THE LEGAL AND ETHICAL CHALLENGES THE ROYAL NAVY MAY FACE WHEN DEPLOYING LETHAL AUTONOMOUS SURFACE VESSELS INTO THE MARITIME BATTLESPACE

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Introduction

The technology relating to Autonomous Systems and Artificial Intelligence is advancing at pace. Many forms of autonomous systems are already available, with more advanced systems set to arrive in the near future, including autonomous vehicles and weaponised autonomous vehicles. Many nations' militaries are investing in these systems. Indeed, autonomous air vehicles are already common in the land and maritime battlespace; these new systems and technologies are likely to change the way wars are fought in the future[1]. However, the legal frameworks necessary to govern their use, especially for lethal autonomous surface maritime systems, have yet to be implemented and in most cases have yet to be developed.

This dissertation will seek to interpret existing law regarding the operation of Autonomous Surface Vessels and identify where there may be issues. It will also discuss the ethics of deploying autonomous vessels that could employ lethal force, and how this fits within the existing laws of armed conflict. It will explore where international maritime regulations may need to change to accommodate autonomous vessels – particularly since they did not envisage such technologies when current legislation was composed.

Key to this paper has been understanding how navies currently operate warships and how they may operate Autonomous Surface Vessels in the future. Whilst the UK and The North Atlantic Treaty Organisation (NATO) (defined in chapter 1) publish some information, it has become very clear in researching this subject that there is a plethora of existing additional information that is not available due to its security classification. Accordingly, it is possible and perhaps probable that some, if not all of the conclusion and assertions made are not as accurate or as comprehensive as they could have been. For this reason, also, there are some

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[1] NATO 'Autonomous Systems, Issues for Defence Policy makers' piii

gaps in the references of this dissertation. These will be filled with a logical assumption based on the facts available.

The discussion throughout this dissertation will focus on assessing how autonomous systems could be used for military objectives in the future. To provide a comprehensive evaluation of this, it is vital to consider whether these systems could conform to the law and operate ethically.

1 Glossary of Terms

This chapter describes the main technical and military terminology used throughout the dissertation for context and understanding.

1.1: Autonomous Surface Vessel (ASV)

An ASVs is described by the European Defence Agency as 'an unmanned, self-propelled and self-powered marine vehicle which is capable of working autonomously or being controlled and commanded remotely. It is important to look at the definition of an ASV from a military perspective to understand how they could operate in the future maritime battlespace.

1.2: Artificial Intelligence (AI)

By processing large volumes of data and recognising patterns, computers are beginning to be able to perform human-like tasks. Not only can computers conduct pattern recognition, but they can also learn, develop and improve as they discover new information.[2] Computer programmes are now capable of performing tasks that in the past could only be undertaken by a human.[3] This is known as AI.

1.3: Lethal Autonomous Weapon Systems (LAWS)

Similar to the definition of autonomous above, a LAWS is 'a weapon system which, once activated, can select and engage targets without further intervention by a human operator.'[4]

1.4: The North Atlantic Treaty Organisation (NATO)

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[2] 'Artificial Intelligence: What it is and why it matters' (*SAS*) <https://www.sas.com/en_gb/insights/analytics/what-is-artificial-intelligence.html>accessed 29 January 2019

[3] 'The Dawn of Artificial Intelligence - Clever Computers ' (*The Economist*, 9th May 2015) <https://www.economist.com/leaders/2015/05/09/the-dawn-of-artificial-intelligence> accessed 13 February 2019

[4] Jha U.C., Killer Robots: Lethal Autonomous Weapon Systems Legal, Ethical and Moral Challenges (Vij Books India Pvt Ltd 2016).

NATO is a collection of 29 members who through political and military means seek to protect the freedom and security of one another. [5] It has been described as being Europe's primary tool for collective defence and deals with front line combat as well as stabilisation operations abroad. [6] NATO doctrine also supplies 'fundamental principles by which the military forces guide their actions in support of objectives' which help direct UK military forces in combat situations. [7]

1.5: Warship

A warship, as defined by Article 29 of the United Nations Convention on the Law of the Sea, is 'a ship belonging to the armed forces of a State bearing the external marks distinguishing such ships of its nationality, under the command of an officer duly commissioned by the government of the State and whose name appears in the appropriate 35 service list or its equivalent, and manned by a crew which is under regular armed forces discipline.'[8]

1.6: Float, Move, Fight

UK warship designers use the terms float, move and fight to describe the high-level functions of a warship. [9] These terms are useful in categorising the various legal issues relating to ASV. The float term covers the need for a warship to be structurally sound and provide a stable platform for the crew and weapons to operate. The move term covers the need for the platform to be able to safely navigate and manoeuvre. Both the float and move functions include the need for warships to be built to appropriate standards (class rules). The fight function is reliant on the weapon systems, and the crew that operates them. [10]

1.7 Future Operating Environment 2035 (FOE35)

FOE35 is produced by the MOD's Development, Concepts and Doctrine Centre (DCDC) and outlines what it considers to be the most significant future global trends that navies (and perhaps ASVs) may face.

2   Policy, Strategy and Future Trends

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[5] 'What is NATO?' (*NATO*) <https://www.nato.int/nato-welcome/index.html> accessed 15 January 2019
[6] 'Indispensable allies: US, NATO and UK Defence Relations House of Commons Defence Committee Eighth Report of Session' 2017–19 Published on 26 June 2018
[7] NATO Glossary of Terms and Definitions AAP-06 Edition 2018 p43
[8] United Nations Convention on the Law of the Sea A29
[9] Matthew Heywood, Tim Lear, ' Prevent – A Tool to Reduce Vulnerability Early in the Design' (Warship 2006: Future Surface Warships, June 2006) <https://www.bmtdsl.co.uk/media/6097855/BMTDSL-Prevent-RINAWarship-Jun06.pdf> accessed 5 November 2018
[10] Thompson Eric, On Her Majesty's Nuclear Service (Casemate, 2018) p126

This chapter provides understanding and context on the technology relating to autonomous systems and the functions of a warship that would be particularly challenging for potentially Lethal Autonomous Weapon Systems (LAWS).

2.1: Future Trends and Artificial Intelligence

Advances in this technology result in armed forces investing in the development of military Artificial Intelligence (AI) to help maintain superiority in the battlespace.[11] NATO have made the following statement; 'In a world where some of the most game-changing technologies will be widely available, uncovering the best uses of that technology - and doing so urgently - will be vital to sustaining NATOs military dominance.'[12] This highlights how autonomous systems could change the way in which the military will have to approach conflict situations in the future.

The technology to enable fully autonomous vessels now exists. Finferries (Finnish ferry operator) and Rolls-Royce have created and demonstrated the world's first fully autonomous ferry.[13] A further development of ASVs has led to the construction of another purpose built ASV, the MV Yara Birkeland. This is a fully electric powered autonomous container ship that will produce zero emissions and 'reduce diesel-powered truck haulage by 40,000 journeys a year.'[14]

The United States (U.S.) Navy is trialling a prototype of a self-driving surface ship, known as Sea Hunter.[15] It is believed that this vessel, when fully operational, will be assigned anti-submarine warfare tasks, such as tracking enemy submarines, and is set to lead to future fleets of military ASVs.[16]

NATO and armed forces around the world have significant interests in the growth of autonomous systems (not just vehicles), with particular attention being placed on the

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[11] Tuneer Mukherjee 'Securing the Maritime Commons: The Role of Artificial Intelligence in Naval Operations' ORF Occasional Paper 159 (16 July 2018)

[12] NATO 'Autonomous Systems, Issues for Defence Policymakers' p6

[13] Mike Schuler, 'Fully-Autonomous Ferry Demonstrated in Northern Europe' (*GCaptain*, 3 December 2018) <https://gcaptain.com/another-fully-autonomous-ferry-demonstrated-in-northern-europe/ > accessed 13 February 2019

[14] Asle Skredderberget, 'The first ever zero emission, autonomous ship' (*YARA*, March 14, 2018) <https://www.yara.com/knowledge-grows/game-changer-for-the-environment/> accessed 14 February 2019

[15] Magdalena Petrova , 'This Self-driving Ship Could Be the Future of Military Warfare' (*CNBC*, 16 February 2018) <https://www.cnbc.com/2018/02/16/the-sea-hunter-autonomous-ship-could-be-the-future-of-military-warfare.html > accessed 18 February 2019

[16] Kyle Mizokami, 'The US Navy Just Got the World's Largest Uncrewed Ship' (*Popular Mechanics,* 5 February 2018) <https://www.popularmechanics.com/military/navy-ships/a16573306/navy-accept-delivery-actuv-sea-hunter/ > accessed 18 February 2019

development of LAWS. In 2016, the RN, industry and Academia hosted 'Exercise Unmanned Warrior', which showcased the latest technologies.

Throughout history the introduction of new weapon technology has changed the way in which wars have been fought. From crossbows to tanks, killing is becoming more efficient with every new invention.[17] Currently there are no fully autonomous killer robots. The semi-autonomous weapons operating today are used to shoot and eliminate threats in self-defence, or offensively when missiles are fired at a defined target.[18]

2.1.1: LAWS on ASV

ASV and LAWS are both new forms of AI capabilities that armed forces are interested in developing, but at what stage will an autonomous surface vessel carry a lethal weapon system and become a fully autonomous warship, and what are the legal implications of this? Sea Hunter, the U.S. Navy's prototype ASV mentioned above, is not weaponised and there are no plans for this to change.[19]

An autonomous weapon system hosted on a vehicle would have the ability to navigate a larger area and move over more difficult terrain. The issues for soldiers of 'sleep deprivation, fatigue, low morale, perceptual and communication challenges in the 'fog of war', and other performance-hindering conditions' would be eliminated.[20]

2.2: Missions and Tasks

A 'Warship' is defined in Article 29 of UNCLOS. The wording of this article suggests that a ship does not have to be actively engaging in a combat situation to be defined as a ship of war. As a result, 'warship' adopts a wider meaning. The RN undertakes many tasks including, but not exclusive to, frontline combat. This Article gives it scope to carry out these missions while still operating under the laws of a 'warship'.

The importance of 'Understanding and Decision-making' in a military situation is broken down in Military of Defence (MOD) Joint Doctrine Publication 04. It puts the emphasis on decision-

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[17] Arkin, Ronald. 'Lethal Autonomous Systems and the Plight of the Non-combatant', in *The Political Economy of Robots*, pp317-326

[18] The Economist,' Taming terminators - How to Tame Autonomous Weapons' (Jan 15th 2019) pp1-2

[19] Magdalena Petrova, 'This Self-driving Ship Could Be the Future of Military Warfare' (CNBC, 16 February 2018) <https://www.cnbc.com/2018/02/16/the-sea-hunter-autonomous-ship-could-be-the-future-of-military-warfare.html> accessed 24 February 2019

[20] Lin, Patrick, George Bekey, and Keith Abney. *Autonomous Military Robotics: Risk, Ethics, and Design.* California Polytechnic State Univ San Luis Obispo, 2008 p1

making not being an activity which is wholly rational, as different variables will affect peoples' judgement in different ways.[21]

The roles of the RN can be narrowed down to three categories; defence engagement, maritime security and war fighting.[22] All three of these roles requires understanding and decision making. This would be considered of high importance in the context of a weaponised ASV. As described in the Joint Doctrine Publication on UK Maritime Power, a naval ship must be able to maintain Military Maritime Power (MMP) to influence the behaviour and actions of others and possible events that may happen in the maritime environment.[23] This is relevant to all three roles of the RN. Weapons (whether for defence or attack purposes) are important to each of these tasks and the maintenance of maritime power.

A completely autonomous vessel would need to be capable of making decisions and understanding situations to be a useful asset for the RN to deploy on missions. Understanding helps to 'identify the causes of conflict, the nature of emerging crises, and the context required for determining deterrence, coercion or response postures.'[24] Without the ability to process its own action procedure an ASV will not understand when it is appropriate to fire. A warship manned by military personnel can manage all of the above missions and tasks, as would an ASV to be effective. Could an ASV be as or more effective at performing these missions than a fully manned warship?

There are some roles that will require humans to be embarked to conduct specific tasks. These tasks include counter terrorism, counter drugs, and counter piracy, where Navies act as maritime police. To achieve this, teams of military personnel will be required to board, search, gather intelligence and if necessary, arrest people. In some cases, specialist military may be needed to board vessels to engage armed operations. It is considered unlikely and perhaps unnecessary for ASVs to be used to transport humans. However, in the future crews may be reduced as technology takes over some of the more mundane tasks.

With prototypes such as Sea Hunter already in production, it is clear at the very least that an autonomous ship will be able to navigate the sea; whether by pre-programmed routes, or

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[21] Military of Defence 'Understanding and Decision-making' Joint Doctrine Publication 04 (2nd ed) December 2016
[22] Military of Defence Joint Doctrine Publication 0-10 'UK Maritime Power' (5th Ed) October 2017 p7
[23] ibid p6
[24] Military of Defence 'Understanding and Decision-making' Joint Doctrine Publication 04 (2nd ed) December 2016 p3

something smarter.[25] The question still stands whether autonomous vessels will be capable of preventing and dealing with conflict like the manned ships of today. There are a few ways in which ASVs could provide protection at sea. It has already been discussed that Sea Hunter will be used for anti-submarine countermeasures, but also to act as a decoy to help shield friendly forces.[26] However, this is problematic, as ASVs will not be cheap to produce. The RN may not want to use expensive assets as simple decoys. If the ASV is unarmed it would also have no way to protect itself, and becomes a sitting target. This is not a practical use of the military's money.

There are ways of making unarmed autonomous vessels both useful and economical. The US navy has plans to create a surface fleet of small un-weaponised autonomous ships equipped with sensors. They are to be sent out into the battlespace at the same time. It is harder for the enemy to track a large number of smaller ships, then one big vessel. Also, the more ASVs deployed the more effective the data they collect will be.[27] However, for the reasons mentioned above, the ASVs being completely unarmed leaves them vulnerable.

In conclusion, there are many challenges that are thrown up when discussing new AI technology such as ASVs, and while they will likely become a reality, the level of autonomy they will possess is still being debated. Following the statements made by NATO and the analysis of possible tasks an ASV could achieve, it is clear that the RN will want to deploy them on its behalf one day, preferably armed. To do this, however, significant legal hurdles must be overcome and ethical questions debated.

3   Current Law and Legal Barriers

This chapter will discuss the current maritime laws and investigate how they could accommodate ASVs in the future. It also considers whether these laws will have to change in order for the RN to deploy ASVs on missions where lethal force could be required. In addition,

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[25] Wyatt Olson, 'Navy's revolutionary Sea Hunter drone ship being tested out of Pearl Harbor' (*Stars and Stripes*, 7 November 2018)<https://www.stripes.com/news/navy-s-revolutionary-sea-hunter-drone-ship-being-tested-out-of-pearl-harbor-1.555670> accessed 29 March 2019
[26] Joseph Trevithick, 'Navy's Sea Hunter Drone Ship Has Sailed Autonomously To Hawaii And Back Amid Talk Of New Roles' (*The Drive*, 4 February 2019) <https://www.thedrive.com/the-war-zone/26319/usns-sea-hunter-drone-ship-has-sailed-autonomously-to-hawaii-and-back-amid-talk-of-new-roles> accessed 29 March 2019
[27] Victor Tangermann, 'The US Navy Wants to Roll out Autonomous Killer Robot Ships' (*Futurism* , 16 January 2019) <https://futurism.com/us-navy-autonomous-killer-robot-ships> accessed 20 March 2019

the laws on war will be analysed to see how or if a fully autonomous vessel would legally be allowed into the maritime battlespace to fight on the RN's behalf.

The starting point is to consider, what is maritime law? Maritime law is a collection of laws, conventions and treaties that encompasses all aspects of maritime activity and security, including private shipping and shipping offences to international regulations on the 'rules of the road'.[28] Many of these conventions are passed by the UN through the International Maritime Organisation (IMO) who are responsible for the regulation of international shipping.[29] The navies and coast guards of the countries who have signed a particular treaty are able to carry out enforcement where necessary.[30]

The current and future legal aspect of operating ASVs will be investigated in the context of the key functions of a warship: Float, Move and Fight, as outlined in Chapter 2. The Float and Move aspects of the operation of ASVs have been considered recently by governments through the IMO and industry. UK Industry and Academia (including support from Plymouth University) have recently produced 'An Industry Code of Practice' with the aim of setting 'Initial standards and best practice for those who design, build and manufacture (including testing and commission), own, operate and control' ASVs of less than 24m in length. It should be noted that this document stresses that it 'carries no legal status and will need to be amended or removed as the International and UK regulatory organisations policies' are generated.

3.1: Float

For a warship to operate effectively it needs to be structurally sound. The concept of floating seems obvious in relation to any ship, even more so for one that may engage in combat. Features of a ships design need to be evaluated and approved. Once design considerations have been met, repairs become the next issue. If in such a situation the ship sustains damage, it is important that it retains sufficient watertight integrity for long enough for it to be repaired, in order for it to continue floating and in turn manoeuvre and, if necessary, to fight.[31] Like cars, ships have a set of safety regulations that need to be fulfilled before they can be insured to go to sea. This is known as ship classification. The aim of vessel classification is to ensure the

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[28] Julia Kagan, 'Maritime Law' (*Investopedia*, 15 April 2019)
<https://www.investopedia.com/terms/m/maritime-law.asp> accessed 19 April 2019
[29] International Maritime Organisation, 'About IMO' (IMO)
<http://www.imo.org/en/About/Pages/Default.aspx> accessed 1 April 2019
[30] Julia Kagan, 'Maritime Law' (*Investopedia*, 15 April 2019)
<https://www.investopedia.com/terms/m/maritime-law.asp> accessed 19 April 2019
[31] Andrew Clowes, 'Float, Move, Fight - A Nautical Perspective on Running IT' (ACO) <https://it-service-management.apacciooutlook.com/cxoinsights/-float-move-fight-a-nautical-perspective-on-running-it-nwid-3629.html> accessed 1 April 2019

strength and structural integrity of the ship, and the functioning of other features, such as steering systems to make sure the vessel is seaworthy.

The bodies responsible for carrying out ship classification are the members of the International Association of Classification Societies (ISACS). One of the leading and oldest providers of marine classification internationally, responsible for its own Rules and Regulations for the Classification of Naval Ships, is Lloyds Register.[32]

3.1.1: Classification of ASVs

The Lloyds Register 'Rules and Regulations for the Classification of Naval Ships, January 2019' states that a vessel has to undergo a series of regular checks and visits by a LR surveyor.[33] For the vessel to have complied with these rules the owner must provide:

> The effectiveness of other defined features and systems which have been built into the ship in order to establish and maintain basic conditions on board whereby appropriate stores, fuels, equipment and personnel can be safely carried whilst the ship is at sea, at anchor, or moored in harbour.[34]

This issue with the above regulation is that an unmanned ASV could carry these things, but if damage was to occur, it may not be able to 'establish and maintain' basic conditions on its own. So, the question is, how much regulatory change will be necessary to allow ASV to be in class?

LR has released a guidance document covering classification of autonomous ships. The main discussion of this document is the importance of recognising the vessel's functions and matching the Autonomy Level (AL) to the vessel, depending on its purpose.[35] LR has currently identified 7 levels of autonomy, the change in regulation will depend on the AL and activities of the ship as mentioned above. [36] But to achieve classification, LR will also take into consideration the risk for others on the sea and the ship itself while undertaking the task it was built for. [37] For this reason, which of the 7 levels is chosen may make a difference between

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[32]Lloyds Register, 'A Class Apart' (LR) <https://www.lr.org/en-gb/marine-shipping/> accessed 1 April 2019
[33] Lloyds Register 'Regulations for the Classification of Naval Ships' (January_2019) at page 8
[34] ibid
[35] Lloyd Register, 'Cyber-enabled Ships, ShipRight Procedure - Autonomous Ships' First ed, July 2016 p2 section 1
[36] Lloyd Register, 'Cyber-enabled Ships, ShipRight Procedure - Autonomous Ships' First ed, July 2016 p6 section 5.3
[37] ibid p4 section 4

classification being accepted or rejected. The AL range is from fully manned to partially manned (allowing humans to assist in decision making). There are two ALs that are unmanned but require remote operation and one AL that is fully unmanned and autonomous.[38]

A fully autonomous unmanned and unarmed naval vessel would be useful to the RN, but it would also have a very high risk of attack, without the ability to defend itself. For this reason, it seems that other levels of autonomy would have to be considered to allow this type of ship to be classified by LR. Even more so for an armed vessel, where the decision to apply lethal force would be left completely at the discretion of a machine's algorithm. Although this is a prominent issue, it is not one that needs to be considered in relation to classification, as for instance a private yacht can pass classification rules yet still has no way to defend itself.

In relation to the autonomous vessels already on the sea, these are only being sailed in national waters, under national regulation.[39] The IMO could take years to produce the appropriate amendments to its policies to allow them to sail in international waters.[40]

3.2: Move

Once the 'float' hurdle has been overcome and a vessel has been successfully classified, the focus shifts. It is now important to consider the ship's movement and manoeuvrability.

Due to the open nature of the ocean, it is hard to police. It is even harder to control 'traffic' when ships are free to go where they like, in what direction they like (within reason). The International Regulations for Preventing Collisions at Sea (COLREGs) were published by the IMO to set out the highway code of the oceans and, most importantly, to help prevent collisions between two or more vessels.[41]

3.2.1: International Regulations for Preventing Collisions at Sea (COLREGs)

The first rule of the COLREGs states that 'these Rules shall apply to all vessels upon the high seas and in all waters connected therewith navigable by seagoing vessels.'[42] In short, all vessels on the sea are subject to these rules, including naval vessels as highlighted in the case of *Ng Keng Yong and Another v Public Prosecutor*. A Republic of Singapore Naval vessel

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[38] ibid p2 section 1
[39] Micheal F. Merlie , 'Autonomous Ships: Regulations Left in Their Wake?' (*The Maritime Executive*, 20 July 2017) <https://www.maritime-executive.com/editorials/autonomous-ships-regulations-left-in-their-wake> accessed 5 April 2019
[40] International Maritime Organisation, 'IMO takes first steps to address autonomous ships' (IMO, 25 May 2018) <http://www.imo.org/en/mediacentre/pressbriefings/pages/08-msc-99-mass-scoping.aspx> accessed 5 April 2019
[41] International Regulation for Preventing Collisions at Sea 1972
[42] International Regulation for Preventing Collisions at Sea 1972, rule 1(a)

named RSN Courageous crashed into a merchant vessel after the trainee Officer of The Watch (OTW) made a decision to turn into the oncoming ship's path.[43] This collision subsequently caused the death of 4 and injured 8 of its own crew.[44] The OTW, even though in training, breached the COLREGs and was found negligent for the death of his colleagues.[45] It can be inferred that one day ASVs, including autonomous warships, will be subject to these rules too.

Considering that COLREGs cover a vast variety of subjects, including but not limited to priority and manoeuvring rules, safe speed, signalling and even liability in an accident, it is no surprise that these rules pose important questions for ASVs. [46] The main question being, will a fully autonomous vessel be safe to navigate the sea according to these regulations?

3.2.1.1: Steering and Sailing Rules

The ultimate aim of the COLREGs is to prevent collisions between two or more vessels. To help achieve this aim, Rule 5 of the regulation stipulates that all vessels, no matter the conditions, must have a look-out. This look-out must be able to provide clear sight and sound information, so if a concern arose a full appraisal of the situation and collision risk could be conducted.[47] Having a manned visual look-out has been a traditional aid to navigation for many years.[48] As time and technology moves on, there is movement away from human look outs, on some vessels today 'a trained operator remotely monitors the state of the vessel with the help of an on-board camera and safely navigates around obstacles.'[49] The wording of the rule does not include the need for a human look-out; just that 'every vessel shall at all times maintain a proper look-out'.[50] Even though 'proper' is a subjective word the phrasing of this rule is broad. Even if courts interpreted the rule literally, it seems possible that with the evolution of AI, ASVs may be able to provide a sufficient look-out to satisfy this rule.

As a fully autonomous ASV will have no man involved, it is important that the technology is advanced enough to take over the roles that the crew of manned ships perform. Rule 7

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[43] *Ng Keng Yong and Another v Public Prosecutor* [2005] 2 LRC p368 para g
[44] ibid p369 para d
[45] ibid pp390-1
[46] Pol Deketelaere, 'The Legal Challenges of Unmanned Vessels' (Master, University Ghent, 2017) p62
[47] International Regulation for Preventing Collisions at Sea 1972, rule 5
[48] Hanno Weber, 'Fast Craft and the COLREGS' [1998] 51(1) The Journal of Navigation pp132-140
[49] Sable Campbell, Mamun Abu-Tair and Wasif Naeem, 'An Automatic COLREGs-compliant Obstacle Avoidance System for an Unmanned Surface Vehicle' [2014] 228 Journal of Engineering for the Maritime Environment pp108-121
[50] International Regulation for Preventing Collisions at Sea 1972, rule 5

discusses 'Risk of Collision'[51] and 8 'Action to Avoid Collision'.[52] It is prominent within these Rules that the issue of decision-making and understanding is essential to complying with COLREGs. 'Every vessel shall use all available means appropriate to the prevailing circumstances and conditions to determine if risk of collision exists.'[53] How well will a fully autonomous vessel be able to determine a risk and decide to move appropriately? If an ASV depends on sensors to maintain situational awareness of the circumstances and conditions, will it have these powered up all the time – or only when its AI determines it is necessary in order to preserve energy?[54] Secondly, if the ASV is being used for military purposes, it might be desirable for it switch off sensors that emit energy in order to avoid counter detection by an adversary's sensors.

As discussed in the previous chapter, decision-making will be a significant challenge for ASVs, no matter what area is looked at. The level of autonomy in a decision-making situation may make the difference between compliance or non-compliance to these regulations. Until AI exists that can make choices in the way a human can, a fully autonomous ship is unlikely to align with these current laws or classifications. However, a semi-autonomous ASV might, as humans will still have a hand on the wheel and ultimately be involved in the final decision making. An ASV could have occasional remote control – as demonstrated by Reaper autonomous air vehicle.[55] When certain criteria are satisfied, the ASV could send data back to a remote operator to make a decision or approve an action. One operator could potentially shepherd multiple ASVs from a single remote location. [56] However, 75-96% of marine accidents and casualties are caused by human error.'[57] If all ships on the sea were autonomous, the issues would be easier to solve as they would all be programmed to react to each other in a similar way. This does not seem likely even in the more distant future, as there will always be manned ships and boats, even if they are only used recreationally. Thus it would be legally risky to put a fully autonomous vessel onto the ocean without more consideration of these issues.

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[51] International Regulation for Preventing Collisions at Sea 1972, rule 7
[52] ibid, rule 8
[53] ibid, rule 7(a)
[54] Tim Dawkings, 'Autonomous Cars 101: What Sensors Are Used in Autonomous Vehicles?' (*Level Five Supplies*, 14 January 2019) <https://levelfivesupplies.com/sensors-used-in-autonomous-vehicles/> accessed 19 April 2019
[55] Royal Air Force, 'ABout the MQ-9A Reaper' (*RAF*) <https://www.raf.mod.uk/aircraft/mq-9a-reaper/> accessed 14 April 2019
[56] Stew Magnuson, 'Air Force Looks to Upgrade Reaper Unmanned Aircraft' (*National Defense*, 27 October 2017) <http://www.nationaldefensemagazine.org/articles/2017/10/27/air-force-looks-to-upgrade-reaper-unmanned-aircraft > accessed 14 April 2019
[57] LP Perera, JP Carvalho, CG Soares 'Autonomous Guidance and Navigation Based on the COLREGs Rules and Regulations of Collision Avoidance' [2009] Advanced Ship Design for Pollution Prevention pp205-216

3.2.2: Under Command/ Manned

3.2.2.1: COLREGs

Under command has a significant definition in the COLREGS steering and sailing rules. This term is not just about whether a vessel should be manned by a physical crew, even though this is a significant legal issue (see below). Rule 3(f) states that if a vessel cannot manoeuvre to maintain its course or position, it is declared as 'not under command'.[58] Once a vessel has been declared as such, it must fly symbols/lights to indicate that it is Not Under Command (NUC).[59] If an ASV is unable to recognise that it is now in the state of NUC and therefore does not issue the correct warnings as defined by the COLREGS, it will be acting illegally. This may also have important implications under wreck and salvage laws. Could, for example, a third-party claim wreck or salvage rights over an ASV if it were not legally 'under command'?

A definition of a 'wreck' can be found in the Merchant Shipping Act 1995, where a 'wreck' includes jetsam, flotsam, lagan and derelict found in or on the shores of the sea or any tidal water.'[60] The term 'derelict' describes 'property, whether vessel or cargo, which has been abandoned and deserted at sea by those who were in charge of it without any hope of recovering it.'[61] If a fully autonomous vessel, with no ability to communicate or be controlled by a third part, gets lost in a state of NUC it may become officially derelict. With no way to trace or recover the vessel it may be considered as having no hope of recovery. This of course can be amended with the ability for the ASV to have contact with a third party or be tracked by such a party, as this would mean there is a chance of recovery. Without this capability it would be hard to argue the case for hope of recovery.

This can however be counterbalanced by The Protection of Military Remains Act 1986, which provides for the protection of sunken or stranded vessels while in the service of the military if the Secretary of State so orders.[62] This protection is relevant to both wartime and peacetime. It should be noted that this dissertation focuses in particular upon ASVs in a military setting. For this reason, even though wreck laws could remain an issue for civilian ASVs, it appears that this clause would save military vessels in this situation.

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[58] International Regulation for Preventing Collisions at Sea 1972, rule 3(f)
[59] ibid, rule 27(a)
[60] Merchant Shipping Act 1995, s255(1)
[61] 'Guidance - Wreck and salvage law' (*Gov.com*, 30 January 2018) <https://www.gov.uk/guidance/wreck-and-salvage-law> accessed 24 April 2019
[62] The Protection of Military Remains Act 1986 s1(2)(a)

Salvage law is a principle that applies when a person recovers another ship or cargo, which without being recovered would have led to it being lost or destroyed.[63] To salvage a ship, it is considered as the recovery of wreck material. Therefore, the definition of derelict still stands.[64] It is a common belief that those who salvage a wreck get to keep the finds.[65] This is slightly misplaced, as under the Merchant Shipping Act those who find a wreck must do their utmost to declare their findings and alert the vessels owner. Failure to do so may result in a fine.[66] If the owner claims the wreck, the salvager may be entitled to an award, along with the payment of fees and expenses.[67]

The question remains as to whether The Protection of Military Remains Act covers wrecks in a salvage situation, as this is not made clear. It can be assumed that since to be salvaged it falls into the detention of a wreck (derelict), this Act would carry the authority to protect the ASV in such a situation. However, as it does not state this explicitly, this may come down to the decision of the courts, or the statutory interpretation of these terms.

3.2.2.2: UNCLOS
The definition of a 'Warship' comes from Article 29 of UNCLOS:

> For the purposes of this Convention, "warship" means a ship belonging to the armed forces of a State bearing the external marks distinguishing such ships of its nationality, under the command of an officer duly commissioned by the government of the State and whose name appears in the appropriate 35 service list or its equivalent, and manned by a crew which is under regular armed forces discipline.[68]

It needs to be considered that UNLOS is very old law; autonomous vessels were not foreseen when these rules were drafted and for this reason it raises some significant legal issues. The phrases 'Under Command' and 'Manned' are of crucial importance in relation to ASVs. If a fully autonomous ship has to both be Under Command and Manned, can it not therefore be

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[63] Encyclopaedia Britannica, 'Salvage - Maritime Law' (*Encyclopaedia Britannica*, 20 July 1998) <https://www.britannica.com/topic/salvage> accessed 25 April 2019
[64] Laura Moore, 'Wreck and Salvage Law' (*Ashfords*, 10 November 2017) <https://www.ashfords.co.uk/news-and-events/general/wreck-and-salvage-law> accessed 24 April 2019
[65] 'UK MCA informs of wreck and salvage law' (*Safety4Sea*, 12 July 2017) <https://safety4sea.com/uk-mca-informs-of-wreck-and-salvage-law/>accessed 24 April 2019
[66] Merchant Shipping Act 1995, s236(1)
[67] ibid, s239(1)
[68] United Nations Convention on the Law of the Sea, Subsection C, Article 29

classed as a Warship by definition of this convention? To answer this, we must first explore the significance that people have in the running of this class of vessel.

3.2.2.3: Could an ASV become a warship as the current definition stands?

The issue of no crew is the real root concern for ASVs. If the AI algorithms exist it can be said confidently that autonomous ships will be able to act as their own sufficient crew and will not make errors like humans, so therefore will probably be seaworthy. But if a warship must be 'manned' by military employees, could a sufficient RN approved AI algorithm constitute the manning of a boat?

Since Article 29 states that a warship must be manned by military personnel, as it is currently worded, an ASV could not become a warship. How could the drafters have known that one day unmanned ships were a possibility? For this reason, a change in the wording of this law may be appropriate. Another aspect, which could see an ASV fitting into the current law, relates to the level of autonomy. A ship that is partially autonomous and that can be controlled from land could be considered both 'under command' and 'manned' by RN personnel. To what extent this partial autonomy could be pushed within the remit of this convention would depend on interpretation, but this seems to be a way around the issue.

3.3: Fight

A warship's ability to 'fight' is essential in situations where a country is considered to be 'at war'. For this reason, it is important to consider the legal context for the missions and tasks identified in the previous chapter, particularly when the law states that there is a difference between operations during wartime (ready to fight), the conditions under which we may decide to go to war, or during peacetime operations.

It is clear that the decision-making process regarding when to engage an enemy with a lethal system (the 'Rules of Engagement'), will be the most challenging legal hurdle for an armed ASV. Potentially the legal aspects may be different when the ASV is operating during wartime or engaged in maritime security operations, just like for manned ships, but the issue arises when an ASV cannot understand the difference between these two situations.

3.3.1: Jus Ad Bellum

Jus Ad Bellum (JAB) (also known as the just war theory) refers to 'the conditions under which States may resort to war or to the use of armed force.'[69] Once a war has begun, Jus In Bello (JIB) principles come into effect to regulate (impartially) how wars should be fought.[70] These are also known at the Laws on War. Throughout history, when countries have resorted to war, they claim to be doing so on 'just terms' even though this may not be the case.[71] The quote "one man's terrorist is another man's freedom fighter" highlights this point well. Even though declaring war seems to be the right thing, it may not be 'just' for the people on the receiving end. The laws on war work hard to protect innocent people from being hurt during wartime, as well as regulating what can or cannot be done to belligerent states. But before this can be discussed, a clear understanding of what is wartime and what is peacetime needs to be established. If the conditions in which a state can go to war (JAB principle) can be understood, this provides a clear basis as to the distinction between these two conditions.

There are six elements that form the Jus Ad Bellum principle: just cause, right intention, right authority, reasonable hope, proportionality, and last resort. If one or more of these elements is met, then a country may resort to war.[72]

Just cause is the most important of the six criteria. It includes elements such as self-defence, defence of others, protection of the innocent or punishment for grievous wrong doings.[73] Defence is the main element of the 'just cause' criterion and is backed up in law. Article 51 of the UN Charter declares that nothing in the charter will impair the right of a Member State (MS) to defend itself in a situation of armed attack, until the security council can take measures to maintain the peace.[74] North Atlantic Treaty Article 5 states:

> The Parties agree that an armed attack against one or more of them in Europe or North America shall be considered an attack against them all and consequently they agree that, if such an armed attack occurs, each of them, in exercise of the right of individual

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[69] 'What are Jus ad Bellum and Jus in Bello?' (International Comittie of the Red Cross, 22 January 2015) <https://www.icrc.org/en/document/what-are-jus-ad-bellum-and-jus-bello-0> acsessed 25 April 2019

[70] Karma Nabulsi, 'Jus ad Bellum/Jus in Bello' (*Crimes of War Project*, 2007) <http://www. crimesofwar. org/thebook/jus-ad-bellum. html> accessed 25 April 2019

[71] François Bugnion, 'Jus ad Bellum, Jus in Bello and Non-international Armed Conflicts' [2003] 6 Yearbook of International Humanitarian Law pp167-198

[72] Michelle Maiese, 'Jus ad Bellum' (*Beyond Intractability*, June 2003) <https://www.beyondintractability.org/essay/jus_ad_bellum> accessed 25 April 2019

[73] 'Just War Theory' (*Internet Encyclopedia of Philosophy*) <https://www.iep.utm.edu/justwar/#H2> accessed 25 April 2019

[74] United Charter and the Statute of International Court of Justice, Chapter VII, Article 51

or collective self-defence recognised by Article 51 of the Charter of the United Nations, will assist the Party or Parties so attacked by taking forthwith, individually and in concert with the other Parties, such action as it deems necessary, including the use of armed force, to restore and maintain the security of the North Atlantic area.[75]

These two defence laws cover both the right of self-defence and the promise the UK has made to assist other NATO members. This makes it clear that these are both reasons that justify war. Even though there is no law to back up the final two elements it could be argued that a threat to innocent people could also fall into the self-defence category, as the RN is protecting not only itself but also British citizens.

Although very similar to 'just cause', having the right intention is also vital to keeping the reasons for war just. If there is a situation where there is both a just and unjust reason to wage war (for example recourses vs self-defence), only the just reason can be the grounds for which a state can enter into war.[76]

The principle of right authority simply means that a war can only be initiated by the correct governing body of that nation; this is to make sure that the powers of the state have power to deliberate what is just in times of war.[77]

Reasonable hope or probability of success is also a contributing factor. A state must consider whether a military impact will be the cause of unnecessary bloodshed. This seems logical and fair, yet for some smaller countries it means that they do not have a just reason to fight in any war, as the proportionality will not work out in their favour at any point.[78]

Proportionality has been interpreted in many different ways. The first being the 'eye for an eye' or 'tit for tat' approach; the response must be in proportion to the initial provoking act. However, taking a more defensive approach, proportionality also 'relates to whether the force used (the means) is proportionate to the legitimate ends of using that force (self-defence).'[79]   With

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[75] NATO The North Atlantic Treaty (1949) Article 5
[76] Todd Allan Burkhardt, 'Just War and Human Rights: Fighting with Right Intention' (Dissertation, University of Tennessee, 2013) p8
[77] Jon Dorbolo, 'Just War Theory' (2001)
<https://oregonstate.edu/instruct/phl201/modules/just_war_theory/criteria_intro.html> accessed 25 April 2019
[78] Rob Mclaughlin, 'The Reasonable Hope of Success as an Element in Jus ad Bellum Theory' [1998] 23 Australian Journal of Legal Philosophy pp48-91
[79] David Kretzmer, 'The Inherent Right to Self-defence and Proportionality in Jus ad Bellum' [2013] 24(1) European Journal of International Law pp235-282

respect to attacking procedure, precautions must be taken in order for the attack to be 'proportional':

> (a) those who plan, decide upon or execute an attack must take all feasible measures to gather information which will assist in determining whether or not objects which are not military objectives are present in an area of attack; (b) in the light of the information available to them, those who plan, decide upon or execute an attack shall do everything feasible to ensure that attacks are limited to military objectives; (c) they shall furthermore take all feasible precautions in the choice of methods and means in order to avoid or minimize collateral casualties or damage; and (d) an attack shall not be launched if it may be expected to cause collateral casualties or damage which would be excessive in relation to the concrete and direct military advantage anticipated from the attack as a whole; an attack shall be cancelled or suspended as soon as it becomes apparent that the collateral casualties or damage would be excessive.[80]

Many of the strategies for fighting a battle can be programmed; computers can now beat humans in chess. However, there are some well-remembered rules that cannot be easily replicated, so any fully autonomous ASV would need to be able employ levels of self-learning and the ability to re-plan without consultation. The conclusion must be that ASVs in a warfighting situation must, for legal and operational reasons, be able to communicate and seek counsel with 'Command', just as currently manned warships must do when they request changes to their existing direction for operations.

The principle of last resort simply means that all other means must be exhausted. This rarely ever occurs, due to the vast amount of options available for dealing with conflict situations.[81]

The JAB principle has a clear set of rules. If these are the rules under which a country can resort to war, it is also useful to examine the rules that govern wars when they have begun (JIB principle).

3.3.2: Jus In Bello
International humanitarian law was born in 1864, when the first Geneva Convention was published. Since then this document has been amended multiple times, the most recent of which is the Geneva Convention 1949, which still governs the way in which wars are fought

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[80] San Remo Manual on International Law Applicable to Armed Conflicts at Sea (12 June 1994), Section II: 'Precautions in Attack' para 46
[81] Cecile Fabre, 'Cosmopolitanism, just war theory and legitimate authority' [2008] 84(5) International Affairs pp963-976

today.[82] Maritime warfare has been discussed within treaties and conventions, but it has not been developed or codified in the same way as the laws of land warfare have been, leaving the legislation for navies to follow somewhat limited and frankly confusing.[83]

3.3.2.1: Distinction

These rules highlight the need for military personnel to be able to make a clear distinction between what are, and what are not targets. 'While the textual basis for the distinction appears clear, realities on the ground oftentimes leave ambiguous whether a target is legitimate or not. In the case of UVs this means that the underlying software would have to be able to determine whether a particular target is civilian or military in nature.'[84]

With the theme of distinction also comes the importance of understanding and decision making in these wartime situations. These have been highlighted by the JDP 'Understanding and Decision-making', as discussed in the previous chapter. It has also been considered how these concepts will be considerably harder for ASVs to fulfil.

The San Remo Manual paragraph 42 lists forbidden methods of warfare.[85] 'Weapons that violate the laws of distinction and proportionality in war are already prohibited. Just like any other weapon, killer robots should be used only if doing so is in compliance with the law; otherwise their use is a war crime.'[86] For a fully autonomous vessel to abide by these laws it would have to understand all of these methods and the situations in which they are forbidden. It seems clear that even though a machine algorithm may be capable of doing a job to a certain extent, it would be unrealistic to risk deploying a fully autonomous vessel into a situation where it must abide by JIB, as it simply does not have the emotions and empathy that humans do. While this removes the element of human error, it does allow for an error of misunderstanding in the way that a programmed robot may operate, simply due to its inability to understand the situation in its entirety. A semi-autonomous vessel may be a way forward, as man can still make decisions. But ethically (to be discussed in the next chapter) a weaponised ASV, or 'killer robot', should not be capable of making decisions that endanger life until all wars are fought with such robots.

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[82] J. Ashley Roach, 'The Law of Naval Warfare at the Turn of Two Centuries' [2000] 92(1) The American Journal of International Law pp64-77

[83] The Joint Service Manual of the Law of Armed Conflict, Joint Service Publication 383, 2004 ed p348 para 13.2

[84] Markus Wagner, 'Taking Humans Out of the Loop: Implications for International Humanitarian Law ' [2011] 21(1) Journal of Law, Information and Science pp155-166

[85] San Remo Manual on International Law Applicable to Armed Conflicts at Sea, 12 June 1994, Part 1, Section I, Para 42

[86] Vincent C Müller, 'Autonomous Killer Robots are Probably Good News', [2004] Frontiers in Artificial Intelligence and Applications pp297-305

4   Ethical Considerations

This chapter will highlight the ethical issues that surround autonomous systems, in particular lethal autonomous weapons, also known as killer robots. This type of autonomous system will be focused upon to provide a moral argument as to whether it would be ethical for the RN to deploy a weaponised ASV into the maritime battlespace.

Now that technology enabling autonomous systems is a reality, there have been many debates surrounding the ethics of having these systems (in any form) as a part of everyday life. These debates intensify in relation to lethal autonomous weapons which may be used to fight wars in the future. The current situation is that the technology exists, but the law codifying the ethics of what is acceptable use is very far behind. When the law eventually catches up, both technical (discussed in chapter 3) and ethical issues need to be aligned.

Regardless of the type of autonomous system (cars, ships, robots etc), the moral issues lie in whether these systems can understand, interpret (based on the situation) and act within the law. This becomes increasingly more difficult when discussing complex decision-making situations, where the outcome of the decision may result in death or serious injury. Also, will these systems be subject to the same interpretation of the law as non-autonomous surface vessels?[87] It has already been discussed that an ASV will need to follow the rules of the sea, but whether an ASV is capable of understanding and following the laws is another question altogether. This debate raises some serious moral issues in relation to ASVs, weaponised or not, but carries a much higher significance when discussing a killer robot.

4.1: Lethal Autonomous Weapons Systems

LAWS have been met with a mixed reaction; their introduction solves some ethical issues while creating others. In October 2012, the first major movement against LAWS was formed and is still very active. The 'Campaign to Stop Killer Robots' (CSKR) is a non-governmental organisation working to ban fully autonomous lethal weapons systems, with its ultimate aim being to retain human control over the use of lethal force.[88]

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[87] Sameer Rahim , 'Can Robots Break the Law?' (Prospect, 15 February 2017) <https://www.prospectmagazine.co.uk/WP_SITEURLbritishacademy/can-robots-break-the-law> accessed 12 April 201
[88] Stopkillerrobots, 'About Us' (Campaign To Stop Killer Robots) <https://www.stopkillerrobots.org/about/> accessed 19 April 2019

Having been met with such a backlash, it seems that the moral advantages to killer robots are limited. So why are militaries considering them? The main positive to the introduction of LAWS is the removal of the person from the battlespace. Whether on land or at sea, an autonomous killer robot has no need for human presence (unless via remote control).[89] As a result, the loss of human life in war time situations will be greatly reduced,[90] or even prevented entirely. However, if only a few select navies will be able to deploy them in full, this means that human non-combatants may be present, so would it still be ethical to deploy them? This issue may once again lie in machines' abilities to understand and make the correct and most ethical decision on the battlefield.

Being able to make decisions quickly and handling large amounts of information is something that an ASV can achieve. In that regard AI technology may in the future be able to process battlefield information faster and more efficiently than a human soldier. They could also be held continuously at high readiness and deployed at a moment's notice, making reactions to threats almost immediate.[91] But this may be hard to achieve if militaries are reluctant to deploy full autonomous weaponised vessels for the reasons above.

An un-weaponised ASV may be useful at supplying information in missions and tasks for the RN in peacetime, but in wartime they would be of little use, unless they were cheap enough that so many could be deployed that individual losses become irrelevant. The easiest and what would appear the most ethical response to these issues is to codify the acceptable level of autonomy for different applications and circumstances. In particular, a partially remote controlled ASV could be the answer to these ethical situations. This has been a running theme throughout this dissertation, as it provides a marriage between the capabilities of new autonomous technology and the decision-making capabilities of humans, presenting what seems the best of both worlds.

However, the one flaw to this is the element of human feeling. Even though used to an advantage in some situations (defining what is a threat and what is not), emotion has also been an issue for moral situations in wartime.[92] Feelings affect outcomes in situations where the morality of the actions and outcomes are clear cut. For instance, a person operating a lethal capability from a remote location might feel detached from the morality and

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[89] P Singer, 'Robots at War' [2008] Wilson Quarterly pp30-48
[90] U C Jha, Killer Robots, Lethal Autonomous Weapon System Legal, Ethical and Moral Challenges (1st edn, 2016) p4
[91] ibid
[92] Ramadan Halimi, Emond Dragoti, Hidajete Halimi, Nazife Sylejmani-Hulaj, and Sevdie Jashari-Ramadani, ' Socio-Cultural Context and Feelings of Hatred and Revenge in War Veterans with Post-Traumatic Stress Disorder 15 Years after War in Kosovo' [2015] 7(1) Mental Illness

consequences of their actions. Fully autonomous weapons would remove fear and revenge as factors on the battlefield. These two emotions are unhealthy to have in a combat situation and often lead to irrational decisions. An ASV would not be capable of these emotions, or of making decisions due to such emotions.

Amnesty International has made the following statement:

> Allowing machines to kill or use force is an assault on human dignity - Allowing robots to have power over life-and-death decisions crosses a fundamental moral line. They lack emotion, empathy and compassion, and their use would violate the human rights to life and dignity. Using machines to kill humans is the ultimate indignity.[93]

This argument shines a light on the moral arguments that would need to be addressed and overcome for a fully autonomous robot to be brought into the maritime battlespace. It could leave humans suffering more than it is preventing, i.e. creating a greater 'amount of evil'. Public opinion on killer robots seems to follow a similar attitude, with 61% of people voting against killer robots in a global poll.[94]

Anyone can agree that a lack of proportionality would not be morally right. But in a situation where enemies are using such advanced weapon technology to maintain military dominance and a tactical advantage, it will be vital to match it.[95] If a threat involves these robots targeting civilians of NATO countries, would the right thing be to deploy NATO LAWS to fight the adversary's LAWS? Once again what is acceptable and right may be influenced by the level of autonomy. Yet this has not seemed to be considered by organisations such as Amnesty International and CSKR when their arguments have been put forward. For now, 'requiring that human operators approve any decision to use lethal force will avoid the dilemmas described here in the short-to-medium term.'[96]

Conclusion

This dissertation has sought to analyse the future that autonomous surface vessels may have within the military domain. Particular focus has been placed on the legal and ethical issues of

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[93] Rasha Abdul Rahim, 'Ten reasons why it's time to get serious about banning 'Killer Robots'' (Amnesty International , 12 November 2015) <https://www.amnesty.org/en/latest/news/2015/11/time-to-get-serious-about-banning-killer-robots/> accessed 20 April 2019

[94] Stopkillerrobots, 'Global poll shows 61% oppose Killer Robots' (Campaign To Stop Killer Robots , 2018) <https://www.stopkillerrobots.org/2019/01/global-poll-61-oppose-killer-robots/> accessed 20 April 2019

[95] NATO 'Autonomous Systems, Issues for Defence Policymakers' at page 6

[96] Robert Sparrow, 'Killer Robots' [2007] 24(1) Journal of Applied Philosophy 62-77

an ASV's ability to manoeuvre itself without the need of a crew (COLREGS steering and sailing rules), and whether lethal autonomous weapon systems will be able to be deployed into a battle situation. These issues are of importance when considering what tasks the Royal Navy will want to assign to an ASV and whether it will be effective in undertaking these missions.

The current laws on surface vessels, both military and civilian, are codified by UK legislation, conventions, treaties and protocol to which the UK is a signatory. Maritime law such as UNCLOS and The Maritime Shipping Act covers all aspects of maritime activity and security, including private shipping laws and shipping offences. The international regulations on the 'rules of the road' are covered by the COLREGS.[97] These laws have proved to be effective for the manned ships of the day. They do not, however, necessarily work as effectively for all future technological advances of surface vessels. ASVs are here and the old laws simply do not work for them. The main reason for this is that at the time these laws were written, ASVs were not foreseen, and therefore not considered in the drafting process. Even though some ASVs will fit within the remit of these laws, it will depend on the specific design aspects of each individual vessel.

A weaponised ASV with a lower autonomy level could be the answer to the main issues highlighted through this dissertation. Designing a ship which has autonomous manoeuvrability, yet can communicate and be controlled by a human operator would remove the major decision-making issues from a wartime situation, whilst keeping the human out of the battlefield.

It can be shown that there is a future for ASVs in the military domain. If the issues highlighted by the COLREGS and UNCLOS (see chapter 4) are ironed out and amended, the RN could have scope to deploy ASVs to undertake missions on their behalf. The level of autonomy is still unclear, as it will depend on the development of the laws and technology. Most important is how these work together, since as technology advances, the law must keep pace to allow for the best and safest outcome.

No matter how smart AI becomes, it seems there is no real place for fully autonomous lethal weapons systems. The laws of war are based around principles such as morality and what is just, which would not be understood by a machine. Public opinion would also play a big part in this decision. This does not however prevent militaries exploring different AI in relation to

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[97] Julia Kagan, 'Maritime Law' (*Investopedia*, 15 April 2019)
<https://www.investopedia.com/terms/m/maritime-law.asp> accessed 25 April 2019

LAWS, to find the perfect balance between man and machine. This balance would provide an answer for the ethical debates and help the RN to maintain military dominance in the maritime battlespace.