

8. CONCLUSIONS

This study assumes that the information currently available for the OOWs is insufficient for the correct process of decision making when involved in a critical situation of collision. To solve this problem, the paper proposes which information should be accessible for the OOWs of ships in critical situation of collision. By testing simulators, this new information allows the calculation of the RLS of each vessel and the minimum turning circle, either hard to port or hard to starboard, in periods of 10 seconds for the three cases analyzed. The results indicate that providing both vessels with a system of instantaneous representation of minimum turning circle could avoid reaching the RLS and making the correct avoidance maneuver. The results open a new research line for the development of the proposed representation system.

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HOW THE MANILA AMENDMENTS TO THE STCW CODE ENHANCE TRAINING IN MARITIME SAFETY AND SECURITY

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Abstract

This paper shows the changes that have occurred to the Manila Amendments to the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers Code (STCW 2010 Code). In the School of Maritime Engineering of the University of Cantabria with the degrees in Nautical Engineering and Maritime Transport (Deck Officers), Marine Engineering (Engine Officers) and Maritime Engineering (Naval Engineering), we have taken into consideration all these changes and have adapted them to the academic training of the STCW 2010 Code. We recognize the need to train our maritime protection students (future officers, Captains and Chief Engineers of the Spanish Merchant Marine) with the latest and most effective tools and protocols.

Thanks to the Maritime Collaborative Website of the Spanish Navy (ENCOMAR) we can complement and ensure the theoretical and practical training of our students to improve their knowledge on Maritime Security.

Keywords

Maritime Safety, Maritime Security, Spanish Navy, ENCOMAR, Piracy.

1. INTRODUCTION

The Manila Amendments to the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers Code (STCW 2010 Code) have promoted highly significantly the maritime safety and Security, establishing basic training and advanced training in these sectors [11]. Basic training in Safety and Security is a requirement to navigate for all Seafarers. In the School of Maritime Engineering of the University of Cantabria, with the degrees in Nautical Engineering and Maritime Transport, Marine Engineering and Maritime Engineering (Naval Engineering) we have adapted to the changes proposed by Manila and the 2010 STCW Code [11]. We recognize the need to train our students (future officers, Captains and Chief Engineers of the Spanish Merchant Marine) in Maritime Safety and Maritime Security with the latest and most effective tools and maritime security protocols [6] [21] [22].

The practical part of Maritime Security is complemented with the participation of students on an online MARSEC exercise prepared by the Spanish Navy, held every year in mid-May. The Spanish Navy has created, for this purpose, a Web portal called "Maritime Collaborative Website of the Spanish Navy (ENCOMAR)" [26]. In this website the Spanish Navy maintains relevant information on security for the merchant, fishing and recreational (yachts) communities [6].

The new virtual environment [7] has innovative opportunities for collaboration, communication and creation of knowledge. Without doubt, this increases the chances of cooperation and teamwork learning virtually, so far we are limited to a face to face environment [9]. This aspect of education has been able to encourage and facilitate the development of skills and attitudes that stimulate collaborative learning [2][3]. Using personal computers can [8] distance exercises in real time and create learning platforms [27]. These virtual platforms allow us to provide on-line teaching and learning. This method allows students to take courses when they have time and it also allows us to use this system anywhere. Using this, students see their attitudes, autonomy, organizational skills, discipline and group decision making reinforced.

To ensure our objective (better learning of students) to the Likert surveys carried out by the students, we have processed them according to the Rasch technique [23]. The software used for data processing and the extraction of results was Winstep 3.75 [15] [16]. The results assured us [24] the better learning of our students to perform in practice with the Spanish Navy MARSEC Security exercise.

2. MANILA AMENDMENTS TO STCW CODE

The safety and security needs in the maritime activities are in a continuous change. The "Manila Amendments" were adopted at a Diplomatic Conference in Manila, Philippines, held in June 2010, and are aimed at ensuring that the necessary global standards will be in place to train and certify seafarers to operate technologically-advanced ships for some time to come [11]. New requirements are issued by IMO [2] [10], international and national organizations in order to cover as much as possible all dangerous situations which can be met during operation of the ships, boat and sports crafts. These requirements will be reached through an adequate training.

The important changes of the “Manila Amendments” to each chapter of the Convention (STCW Code) are:

- Improved measures to prevent fraudulent practices associated with certificates of competency and strengthen the evaluation process (monitoring of Parties' compliance with the Convention).
- Revised requirements on hours of work and rest and new requirements for the prevention of drug and alcohol abuse, as well as updated standards relating to medical fitness standards for seafarers.
- New certification requirements for able seafarers.
- New requirements relating to training in modern technology such as electronic charts and information systems (ECDIS).
- New requirements for marine environment awareness training and training in leadership and teamwork.
- New training and certification requirements for electro-technical officers.
- Updating of competence requirements for personnel serving on board all types of tankers, including new requirements for personnel serving on liquefied gas tankers.
- New requirements for security training, as well as provisions to ensure that seafarers are properly trained to cope if their ship comes under attack by pirates.
- Introduction of modern training methodology including distance learning and web-based learning.
- New training guidance for personnel serving on board ships operating in polar waters.
- New training guidance for personnel operating Dynamic Positioning Systems.

Maritime Safety and Security is one of the activities where a specific level of knowledge and understanding is required, to be able to react and minimize any possible threat on safety or security of the ship.

The Manila Amendments to the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers Code (2010 STCW Code) design an adequate training scheme and are based on specific competencies among which they maximize security and maritime security.

In the second year of Nautical Engineering and Maritime Transport, Marine Engineering and Maritime Engineering (Naval Engineering) degrees of the School of Maritime Engineering of the University of Cantabria, students have a subject in the second quarter of the academic year named “Maritime Safety and Security I”. This subject has 60 ECTS credits (European Credit Transfer and Accumulation System). This subject has the same load in theoretical classes as in practical classes (30 hours of theory and 30 hours of practical work in the Maritime Safety and Security laboratory, in the Sea, in the fire training center and in the computer room). Similarly, it has 7.5

hours of academic tutorials and 15 hours of evaluation, namely 22.5 hours of follow up class. Complemented with 15 hours of group work and 52.5 hours of autonomous work of each student. All of which amounts to 150 hours of this subject. The part of Maritime Safety is common to 100% to Degree in Nautical Maritime and Transport Engineering and Degree in Marine Engineering.

Therefore, based on Chapter VI of the 2010 STCW Code [11] about Standards regarding emergency, occupational safety, security, medical care and survival functions in Section A-VI/1 with the requirements for safety familiarization, basic training and instruction for all seafarers, we conducted safety familiarization training. Based upon Section A-VI/6 we completed the part of Maritime Security in the Standard of competence for security-related familiarization training.

2.1. BASIC SAFETY TRAINING (BST).

Basic Safety Training (BST) is actually four courses. These courses are: Personal Survival, Basic Firefighting, Personal Safety and Social Responsibility, and Elementary First Aid (this part is conducted in the subject "Health Training and Quality"). This course has to be renewed every 5 years, or under certain conditions, and the mariners have to show that they have at least 1 year of service on board vessels of 200 GRT. or more within the last 5 years.

Now with Manila Amendments to International Convention on Standards of Training, Certification and Watchkeeping for Seafarers Code (2010 STCW Code) [11] all certificates expire after five years. In Table 1 we summarize the theoretical, practical training and evaluation of knowledge of the course on personal survival techniques course OMI 1.19 [12] [13]

Table 1 - Specific competencies in personal survival techniques.

<i>Competence</i>	<i>Theory (10 hours)</i>	<i>Practices (12 hours)</i>	<i>Criteria for evaluation</i>
Survive at sea in the event of ship abandonment.	<p>Types of emergency situations which may occur, such as collision, fire and foundering.</p> <p>Types of life-saving appliances normally carried on ships.</p> <p>Equipment in survival craft.</p> <p>Location of personal life-saving appliances.</p> <p>Principles concerning survival, including:</p> <ol style="list-style-type: none"> 1. Value of training and drills 2. Personal protective clothing and equipment 3. Need to be ready for any emergency 4. Actions to be taken when called to survival craft stations 5. Actions to be taken when required to abandon ship 6. Actions to be taken when in the water 7. Actions to be taken when aboard a survival craft 8. Main dangers to survivors 	<p>Assessment of evidence obtained from approved instruction or during attendance at an approved course or approved in-service experience and examination, including practical demonstration of competence to:</p> <ol style="list-style-type: none"> 1. Don a lifejacket. 2. Don and use an immersion suit. 3. Safely jump from a height into the water. 4. Right an inverted liferaft while wearing a lifejacket. 5. Swim while wearing a lifejacket. 6. Keep afloat without a lifejacket. 7. Board a survival craft from the ship and water while wearing a lifejacket. 8. Take initial actions on boarding survival craft to enhance chance of survival. 9. Stream a drogue or sea-anchor. 10. Operate survival craft equipment. 11. Operate location devices, including radio equipment. 	<p>Action taken on identifying muster signals is appropriate to the indicated emergency and complies with established procedures.</p> <p>The timing and sequence of individual actions are appropriate to the prevailing circumstance and conditions and minimize potential dangers and threats to survival.</p> <p>Method of boarding survival craft is appropriate and avoids dangers to other survivors.</p> <p>Initial actions after leaving the ship and procedures and actions in water minimize threats to survival.</p>

Source: authors based in STCW2010 Code and course OMI 1.19.

In Table 2, we summarize the theoretical, practical training and evaluation of knowledge of the course on Basic Firefighting OMI 1.20.

Table 2 - Specific competencies in fire prevention and firefighting techniques.

<i>Competence</i>	<i>Theory (15 hours)</i>	<i>Practices (7 hours)</i>	<i>Criteria for evaluation</i>
Minimize the risk of fire and maintain a state of readiness to respond to emergency situations involving fire.	<p>Shipboard fire-fighting organization. Location of fire-fighting appliances, emergency and escape routes.</p> <p>Fire triangle. Types and sources of ignition. Flammable materials, fire hazards and spread of fire.</p> <p>The need for constant vigilance, actions to be taken on board ship.</p> <p>Fire and smoke detection and automatic alarm systems. Classification of fire.</p>	<p>Assessment of evidence obtained from approved instruction or attendance at an approved course.</p>	<p>Initial actions on becoming aware of an emergency conform to accepted practices and procedures.</p> <p>Action taken on identifying muster signals is appropriate to the indicated emergency and</p>
Fight and extinguish fires	<p>Fire-fighting equipment and its location on board.</p> <p>Instruction in:</p> <ol style="list-style-type: none"> 1. Fixed installations. 2. Fire-fighter's outfits. 3. Personal equipment. 4. Fire-fighting appliances and equipment. 5. Fire-fighting methods. 6. Fire-fighting agents. 7. Fire-fighting procedures. 8. Use of breathing apparatus for fighting fires and effecting rescues. 	<p>Assessment of evidence obtained from approved instruction, including practical demonstration in spaces which provide truly realistic training of the ability to:</p> <ol style="list-style-type: none"> 1. Use various types of portable fire extinguishers. 2. Use self-contained breathing apparatus. 3. Extinguish smaller fires. 4. Extinguish extensive fires with water, using jet and spray nozzles. 5. Extinguish fires with foam, powder or any other suitable chemical agent 6. Enter and pass through, with lifeline but without breathing apparatus, a compartment into which high-expansion foam has been injected. 7. Fight fire in smoke-filled enclosed spaces wearing self-contained breathing apparatus 8. Extinguish fire with water fog or any other suitable fire-fighting agent in an accommodation room or simulated engine-room with fire and heavy smoke. 9. Extinguish oil fire with fog. 10. Effect a rescue in a smoke-filled space wearing breathing apparatus. 	<p>Clothing and equipment are appropriate to the nature of the fire-fighting operations.</p> <p>The timing and sequence of individual actions are appropriate to the prevailing circumstances and conditions.</p> <p>Extinguishment of fire is achieved using appropriate procedures, techniques and fire-fighting agents.</p> <p>Breathing apparatus techniques and procedures. Comply with accepted practices and procedures.</p>

Source: authors based in STCW2010 Code and course OMI 1.20.

In Table 3, we summarize the theoretical, practical training and evaluation of knowledge of the course on elementary first aid OMI 1.13. This part is conducted in the subject "Health Training and Quality".

Table 3 - Specific competencies in elementary first aid techniques.

<i>Competence</i>	<i>Theory (10 hours)</i>	<i>Practices (6 hours)</i>	<i>Criteria for evaluation</i>
Take immediate action upon encountering an accident or other medical emergency.	<p>Assessment of needs of casualties and threats to own safety.</p> <p>Appreciation of body structure and functions.</p> <p>Understanding of immediate measures to be taken in cases of emergency, including the ability to:</p> <ol style="list-style-type: none"> 1. Position casualty. 2. Apply resuscitation techniques. 3. Control bleeding. 4. Apply appropriate measures of basic shock management. 5. Apply appropriate measures in event of burns and scalds, including accidents caused by electric current. 6. Rescue and transport a casualty. 7. Improvise bandages and use materials in the emergency kit. 	<p>Assessment of evidence obtained from approved instruction or during attendance at an approved course</p>	<p>The manner and timing of raising the alarm is appropriate to the circumstances of the accident or medical emergency.</p> <p>The identification of probable cause, nature and extent of injuries is prompt and complete and the priority and sequence of actions is proportional to any potential threat to life.</p> <p>Risk of further harm to self and casualty is minimized at all times.</p>

Source: authors based in STCW2010 Code and course OMI 1.13.

In Table 4, we summarize the theoretical, practical training and evaluation of knowledge of the course on personal safety and social responsibilities, OMI 1.21.

Table 4 - Specific competencies in personal safety and social responsibilities.

<i>Competence</i>	<i>Theory (10 hours)</i>	<i>Practices</i>	<i>Criteria for evaluation</i>
Comply with emergency procedures	Types of emergency which may occur, such as collision, fire, foundering. Knowledge of shipboard contingency plans for response to emergencies. Emergency signals and specific duties allocated to crew members in the muster list; muster stations; correct use of personal safety equipment. Action to take on discovering potential emergency, including fire, collision, foundering and ingress of water into the ship. Action to take on hearing emergency alarm signals. Value of training and drills Knowledge of escape routes and internal communication and alarm systems.	Assessment of evidence obtained from approved instruction or during attendance at an approved course.	Initial action on becoming aware of an emergency conforms to established emergency response procedures Information given on raising alarm is prompt, accurate, complete and clear.
Take precautions to prevent pollution of the marine environment.	Basic knowledge of the impact of shipping on the marine environment and the effects of operational or accidental pollution on it. Basic environmental protection procedures. Basic knowledge of complexity and diversity of the marine environment.	Assessment of evidence obtained from approved instruction or during attendance at an approved	Organizational procedures designed to safeguard the marine environment are observed at all times.
Observe safe working practices.	Importance of adhering to safe working practices at all times. Safety and protective devices available to protect against potential hazards aboard ship. Precautions to be taken prior to entering enclosed spaces. Familiarization with international measures concerning accident prevention and occupational health.	Assessment of evidence obtained from approved instruction or during attendance at an approved course.	Safe working practices are observed and appropriate safety and protective equipment is correctly used at all times.
Contribute to effective communications on board ship.	Understand the principles of, and barriers to, effective communication between individuals and teams within the ship. Ability to establish and maintain effective communications.	Assessment of evidence obtained from approved instruction	Communications are clear and effective at all times.
Contribute to effective human relationships on board ship.	Importance of maintaining good human and working relationships aboard ship. Basic team working principles and practice, including conflict resolution. Social responsibilities; employment conditions; individual rights and obligations; dangers of drug and alcohol abuse.	Assessment of evidence obtained from approved instruction or during attendance at an approved	Expected standards of work and behaviour are observed at all times.
Understand and take necessary actions to control fatigue.	Importance of obtaining the necessary rest. Effects of: Sleep, schedules, and the circadian rhythm on fatigue. Physical stressors on seafarers. Environmental stressors in and outside .the ship and their impact on seafarers. Changes on seafarer fatigue.	Assessment of evidence obtained from approved instruction or during attendance at an approved	Fatigue management practices are observed and appropriate actions are used at all times.

Source: authors based in STCW2010 Code and course OMI 1.21.

The practical work for personal survival techniques are done in the Maritime Safety Laboratory of the School of Maritime Engineering of the University of Cantabria and in the Bay of Santander. The practical work for fire prevention and firefighting techniques are done in the Maritime Safety Laboratory of the School of Maritime Engineering and the fire training center used by the Santander Firefighters. The Maritime School of Engineering of the University of Cantabria is approved by the General Directorate of Maritime Affairs for these IMO courses (1.19, 1.20, 1.13 and 1.21).

2.2. STANDARD OF COMPETENCE FOR SECURITY AWARENESS

After the terrorist attack on the twin towers in New York on September 11, 2001, new safety and security systems and procedures for the global maritime traffic have been set. These controls and procedures were put in place to help ensure the security of shipping [10]. The security situation in the maritime world changed this horrible day. It created an international standard requiring shipping companies and vessels to have a safety and security plan [1]. These Maritime Safety and Security requirements imply that the captains and officers of the Merchant Marine, the skipper of the Fishing Marine and also yacht users, must know all security protocols. Piracy has existed as long as maritime trade in the last decade maritime piracy is associated with international terrorist movements of a religious nature [18] [19]. The Rise of Piracy in shipping is a global problem for humanity [19]. Maritime piracy acts are related to international terrorist. Nowadays, many people know this problem because of the bloody events in Somalia. Now maritime piracy is rising in the Gulf of Guinea. Piracy is a problem for maritime traffic, fishing and pleasure boating, it is a problem which threatens the maritime business globally [18]. When navigating hostile waters there is a tool called NCAGS (Naval Cooperation and Guidance for Shipping) which is essential for the protection of the ship [21] [22] [26].

The requirements for security-related training and instruction for all seafarers are in Section A-VI/6 of the Manila amendments to STCW Code [11]. The General Directorate of Maritime Affairs has established as standard of competence in security awareness the IMO model course 3.26. This training is given to the three degrees in the subject "Maritime Safety and Security I", the degrees are: Nautical Engineering and Maritime Transport, Marine Engineering and Maritime Engineering (Naval Engineering) of the School of Maritime Engineering of the University of Cantabria.

In Table 5, we summarize the theoretical, practical training and evaluation of knowledge of the course of competence in security awareness, OMI 3.26.

Table 5 - Specific competencies in competence in security awareness.

<i>Competence</i>	<i>Theory (9 hours)</i>	<i>Practices (3 hours)</i>	<i>Criteria for evaluation</i>
Contribute to the enhancement of maritime security through heightened awareness.	<p>Basic working knowledge of maritime security terms and definitions, including elements that may relate to piracy and armed robbery.</p> <p>Basic knowledge of: International maritime security policy and responsibilities of Governments, companies and persons. Organization of Spanish Navy.</p> <p>Maritime security levels and their impact on security measures and procedures aboard ship and in port facilities.</p> <p>Security reporting procedures. NCAGS.</p> <p>Security-related contingency plans.</p>	<p>Assessment of evidence obtained from approved instruction or during attendance at an approved course.</p>	<p>Requirements relating to enhanced maritime security are correctly identified.</p> <p>Writing and sending the formats Alpha and Bravo NCAGS.</p>
Recognition of security threats.	<p>Basic knowledge of: Techniques used to circumvent security measures.</p> <p>Enabling recognition of potential security threats, including elements that may relate to piracy and armed robbery.</p> <p>Enabling recognition of weapons, dangerous substances and devices and awareness of the damage they can cause.</p> <p>Handling security-related information and security-related communications.</p>	<p>Assessment of evidence obtained from approved instruction or during attendance at an approved course.</p>	<p>Maritime security threats are correctly identified.</p>
Understanding, need, methods of security awareness and vigilance.	<p>Basic knowledge of training, drill and exercise requirements under relevant conventions, codes and IMO circulars, including those relevant for anti-piracy and anti-armed robbery.</p>	<p>Assessment of evidence obtained from approved instruction or during attendance at an approved course</p>	<p>Requirements relating to enhanced maritime security are correctly identified</p>

Source: authors based in STCW2010 Code, course OMI 3.26 and manual NCAGS ATP-2(B) Vol II.

The Maritime School of Engineering of the University of Cantabria is approved by the General Directorate of Maritime Affairs for this IMO course (3.26).

The practical part of this course is complemented by the participation of all students of the subject “Maritime Safety and Security I” in the exercise on Maritime Security that takes place every year by the Spanish Navy MARSEC in mid-May. The participation of students is carried out online [3] [8]. The Spanish Navy, on its institutional Web page, has a link called "Maritime Collaborative Website of the Spanish Navy (ENCOMAR)" see Figure 1. In this website the Spanish Navy has maritime traffic information compromised by terrorist areas and piracy [4]. They make several scenarios for collaborative NCAGS training [8] [9], to train units of the Spanish Navy and the merchant navy to familiarize themselves WITH collaborative procedures and establishing cooperation [3] [25] [26].

Figure 1 - ENCOMAR, Spanish Navy Web.



Source: Spanish Navy (ENCOMAR).

The Maritime Collaborative Website of the Spanish Navy (ENCOMAR) is staffed every day of the year, continuously by The COVAM (Maritime Surveillance and Operations Centre). It is the tool used by the FAM (Maritime Action Force of the Spanish Navy) to fuse and analyze the data received through a wide variety of different sources, and by means of which is able to obtain a near-to real-time image of what is happening within the Spanish waters of interest [26]. This activity is known as Maritime Situation Awareness. The product resulting from this continuous merging and analyzing process is known as Recognized Maritime Picture (RMP). The RMP is the final product that the COVAM offers to all Spanish Navy vessels at sea and, under specific request, to those national state-owned agencies with competences at sea [26].

Figure 2 - Students of the School of Maritime Engineering of the University of Cantabria participating online in the exercise of Maritime Security (MARSEC) of the Spanish Navy.



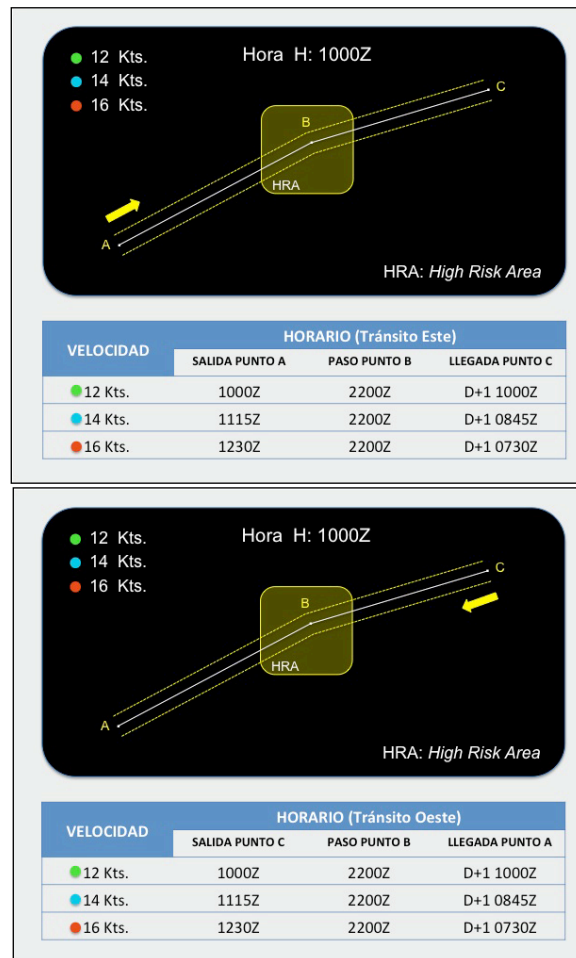
Source: authors

In this experience the Spanish Navy will design various scenarios for MARSEC 2014. The Spanish Navy will design a specific scenario for students of the School of Maritime Engineering of the University of Cantabria. Students will practice with a similar scenario that can be identified in reality.

A scenario of this kind is located in the Gulf of Somalia (GOA), or in the Guinean area [17] [20]. With this scenario the students will practice with the ship security tool NCAGS [21] [22]. The Spanish Navy from its institutional website will also create an access to the exercise for students. The scenario will develop in the Mediterranean waters south of the Balearic Islands (Figure 2). From this platform, the Spanish Navy will receive requests for traffic of students and will simulate cases of ship security. This information is presented in the NCAGS formats Alfa and Bravo, tools to ensure the operation of maritime traffic are guaranteed by a naval force if necessary [21] [21].

Each student will participate in the maritime security exercise operating a vessel with characteristics defined by them. Students will participate in this exercise by performing a simulation of a navigation corridor that ensured their security in navigation, with speed parameters depending on their ships.

Figure 3 - Maritime navigation corridors for School of Maritime Engineering with ENCOMAR.



Source: Spanish Navy (ENCOMAR).

To give more realism to the participation of students, the Spanish Navy will send by e-mail navigation instructions and notices to mariners. This dynamism will serve to reinforce their learning [11] [14] as well as to reinforce the concepts and methods of the ship security tool. In addition, each day the students will visit the NCAGS center of the Naval Command of Santander, where they will receive further explanation of the exercise MARSEC 2014 by naval officers on the data being processed (see Figure 3). Naval officers will answer students' questions on Maritime Security and the competencies of the Spanish Navy.

Figure 4 - Students of the School of Maritime Engineering of the University of Cantabria in NCAGS center of the Naval Command of Santander



Source: authors.

After the teaching experiment carried out in 2013 in the MARSEC exercise, all students had a Likert poll. After processing it according to the Rasch technique [23] we obtained some interesting results for our educational planning. The software used for data processing and extraction of the results was Winstep 3.75. The results assure [5] [15] [16] [24] us better learning of our students to be complemented by the Security practical work in the Spanish Navy

CONCLUSIONS

- Basic training in Maritime Security has to be part of the Nautical Engineering and Maritime Transport, Marine Engineering and Maritime Engineering (Naval Engineering) degrees.
- Participation in the exercise of Maritime Security (MARSEC) of the Spanish Navy in the training of students serves to improve knowledge on Maritime Security.
- The Maritime Collaborative Website of the Spanish Navy (ENCOMAR) is an ideal tool to combat piracy and terrorism, as it helps the merchant, fishing and recreational (yachts) communities ensure maritime protection.
- Students who have participated in the MARSEC 2013 exercise have learned to contact with the Spanish Navy (COVAM) if their ship has a Maritime Security problem. MARSEC is a clear enrichment in the training of students and serves to improve knowledge on Maritime Security.

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