Vessel Autonomy and the Nigerian Maritime Legal Framework: Lessons from Finland, Norway, and the United Kingdom.

Perekedou James Fawei and Bright Amadi Okeh

Federal University Otuoke, Nigeria

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ABSTRACT

The advent of Maritime Autonomous Surface Ships (MASS) signifies a transformative era in global maritime commerce and also poses regulatory challenges within the existing legal frameworks in most countries. This article therefore examines the issues of vessel classification, manning and remote operation centers on the operations of autonomous vessel within the existing legal framework in Nigeria. The objective of this study is to determine the adequacy or otherwise of the existing legal framework on vessel operation in Nigeria having regard to the emergence of autonomous surface ships. This article provides an extensive doctrinal and comparative analysis of the regulatory environments governing MASS in Nigeria, Finland, Norway, and the United Kingdom. It demonstrates that while Finland, Norway, and the United Kingdom have actively adopted performance-based, functional equivalence models to integrate autonomous technologies, Nigeria remains tethered to a human-centric legislative paradigm. Through an examination of vessels classification, manning and remote operation centers, this work identifies the critical regulatory deficiencies in the extant regulatory framework in Nigerian. The analysis argues that for Nigeria to remain globally competitive and safe, it must transition toward a flexible regulatory structure that explicitly incorporates remote operations and algorithmic decision making.

Keywords: Autonomous Surface Ships, Vessel Classifications, Remote Operations, manning.

INTRODUCTION

The advent and predominance of artificial intelligence technology in recent times, has impacted several industries and the maritime industry has not been left out. This emergent technology has disrupted human-centric activities in vessel operations and the industry now witnesses unmanned autonomous maritime vessels in global maritime commerce.[1] Consequently, there has been the creation and use of unmanned vessels also known as Maritime Autonomous Surface ships (MASS). These autonomous vessels or ships are operated with little or no human intervention.[2] Despite earlier researches in this direction, this line of thought was precipitated and brought into reality by the enormous challenges posed on the global maritime sector during the emergence of the COVID-19 pandemic that grounded a substantial chunk of human-centred activities and

* **PhD, LL.M, LL.B., ND (Law), BL, PNM, AC Arb., MCFI, MNIM, FiADRN, FiCMN**. Reader/Associate Professor, Faculty of Law, Federal University Otuoke, Bayelsa State. Phone No. 08037940984; E-mail: perejames2012@gmail.com.

****Diploma in Law (RIVCAS), LL.B (NDU), LLM (RSU) BL, AICMC.** A Barrister and Solicitor of the Federal Republic of Nigeria. E-mail: okeh.bright007@gmail.com; Phone No. 08134146233.

[1] HC Burmeister, W Bruhn, OJ Rodseth and T. Porathe 'Autonomous Unmanned Merchant Vessel and its Contribution towards the e-navigation implementation: The MUNIN Perspective' (2014) *International Journal of e-Navigation and Maritime Economy* Vol. 1(c), pp. 1 – 13.

[2] International Maritime Organization, 'Framework for the Regulatory Scoping Exercise for the Use of Maritime Autonomous Surface Ships (MASS)' (2018). Retrieved from <https://www.maiif.org/wp-content/uploads/2019/06/MSC-100_20-Annex-20-1.pdf.> on 14 May 2025.

operations.[3] This is clearly a shift in paradigm from the conventional and aged-long human-centred vessel operations to remotely controlled or fully autonomous vessel operations in the maritime industry. This development will introduce new technical and operational changes as well as require the building of new mental and physical capabilities for new roles in shipping operations.[4] This paradigm shift invoked by the developments in artificial intelligence technology may have introduced certain practices and operations that may not have been contemplated by extant regulatory frameworks in the industry.

It is these likely practices and operations in such autonomous vessels that needs to be juxtaposed and examined within the context of extant maritime legal architecture in Nigeria in order to determine the adequacy or otherwise of the existing legal framework. In order to successfully embark on such examination, it is pertinent to first conceptualize Maritime Autonomous Surface Ships (MASS) and identify the unique or emergent operational differences with the human-centric operations under the conventional maritime vessel operations. It is only in the face of such evidential exposition that it may be safe to assess the adequacy or otherwise of the extant maritime legal framework in Nigeria with respect to the advancements in artificial intelligence technology in the sector.

This article therefore in the first part examines the concept of Maritime Autonomous Surface Ships and the revolutionary incidents introduced into vessel operations with particular reference to Nigeria. It will thereafter proceed to examine the extant legal architecture on maritime vessel operations in Nigeria with a view to assessing the adequacy or otherwise of the existing legal framework. The article further comparatively examines the legal regimes governing Maritime Autonomous Surface Ships (MASS) in other maritime dominant jurisdictions such as Finland, Norway, and the United Kingdom. These countries are not only ranked amongst the leading maritime laden economies but are pioneers in leading global paradigm shift towards digitalization and automation of operations in the maritime sector. They also have rich historical and bilateral relations with Nigeria that dates back to centuries by virtue of which the Nigerian maritime sector has substantial similarities and has greatly drawn inspiration and compared notes with.

Concept of Maritime Autonomous Surface Ship

The concept of maritime autonomous surface ship (MASS) encompasses a spectrum of operational capabilities, ranging from ships with automated processes requiring human oversight to fully autonomous vessels operating without any human intervention.[5] MASS refers to the capability of a vessel to operate with varying degrees of independence from human control.[6] These category vessels do not require the physical presence of a human person on board in order for it to carry out its operations. They are either remotely controlled by a human in the loop which makes the vessel automated or same is operated fully by an AI-powered system.[7]

The International Maritime Organization (IMO), defined a MASS as a ship that can in varying degrees, operate independently of human interaction.[8] The distinction in the varying degrees matters a lot as they define the activities that require regulation and liability in their respective degrees. The organization has also acknowledged this fact in drawing a glaring distinction between fully autonomous vessel operations and merely automated or remotely controlled vessel operations.

[3] Fortune Business Insights 'Autonomous Ships Market Size, Share, Industry Analysis & Russia-Ukraine War Analysis' (2026). Retrieved from <https://www.fortunebusinessinsights.com> on 28 August 2026.

[4] Wieslaw Wasilewski, Katarzyna Wolak and Magdalena Zaras, 'Autonomous Shipping. The Future of the Maritime Industry?' (2021) *The Malopolska School of Economics in Tarnow Research Papers Collection*, Vol. 51(3), 155 – 163.

[5] I Durlik and others, 'Enhancing Safety in Autonomous Maritime Transportation Systems with Real-Time AI Agents' (2025) *Applied Sciences* 15(9), 4986 <https://doi.org/10.3390/app15094986> accessed 14 May 2025.

[6] *Maritime Education*, 'IMO's Latest Updates on Autonomous Shipping' <https://maritimeducation.com/imos-latest-updates-on-autonomous-shipping> accessed 14 May 2025.

[7] See (note 4) at 155.

[8] *Offshore Energy*, 'IMO MSC Identifies 4 Degrees of Ship Automation' (17 December 2018) <https://www.offshore-energy.biz/imo-msc-identifies-4-degrees-of-ship-automation/> accessed 14 May 2025.

This progression reflects the integration of advanced technologies such as artificial intelligence, machine learning, and sophisticated sensor systems into maritime operations.[9] The development of autonomous ships aims to enhance operational efficiency, reduce human error, and improve safety at sea. The concept of MASS has gained notoriety in most technologically advanced jurisdictions to the extent of deployment of these vessels within the global maritime commercial operations.[10] However, the integration of such technologies into the maritime industry raises and poses complex legal and regulatory challenges especially within legal frameworks tailored after the earlier international legal instruments. For instance, the United Nations Convention on the Law of the Sea (UNCLOS) does not explicitly address the operation of autonomous vessels, leading to uncertainties in their legal status and the applicability of traditional maritime regulations.[11] The uncertainties confronting the extant maritime legal framework in Nigeria which this paper seeks to examine include vessel classification, manning, and remote operation centres on the operations of autonomous vessels in Nigeria. It is therefore pertinent to quickly conceptualize these matrices for fair comparative examination of legal regimes across the selected jurisdictions.

Vessel classification literally entails the categorization of marine and waterway vessels by the similarities as it relates to design features, size and capabilities. It has also been described as a 'system that categorises ships based on their design, construction and purpose'.[12] Despite this seemingly simple definition of vessel classification, it appears to be one of the maritime concepts that has posed ample challenges to ease of regulation. This situation probably has informed the disposition of the International Maritime Organization when it quoted to have stated that 'there are no universally applicable definition of ship types'.[13] Another concept worthy of note is vessel manning. The concept of vessel manning is the practice of assigning a qualified and sufficient number of crew members to safely operate a ship, protect the marine environment and handle emergencies.[14] Having regard to the focus of this paper, the concept of vessel classification and manning shall be examined within the Nigerian legal framework for purposes of determining whether emerging vessel operational design and construction envisages autonomous vessels.

In Nigeria, the extant maritime legal architecture is substantially defined by the operative provisions of the Merchant Shipping Act 2007 and the Nigerian Maritime Administration and Safety Agency (NIMASA) Act 2007. All other regulations within the industry derive their validity mostly on the foundations of these two primary pieces of legislation. This paper will therefore embark on a brief examination of the contents of these statutes with a view to identifying relevant provisions that envisaged and may be resorted to in regulating the emergent nuances introduced by MASS.

Nigerian Maritime Legal Framework

The legal framework of a country refers to the body of domestic and international laws, their inter-relations and application in a particular country which gives structure to relationship between the State and its inhabitants as well as defines the parameters for legal conduct. Therefore, the legal architecture of the Nigerian maritime sector is much broader in scope and application than most person envisage. The foundation of the legal architectural design upon which all other statutes derive validity is the Constitution of the Federal

[9] A Kepesedi, 'Maritime Autonomous Surface Ships: A Critical "MASS" for Legislative Review' (2022) *UNCTAD Transport and Trade Facilitation Newsletter* No 97 <https://unctad.org/news/transport-newsletter-article-no-97-fourth-quarter-2022> accessed 14 May 2025.

[10] Raksha Sharma 'Autonomous Ships Market' (2026). Retrieved from <https://www.dataintelo.com> on 28 August 2026.

[11] M. Kim and others, 'Autonomous Shipping and Its Impact on Regulations, Technologies, and Industries' (2020) 4(2) *Journal of International Maritime Safety, Environmental Affairs, and Shipping* 17 <https://doi.org/10.1080/25725084.2020.1779427> accessed 14 May 2025.

[12] Seavium, 'How to Understand Vessel Classification: A Complete Guide' (12 January, 2025). Available at <https://www.seavium.com> accessed on 10 September 2026.

[13] Vincent Doedee, 'How Ships are Classified: A Reference Guide to IMO, EU and Industry Frameworks' (2026) available at https://www.sustainable-ships.org accessed on 10 September 2026.

[14] A Javed 'Safe Manning of Ships in the Era of New and Emerging Technologies' (2023) The Maritime Commons: Digital Repository of the World Maritime University, available at <https://www.commons.wmu.se/all_dissertations> accessed on 10 September 2026.

Republic of Nigeria, 1999 (as amended). Other legal instruments contributing to shape the maritime legal firmament in Nigeria includes principal statutes, subsidiary legislation, judicial rules or pronouncements as well as applicable international legal instruments.

These body of legal instruments that define the maritime architecture in Nigeria regulatorily covers an array of subjects.[15] However, having regard to the specific focus of this paper on the issue of vessel classification, manning, and remote operation centres on the operations of autonomous vessels in Nigerian waters, the paper will examine only the legal instruments that contemplated the said operational concerns in order to determine their adequacy or otherwise. These instruments include Merchant Shipping Act 2007, NIMASA Act 2007, Cabotage Act 2003, SPOMO Act 2019, NIWA Act, Inland Waterways Transportation Regulations 2023, Merchant Shipping (STCW) Regulations 2025, Merchant Shipping (Marine Environment) Regulations 2012, Nigerian Ports Authority Act, Admiralty Jurisdiction Act and applicable international legal instruments. The above mentioned legislative instruments constituting a substantial part of the extant maritime legal framework in Nigeria will be examined in a communal approach of referencing similar legal instruments in the light of the matrices forming the focus of this paper.

The evolution of maritime autonomous surface ships has necessitated a re-examination of the existing legal framework on the Nigerian maritime sector, such as those pertaining to the vessel classification, manning, and remote operation centres on the operations of autonomous vessels. As autonomous technologies continue to advance, it is imperative for legal frameworks to adapt accordingly to ensure the safe and lawful integration of autonomous vessels into global maritime operations.[16]

A number of legal instruments have made regulatory provisions that will be collectively reviewed to determine the contemplation of MASS in Nigeria. The Merchant Shipping Act 2007 in its classification and certification of ships that can be registered in Nigeria envisages merchant ships, fishing vessels, ships under construction, ships on charters, licensed ships and Floating Production Storage and Offloading (FPSO)/Floating Storage and Offloading.[17] A community reading of the Act shows that there is no category envisaged within which a ship (even an autonomous variant of the above listed ships) may be registered and licensed as a Maritime Autonomous Surface Ship in Nigeria. The Act empowered the Minister of Transportation to make regulations which include the classification, certification and registration of ships in Nigeria, pursuant to which several regulations have been made.[18] The relevant provisions of some of the said regulations such as Merchant Shipping (Manning) Regulations 2010 and Merchant Shipping (STCW) Regulations 2025 envisage manning and watchkeeping training and certification around seafarer and conventional shipboard complement.[19] Also the Merchant Shipping (Safe Manning, Hours of Work and Watchkeeping) Regulations 2010 and Merchant Shipping (Pilot Ladders) Rules 2010 are all expressed and descriptive of human-centred conventional ships.[20]

[15] Such as maritime and Ports administration (Merchant Shipping Act 2007; NIMASA Act 2007 and Nigerian Ports Authority Act 2004.), domestic shipping (Cabotage Act 2003), maritime security (SPOMO Act 2019, Terrorism (Prevention and Prohibition) Act 2022), admiralty jurisdiction (Admiralty Jurisdiction Act, Admiralty Jurisdiction Procedure Rules), inland waterways regulation (National Inland Waterways Authority Act, Inland Transportation Regulations 2015), marine environment (Prevention of Pollution of the Sea Act, Merchant Shipping (Marine Environment) Regulations 2012, NOSDRA Act, Environmental Impact Assessment Act), offshore oil and gas (Petroleum Industry Act 2021, Oil Pipelines Act), cargo regulation (Carriage of Goods by Sea Act), marine resources (Sea Fisheries Act), seafarer competence (Merchant Shipping (STCW) Regulations 2025), maritime labour (Merchant Shipping Labour Regulations), international law instruments (UNCLOS, SOLAS, MARPOL, STCW, COLREG, MLC, SAR etc) and several other subjects.

[16] Ship Universe, 'When No One's at the Helm: Top Legal Risks of Autonomous Vessels' *Ship Universe* (22 April 2025) <https://www.shipuniverse.com/when-no-ones-at-the-helm-top-legal-risks-of-autonomous-vessels/> accessed 7 June 2025.

[17] See the Merchant Shipping Act, section 17 thereof.

[18] See the Merchant Shipping Act, section 435 thereof.

[19] See Regulation 1, 2, 3, 4 and 9 of the Merchant Shipping (Manning) Regulations.

[20] See Regulations 1, 4, 5 and 14 of the Merchant Shipping (Safe Manning, Hours of Work and Watchkeeping) Regulations 2010 and Rules 2, 3(1) and 4 of Merchant Shipping (Pilot Ladders) Rules 2010.

The Nigerian Maritime Administration and Safety Agency Act is the agency of government that basically regulates shipping activities in Nigeria by giving effect to the provisions of the Merchant Shipping Act and relevant conventions of the International Maritime Organization (IMO) ratified and domesticated in Nigeria.[21] The statute establishing this agency vested broad regulatory powers on it but within the limits of extant regulations. Despite its broad regulatory provisions, the Act did not expressly provide for MASS, hence reference has to be made to the IMO convention on MASS. The challenge is that Nigeria is yet to fully domesticate the MASS convention to enable it come into full effect.[22] However, other international legal instruments some of which have been domesticated and therefore enforceable by NIMASA such as SOLAS 1974, COLREG 1972, STCW 1978 and others does not envisage the operations of MASS.

Other maritime regulatory instruments such as Cabotage Act 2003 still requires a domestic shipping activity within Nigerian waterways to comply strictly with ownership and manning provisions.[23] This makes it difficult for a MASS operation in Nigeria without contravening this statute. Similarly, National Inland Waterways Act and the Inland Waterways Transportation Regulation 2023 made no provision for autonomous vessel category and therefore applies only to a vessel navigating the inland waterways of Nigeria which the Cabotage or other statutes envisage must be manned and therefore cannot operate as MASS. The Nigerian Ports Authority Act in all its provisions, envisages the operations of only conventional ships, hence the regulations revolve around human-centric activities. While the wordings of the Admiralty Jurisdiction Act 1991 did not contemplate a MASS classification, though not expressly excluded as well; the Sea Piracy and other Maritime Offences Act 2019 made no distinction on conventional and autonomous ships in proscribing the set of conducts provided as criminal offences in maritime operations.

Operational Developments in Maritime Autonomous Surface Ship

The technological developments in the global maritime industry have witnessed substantial operational changes having regard to the emergent unmanned autonomous vessels. Several countries have invested huge sums of monies in embarking on rigorous technological researches and consciously taking steps to convert them into reality. The products of these huge investments and rigorous scientific and technological researches have been duly deployed into the global maritime sector by the respective countries.[24] The focus of this article has not been the deployment but the emergent technical changes introduced by the deployment of these technologies that may invoke legal or regulatory concerns.

Nigeria has also been deliberate on its resolve not to take the backseat in the emerging technologically driven global maritime economy. Available records as at the time of this research shows that Nigeria has recorded just a few instances of the operations of autonomous vessels within its territorial waters. This paucity of evidence may therefore impact the analysis of the technical operations of autonomous vessels and the incidents invoked that may require regulation. The first recorded incident of deployment of unmanned surface vessel (USV) is that of Shell Petroleum Development Company's 'Accession 500' at Bonny in Rivers State, Nigeria. The said crewless vessel which was deployed for a pipeline-route survey operation in shallow inland waterways at Bonny, occurred in January 2024 and lasted for approximately 7 days.[25] While the said vessel may not be fitly described as a fully autonomous commercial vessel, same being a remotely operated unmanned surface vessel (USV), it marks the introduction of vessel operations without direct human involvement on-board the vessel. This development represents a lower level of the International Maritime Organization's Maritime Autonomous Surface Ship (MASS) operations within the territorial waters of Nigeria that has sparked discussions on regulatory framework.

[21] See <https://www.nimasa.gov.ng> accessed on 28 August 2026.

[22] Celestine Ogbonnaya and Adizua Vianney, 'Navigating the Future: Legal Implications of Maritime Autonomous Surface Ships (MASS) in Nigeria' (2025) *Mondaq* <https://www.mondaq.com> accessed on 28 August 2026.

[23] See Cabotage Act 2003, sections 3 – 8 thereof.

[24] The Nippon Foundation 'World's 1st Simultaneous Monitoring and Support for Multiple Autonomous Vessels' (27 March, 2026). Retrieved from <https://www.en.nippon-foundation.or.jp> on 28 August 2026.

[25] Dare Olawin, 'Shell deploys unmanned vessel for pipeline route survey' *Punch* (29 February, 2024) <https://www.punchng.com> accessed on 25 August 2026.

The record accessed in the course of this research identified the SPDC's 'Accession 500' as the only USV that has had operational activities within the Nigerian waterways. However, another important development in this regard showing further developments and steps taken by a Nigerian entity is the acquisition of an REAV-47 uncrewed surface vessel by Geodetic Offshore Services Limited (GOSL). The vessel which is a battery-hybrid REAV-47 was produced by a UK based company known as HydroSurv and was reported thus:

…the vessel can sustain survey operations for up to 72 hours with a battery-hybrid system and a 4 KW Fischer Panda generator. The REAV-47, which uses hydroSurv's virtual watchkeeper vessel control system, also has autopilot technology from Dynautics and advanced navigation and situational awareness spread from Furuno and TimeZero.[26]

The deployment of SPDC's Accession 500 and GOSL's acquisition of REAV-47 in 2025 with the hope of deploying same within the Nigerian waterways signals a turning point and a hope of a fully autonomous vessel operational maritime economy. The above developments constitute evidence of the operations of autonomous vessels in Nigerian waterways but did not generate situations that would have required an attempt to apply the existing legal framework on the operations of these vessels.[27] Despite the fact that no record of attempts at enforcement of the relevant provisions of the extant legal architecture in the maritime sector, it remains valid to invoke conversations around the recorded operations.

It was recorded that SPDC's unmanned surface vessel - Accession 500 carried out its survey operations within the inland waterways of Nigeria. Such a vessel must fit into one of the classifications provided for in the Merchant Shipping Act or the Merchant Shipping (Pilot Ladders) Rules 2010 and requires certification and registration.[28] The vessel was unmanned because it was remotely controlled by its operators which obviously contravenes the provisions of the Inland Waterways Transportation Regulation and the Merchant Shipping (Manning) Regulations.[29] The case under review from the report reveals the outstanding advantages enjoyed by the SPDC in the deployment of its automated and remotely controlled Accession 500 USV in its geophysical survey operations within the Nigerian inland waterways.[30] This situation has however exposed the weakness and backwardness of the extant maritime legal architecture in Nigeria. It therefore becomes pertinent to comparatively examine the respective maritime legal regimes in other technologically advanced jurisdictions such as Finland, Norway and the United Kingdom having specific regard to the concerns of classification, manning and remote operation centres.

Comparative Examination of MASS operations and the Maritime Legal Regimes of Finland, Norway and the United Kingdom.

This section examines the classification, manning, and remote operation centres. It compares each aspect across jurisdictions, noting Nigeria's silence on autonomy versus Nordic/UK initiatives.

1. Classification of Autonomous Ships

The classification of Maritime Autonomous Surface Ships (MASS) is a critical aspect of integrating autonomous vessels into the global maritime industry.[31] The International Maritime Organisation (IMO) has identified four levels of autonomy for MASS which are (1) Ship with automated processes and decision

[26] Melisa Cavcic, 'Battery-hybrid USV order takes UK's HydroSurv to West African Waters' *Offshore Energy* (16 June 2025) <https://www.offshore-energy.biz> accessed on 25 August 2026.

[27] See notes 25 and 26.

[28] Section 17 of Merchant Shipping Act 2007 and Rule 4 of the Merchant Shipping (Pilot Ladders) Rules 2010.

[29] See Regulation 4 of the Inland Waterways Transportation Regulations 2023 which expressly requires a Boatmaster with the prescribed qualifications; and Regulation 9(3) of the Merchant Shipping (Manning) Regulations which states that 'A ship shall have on board the ship not less than the complement of the crew specified in these Regulations'.

[30] See (n. 25).

[31] Det Norske Veritas Group (DNV), 'Autonomous and Remotely-Operated Ships' <https://www.dnv.com/ maritime/autonomous-remotely-operated-ships/regulatory/> accessed 13 June 2025.

support; (2) Remotely controlled ship with seafarers on board;[32] (3) Remotely controlled ship without seafarers on board;[33] (4) Fully autonomous ship.[34] The Nigerian Merchant Shipping Act and related regulations classify vessels by type (tankers, cargo ships etc.) and tonnages but make no provisions for degrees of autonomy or distinct MASS classes. The Act broadly defined a "ship" as "every description of vessels used in navigation".[35] This definition technically includes any autonomous craft, but this appears not to be feasible in Nigeria as it has not adopted IMO's autonomy levels or specific classification rules. All Nigerian ships must be registered and classed with an approved classification society, but there is no special MASS classification requirement.

Finland has adopted a more progressive and functional approach to vessel classification in the context of autonomous shipping. While Finnish maritime legislation does not yet provide a comprehensive statutory classification of MASS based on autonomy levels, regulatory practice reflects an implicit recognition of different degrees of autonomy. The Finnish Parliament in June 2018 amended its regulatory framework and therein exempted minimum vessel manning requirements and watchkeeping for a fixed term aimed at promoting technological innovation.[36] The amendment permitted the testing of autonomous and remotely operated vessels through exemptions from conventional manning rules. The Finnish Transportation and Communication Agency (Traficom) through its regulations facilitated and supervised what has been reported as the World's first testing area for autonomous ships located off the west coast of Finland.[37] In doing so, Traficom assesses vessels based on their operational characteristics, including the level of automation, remote control capabilities, and system redundancy. Although, Finland has not formally codified the IMO's four levels of autonomy into legislation, its regulatory framework aligns closely with the IMO's functional approach, which distinguishes between ships with automated processes, remotely controlled ships with crew on board, remotely controlled ships without crew on board, and fully autonomous ships.[38] Thus, Finnish's classification approach is not strictly statutory but is operational and risk-based, allowing flexibility while maintaining safety oversight.

In the case of Norway, one of the notable regulatory instruments on maritime vessel operations is Ship Safety and Security Act. The Act basically requires a ship to be designed, constructed and equipped according to the purpose or trade area while ensuring satisfactory protection of life, health, property and the environment.[39] On the emergence and deployment of autonomous vessels, Norway has taken a leading role in developing practical classification approaches for MASS through administrative channels without amending its statute. The Norwegian Maritime Authority (NMA) in this regard has through the instrumentality of a circular recognised the need to assess vessels based on their degree of autonomy and operational configuration.[40] Unlike Nigeria, Norway adopts an "equivalence principle," under which autonomous vessels may be approved

[32] T Notteboom and Z. H. Munim, 'Remote Control in Autonomous Shipping: Technical, Managerial and Regulatory Issues' *Journal of Shipping and Trade* <https://jshippingandtrade.springeropen.com/rcc> accessed 13 June 2025.

[33] E Niiler, 'The Robot Ships Are Coming … Eventually' *WIRED* (30 October 2020) <https://www.wired.com/ story/mayflower-autonomous-ships> accessed 14 May 2025.

[34] A Chircop, 'Remotely Operated and Autonomous Ships: New Issues for the Law of the Sea?' Marine & Environmental Law Institute, Dalhousie University <https://wwwcdn.imo.org/localresources/en/OurWork/ Safety/PublishingImages/Pages/MASS/01_Aldo%20Chircop_MASS%20and%20the%20Law%20of%20the%20Sea.pdf> accessed 7 June 2025.

[35] Section 2 of the Merchant Shipping Act 2007.

[36] See Ships' Crew and Safety Management of Ships Act (2018) known in Finnish as 'Laki fartygspersonal och sakerhetsorganisation for fartyg, 1687/2009'.

[37] Business Finland, 'Finland trials autonomous ships' *Science Business* (5 September, 2018) <https://www.sciencebusiness.net> accessed on 28 August 2026.

[38] International Maritime Organization, *Regulatory Scoping Exercise for the Use of Maritime Autonomous Surface Ships (MASS)* MSC 101/5 (2019).

[39] See section 9 of the Ship Safety and Security Act, 2007 (No. 9).

[40] Norwegian Maritime Authority, 'Guidance in Connection with the Construction or Installation of Automated Functionality aimed at Performing Unmanned or Partially Unmanned Operations' Circular RSV 12-2020, Journal No. 2020/37328-1SDM/JKS issued on 27 August 2020. <https://www.sdir.no> accessed on 28 August 2026.

if they achieve a level of safety equivalent to that required of conventional ships.[41] This allows classification to be based not only on traditional criteria such as tonnage and vessel type but also on technological features such as automation systems, remote control infrastructure, and cybersecurity arrangements. In addition, classification societies operating in Norway, such as DNV, have developed specific rules for autonomous and remotely operated ships, thereby complementing the regulatory framework.[42] These rules provide technical standards for different levels of autonomy, effectively creating a *de facto* classification system for MASS.

The United Kingdom adopts a cautious and technology-neutral approach to vessel classification. UK maritime legislation does not explicitly classify vessels based on autonomy levels, and existing statutory definitions of a ship remain broad enough to include autonomous vessels.[43] This accommodating state of ship classification has enabled the Maritime and Coastguard Agency (MCA), working with King's Harbour Master Plymouth has established designated trail areas to facilitate trials of autonomous vessels, assessing them on a case-by-case basis.[44] This approach allows the UK to accommodate different levels of autonomy without formally redefining vessels classification categories. While the UK has not yet formally adopted the IMO's classification of MASS, its regulatory practice implicitly recognises varying degrees of autonomy through its approval process. However, the absence of a codified classification framework may limit legal certainty in the long term.

Comparatively, the aforementioned discuss reveals a clear divergence in approach among the jurisdictions examined. Nigeria represents the most rigid position, maintaining conventional and strict crew-based requirements with no provision for exemptions or alternative operational models. This effectively excludes the possibility of autonomous or unmanned vessel operations within its jurisdiction.

Finland and Norway, by contrast, have adopted flexible, performance based approached that allow or reduced or unmanned operations, subject to strict safety conditions. Norway, in particular, stands out for its explicit recognition of shore-based control centres and its implication of the equivalence principle. The United Kingdom occupies an intermediate position, permitting limited deviations through administrative approvals while retaining its traditional legal frameworks.

Minimum Manning and Watching Keeping Requirements

The regulation of manning and watch keeping requirements constitutes a central pillar of maritime safety law. Traditionally, both international conventions and domestic legislation have been predicated on the assumption that ships are operated by qualified personnel physically present on board. The emergence of Maritime Autonomous Surface Ships (MASS), however, challenges this foundational premise by introducing operational models that range from reduced crew to fully unmanned vessels. In Nigeria, manning and watch keeping requirements are governed primarily by the Merchant Shipping Act 2007, subsidiary pieces of legislation made pursuant to it and relevant international conventions, particularly the International Convention on Standards of Training, Certification and Watch keeping for Seafarers 1978 (STCW) and the International Regulations for Preventing Collisions at Sea 1972 (COLREGs).

The prescription by statute is that every Nigerian ship shall be "sufficiently and efficiently manned" to ensure safety at sea.[45] The Act further empowers the Minister to prescribe minimum safe manning levels through regulations.[46] These provisions are implemented through the issuance of Safe Manning Certificates, which specify the minimum number and qualifications of crew required on board a vessel. In addition, the Act

[41] ibid.

[42] Margrethe Andersen, 'DNV launches class notations to provide framework for safe development of autonomous shipping technologies' (2025) <https://www.dnv.com/rules-standards> accessed on 28 August 2026.

[43] Merchant Shipping Act 1995 (UK).

[44] Maritime and Coastguard Agency, 'Guidance Autonomy (MASS) – UK Maritime Innovation Hub' (2026) <https://www.gov.uk> accessed on 29 August 2026; Society of Maritime Industries, 'Maritime and Coastguard Agency Update: Innovative Vessel Trials in Plymouth Harbour' (2026) <https://www.maritimeindustries.org> accessed on 29 August 2026.

[45] Merchant Shipping Act 2007 Section 131.

[46] Merchant Shipping Act 2007 Section 132.

incorporates international obligations relating to watch keeping and safe navigation, thereby giving effect to the STCW Convention within Nigerian law.[47] Under STCW and COLREG Rule 5, ships are required to maintain a proper lookout at all times by sight and hearing, a duty that presupposes the physical presence of crew on board.[48]

Notably, Nigerian law does not provide any mechanism for waiving or modifying these manning and watch keeping requirements in the context of autonomous or remotely operated vessels. There is no statutory recognition of remote operators or shore-based control centres as substitutes for onboard crew. Consequently, if a vessel were to be declared "unmanned," the existing legal framework would be incapable of regulating its operation effectively, thereby creating significant legal uncertainty.

Finland on the other hand has adopted a more flexible and forward-looking approach to manning and watchkeeping requirements in the context of autonomous shipping. In 2018, Finland introduced legislative amendments designed to facilitate the testing and development of autonomous vessels within defined maritime areas. These amendments empower the Finnish Transport and Communications Agency (Traficom) to grant fixed-term exemptions from standard manning and watchkeeping rules for vessels engaged in approved trials.[49] Under this regime, vessels may operate with reduced crew or, in certain cases, without any crew on board, provided that the operator demonstrates that an equivalent level of safety is maintained. A notable example is the Jaakonmeri autonomous test area, where vessels under 500 gross tonnages (excluding tankers) may operate with reduced crew or in a "pilotless" mode for limited periods.[50] Permits for such operations are typically granted for up to two years, subject to regulatory oversight and compliance with specified safety conditions.

These legal provisions explicitly relax minimum crew documentation and watch-keeping requirements for vessels participating in autonomy trials. However, the exemption regime is carefully controlled and limited in scope, reflecting a balance between innovation and safety. Human oversight remains a critical component, with remote operators expected to monitor vessel operations and intervene where necessary. Finland's approach thus represents a transition from prescriptive manning rules to a risk-based, performance-oriented model that accommodates emerging technologies while maintaining regulatory control.

Norway's approach to manning and watchkeeping in the context of MASS is grounded in the Ship Safety and Security Act 2007 and supplemented by regulatory guidance issued by the Norwegian Maritime Authority (NMA), particularly Circular RSV 12-2020. The Ship Safety and Security Act 2007 requires that ships be safely manned in a manner that ensures the safety of life, property and the environment.[51] Unlike Finland, Norway does not provide a blanket statutory exemption from manning requirements. Instead, it applies the principle of equivalence, allowing alternative arrangements where they can be shown to achieve an equivalent level of safety.

Under the Norwegian framework, operators of autonomous vessels are required to submit a detailed Concept of Operations (CONOPS) outlining how essential functions traditionally performed by onboard crew, such as navigation, lookout, and emergency response will be carried out through automated systems or remote control.[52] Importantly, Norwegian regulations emphasize that autonomous vessels must comply with the functional requirements of COLREG Rule 5 and other watchkeeping obligations. Where automation replaces human functions, it must be demonstrated that the technological solution is at least as effective as a human operator.

[47] Merchant Shipping Act 2007 Section 274.

[48] Convention on the International Regulations or Preventing Collisions at Sea 1972 (COLREGs) r 5; International Convention on Standards of Training, Certification and Watch-Keeping for Seafarers 1978 (as amended).

[49] Finnish Transport and Communications Agency (Traficom), 'National Interpretation regarding IMO Publication: International Convention for Safety of Life at Sea (SOLAS 1974) as amended' (2024) Regulation 3 thereof. Also see Business Finland (n. 37).

[50] Ibid; see also Finnish Government Decree on Maritime Test Areas.

[51] Ship Safety and Security Act 2007 (Norway) s 15.

[52] Norwegian Maritime Authority, Circular RSV 12-2020.

Norway also recognizes shore-based control centres as integral components of vessel operations. Personnel in such centres may perform roles analogous to those of the master and crew, provided that the overall safety level is maintained. This represents a significant evolution in maritime regulatory thinking, shifting the focus from physical presence to functional performance.

The United Kingdom (UK) adopts a cautious but evolving approach to manning and watchkeeping requirements in relation to MASS. Under existing UK law, ships must be adequately manned in accordance with the Merchant Shipping Act 1995 and the Merchant Shipping (Safe Manning, Hours of Work and Watchkeeping) Regulations.[53] These provisions are aligned with SOLAS and STCW standards and assume the presence of a master and crew on board. However, the UK has initiated a series of consultations and policy developments aimed at adapting its legal framework to accommodate autonomous shipping. A key proposal is the introduction of the concept of a "MASS master," defined as a person who has command of the vessel but need not be physically present on board.[54]

Under this proposed framework, the responsibilities traditionally assigned to the master such as navigation, safety management, and compliance with international regulations would be exercised by a shore-based operator. This represents a fundamental shift in the legal understanding of command and control in maritime operations.[55] In addition, the UK Code of Practice for Maritime Autonomous Ships envisages that remote controllers, even if not trained as conventional seafarers, will assume specific operational roles and must comply with applicable safety and working time regulations.[56] At present, fully unmanned operations remain subject to case-by-case approvals, and there is no comprehensive statutory framework governing MASS. The UK's approach can therefore be characterized as transitional, combining elements of traditional regulation with emerging concepts of remote operation and functional equivalence.

A comparative analysis of manning and watchkeeping requirements across the four jurisdictions reveals a clear divergence in regulatory philosophy and preparedness. Nigeria maintains a rigid, rule-based framework that strictly requires onboard crew and provides no mechanism for exemptions or alternative arrangements. This effectively precludes the operation of autonomous or unmanned vessels within its jurisdiction. Finland and Norway, by contrast, have adopted flexible, performance-based approaches that allow for reduced or unmanned operations under controlled conditions. Finland achieves this through formal exemption regimes for trials, while Norway relies on the principle of equivalence and detailed safety assessments.[57] The United Kingdom occupies an intermediate position, retaining its traditional legal framework while actively exploring reforms to accommodate autonomous shipping. Its proposed recognition of a shore-based "MASS master" represents a significant conceptual innovation.[58]

Overall, the comparative analysis demonstrates that while advanced maritime jurisdictions are progressively adapting their manning and watchkeeping rules to accommodate MASS, Nigeria remains anchored in a traditional regulatory model. This highlights the urgent need for legislative reform in Nigeria to introduce flexibility, recognize remote operations, and align with emerging international standards.

Remote-Control Centres Requirements

The emergence of Maritime Autonomous Surface Ships (MASS) has necessitated the development of Remote-Control Centres (ROCs), which serve as land-based facilities from which vessels may be monitored, controlled, or supervised. These centres represent a fundamental shift in maritime operations, relocating core

[53] Merchant Shipping Act 1995 (UK); Merchant Shipping (Safe Manning, Hours of Work and Watchkeeping) Regulations.

[54] UK Department for Transport, 'Future of Transport Regulatory Review: Maritime Autonomy and Remote Operations' (14 September, 2023) <https://www.gov.uk> accessed on 28 August 2026.

[55] Fiona Cain and Kayley Rousell, 'Maritime Autonomous Surface Ships: Consultation for New MCA Workboat Regulations' (7 December, 2022) <https://www.haynesboone.com> accessed on 28 August 2026.

[56] UK Maritime and Coastguard Agency, *Code of Practice for Maritime Autonomous Ships (2019).* <https://www.maritimeuk.org> accessed on 28 August 2026.

[57] See (n. 52).

[58] UK Department for Transport (n. 54).

navigational and operational functions from the ship to shore-based infrastructure.[59] Under Nigerian law, there is no statutory or regulatory recognition of Remote-Control Centres. The extant legal architecture in Nigeria is entirely predicated on the assumption that navigation and operational control occur onboard the vessel under the authority of the master.

The position of the law in Nigeria only envisages that ships be "sufficiently and efficiently manned,"[60] while provisions relating to the duties of the master presuppose physical presence on board.[61] There is no provision in the Act or in regulations made by the Nigerian Maritime Administration and Safety Agency (NIMASA) that authorises the supervision or control of ship navigation from ashore. Furthermore, Nigerian law contains no framework for the licensing, certification, or regulation of remote operators. There are also no rules governing the establishment, location, or operational standards of ROCs, including communication systems, redundancy requirements, or safety protocols. As a result, the SPDC's Accession 500 survey autonomous vessel that operated from a shore-based control centre, fell outside the scope of existing Nigerian maritime law, creating significant legal uncertainty and regulatory gaps.[62]

Finland implicitly recognises the use of Remote-Control Centres within its experimental regulatory framework for autonomous shipping. While Finnish maritime legislation does not expressly define or regulate ROCs, the system of trial permits administered by the Finnish Transport and Communications Agency (Traficom) allows for shore-based control and monitoring of vessels.[63] In practice, autonomous vessel trials in Finland involve the use of remote-control systems whereby operators may assume control of the vessel from land-based facilities, particularly during critical manoeuvres. However, there are no comprehensive statutory provisions prescribing standards for the design, operation, or certification of such centres.

Instead, regulatory oversight is exercised on a case-by-case basis through the approval process. Applicants must demonstrate that their operational arrangements, including remote control infrastructure, achieve an equivalent level of safety to conventional ship operations. Finland's approach thus reflects a transitional regulatory model in which ROCs are recognised in practice but not yet codified in general maritime law.

Norway on the other hand has taken a more advanced and structured approach to the recognition of Remote-Control Centres, although regulation remains largely based on administrative guidance rather than primary legislation. The Norwegian Maritime Authority (NMA), acknowledges that autonomous vessels may be monitored and controlled from shore-based facilities.[64] These facilities are treated as integral components of the vessel's operational system, and their functionality is subject to regulatory scrutiny.

Under the Norwegian framework, operators must demonstrate through a detailed Concept of Operations (CONOPS) how remote-control systems will ensure safe navigation and compliance with international obligations.[65] This includes addressing issues such as communication reliability, system redundancy, and emergency response capabilities. Importantly, Norwegian guidance does not require ROCs to be located within Norwegian territory. However, all remote-control systems must meet stringent safety and security standards, and the NMA may require third-party verification of new technologies to ensure compliance with the equivalence principle.[66] In practice, Norway has operationalised this framework through facilities such as the "Massterly Remote Operations Centre" in Horten, which supports the operation of autonomous vessels like the

[59] Noah Ugur Kilinc, 'Maritime Autonomous Surface Ship's Remote Operation Centers: Multidimensional Analysis for Safe and Sustainable Operations' (2025). <https://www.researchgate.net> accessed on 29 August 2026.

[60] Merchant Shipping Act 2007 (Nigeria) s 131.

[61] Ibid, provisions on duties of the master.

[62] Section 17 of Merchant Shipping Act 2007 and Rule 4 of the Merchant Shipping (Pilot Ladders) Rules 2010.

[63] See Business Finland, (n. 37). Finnish Transport and Communications Agency (Traficom), Autonomus Vessel Trial Regulations (2018).

[64] Norwegian Maritime Authority, (n. 40).

[65] Norwegian Maritime Authority, (n. 40).

[66] Norwegian Maritime Authority, (n. 40).

Yara Birkeland.[67] Although the legal framework is not fully codified, regulatory oversight of ROCs is effectively exercised through certification and approval processes.

The United Kingdom has taken a more explicit and forward-looking approach to the regulation of Remote-Control Centres. The Maritime and Coastguard Agency (MCA), through its Code of Practice for Maritime Autonomous Ships, defines a Remote Operations Centre as a land-based location from which a MASS may be controlled or monitored.[68] The UK Government has proposed granting the MCA statutory authority to regulate ROCs as part of a comprehensive legal framework for autonomous shipping.[69] This includes the power to prescribe requirements relating to the location, design, cybersecurity, and operational standards of such centres. Notably, the UK recognises that ROCs may be located outside the flag State's jurisdiction. However, it emphasises that such centres must comply with strict safety and cybersecurity requirements, ensuring that remote operations meet or exceed the standards applicable to conventional ship operations.[70] The UK approach therefore represents a significant evolution in maritime regulation, explicitly incorporating shore-based control into the legal framework and recognising the central role of ROCs in autonomous shipping.

The comparative analysis reveals a clear divergence in regulatory approaches to Remote Control Centres. Nigeria's legal framework does not recognise ROCs at all, reflecting its continued reliance on traditional ship-based operations. Finland and Norway, by contrast, acknowledge the practical necessity of ROCs and incorporate them into their regulatory frameworks through administrative approvals and guidance. Norway, in particular, has developed a more structured approach, integrating ROCs into its safety and certification processes.

The United Kingdom stands out for its explicit recognition of ROCs and its intention to regulate them comprehensively through legislation. This positions the UK as a leader in the formal legal integration of shore-based control systems. The absence of any equivalent framework in Nigeria highlights a critical regulatory deficiency, particularly given the central role of ROCs in MASS operations.

Implementation of COLREGs for Autonomous Vessels)

The COLREGs constitute the cornerstone of international maritime navigation safety. They impose duties relating to lookout, safe speed, risk assessment, and manoeuvring, all of which are traditionally performed by human operators exercising judgment at sea.[71] Nigeria incorporates COLREGs into its domestic legal system through the Merchant Shipping (Distress Signals and Prevention of Collisions) Regulations, made pursuant to the Merchant Shipping Act 2007.[72] Compliance with these rules is mandatory for all vessels operating within Nigerian waters. It is required by COLREGs that "every vessel shall at all times maintain a proper lookout by sight and hearing as well as by all available means appropriate in the prevailing circumstances and conditions."[73] This provision clearly presupposes human sensory perception and cognitive judgment. The instrument further imposes a general duty of good seamanship, which inherently involves human discretion.[74]

Though, the statutory definition of a ship is seemingly broad and encompasses autonomous vessels,[75] Nigerian law does not address how such vessels may comply with COLREG obligations through artificial intelligence, sensor fusion, or remote monitoring systems. This creates a doctrinal gap as autonomous systems are not recognised as lawful substitutes for human lookout, yet they are the primary means by which MASS operate.

[67] MASS World, 'Massterly Opens Remote Operations Centre in Horten, Norway' (11 March, 2024). <https://www.massworld.news> accessed 10 September, 2026.
[68] UK Maritime and Coastguard Agency, (n. 56).
[69] UK Department for Transport, MASS Consultation.
[70] Ibid.
[71] Convention on the International Regulations for Preventing Collisions at Sea 1972.
[72] Merchant Shipping Act 2007 (Nigeria); Merchant Sipping (Distress Signals and Prevention of Collisions) Regulations.
[73] Convention on the International Regulations for Preventing Collisions at Sea 1972. r 5.
[74] Convention on the International Regulations for Preventing Collisions at Sea 1972. r 2.
[75] Merchant Shipping Act 2007 (Nigeria) s 2.

Consequently, compliance with COLREGs by unmanned vessels in Nigeria remains legally ambiguous and practically uncertain.

The approach adopted by Finland and Norway in the interpretation and application of COLREGs is rather technology-neutral and outcome-based. In Norway, the Norwegian Maritime Authority (NMA), through its circular, explicitly requires that autonomous vessels demonstrate compliance with COLREGs by achieving an equivalent level of situational awareness through technological means.[76] This includes advanced sensor arrays such as radar, LiDAR, infrared cameras, and AI-driven decision systems capable of detecting and responding to navigational hazards. Importantly, Norway's framework emphasises the concept of "functional equivalence." Autonomous systems must not only replicate human capabilities but, where possible, exceed them in reliability and responsiveness. This reflects a shift from prescriptive compliance (human lookout) to performance-based compliance (effective collision avoidance). Finland adopts a similar approach through its trial authorisation regime. Autonomous vessels are required to comply with COLREGs, typically under a "human-in-the-loop" model in which remote operators supervise automated systems and intervene when necessary.[77]

The United Kingdom on the other hand adopts a cautious but evolving approach. The Maritime and Coastguard Agency (MCA) require that MASS demonstrates full compliance with COLREGs as a condition for operation.[78] The UK Code of Practice emphasises that any deviation from traditional methods of compliance must be justified through rigorous safety assessments. For example, where a vessel relies on automated detection systems rather than human lookout, it must be demonstrated that such systems provide an equivalent or superior level of safety. The UK also aligns with the International Maritime Organization's Interim Guidelines on MASS trials, which stress that the introduction of autonomous systems must not compromise the safety of navigation.[79]

Navigation Safety Requirements

Modern MASS rely on integrated navigation systems combining Automatic Identification Systems (AIS), Electronic Chart Display and Information Systems (ECDIS), Global Navigation Satellite Systems (GNSS), radar, and increasingly, artificial intelligence. Nigerian law mandates the carriage of standard navigational equipment in accordance with SOLAS requirements.[80] However, these provisions are limited to conventional systems and do not address advanced technologies such as AI-based navigation, sensor fusion, or autonomous decision-making algorithms. Furthermore, Nigerian law does not recognise the role of shore-based operators in navigation. There is no legal framework enabling remote operators to participate in Very High Frequency (VHF) communications, Automatic Identification Systems (AIS) reporting, or electronic navigation systems. This creates a regulatory disconnect: while autonomous vessels rely heavily on advanced digital systems, Nigerian law continues to regulate navigation through a framework designed for human-operated ships.

Finland and Norway have actively integrated advanced navigation technologies into their regulatory frameworks. Norwegian autonomous vessel trials have demonstrated that sensor suites combining radar, LiDAR, cameras, and AI-based processing can achieve situational awareness comparable to, or exceeding, that

[76] Norwegian Maritime Authority, (n. 40).

[77] MS Islam, 'Navigating Modern Era at Sea: Legal Challenges and Opportunities of Unmanned and Autonomous Shipping' (2024) *AI and Ethics*, Vol. 5(3): 2293 – 2306; and Koen Van de Merwe and others, 'Supporting Human Supervision in Autonomous Collision Avoidance through Agent Transparency' (2024) *Safety Science*, Vol. 169 available at <https://www.pdf.sciencedirectassets.com> accessed on 10 September 2026. Also see Finnish Transport and Communications Agency (Traficom), Autonomous Vessel Trial Regulations (2018).

[78] SMI, 'Being a Responsible Industry: Maritime Autonomous Ship Systems (MASS) UK Industry Conduct Principles and Code of Practice' (November, 2019) available at <https://www.maritimeindustries.org> accessed on 10 September 2026.

[79] International Maritime Organization, Interim Guidelines on MASS Trials.

[80] SOLAS Convention 1974 (as amended).

of human operators.[81] These systems are capable of continuous monitoring, real-time data processing, and predictive collision avoidance.

Finland is similarly advancing digital navigation through the deployment of 5G-enabled systems, enabling real-time data exchange, remote monitoring, and dynamic route optimisation. Interestingly, Finland has collaboratively worked with the European Union in this regard towards building 'scenarios, risks and opportunities of digital solutions in transition towards green and sustainable marine logistics.[82] The United Kingdom requires MASS to maintain navigation systems equivalent to those of conventional vessels, while also accommodating emerging technologies. The MCA has explored how remote operators will access electronic charts, interpret navigational data, and communicate with maritime authorities.[83]

Nigeria's regulatory framework remains limited to conventional navigation systems, with no recognition of advanced technologies. The framework is human centred and prioritizes seafarers' welfare, labour standards and local workforce development through instruments required to be enforced by the Nigeria Maritime Administration and Safety Agency (NIMASA).[84] In contrast, Finland and Norway are actively integrating AI and digital systems into navigation, while the UK is adapting its framework to accommodate such developments.

Vessel Traffic Services and Management

Nigeria operates Vessel Traffic Services (VTS) in major ports, requiring vessels to report to port authorities and engage licensed pilots.[85] However, there is no provision for autonomous vessels to comply with these requirements through remote or automated systems. This creates a regulatory vacuum, as MASS cannot legally integrate into existing VTS frameworks. Finland and Norway are actively adapting VTS and pilotage frameworks to accommodate autonomous vessels.

Norway has granted pilotage exemptions to autonomous vessels operating under strict safety conditions, while maintaining coordination with VTS through radio communication.[86] Finland is experimenting with remote pilotage, whereby shore-based pilots guide vessels through digital interfaces. The United Kingdom requires MASS to comply with existing VTS and pilotage requirements but is developing digital pilotage systems that may replace onboard pilots with remote operators.[87]

CONCLUSION

The analysis of current regulatory frameworks indicates that Nigeria is lagging significantly behind international best practices in the integration of autonomous maritime technologies. While jurisdictions like

[81] Ole Andreas Alsos and others, 'Lessons Learned from the Trial Operation of an Autonomous Urban Passenger Ferry' (2024) Transportation Research Interdisciplinary Perspectives Vol. 26, 10142. See https://www.sciencedirect.com/journal/transportation-research-interdisciplinary-perspectives accessed on 10 September, 2026.

[82] Kotka Maritime Research Center, 'Gyroscope' (2025). See <https://www.merikotka.fi> accessed on 10 September, 2026. Also see Guangrong Zou and others, 'Enabling Maritime Digitalization by Extreme-Scale Analytics, AI and Digital Twins' (2023) *VTT's Research Information Portal*, through <https://www.cris.vtt.fi> accessed on 10 September 2026.

[83] Cathal Leigh-Doyle, 'MCA's New Rules for Remotely Operated Unmanned Vessels come into Force' (2023) *Maritime, Trade and Offshore, Stephenson Harwood*. https://www.shlegal.com accessed on 10 September, 2026.

[84] Olisa Agbakoba, 'Regulatory Battles Shaping Nigeria's Maritime Economy' (2025) *Olisa Agbakoba Legal*. <https://www.oal.law> accessed on 10 September 2026.

[85] Nigerian Ports Authority (Pilotage) Regulations 1961. Also see Ateme Michael Efeturi, 'Improving the Safety of Navigation through Vessel Traffic Services (VTS) at Lagos Port Complex, Nigeria'. A Thesis for the award of Master of Science in Nautical Science and Maritime Transport Management, Barcelona (2021).

[86] Norwegian 'Regulations on Compulsory Pilotage and the use of Pilot Exemption Certificates (Compulsory Pilotage Regulations). See <https://www.kystverket.no> accessed on 10 September 2026.

[87] Liro Torma, Jussi Haapasaari and Jukka Hakkinen, 'Enhancing Shared Situational Awareness in Remote Pilotage: A Prototype for 3D Route Briefing' (2025) *Journal of Physics Conference Series* 3123(1): 012059. <https://www.researchgate.net> accessed on 10 September 2026.

Finland, Norway, and the United Kingdom have adopted adaptive, performance-based models that prioritize safety outcomes over traditional crewing, Nigeria remains restricted by an outdated, human-centric legal paradigm. To secure its future in the global maritime economy, Nigeria must undertake comprehensive legislative reform. This requires formally adopting the IMO's four levels of autonomy, amending the Merchant Shipping Act 2007 and all other relevant legal instruments to recognize automated vessel operations classification, remote operations and the role of shore-based masters, establishing a robust, cyber-resilient regulatory regime for ROCs.