MARSH

On the Horizon: The Potential Risks of Drone Technology in Shipping

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The use of autonomous (or "drone") technology has, so far, largely been limited to the operation of unmanned aerial systems (UASs) in our skies, and, more recently, the development of self-driving cars. It now appears the next frontier for this technology will be the seas, in the form of remotely controlled, perhaps one-day fully autonomous, ships.

AUTONOMOUS TECHNOLOGY EXPANDING FROM SKY AND LAND TO THE SEA

To date, maritime companies have used autonomous technology to film corporate videos with UASs from the air, or to monitor on-board conditions and check for issues surrounding the ship. But this emerging technology has the potential to revolutionize the shipping industry in an altogether different way, if it is employed within the ships themselves.

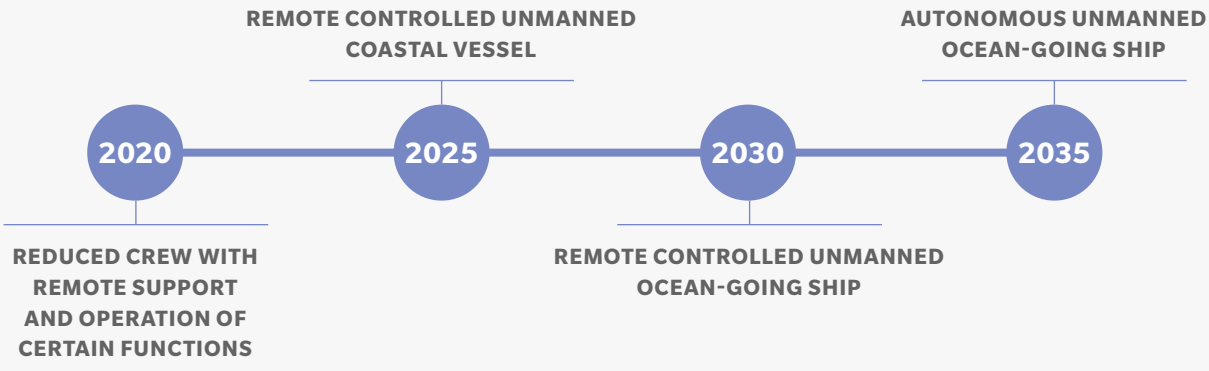
While crewless, fully autonomous ships (also known as “drone ships”) are yet to navigate global waters, a combination of rising transport volumes, growing environmental concerns, and an inevitable shortage of experienced and qualified seafarers has driven interest in this area. Several steps have already been made towards the development of autonomous technology in shipping, which could, in theory, provide solutions to these challenges.[1]

Shipping research firm DNV GL unveiled its plans for a crewless cargo ship as far back as 2014.[2] More recently, Rolls-Royce revealed plans for a remotely controlled ship that could be in operation on the seas as early as 2020. The company has claimed the ships will be cheaper and safer to operate, and will be able to carry more cargo than their crewed counterparts.[3] Meanwhile, in Norway, the Norwegian Government has gone so far as to designate an area for testing autonomous technology in ships, paving the way for the adoption of these ships.[4]

SPOTLIGHT

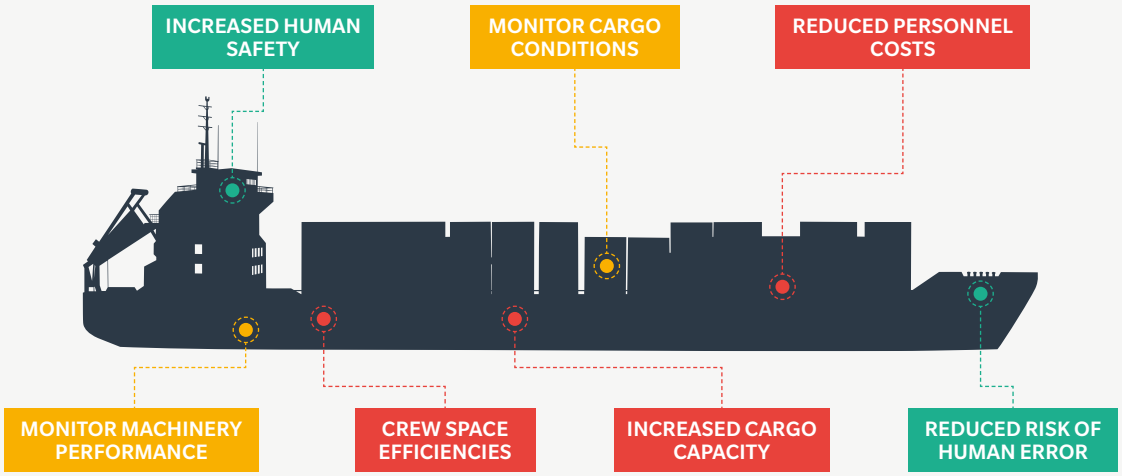
Rolls-Royce reveals plans for fully autonomous ship

Rolls-Royce has announced plans for a remotely controlled ship, due to hit the high seas by 2020. The ship would be controlled by a captain located at an onshore command center and certain aspects of operation and navigation would become automated. The company has said the technologies these ships use to operate devices, such as sensors and communication, are already in existence. The ship would be completely crewless, enabling a design that eliminates many traditional parts of a cargo ship, such as the deckhouse. Rolls-Royce representatives have compared development to that of the smart phone in terms of its impact on the industry.[5]



POTENTIAL COST REDUCTIONS AND SAFETY ENHANCEMENTS

While the use of autonomous technology in shipping might be years away, it could have more immediate implications for the industry, including data transfer, communication, navigation, surveillance, and repair/maintenance, which could improve shipping efficiency and reduce the impact of external threats, human error, and increasing operational costs.



Greater monitoring of vessel performance

New and emerging technology can be used in the shipping industry to remotely monitor conditions of the cargo on board the ship and help to raise any issues more quickly. As a result, the possibility for litigation with cargo owners if cargo arrives damaged or ruined would be reduced.

Some shipping lines already use similar technology to monitor the performance of the vessel's engines, while other machinery is constantly monitored by its manufacturers. This is often done from offices located on the other side of the world, where it is possible to detect the failure of parts or identify excessive wear to avoid breakdown.[6]

Cost reductions

If remotely controlled ships are brought into use, one of the key benefits to the industry would be the resulting cost reductions. These ships would require fewer personnel and less fuel to complete journeys. If a vessel is fully autonomous, it would eliminate the need for crew facilities – such as sleeping quarters – on board. This would lead to more space for cargo carriage, which would mean increased profitability for shipping companies using these vessels.

Reduced risk to human life

Without navigation and engineering personnel on board, these ships might also achieve the benefit of increased human safety. The ship would be largely, if not entirely, controlled from a remote location, meaning the risk to human life from accidents or the loss of the ship would be reduced. In addition, the possibility for human error, which is widely thought to be a contributing factor in more than 70% of all accidents at sea, has the potential to be reduced if systems are more automated.

CHALLENGES FOR THE SHIPPING INDUSTRY

Until this new technology has been tested, the risks cannot be comprehensively identified. The attitudes of regulators and insurers also remain uncertain; ultimately, they will play a vital part in the speed of its adoption.

THE IMPORTANCE OF REGULATION

Given the novelty of this technology, regulation has not yet been developed, meaning the accepted use of autonomous technology in shipping could still be some way off. Undoubtedly, the attitudes of the regulators will determine how successful and widespread this new technology becomes.

When unveiling its plans, Rolls-Royce said the fully autonomous ships would need to be "at least as safe" as existing crewed vessels in order to get regulatory approval.[7]

International maritime conventions do not take much account of the potential for unmanned ships. Therefore, completely crewless vessels may not be seen until such a time that the safety measures in place would satisfy regulators, and changes to the law were made as a result. Unlike that for UASs, which generally operate within a given jurisdiction, regulation regarding a remotely controlled, or fully autonomous, ship would be complicated and subject to multiple governing bodies if it were passing through international waters.

Several international conventions, including those adopted by the International Maritime Organization (IMO) and the International Labour Organization (ILO), would need to be changed in order to allow unmanned vessels to operate. At the moment, the International Convention for the Safety of Life at Sea (SOLAS) states that vessels need to have a specified number of crew on board for safety reasons. As regulations can take considerable time to catch up with emerging technology, due to the amount of work that needs to be done on an internationally agreed level, it could be some time, if ever, until completely crewless ships will be used in commercial operations.

Worryingly, technology already in use is racing ahead and expanding in its vision and capabilities before regulating bodies can catch up. Regulation is already struggling to keep up with UASs, and, while they offer great opportunities for an "eye in the sky", they have also reportedly been used for illegal purposes, such as drug-trafficking, invasions of privacy upon private yachts, and can be used by pirates to "spy" on conventional vessels.[8] Often, the law is unclear as to what countermeasures can be taken by vessels that are threatened in this way.

THE POSSIBLE RISKS POSED BY AUTONOMOUS TECHNOLOGY

If the relevant regulatory approvals are achieved and we begin to see the introduction of autonomous technology, the traditional and emerging risks these vessels pose will need to be carefully considered and mitigated by the ships' operators. A survey conducted by SAFETY4SEA among maritime stakeholders, which assessed the challenges associated with the use of unmanned ships, found that

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navigational risk, cyber security, and loss of communication were considered to be the greatest challenges facing the development of fully autonomous ships (see FIGURE 1).

The impact on traditional risks

The way in which some traditional risks, such as cargo liability, will be impacted will depend on the safety and reliability of the technology being developed. While the loss at sea of a vessel with reduced or no crew on board wouldn't put as many lives at risk, it could still mean the loss of the vessel and cargo, along with resulting wreck removal and clean-up costs.

Although the risk to crew on board would be reduced if a ship was being controlled from a remote location, this would raise issues about the due diligence being exercised by those remote operators. It could raise the possibility of those not on the ship being held responsible for the operation of the vessel; something that, to date, has been the responsibility of the Master, officers, and crew.

This raises several legal and insurance issues, and could have an impact on liability, should an incident occur. One of the key defenses within charter parties and within the Hague-Visby Rules (1968) that ship operators rely on when disputes arise with shippers is known as the "navigation defense", whereby the ship operator is not deemed to be held responsible for the actions of the Master, officers, or crew, provided the operator was unaware of actions taken by the crew, and that those actions were outside the company rules. There have been attempts to remove this defense under later versions of the rules governing the carriage of goods by sea, but these have (to date) been strongly resisted by carriers. However, remotely controlled or fully autonomous ships without a crew on board could be viewed as a threat to operators in which "navigation defense" could be eroded or even removed.

Risk of human error remains

It is likely that vessels using autonomous technology would be navigated by a remote captain located on shore; therefore, the possibility for human error – one of the top causes of vessel losses – remains. Indeed, not having a ship's Master at the physical location to assess and take decisions could create an additional risk in itself.

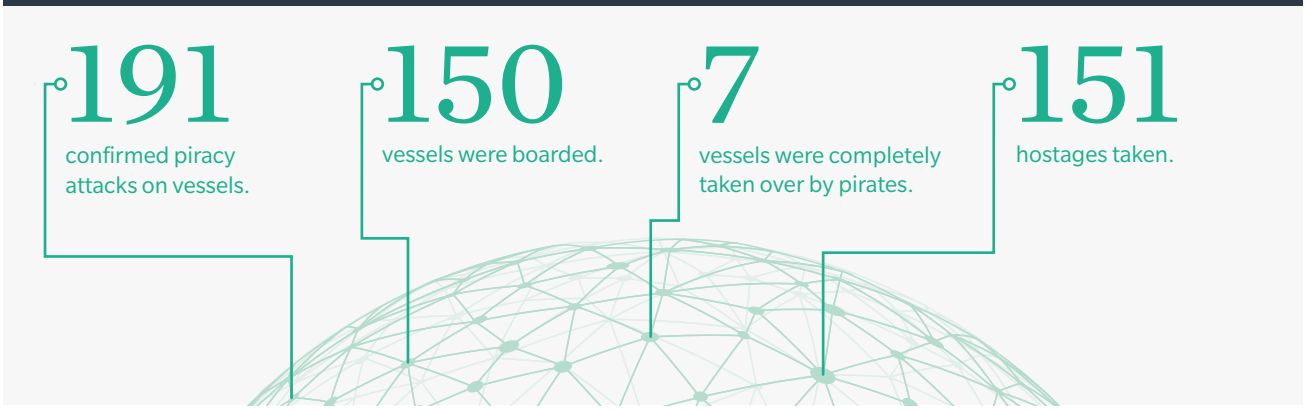
Until this technology is thoroughly tested, it is unknown whether a remotely controlled vessel would lessen or heighten the risk of collision. Captains would need to be thoroughly trained in navigating from a remote location using new systems and technology, and any data being used to support this would need to be reliable and up-to-date for these to be considered safe on the high seas.

Both regulators and insurers will be interested in the training that those operating remotely controlled ships would be required to undertake. Captains and crew operating and monitoring these systems from a remote location will likely need to undergo training. In addition, the role of non-qualified mariners who understand the technology of the autonomous systems and are involved in decision-making processes would need to be carefully considered. By law, the ship's Master is always in command of their vessel, and currently even pilots, who are required to be on board the vessel for navigating certain channels or canals, are only advisors to the Master, legally. A similar understanding would have to be reached for those who operate autonomous systems, but who have to do so in collaboration with the person who is taking overall responsibility for the navigation of the vessel.

FIGURE 1 **Risks Associated with the Use of Unmanned Ships**
Source: SAFETY4SEA, *Smart Shipping Survey*[9]

Participants to SAFETY4SEA's 'Share your Smart Shipping Insights' survey listed the following as the top risks associated with the use of unmanned ships:

FIGURE 2 **Global Piracy Incidents in 2016**
Source: International Maritime Bureau (IMB)[10]



Scrutiny would have to be given to the buyers of second-hand vessels which are designed to be operated remotely, as there is a risk that new buyers would not have the skills or resources required to operate such vessels, and may not exercise the same level of due diligence that the major, high-profile operators would. Shipping companies that order and operate new vessels are generally major operators with considerable resources to equip and train their maritime staff about new pieces of technology. Buyers of second-hand vessels may also have such capabilities, but many purchasing these cheaper vessels run at much smaller profit margins and often operate on less high-profile and policed routes. Whether secondary operators would adequately train their crews in the use of this new technology is uncertain, potentially creating a larger risk exposure.

NEW CYBER RISKS COULD EMERGE

Along with the continuation of traditional risks, autonomous technology exposes the shipping industry to vulnerabilities from cyber-attacks, system failure, and the possible evolution of piracy risks. Similar to other interconnected systems, autonomous technology could increase the exposure of the shipping industry to cyber security risks, such as hacking. If those wishing to perpetrate a cyber-attack managed to breach a ship's system, they might even succeed in taking over operation of the vessel. The marine industry could therefore find itself susceptible to politically motivated attacks, or "ransomware" attacks, where the vessel is effectively held hostage with the threat of being destabilized and sunk if a ransom is not paid.

Unlike the UAS market, in which the value of the UAS is limited, and anything being carried is likely to be small and limited in value, cargo ship losses resulting from a cyber-attack have the potential to be considerably higher due to the combined vessel and cargo value, as well as the potential disruption to the commercial cargo transport industry. On the other hand, since we would initially expect these vessels to be operated by large, well-regulated companies, we are unlikely to see safety risks similar to those posed to airliners by amateur UAS users, as remotely controlled or fully autonomous ships would not be allowed to operate if there was any increased risk of collision.

Cyber piracy risks

Maritime pirates have already begun to understand the potential to use this technology to assist in their criminal activities. The ability to see on board the vessels they wish to target for attack hugely increases the capabilities now offered to them.

A completely unmanned ship would lessen piracy risks in the sense that there would be no crew to take hostage. However, the ships would still have cargo on board and would carry considerable value, making them attractive targets. It can also be argued that having a human crew on board does offer some degree of protection, and that by removing the crew, the vessel could become a more attractive target as there would be less protection for the cargo. For example, of the 191 piracy attacks noted by IMB in 2016 (see FIGURE 2), 22 were successfully thwarted by the crew.

System error or failure

Relying on automated systems could result in errors or system failure, following an electrical or cyber derangement, which could have severe consequences. The system may not pick up on an issue on board the ship, or an error or failure could cause sensors not to pick up on a danger or obstacle on or in the water. Safeguards and backup systems with their own power sources would need to be part of the overall design, in case primary systems fail or communications with the ship are interrupted.

INSURANCE ISSUES AND CONCERNS

Until regulation is developed for the use of autonomous technology in the shipping industry, insurers are likely to show restraint in underwriting these risks. The marine cargo insurance market has faced some challenges over the past few years, including damaging losses and decreased profitability from an economically strained marine market, meaning underwriters are likely to remain cautious to new risks if conditions prevail.

Should cargo be lost or damaged at sea, it may be easier to prove negligence on the part of the cargo carrier if the data exists to show exactly what happened. The constant remote monitoring of cargo being carried at sea is already a possibility, but such technology might conversely act against cargo insurers, if vessel operators are able to prove (using the same data) that an accident occurred without a lack of due diligence on their part. Under many international cargo carriage rules, such as the Hague-Visby Rules (1968), navigation defense (that is, any negligence on behalf of the Master, officers, and crew that does not constitute a lack of due diligence of the carrier) could lead to expensive legal cases, which cargo insurers may be reluctant to venture into.

Any insurers that do show an appetite for these risks are likely to underwrite at high premiums to cover the possible high cost of litigation that could result, at least until autonomous technology is proven and accepted.

While some costly protection and indemnity (P&I) risks might be reduced as a result of reductions in crew numbers, P&I clubs and fixed premium P&I providers are likely to have some considerable concerns in taking on the liabilities of remotely controlled or fully autonomous ships, as many of the risks they cover would still remain, such as liabilities to the cargo, liability for collision with other ships, and environmental and pollution liability. However, the legalities around these liabilities in the case of remotely controlled or fully autonomous ships remains unclear, as relevant case law is currently non-existent.

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WHAT NEXT?

Autonomous technology presents no immediate threat to traditional shipping industries, but its adoption may not be as far off as originally predicted. The attraction of possible cost savings, safety enhancements, and even an easing of the talent shortage facing the industry could prove enticing. However, the emergence of new risks and the continuation of traditional maritime risks will need to be carefully considered and mitigated if this technology is to prove successful.

It appears that the move towards greater automation in the shipping industry is inevitable; however, we predict that technology such as this is unlikely to replace traditional cargo ships completely in the foreseeable future. Instead, we foresee this technology likely being used on short shuttle service journeys. For example, ferry operations could be an area where fully autonomous vessels may be commercially viable at some point in the future.

The uncertainty of whether these ships will prove as safe, or safer, than traditional cargo ships means that the full extent of the risks involved remains to be seen. If the technology is tested and found to be viable, the support of regulators and the insurance industry will be essential to the deployment of these ships in everyday commercial activities.

We will continue to monitor the development of autonomous technology in the shipping industry and provide updates as warranted.

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