all form part of a series of activities which in some way will affect the human activities in this sector.

There is a series of recommendations that must be followed when preparing the assessment of occupational risks. In accordance with article 16 LPRL, the risks arising from the production activity being assessed must be highlighted. For this purpose the opinion of the seafarers must be taken into account, among other questions, when organising the activities arising from their work as well as determining clearly the functional organisation rules, which must be simple, clear, specific and concise.

To be able to assess the risks, they must first be made visible and the potential problems in the working environment specified in order to prepare the relevant preventive measures. For this it is necessary to determine the decisions to be taken, the dangerous conditions, the factors and the possible safety problems and propose the relevant and necessary measures.

With regard to the psychosocial factors, the human element has an essential role as the central component of any worker and that integrates the aptitudes and limitations,

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6) STS, 12-5-99, Ar. 48420.

7) International Maritime Organisation (IMO) (2003): Resolution A.947 (23) Human element vision, principles and goals for the organisation.

whether physical, physiological, psychological or psychosocial. These elements must be taken into account when organising the management, supervision and interactions between the crew and the communications.

Other elements peripheral to the human factor are the physical and environmental conditions, the relationships with health and safety which, if not well assessed and therefore determined, may directly affect the psychosocial variables. The same address with the organisational factors such as unsuitable rules and procedures, insufficient training of the workers or their supervisors, excessive workload and haste<sup>8</sup>, among others.

### 2.3. TRAINING AND INFORMATION

To this the duty of training and information must be added through effective mechanisms. It is a primordial obligation of the employer in complying with the general protection duty to guarantee that each worker receives sufficient and suitable theoretical and practical training on joining, when there is a change of functions, due to the incorporation of new technologies, as a consequence of changes in the working equipment and during the working day. Training may be given by in-house or external means, free and, above all, must be focused specifically on the work post or function of each worker (19.1 LPRL), generic, abstract and indiscriminate training being insufficient<sup>9</sup>. At the same time, information must be given on the risks found once the assessment has been made in each work centre for each post or function as well as the protection or prevention means to be adopted with respect to these risks or risk factors, the emergency measures planned for first aid, fire fighting and worker evacuation.

Worker consultation and participation is essential since there is no-one who better knows at first hand the risks involved in the work post. It is therefore a duty and obligation to consult workers on everything regarding prevention activity as well as allowing their participation and suggestions on questions that affect occupational health and safety, which must be aimed both at the employer and at the participation and representation organisations as per article 18 of the LPRL.

### 2.4. HEALTH MONITORING

Health monitoring is another of the basic pillars of prevention with various modes. Firstly, an initial monitoring on entering the company, an additional one due to symptoms of worsening or exposure to certain specific risks, a periodic one carried

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<sup>8</sup>) International Maritime Organisation (IMO) (1999): Resolution A.884 (21) amendments to the Code for the investigation of maritime casualties and incidents Resolution A.849 (20).

<sup>9</sup>) SSTSJ in Extremadura, 11-2-98, Ar. 919.

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out at a certain determined frequency and, finally, a post-occupational assessment that is made or must be made once the employment relationship ends.

Article 22 of the LPRL includes the duty of the employer to guarantee «the workers in its service the periodic monitoring of their health according to the risks inherent to the work», so that these tests or control procedures must detect all the risks in the work post, that is, those derived from safety, industrial health, ergonomics and psychology.

In this sense, it can be seen that a full monitoring of the workers' health according to the risks arising from the specific work post is carried out on very few occasions. It is well known that psychosocial risks are present in the work post but they are not always adequately catered for. On most occasions, health monitoring is reduced to mere physical check-ups without attending to personal, age or gender conditions or the work carried out, that is, to circumstances that must be taken into account to be able to carry out an integral control of health monitoring according to the risks inherent in the work, as required by the regulations.

Very rarely psychological tests are given to check whether workers have a health problem at the time or if there is the possibility of their suffering a work-related pathology in the future. These tests are necessary to detect illnesses such as depression which often appears as the last stage in a chain that begins with symptoms such as stress, anxiety, lack of motivation and other, accompanying, physical pathologies. These risks must not be reduced to the worker's purely private sphere but must be assumed, externalised and managed from the employment setting because they often come from and have their origin in work.

Therefore, the area of analysis must cover not only physical but also psychosocial health since there are types of work in which, because of their special nature and continuous contact with other persons, the psychosocial risk is the main one. If this is so, all necessary controls must be undertaken to detect certain pathologies that frequently arise from interpersonal relationships or from the organisation of work<sup>10</sup>.

This fact must be highlighted for an overall monitoring of health that covers the physical and psychological variables to be able to prevent risks that are invisible unless a specific assessment is made<sup>11</sup>.

There are risks related directly to work which form emotional situations caused by

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<sup>10</sup>) Technical note number 926 on Psychosocial factors: assessment method, INSHT.

<sup>11</sup>) Gil Pérez, ME. (2003) «Mujer y salud laboral.» *Mujer y trabajo*, ed. Bomarzo.

Gil Pérez, ME. (2012) «Riesgos laborales ligados a la maternidad desde una perspectiva jurídica.» *Tratado de Health Laboral*, Volume II Aranzadi, p. 565.

various employment conditions –organisation, interpersonal relationships– and that could be the origin of pathologies arising from the activity. These situations can cause from a reduction of work output to the development of an illness.

Royal Decree 568/2011, 20 April, sets the minimum conditions for protecting the health of and providing medical assistance to seafarers. Nevertheless, it refers to care treatment, given the properties of the specific activity. But from the prevention rather than from the repairing point of view, the monitoring must cover both physical and psychological health since, as already stated, the complexity of the activity at sea and the special situation of the workers in this sector make it advisable.

## 2.5. SPECIFIC RISKS

### 2.5.1. HUMAN FACTOR AND INTERPERSONAL RELATIONSHIPS

One of the consequences of the risks related with the human factor can be emotional distress, this being understood as the upsets that can directly affect a person's capacity to carry out the required activity normally. This upset may appear in a panic situation arising from fear that overcomes a worker. Anxiety is another of the symptoms that may be connected to these emotional upsets when there is a state of uncertainty regarding future work that does not allow concentration on the task in hand.

Another risk that could sometimes be the consequence of the pathologies described is the consumption of substances harmful to the worker's health such as, for example, alcohol, drugs and other substances that alter the worker's neuronal state and, as a consequence, the work carried out as well as the worker's behaviour with the rest of his or her companions.

All of this could cause a deterioration of mental health with the consequential reduction of intellectual capacity, directly affecting the activities to be carried out with the logical consequences of loss of attention and distraction. Lack of attention could cause physical injuries of any type such as crushing, cuts, falls and burns, among others. Psychosocial risks are increasingly more frequent and the consequences can be both physical and psychological. As well as psychotic behaviour, depression and hallucinations, it may be accompanied by a clear physical deterioration and by other disorders that are concentrated in specific pathologies such as migraines, fainting, colds, ulcers, cardiovascular disorders, digestive problems and nervous system problems. It also involves lack of attention, strength, speed, inability to react to any event, lack of coordination, decision taking and balance and even loss of visual acuity<sup>12</sup>.

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12) International Maritime Organisation (IMO) (2003): Resolution A.947 (23) Human element vision, principles and goals for the organisation, pp 32, 33 and 34.

All of this is accompanied by a clear lack of motivation with the possible abandoning of functions, insubordination and sabotage. Lack of motivation involves a reduction of will and a lack of confidence or discipline. The causes of this demotivation may be varied but in most cases appears in interpersonal relationships ranging from problems of coexistence arising from the bad organisation of excessive work and, therefore, a deficient output to the reduction of the worker's physical and psychological capacity, problems of interpersonal relationships and cultural problems to bad work organisation. Moreover work at sea involves excessively long periods of service in ships, the multicultural variety of crews with the problems of coexistence that this involves and many problems arising from all of this<sup>13</sup>.

### *2.5.2. RISKS ARISING FROM SAFETY AND ENVIRONMENTAL CONDITIONS*

Safety risks are related with the ship's activity itself and the elements in it such as noise, vibration, cooling, heating, ventilation, decks, stairs, ladders, dangerous working surfaces, protection devices, guard rails and unsuitable grips, deficient orientation of operations posts with respect to the ship's dynamics in general. Also on board risks are related with safety management because it may arise from a lack of technical knowledge by the crew or the current state of the ship, lack of coordination and communication between the crew and the management and command organisations, deficient knowledge of the ship's operations, of the rules and standards, of the on-board procedures, of the tasks or functions, even of linguistic knowledge since crews are often multi-racial with diverse cultural and religious origins, with the difficulties that arise from this situation<sup>14</sup>.

Because of all this, the persons responsible for organising and controlling the crew must be prepared to manage work and avoid any lack of discipline, failures in the exercising of command that involve erroneous orders, deficient supervision, lack of coordination and communication both between the management organisations and with the rest of the crew. Reality shows that a bad work organisation can cause many problems that result in occupational accidents.

As a consequence, the standards for functioning, the procedures to be carried out and the suitable practices must be established clearly and in detail so that they are effective. If these are not established precisely, there may be errors arising from a

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<sup>13</sup> International Maritime Organisation (IMO) (1999): Resolution A.884 (21) Amendments to the Code for the investigation of maritime casualties and incidents.

<sup>14</sup> International Maritime Organisation (IMO) (1993): Resolution A.742 (18) Procedures for the control of operational requirements related to the safety of ships and pollution prevention.  
International Maritime Organisation (IMO) (1997): Resolution A.849 (20) Code for the investigation of maritime casualties and incidents, approved on 27 November 1997.

lack of understanding of instructions and lack of knowledge of the situation which, in a given moment, could cause the failure to identify a potential risk.

Management involves not only human resources but also physical ones so that there must be a good practice with regard to the organisation, conservation and management of tools, installations, provisions and water with foresight so that these resources do not lack<sup>15</sup>.

### 2. 5.3. MARINE ENVIRONMENT

Likewise, it is necessary to add that the working environment is dangerous in itself since it is a natural medium that involves elements that are difficult to control such as waves, storms, currents, strong tides, sandbanks, ice, rocks, wind, fog, rain, snow and hail, among others. This can generate an added element of stress because of the uncertainty that these natural elements can cause<sup>16</sup>.

### 2.5.4. SPECIAL REFERENCE TO FATIGUE

Fatigue can be defined as the temporary alteration of the worker's functional, mental and physical deficiency<sup>17</sup>. Fatigue appears when the requirements of the daily task, such as the effort required, the working rhythm, the level of attention or the emotional tension exceeds the worker's ability to respond.

Fatigue can be both physical and mental and appears as various symptoms such as a sensation of tiredness, muscular pain, loss of vision or hearing, sleeping disorders, irritability and reduction of the capacity to respond in work<sup>18</sup>.

Fatigue has been started especially in the ambit of seafarers since it is a clear consequence of the risks arising from this activity. In this sense, the studies show that on some types of ships this risk appears due to a series of circumstances such as a minimum manning, the fast turnaround, bad weather, long working days, lack of rest, noise, vibration, extreme temperatures and workload, among others<sup>19</sup>.

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15) International Maritime Organisation (IMO) (2003): Resolution A.947 (23) Human element vision, principles and goals for the organisation, p. 35 and ff.

16) International Maritime Organisation (IMO) (2003): Resolution A.947 (23) Human element vision, principles and goals for the organisation, p. 34.

17) NTP 445: Mental work load: fatigue, IHSHT.

18) In this sense, the purpose of Resolution A.772 (18) of the International Maritime Organisation (IMO), on fatigue factors in manning and safety, 4 November 1993, is to increase awareness of the complexity of fatigue and its taking into consideration by all parties involved in work on ships to take them into account when taking decisions to reduce maritime casualties and improve the workers' health and safety.

19) Smith, A. (2007): *Adequate crewing and seafarers' fatigue: The international perspective*, Centre

The various working conditions to which seafarers are exposed require their multidisciplinary management to prevent occupational fatigue with a series of strategies that are effective for the purpose. The management strategies must be specified through the contributions of the representatives of management and workers in each sector as well as the contributions resulting from investigations into accidents and casualties which often show the need for higher crewing levels, improved working environments and changes in the distribution of working hours both in the duration of service period and in the time for rest and recovery – that is, in better compliance with current regulations<sup>20</sup>. To this must also be added the need for measures that help to promote a cultural change among ship owners and operators to guarantee that short-term commercial considerations do not affect the health and safety of seafarers<sup>21</sup>.

### 3. ON-BOARD PSYCHOSOCIAL RISKS AND THEIR EFFECT ON MARITIME SAFETY

#### 3.1 The human factor as a cause of accidents in the maritime ambit

In the last 50 years, the maritime industry has focused on improving the structure of the ship and the reliability of the on-board systems and equipment to reduce the number of accidents and increase efficiency and productivity in the sector. Today,

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for Occupational and Health Psychology, Cardiff University, pp 23 and ff.  
Christodoulou-Varotsi, I. (2009): *Maritime Safety law and Policies of the European Union and the United States of America: Antagonism or Synergy?*, ed. Springer.

In this sense, the dispositions of ILO Convention number 188 on work in the fishing sector, approved on 30 May 2007, are aimed at guaranteeing that workers in this sector have improved occupational health and safety at medical care at sea, including care on land, as well as the necessary rest time to preserve their health and safety. Another objective is to guarantee that fishing vessels are built and maintained such that the workers have suitable living conditions for the long periods spent at sea.

20) Especially ILO Convention 180, 22 October 1996, on seafarers' hours of work and the manning of ships, obliges states to set a maximum for working hours and minimum rest periods on the vessels that fly their flag. And European Parliament and Council Directive 2003/88/CE, 4 November 2003, concerning certain aspects of the organisation of working time.

In this sense, the 2006 Convention on maritime work sets the minimum conditions for the work of seafarers on vessels with dispositions on the employment conditions, working time, accommodation, leisure installations, food and catering, health protection, medical care, well-being and social protection. In addition, articles 40 and 3.1 of Resolution A.890 (21), 25 November 1999, on the principles of safe manning and Resolution A.955 (23), 5 December 2003, on amendments to the principles of safe manning, respectively, cover the need to determine the minimum safe manning for a ship and to guarantee that there is sufficient personnel with the category or position required for operating the ship in safe conditions, its protection and the protection of the marine environment.

21) Smith, A. (2007): *Adequate crewing and seafarers' fatigue: The international perspective*, Centre for Occupational and Health Psychology, Cardiff University, p 38.

ships are highly advanced and reliable from the technology point of view but despite these technological advances and the implementation of wide regulations on safety, the percentage of maritime accidents remains very high. This is because the structure of the ship and the reliability of the technological systems are only part of the safety «equation», an «equation» in which the crew and their working conditions form the greatest part<sup>22</sup>.

Today it is commonly accepted and widely documented that approximately 80% of maritime accidents are due in part to human error<sup>23</sup>. However, despite this consensus on accidents causes, the concept of human error is often confused in literature on the matter with the concepts of «human element» and «human factor» for which there are no clear and internationally accepted definitions<sup>24</sup>.

To understand the difference between «human error» and «human factor» we must associate them with the concepts of «immediate cause» and «root cause».

Human error, that is failure, lack of care, violation of standards, etc, is the «immediate cause» of the accident as may also be the sudden failure in the equipment or technological system. Human error is the immediate cause of the accident: a crew member touches the wrong button and an accident occurs. Human error is defined as the deviation of a person or group of persons from the accepted or convenient practices the consequence of which is undesirable or unacceptable results<sup>25</sup>.

The human factor –working conditions, ergonomics, work organisation, etc.–, is the «root cause», the point of departure of an unsuitable journey which takes us, according

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22) Squire, D. (2004): «The importance of human element in shipping». Accessible at [<http://www.he-alert.org>].

Psaraftis, H.N., Caridis, P., Desypris, N., Panagakos, G. and Ventikos, N. (1998): «The human element as a factor in marine accidents». *IMLA-10 Conference*, Saint-Malo, France.

Ruthblum, A. (2003): *Human error and marine safety*. Accessible at [<http://www.uscg.mil>].

Talley, W. (1999): «The safety of sea transport: determinants of crew injuries». *Applied Economics*, 31(11): 1365-1372.

23) UK P&I (1997): *Analysis of major claims*. Accessible at [<http://www.ukpandi.com>].

Barnett, M. (2005): «Searching for the root causes of maritime casualties: individual competence or organizational culture». *WMU Journal of Maritime Affairs*, 4(2): 131-145.

Pomeroy, R.V. (2002): «The human element in engineering systems». *Seaways*, April 2002: 8-11.

Martínez de Osés, F.X. and Ventikos, N. (2003): «A critical assessment of human element regarding maritime safety: issues of planning, policy and practice». *Revista del Instituto de la Navegación de España*, 17(17): 68-80.

Ruthblum, A. (2003), *Human error and marine safety*, Accessible at [<http://www.uscg.mil>].

24) The Nautical Institute (ed) (2003): *The International Maritime Human Element Bulletin 1*. Accessible at [<http://www.he-alert.org>].

25) International Maritime Organisation (1999): Resolution 884(21) Amendments to the Code for the investigation of maritime casualties and incidents.

to the Swiss cheese theory of Reason<sup>26</sup>, to error and, consequently, to an accident. Human factors are aspects that affect the behaviour of persons in their work and in their life<sup>27</sup>. The human factor is defined as the set of parameters (organisation, equipment, environmental, ergonomic, etc.) that converge on and influence the work of persons. The human factor is defined in other settings as occupational psychosocial risk factors.

Half way between the human factor and human error there is, on the one hand, the human element, that is, the individual's own characteristics that determine the way in which he or she interacts with the medium, and on the other, a series of «propagating» factors that constantly degrade the ship's safety and the health of its crew: fatigue, stress, bad operating practices, etc. We define the human element as the set of the individual's own characteristics (aptitudes, attitudes, knowledge, values, expectations, etc) which, acting together with the human factors, determine the way in which individuals interact with other individuals, systems and equipment.

Figure 1, based on the SHEL model<sup>28</sup> for classifying human factors, shows the interaction between the various components of the human factor and the human element and how this interaction influences both the seafarers' professional performance and the ship's safety as well as personal health and safety itself. If the condition of the ship, work organisation, external environment, living conditions and interpersonal relationships are deficient, professional performance will deteriorate, resulting in, among other, lack of maintenance of the ship and bad operational practices. Equally, the worker's health will be compromised, with problems of fatigue, stress, burn-out, anxiety, depression, cardiovascular illnesses and other mental and physical illnesses appearing. In this situation, the ship's safety and that of its crew diminishes and the risk of an accident becomes clear.

The human factor - human element system is a complex one that is present in all phases of a ship's life from its design and building, operation and maintenance to its scrapping and involves all the «stakeholders» with interests and responsibilities in each of these processes, from the naval engineer to the ship owner, including the manager, the seafarer and the legislator. This system is also flexible and susceptible to change since all its components interact and can be modified, for better or for worse, by the wishes of the interested parties or by circumstances unconnected with those wishes.

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26) Reason, J 1997: *Managing the risks of organizational accidents*. Ashgate. Aldershot, UK.

27) Gil de Egea, B., Calvo, P., García, C. and Cambor, M. (2003): *Guía de factores humanos para la investigación de accidentes marítimos*. Instituto de Investigación en Seguridad y Factores Humanos, Oviedo.

28) Hawkins, F.H. (1987): *Human factors in flight*. Ashgate. Aldershot, UK.

For its correct functioning, to guarantee the safety of the ship, its crew and the environment, it is necessary to seek a balance between the components in the system so that the shortcomings that cannot be corrected in one ambit can be compensated in others with special measures that are beneficial to the worker's health and safety.

People are fundamental and essential elements for efficient and safe maritime transport<sup>29</sup>. To obtain a crew that is cohesive and motivated and a suitable work organisation for the ship and its commercial purpose, it is necessary to take into account the minimum number of crew needed to operate the ship in safe conditions, the formation of crews with cultural, social and linguistic cohesion, their training needs, the work and rest times as well as the social and labour conditions that the company must offer them. Thus, to understand and manage the human factor suitably, it is necessary to focus less on the human condition, although without neglecting it, and more on the seafarers' working conditions<sup>30</sup>.

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29) Squire, D. (2005): *The human element in shipping*. Accessible at [<http://www.he-alert.org>].

30) Macrae, C. (2009): «Human factors at sea: common patterns of error in groundings and collisions». *Maritime Policy and Management*, 36(1): 21-38.

Kovats, L. (2001): «Human factors on board». *Proceedings of International Symposium Human Factors on Board*, Bremen.

Schröder-Hinrichs, J.U., Hollnagel, E. and Baldauf, M. (2012): «From the Titanic to Costa Concordia - a century of lessons not learned». *WMU Journal of Maritime Affairs*, 11: 151-167.

Graveson, A. (2004): «Human factors and safety at sea». *Proceedings of Safety and the Seafarer Conference*, Greenwich.

Ruthblum, A. (2003): *Human error and marine safety*. Accessible at [<http://www.uscg.mil>].

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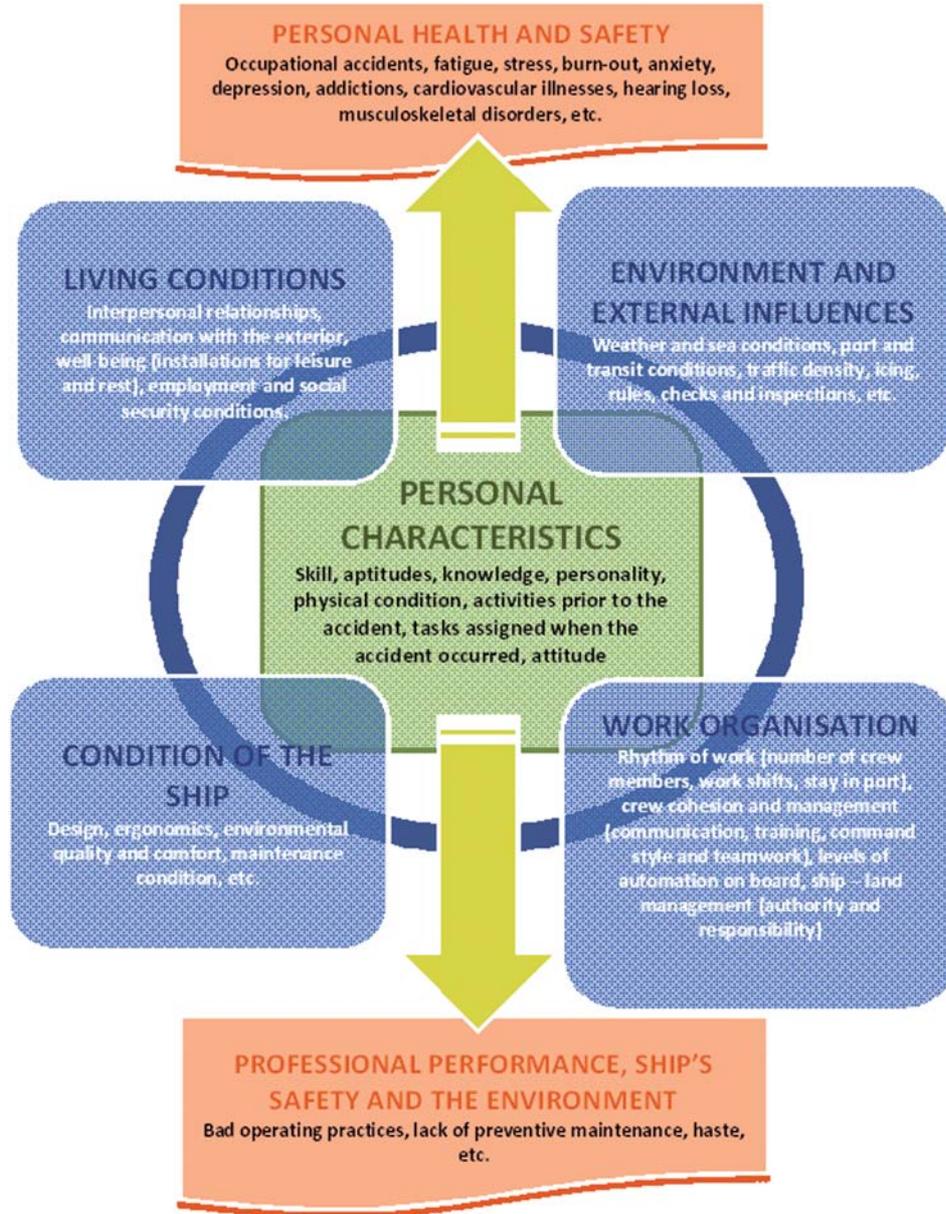


Figure 1: Human factor - human element system model

As can be seen in Figure 1, The quality of many human factor components depends on the management style undertaken by the shipping company ashore<sup>31</sup>, so that this must be aware of the role of its decisions on the ship's safety, since wrong decisions by the shore based management could lead to accidents on board<sup>32</sup>.

The following shows how these factors inter-relate and how they can negatively affect safety in the sector.

### 3.2. Work organisation on board

The main factors on which on-board work organisation depends are, according to Figure 1 above, the work rhythm, the crew's cohesion and management properties, the levels of automation on board and the relationship of the ship with its managers ashore.

Unfortunately, current maritime transport management displays a series of customary practices that are of little benefit to on-board work organisation and that have often endangered the safety of the ship and crew, such as excessively reduced manning, excessive on-board automation, the uncontrolled increase in bureaucratic tasks, the increased responsibility assumed by those in command together with a reduction in their authority, the formation of multilingual crews, the failure to comply with the minimum standards of training, the short periods in port and the time pressures imposed by the shipping company for commercial profits.

#### 3.2.1 Shift work and reduced manning

Shift work is a normal practice in many occupational sectors. However, on-board work management requires taking into account the special features of this sector that give it an especially delicate character:

- Manning limitations: the number of crew members on a ship is invariable during the voyage.
- Rest periods: given the personnel limitations, an eventual excess in the workload cannot be compensated with more rest. A crew member working four-hour watches has a maximum of eight hours' continuous rest. As well as sleeping, eating and toileting in this period, he or she must carry out other work-related tasks that cannot be undertaken while on watch.
- The «environmental» properties of the work place: the ship is subject to special

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31) Seng Kong, L. (2012): *Human element in shipping accidents*. Accessible at [<http://www.itfglobal.org>].

32) Parvez, T. (2012): *Does the presence of human element in shipping companies contribute towards accidents on ships?* Greenwich Maritime Institute. Accessible at [<http://general.marine-files.net>].

Cahuvin, C. (2011): «Human factors and maritime safety». *Journal of Navigation*, 64(4): 625-632.

## II. Psychosocial risks of the seafarers

environmental conditions of noise, vibration, temperature, humidity and lighting. These special «environmental» conditions can negatively affect both the work carried out on board and the quality of the crew's rest.

The reduction in manning is perhaps the factor with the greatest negative impact on operating the ship in safe conditions. Currently, approximately 40% of ships carrying cargoes on the seas and oceans world wide (those under 1000 GRT) are allowed to sail with a deck crew of just four members, a captain, an officer of the watch and two seamen<sup>33</sup>. In this case, the watches are shared generally as six hours on watch and six hours' rest. In addition, these ships frequently sail on short and medium distance coastal voyages. This means that their sailing periods are short and often in areas with a very high traffic density, their visits to ports are very frequent and the activity during the short stays in ports is frenetic<sup>34</sup>. The duration of the voyage has a great influence on manning requirements, as does the time in port, and on the ship's commercial activities such as cleanliness and maintenance. However, these factors are not taken into account by current regulations when setting the minimum safe manning<sup>35</sup>.

Although best maritime practice is opposed to carrying out bureaucratic and administrative tasks not directly related to the navigation watch during that period, the overwork caused by the lack of personnel often leads the officer of the watch to take the risk of undertaking this type of task in those moments. Fatigue and stress caused by overwork also contribute to increasing the risk of accidents. Other risk factors during the navigation watch on a ship with a reduced crew are undertaking the navigation watch alone and distractions due to the need to fill in forms by the officer of the watch<sup>36</sup>. It is obvious that two persons cannot fulfil the obligation of undertaking a safe navigation watch in a system of 6/6 watches, carry out management, administrative and maintenance tasks outside watch hours and also have time to rest, eat and wash suitably without putting the ship, its cargo and its crew at serious risk of accident<sup>37</sup>.

It is therefore absolutely essential to revise the regulations referring to minimum safe manning and minimum rest times.

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33) International Maritime Organisation (2010): *International Convention on Standards of Training, Certification and Watchkeeping*.

34) Lloyd, M. (2007): «The manning problem». *Seamanship international*, August 2007. Accessible at [<http://www.witherbyseamanship.com>].

35) Parker, C.J. (2001): «Shipping and the human factor». *Seaways*, November 2001: 4-8.

36) UK P&I (ed) (2006): «Distractions on the bridge». *Technical Bulletin*, 20.

37) Lloyd, M. (2007): «The manning problem». *Seamanship international*, August 2007. Accessible at [<http://www.witherbyseamanship.com>].

### 3.2.2 Commercial pressures

The traditional way to increase cargo movement – and therefore profit – in the maritime business has been to increase the size of ships, thus increasing the cargo capacity on each voyage.

However, an alternative and perhaps more flexible way to increase cargo capacity is to increase the number of voyages that a ship can make in a given period<sup>38</sup>. For this, the ship must increase its cruising speed and that of cargo handling in ports. The modification of the parameters of navigation speed and speed of loading/unloading can be directly harmful to the ship's safety and that of its crew if additional measures are not taken both in the design and building of the ships and in the work organisation on board and the manning to allow and guarantee the undertaking of on-board activities in optimal conditions.

All regular coastal navigation lines have a common denominator – complying with the set schedule and number of voyages – which can give rise to errors due to haste and routine work. Any delay in port results in an accumulation of delays in the rest, prolonging the working day. Some of these lines operate high speed ships, a type that requires greater concentration due to the speed of its manoeuvres.

A study made in 2012<sup>39</sup> relates time pressures with fatigue and accidents in coastal navigation ships of regular lines, stating that time pressures arising from commercial pressures imposed by the company to meet schedules and prevent delays, among others, result in higher navigation and manoeuvring speeds up to dangerous values, as well as cutting safe navigation distances.

The erroneous decision to cut distances increases the risks to the safety of the ship which, in an emergency, will not have sufficient time and space for a manoeuvre that avoids disaster<sup>40</sup>.

One example of this problem is the accident to the container ship *Rena*, which ran aground on the coast of New Zealand in October 2011 after making a series of «cuts» to the initial navigation plan to meet its scheduled port entry time.

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38) Fuentes, P. and Couvillion, W. (2004): «The Economics of Increasing Speed in Sea Transportation: The Case for the Southern U.S., Mexico, Central America and the Caribbean». *Journal of Food Distribution Research*, 35(1): 93-99.

39) Bouzón, R., de la Campa, R., Costa, A. and Romero, J. (2012): «Fatigue and time constraints in regular-line short sea shipping: safety management code application and limitations». *Proceedings of Maritime Transport V*, 1188- 1200. Barcelona.

40) Schröder-Hinrichs, J.U., Hollnagel, E. and Baldauf, M. (2012): «From the Titanic to Costa Concordia - a century of lessons not learned». *WMU Journal of Maritime Affairs*, 11: 151-167.

Also the possibility of a shore visit while the ship is moored is important for maintaining seafarers' physical and mental well-being. Today, the periods in port have been reduced drastically, making this possibility difficult or impossible, with approximately 80% of ships remaining in port for less than 24 hours<sup>41</sup>.

As well as the short stays in port, the lack of transport to cities and the restrictions of the port authorities are two of the main reasons that prevent seafarers from enjoying shore leave<sup>42</sup>.

### 3.2.3 Training

Despite the minimum training standards set in the STCW Convention, crew members come from different cultures with different languages and different maritime traditions. This gives rise to differences in the interpretation of international directives and inconsistent standards of training and education so that there are still reports of crews with low training standards<sup>43</sup>.

We must also remember that worker training must not be limited to that acquired in training centres before embarking but that it must be kept updated according to progress in technology. This continued training responsibility must be shared between the ship owner and the crew member, firstly for obvious safety questions and secondly for questions of professionalism.

### 3.2.4 Communication

The globalisation of maritime commerce involves contact between persons of very diverse nationalities with different languages and cultures who must work efficiently in a complex medium.

Communication is closely related to safety. There are broadly documented cases in which communication difficulties on board triggered an accident or helped to make later search and rescue operations difficult, such as happened during the fire on the ferry *Scandinavian Star* and the groundings of the *Royal Majestic* and the *Sea Empress*<sup>44</sup>.

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41) Von Dreele, J. (2008): «The human element in shipping: a maritime chaplain's perspective». *Proceedings of API Conference*, San Diego.

42) Kahveci, E. (2007): *Port based welfare services for seafarers*. Seafarers International Research Centre. Cardiff University.

43) Lloyd, M. (2006): «Why ships really collide». *Seaways*, October 2006: 10-12.

The Nautical Institute (ed) (2005): *The International Maritime Human Element Bulletin*, number 6. Accessible at [<http://www.he-alert.org>].

44) Pyne, R. (2006): «Investigating accidents in the maritime domain - the influence of crew interaction

Today, more than three quarters of ships are operated by mixed crews<sup>45</sup>. This factor requires the setting up of a common working language to operate the ship safely, and all crew members must know this language and be able to use it.

Regarding interactions between ships all between these and shore services, English has become the communications medium at sea so that the entire operation of the international maritime industry, safety at sea and the protection of the environment depends in many aspects on the level of knowledge and use of that language.

But the barriers that make communication on board difficult are not only linguistic in the oral context but they are also found in the written context, cultural barriers, occupational barriers or those depending on the style of command on board and technical or technological barriers arising from the difficulties of using communications equipment, especially VHF.

One problem that is increasingly common on board is related to the way in which the technical manuals are prepared – unreliable translations that lack clarity of reading, do not cover the real needs of the end user, have an excessively generic content or simply are prepared in a language other than the working language of the crew<sup>46</sup>.

Another problem that affects communication is the increasing use of technologically advanced communication systems such as the cell phone and e-mail. Although these allow a more fluid communication between the ship and its company on shore at minimal cost, they can also take up and overload the captain and other crew members responsible for these tasks if a rational use of them is not established<sup>47</sup>.

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Short, V. (2006): «Maritime English valuing a common language». *Nautical Briefing*. The Nautical Institute.  
Rashed, S. and Kamal, A. (2010):»Maritime English holds a great stake in both the safety and security of merchant vessels». *Proceedings of International Maritime English Conference, IMEC 22*, Alexandria: 208-219.

Okon Joe, J. (2010): «Cross-cultural communication issues on board». *Proceedings of International Maritime English Conference, IMEC 22*, Alexandria: 248-261.

45) Squire, D. (2006): «The human element- the importance of effective communication». *Proceedings of Maritime Communications & Technology Conference*, London. Accessible at [<http://www.he-alert.org>].  
Trenkner, P. (2007): «The IMO Standard Marine Communication Phrases- a communicative survival kit». *The International Maritime Human Element Bulletin*, 14:3.

46) Squire, D. (2006): «The human element - the importance of effective communication». *Proceedings of Maritime Communications & Technology Conference*, London. Accessible at [<http://www.he-alert.org>].  
The Nautical Institute (ed) (2007): *The International Maritime Human Element Bulletin*, number 14. Accessible at [<http://www.he-alert.org>].

Rashed, S. and Kamal, A. (2010):»Maritime English holds a great stake in both the safety and security of merchant vessels». *Proceedings of International Maritime English Conference, IMEC 22*, Alexandria: 208-219.

47) Prasad, K. (2010): «Communication and Human Element in shipping commerce- notes from a

In recent years, an increase has been seen in the need to understand the relationship between cultural aspects and communication to suitably manage these factors and reduce the safety problems of multicultural crews. Communication is without doubt an integral part of any culture so that understanding the concept of culture prepares seafarers for intercultural communication and cross-cultural management on board<sup>48</sup>. Factors such as the distance of power and individualism/collectivism that are purely cultural factors, have an impact on the style of command and teamwork and thus communications between workers on different levels and even on the same level<sup>49</sup>.

Some of the difficulties associated with cultural differences that degrade communication are the lack of knowledge of social customs of other nations, lack of understanding of intentions, attitudes and actions, erroneous interpretation of body language and the tendency to stereotype the other's behaviour according to their nationality<sup>50</sup>. At the group level, this generates misunderstandings and conflicts that deteriorate the relationship between workers, leading to failure when carrying out tasks, lack of loyalty, teamwork problems, problems in the flow of information and failures in social interaction and, at the individual level, causing suspicion and social isolation<sup>51</sup>.

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shipbroker». Accessible at [<http://www.he-alert.org>].

Squire, D. (2006): «The human element- the importance of effective communication». *Proceedings of Maritime Communications & Technology Conference*, London. Accessible at [<http://www.he-alert.org>].

48) Chirea-Ungureanu, C. and Georgescu, M. (2009): «Managing cultural diversity». *Proceedings of International Maritime English Conference, IMEC 21, Szczecin*: 49-56.

49) Oleneva, T. (2010): «The key role of values for communication in multilingual crews». *Proceedings of International Maritime English Conference, IMEC 22, Alexandria*: 262-273.

Sampson, H. and Zhao, M. (2003): «Multilingual crews: communication and the operation of ships». *World Englishes*, 22(1): 31-43.

Culic-Viskota, A. and Bielic, T. (2007): «Cultural and linguistic differences as factors of ineffective communication». *Proceedings of International Maritime English Conference, IMEC 19, Rotterdam*. Accessible at [<http://home.planet.nl>].

50) Wang, Y.Q. and Gu, P. (2005): «Reducing intercultural communication barriers between seafarers with different cultural backgrounds». *Proceedings of the 6<sup>th</sup> Annual General Assembly of the International Association of Maritime Universities*, Malmö: 121-124.

Wang, Y. and Shi, C. (2008): «Culture matters: how Chinese culture shapes and influences communication of shines seafarers». *International maritime English conference, IMEC 20, Shanghai*. Accessible at [<http://home.planet.nl>].

Chirea-Ungureanu, C. (2010): People interACT! On board intercultural communication: the must-have of education». In Vangehuchten, L., Van Parys, W. and Noble, A. (eds). *Communication for maritime purposes: an international and interdisciplinary issue*, 87-99.

Culic-Viskota, A. and Bielic, T. (2007): «Cultural and linguistic differences as factors of ineffective communication». *Proceedings of International Maritime English Conference, IMEC 19, Rotterdam*. Accessible at [<http://home.planet.nl>].

51) Wang, Y. and Fu, Y. (2007): «Language Barriers in Maritime Communication and Countermeasures in Teaching». *Proceedings of International Maritime English Conference, IMEC 19, Rotterdam*. Accessible at [<http://home.planet.nl>].

Wang, Y. and Shi, C. (2008): «Culture matters: how Chinese culture shapes and influences

However, it must not be forgotten that culture explains one part of individual behaviour and that communication problems can also be related to the position in the occupational hierarchy, age, personality and gender, among others<sup>52</sup>.

Finally, it should be noted that communication, linguistic and cultural problems have negative effects not only on the operation of the ship but also on the social life on board.

### 3.2.5 Command style and teamwork

The concepts of communication, leadership and teamwork are closely related and the way in which they are managed on board may depend on both cultural questions and the operational practices set by the company.

Safety in operations on board depends greatly on the leadership capability of senior officers<sup>53</sup>. The behaviour of persons within an organisation is strongly influenced by the daily behaviour of the leaders more than by their verbal approaches.

On board, the role of leader falls undoubtedly to the captain who, as the direct representative of the shipping company, has the duty and responsibility to manage the ship as well as the authority to maintain order and discipline among the crew members. The captain's authority may be defined from two points of view<sup>54</sup>. On the one hand there is the formal influence based on status on board and on the other, an influence based on knowledge, experience and ability to organise work. Putting authority into practice requires a command or management style and this in turn will depend on the ship's organisational structure and on the nationality of the crew members. The command style may vary from a rigid and authoritarian approach where the captain's criterion cannot be questioned to a flexible management style which takes into account the different cultures of the crew members and encourages collaboration and teamwork.

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communication of shines seafarers». *International maritime English conference, IMEC 20*, Shanghai. Accessible at [<http://home.planet.nl>].

Rashed, S. and Kamal, A. (2010): «Maritime English holds a great stake in both the safety and security of merchant vessels». *Proceedings of International Maritime English Conference, IMEC 22*, Alexandria: 208-219.

52) Chirea-Ungureanu, C. (2010): People interACT! On board intercultural communication: the must-have of education». In Vangehuchten, L., Van Parys, W. and Noble, A. (eds). *Communication for maritime purposes: an international and interdisciplinary issue*, 87-99.

53) Little, A. (2004): *Driving safety culture: identification of leadership qualities for effective safety management*. Maritime and Coastguard Agency.

54) Culic-Viskota, A. and Bielic, T. (2007): «Cultural and linguistic differences as factors of ineffective communication». *Proceedings of International Maritime English Conference, IMEC 19*, Rotterdam. Accessible at [<http://home.planet.nl>].

From practical and legal point of view, the captain must lead his team and ensure that the ship is seaworthy at all times<sup>55</sup>. He must make sure that his officers navigate and operate the ship safely according to best maritime practice. This requires a series of skills that must be part of officers' training. In fact several authors demand the need for more extensive and complete training both in the development of leadership skills and teamwork and on board resources management<sup>56</sup>.

### 3.2.6 Level of automation

It is obvious that we live in the era of technological revolution that provides maritime transport with new instruments offering more precise and complete information on the conditions in which it is carried out. However, the implementation on board of these new technology systems is a double-edged sword. The initial proposal of on-board automation is to reduce human error and workload and increase efficiency but its effects may be the opposite when its introduction obeys the wish of the ship owner to reduce costs and manning levels<sup>57</sup>.

The introduction of new technology systems and automation has changed the form of human interaction with machines, resulting in the appearance of new risks to maritime safety which have repeatedly been the cause of major maritime accidents<sup>58</sup>.

The negative effects introduced by automation on board are mainly<sup>59</sup> the change in

55) Wake, P. (2004): «The master's leadership role in the safety culture. A training need». *Proceedings of the UK MCA Human Factors Seminar*. Accessible at [<http://www.he-alert.org>].

56) Hetherington, C., Flin, R. and Mearns, K. (2006): «Safety in shipping: the human element». *Journal of Safety Research*, 37: 401-411.

Deboo, K.N. (2004): Bridge Resource Management. Accessible at [<http://www.he-alert.org>].

57) Lützhöft, M.H. and Dekker, W.A. (2002): «On your watch: automation on the bridge». *Journal of Navigation*, 55 (1). 83-96.

The Nautical Institute (ed) (2007): *The International Maritime Human Element Bulletin*, 15. Accessible at [<http://www.he-alert.org>].

59) Ziarati, R. and Ziarati, M. (2011): «Review of accidents with special references to vessels with automated systems – a way forward». Accessible at [<http://marifuture.info>]. Lützhöft, M.H. and Dekker, W.A. (2002): «On your watch: automation on the bridge». *Journal of Navigation*, 55 (1). 83-96.

Lützhöft, M.H. and Dekker, W.A. (2002): «On your watch: automation on the bridge». *Journal of Navigation*, 55 (1). 83-96.

Pomeroy, R.V. and Sherwood, B.M. (2002): «Managing the human element in modern ship design and operation». *Proceedings of Human Factors in Ship Design and Operation Conference*. Royal Institution of Naval Architects, London.

59) Schager, B. (2008): «When technology leads us astray: a broadened view of human error». *Journal of Navigation*, 61(1): 63-70.

The Nautical Institute (ed) (2007): *The International Maritime Human Element Bulletin*, 15. Accessible at [<http://www.he-alert.org>].

Sauer, J., Wastell, D., Robert, G., Hockey, J., Crawshaw, C., Ishak, M. and Downing, J. (2002): «Effects of display design on performance in a simulated ship navigation environment». *Ergonomics*, 45(5): 329-347

the role of the officer, who changes from being an operator to carrying out monitoring tasks, the distraction and confusion generated by an excess of alarms, excessive confidence given to the results shown by the systems and in the actions suggested by them, the polarising of the workload, the introduction of integrated electronic systems that increase workload and fatigue, a feeling of lack of control by the operator as well as a loss in the set of data obtained that is determined by the system itself.

The advantages and limitations of these systems must be clearly established through training on their functioning. Also it is necessary to understand that these are systems that help and complement the perception of the situation determined by the human eye and the application of best maritime practices and that in no case do they replace the capacity for decision based on knowledge and experience, that must remain with the officer of the watch<sup>60</sup>.

### 3.2.7 Captain's authority and responsibility

The criminalization of seafarers is a trend that has increased in the last 30 years, due to the captain's increasing legal responsibility. Various recent examples can be mentioned in which coastal states have used their criminal laws to arrest and imprison seafarers involved in maritime accidents resulting in pollution such as the cases of the *Erika*, the *Prestige* and the *Tasman Spirit*. In many of these cases, the seafarers had no direct control over the accident management and appear to have been used as «scapegoats» for political or public opinion reasons<sup>61</sup>.

During this period, the structure of maritime commerce has changed drastically but, paradoxically, the person with the least ability to influence these changes has been the captain who has seen how the main features of his relationship with the ship's operator have become increasingly blurred<sup>62</sup>. The captain continues to have maximum responsibility for the safety of the ship, the crew and its cargo but without the necessary authority for management in matters relating to the ship's operation. Captains today can contact their ship owners or managers almost instantaneously but this is not necessary beneficial to them since the ship owners or managers thus acquire the opportunity to intervene in decisions on the ship's operation or safety, giving priority

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Mills, S. (2006): «Integrated marine electronic systems-some user associated issues for the designer». *Journal of Navigation*, 59(3): 423-433.

Lützhöft, M.H. and Dekker, W.A. (2002): «On your watch: automation on the bridge». *Journal of Navigation*, 55(1). 83-96.

60) Schröder-Hinrichs, J.U., Hollnagel, E. and Baldauf, M. (2012): «From the Titanic to Costa Concordia-a century of lessons not learned». *WMU Journal of Maritime Affairs*, 11: 151-167.

61) Gold, E. (2005): «The fair treatment of seafarers». *WMU Journal of Maritime Affairs*, 4(2): 129-130.

62) International Maritime Organisation (2012): *Guidelines on fair treatment of seafarers in the event of a maritime accident*. Accessible at [<http://www.imo.org>].

to commercial interests, when these decisions must be taken genuinely by the captain<sup>63</sup>.

Captains and officers assume immense responsibility for protecting the life of the crew, the cargo and the environment from the limitations imposed by the current system of maritime transport with reduced crews, short and frenetic work periods in port, overload of bureaucratic work, etc, which does not give them a complete and detailed review of the state of the ship nor guarantees of its seaworthiness and even less, in taking decisions giving priority to safety over economy. Because of this, the maritime industry and all the organisations interested in maritime commerce must take great care with how these seafarers are treated and with the image which, in a maritime accident, is offered of the persons who operate the ships. Only in this way can crews with the best standards of training and qualifications be recruited and retained on board<sup>64</sup>.

### 3.3. The ship's condition

The ship's condition determines the features of the internal working place. Factors such as ergonomics, the state of maintenance and the environmental quality and comfort affect both the working performance of the seafarers and the quality of their rest.

#### 3.3.1 Ergonomics

The design and building of ships must take into account that they contain a high number of very different working places (the bridge, the engine room, the holds, the galley, etc) but that at the same time, the ship is also a home for those working on board. Likewise, taking into account the close relationship between the human factor and maritime safety, it is to be expected that ships be designed and built using ergonomic principles and data. However, ergonomic considerations must be taken into account beyond the design and building of the ship and must be applied throughout its useful life<sup>65</sup>, for example, when the activity for which it was designed changes, there are changes to the manning assigned to it or new systems or equipment are installed.

It must be accepted that both the ship owner and the builder consider the economic

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63) Gold, E. (2004): «From Privilege to Peril: the shipmaster's current legal rights and responsibilities». *WMU Journal of Maritime Affairs*, 3(1): 51-66.

64) McDonald, R. (2005): «Criminalisation in shipping». *Seaways*, March 2005: 5-7.

65) Earthy, J.V. and Sherwood Jones, B.M. (2010): Design for the human factor. The move to goal-based rules. Accessible at [<http://www.he-alert.org>].

criterion to be primary when building a ship<sup>66</sup>. However, economic criteria can be contemplated whenever minimum standards are met and the safety of the ship and its crew guaranteed. To obtain a safe ship that is operational and with a high degree of quality of habitability, it will be necessary to consider the opinions of everyone involved in its design, building and operation – naval architects, ship owner, operators and seafarers.

Naval architects must consider how to build a ship which is at the same time cheap, safe, comfortable, easy to maintain, easy to operate and environment-friendly<sup>67</sup>. Unfortunately, ergonomic questions have not been regularly taken into account in the design of ships so that currently knowledge and appreciation of the implications of the human element on board are very limited among naval architects and inspectors<sup>68</sup>.

The design and operation of the ship must be more focused on the end user<sup>69</sup>, taking into account the complex and dynamic situation of the maritime industry where the operational context, the seafarer's profile and the design of the equipment are in constant change and it is not obvious that all these independent changes are compatible.

It must be remembered that a human operator working on a moving platform may find his or her capabilities degraded in many ways either at the physical level (difficulties to maintain a static posture, difficulties to walk and carry out operational and maintenance tasks that require physical movement) or at the cognitive level (difficulty with attention, perception, memory and decision making)<sup>70</sup>. But also, in the case of ships and taking into account their function as a place of rest, poor ergonomic conditions may degrade the quality of the workers' rest, increasing their levels of fatigue and stress.

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66) Tham, K.S. (2004): «The case for a decent design». *The International Maritime Human Element Bulletin*, 3: 3

67) Rasmussen, J. (2005): «Designing usable ships». *Proceedings of Human Factors in Ship Design and Operation*. Royal Institution of Naval Architects, London.

68) Walker, O. (2011): «The human element competency required for design appraisal». *Proceedings of Human factors in ship design and operation conference*. The Royal Institution of Naval Architects.

69) Earthy, J.V. and Sherwood Jones, B.M. (2010): Design for the human factor. The move to goal-based rules. Accessible at [<http://www.he-alert.org>].

70) Dobie, T. (2002): «The importance of the human element in ship design». *UNOLS Research Vessel Operators' Committee Meeting*. Accessible at [<http://www.unols.org>].

Osterman, C., Rose, L. and Osvalder, A.L. (2010): «Exploring maritime ergonomics from a bottom line perspective». *WMU Journal of Maritime Affairs*, 9(2): 153-168.

### 3.3.2 Environmental quality and comfort

The environmental quality and comfort on board are determined by factors such as temperature, humidity, vibration, noise, lighting and the presence of harmful particles in the air. The level that may be reached on board for each of these parameters will depend on the ship's design itself and on the particular working or living space. Thus engine rooms usually have the worst environmental conditions, normally with high levels of temperature and humidity, noise and vibration levels above those established as comfortable, poor lighting and air polluted with smoke and gases. The living spaces, on the other hand, are usually those with the best environmental quality and comfort since they are designed, among other things, for physical and mental recovery and rest.

Of all these factors, noise is perhaps the most problematic and also the most studied. Noise makes concentration and communication difficult, negatively affects monitoring and the performance of work, may cancel out or hide other noises relating to safety such as alarms and prevent suitable rest, favouring the appearance of fatigue<sup>71</sup>. Noise is also the main cause of hearing loss, a major occupational illness among engine room workers. On the other hand, rest periods on board are not sufficiently long to allow optimal hearing recovery since the rest areas are also affected by more or less important noise levels, depending on their location<sup>72</sup>.

Regarding the exposure of seafarers to vibration, its propagation through the decks and bulkheads exposes crew members to total body vibration. The effect of vibration on the health of the seafarer, which depends on the exposure time and their frequency, may range from simple discomfort to bone degeneration, passing through fainting, abdominal and digestive problems, cardiovascular, respiratory, metabolic, motor, posture and visual disorders, back problems and musculoskeletal damage<sup>73</sup>. In the

71) International Maritime Organisation (1981): Res. A. 468 (XII) *Code on noise levels on board ships*.  
Dobie, T. (2003): «Critical significance of human factors in ship design». *Proceedings of 2003 RVOV Meeting*. Accessible at [<http://www.unols.org>].

Picard, M., Girard, S., Simard, M. and Larocque, R. (2008): «Association of work-related accidents with noise exposure in the workplace and noise-induced hearing loss based on the experience of some 240,000 person-years of observation». *Accident Analysis and Prevention*, 40: 1644-1652

Kurt, R.E. and Turan, O. (2011): «Effect of noise on human performance on board ships». *Proceedings of Human Factors in Ship Design and Operation Conference*. The Royal Institution of Naval Architects.

72) Louro, J., de la Campa, R. and Vazquez, P. (2011): «Legal gaps relating to labour safety and health in the maritime transport sector in Spain». *International Maritime Health*, 62(2): 91-97.

Ellis, N. (2009): «Vessel design and the wellbeing of seafarers». *SIRC Symposium*, Cardiff University, 75-90.

73) Paschold, H. and Sergeev, A. (2009): «Whole-body vibration knowledge survey of U.S. occupational safety and health professionals». *Journal of Safety Research*, 40: 171-176.

Calhoun, S.R. (1999): Human factors in ship design: preventing and reducing shipboard operator fatigue. Accessible at [<http://www.ardujenski.com>].

work environment, exposure to vibrations can cause interruptions in undertaking tasks, decreased levels of work performance, visual problems and problems interpreting data, mainly on screens, fatigue and a tendency to accidents<sup>74</sup>.

Exposure to extremely high temperatures is known as thermal stress. An unsuitable thermal atmosphere causes reduced physical and mental performance, irritability, increased aggressiveness, distractions and errors, variations in the cardiac rhythm and can sometimes end in death<sup>75</sup>.

To date, there is little literature on the effects of lighting levels and the quality of interior air on seafarers' health and safety. It should be noted with regard to lighting levels that light maintains the rhythm of the human biological clock<sup>76</sup> which directly regulates the circadian rhythm. The human body needs exposure to natural light to maintain an appropriate circadian cycle and the questions of well-being and health. However, many crew members spend a large part of their working day, if not all of it, in artificial electrical light. An inadequate artificial lighting system contributes to high fatigue, increases error levels, reduces reaction times, reduces levels of alertness and deteriorates the frame of mind.

In the case of officers and sailors carrying out navigation watches on the bridge at night, adaptation to darkness is a factor of vital importance that depends on the level of lighting inside and outside the bridge and on atmospheric conditions, among others<sup>77</sup>.

Other factors that also affect the well-being and behaviour of seafarers are aesthetics and confinement<sup>78</sup>.

### 3.3.3 Preventive maintenance

Two of the main consequences arising from the current world financial crisis that affect maritime transport and that have a direct impact on the operational safety of

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74) Dobie, T. (2003): «Critical significance of human factors in ship design». *Proceedings of 2003 RVOV Meeting*. Accessible at [<http://www.unols.org>].

75) Orosa, J.A., Santos, R. and Pérez, J.A. (2011): «A practical case study of the relationship between work risk prevention and fatigue at work in Spanish merchant ships». *Human factors and ergonomics in manufacturing & service industries*, 00(0):1-9.

76) Calhoun, S.R. (1999): Human factors in ship design: preventing and reducing shipboard operator fatigue. Accessible at [<http://www.ardujenski.com>].

77) Wynn, T., Howarth, P. and Kunze, B. (2012): «Night time lookout duty: the role of ambient light levels and dark adaptation». *Journal of Navigation*, 65(4): 589-602.

78) Ellis, N. (2009): «Vessel design and the wellbeing of seafarers». *SIRC Symposium*, Cardiff University, 75-90.

ships are the delaying of maintenance and repair programmes and the reduction in manning. The manning reduction also has a direct effect on the effective undertaking of maintenance programmes on board since a ship that sails with a reduced crew according to the minimum set by law must prioritise between keeping the ship operational or carrying out maintenance tasks which, although necessary, are not urgent<sup>79</sup>.

Preventive maintenance plays a priority role in the management of a ship directly related to its safety and that of its crew and cargo. For example, a study by the Japan International Cooperation Agency<sup>80</sup> concludes that most fires on ships start in the engine room and are often caused by a lack of suitable maintenance. The lack of suitable maintenance is also one of the main causes of structural failure<sup>81</sup>. Likewise, a ship on which suitable and effective maintenance is not carried out will suffer deterioration to its hull and equipment in the short term that could lead to the collapse of its commercial viability.

The typical elements of maritime transport that harm the effective undertaking of preventive maintenance include coastal navigation with limited sailing times that make it difficult to plan and carry out maintenance tasks under way, short stays in port that do not allow time for carrying out complex maintenance tasks with the ship stopped and reduced crews with scarcely sufficient personnel for the proper operation of the ship and clearly insufficient for the effective undertaking of maintenance tasks.

### 3.4. Conditions of life on board and employment conditions

While in more traditional work posts the psychosocial risks are limited to the place and time of work, in the case of on-board work this concept must be enlarged since during sailing, seafarers work and live in the same confined space and therefore the amount and quality of their rest, this being understood as the time spent sleeping and at leisure, and the amount and quality of their interpersonal relationships at the social level affect their physical and psychological health and therefore affect their working performance.

The contracting conditions also have a great influence on seafarers' health and well-

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79) De la Campa, R.; Bouza, MA.; Louro, J. and Vázquez, P. (2011): «La gestión del mantenimiento preventivo como herramienta para la mejora de la seguridad laboral a bordo: casos prácticos». *Medicina Marítima*, 11(2): 155-160.

80) Anderson, P. (ed) (2007). Maintenance and ISM. *Report ISM*, n 6, p 5. Accessible at [<http://www.consultism.co.uk>].

81) Kim, T. (2005): «Human factors and regulatory regime in design and construction of safe and robust ships and maintaining them for their lifetime». *Proceedings of Human Factors in Ship Design and Operation*. Royal Institution of Naval Architects, London.

being. The duration of voyages and holiday periods, the payment level, the stability of employment and the social benefits offered by the shipping company partly determine the workers' level of satisfaction with work on board and loyalty to the employer.

### 3.4.1 Interpersonal relationships

The working organisation on board is based on a hierarchical distribution of tasks and responsibilities. This hierarchical structure exceeds the employment plane and also determines the relationships at the social level, greatly helped by the distribution of the communal and private spaces on board for leisure and rest<sup>82</sup>. Thus, generally, cabins and communal spaces for officers occupy the upper decks of the accommodation while the cabins and communal spaces for lower ranks occupy lower decks in that space. This separation of spaces according to levels of responsibility makes physical interaction between officers and lower ranks difficult, making social interaction between crew members of different ranks infrequent.

Today, interpersonal relationships at the social level are subject to two conditions typical of current maritime commerce, the reduction of manning and the formation of multilingual and multicultural crews.

Regarding the implications of language problems and social life, easy communication with other crew members is a necessity for the worker, comparable to matters such as having a place of rest and suitable food<sup>83</sup>.

The International Maritime Organisation recognises this circumstance and places on-board communication as one of the factors present in the environment of a ship that could contribute to unfavourable psychological behaviour<sup>84</sup>.

Unfortunately, the social side of on-board interaction is a topic frequently neglected by the institutions and organisations related to health and safety despite social interaction being critical to maintaining high morale on board, a factor related to the

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82) Acejo, I. (2009): «Transnational crews and their ways of belongingness». *Proceeding of the International Conference on Migration, Citizenship and Intercultural Relations*, Burwood. Accessible at [<http://www.deakin.edu.au>].

Acejo, I. (2012): «Seafarers and Transnationalism: Ways of Belongingness Ashore and Aboard». *Journal of Intercultural Studies*, 33(1): 69-84.

Kahveci, E., Lane, T. and Sampson, H. (2001): *Transnational Seafarer Communities*. Seafarers International Research Centre. Cardiff University

83) Rodriguez-Martos, R. (2000): «The importance of special training in leadership for captains and officers for a safe navigation and preservation of the environment». *Proceedings of 2nd International Congress on Maritime Technological Innovations and Research*. Cádiz: 999-1006.

84) International Maritime Organisation (ed.) (2000): *Curso Modelo 1.14 Primeros Auxilios Sanitarios*

safety of the ship's operation<sup>85</sup>.

The formation of multicultural crews is not a new phenomenon but has become a normal practice adopted by maritime managers to reduce the operating costs of their ships<sup>86</sup>. One of the many obstacles that the 21st-century seafarer must face is the need to manage the different cultures on board<sup>87</sup>. Cultural awareness implies not only understanding and accepting the more evident cultural differences such as customs of religion, clothing or food but also understanding certain cultural values that have a great influence on the behaviour of individuals such as individualism/collectivism, family values, the attitude towards time and interpersonal space<sup>88</sup>.

Manning reduction increases working hours and means that crew members not on watch or working on transverse tasks are sleeping. Thus social relationships are few and group activities impossible. The trend for the continuous rotation of crews prevents the establishing and maintaining of friendship relationships on board. Given that social relationships are important for emotional and physical health, these recruiting practices lead to the social isolation of crew members and high levels of stress that have been associated with the high level of suicides on board<sup>89</sup>.

### 3.4.2 Communication with the exterior

As well as possibilities for social communication on board, seafarers need the opportunity to communicate with their relatives<sup>90</sup>. Regular contact with family and friends is fundamental for maintaining effective relationships and for not losing the connection with life ashore<sup>91</sup>. In delicate circumstances in life, the impossibility of communicating with the exterior aggravates the seafarer's isolation and may lead to great stress.

85) Kahveci, E. and Sampson, H. (2001): «Findings from the shipboard based study of mixed nationality crews». *SIRC Symposium*. Cardiff: Cardiff University: 39-60.

86) Progoulaki, M. and Roe, M. (2011): «Dealing with multicultural human resources in a socially responsible manner: focus on the maritime industry». *WMU Journal of Maritime Affairs*, 10: 7-23  
Kahveci, E., Lane, T. and Sampson, H. (2001): *Transnational seafarer communities*. Seafarers International Research Centre. Cardiff University.

87) Benton, G. (2005): «Multicultural crews and the culture of globalisation». *Proceedings of the 6<sup>th</sup> Annual General Assembly of the International Association of Maritime Universities*, Malmö: 125-128.

88) Oleneva, T. (2010): «The key role of values for communication in multilingual crews». *Proceedings of International Maritime English Conference, IMEC 22, Alexandria*: 262-273.

89) Thomas, M. (2003): *Lost at sea and lost at home: the predicament of seafaring families*. Seafarers International Research Centre. Cardiff University.

90) Squire, D. (2006): «The human element- the importance of effective communication». *Proceedings of Maritime Communications & Technology Conference*, London. Accessible at [<http://www.he-alert.org>].

91) Lee, P.J., Shim, M.H. and Jeon, J.Y. (2010): «Effects of different noise combinations on sleep, as assessed by a general questionnaire». *Applied Acoustics*, 71: 870-875.

It is the task of the ship owner to provide appropriate means on board for communicating with the exterior and to guarantee the possibility that, once in port, the crew members have the opportunity to access communication means on shore that allow them to maintain contact with their family and friends.

Access to communications services on land is in turn limited by the time spent in port and the availability of transport means to travel to cities or centres with telephone boxes.

### 3.4.3 The well-being of seafarers: facilities for leisure and rest

Outside of watch hours, crew members have no possibility of taking a long walk, going shopping, taking a coffee in a nearby bar or going to the cinema or gym but must be content with the scarce activities they can carry out within their cabins or in the limited communal spaces such as the galley, the dayroom or the office. Some ships –the larger ones– may have small spaces equipped with some sports equipment or a small cinema; it is very infrequent that there is sufficient space to organise a football game or take a ride on a bicycle.

The size and comfort of the private and communal spaces for leisure and rest are therefore of vital importance and must offer seafarers the opportunity to relax, rest and have a social life that allows them to disconnect from work and enjoy a healthy lifestyle.

Giving ships a suitable comfortable living area as well as galleys, dayrooms and spaces for leisure, taking into account variations in size, shape and gender of seafarers and the various environmental stressors is important for maintaining suitable levels of physical and mental health among crew members, reducing the possibilities of the appearance of fatigue and human error and increasing morale, comfort and the general quality of life on board<sup>92</sup>.

Under this criterion, some classification societies such as ABS<sup>93</sup> have prepared and published guides for accommodation on ships, emphasising the negative effects of a bad design of accommodation spaces and the ship owner's responsibility for taking these aspects into account.

The design of the ship must avoid the sensation of confinement and claustrophobia

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92) The Nautical Institute (eds) (2008): *The International Maritime Human Element Bulletin*, number 18. Accessible at [<http://www.he-alert.org>].

ABS (eds) (2012): *Guide for crew habitability on ships*. Accessible at [<http://www.eagle.org>].

93) Vázquez, P., de la Campa, R. and Bouza, M.A. (2010): «Efectos del estrés térmico por calor en la salud de los marinos». *Medicina Marítima* 10(1): 12-13.

to which today's ships tend, giving greater emphasis on providing spaces for work, leisure and rest on board with a more humanised design<sup>94</sup>.

The classification society RINA has also introduced a voluntary notation that will help ship owners to comply with the new international standards for crew accommodation set in the 2006 ILO Maritime Labour Convention<sup>95</sup>.

However, and despite the recognition of the importance of giving ships high-quality accommodation, standards vary considerably from ship to ship. Thus, for example, the ships managed by companies in northern Europe, Japan, the Republic of Korea and the United States tend to have higher accommodation standards<sup>96</sup>. The age of the ship is not necessarily related to the quality of accommodation since cases have been noted of new ships with defects in soundproofing, built with less robust materials or that suffer continuous vibration. Ferries, cruise ships and bulk carriers usually have the worst standards of crew accommodation.

#### 3.4.4 Employment conditions

Good employment conditions are crucial so that the maritime industry has a facility for recruiting and retaining competent and well-qualified seafarers. Spending several months on board has its disadvantages so that generous holidays and good payment and employment conditions provide a compensation that may encourage workers towards a career at sea.

In its publication *Guidelines on good employment practice*, the International Shipping Federation describes a series of conditions that are the responsibility of the shipping company or shipping managers who contract personnel, including:

- Establishing and complying with the employment contract within the conditions regulated internationally.
- Covering the costs of repatriating crew members at the end of the voyage.
- Ensuring that rest hours are complied with as legally established.
- Setting up complaint procedures for crew members.
- Setting company policies against discrimination and abuse.

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94) Khodayari, S. (2012): Claustrophobia and new ship design. Accessible at [<http://general.marine-files.net>].

95) International Labour Organization (2006): *Maritime Labour Convention*.

96) Alderton, T., Bloor, M., Kahveci, E., Lane, T., Sampson, H., Thomas, M., Winchester, N., Wu, B. and Zhao, M. (2004): *The Global Seafarer: Living and working conditions in a globalized industry*. International Labour Office. Geneva.

- Ensuring the health, safety and well-being of crew members.
- Covering the costs arising from sudden illness or accident suffered during the voyage.
- Offering financial compensation in the case of death or disability arising during the voyage.
- Setting company accident prevention policies.
- Equipping the ship with installations for well-being and leisure as well as providing communications with the exterior and the possibility of visiting the shore while the ship is moored.

Many of these conditions are today subject to the nationality of the crew members.

### 3.5. Environment and external influences

Among the psychosocial factors, these are the most difficult to manage since in almost all of them, control escapes the possibilities of the maritime managers who can only set up measures designed to palliate their negative effects on the professional performance and health of the crew members.

#### 3.5.1 Weather conditions

The ship is a floating platform and as such is subject to the conditions of the movement of the sea, the wind and the currents affecting it at any time. Although it is not feasible to control weather conditions to facilitate work on board, it is pertinent that, during the ship's design phase, all necessary measures are taken to give it the greatest possible stability in bad conditions<sup>97</sup> and even, to a certain point, take into account the usual weather conditions on the route to which the ship is destined to give it mechanisms that allow working and living on board in the most comfortable conditions as far as possible.

Despite all this, the ship moves and not everyone has the same physical and physiological tolerance to such movements. At the organisational level, the ship's movements limit the capacity of the crew members to carry out command, control, communication, navigation and maintenance activities<sup>98</sup>. At the physical level, the ship's movements can generate a wide variety of inconveniences such as the increased energy needed to carry out work activities or increased levels of fatigue

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97) Riola, J.M. and García de Arboleya, M. (2006): «Habitability and personal space in seakeeping behaviour». *Journal of Maritime Research*, 3(1): 41-54.

98) Stevens, S and Parsons, M. (2002): «Effects of motion at sea on crew performance: a survey». *Marine Technology*, 39(1): 29-47.

and somnolence, the most common and well known effect being seasickness.

As well as feeling physically ill to a greater or lesser extent, crew members suffering from seasickness suffer from demotivation and apathy so that their capacity to work in safe conditions is reduced and their responsibilities must be assigned to other crew members who must face the work overload in physically adverse conditions.

The ship's movements may have other effects on the crew's capability to carry out their activities which are perhaps not so obvious as seasickness<sup>99</sup> such as, for example, the loss of posture control which could result in a fall and interference with fine motor abilities that makes the use of manual controls difficult (keyboard, mouse, touch screen, joystick, etc.), affecting the worker's motivation and causing fatigue.

### 3.5.2 Regulation and inspection

It is unquestionable that international regulation and the setting of minimum standards relating to maritime safety and environmental protection are strictly necessary for the good operation of this industry. The design and construction of ships, the operating procedures, the training of seafarers and the protection of their employment rights are key factors that require strict regulation and control.

In recent years, to improve maritime safety, legislators have set a very high number of new regulations which in turn involve greater control and an increased administrative workload on board<sup>100</sup>.

Although, as just mentioned, these new regulations are designed to increase the safety of the maritime industry and of its workers, it seems that the effects achieved have not been as expected and the obligations imposed by these new regulations have not been well accepted by seafarers<sup>101</sup>.

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99) Dobie, T. (2003): «Critical significance of human factors in ship design». *Proceedings of 2003 RVOV Meeting*. Accessible at [<http://www.unols.org>].

100) Knudsen, F. (2009): «Paperwork at the service of safety? Workers' reluctance against written procedures exemplified by the concept of seamanship». *Safety Science*, 47: 295-303. Van Hemmen, H. (2009): «Human factors analysis and the shipboard environmental department». *Marine Technology*, 46(4): 200-210.

101) The Nautical Institute (eds) (2004): *The International Maritime Human Element Bulletin*, number 2. Accessible at [<http://www.he-alert.org>].

The Nautical Institute (eds) (2006): *The International Maritime Human Element Bulletin*, number 10. Accessible at [<http://www.he-alert.org>].

Knudsen, F. (2009): «Paperwork at the service of safety? Workers' reluctance against written procedures exemplified by the concept of seamanship». *Safety Science*, 47: 295-303.

Van Hemmen, H. (2009): «Human factors analysis and the shipboard environmental department». *Marine Technology*, 46(4): 200-210.

Lloyd, M. (2006): «Why ships really collide». *Seaways*, October 2006: 10-12.

Among the reasons for this rejection, the increased paper work and on-board bureaucracy are the most critical, mainly taking into account that this increased workload has not involved a proportional increase in the manning level, significantly increasing seafarers' fatigue and leading them to carrying out unsafe operational practices.

### 3.5.3 Transit conditions: high traffic density

Navigation in areas with a high traffic density involves extra attention and vigilance by the officers of the watch, which entails an increase in workload and in the required level of alertness. Increased traffic density in turn involves an increased risk of collision and the decisions taken by the officer of the watch to prevent a collision depend on the officer's own personal characteristics<sup>102</sup>. Generally, the decision to be taken must be based on the International Regulations for Preventing Collisions at Sea, taking into account the state of the sea, the ship's condition, the traffic situation and the manoeuvring space available. However, there are other personal factors that affect the decision to be taken – lack of knowledge of the standards, perception errors, lack of attention, failure to appreciate the limits of the navigation equipment, navigation difficulties and fatigue are some of these factors<sup>103</sup>. If the passage through highly transited waters, the possibilities of crossing traffic, concentration of fishing vessels and other usual circumstances are not planned or if there is no clear knowledge and full availability of the navigation aids, the stress level will rise dangerously. This situation is worsened in bad weather – fog, waves, wind and rain are factors that make transit through these waters exceedingly difficult.

The traffic density must also be taken into account when setting the number of persons on watch on the bridge since in these cases it is very probable that a single officer on the bridge, without the help of a look-out, cannot maintain efficient control over the traffic present at all times or be precisely aware of the presence of other dangers to navigation which could lead to taking erroneous decisions regarding the manoeuvres needed for safe navigation<sup>104</sup>. The problem of the short stays in port also aggravates

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Squire, D. (2005): «The human element in shipping». Accessible at [<http://www.he-alert.org>].

De la Campa, R., Salgado, A. and Iglesias, S. (2011): «El camino hacia la cultura de seguridad en el transporte marítimo a través de la aplicación del código IGS». *Régimen del Transporte en un Entorno Económico Incierto*, Marcial Pons: Madrid.

Kahveci, E. (2007): *Port based welfare services for seafarers*. Seafarers International Research Centre. Cardiff University.

102) Lin, B (2006): «Behaviour of ship officers in manoeuvring to prevent a collision». *Journal of Marine Science and Technology*, 14 (4): 225-230

103) Squire, D. (2003): «The hazards of navigating the Dover Strait (Pas-de-Calais) Traffic Separation Scheme». *The Journal of Navigation*, 56: 195-210.

104) MAIB (2004): *Bridge watchkeeping safety study*. Accessible at [<http://www.maib.gov.uk>].

the dangers of navigation in congested waters<sup>105</sup> since an officer who has been frantically occupied in the work of loading and unloading during the stay in port, without the possibility of resting before going on watch in a high traffic density area, will have greater difficulties for being alert, being competent and taking safe decisions during navigation.

The technological systems for aiding navigation may be of great help for reducing the risk of collision in these waters<sup>106</sup>, although it must be remembered that specific training on the use of these devices and knowledge of their limitations is necessary<sup>107</sup>. It is equally important that the design of the bridge and the layout of the electronic equipment on it facilitates the officer's work so that he has a wide arc of visibility, can approach the bridge windows and access instruments without losing exterior visibility<sup>108</sup>.

Equally, the setting up of traffic separation areas and the VTS systems allows ships to be monitored by separation devices, advising ships in difficulties during transit or manoeuvring and, therefore, reducing the risk of collision.

#### 3.5.4 Transit conditions: piracy

Piracy is perhaps the most important blot that currently affects maritime transport as well as other sectors connected with the use and enjoyment of the seas and oceans, reaching a very worrying magnitude in certain areas such as the waters off the coast of Somalia and the Gulf of Guinea.

Considering that almost a thousand seafarers suffer the physical and psychological consequences of a pirate attack each year, piracy has become one of the major worries for seafarers who must transit the affected waters.

The consequences of a pirate attack on seafarers' health start long before the attack occurs; from the moment in which they are aware of the need to transit the affected areas, their levels of anxiety and stress increase<sup>109</sup>. Physical deprivations regarding

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105) Le Pla, R.N. (1978): «Problems of navigation in high density traffic». *Journal of Navigation*, 32(2): 310-319.

106) Gattuso, D., Napoli, S. and Meduri, A.G. (2009): «Safety of the navigation in congested maritime area. The case of the Messina strait». *European Transport*, 42: 83-101.

107) Squire, D. (2003): «The hazards of navigating the Dover Strait (Pas-de-Calais) Traffic Separation Scheme». *The Journal of Navigation*, 56: 195-210.

108) Le Pla, R.N. (1978): «Problems of navigation in high density traffic». *Journal of Navigation*, 32(2): 310-319.

109) Lynge, M.L. (2012): «Sailor education and training: cutting the human cost». *2<sup>nd</sup> International Counter Piracy Conference Proceedings*. Accessible via [<http://www.counterpiracy.ae>].

food, sleep, movement, etc, and the psychological mistreatment suffered during captivity without doubt generate other physical and mental health problems such as malnutrition and post-traumatic stress that require later more or less prolonged medical attention, depending on the properties of the attack and of the victim.

Although considerable progress has been made in measures designed to prevent pirate attacks<sup>110</sup>, it is still necessary to progress in how to help both those seafarers who have suffered a pirate attack and those who are threatened with the fear of suffering one.

The scarce literature on the humanitarian response to maritime piracy notes training and information for seafarers as the main measure designed to minimise both the consequences to health of the transit through affected areas and those arising from a real attack.

The commitment of the company to the well-being of seafarers in these situations, shown in the information and the treatment received by their families in the case of kidnapping, the knowledge that the company is attending to their needs in some way and its concern to give them medical and psychological care at the end of captivity are measures that increase the workers' level of confidence with their employers, allowing them to face the situation or the possibility of this situation with lower stress levels.

#### 4. CONCLUSIONS

On-board psychosocial risks cover a very wide range of circumstances and working conditions that interact and may be susceptible to change over time or according to the company's management model and commitment to the safety of its ships and crews.

The perception and influence of psychosocial factors on seafarers may also differ for each worker since this will depend on individual characteristics, motivations, expectations, attitudes and aptitudes as well as on their prior physical and mental condition.

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Maritime Piracy- Humanitarian Response (2011): *Good Practice Guide for Shipping Companies and Manning Agents for the Humanitarian Support of Seafarers and Their Families*. Accessible via [<http://www.mphrp.org>].

110) Stevenson, D. B. (2012): «The Humanitarian Response: Seafarers Health and Welfare. Can we declare victory and go home?». *2<sup>nd</sup> International Counter Piracy Conference Proceedings*. Accessible via [<http://www.counterpiracy.ae>].



## II. Psychosocial risks of the seafarers

It is therefore very complicated to assess the influence that these factors may have on each individual but knowledge of them and of the possible interactions with work performance and the health and safety of workers overall is of incalculable value to achieve as healthy and safe a working environment as possible.

To finalise, it is necessary to remember that a ship is above all a system of persons. It is managed and crewed by men and women with real working and social needs and expectations who must work and live with persons from other nationalities, cultures, languages and religions, in a confined space for long periods of time and in almost total isolation from relatives and friends, subjected to the working pressures imposed by the shipping companies, assuming civil and sometimes penal responsibilities that go beyond the legally, ethically or morally enforceable, sometimes even putting their own safety and that of the ship at risk to the benefit of the mercantile company.

Therefore, the efficient planning of the living and working conditions on board must take into account both the characteristics of the crew members and those of the ship as well as the possible results of the interaction between both.



Many partial solutions have been proposed to the problems arising from on-board psychosocial risk factors. However, we have seen that all these problems arise from bad customary practices connected today to maritime transport and to the form in which the managers understand the maritime business. Basic questions such as the lack of experienced officers and seamen, the difficulties associated with the formation of multicultural crews, excessively reduced crews, lack of training, language difficulties and the lack of appropriate maintenance are problematic areas which are still under-regulated. The solution to these problems almost invariably involves two measures proposed as really effective – the reduction of the workload and/or the increase in the number of crew members.



Unfortunately, few maritime managers are seriously willing to assume responsibility for increasing on-board safety by putting seafarers above commercial interests and short-term financial profits.

