THE UNMANNED SHIP SETS SAIL – IS SOUTH AFRICA PREPARED TO OPEN THE SHIP REGISTER?

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2017

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CHAPTER 1 - INTRODUCTION

In times of rapid development and extensive changes in technology, laws, on international and national level equally, have often proven to lag behind. For the law on unmanned shipping the same destiny seems to be in prospect. From a technical perspective, innovations are being created rapidly, whilst the law does not seem to keep pace. Therefore, the development of a regulatory framework is one of the key challenges.[1] Solutions for autonomous sailing vessels are already available,[2] or have reached an advanced stage of development.[3] Considering that the shipping industry is under enormous pressure with regard to overcapacities and cost effective transport,[4] it is to be expected that most market players will not hesitate for an instance as soon as significant cost reductions appear on the horizon. Unmanned shipping might be the tool to make some competitors survive a crisis that other will not.

Although the winds of change seem to blow strongly in this regard, the practical feasibility and particularly the questions of registration and the subsequent use of unmanned vessels, which will be called 'Marine Autonomous Vessels' (=MAV) herein, seem to be rather unexamined, especially in South Africa. Therefore, it needs to be determined, whether the Republic of South Africa should soon open its Ship Register for unmanned vessels to become a trailblazer in the field of unmanned shipping and to fully seize the benefits that are in prospect. This dissertation seeks to support the assertion, that opening the Register to unmanned vessels would be highly beneficial and therefore advisable. Moreover, it will evaluate the status quo and answer the question whether the time has already come to do so. This assertion will be supported by a thorough examination of the key factors, for example prerequisites for registration and compliance with national and international law, and will

[1] James Fanshawe 'Smart Ship Regulation' available *at http://www.rina.org.uk/Smart-Ship-Regulation.html*, accessed on 12 March 2017.
[2] Hereinafter the term Marine Autonomous Vessel (=MAV) will be used. In cases where it makes a difference, reference will be made to the varying degrees of autonomy explained in detail in Chapter 3.
[3] See *Maritime Unmanned Navigation through Intelligence in Networks (MUNIN)* Final *Report D9-3 Quantitive Assessment* (2015) 57 available at *http://www.unmanned-ship.org/munin/wp-content/uploads/2015/10/MUNIN-D9-3-Quantitative-assessment-CML-final.pdf*, accessed on 12 March 2017,
stating that unmanned ships could well be a reality in few years.
[4] See e.g. the Hanjin insolvency. Hanjin was, prior to its demise, one of the world's top ten container carriers. In August 2016, the company applied for receivership. The shipping industry is believed to suffer from overcapacities that were built up during the economic crisis in 2008. Those are leading to strongly reduced shipping rates. See 'Hanjin-Pleite treibt Frachtraten nach oben' *Spiegel Online* 13 September 2016, available at *http://www.spiegel.de/wirtschaft/unternehmen/hanjin-pleite-treibt-container-frachtraten-nach-oben-a-1112029.htm*l, accessed on 12 March 2017.

therefore, inter alia, entail a cost-benefit-analysis that considers the prospective benefits on the one hand and the costs, especially the Republic's obligations and risks on the other hand.

As will be seen, the registration of vessels to the South African Ship Register is in general properly organised. Certain requirements need to be met in order to get a ship flying the South African flag. A Ship Registration Act,[5] and Ship Registration Regulations[6] are in place. However, a survey will bring to light, that this Act and the accompanying Regulations were not designed to apply to unmanned vessels. At first glance, nothing in the Ship Regulation Act seems to suggest that unmanned vessels cannot be registered in South Africa. Nonetheless, the Registrar has the right to refuse the registration for a number of reasons. The Ship Registration Act contains no outright prohibition on the registration of autonomous or unmanned ships and so any refusal to register such ships would presently be based on either a failure to comply with any conditions for registration, relating primarily to safety, or the exercise of the of the Registrar's general discretion to refuse to enter ships on the register despite meeting the relevant eligibility criteria and other conditions for registration.

The registration may be denied if, for example, the Registrar is satisfied that the ship is not in a condition to be registered or if interests of the Republic or of international merchant shipping are concerned.[7] Although the Registrar's ruling in this regard is an administrative decision and therefore subject to review, he or she will still have a wide range of discretion. Therefore, it is of paramount importance to assess whether the time to set sail on unmanned vessels has already come. Not only will it be necessary to evaluate whether unmanned vessels are safe enough to sail the oceans and thus are in a condition to be registered. In fact, close attention also has to be paid to the question of a cost-benefit-analysis from the Republic's perspective. The possible registration of unmanned vessels will rely heavily on the outcome of an investigation of the benefits and costs respectively of allowing registration of such vessels. Prospective benefits such as economic growth, development of a new industry, job creation and tax income need to be balanced against the risks and the State's obligations that would follow the decision to allow unmanned vessels to fly the South African flag.

Therefore, following the introduction of the necessary terminology and an overview of the state of affairs of unmanned shipping in general, a two-step evaluation is necessary. Firstly, it will be assessed whether an unmanned vessel can be considered safe under current

[5] Ship Registration Act 58 of 1998.
[6] Ship Registration Regulations GG 23345 (RG 7336) of 26 April 2002.
[7] See S 18 (1) (*a*) (*ii*) Ship Registration Act.

South African and international law and, if so, to what degree of autonomy. The assessment requires a distinction between various levels of autonomy. It will be examined what levels should be distinguished and to what extent they can be regarded as safe. Therefore, among other things, it is necessary to evaluate the implications that, for example, the ISM Code[8] would have for unmanned vessels. SOLAS[9] chap V reg 14, for example, requires that 'all ships need to be sufficiently and efficiently manned'. Regulation 22 holds provisions for the navigational bridge visibility, that need interpretation. It needs to be determined whether an extensive interpretation of those rules is even feasible in the first place and, if so, to what extent.

Secondly, a cost-benefit-analysis will identify the benefits of unmanned shipping in South Africa and compare these to the calculated cost implications. In order to get the latter right, not only the explicit monetary implications matter, but also all costs must be considered. The risk for the Republic's Register to be considered as a register of convenience for example might entail a flood of other effects that would be fairly hard to anticipate. Then again, other implications will be more straightforward. The State will still have jurisdiction over those vessels and they need to be placed in the Register, which itself must be maintained. Also, the necessary documents must be issued. More importantly, art 94 UNCLOS[10] requires the State to ensure that vessels comply with international safety standards. What those standards might be for unmanned vessels and what the State is supposed to do, if no standards are directly applicable will be discussed. Article 94 UNCLOS, to a certain extent, specifies what is required. Therefore, it will be identified which contents can be interpreted to equally work for unmanned vessels and which sections cannot be applied without rendering the provisions meaningless or simply incorrect. In doing so, it will be examined, what the real costs for the Republic would be if it were to allow unmanned vessels on its registry. Once the range of impact of registering such vessels is mapped out in detail, it can be compared to the advantages an unmanned shipping industry might bring.

The dissertation will also, within the respective chapter, touch upon a look ahead. At this stage, developments are expected to unfold rapidly. It is of major importance to clarify what changes will occur in the near future and what the key factors are that need to be monitored in order to keep up with the developments of this emerging part of the shipping

[8] International Management Code for the Safe Operation of Ships and for Pollution Prevention of 1993, South Africa has given effect to the ISM Code by means of the Merchant Shipping (Safety Management) Regulations, 2003.
[9] International Convention for the Safety of Life at Sea, 1974.
[10] United Nations Convention on the Law of the Sea, 1982.

industry. Furthermore, reference to other jurisdictions will be given where sensible. It will be shown which nations are already engaging with the registration of unmanned ships and what their approach is and what can be improved by studying their engagement with the problems arising.

CHAPTER 2 - TERMINOLOGY AND STATE OF AFFAIRS

In order to stay within the scope of the dissertation, it is necessary to limit the extent of matters dealt with in this paper. The area of unmanned shipping, per se, comes in many facets and layers. Thus, a precise delimitation of what is subject to the following examination is inevitable. Thereafter, to gain further insight into what changes are to be expected in the near future and to understand what major improvements have already been achieved, it is vital to briefly portray the state of affairs of unmanned shipping. Since the possibilities are manifold, it must subsequently be discussed what levels of autonomy should be distinguished. For broad parts of this dissertation it is indispensable to exactly determine the level of autonomy discussed.

I SCOPE OF APPLICATION

The sheer number of vessels sailing the world's oceans is almost unimaginable and their purposes are diverse.[11] For the purposes of this dissertation only the vessels that are serving economic purposes, shall be considered. Additionally, only non-military and non-submerged vessels shall be looked at. Vessels that are highly reliant on personnel, such as cruise liners, will not be in the center of this dissertation either, although they are not explicitly excluded. Since it is to expect, that prospective benefits in cost reductions - as a result of a lesser number of crew members and increased maximum loading capacities - will be the driving force in the future development of unmanned shipping, the main focus shall be on cargo vessels and tankers. Even though first studies, experiments and tests might mostly be performed with much smaller vessels as they are comparatively low-risk and necessitate a smaller assignment of resources, the ultimate goal of the current developments will be a

[11] With regard to bigger vessels, modern services available on the Internet do give an indication of what commercial shipping actually looks like. For example, see services such as*: www.marinetraffic.com* or *shipmap.org*. Especially a look towards international shipping hubs creates an impression of the technological efforts necessary to allow the smooth operation of fully autonomous vessels.

significant cost reduction for the mass transport of goods. This must be borne in mind, especially when assessing safety and liability issues.

II STATE OF AFFAIRS

The concept of an autonomously sailing vessel itself is not completely new, although large parts of it remain unresearched. Admittedly the idea of a fully autonomous massive vessel must have appeared to be rather pointless until most recently. Nonetheless, it has always been desirable to sail a ship as autonomous as possible for obvious reasons. But apart from tying a rope around the rudder, no remedy seemed to be at hand for centuries. The improvements which are now in prospect are mostly founded on inventions of the past decades such as GPS, the Internet, advances camera technology, night vision, radar, thermal imaging, high speed computers, modern weather data etc.

In order to understand the near future, it is of significant importance to follow up on what has already been achieved in the past. Whilst the widely-used autopilot – often built into the ECDIS of large vessels – actually is very helpful and reduces the efforts of steering and navigation on the open ocean, it can only be considered as a first step towards actual autonomous shipping. Although modern autopilots manage to keep a vessel very close to a route that was planned beforehand, they cannot fully compensate any person on deck a sailing vessel. Manning on the bridge and everywhere else is basically not reduced and the system must be checked constantly. Therefore, cost savings exist only to a small extent. Since cost savings seem to be the main incentive for the industry to invest in MAVs, this raises the question of what could be achieved extending beyond autopilots so far.

In different locations in the world, working groups and alliances that are working on various implications of unmanned shipping have already been formed. The most important and promising projects and concepts shall be illustrated in the following.

III ROLLS-ROYCE PROJECT

One, if not the most spectacular project at present is the unmanned shipping project conducted by Rolls-Royce. This project focusses in its current state rather on the control of vessels from shore than on the vessels technology itself. What is being introduced by an impressive short video of six minutes is the concept of a future remote control centre based

on shore.[12] A small crew of 7 to 14 people is in control of the operation of a fleet of vessels across the world and monitors the whole fleet simultaneously.[13] Rolls-Royce's aim was to announce its plan to develop autonomous and remote controlled vessels. Therefore, it collaborates with the VTT Technical Research Centre of Finland Ltd and the University of Tampere and aims to achieve major steps before the end of this decade.[14] Rolls-Royces plans are not being presented in detail yet, they seem to have an emphasis in fields like remote diagnostics, connectivity between ship and shore based crew and shore based control centres.[15] Although these objectives may seem very ambitious it remains that Rolls-Royce does invest lots of efforts into this project. It not only appears that Rolls-Royce formed a unit that focusses on MAVs, but it has also built strong alliances with third parties.

IV AAWA

One of these alliances is the Advances Autonomous Waterborne Applications Initiative (AAWA). This project, led by Rolls-Royce, consists of participants from the academic as well as from the business world. Thus, researchers from the Tampere University of Technology, the VTT Technical Research Centre of Finland Ltd, the Abo Akedemi University, the Aalto University and the University of Turku are part of the project. Members of the maritime cluster are Rolls-Royce, DNV GL, Inmarsat, Deltamarin, NAPA, Brighthouse Intelligence, Finferries and ESL Shipping.[16] Moreover, practical tests are already being conducted by the partners Finferries and ESL. Finferries is carrying out a series of tests of sensors arrays on their 65 metre double ended ferry in order to find the best, cost effective combination of visual and thermal cameras, radar and the like.[17] ESL's role in turn is to explore the implications of remote and autonomous ships for the short sea cargo sector.[18] The

[12] Film available at *https://www.youtube.com/watch?v=vg0A9Ve7SxE&feature=youtu.be*, accessed on 12 March 2017.
[13]See press release 'Rolls-Royce reveals future shore control centre' 22 March 2016, available at *http://www.rolls-royce.com/media/press-releases/yr-2016/pr-2016-03-22-rr-reveals-future-shore-control-centre.aspx*, accessed on 12 March 2017.
[14] Ibid.
[15] To date 'multifaceted enhancements in vessel performance and operation' are being promised. See Rolls-Royce Homepage about the project, available at *http://www.rolls-royce.com/products-and-services/marine/ship-intelligence.aspx#section-overview1*, accessed on 12 March 2017.
[16] See Esa Jokioinen 'Remote and Autonomous Ships – The next steps' AAWA Position Paper p 5, available at *http://www.rolls-royce.com/~/media/Files/R/Rolls-Royce/documents/customers/marine/ship-intel/aawa-whitepaper-210616.pdf*, accessed on 12 March 2017.
[17] See 'We are making autonomous vessels a reality - testing of sensors at sea begins in the Baltics' available at *http://www.rolls-royce.com/products-and-services/marine/customer-focus/making-autonomous-vessels-a-reality.aspx* accessed on 12 March 2017.
[18] Ibid.

project took its tasks seriously and published a comprehensive white paper containing explanations and reports on various relevant matters around unmanned shipping. Not only did they list the different fields that need close attention in the future, but also technological ideas and solution were introduced. Next to an assessment of safety and security issues, legal implications were being discussed that will be looked at closely in the following course of the dissertation. Additionally, the AAWA addresses problems that deal with market related questions, such as business relationships or the role between the key actors and it further provides with a transition roadmap.

V MUNIN PROJECT

Another project that must be mentioned is the MUNIN project (Maritime Unmanned Navigation through Intelligence in Networks). This project was mainly funded by the European Union, coordinated in Germany by the Fraunhofer Gesellschaft and was conducted from September 2012 to the end of August 2015. Its objective was to develop an autonomous ship concept by combination of automated decision systems with remote control via a shore based station.[19] The project addresses a vision paper that was prepared by Waterborne TP, which is a European consortium. It focusses mainly on the deep-sea part of a vessel's voyage the system not being intended for the use in congested ship lanes or harbours.[20] The case investigated in this project is a dry bulk carrier operating in international waters.[21] What the project did here was to include a wise two-step procedure. Firstly, it implemented technical work packages, defining and studying matters as the vessels architecture, an autonomous bridge, an autonomous engine room and the shore control centre. Only then, in a second step, those technical solutions were assessed and evaluated. The project has delivered 35 technical reports and specifications and made those publicly available for everyone willing to work further on the concept. They can be accessed on the project's homepage.[22] One of the promising findings the project has brought to light is the estimation that a MAV in the form of a bulker would indeed be commercially viable under certain circumstances. Through personnel cost savings and the then possible changes in the ship design, it is to expect that the

[19] See European Commission's Homepage on the MUNIN project with periodic and final Reports, available at *http://cordis.europa.eu/project/rcn/104631_en.html* accessed on 12 March 2017.
[20] See the European Commission's 'MUNIN Result In Brief', available at *http://cordis.europa.eu/result/rcn/169600_en.html*, accessed on 12 March 2017.
[21] See the executive summary of the 'Final Report Summary – MUNIN', available at *http://cordis.europa.eu/result/rcn/181600_en.html*, accessed on 12 March 2017.
[22] Available *at www.unmanned-shipping.org*, accessed on 12 March 2017.

considered vessel will raise the expected present value by seven million USD over a period of 25 years.[23] Furthermore, the study held possible that a decrease of ten times of the risk of collision and foundering, compared to a manned vessel, can be realised, mainly due to the elimination of fatigue issues.[24]

VI MASRWG (MILC)

A different approach is being chosen by the Maritime Autonomous Regulatory Working Group (MASRWG). This working group was formed by the UK Marine Industries Alliance and reports to the MILC (Maritime Industries Leadership Council) through the Maritime Coastguard Agency (MCA).[25] Its aim is the development of a regulatory framework for MAVs. Therefore, it engages with national bodies and through them with international bodies and organisations and aims for the formulation of a regulatory framework that can be adopted by the United Kingdom, other States and international bodies.[26] Although this final output draft has not yet been submitted, interim outputs were and can be accessed on the working group's homepage.[27] What the mentioned projects have in common is that they see the ships autonomy from the fall-back position of an shore based control centre. From here on they try to implement the maximum level of autonomy.

CHAPTER 3 – LEVELS OF AUTONOMY

What is already apparent when looking at the different projects and the development of unmanned shipping, is that MAVs will not just appear someday as 'fully autonomous' without the need of someone on board or on shore to assist a vessel's journey. Even though rapid developments are taking place and are expected in the near future, it cannot be assumed that full autonomy on the world's oceans and especially in congested areas and ports will be seen within the next decade. Thus, and in order to be able to assess the practical feasibility of

[23] Executive summary of the 'Final Report Summary – MUNIN', p.1, available at *http://cordis.europa.eu/result/rcn/181600_en.html*, accessed on 12 March 2017.
[24] Ibid.
[25] A list of the MASRWG members can be retrieved on the working group's homepage at *http://www.ukmarinealliance.co.uk/MAS* - Members range from governmental agencies, NGOs and universities to a wide array of industrial market players.
[26] See the MASRWG's purpose revealed at *http://www.ukmarinealliance.co.uk/content/masrwg-terms-reference*, accessed on 12 March 2017.
[27] Available *at http://www.ukmarinealliance.co.uk/MAS*, accessed on 12 March 2017.

different concepts and projects, it will be vital to differentiate various levels of autonomy. At the latest, when discussing the legal framework adaptions that might be necessary to make a wold of real unmanned shipping possible, this applies all the more. Rather not coincidental it was a classification society that anticipated this pitfall and made a first suggestion at how different categories could look like. The Lloyd's Register therefore applies a range of seven different levels of autonomy for unmanned vessels. These are differentiated as follows:[28]

AL 0 ***Manual – no autonomous function****. All action and decision making is performed manually – i.e. a human controls all actions at the ship level. Note: systems on board may have a level of autonomy, with 'human in/on the loop'; for example, pms and engine control. Straight readouts, for example, gauge readings, wind direction and sea current, are not considered to be decision support.*

AL 1 ***On-ship decision support:*** *All actions at the ship level are taken by a human operator, but a decision support tool can present options or otherwise influence the actions chosen, for example DP Capability plots and route planning.*

AL 2 ***On and off-ship decision support:*** *All actions at the ship level taken by human operator on board the vessel, but decision support tool can present options or otherwise influence the actions chosen. Data may be provided by systems on or off the ship, for example DP capability plots, OEM configuration recommendations, weather routing.*

AL 3 ***'Active' human in the loop****: Decisions and actions at the ship level are performed autonomously with human supervision. High impact decisions are implemented in a way to give human operators the opportunity to intercede and over-ride them. Data may be provided by systems on or off the ship.*

AL 4 ***Human on the loop - operator/supervisory****: Decisions and actions are performed autonomously with human supervision. High impact decisions are implemented in a way to give human operators the opportunity to intercede and over-ride them.*

AL 5 ***Fully autonomous****: Unsupervised or rarely supervised operation where decisions are made and actioned by the system, i.e. impact is at the total ship level.*

AL 6 ***Fully autonomous:*** *Unsupervised operation where decisions are made and actioned by the system, i.e. impact is at the total ship level.*

In the Lloyd's Register's table, only levels AL5 and AL6 are being considered fully autonomous. Moreover, it appears that no line is drawn between the different positions of a

[28] Lloyd's Register guidance document 'Cyber-enabled ships: ShipRight procedure – autonomous ships, First edition, July 2016, p6. Available at*: http://www.lr.org/en/news-and-insight/news/LR-defines-autonomy-levels-for-ship-design-and-operation.aspx*, accessed on 24th January 2017.

vessel on its journey. This means that for example if the table relates to 'unsupervised operation', in doing so, it does not differentiate between unsupervised operation on the open ocean with only little traffic on one hand and very dense areas or even ports on the other. This lack of differentiation may be subject to criticism. Not only common sense but also technical aspects as the amount of processed information or the risks at stake suggest, that further technological development will not be in full harmony with the Lloyd's Register's level system. It is more plausible, that the technological development will in fact happen in such way that a newly constructed MAV might be classified as maybe AL5 for the longest parts of its journey on the open ocean, but then in turn might be only classified as AL3 in high density areas, where the risk at hand suggests that an active human should supervise the vessel's manoeuvres consistently. This finding in turn, from a cost implication perspective, demonstrates the importance of the development of systems that allow utilising the human skills of an experienced master, without the accompanying need of physical presence on board. Although the classification actually refers to 'high impact decisions' in AL3 and AL4, it shall be noted that in practice it rather seems to be a question of time than of the amount of decisions. Shipowners around the globe are very likely not to be interested in ships that require the master to make less decisions per unit of time, but rather in vessels that are allowed to be on their own without any intervention and supervision of a master at all.

Against this background the matter of time management in shipping might be enriched by one more important element that has not been of major influence so far. Cost reductions in master and navigational personnel will only be significant at AL 3 and AL4 if the persons responsible manage to distribute the time periods of 'high impact decisions', e.g. the time in dense areas, in such way that the masters employed will only be burdened with the supervision of one vessel after another instead of several vessels simultaneously. In a scenario of the latter, a cognitive overload easily seems to be in prospect, which is very likely to cause damages of inconceivable dimension. As a result of this nightmarish thought, basically the same amount of masters per fleet would have to be employed with rarely any cost reduction. Thus, only by organising a fleet of AL3 and AL4 vessels in a manner that allows consecutive – in contrast to simultaneous - processing is likely to entail staff cost reductions. Then again it might be highly questionable if those cost reductions are desirable considering delays in delivery and thereby a reduced utilisation of the whole vessel as possible consequence. Given that those decisions are potentially very costly, compared to the employment of a master, it is to assume that the application of AL3 and AL4 vessels will not

be very beneficial without more ado. Cost savings may only be expected at a stage where autonomy is ensured even in high density areas and the master's assistance will only be required in very few and special situations. Then again, even if the costs for employment of the master would stay fairly unchanged, the rest of the crew might be reduced to zero, making changes in ship design possible and allow more goods to be carried per voyage.

It might be questioned whether this autonomy-level-structure will prevail on an international level during the next years. For this dissertation, it shall suffice for the purpose of differentiation between the requirements that the law will bring. And moreover, for now, it provides a good deal of clarity to designer, shipbuilders, equipment manufacturers, ship owners and operators.[29]

CHAPTER 4 - VESSEL REGISTRATION

Having said this, the question arises whether or not and under what circumstances it would be possible to have a MAV registered in South Africa. This does not only matter for its own sake but has very practical implications on all market players concerned. Unmanned shipping will become a non-negligible sector of industry in the near future. And if the South African economy wants to participate in gaining prospective benefits, it seems inevitable that the industry needs to adjust and prepare for the things to come. No matter if suppliers for provisions, bunkers or spare parts, if repair shops or ports, if personnel or all sorts of service providers. What they all have in common is that training and tests will be necessary to establish their services and products. This is rather unthinkable without vessels to conduct test series and try out of the practical feasibility of each and any project. Having MAVs registered to the South African ship registry would not only allow all of these projects to be carried out, but may be highly beneficial in terms of the development of an own unmanned shipping industry in South Africa with new jobs and considerable revenue in prospect. On the other hand, vessels registered in other countries will start to sail the world's oceans. Most certainly they will want to visit the ports of South Africa, too. Therefore, measures need to be taken to allow and to deal with this kind of traffic anyway. In this regard, it might be possible to hit two birds with one stone since the regulations for foreign ships visiting could be

[29] News section of Lloyd's Register's homepage, LR defines 'autonomy levels' for ship design and operation, available at *http://www.lr.org/en/news-and-insight/news/LR-defines-autonomy-levels-for-ship-design-and-operation.aspx*, accessed on 12 March 2017.

inspired to a great extent by the regulations that by then would have been put in place for the domestic vessels. Thus, it is of great importance to question the feasibility of the registration of an MAV to the South African ship register.

I VESSEL REGISTRATION IN GENERAL

Matters around the registration of ships in South Africa are regulated mainly by the Ship Registration Act 58 of 1998.[30] It is accompanied by Ship Registration Regulations adding detail to the provisions.[31] For the purpose of this survey it is essential to differentiate three hurdles of registration. Firstly, the eligibility criteria for registration based on ownership need to be met. Secondly, compliance with the stipulated conditions for registration that are generally relating to safety standards and the like is to be ensured. Thirdly, there is the Registrar's residual discretion to refuse the registration even though both the eligibility criteria and the conditions for registration are met. All three stages need to be examined in the context of automated shipping activities.

II ELIGIBILITY CRITERIA

The Ship Registration Act distinguishes different kinds of ships entitled to be on the register. Those are South African Ships, small non-fishing vessels wholly owned or solely operated by South African residents and/or nationals and ships on bareboat charter to South African nationals.[32] On a higher level, the question arises if an MAV is even considered a ship in the first place. As the definition in s 1 (1) of the Act states, a ship may be 'any type of vessel capable of navigation by water'. Therefore, nothing indicates that either crew or master are necessary to consider a MAV a ship. This finding is in line with the definitions existing in most of the international maritime conventions and national maritime laws so that MAVs would be covered by the great majority of the regulatory definitions.[33] Thus, most conventions and national law would not need to be revised in this regard.

[30] Supra at fn 5.
[31] Supra at fn 6.
[32] John Hare *Shipping Law & Admiralty Jurisdiction in South Africa* 2 ed (2015) 209.
[33] See Eric van Hooydonk `The law of unmanned merchant shipping – an exploration´ (2014) 20 JIML 403 at 406 with a comprehensive overview concerning national and international law and the respective 'ship' definitions.

Starting point for the Registration itself usually is s 4 (1) of the Act that entitles every 'South African ship' to fly the national flag.[34] A South African ship, in turn, is a ship entered on the South African ship register or a ship that is unregistered but entitled to be registered either as a 'South African owned ship' or a 'small vessel', other than a fishing vessel, that meets the eligibility criteria for registration of such vessels.[35] As discussed above the basis of this survey is a non-registered vessel that is a neither a small nor a fishing vessel. Thus, the eligibility criteria contained in s 16 (a) for a South African owned ship are applicable. The option of a bareboat charter shall not be considered in this examination. The eligibility criteria mainly focus on the ownership of the ship and on the link that the owners have with South Africa.[36] Although interesting questions arise around the ownership and especially the genuine link that is required, these questions shall not be in the centre of this dissertation. The criteria have been relaxed recently and it shall be assumed that the entity which is going to register the ship in its name at least has a place of business in South Africa.[37] Furthermore, the vessel considered in this survey does not fall under the prohibition of registration that is stipulated by Regulation 12 concerning wooden ships of primitive build nor does it fall under s 19 (1) of the Act concerning ships that are already registered in terms of the law of another state. Therefore, the eligibility criteria stipulated by the Ship Registration Act can as well be met by an MAV.

III CONDITIONS FOR REGISTRATION – SAFETY STANDARDS

(a) TONNAGE MEASURE, MARKING EVIDENCE AND LOAD LINES

Additionally, as has already been pointed out, the conditions for registration must be met. What is necessary in this regard is the following. Firstly, a certificate relating to the tonnage measure of the ship is required according to s 17 (1) (a) (b) Ship Registration Act. This does not constitute a major problem regarding MAVs since the tonnage measure would not deviate considerably from that of a manned vessel from a legal point of view. Secondly, as stipulated by s 20 (1), evidence must be lodged, that the ship has been marked in the prescribed manner. Similar to the tonnage measure, this provision can be applied to MAVs, too. Thirdly, the

[34] John Hare *Shipping Law & Admiralty Jurisdiction in South Africa* 2 ed (2015) 208.
[35] WA Joubert *Law of South Africa – Volume 25 (2)* 2 ed (2016) par 39.
[36] WA Joubert *Law of South Africa – Volume 25 (2)* 2 ed (2016) par 40.
[37] According to the definition of s 1 (1) of the Ship Registration Act a body corporate is regarded as a 'South African national' as long as it has a place of business within the Republic. What this prerequisite may entail in detail has been discussed broadly.

same thought can be applied to the certification of compliance with regulations relating to load lines as contained in s 205 (1) of the Merchant Shipping Act.[38]

(b) COMPLIANCE WITH SAFETY REGULATIONS

Then again, another condition for the registration of a vessel is the compliance with the relevant safety regulations as stipulated by s 190 (1) of the Merchant Shipping Act. This obviously raises the question if a respective certificate could be issued for a MAV of a certain level of autonomy. In this consideration a ship is involved, that is not a passenger ship according to the definition section of the Merchant Shipping Act. Therefore, s 193 (1) and (2) of the Act is applicable, regarding ships other than a passenger ship to which in turn the International Convention for the Safety of Life at Sea (SOLAS) is applicable. As a contracting government to the SOLAS convention, the convention is applicable to ships that are entitled to fly the South African flag and thereby for the ships considered herein.[39]

Although the SOLAS convention underwent many adjustments since it was first drafted as a result to the RMS Titanic tragedy, it was never meant to be an answer to or even in relation to unmanned shipping. The current version is the 1974 version which subsequently was amended several times. None of these amendments dealt with the perils and characteristics of unmanned shipping either. Therefore, it is highly questionable if shipping without a crew on board can ever be put into practice without a major amendment of this convention. Some of its provisions are worded in such manner, that even an interpretation which is walking the line between permissability and unacceptable interpretation might not be enough to justify its application to unmanned ships. One of these provisions might be reg V/24, which in certain situations requires the possibility to switch over to manual steering of the ship immediately.[40]

Even though this provision indicates that the lawmakers did consider heading and track control systems, and thereby an early form of automated shipping, it in turn expresses with very little doubt that fully autonomous shipping, according to levels AL5 or AL6, was not included in the field of application. In order to make the provision work for MAVs, it is

[38] Merchant Shipping Act 57 of 1951.
[39] Accession of the Republic of South Africa 25 May 1980.
[40] See E D Brown, N J J Gaskell The Operation of Autonomous Underwater Vehicles. Vol Two: Report on the Law (London 2000); Vol Three: The Law Governing AUV Operations (London 2001) at 113. Brown in this context, seems to be convinced that SOLAS will always be a primary obstacle without a comprehensive amendment.

tempting to interpret the provision in a manner that would allow the inclusion of MAVs and the assertion that the mere ratio behind the provision was to take away the control from a computer and give it back to a human again. If this task is decomposed into its fragments it might be possible to argue that the prevailing thought behind said provision was to switch from an artificially steered program to the overriding control of a human mind with its experience and abilities. Building up on this thought, it can further be argued that the experiences and skills of a slick master can be utilised from a shore based control centre as good or even better as from the respective vessel itself. This thought, however, is dangerously close to disobeying the intention of the legislator. Not only does it seem evident, that the lawmakers did not want to make provision for unmanned shipping at all with this regulation, but also the wording itself suggests otherwise. The regulation uses the words ‘manual control’ which, without any deviating definition at hand, normally suggests that that there is a real person on board the vessel, controlling the rudder with its own hands. What this shows, at the least, is that the SOLAS Convention was not meant to count for unmanned shipping at all.

Therefore, under current regulations it is necessary to examine which of the most relevant rules are rather unproblematic and to detect those, that will prove difficult for an unmanned vessel to comply with.

(c) MUNIN PROJECT STANDARD

It is obvious, that the more autonomy a vessel is furnished with, the more problems will arise with the regulations in place. MAVs will be equipped with a whole range of different systems that assist navigation, steering and connection between vessel and shore. The possible solutions that are being discovered at present and will be found in the future are manifold and each of those will have a very different impact when measured against international safety regulations. As a result, it is necessary to stay within the margins of what will be a realistic development in the near future. The industry will be forced to work with what is actually available and might be capable to achieve further developments in those technologies. The members of the MUNIN project understood this thought and made the effort to specify in detail what can be expected in the near future. On this basis it is possible to evaluate if the technology created and put to work will be sufficient so comply with international regulations. Therefore, the standard of technique used in this dissertation shall be the

identical to the technology that was taken as an example in the MUNIN project in order to provide a background for further examination. It can be assumed that his is equivalent to a level of autonomy AL4 or AL5. This project, as well as other big projects, e.g. the Rolls-Royce project, have in common that they deem unmanned shipping as an operation that is policed and controlled from an office at shore. In these shore based control centres the coordination of the whole operation will be conducted. The vessel itself will be furnished with various systems that deliver the vital data to the control centre at shore. An advanced navigation system, called DSNS (Deep Sea Navigation System) in the MUNIN project would work in conjunction with another system of sensors, cameras and computers that MUNIN calls ASM (Advanced Sensor Module) capable of providing data about the environment around the ship. Additionally, the ship itself is being controlled and monitored by another system of sensors, detectors and computers, called AEMC (Automated Engine Monitoring and Control) that provides with extra data about the status of the vessel, its engine and the vessel's most crucial installations. The System that is capable to take over the navigation of the ship from shore is called RMSS (Remote Maneuvering Support System) in the MUNIN project. Those systems taken together provide the respective owner or master at shore with a comprehensive set of tools to monitor the environment surrounding the ship and its integrity. With, among others, daylight and infra-red cameras, GNSS, echosounders, speed logs, NAVTEX, weather forecast and sea charts it is believed that the MAV can operate just like a normal ship.[41]

(d) HUMAN LOOKOUT

Taken these standards as a basis, it shall be surveyed which of the international regulations might emerge as the most problematic. As one of the first difficulties, the international regulation for the maintenance of a proper lookout requires some attention. The International Regulations for Preventing Collisions at Sea (COLREG)[42] stipulate in rule 5 that every vessel must have a proper look out by sight and hearing at all times. Moreover, it requires the utilisation *'of all available means appropriate in the prevailing circumstances and conditions so as to make a full appraisal of the situation and of the risk of collision'*. Therefore, it is unclear if the rules set up allow their observance by non-human technology, and if so, on the basis of which standard of technology. Not only common sense but also scientific research

[41] MUNIN Report D9-3, p59.
[42] Convention on the International Regulations for Preventing Collisions at Sea, 1972.

shows, that most[43] casualties at sea are caused by human error due to fatigue, unawareness and attention deficit. Such faults are not familiar to computers, cameras and sensors. Additionally, while a person can only police and process a rather limited amount of information, e.g. look and hear into one direction, a sophisticated high-tech system with lots of cameras, microphones, sensors and huge computing capacity is capable to monitor a multitude of information at the same time, compared to a human being. Regardless of these obvious advantages, compliance with the law in place is necessary for the registration of a vessel to the ship register. In order to determine what a proper lookout as required by the COLREGs is, it helps to look at court decisions and their respective interpretations.[44] U.S. courts have had the opportunity to decide cases with reference to lookout duties. They describe the lookout as 'both eyes and ears of the ship'[45] and claim that the persons conducting the lookout must be 'of suitable experience, properly stationed on the vessel, and actually and vigilantly employed in the performance of that duty'[46]. Moreover, it is necessary that the lookout is not only on watch for large objects, such as ships, but also for smaller items adrift in the water.[47] Against the backdrop of these duties, it becomes clearer why most of the projects that are conducting research in the field of unmanned shipping are not only trying to find solution for the navigation and steering of vessels but also focus on camera and detection solutions equally. Whilst, as discussed in CHAPTER 3, first approaches have been adopted to distinguish between vessels with a certain level of autonomy, so far no system of differentiation between levels of compliance with lookout duties has been announced. Hence, it is difficult to assess, whether the current state of technology would suffice to comply with the lookout duties without an adaption of national or international law by the IMO and the flag states. Irrespective of the answer to the question if an actual human is required on board a vessel to perform lookout duties, it must be noticed that under current law, the technology used on board must at least be capable to guarantee the same set of skills that a human would have. Therefore, in order to register a vessel, it would be necessary that the system in place would be able to detect other vessels, large and small objects and have voice detection

[43] Anita M. Rothblum 'Human Error and Marine Safety' p 1 available at *http://bowles-langley.com/wp-content/files_mf/humanerrorandmarinesafety26.pdf*, accessed on 12 March 2017.

[44] In this regard, Paul W. Pritchett suggests to look at what U.S. courts have given as considerable guidance. See Paul W. Pritchett 'Ghots Ships: Why the Law Should Embrace Unmanned Vessel Technology' (2015) 40 Tulane Law Journal 197 at 204.
[45] Dahlmer v. Bay State Dredging & Contracting Co., 26 E2d 603, 605, 1928 AMC 1044, 1048 (1st Cir. 1928).
[46] Chamberlain v. Ward, 62 U.S. (21 How.) 548, 570 (1858).
[47] *See Cook* v. Moran Towing & Transp. Co., 193 F. 48, 50 (2d Cir. 1911).

implemented. Although these requirements could be met rather easily by installing high definition cameras and microphones on board the vessel, this solution would obviously thwart the idea of cost savings behind unmanned shipping. If the vessel would rely on an actual person to maintain a proper look-out at all times, no costs would be saved if said person was to sit in an office on shore. On the contrary the building costs of such vessel would even be higher than the costs of a conventional vessel, since high-tech cameras, microphones, computers and a stable and fast connection to the shore would be necessary. Then again, if this person was to be the only human occupied with the control of a huge vessel and other personnel could be saved, the venture could still be financially sensible. Therefore, in order to get to a state of development where a vessel would recognise perils autonomously, the leading projects in the industry are developing technology that will perform the lookout duties just as a human but without its natural errors and restrictions.[48] Although a perfectly working system has not been announced yet, it is safe to assume, that such a system will be available rather sooner than later. When it comes to ship registration and the accompanying question if the authorities, in this case SAMSA, will be satisfied that the rules of a proper lookout, imposed by international law are being met, it is very likely that a comparison with an actual person on board a vessel will be carried out. For this purpose, it is to assume that the technology will not fail the test and that the technology will excel the human capabilities as predicted by many.

What still remains is the question of applicability of the COLREGs in this case. Even if it were possible to prove that an MAV's technology is sufficient or even better at performing the duties in question, the wording of written law and court decisions must be acknowledged. Therefore, it is necessary to interpret those provisions and judgements.

To this end, Rule 5 of the COLREGs shall be examined. What instantly attracts attention is that the wording of Rule 5 addresses the vessel directly. The wording does not explicitly stipulate that a human needs to maintain the proper look out, but rather assigns this task to the vessel. Given the fact, that this wording stayed unchanged since the first version of COLREGs from 1972 where unmanned shipping was not somewhere near as it is today, it would be rather brash to assert that the lawmakers then made provision for the beginning of unmanned shipping in the 2020s. Otherwise, it was not expressed clearly, that the lookout

[48] See e.g. Jacoby Larson et al. 'Autonomous Navigation and Obstacle Avoidance for Unmanned Surface Vehicles' (2016), available at *http://www.public.navy.mil/spawar/pacific/Pages/default.aspx*, accessed on 12 March 2017 for the U.S. Navy project creating a prototype system designed to detect multiple maritime objects.

duties can only be fulfilled by a human being. Since it was not made clear what the rule might entail in detail, when it comes to this question, it is crucial to take the intention of the provision into account in order to provide guidance. What the provision aimed to do by implementing rule 5 was to establish a permanent duty to gather all information available in the surrounding of a vessel that is subject to the COLREGs.[49] Moreover, a full appraisal of the situation shall be made and the risk of collisions should be monitored. As can be seen from first results and as the near future will most likely reveal, the task of gathering data can be fulfilled by technology as well. Apart from that, with more development to come, it is safe to assume that technology will be able to prevent many accidents by its mere nature. One need only think of cameras that can see through the dark night, through fog and rain in all compass directions simultaneously, without getting tired, bored or distracted. Sensors that detect differences in the water structure, such as big and small objects, way further than the human eye ever could. Directional microphones that are capable to capture distant sounds and are not vastly drowned by the vessels engine and other disturbances. A fast and direct nexus between the recognition of a potential threat and the much needed remedial action. All these advantages will be combined with the possibility to immediately give back the vessel's command and control to an experienced and rested master based on shore. Against this background it cannot be denied that the ratio legis of the lookout provisions is more than met, as soon as said technology is available. Until then it will be in the hands of the respective authorities and their estimation of the safety situation to allow MAVs to be registered. In the decision process they will have to determine the level of technology required to assure that at least the degree of safety is guaranteed that would be provided by a human lookout. Most likely classification societies will play a significant role in this process. As seen above in Chapter 3, the classification societies are already concerned with the issue. This is important since it is not to expect, that single flag states will provide with a comprehensive assessment of every technology that will be available on the market. Hence it will be on the societies to develop a working system to classify unmanned vessels and their respective technology. Therefore, if the industry manages to convince with technology capable to at least work as effective as a human lookout on board, the lookout provisions of COLREG are being fulfilled. Whilst single court decisions may suggest that an actual human is required in the process of watchkeeping, the COLREG's wording does not require this. Hence, the court rulings are to be looked at as a guideline for vessels without the necessary technology on

[49] See also Paul W. Pritchett 'Ghots Ships: Why the Law Should Embrace Unmanned Vessel Technology' (2015) 40 Tulane Law Journal 197 at 205.

board to meet the lookout duties with advanced technique. Therefore, the so far established specification by case law can only be applied to a situation where an actual human is on lookout. Not only because the courts never dealt with MAVs and lookout questions but also because mentioned judgements are based on the old picture of an actual human on board and its duties during the performance of the job.

(e) MANNING REQUIREMENTS

The manning requirements of current national and international law are sometimes described as the largest hindrance to automated shipping.[50] This is only partly surprising since the Carriage of Goods by Sea Act (COGSA), The United Nations Convention on the Law of the Sea (UNCLOS), the United Nations Convention on the Safety of Life at Sea (SOLAS) and IMO Resolutions deal with manning requirements to various extents. Those are then accompanied by certain domestic regulations of the respective flag state. Those national regulations, as Chwedczuk points out for the U.S. maritime law, may not only be a hindrance to autonomous shipping, the construction and use of MAVs in the respective state, but can also be imposed on foreign vessels.[51] This, in turn, does not only concern the respective state but has significant implication on other nations and on the whole world of autonomous shipping. It needs to be recalled that the world of shipping and commerce in itself is as international and intertwined as it gets. The prospect of not being able to visit a certain important country with such a vessel, due to legal hardships or inadmissibilities, might be the one factor holding the balance between a rapid development of unmanned shipping or a rather slow overall progress. Therefore, the world of MAVs and their near future can be described as frail without a strong set of rules implemented by the IMO, binding all member states.[52] As long as this is not completed it will be necessary to rely on the interpretation of the mentioned international conventions and national law.

[50] Paul W. Pritchett 'Ghots Ships: Why the Law Should Embrace Unmanned Vessel Technology' (2015) 40 Tulane Law Journal 197 at 202.
[51] Michal Chwedczuk 'Analysis of the Legal Status of Unmanned Commercial Vessels in U.S. Admiralty and Maritime Law'(2016) 47 JMLC 123 at 145.
[52] As described by Volker Bertram in his presentation 'Towards Unmanned Ships' at slide 47, the number of 14 IMO conventions are concerned with questions of unmanned shipping, available at *https://www.ntnu.edu/documents/20587845/1266707380/UnmannedShips.pdf/e60834b0-b0f7-4d61-b368-3ee38f829afc*, accessed on 12 March 2017.

(i) COGSA, UNCLOS, SOLAS

Art. III (1) (b) COGSA (South Africa) imposes the duty on the carrier to exercise due diligence to properly man, equip and supply the ship, right next to the obligation to make the ship seaworthy for her voyage. What it does not provide is an explanation of what is meant by a proper manning. Considerable similarities can be found in Art. 94 (3) (b) UNCLOS, requiring the member states to take such measures for ships flying its flag as are necessary to ensure safety at sea with regard, inter alia, to the manning of ships […]; again without further specification. Eventually Chapter V, Regulation 14 (1) SOLAS urges the contracting governments to take measures to ensure that, from the point of view of safety of life at sea, all ships shall be sufficiently and efficiently manned and further demands a minimum safe manning document issued by the administration in reg 14 (2). Again, no detailed answers can be found within SOLAS to what this could mean in numbers. Given these insecurities, the IMO tried to provide with some support in order to find the urgently needed answers.

(ii) IMO RESOLUTIONS

What the IMO has done so far is the adoption of a resolution on principles of safe manning in 1999[53], which has then been revoked by the resolution on principles of minimum safe manning in 2011.[54] The resolution, however, is not furnished with the power to bind the contractual parties due to its very nature. Therefore, it only provides guidance to flag and port states in order to set minimum safe manning requirements.[55] As Pritchett points out, the 1999 version of said resolution stipulates nine factors that the principles suggest to take into account. This number of factors was increased to eleven under the 2011 resolution. Those are: (1) size and type of ship; (2) number, size and type of main propulsion units and auxiliaries; (3) level of ship automation; (4) construction and equipment of the ship; (5) method of maintenance used; (6) cargo to be carried; (7) frequency of port calls, length and nature of voyages to be undertaken; (8) trading area(s), waters and operations in which the ship is involved; (9) extent to which training activities are conducted on board; (10) degree of shoreside support provided to the ship by the company; (11) applicable work hour limits and/or rest requirements; and (12) the provisions of the approved Ship's Security Plan.

[53] Resolution A.890(21) of 25 November 1999.
[54] Resolution A.1047(27) on 30 November 2011.
[55] Paul W. Pritchett 'Ghots Ships: Why the Law Should Embrace Unmanned Vessel Technology' (2015) 40 Tulane Law Journal 197 at 202.

It had already been argued under the law of the 1999 resolution, for instance were a vessel was built and configured accordingly, that a case could be made for a minimum manning requirement of zero.[56] Following this thought, especially the new provisions (3) and (10) in the 2011 version suggest that a requirement of zero might be realistic in some cases. Whilst it cannot be stated with certainty that these provisions were added to make room for fully automated shipping, it nevertheless demonstrates that the level of autonomy and the degree of shoreside support does constitute significant criteria for the IMO when minimum manning requirements are on the table. Therefore, if a ship is at hand that might fall under the autonomy level AL5 or AL6, which actually can be steered from a shore based control center as proposed by the MUNIN project or the Rolls-Royce plans, together with the compliance of the other principles, it appears to be quite conceivable to have unmanned vessels on the open ocean because local authorities might hold an unmanned vessel for sufficiently manned under this resolution. This should hold true all the more if the new emphasis in principle (8) 'trading areas' will be paid attention to. If the owner makes clear that its intentions are only to trade and sail in areas that are of rather limited thread to the vessel to be registered and other vessels and facilities, it could prompt the authorities to grant the necessary permission. Therefore, in its current state under the new 2011 resolution and in view of its non-binding nature, it is safe to assume that the IMO Principles of Safe Manning do not form a major obstacle to the breakthrough of unmanned shipping.

However, what does form a huge impediment in some instances is the comparatively strict domestic law of some flag states. The U.S. for example, require vessels under their flag to carry a minimum contingent of personnel of which many are required to hold the U.S. citizenship.[57] On markets with such strict rules in place, MAVs do not seem to have a bright future of development and registration without more ado.[58] The consequences in prospect for those states might be that the relevant developments in technology will be made somewhere else and that the legal system in place will take a reactionary role, which might lead to

[56] Ibid. at 203.

[57] This does not apply to all vessels but only to those that are subject to Coast Guard inspections, which in turn are mostly those vessels that could make use of the unmanned situation. Vessels not within the ambit are fishing vessels, some sailboats and yachts. See 46 U.S.C. §§3301, 8301, 8901-8903. For a brief overview on the problems arising see Paul W. Pritchett 'Ghots Ships: Why the Law Should Embrace Unmanned Vessel Technology' (2015) 40 Tulane Law Journal 197 at 203 and Michal Chwedczuk 'Analysis of the Legal Status of Unmanned Commercial Vessels in U.S. Admiralty and Maritime Law'(2016) 47 JMLC 123 at 144.

[58] Although Chwedczuk sees a chance even for the U.S. since the Coast Guard might be able to waive the minimum crew requirements entirely if satisfied that MAVs are capable of safe operation and navigation, and that such vessels may even be safer than traditionally manned vessels, see Michal Chwedczuk 'Analysis of the Legal Status of Unmanned Commercial Vessels in U.S. Admiralty and Maritime Law'(2016) 47 JMLC 123 at 144.

inconsistent structures.[59] As mentioned before, on the other hand, those states also represent a threat for the whole industry of unmanned shipping considering its interconnectedness.

Other Countries in turn, leave it to their respective authorities and their discretion to determine the vessels minimum manning requirements. A feasible method, practiced in Germany[60] and elsewhere around the word, is to refrain from specifying a precise number of on board personnel, but rather to urge the owners to come up with a safe manning proposal. The latter will then be subject to verification by the competent authorities. If the authorities are satisfied that the manning is sufficient depending on the purpose, a safe manning certificate will be issued. Although there still might be a lot of effort necessary to fulfill all the requirements that authorities would probably impose in this regard, with the revised IMO principles from 2011 as a background, countries with this approach seem to be much more likely to grant the owners of an MAV a manning certificate and therefore will rather tend to allow these vessels on their register. The situation in South Africa is similar. International conventions are being applied and policed by the South African Maritime Safety Authority (SAMSA), which also respects the IMO principles in their decisions. No deviating regulations are in place that would impose stricter rules on the owners of an MAV. Therefore, it can be argued that SAMSA might possibly be convinced to provide with the necessary certificates if the MAV in question were to prove to be at least as safe and reliable as a ship with a crew on board. This again might overstrain the respective flag state's authorities and will probably be relocated to the big classification societies. Those will be in charge to develop a system that could make sure that MAVs of certain categories would fulfill the safety and reliability requirements that at best exceed those of conventional ships.[61]

(f) THE DUTY TO RESCUE AT SEA

Shipping law itself is a rather traditional area of law and so is the obligation to rescue people and vessels in distress.[62] Although closely interlinked with the law of salvage, which can be a

[59] Paul W. Pritchett 'Ghots Ships: Why the Law Should Embrace Unmanned Vessel Technology' (2015) 40 Tulane Law Journal 197 at 225.
[60] See the German regulation for safe manning 'Schiffsbesetzungsverordnung' of 18 July 2013 which does not differentiate between the two German registers and thus makes the provision applicable for both.
[61] How these tests and surveys could look like, as well as questions pertaining to the liability of the classification societies are outside the scope of this dissertation, but should also be examined closely in the near future.
[62] As it has been pointed out, it has been the duty of seafarers to render assistance to those in distress since the lex maritima itself. See Chwedczuk supra p 147, with reference to Jeffrey Maltzmann & Mona Ehrenreich, 'The Seafarer's Ancient Duty to Rescue and Modern Attempts to Regulate and Criminalize the Good Samaritan' 89 TUL. L. REV. 1267 (2015).

tough and ruthless business sometimes, this duty still has the power to restore faith in humanity, given that people regardless of their origin, ideologies or missions are helping each other out on the open ocean when in desperate need of help. It it remarkable that this honorable and ancient duty made its way into international conventions like SOLAS and UNCLOS as a codified expression of the natural helpfulness among seafarers. The prospect that this quite romantic era will come to an end with unmanned and soulless vessels entering the oceans, is not only interesting from a humane but also from a legal perspective. Without any changes, it seems that even unmanned vessels must be equipped with all sorts of gear that usually is intended for human beings. The SOLAS convention prescribes in detail requirements for life-saving appliances and arrangements including life boats, life jackets and rescue boats considering various vessels.[63] Since no exemption has been included for MAVs, to be consistent, the unmanned ship must be furnished with said equipment, too. This, at first glance, seems to be a major obstruction as some of the advantages associated with the use of MAVs will be limited up to a certain dimension. Every lifeboat on deck and every room that is capable to take in passengers, food, water, life vests and more equipment can only be provided at the expense of the potentially increased storage of containers, bulk or oil. Therefore, to a certain degree, the benefits of unmanned shipping will be constrained by these arrangements. This, on the other hand does anticipate quite some time and progress. To assume that unmanned vessels would sail the world's oceans in the near future without ever having the need to put any crew on deck must be considered dreamy even by the most forward-looking visionaries. It is very hard to believe that the progress will be that radical that within the next couple of years, ships will sail fully autonomous in every situation and moreover, that local authorities and legislators all over the world will allow unmanned vessels in high density areas without a compulsory pilot on board.[64] Against this backdrop and the remaining need for maintenance, conduction of tests and unforeseen misfortunes such as accidents or loss of connection to shore, it will still be important, at least in foreseeable future, that people can actually get on board a vessel that might be unmanned for most of its lifetime. Since it would be rather mindless to assume that those people would never be in need of rescue equipment, the obligation to furnish the ship with said equipment simply cannot vanish entirely for the time being.

[63] See SOLAS 2004, Chapter III.
[64] See subitem cyber-crime and piracy for example.

From what we have seen so far regarding the rescue duties it is safe to conclude that for MAVs the current regulations are unsatisfactory at least. The lawmakers in the future are well-advised to adjust the provisions in a manner that would differentiate between manned and (usually) unmanned vessels. In doing so, it would become possible to respect particular characteristics of the different systems. Thinking about the regulations that might be applied to MAVs, the opportunity arises to implement measures which are able to combine the two interests. On one hand the opportunity should be taken to radically reduce the requirements of international law currently in place. Since it is to assume that a crew would only be on board occasionally, in very reduced numbers and most likely rather close to shore, the demands in this regard should be reduced to a bare minimum. In exchange for this, the owners of MAVs could be charged with measures to serve a greater good. If the rescue of own personnel starts to play a lesser role, the salvation of other vessels and persons in distress could become more prominent. Therefore, ship builders, owners and charterers could be asked to equip vessels with technology from which others could benefit. The deployment of large rafts or other contrivances might then be the remedy to fulfill its duties.[65] Those again could be equipped with more supplies and medical aid to help others survive in a situation that would lead to their certain death without the help of another vessel close by. Decision-makers are likely to have a hard time in the development of those regulations since it will not be easy to find a solution that suits all interests likewise. On one hand, more equipment on board will not only entail greater costs for purchase and maintenance, but also reduce the benefits of MAVs that are in prospect. On the other hand, as can be seen regularly these days, e.g. with the African-European refugee crisis or from maritime disasters of the past, it might as well happen that hundreds of humans will be in urgent need of help as a matter of life and death. Not only the owners or charterers, but also politicians and other members of the shipping industry will then have to answer the haunting question why only a very limited amount of humans could be saved. Given the fact that basically all vessels flying the flag of one of the signatory states would have to deal with rather similar costs, which then in turn would be imposed on the final consumer, it is hard to argue that very low rescue and equipment duties had been the only sensible choice. Therefore, a reasonable balance between the interests at stake needs to be found within the following years.

[65] See Paul W. Pritchett 'Ghots Ships: Why the Law Should Embrace Unmanned Vessel Technology' (2015) 40 Tulane Law Journal 197 at 210.

(g) CONCLUSION – SAFETY STANDARDS

In conclusion, as outlined in this chapter, it can be stated that although or maybe exactly because the manning requirements are somewhat vague and were never explicitly made for unmanned shipping, it seems that even under the current international law and most examined domestic laws, it would be possible to comply with the rules stipulated and to obtain the necessary certificates for an MAV in order to get it registered. The examination of the watchkeeping and lookout duties produces the same result. Additionally, even the rescue duties can be interpreted to suit an MAV and the latter can be equipped with everything that is necessary under current law, although this might not be sensible or economically viable. These considerations hence suggest that it could actually be possible to fulfill not only the eligibility criteria for the registration of an MAV in South Africa, but also indicate that the conditions for registration, especially the compliance with safety regulations could be met if the provisions applicable are open to a wide interpretation.

This, from a South African perspective, leads to the question of s 18 of the Ship Registration Act and thereby to the Master's discretion.

IV THE REGISTRAR'S RESIDUAL DISCRETION

(a) SCOPE OF DISCRETION

As has been pointed out in the introduction the registration is subject to a three-step examination carried out by the Registrar. The Registrar has a residual discretion as to the compliance with certain registration requirements. However, his discretionary power does not extend to all steps. The first hurdle in terms of registration requirements relates to eligibility criteria which need to be met for the ship to be registrable. S 16 enumerates the ships which are entitled to be on the register building on the owner's nationality. Providing the ship in question falls under one of the provisions in s 16 it is entitled. In this context the Registrar does not enjoy discretionary power. This is reflected in s 18 as well, which states that the Registrar may refuse the registration in the circumstances there described, despite the ship being entitled to be registered. Two inferences can be drawn from this provision. The provision confers a residual discretion on the Registrar in terms of certain criteria which do not relate to the entitlement of a ship to be registered as stipulated in s 16. E contrario this means that the Registrar has no discretion as to the entitlement of the ship to be on the register.

The second step of the examination involves the question of compliance with conditions regulated by law for registration, pertaining inter alia to safety requirements such as tonnage and marking. Here too, the Registrar is without discretion as regards the conformity with said conditions. If the conditions are complied with the respective ship shall be entitled to be registered, without the registrar having the right to refuse the registration based on considerations other than the ones incorporated in s 18.

The third step of the examination finally involves the Registrar's exercise of discretion. Even if both eligibility and conditions for registration are met, s 18 allows the Registrar to refuse the registration if she or she is satisfied that

> *(a) it would be inappropriate for the ship to be registered having regard—*
> *(i) to the relevant requirements of the Shipping Acts in respect of—*
> *(aa) the condition of the ship in respect of its safety or any risk of pollution; and*
> *(bb) the safety, health and welfare of persons employed or engaged on the ship; or*
> *(ii) to the interests of the Republic or international merchant shipping;*
> *(b) the prescribed conditions have not been complied with; or*
> *(c) the registration of the ship is prohibited in terms of regulations under section 56(3)(d).*

As can be seen the discretionary power on the one hand extends to the compliance with specific requirements in relation to the condition of the ship with regard to her safety and pollution, as well as the safety, health and welfare of persons working on the ship as stipulated in the South African Shipping Acts. Let it be supposed that safety conditions are considered to be met, the Registrar can nonetheless refuse the registration if he or she is confident that the registration would be inappropriate.

On the other hand, the Registrar is granted a broader discretion which is not tied to specific requirements but to unspecified general interests of the Republic or international merchant shipping. In case of refusal to register at the Registrar's discretion the question arises, if any, which remedies are available, if the applicant challenges the legitimacy of the decision. It should be noted that the scope of discretion is not unlimited. The Registrar's refusal constitutes an administrative decision and therefore must be consistent with the Constitution according to the principle of legality.[66] The requirements of legality are set and

[66] According to the definition in the Promotion of Administrative Justice Act 'decision' for the purposes of the Act, includes any decision of an administrative nature made, relating to refusing to do any act or any thing of an administrative nature.

put in concrete terms by the Promotion of Administrative Justice Act (PAJA).[67] Founded on s 33 of the Constitution[68], which requires an administrative action to be lawful, reasonable and procedurally fair, s 6 of PAJA points out in detail which requirements shall apply to administrative action. Section 6 provides for the possibility of judicial review of administrative action in subsection 1 and then enumerates grounds of review in subsection 2. One absolute prerequisite for the decision's legitimacy is compliance with the underlying empowering provision. Here the empowering provision is s 18, as a 'law in terms of which an administrative action was purportedly taken'.[69] The decision taken by the administrator needs to be authorised by the empowering provision to begin with, as stated in s 6 (2) (f) (i), s 18 clearly authorises the refusal to registar. It is further required that the decision, more specifically the refusal, is only based on a reason which is authorised by the empowering provision according to s 6 (2) (e) (i) PAJA. As inappropriateness having regard to the interests of the Republic constitutes on reason the refusal can be built on, the Registrar has a wide range of considerations that he can submit in reference to refusing the registration. Of course the statement pertaining to the conflicting interests of the Republic, the Registrar might be relying on in the context of its decision, need to be internally coherent and must not manifest error of assessment.[70] In order to determine whether or not to register an MAV as regards the interests of the Republic, the Registrar ought, in fact, to carry out an analysis pertaining to cost and benefits of such registration, which is open to judicial review.

(b) COST-BENEFIT-ANALYIS

Within this analysis, the focus shall be on the benefits and costs that the flag state will incur. Obviously, what is good for the flag state must not be good for the shipowner, the master or a third party.

(i) BENEFITS

As it was shown, research is being conducted by universities and the European Union, money is being invested by private companies, time is spent in endless meetings and conferences, political interference and drafting of new regulations has started. All this has happened for

[67] Promotion of Administrative Justice Act 3 of 2000.
[68] The Constitution oft the Republic of South Africa 1996.
[69] See definition section of PAJA.
[70] See s 6 (2) (*e*) (*iii*), s 6 (2) (*f*) (*ii*).

one reason: The benefits in prospect. When push comes to shove, those are setting the bar for the question whether the costs and risks that will inevitably come with the change are worth being taken or not. Thus, it is them that matter the most. That improvements, advancements and therefore profits are very likely to be the product of this new technology in the future is quite undisputed. From the perspective of a free market economy, this can already be derived by the mere fact that private companies are investing money right now. And without any doubt, being the first market player with a product that classification societies, states and the IMO would accept as on a par with manned vessels, a huge sale is in prospect. It does not need comprehensive calculations to realise that a vessel capable to carry 20% more goods, saving 90% of personnel costs and having reduced fuel consumption would outperform on the market and would be a huge competitive advantage. Therefore, a distinction between the benefits is necessary. Some benefits will affect the shipping industry, companies and ventures. Others will be in favour of the state and its people. The latter category will be of more interest for the registrar's decision, although large overlap might be found.

4.IV.b.i.1 Ships on the register and Taxes

An opening of the South African register for MAVs is very likely to attract ships to its register. Given the regulations in place, South Africa does not seem to be thrown off in the competition of the registers and if it's register was to be one of the first known for a cooperative administration and a fair chance to get an MAV registered, a rush for registration was to expect once the technology would enter the market. Moreover, attracting ships to the register is one of the overriding objectives set out by the Department of Transport since it aims to develop South Africa to one of the world's top 35 maritime nations.[71] Growth within the national maritime transport system is regarded as fostering socio-economic development of the country.[72] This is reasonable thinking since a relation between ships on the register and the order situation of local businesses is self-evident, although a huge impact is not mandatory as the case of some of the registers of convenience shows. Still, the hope to create business and industry by having ships registered stays alive for good reasons. At least from a

[71] See Peter Lamb 'Creating an attractive Ship's Registry – the draft South African Maritme Policy', accessed on 12 March 2017, available at:
http://www.mondaq.com/southafrica/x/273050/Marine+Shipping/Creating+an+attractive+Ships+Registry+the+draft+South+African+Maritime+Policy.

[72] See Ministerial Foreword of the ‚Draft Comprehensive Maritime Transport Policy for South Africa, 2017', accessed on 12 March 2017, available at:
http://www.transport.gov.za/LinkClick.aspx?fileticket=tSb_a6K0Z60%3d&tabid=331&mid=1786.

tax perspective, that in the long run would benefit the state and above all its citizens in a well-positioned democracy, this plan should bear fruits. Therefore, along with the already existing aim to get more market players to register their vessels in the Republic, the registrar would most likely be tempted to allow vessels on the register if somehow justifiable.

4.IV.b.i.2 Job creation, new industry, trailblazer role

Furthermore, the registration of vessels in South Africa is believed to be accompanied by the creation of jobs and business opportunities. Whilst unmanned shipping, by its very nature, aims to reduce men and women on board vessels and therefore might at first glance be regarded as an eradicator of jobs, it is likely to create jobs in the republic even though they might not be on board of vessels. When it comes to South Africa's current structure it is without doubt that at an unemployment rate of 26,6% in 2016, jobs are missing and that this constitutes a huge problem. What also creates a problem, is the non-availability of decent jobs that are suitable to improve the situation of social inequality.[73] Therefore, a political decision process would be necessary to decide whether the Government would be in favour of jobs that need less training and create less income because people would compete with those from other countries that have even lower average income, or in favour of jobs that need a lot more training, but could generate income sufficient to overcome social inequality. Although accurate figures are not possible to delineate at present, it must be assumed that the investment in jobs that do not aim to feed a single person but rather to support the republic's advancement are preferable in the long term.[74] These considerations originate in the assumption that a whole branch of industry will emerge if the government considers to act as a trailblazer in the field of unmanned shipping. If, as Pritchett concludes wisely for the U.S., a state is running late in its adaptions to the future of shipping, the technology will be developed elsewhere.[75] With the creation of jobs, it will be just the same. If South Africa does not provide with the possibilities for shipowners and charterers to refill bunkers, take provisions on board and conduct necessary repairs or maintenance-work specialised on unmanned vessels, most likely other ports in the region such as ports of Namibia or

[73] South Africa was ranked 116th in the inequality-adjusted HDI of 2014, report available at: http://hdr.undp.org/en/composite/IHDI, accessed on 12 March 2017.

[74] Even though South Africa might not be one of the big vessel manufacturers in the world, the high-tech supply industry for unmanned vessel could be a highly profitable sector and could create thousands of jobs that would be well paid in comparison to the wages of ordinary seaman which must compete with people from the world's poorest countries. See similar arguments at Chwedzuk, supra at 167.

[75] Pritchett, supra at 225.

Mozambique will. Besides this, no 'if-else-decision' seems to be at hand. By just doing nothing regarding unmanned shipping, no jobs will be created anyway. Given the structure of South Africa's shipping industry it is not to expect, that thousands will lose their jobs due to unmanned shipping for new-registrations have not been too exuberant since the new ship registration Act came into force.[76] Therefore, on the current merits of the case it is highly advisable for South Africa to seize this opportunity at hand. It is to assume that its outstanding geographical location will strategically be of great help.

4.IV.b.i.3 Better working conditions, Increased safety, protection of environment etc.

Working condition of employees would significantly be increased. Not only would seafarers be sheltered from the perils of the sea, but they would also enjoy a more balanced daily life. Additionally, as most projects and studies mentioned above conclude, overall safety would improve due to eradication of human error. This in turn would lead to a lesser number of casualties and accidents and therefore statistically to a better protection of environment due to fewer oil spills and sinking or capsizing vessels.

(ii) COSTS AND RISKS

In order to evaluate what the real costs of unmanned shipping are, it is mandatory to estimate the risks that would come with it. Costs in this connection are not necessarily to be seen as pure monetary implications, but other factors do play an important role. Obviously, the costs of revision of statutes and re-organisation of authorities are measurable, too. Those on the other hand are rather insignificant and would appear anyhow in order to deal with a development that South Africa could never stop on its own. Beyond that, not many costs are likely to emerge for the government and the national budget.

4.IV.b.ii.1 Questions of Liability

Then again, liability questions will arise. Together with the authorization of MAVs on the South African register the question arises whether the Nation itself could be held liable by other Nations for misfortunes that might occur. Leaving the Territorial Waters and even the

[76] See NDoT SA Maritime Transport Sector Study, Part 1, 27 July 2011 at 21 (1.6.1.), accessed on 12 March 2017, available at: http://www.transport.gov.za/Portals/0/Maritime/Part%201_Final_270711yfx.pdf.

Exclusive Economic Zone (EEZ) out of consideration, the question still needs to be answered in case of possible tragedies. An MAV in mind, hitting bad weather conditions, losing connection to the shore based control center, breaking in two and producing a huge oil spill or a container vessel out of control on the open ocean washed ashore at the coast line of another country. The threatening damages that would be the effect of such misfortune are of enormous extent. Assuming the case of lack of agreements between the countries and the other party as the damaged party would be seeking financial compensation and reason that Art. 94 UNCLOS has been violated since every state is asked to make sure that the vessels flying its flag are complying with international safety rules. The outcome of a lawsuit like this would be highly interesting and rather hard to predict on the against the backdrop of the question whether the flag state did everything necessary in its power to prevent damaged parts from harm.

4.IV.b.ii.2 Pollution Risk

Another important matter is the risk of pollution. The bulk carrier which was the foundation for the examination of the MUNIN project might not evoke special problems in this regard, since the goods carried might as well be harmful for the environment but have not been known for their disastrous effects, if compared to different oil spills from tankers that occurred in the history of shipping. However firstly, the shipping industry will be tempted to utilise the technology, when developed, for those vessels as well. Secondly, even other vessels do constitute a risk for the environment, which should not be underestimated. This problem will not stay unconsidered by the registrar's decision. Although it might be a temporary solution only to accept non-dangerous vessels for now, a long-term solution must be found. It seems to be unlikely that South Africa, or any other county, would be willing to take high risks in this regard without more ado. An answer to this problem could be found in the insurance business. Since it is assumed by many that unmanned shipping will come with a reduced number of casualties, it would not be shocking that insurance for those vessels and journeys could be a lot more affordable than it might appear at first glance. Therefore, in order to compromise, the Registrar could ask the owners for an increased insurance cover. Another solution might be to furnish the owners with letters of indemnity which is not unusual in shipping business. Thus, whilst the Republic's risks from a pollution point of view do exist, they could be dealt with appropriately.

4.IV.b.ii.3 Piracy and Cyber Crime implications

With the age of unmanned shipping two very different fields for criminal activity will start to touch one another. The very old 'business' of maritime piracy will merge with the rather new cyber-crime to some extent. The implications of this merger will be hard to predict. However, the possible negative effects can be devastating. Given that big vessels aim to be able to come to a standstill within the distance of fifteen times their size, this could easily be more than five kilometers for a 300m long vessel that only misses this goal slightly. Having such a vessel out of control close to a major city at the coast such as New York, Istanbul, Cape Town, Rio de Janeiro, Sydney or Singapore is something nightmares are made of and renders a further display of the topic's importance dispensable. Although most certainly vessels will still be equipped with the capability to control them by a person on board, it becomes clear that this equipment can be locked from shore as well. Therefore, it is rather unlikely that traditional pirates will be successful in trying to hijack an MAV. A shift of paradigm is at hand that will lead away from armed strong men in fast boats to computer specialists on the internet. Although no hostages are available to captivate, the risk of a cyber-attack is real and can only be fought by the most modern computer systems. Although this might be a disadvantage in international shipping, it is very obvious that the unmanned vessels will make its way towards the oceans anyway. Therefore, it is the shipowners only chance to develop effective counter measures, which is not impossible as we can see from modern anti-virus software on every computer, but will come at a price.

4.IV.b.ii.4 Being regarded as a Register of Convenience

One of the more problematic issues is that of the register's reputation. If it was to expect, that the international community would observe that the conditions to register a ship in South Africa are too soft and that safety requirements or the like are not complied with, this would have a direct impact to the flag's reputation. Even if the Republic's register would not be regarded a register of convenience defined by how the International Transport Worker's Foundation (ITF) sees it,[77] negative effects could still be the result. Local port authorities all around the world could be very demanding and business-disrupting once the South African flag would be regarded as difficult or dangerous. This effect on the other hand would only be

[77] John Hare *Shipping Law & Admiralty Jurisdiction in South Africa* 2 ed (2015) 203.

expectable, if the criteria for the registration of unmanned vessels would be too low. Since other risks are at stake too, such as pollution or danger for other vessels, this should only be another incentive not to permit all kinds of unmanned vessels on the register without further ado. What would be necessary to ask here, as in so many other similar questions, at least the same safety standards that a conventional vessel would have to comply with. The MAV does not constitute an exemption in this regard. Maintenance, periodic inspections and the use of contemporary technology will be key here as well. Whilst maintenance will be done by the owners anyway and inspections are nothing new to them as well, the level of technology required is a rather new concern given its huge extent necessary and the rapid developments that will emerge in the near future. Government and Authorities will have to adapt in this context and it will be essential to schedule and clarify the measures that are expected of an owner of an MAV. Asking too much in this regard may thwart the whole long-term planning of owners and charterers and would certainly provoke them to examine alternative flags. This on the other hand is not a real novelty to the shipping industry. Technology has always progressed and adjustments in law have always been necessary. To find the compromise between safety questions, for example the need of double-hull oil tankers and the costs for shipping owners that come with those decision, has never been easy. The upcoming of MAVs does not constitute an anomaly in this regard and will most likely be dealt with accordingly.[78]

4.IV.b.ii.5 Masters Liabilities/Relationship Master/Owner,

Another precarious parameter in the evaluation of risks and costs is the relationship between the persons involved, especially in connection with the master's duties and liabilities. For centuries the master of a vessel basically was the only authority, the person in charge and the agent for the shipowners, at least when the vessel was on the open ocean or in a foreign port. His position was sui generis, and his powers and duties characterized by independence and strength.[79] Whilst a transition away from this special perception towards a more ordinary employee-function was to notice during the past decades, the master's role in the context of unmanned shipping is fairly unclear. Although the master still had its strong status in law during the past centuries, with increasing technology and the possibility to get in contact with the owners promptly, it was not necessary to make use of his power in practice for most of

[78] See also Eric van Hooydonk `The law of unmanned merchant shipping – an exploration´ (2014) 20 JIML 403 at 423.

[79] For an overview of the master's relationship with the owner and additionally for his or her duties and powers see John Hare *Shipping Law & Admiralty Jurisdiction in South Africa* 2 ed (2015) 286-294.

the time lately. Now, with unmanned shipping appearing out of the mist, his role once again becomes even more unclear. Under the current regulations his position is still strong on paper. The first question, however, is whether the master still exists at all on an MAV.[80] Then secondly, even if this answer is affirmative, it still is unclear if the provisions for the master can be applied for a master that actually is not on the ship. The term master usually is not defined by domestic or international law and all things considered, there is not even a need for such a definition. In fact, being a master would be the result of either one of two situations. Firstly, someone is being appointed to be the master of a vessel, or secondly, someone is provided with the powers and duties that a master has and thereby, de facto, is the master. Disappointingly both alternatives are not necessarily applicable for unmanned vessels. On one hand, no one might be appointed to be the master since there would not necessarily be a need for one. And on the other hand, the duties and obligations executed by the master would very likely be split up between different people.[81] Thus, the provisions in place do not fit the actual situation anymore. Even if the person that is in charge of the vessel during his or her night shift, performing monitoring duties and taking over control if necessary would be regarded as the master, the current law with all its duties and liabilities would not be suitable as a whole. If the shore based controller of the vessel can be regarded as the master of a ship, for example under UNCLOS, must be called into question. As van Hooydonk states, this could possibly be justified by a teleological approach but is already at the borderline of being an interpretation per analogiam, which could be too extensive in international law.[82] Likewise the MUNIN Report finds that in terms of liability the biggest issue is the attribution of the existing ship master duties to the relevant and adequate persons involved.[83] This attribution must be upgraded with new statutes to come in the future. While civil and criminal liability of the master was not an exception but rather the usual case, most likely because it basically was the only person another jurisdiction could get hold of in case of accidents, it would be advisable to shift this liability to the owners or charterers of a vessel

[80] See Eric van Hooydonk `The law of unmanned merchant shipping – an exploration´ (2014) 20 JIML 403 at 409 stating that two options are at hand. Firstly, the provisions are pointless and remain unapplied, or secondly, that the provisions must be applied by analogy to the shore-based controller of the ship.
[81] For example, it is to assume that one person would do the steering, maybe another would do the paperwork such as Bills of Lading or the like, someone else in the HR department would care for the other employees and then again someone else would be in charge for maintenance, emergency repairs or counter piracy measures.
[82] See van Hooydonk `The law of unmanned merchant shipping – an exploration´ (2014) 20 JIML 403 at 410.
[83] See final MUNIN report D9-3 quantitative assessment (2015) 137. Available at *http://www.unmanned-ship.org/munin/wp-content/uploads/2015/10/MUNIN-D9-3-Quantitative-assessment-CML-final.pdf*, accessed on 12 March 2017.

for the future since no one else will be at hand to call to account.[84] Admittedly without further ado, this will not be a good solution in terms of safeguarding that debts and damages will be paid. Hence, other methods must be thought of. Those could be a digital signature for every vessel that would be linked to a company or an owner, verifying its financial standing before entering the EEZ or even territorial waters. Another option would be an adjusted system of insurance or letters of indemnity. In conclusion, it is apparent, that the lesser people are concerned about their own liabilities, the more it will be important to make sure that at least the companies will have to take responsibility one way or the other. For now, and for the registration under current law other measures could be taken. The registrar could ask for a large deposit to make up for the lack of personal liability. Maybe this could also be surrogated by a bank guarantee to limit the use of cash. In conclusion, although it might not be the perfect long-term solution, it would be possible to let unmanned vessels sail the oceans for now by imposing unpleasant penalties for the owners in order to compensate the missing personal liability. This might indeed be unpleasant for now, but it would enable the market players to start developing and testing vessels in genuine conditions long before international regulations will be in place.

(iii) COST-BENEFIT-CONCLUSION

On balance, it could be shown, that superficially the benefits outweigh the risks and costs in this examination. Reduced fuel consumption, higher cargo capacities per vessel, reduced personnel costs, fewer casualties, better working conditions and the prospect of a whole new branch of industry with thousands of potential jobs. Those advantages seem to convey a clear result. Nonetheless, they do not include the time-component so far. Adding time to the calculation, a deviating result is obtained. Regarding most of the risks - such as liabilities for the republic, pollution, piracy and cyber-crime, the register's reputation or legal disputes associated with the liabilities between masters and owners - it was argued that – when push comes to shove - the underlying regulations and principles can be interpreted in a manner that would suit unmanned shipping and that solutions can be found in one way or another. This on the other hand, does not indicate at all whether the time is right. Taking all the mentioned risks together, it seems rather hasty to just go ahead and be blinded by the bright and golden

[84] Therefore, provisions like the limitation of liability under the Hague-Visby Rules and the like must as well be reassessed.

days of unmanned shipping that might lay ahead. The possible remedies[85] that have been pointed out are neither unrealistic nor highly complicated, they only lack one thing: They are not available yet. As long as this is the case, it is rather flimsy to assert that solutions are already available only because they are conceivable.

CHAPTER 5 - CONCLUSION

In conclusion, the answer to the question whether South Africa should open its Ship register is yes ultimately, but not now. It was found that the eligibility criteria do not form an obstacle in the registration process. The conditions for registration, however, called for a more sophisticated examination. It turned out that, eventually, they can be complied with as well, if a rather liberal approach is chosen. Nonetheless, an interpretation in such manner is always dangerously close to an excessive interpretation given that most of the regulations in place were simply not meant to apply for unmanned vessels. Therefore, a high risk is incurred by only taking those findings at face value. Ultimately, the question would have to be answered by the registrar and its residual discretion. Therefore, a cost-benefit-analysis was conducted which brought the manifold benefits of unmanned shipping to light. What it also did was to examine what the costs and risks are. Eventually, a solution approach could be determined for all the risks at hand. Nonetheless, those approaches are only intellectual games so far and not available in practice yet. With that said, the registrar is most likely to use his or her discretion to refuse the registration. In the end, this decision would be the right call for now. The benefits in prospect are manifold, but so are the risks. Although unmanned vessels will certainly be the future of shipping, it would simply be too risky and therefore premature to allow unmanned ships to fly the South African flag without an appropriate regulatory framework in place. Additionally, by granting special licenses and forming intergovernmental agreements, the industry's needs for tests in practice could be met, without having high-risk-vessels sailing the world's oceans on the republic's register. Moreover, the value of such a registration can be doubted since it is not to be expected that other coastal states would even consider letting an unmanned vessel near its territorial waters without an agreement or further ado. Against this backdrop it is of utmost importance to be alert to progress being made in

[85] For example, as mentioned above: Insurance against third-state-liability or against pollution, special precautions for cyber-crime, a set of rules to protect the registers reputation, guidelines developed by classifications societies or Letters of Indemnity for MAVs.

other countries and to be best prepared for implementing guidelines once they are available. Missing out in this regard means losing out in the competition of attracting ships onto the republic's register and to lose a great proportion of the benefits in prospect.

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