

Autonomous/Unmanned Ships

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George Quick

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Good Afternoon,

I appreciate the opportunity to say a few words about autonomous or unmanned ships from the perspective of the International Transport Workers Federation (ITF). The ITF represents more than 700 transportation sector unions in over 150 countries with 4.5 million members. I am chairman of the ITF Ship Automation Working Group that determines ITF policy on maritime automation issues.

The increasing movement to automation, information and communication technology, and robotics by industry is a major concern of the ITF as it affects all transport sectors and has the potential to disrupt existing employment relationships as well as destabilize existing social and political institutions. While globalization is viewed as part of the reason for the current political turmoil in many parts of the world, automation with deskilling or technological unemployment plays an equally large role. So, we see any discussion of unmanned ships in a broader context than just a technical maritime issue.

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Manufacturers like Rolls Royce and Kongsberg, and MUNIN (*Maritime Unmanned Navigation through Intelligence in Networks*), funded by the European Commission, are promoting a vision of fully autonomous ships with no seafarers on board. It will occur fairly soon on the national level under national regulation. As they see it as a new potential market for goods and services. It is claimed it would be safer as it would eliminate human errors [*of course the potential for human error would just be moved from the ship to the shore station and increase the potential for error in the management software and complex, integrated and interconnected systems*], they would be cheaper to build as there would be no need to build the crews accommodation, and cheaper to operate as there would not be a need to pay for a crew [with no OT, vacation, pension and medical costs] and more fuel efficient. They also point to a shortage of suitably trained seafarers.

Some reports predict a shortage of 92,000 officers by 2020. But, the latest Manning Report published by Drewry, maritime consultants, reaches very different conclusions. It expects the global cargo carrying shipping fleet to rise by only 300 vessels in the next four years due to the weaknesses in demand. This will result in a net shortage of only about 7,700 officers by the end of 2020. That is only about 1% of the total number of officers and equivalent to a rounding error.

For unmanned ships to operate in international trade it will require the adoption of an international regulatory regime by the IMO. We doubt that there will be many ships in international trade without a crew in the next 10 – 20 years. There are two reasons. No shipowner in international trades would risk building an unmanned ship until the regulatory

framework for their operation is established by the IMO, and that may take quite a long time. Perhaps 10 years or more. And, the conclusion of the major players both MUNIN and Rolls Royce is that it is not possible to convert existing vessels and as the world fleet is comparatively quite new, it will be some time before they are replaced.

The economic feasibility or business model for unmanned ships is unproven. The actual cost of building and operating an unmanned ship is unknown, especially the costs of the additional redundancy in equipment, and given that all routine maintenance and repairs may be carried out by high wage labour while the vessel is in port, rather than by low cost seafarers from labour supply countries; it is unlikely a fully autonomous ship would be economically viable in most international trades. However, a MUNIN study suggests that unmanned ships could save 7 million dollars over a 25 year life cycle in fuel use, crew supplies and salaries. But, that is less than \$1,000/day. Not a very significant figure in a capital intensive industry like shipping. Where fuel costs for a large ship, even at today's relatively low bunker costs, can run over \$45,000/ day.

While unmanned ships may not be economically feasible in many trades, It is inevitable that advances in information and communications technology will lead to a much higher level of shore based monitoring and decisions regarding all ship board navigation and engineering systems. With potential for deskilling and reductions in crew size and responsibilities. This is facilitated by the new Inmarsat satellite systems and the Global Xpress system providing greater bandwidth for monitoring and control.

Rolls Royce is building a Fleet Management Center in Finland to remotely monitor and control ship board systems. The Carnival Corporation, which dominates the cruise industry with 102 cruise ships and 48% market share is establishing a worldwide network of shore based Fleet Operations Centers, the Neptune Project, to monitor 28 navigation parameters for navigation safety and analytics on all 11 Carnival owned cruise ship brands (*P&O, Holland America, Costa, Princess, Cunard, Seabourn*). They say it is not their intention to interfere with onboard decisions – at this time. But, they are collecting big data for machine learning and gaining experience. It is the classic business school thinking – if you can measure it, you can manage it.

It is only a matter of time before much more of the decision making aboard ship is shifted to shore whether the ship is manned or unmanned. But, the ultimate goal for the technology companies is unmanned ships remotely controlled from shore or perhaps using shipboard artificial intelligence to even eliminate the shore based controller. Some refer to shore based support in decision making as creating Smart Ships. *[that seems to be based on a concept that any one ashore is smarter than any one on a ship]* But, Smart Ships have implications for the future role of masters and navigating officers.

When does support shift to recommendations and eventually lead to control? What are the masters' responsibilities and liability if effective recommendations or control is shifted to shore based operators? Will the result be an up-skilling or down-skilling of masters and officers? What impact will it have on training and licensing? What are the qualifications of shore based operators? Will it further reduce manning levels? Will it reduce employment opportunities or create better jobs ashore? We can only speculate on the answers. But, I

don't expect good things to happen automatically and mariners and maritime unions need to play an active role in shaping the future.

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At the present time small unmanned ships are being developed and trialled in Norway and Finland under national regulations for operation limited to domestic trade, such as ferries or offshore supply vessels. There may be a niche market for unmanned ships in some situations. But, for them to engage in international trades will require IMO establishing an international regulatory regime for the construction and operation of unmanned ships.

A proposal has been submitted to the June meeting of the IMO Maritime Safety Committee by Denmark, Estonia, Finland, Japan, the Netherlands, Norway, the Republic of Korea, the United Kingdom and the United States to place a Work Plan on the agenda to determine the revisions needed in existing regulations to permit unmanned ships to operate in international trade.

The ITF believes the proposal is premature, and ignores and over simplifies the issues involved. It is based on an assumption that unmanned ships are equally as safe and reliable as manned ships without any basis for that assumption. There is a need to first examine the reliability, robustness, resiliency and redundancy of the underlying technical, communications, software, cyber security, navigation and engineering systems for unmanned ships to determine if they can provide an equivalent level of safety.

The issue is also larger than just unmanned ships. Autonomous remotely controlled ships could be partially manned with crew or personnel that do not include a master or qualified navigation and engineering watch officers as all decisions and control are with a shore based operator. Such ships present many of the same issues as unmanned ships and should be included in any regulations.

It is anticipated that autonomous ships in international trades will evolve progressively in stages with different levels and mix of autonomous systems. Lloyd's Register defines six levels of automation. From onboard decision support to remote shore control and eventually truly autonomous ships operating independently of human intervention using artificial intelligence. Each stage may present different technical, legal, regulatory and operational issues. The proposed plan to merely identify which IMO documents need to be revised to permit the operation of unmanned ships is a leap too far and underestimates the complexity of the issues that need to be addressed progressively as the technology is evolving.

The revision of regulations should also not be taken in isolation from their potential consequences. Any revision to accommodate remotely controlled or unmanned ships should also consider the possible consequences of that revision on the safety of shipping from a technical and human element perspective. As well as the legal implications for established general maritime law, and the possible conflicts with other international documents, such as UNCLOS.

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IMO rules of procedure requires any proposed Work Plan to demonstrate that the human element has been sufficiently addressed. Assembly resolution A.947, defines the human element as *“a complex multi-dimensional issue that affects maritime safety, security and marine environmental protection. It involves the entire spectrum of human activities performed by ships' crews, shore-based management, regulatory bodies, recognized organizations,.....”*. The proposed Work Plan failed to provide a required checklist addressing the human element issues in their proposal. They took the position that an unmanned ship had no human element issues as no humans are onboard. But, we believe the broad IMO definition requires an examination of human element issues that need to be addressed.

Aside from the issues at IMO, the ITF has a broader concern with the impact of automation on labor, society and its political institutions. It is conservatively estimated that more than 40% of existing jobs could be replaced by automation. Consideration of unmanned ships is only a small part but indicative of a much larger problem facing the future of society. To try and have at least a small role in shaping that future the ITF has formed the Ship Automation Working Group as part of a larger cross-sectional working group covering all transport sectors. We will have a meeting of maritime unions in Cape Town, South Africa, in June. It will include a panel discussion on autonomous/unmanned ships with a Vice President of Maersk Line, a professor from the IMO supported World Maritime University in Malmo, Sweden, researching the impact of automations on society and labor, and my self representing the mariner's perspective. Also, the theme of the ITF Congress next year in Singapore is *“Automation”*. So it is clear, the ITF is taking automation a high priority.

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The ITF has submitted comments to the IMO proposing that the scope of any unmanned ship work plan be expanded to take into account the full range of issues that unmanned ships raise regarding their underlying human element, technical, communications, software and engineering systems.

The issues which we have identified include:

- The degree of redundancy and robustness in technical, navigational and engineering systems; *(LNG/electric drive/no rudder/prop)*
- The quality of the software and algorithms; *(Quality assurance and bug free)*
- Cyber security and the reliability of the communications system; *(Hacking/ data link)*
- The risks in mixed manned and unmanned traffic; *(Colregs/ communications/liability)*
- The situation awareness of the human controller is limited to data from remote sensors; *(flying blind on radar /GPS/ECDIS)*

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- The reliability of the sensors and systems in all environments;*(sensor failure)*
- System failure in remote areas;*(distant water operation -mid ocean)*
- Security and environment issues and concerns; *(piracy/risk of collision/grounding)*
- Infrastructure requirements and costs; *(shore base station costs/ public/private)*
- Training for the shore-based remote control personnel; *(certification)*
- Responsibility and Liability issues;
- Regulatory constraints and the duty to render assistance; *(IMO/UNCLOS)*

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- Pilotage requirements;
- The cost and interaction with tug services, mooring personnel and ports;
- The cost of delays and having maintenance and repairs done while in port;
- The cost of remote control and monitoring, including escort ships; and
- The cost of insurance.