TRANSNAV the International Journal on Marine Navigation and Safety of Sea Transportation
http://www.transnav.eu
Volume 15
Number 1
March 2021
DOI: 10.12716/1001.15.01.10

Preparing for an Unknown Future. Autonomous Ships Versus Position of the Maritime English/IMO Standard Marine Communication Phrases(ME / IMO SMCPs) in Maritime Practice. How Are We Going to Solve this Problem?

C. Chirea-Ungureanu
Constanta Maritime University, Constanta, Romania

ABSTRACT: The reason for modern Maritime Education and Training (MET) is to provide students with the necessary skills, and knowledge to be successful in the future outside of school. Futuristic teachers need to help students become life-long learners who are ready, organized, and equipped for new challenges. This paper tries to find position of Maritime English/IMO Standard Marine Communication Phrases (ME/ IMO SMCPs) versus autonomous ships, to facilitate developments in a safe predictable environment and for ensuring safe navigation in the future, also in a mixed traffic situation where both manned and unmanned ships will be sailing on the same routes and ports. In its attempts, this paper tries to analyse the Obstacles and Disadvantages when no crew is required on board; this could jeopardize the statute of seafarers, and not every aspect of unmanned shipping is all roses. The work is much future oriented and requires challenging conventional concepts and operations.

1 INTRODUCTION

In our fast paced, technology driven society, we engage in a wide range of multimodal technologies. Research and innovation represent the first steps to take so to come out of the current economic crisis. Tougher competition and the arrival of new world players leave us the only choice but to invest in the future through the development of research and innovation.

How does the ship industry work? Over the last few years, there have been some initiatives concerning autonomous or unmanned or the "robot ships". On these levels, new definitions of the Ship and Master of the ship are on the horizon….as there will be no humans on board. Where do we go from here? How can we make communication be effective? Is there a reinvented definition of the Maritime English/IMO Standard Marine Communication Phrases (ME/ IMO SMCPs) available for what is to be the Shore Control Centre (SCC)? As Maritime Education and Training (MET) educators, how are we going to solve this problem? The application of new information technologies, digitalisation and automation may rapidly change the way maritime transport works and operates. We are currently preparing students for jobs that do not yet exist, using technologies that have not been invented capable to solve problems we do not even know are problems yet….

In March 2014, the Robotics Business Review (RBR) staff presented autonomous ships and their" unmanned bridge of the future", where „ship captains in 2025 will use heads-up displays to turn the bridge into an augmented reality control system". They took this step after Rolls-Royce's announcement in February 2014 about their intention to build crewless cargo ships to serve a global shipping industry. The report indicated that was worth an estimated $375 billion annually: „By 2025, crews manning the bridges of tugs, cargo ships, and platform supply vessels

could be using new bridge technology being developed by the VTT Technical Research Centre of Finland (VTT) in collaboration with Rolls-Royce Marine and Aalto University of Finland. The future ship's bridge, [..] could also help crews sail the seven seas without getting their feet wet, by supporting remote operation of a range of seafaring vessels. On-board versions of the bridge automatically detect which crewmember is at the console and automatically adjusts to the user's predefined settings. The bridge window acts as a heads-up display with information about the location of the ship (and other vessels)" [8].

More than that, the same report gave information about another $4.8 million European project called Maritime Unmanned Navigation through Intelligence in Networks (MUNIN) to be concluded by end of 2014.The project main objective was to „develop prototypes of a range of technologies, including autonomous route finding and collision avoidance systems, and shore-side control" [8].

In this paper, the author is inviting you to venture into your imagination to navigate on autonomous-unmanned ships and on manned vessels as well, so to manage after that to focus on reality and to bring to light their advantages and/or obstructions in the maritime industry, along with the major changes that the use of autonomous-unmanned ships presume.

2 THE STRONG CONFLICT OF OUR SOCIETY: SHIPPING AND WORLD TRADE

Shipping is the heart of the global economy. People say if ships stop operating half the world will die of hunger and the other half will freeze to death. There is no question that nowadays ships cannot run on fuel and sophisticated equipment only. A great number of adequately trained, qualified and experienced seafarers must operate the ships to sail safely, and the cargo be delivered to the consignee in as good conditions as it was received.

The pace of change in our world is accelerating. Technology is helping us manage this change and stay connected across the globe. New technologies such as the Internet of Things (IoT), artificial intelligence, robotics, and virtual reality, are set to innovate the maritime industry, including ship design, operations, and managerial patterns, so to reduce costs and increase profits. That is not easy to do as there are many steps to take; moreover, the open-ended digital technology pushes the companies to arrange how they Identify, Operate, Evaluate Risks or Fail these new technologies. Digital solutions offer opportunities to scale rapidly and disseminate fast when the solution answers a crucial need. If companies hope to preserve their competitive edge and avoid division, then they must use the new technologies and facilitate the rapid dissemination of digital assets.

Each digital innovation is a building rock to create new combinations for innovation and division. The expertise and equipment knowledge makes some companies the ideal partners to transform current-days vessels for tomorrow's needs. Therefore, remote, and autonomous ships will be safer, more efficient, and cheaper to build and operate. More than that, they are solutions to reduce human-machine interaction by remotely controlled tasks and processes, while keeping the human at the centre of critical decision-making.

Alan Tovey (2016) in his article published on April 11, 2016, in The Telegraph (Business page) announced the crewless 'drone ships' will be sailing the seas by 2020, citing Oskar Levander, head of innovation for Rolls-Royce marine unit: "This is happening. It is not a question of if, it is a question of when. We will see a remote controlled ship in commercial use by the end of the decade"[9]. Oskar Levander also predicted the system could turn ships into a seaborne version of car service Uber, with the potential to change completely the current shipping sector: "Drone ships will allow the creation of new services, which will support existing players to make their businesses more efficient and enable new entrants with new business models to the sector, with a potentially similarly disruptive effect to that caused by Uber, Spotify and Airbnb in other industries" [9].

As a result, the ships will be steered from 'virtual bridges' based on shore. Crews could control the ships from shore simultaneously. Sensors such as radar, lasers and computer programs will allow the ships to pilot themselves, with shore-based captains taking over if there is a problem or for complex docking procedures, although the seafarers will be on board ship at first to oversee the pilot projects. In the long term, one of the most important advantages of this innovation is the fact that crewless 'drone ships" are expected "to help overcome the staffing shortages in the marine sector, with people increasingly reluctant to take on careers that mean months away from home" [9]. Therefore, "virtual" captains and crews will be able to monitor the vessels from shore, meaning normal home lives. They have predicted that crews stationed around the world will be ready to be transferred by helicopter to crewless ''drone ships'', when the latter might encounter problems, they could not handle themselves.

Having arrived at this point there are some questions to puzzle over: Can you think of a specific situation where having seafarers present would be an advantage over just having users and display of information? Can you assume a situation where users to have is an advantage? Can you consider a situation that model a danger to the ship and voyage? Accordingly, would you rather have seafarers, who might cope and find solutions against e.g., sea pirates' attacks, or evaluate, who are less likely to cope but a lot easier to "write off"? Can you think of cyber pirates that can hack a ship?

Taking into consideration the challenges for MET institutions and shipping organizations as well in facing the Digital Era, the shipping companies often fail to recognize what an attractive target they are to cybercriminals. The NotPetya cyber-attack in June 2017 affected badly several shipping companies, including the shipping giant A.P. Moller Maersk group. On 18 August 2017, Chris Baraniuk, a technology reporter, analysed „How hackers are targeting the shipping industry", and „breaking into a shipping firm's computer system could allow

attackers to access all kinds of sensitive information" [1].

The modernized ships, increasingly computerised, are vulnerable. For many involved in the maritime domain, this is the greatest headache. Malware, including NotPetya and many other pains, can spread from computer to computer on a network. That means connected devices on board ships are also potentially vulnerable. On April 03, 2018, the online editor at ComputerworldUK and Techworld, Tamlin Magee wrote on his blog:" Security researchers have for years been warning the maritime industry that it is low hanging fruit as incredibly high-value cargo is transported on ships with legacy systems, combined with poor processes and awareness, while the seaports they dock in often suffer from the same problems. In 2015, Kaspersky Labs went as far as to claim shipping was ‚easy meat' for hackers. […] The Russian cybersecurity vendor reported on a wave of significant hacks: these ranged from a drilling rig that was hacked and tilted from its site in South Korea towards South America – in 2010. […] In 2012, a criminal gang hacked into the systems of the Australian Customers and Border Protection Service agency, so they could be one-step ahead of authorities that placed containers under suspicion. […] Maritime security company CyberKeel warned that ships were switching off their navigation systems when travelling through waters where armed pirates are to operate – sometimes faking the data to make the ships appear they were elsewhere. […] A daring scheme in the Belgian port town of Antwerp meanwhile saw criminals gain access to systems that controlled the movement of containers to smuggle cocaine, heroin, and guns. ‚If your goal is to steal cargo there are easier ways of approaching piracy than some of the more sophisticated headlines demonstrated by security researchers'. […] In 2017, a cargo ship travelling from Cyprus to Djibouti lost control of its navigation system for 10 hours – preventing a captain from manoeuvring and with the intention of steering it into territory where it could be easily boarded by pirates and robbed" [6].

Accordingly, hack the Electronic Chart Systems (ECDIS) and you can send a ship to wrong way, or you may be able to crash the ship, particularly in fog. Very often there is a lack of network segregation on vessels. Hack the satcom terminal and you connect yourself to the vessel network. If the ship is remotely controlled and communicating with satellites, that means hacking could play a role in future piracy at sea. "Spoofing" is a technique that sends different GPS coordinates to a vehicle with the aim of throwing it off course. Rather than a hostile attempt to crack into a computer system, spoofing simply tries to feed GPS readers incorrect information. Could you imagine what it would take to spoof a ship?

Experienced seafarers describe their younger mates as working 'screen fixated' all too often, believing the electronic screens instead of looking out of the window. All the above-mentioned examples have a common feature: crewmembers working in departments and positions on board vessel. Therefore, MET institutions should be increasingly connected to explore the challenges of maritime cyber security so to understand the issues with securing vessels at sea, along with the shore-based centres. Our students should be trained to face the severity of the problem. A human crew is advantageous in many ways in terms of ship security. On the first place, they may be able to verify that the ships' systems function as intended. On the second place, if these systems are modified to query the crew during potential cyber-attacks, it is more difficult for a cybercriminal to go undetected. It is prudent to take advantage of humans on board ship. That is why the seafarers' training on how to keep these systems secure is much important. Considering keeping the vessel safe, it is useful to impart the use and protection of passwords and access keys, the proper use of the ship's system, what a cybercriminal looks like, together with how to disable, restart, or suspend certain systems in case of distress or a hazard situation.

Statistics published by Sam Chambers on March 28, 2018 shows shipping as the softest target for hackers: „A survey of nearly 6,000 active seafarers carried out by Futurenautics has shown 47% of respondents said that they sailed on a vessel that had been the target of a cyber-attack. Moreover, only 15% of seafarers had received any form of cyber security training. Just as alarming only 33% of seafarers said the company, they last worked for had a policy to regularly change the passwords onboard and just 18% of those polled said the company they last worked for had a policy to change default equipment passwords on board [..] More seafarers than ever before had had access to connectivity and communications. Seafarers who can use the internet at sea has increased by 527,000 since the last survey in 2015, and those who can access it for free has increased by more than 200,000. Also, of note, 53% of seafarers are now reporting that crew communications have led to a decline in social interactions on board" [2].

Taking notice of all these, how worried should we be? Like so many challenges we encounter daily, the answer to whether we should be concerned about ships being hacked depends on understanding the fact that even one item easily accessible in the above-described manner is enough to cause a disastrous accident. In addition to thinking of the type of cargo carried by the ship, we must find ourselves taking all these kinds of vulnerabilities a lot more seriously while thinking of cooperation between crews to find solutions to any problems.

3 MANNED OR UNMANNED SHIPS OF THE FUTURE?

„So, the Reindeer, crewless, lay across the estuary at the sandspit".

Jack London, John Barleycorn, Chapter XI, 1913

Maritime transport is the backbone of world trade and globalization. Ships are the cost-effective way to carry cargoes to all places of the globe. Following the first steps towards driverless cars on land, companies are starting to imagine ships without crews or with crews, but remote ones. The latter will oversee the ship by satellite and control it from consoles on shore. In most cases the drawing plans for autonomous ships are not mainly about security. Instead, these are cost-savings

schemes. Crews cost money, and because of their' 'troublesome'' needs like, e.g., accommodation on board ship, seafarers take up some space that could instead fit more cargo loading. Removing the crew from the ship should translate into cheaper operating costs and could even reduce the numbers of accidents caused by human factor. Still, they say the ships would not be entirely alone at sea. There will be supervising humans tracking their progress by Shore Control Centres (SCC) and sensors on the vessels alerting the humans to fix the problems via monitors. We might consider these humans will be the 'seafarers' of the future. If so, and based on COLREG, regulation 2, on good seamanship (section 4.4.1), it must be presumed that remote operators will, as a minimum, be required to complete the usual training programme for navigating officers and meet the requirements for this under the STCW Convention [4]. To this, they should add other competences necessary to steer an autonomous ship, especially education and qualifications within operational technology and other relevant technology of importance to the operation of autonomous ships. Furthermore, they should also make an amendment to the ISM Code that establishes the principles for remote operators. Such regulation could cover organisational and decision structures, means of communication and emergency procedures, and should be based on the principles and requirements made in relation to the" Master's Responsibility and Authority" in part A, regulation 5 of the ISM Code [4]. Remote operators will presumably be specialised as either operators with navigating tasks or operators with engineering tasks. In the long term, the operator's role will presumably include both elements of the deck officer's and the engineer officer's functions.

This is a concept for the future, but putting in place the satellites, autonomous ships, remote monitoring, and drone stations to inspect underway vessels is the work of years, if not decades.

Crewless ships, experts say, will be a game-changer for marine underwriters. An example: They will change the way insurers view risk and handle claims. Exactly how that plays out, time will tell. At this point, insurers have more questions than answers about these crewless vessels. On March 01, 2018, Caroline McDonalds published her article "The Rising Tide of Maritime Shipping Risks", in The Risk Management Magazine. She cited Capt. Andrew Kinsey, senior marine risk consultant at Allianz Global Corporate & Specialty, who considered "Crewless ships will no doubt be deployed, but the jury is still out on whether safety concerns and regulations will clear the way for ocean-going autonomous vessels in the near future. Ultimately, [he believes] technology will support, rather than fully replace, ship crews" [7].

Above all, they have concerns by the number. Cyberattacks, piracy, casualty management, vessel maintenance, assignment of liability and safety, all have a spot on that list. There is no question: Before crewless vessels hit international waters, they must navigate a sea of regulatory changes.

After examination of all the above data, the author of this paper considers that the comprehensive introduction of autonomous shipping seems to be less a technological problem though also here quite a few essentials remain unsolved so far. It is more safety, security, legal and similar aspects, which bar the application of unmanned vessels within a predictable time.

Just to name a few:

1. Development of an internationally agreed regulatory framework most likely to be done by the IMO. Knowing somewhat the lyrics of the legislative process of that Organization, the author of this paper strongly doubts that practicable solutions can be achieved keeping up with the speed of the technological progress involved.
2. Safety issues arising, for instance, from collisions between, e.g., crewless vessels themselves (or with what "floating object" ever) or, even worse, with passenger liners. It is surely beyond the imaginative power of even the most enthusiastic supporter of an autonomous shipping that one of these far away days cruise liners will sail the seas without a qualified navigation/engineering staff on board.
3. Emergency considerations including environmental aspects. The decision-making activities to fight a fire or to limit an oil spill, e.g., are normally much complex and may hardly be mastered without action by whatever crew.
4. What will happen when technology fails – there is not any infallible technology – or when ships will be attacked by cybercriminal actions, the hazard potentials of them are presently not even visible yet.
5. The autonomously sailing fleets must be operated and controlled by (national/international?) closely coordinating Shore-based Control Centres (SCC). It is hardly imaginable that under the conditions of a violent competition in maritime trade any kind of successful coordination will be manageable.

It is interesting to see that the most optimistic opinions regarding the introduction of autonomous shipping are preferably expressed by scientists, theoreticians, academics and those alike. More realistic views, scepticism and even demurring comments are first of all given by Master Mariners who know the industry in depth.

Another example: Germany has started kind of experiment with unstaffed vessels: Crewless barges of about 30 to 50 TDW will be operated on the tight-meshed network of inland waterways probably in Berlin. This procedure is similar to the operation of autonomous streetcars, the development of which has already reached a comparatively high level. The outcome of this experiment remains to be seen, but conclusions cannot be drawn 1:1 as these barges will be under close supervision on each metre they will cover, and in case of an unforeseen technical incident intervention can be started immediately. Communication between those barges will play no part.

4 AND…HERE WE ARE! WHERE IS THE ME/IMO SMCPS GOING?

"It is, I suppose, only to be expected than an activity such as seafaring, which is international by nature, should feel the need for an international language. It seems reasonable that this language should be English."

Commodore T. W. Stevens, Royal Mail Lines Limited, 1961

The IMO Working Group on the Standard Marine Communication Phrases (SMCPs) worked about eight years to develop "this standardized safety language enacted in 2001-IMO 2002" [10]. After that, it took another couple of years to familiarize the ships officers with the proper use of the IMO SMCPs as required by the STCW Convention 1978/95 as revised. To accomplish this section, the Maritime English (ME) teachers and instructors of the Maritime Education and Training (MET) institutions played a prominent part.

Regarding onboard, ship-to-ship and ship-to-shore communication in the current-days: ME in general and the IMO SMCPs are the internationally agreed medium for verbal communication among people performing their jobs on board vessels, in ports and in maritime administrations such as VTS Centres. This will remain as it is for the foreseeable future, will say if human beings are involved.

If one of these days still beyond the horizon autonomous fleets will sail the oceans, then verbal interchange of intelligence will no longer play a role – shipping will dispense with seafarers in our traditional understanding and consequently with ME and the IMO SMCPs as well. In this case electronic data streams between vessels and from shore to vessels (and vice versa) will perform the routine jobs of ship operation such as fixing position, determining/altering course and speed and other navigational tasks.

It is conceivable that maintenance and repair in shipyards will remain for a longer period as one of the rare fields where highly qualified personnel will depend to a certain extent on a clear verbal medium for the exchange of intelligence, and this could be English. The IMO SMCPs, however, are not suited and not intended to master the demanding communication challenges in this area.

5 CONCLUSIONS

Worldwide, the number and scope of projects dedicated to autonomous crewless vessels is increasing. Additionally, increased autonomy raises complex questions regarding the maritime labour force and staffing levels of the future. How might autonomous ships breakthrough in the future affect seafarers?

It seems that experts understand our concerns when they explain: "I wouldn't be too worried, however, because there will also be manned vessels in the future, autonomy is not for all ships…it will not drastically reduce the number of seafarer jobs in the future. [..] In my mind, the breakthrough happens when the IMO allows operation of unmanned vessels in international waters'' [5]. That not happened yet.

As Maritime English teachers, we are thinking of our students. "We cannot ignore that the concept of MELF (Maritime English as a Lingua Franca) at SEA with all its associated demands, has now been subtly and almost imperceptibly incorporated in the syllabi, methodologies, and teaching goals of marine higher education institutions [..] Cross-curricular approaches, intercultural considerations, the learning of languages following content-based teaching, materials development for the new curricula and methods constitute areas of current research worldwide. The challenging new ideas aspire to add useful insights into the relevant issues and promote ideas and practices" [3].

Advanced navigation and engineering technology is no stranger to students as Generation Y. Is the 'breakthrough' year here? Is technology transferable to operate and control navigation and engineering systems in large crewless ships? Regarding this, another problem may sooner or later have a direct impact on us, the MET institutions: How can we convince young men/women to time-consuming qualify for the challenging profession of a deck officer or engineer officer when they learn that their job is a dying breed? That is why the main goal of this paper is to illustrate that the reasons for creating and applying the IMO SMCPs are still on the agenda, as "an efficient and specific device for verbal communication in order to promote safety at sea, on board vessels and in ports if taught applying appropriate methods" [10].

To sum it up: Should a comprehensive autonomous shipping come true with all its aspects, then the IMO SMCPs will have no job to do as there will be no persons who must use this standardised safety language for a clear intercommunication. For the time being, however, and for a foreseeable future counting by decades, MET institutions are well advised to teach their students and cadets the highest possible competence in mastering Maritime English (ME) including the IMO SMCPs as required by the STCW Convention, 2010. Full speed ahead, ME teachers!

REFERENCES

1. Baraniuk, C.: How hackers are targeting the shipping industry, https://www.bbc.com/news/technology-40685821, (2017).
2. Chambers, S.: Shipping seen as the softest of hacker targets, https://splash247.com/shipping-seen-softest-hacker-targets/, last accessed 2021/03/25.
3. Chirea-Ungureanu, C.: Developing cross-curricular teaching by "Marinisation" of ME teachers. Presented at the Proceedings of International Maritime English Conference (IMEC 28) , Gothenburg, Sweden (2016).
4. Danish Maritime Authority: https://www.dma.dk/Documents/Publikationer/Analysis%20of%20Regulatory%20Barriers%20to%20the%20Use%20of%20Autonomous%20Ships.pdf, last accessed 2021/02/01.
5. Jokioinen, E.: Is 2017 the breakthrough year for unmanned vessels?, https://www.ship-technology.com, last accessed 2021/03/25.

6. Magee, T.: Can you hack a ship? Global maritime industry ripe for hacking, https://www.techworld.com/security/can-you-hack-ship-global-maritime-industry-ripe-for-hacking-3674517/, last accessed 2020/08/01.
7. McDonald, C.: The Rising Tide of -Maritime Shipping Risks – Risk Management, http://www.rmmagazine.com/2018/03/01/the-rising-tide-of-%c2%admaritime-shipping-risks/, last accessed 2021/03/25.
8. Robotics Business Review: Autonomous Ships: Inside the Unmanned Bridge of the Future, https://www.roboticsbusinessreview.com/rbr/autonomous_ships_inside_the_unmanned_bridge_of_the_future/, last accessed 2021/03/25.
9. Tovey, A.: Crewless "drone ships" will be sailing the seas by 2020, https://www.telegraph.co.uk/business/2016/04/09/crewless-drone-ships-will-be-sailing-the-seas-by-2020/, (2016).
10. Trenkner, P.: The IMO -Standard Marine Communication Phrases - Refreshing memories to refresh motivation. Presented at the IMLA 17th International Maritime English Conference , Marseille, France (2005).