# AUTONOMOUS VESSELS AND THE AUSTRALIAN DOMESTIC MARITIME REGULATORY FRAMEWORK

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*The Australian maritime industry has embraced the use of autonomous vessels to improve operational efficiency and safety while reducing environmental impact. However, complexities regarding how autonomous vessels fit into the Australian maritime regulatory framework are hampering innovation by adding delay and risk to projects, jeopardising realisation of the potential benefits. Based on a regulatory analysis, this article argues that: (A) an autonomous vessel is capable of being considered a domestic commercial vessel; (B) an autonomous vessel is capable of compliance with the maritime regulatory framework; and (C) national law governing domestic vessels can be updated independent of progress being made on an international law level. Clarity regarding these questions will facilitate the operation of autonomous vessels in Australia and support necessary future regulatory developments.*

## I INTRODUCTION

The Australian maritime operating environment presents unique challenges for those seeking to navigate, undertake commercial activities, or conduct research within it –including vast coastlines, sensitive reef ecosystems, and challenging sea conditions.[1] The growing use of bespoke and 'off the shelf'

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[1] Grant Judson and Rachel Horne, 'The Regulatory Approach for Vessels Capable of Autonomous and Remote-Controlled Operation' (2019) *Pacific International Maritime Conference 2019*, Sydney. For a list of challenges

autonomous and remotely operated vessels ('autonomous vessels') within Australia are addressing these challenges with small, agile and long-endurance vessels currently in use for purposes such as coral reef monitoring, hydrographic surveying, and persistent surveillance.[2]

Across the globe there has been recent rapid development and commercial deployment of automated technologies in the maritime domain.[3] In the context of regulation, the focus has been on international waters and adapting international maritime law and frameworks to automation.[4] There has been less concern with autonomous vessels which are regulated as domestic vessels under the relevant national maritime safety legislation of their home nation.[5] By 'domestic vessel' we mean vessels that are not undertaking international voyages on the high seas but operating in territorial and inland waters. However, it is with these vessels used for commercial, research, and government purposes – such as fishing, ferrying, hydrographic surveys, scientific monitoring, and border surveillance — that the advantages of automation as safer and more efficient than traditional crewed vessels are particularly evident.[6] The rising number of autonomous vessels operating in waters where the law of the coastal nation applies is creating an urgent need to consider the adaptability of national maritime frameworks.

In Australia, vessels operating for commercial, research or governmental purposes in domestic waters are regulated by the Australian Maritime

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specific to tropical Australia such as biofouling, heat, communications, environmental obstacles, and wildlife see: 'AIMS', *ReefWorks* (Web Page) <https://www.aims.gov.au/about/facilities/reefworks>.

[2] Fran Humphries et al, 'Uncrewed Autonomous Marine Vessels Test the Limits of Maritime Safety Frameworks' (2023) 22 *WMU Journal of Maritime Affairs* 317, 327.

[3] Sean Pribyl and Alan Weigel, 'Autonomous Vessels: How an Emerging Disruptive Technology is Poised to Impact the Maritime Industry Much Sooner than Anticipated' (2018) 1(1) *Journal of Robotics, Artificial Intelligence & Law* 17, 17.

[4] Rachel Horne et al, 'Navigating to Smoother Regulatory Waters for Australian Commercial Vessels Capable of Remote or Autonomous Operation: A Systematic Quantitative Literature Review' (2023) 15(4) *Australian Journal of Maritime & Ocean Affairs* 496, 497.

[5] Ibid 496.

[6] Humphries et al (n 2), 318; Rachel Horne, *Autonomous and Remotely Operated Vessels 2021 to 2040, MIAL Future Leaders White Paper. Predictions for the Australian Maritime Industry 2040* (Maritime Industry Australia Limited, 2021).

Safety Authority ('AMSA') under the *Marine Safety (Domestic Commercial Vessel) National Law Act 2012* (Cth) ('National Law').[7] The National Law, which commenced in 2013, replaced earlier state and territory regulation of commercial vessels with a uniform national regime.[8] The National Law applies a series of certification and other requirements to craft that come under the definition of 'domestic commercial vessel' ('DCV'), with compliance necessary to avoid civil and criminal penalties. The National Law was written for crewed vessels and does not have specific provisions for autonomous vessels.[9] If owners fail to obtain necessary approvals from AMSA under the National Law before deploying their autonomous vessel in Australian domestic waters, they could be liable for civil penalties and, if a serious incident were to occur, potentially criminal prosecution.

While some autonomous vessels look and operate similar to traditional crewed surface vessels, many are radically different in their design, construction and operation.[10] The extent of difference between traditional vessels and many autonomous vessels, particularly subsurface vessels, causes difficulty in applying existing regulatory frameworks.[11] This causes delays and additional risk for parties seeking to use autonomous vessels and, in some cases, can prevent deployment of the vessel.[12] Addressing the fundamental questions of the relationship between autonomous vessels and the regulatory definition of DCV, whether an autonomous vessel can comply with the national maritime regulatory framework, and whether Australian law can progress independently of international law, is critical

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[7] Unless there is an opt-in declaration in force for the vessel and it is considered a regulated Australian vessel, *Navigation Act 2012* (Cth) s 15.

[8] Kate Lewins and Ashwin Nair, 'International and Recent Developments Australia' (2013) 38(2) *Tulane Maritime Law Journal* 583, 610.

[9] Rachel Horne, Maaike Vanderkooi and Damian Guihen, 'Autonomous Vessel Regulation in Australia: Why an Australian Code of Practice is Required' *IndoPacific International Maritime Conference* (2022, Sydney).

[10] Examples of autonomous vessels in use in Australia available at Figure 1 and Rachel Horne et al, *Body of Knowledge: Assurance and Accreditation of Autonomous Systems in Australia* (Trusted Autonomous Systems, 1st$^{th}$ ed,2022) 31–4.

[11] Kate Devitt et al, 'Trust and Safety' in Robotics Australia Group (ed)*, A Robotics Roadmap for Australia 2022* (Robotics Australia Group, 2022) 1, 16, 24.

[12] Horne et al 'Body of Knowledge' (n 11), 79; Humphries et al (n 2), 333.

to support both industry and AMSA in managing the increased use of autonomous vessels in Australian domestic waters.[13]

This article examines the Australian domestic maritime regulatory framework's adaptability to autonomous vessels, addressing the posed questions. There is currently little Australian research and analysis of the adaptability of the domestic commercial vessel regulatory framework to autonomous vessels and this article aims to provide substantial baseline analysis. It argues that: (A) an autonomous vessel can be considered a DCV; (B) an autonomous vessel is capable of compliance with the maritime regulatory framework but that the current use of 'flexibility mechanisms' is sub-optimal; and (C) national law governing domestic vessels can be reformed independent of progress being made at the international law level.

This article identifies that while autonomous vessels are capable of being compliant DCVs, the more they depart from the legacy paradigm of a human-crewed ship (that is, a vessel large enough to have humans on board who are responsible for navigation and operation), the more regulatory uncertainty exists, and the more flexibility mechanisms like general or specific exemptions need to be utilised. Having to use flexibility mechanisms can lead to slow, uncertain, and expensive regulatory processes, and may stifle the development of autonomous vessel technologies and industries in Australia, and, more broadly, the deployment of autonomy across the Australian commercial maritime fleet.[14] The use of such mechanisms does not prohibit automation in commercial vessels in Australian waters but does add significant costs.[15] A reform agenda needs to be pursued to better cater for autonomous vessels, reducing current regulatory burdens for manufacturers, operators, and AMSA.[16]

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[13] Horne et al 'Navigating to Smoother Regulatory Waters' (n 4), 503–4.
[14] Rachel Horne (n 6).
[15] Ibid.
[16] Note in 2022 an Autonomous Vessel Forum was run by Trusted Autonomous Systems, where stakeholders from industry, academia, government and defence identified their priorities for the autonomous vessel sector as including "improving the regulatory experience; creating and adopting standards; and increasing clarity within future regulatory frameworks. The sector supports the adoption of lessons learned from the air domain". See 'Rachel Horne', *Trusted Autonomous Systems, Autonomous Vessel Forum 2022: Post-event Communique* (Blog Post, 14 November 2022) <https://tasdcrc.com.au/reflecting-on-the-autonomous-vessel-forum-2022/>.

This article is in four parts. Part II overviews autonomous vessels and their current use in Australian domestic waters. Part III argues that autonomous vessels are capable of being captured by the definition of DCV under the National Law. To get to this conclusion, Part III overviews the history and structure of the regulatory framework established by the National Law. Part IV argues that, currently, autonomous vessels can be used in domestic waters if significant exemptions and discretions vested in AMSA under the National Law are activated. Part V argues that reforms to the processes under the National Law, including a new general autonomous vessel exemption, and deeper reforms to the National Law should be pursued to better accommodate autonomous vessels, and this can happen independent of international legal developments.

## II USE OF AUTONOMOUS VESSELS IN AUSTRALIA

Assessing the adequacy of Australia's domestic commercial maritime regime to regulate autonomous vessels, requires an understanding of the technologies enabling vessel automation, the benefits of autonomous vessels, and an overview of the autonomous vessels currently under trial or in service in Australian domestic waters.

Autonomous vessels are vessels that can operate without a human on board. These vessels can incorporate a wide variety of different technologies and capabilities, with a broad spectrum of autonomous behaviours and support functions available.[17] There is a diversity of terminology used to describe autonomous vessels, often based on where they operate (surface or subsurface) and the method of operation (remotely operated or autonomous). For example: Autonomous Surface Vessel (ASV), Autonomous Underwater Vessel (AUV), Unmanned Surface Vessel (USV), Unmanned Underwater Vessel (UUV), or Unmanned X Vessel (UXV) which describes autonomous and unmanned maritime, air and land vehicles, vessels, or drones.[18]

Autonomous vessels are increasing in popularity because they provide substantial benefits over the use of traditional crewed vessels for many

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[17] 'World Maritime University', *Transport 2040: Autonomous Ships: A New Paradigm for Norwegian shipping — Technology and transformation* (Web Page, 2019) <https://commons.wmu.se/cgi/viewcontent.cgi?article=1072&context=lib_reports>.

[18] Horne, Vanderkooi and Guihen (n 9).

commercial, research and government uses. A primary benefit is cost of operation. Autonomous vessels are considerably more cost effective to operate due to reduced crewing costs and as most autonomous vessels are much smaller than crewed vessels, use significantly less fuel.[19] Small autonomous vessels promise less environmental impact in use and inherently less risk to human life by not carrying human crew. They also offer the ability to scale impact, for example by having persistent autonomous vessels patrol an area or conduct reef scanning requiring fewer humans and supporting infrastructure.[20] Many nations, including Australia, are using autonomous vessels for a growing range of commercial and defence activities,[21] including hydrographic surveys, scientific research, monitoring, and surveillance.

The Australian maritime operating environment presents unique challenges for vessel operators, including vast and sparsely inhabited coastlines, sensitive reef ecosystems, and challenging sea conditions.[22] The growing use of autonomous vessels within Australia, which commenced in approximately 2017,[23] can be seen as a response to these challenges.[24] AMSA has stated that:

> Rapid new developments in technology can be both disrupting and offer opportunities. More technologically advanced vessels are operating in Australia, using increasing levels of automation in navigation, communications and cargo and engine control systems. While technology can improve safety, efficiency, and environmental protection, it comes with new safety, security and environmental risks that must be properly understood and managed.[25]

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[19] Humphries et al (n 2), 318.
[20] Ibid.
[21] Horne et al 'Body of Knowledge' (n 11), 31, 35.
[22] Grant Judson and Rachel Horne (n 1); See also: 'AIMS', *ReefWorks* (Web Page) <https://www.aims.gov.au/about/facilities/reefworks>.
[23] The Seaworker 5 vessel was the first autonomous vessel to receive a specific exemption from AMSA enabling operation in Australia.
[24] For examples refer to Figure 1; Humphries et al (n 2), 324.
[25] Australian Maritime Safety Authority, *2020/21 Corporate Plan* (2020–21 to 2023–24) <https://www.amsa.gov.au/sites/default/files/corporate-plan-2020-21.pdf>.

Figure 1 illustrates the breadth of autonomous vessel types in operation (for commercial, testing, or demonstration purposes) in Australia in 2022, ranging from small subsurface to large surface vessels.[26]


*Figure 1: Examples of autonomous vessels in Australia in 2022, image compiled by Rachel Horne used with permission of Trusted Autonomous Systems.*

The compilation image in Figure 1 includes both surface and subsurface, small- and medium-length, commercial and defence use cases, and off-the-shelf and purpose-built vessels. The first vessel pictured top left is the Ocius Bluebottle, an Australian-built vessel approximately 6.8m in length used primarily for sustained surveillance due to its ability to use wind, solar, and wave power.[27] The second vessel pictured to the right of the Bluebottle is the WAM-V, which is a common robotics testing platform that is available in different sizes and configurations.[28] The next vessel pictured to the right of the WAM-V is the Unipact platform operated by Unique Group, which is a 3m-long purpose-built hydrographic survey vessel.[29] The next vessel, the FireTail Surfbee, is an off-the-shelf-style platform used for water monitoring and survey and is available in different

[26] For more information on these vessels and other vessels in use in Australia see: Horne et al 'Body of Knowledge' (n 11), 30–7.

[27] For more information see: 'Ocius', *Autonomous Maritime Domain Awareness* (Web Page) <https://ocius.com.au/>.

[28] For more information see: 'OPT', *Unlock the Power of WAM-V* (Web Page, 2023) <https://wam-v.com/>.

[29] For more information see: 'Unique Group', *Deep Imagination Innovation in subsea technologies and engineering* (Web Page, 2024) <https://www.uniquegroup.com>.

sizes and configurations.[30] The larger surface vessel pictured is the BtB Marine 'Indigo', a 7.5m-long survey vessel.[31] Other vessels pictured include the Coral AUV,[32] an Ocius test platform, the Australian Droid and Robot Grey Ghost, a tethered crawler test platform, a Fugro USV,[33] a Remus AUV,[34] and an Iver AUV.

In summary, Australian domestic vessel operators have identified advantages in developing and deploying autonomous vessels, including for scientific, survey, and surveillance purposes. This demand has led to a significant emergent Australian autonomous vessel research and development industry. However, at this nascent stage, the regulatory pathways for assurance and legal operation of these vessels in domestic waters are unclear.[35] This lack of certainty stems from the crewed-vessel paradigm that underpins the existing national regulations.

## III Autonomous Vessels as Domestic Commercial Vessels

This section argues that autonomous vessels, irrespective of design, if deployed for commercial, research, or governmental purposes within Australian domestic waters, generally fall within the definition of a DCV in the National Law. In making this argument, this section overviews Australian maritime law and regulation and the core features of the National Law.

### A *Australian Maritime Law and Regulation*

Prior to federation, the British colonies' maritime law fell within the purview of Imperial legislation. The *Merchant Shipping Act 1894* (Imp)

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[30] For more information see: 'FireTail Robotics', *Complex Clever Industrial Hardware at the Speed of Agile* (Web Page, 2024) <https://firetailrobotics.com/>.

[31] For more information see: 'BtB marine', *Building Specialised Aluminium Work Boats* (Web Page, 2024) <https://www.btbmarine.com/>.

[32] For more information see: 'AIMS', *CoralAUV* (Web Page) <https://www.aims.gov.au/research/technology/reefscan/CoralAUV>.

[33] For more information see: Ivar de Josselin de Jong, 'Fugro', *Remote inspection Services and Autonomous Solutions* (Web Page, 2024) <https://www.fugro.com/about-fugro/our-expertise/remote-and-autonomous-solutions/remote-and-autonomous-vessels>.

[34] For more information see: 'Blue Zone Group', *HII Remus AUVs* (Web Page, 2022) <https://bluezonegroup.com.au/product-catalogue/ras/auv/remus-autonomous-underwater-vehicles-1/>.

[35] Humphries et al (n 2), 340.

authorised a colony's governor to maintain a register of British ships, masters, and seamen.[36] The *Colonial Courts of Admiralty Act 1890* (Imp) ensured that colonial courts could exercise the admiralty jurisdiction and that colonial legislatures could confer admiralty jurisdiction to colonial courts.[37] At federation, primary responsibility for maritime matters remained with the states.[38] Over the 20th century, the Imperial Acts were predominantly replaced with Commonwealth, state, and territory laws.[39] In 1912 the Commonwealth enacted the *Navigation Act 1912* (Cth), superseding the *Merchant Shipping Act 1894* (Imp).[40] This Act has since been replaced by the modernised *Navigation Act 2012* (Cth) as the core legislation dealing with Australian-flagged vessels and international-flagged vessels in Australian domestic waters. The *Navigation Act 2012* (Cth) is the primary law that implements the Commonwealth's obligations under international maritime and shipping law,[41] and it deals with vessels

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[36] *Merchant Shipping Act 1894* (Imp) s 89.

[37] *Colonial Courts of Admiralty Act 1890* (Imp) s 2.

[38] The Commonwealth's trade and commerce power in s 51(i) of the *Constitution* as elaborated by s 98 to explicitly include 'navigation and shipping' is the basis of the Commonwealth's legislative power over the maritime domain.

[39] Some Imperial Acts still apply, for example the *Colonial Courts of Admiralty Act 1890* (Imp) where state and territory laws have not enunciated the admiralty jurisdiction of the state or territory Supreme or lesser courts.

[40] Sarah Derrington and Michael White, 'Australian Maritime Law Update' (2000) 31(3) *Journal of Maritime Law and Commerce* 437, 437.

[41] Including: *Convention of Limitation of Liability for Maritime Claims,* opened for signature 19 November 1976, [1991] ATS 12 (entered into force 1 December 1986), *Convention on the International Regulations for Preventing Collisions at Sea*, opened for signature 20 October 1972, 1050 UNTS 16 (entered into force 15 July 1977), *Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter*, opened for signature 29 December 1972, 1046 UNTS 120 (entered into force 30 August 1975), *International Convention for Safe Containers,* opened for signature 2 December 1972, 1064 UNTS 3 (entered into force 6 September 1977), *International Convention for Standards of Training, Certification and Watchkeeping for Seafarers*, opened for signature 7 July 1978, 1316 UNTS 190 (entered into force 28 April 1984), *International Convention for the Prevention of Pollution from Ships,* opened for signature 2 November 1973, 1340 UNTS 62 (entered into force 2 October 1983), *International Convention for the Safety of Life at Sea,* opened for signature 1 November 1974, 1184 UNTS 278 (entered into force 25 May 1980), *International Convention on Load Lines,* opened for signature 5 April 1966, 640 UNTS 133 (entered into force 21 July 1968), *International Convention on Salvage,* opened for signature 28 April 1989, 1953 UNTS 165 (entered into force 14 July 1996),

that predominately operate on the 'high seas', that is vessels making international voyages. Given that this article is concerned with vessels within domestic waters, the regime underpinned by the *Navigation Act 2012* (Cth) is not the focus.

At present, domestic water transport and maritime safety in Australia are regulated by the Commonwealth,[42] the states,[43] and territories.[44] There remains considerable overlap between Commonwealth and state and territory authorities and regulations. For example, DCVs are regulated by the Commonwealth yet, as workplaces, they are also subject to state and territory laws and regulators.[45] Recreational vessels, like private motor vehicles, remain a state and territory responsibility, yet are also impacted by Commonwealth law relating to designs and standards.

The current Australian maritime safety framework has its origins in the Council of Australian Governments' 'Intergovernmental Agreement on Commercial Vessel Safety Reform' of 2011 ('IGA').[46] Underpinned by productivity reforms across all transport domains to reduce complexity from overlapping jurisdictions and variations between states and territories, the agreement provided the basis for a national framework and

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*International Convention on the Control of Harmful Anti-fouling Systems on Ships*, opened for signature 5 October 2001 (entered into force 17 September 2008), *International Convention on Tonnage Measurement of Ships* opened for signature 23 June 1969, 1291 UNTS 3 (entered into force 18 July 1982), *Maritime Labour Convention,* opened for signature 23 February 2006, 45 ILM 792, UNTS Reg No I-51299 (entered into force 20 August 2013), and *United Nations Convention on the Law of the Sea,* opened for signature 10 December 1982, 1833 UNTS 397 (entered into force 16 November 1994).

[42] See, eg, *Navigation Act 2012* (Cth).

[43] See, eg, *Transport Operations (Marine Safety) Act 1994* (Qld).

[44] See, eg, *Marine Act 1981* (NT). Although the Australian Capital Territory is landlocked, Jervis Bay (in New South Wales) is part of the Australian Capital Territory's jurisdiction.

[45] This was highlighted in the *Inquest into the death of Ryan Harry Donoghue* [2016] NTLC 009. Another circumstance where there is overlapping responsibility is the reporting of maritime incidents where reports should be made to Commonwealth and state authorities. Shane Bosma, 'A Sea Change in Queensland's Marine Safety Laws: Recent Marine Safety Reforms in Queensland' (2017) 31(1) *Australian and New Zealand Maritime Law Journal* 37.

[46] Council of Australian Governments, 'Intergovernmental Agreement on Commercial Vessel Safety Reform' <https://www.coag.gov.au/sites/default/files/agreements/Maritime_IGA-19August2011.pdf>.

regulator for 'commercial vessels operating in Australian waters'.[47] The central reforms from the IGA were the *Navigation Act 2012* (Cth) and the *Marine Safety (Domestic Commercial Vessel) National Law Act 2012* (Cth) [48] with supporting legislation by the states.[49] A primary aim of these legislative changes was an expanded role for AMSA as the national regulator of commercial vessels, both international and domestic.

AMSA is a corporate Commonwealth entity established under the *Australian Maritime Safety Authority Act 1990* (Cth),[50] having members appointed by the Minister.[51] It is a part of the Commonwealth Department of Infrastructure, Transport, Regional Development, Communications and the Arts. AMSA commenced operations on 1 January 1991 and has wide-ranging responsibilities, including survey and certification of ships, safety standards for foreign ships, standards of crew competence, the safe handling of cargo, marine navigation aids, ship registration, marine search and rescue, and liaison with the commercial industry. Moreover, it is responsible for the administration of the *Navigation Act 2012* (Cth),[52] *Shipping Registration Act 1981* (Cth),[53] the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cth),[54] and the *Protection of the Sea (Civil Liability) Act 1981* (Cth).[55] It is also the designated National Maritime Safety Regulator under the auspices of the National Law.[56]

AMSA also has various functions, which include providing search and rescue, marine safety, marine environment protection, strategic

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[47] Ibid art 14.
[48] *Marine Safety (Domestic Commercial Vessel) National Law 2012* (Cth).
[49] *Marine Safety Amendment (National Law Application Act* 2012 (NSW) (which made amendments to the *Marine Act 1988* (NSW); *Marine Safety (Domestic Commercial Vessel) (National Law Application Act) 2013* (NT); *Marine Safety (Domestic Commercial Vessel) National Law (Application) Act 2013* (SA); *Marine Safety (Domestic Commercial Vessel National Law Application) Act 2013* (Tas); *Marine (Domestic Commercial Vessel National Law Application) Act 2013* (Vic).
[50] *Australian Maritime Safety Authority Act 1990* (Cth) s 5.
[51] Ibid s 10.
[52] *Navigation Act 2012* (Cth).
[53] *Shipping Registrations Act 1981* (Cth).
[54] *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cth).
[55] *Protection of the Sea (Civil Liability) Act 1981* (Cth).
[56] *Marine Safety (Domestic Commercial Vessel) National Law* sch 1 pt 2 s 9. For the functions of the National Regulator, see sch 1 pt 2 s 10.

development, and corporate services.[57] Finally, particularly pertinent to adapting novel vessel technologies like autonomy, AMSA has powers under the National Law to make Marine Orders.[58]

### B *The National Law*

The National Law replaced eight previous Commonwealth, state, and territory laws dealing with DCVs and crews in Australian waters with a single national framework.[59] Behind the National Law is a cooperative scheme between the Commonwealth, states, and territories to provide consistent national standards, which ensure the safe operation, design, construction, and equipping of DCVs.[60]

The core regulatory framework provided for in the National Law is based on the prohibit and regulate model. A DCV cannot be in-service unless:

1. It has and displays a Unique Vessel Identifier.[61]

2. It has a certificate of survey[62] ('survey' is a maritime term relating to ship design, construction and general 'seaworthiness').

3. It is listed on a certificate of operation.[63] This focuses on the use of the vessel and consideration of risks and risk minimalisation while in-service. This includes being crewed by persons holding the required certificate of competency.[64]

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[57] *Australian Maritime Safety Authority Act* 1990 ss 5, 6(1). For an overview of the functions performed, see Ambrose Rajadurai, 'Regulation of Shipping: The Vital Role of Port State Control' (2004) 18 *Australian and New Zealand Maritime Law Journal* 83, 83–106.
[58] *Marine Safety (Domestic Commercial Vessel) National Law Act 2012* (Cth) sch 1 pt 2 s 10(a) in terms of s 163.
[59] Ibid sch 1 pt 1 s 3(a). See generally 'Australian Maritime Safety Authority', *National Law and Related Legislation* (Web Page) <http://www.nationalsystem.amsa.gov.au/nationallaw.php>.
[60] *Marine Safety (Domestic Commercial Vessel) National Law Act 2012* (Cth) sch 1 pt 1 s 3(a) and s 3(d).
[61] Ibid sch 1 pt 4 div 1 ss 30–6.
[62] Ibid sch 1 pt 4 div 2 ss 37–46.
[63] Ibid sch 1 pt 4 div 3 ss 47–57.
[64] Ibid sch 1 pt 4 div 4 ss 58–70.

DCVs are surveyed by accredited marine surveyors[65] and are subject to compliance action by AMSA-appointed Marine Safety Inspectors. Underneath the National Law are Marine Orders 501 to 507 that particularly apply to DCVs.

The National Law provides for four overarching categories of DCVs: passenger vessels, non-passenger vessels, fishing vessels, and hire and drive vessels used for short-term recreation purposes. There are no limits on the construction or design of vessels. This means that there is significant diversity in the type, size, and uses of the vessels that are subject to the National Law. This gives the regulatory framework established by the National Law a degree of complexity because it regulates from very small vessels to very large, from sail to motored, and from passenger to cargo to vessels used in primary industries.

To address this diversity of vessels and activities regulated by the National Law, AMSA has a degree of flexibility in how it manages the risks of specific vessels and operations. The two principal flexibility mechanisms are exemptions and equivalent means of compliance ('EMOCs'). These are of particular importance when considering autonomous vessels in Part IV of this article.

The first flexibility mechanism is the power under the National Law that allows AMSA to exempt a specified vessel or class of vessels or a specified person or class of persons from the application of provisions of the National Law.[66] The exemption may be confined to one or more specified time periods and one or more specified operations.[67] Exemptions are granted upon application or on AMSA's own initiative.[68] The exemption is subject to the conditions specified in the exemption instrument.[69] Partly the exemption framework was included to allow for 'grandfathered' vessels to

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[65] Australian Maritime Safety Authority, *National Law - Marine Surveyors Accreditation Guidance Manual 2014. Part 1 — Accreditation of marine surveyors* (as amended in June 2018) Chapter 1: an 'accredited marine surveyor' is defined as 'a surveyor who is accredited in accordance with Part 3 of the National Law Regulation.' See generally <https://www.amsa.gov.au/sites/default/files/marine-surveyors-manual-part-1.pdf.>.

[66] *Marine Safety (Domestic Commercial Vessel) National Law Act 2012* (Cth) sch 1 pt 8 div 2 ss 143(1), (2).

[67] Ibid sch 1 pt 8 div 2 s 143(3).

[68] Ibid sch 1 pt 8 div 2 s 143(4).

[69] Ibid sch 1 pt 8 div 2 s 143(6).

continue to operate according to older regulatory arrangements.[70] Once an exemption is in place, it is an offence by owners, masters, and other persons to not comply with a condition of the exemption.[71] Before granting an exemption, the National Law provides a threshold that AMSA must be 'satisfied that the exemption concerned, taken together with the conditions to which it is subject, will not jeopardise the safety of a vessel or a person on board a vessel'.[72] Relevantly, the reference to 'a vessel' rather than 'the vessel' means consideration must be given to the impact of other vessels interacting with the subject vessel rather than just the impact on the vessel itself.

The second flexibility mechanism is the EMOC. An EMOC is used when there is a need to meet an outcome specified by the National Standard for Commercial Vessels ('NSCV') through an alternative means to the listed 'deemed to satisfy' solutions. EMOC applications and approvals are provided for in Division 4 of *Marine Order 503 (Certificates of survey — national law) 2018*.[73] The key criterion is that AMSA needs to be satisfied that the EMOC 'is at least as effective as any part of the standards that it replaces'.[74] Applications for an EMOC must be supported by:

> (a) details of the standards in this Order [Marine Order 503] that apply to the vessel, to which the application relates; and
>
> (b) a statement explaining how the proposed EMOC is at least as effective as compliance with the standards applying to the vessel, that it is to replace; and
>
> (c) at least one document supporting the statement mentioned in paragraph (b).[75]

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[70] *Marine Safety (Domestic Commercial Vessel) National Law Bill - Explanatory Memorandum 2012* (Cth) 74.
[71] *Marine Safety (Domestic Commercial Vessel) National Law Act 2012* (Cth) sch 1 pt 8 div 2 ss 144–6. These are strict liability offences with a penalty of 60 penalty units.
[72] Ibid sch 1 pt 8 div 2 s 143(5).
[73] *Marine Order 503 (Certificates of survey — national law)* 2018 div 4.
[74] Ibid div 4 s 17(2).
[75] Ibid div 4 s 18(2).

The EMOC provisions relate to survey requirements — hull, decks and openings, machinery, equipment, maintenance, and so on — and not certificate of operation requirements involving crewing and use.[76]

In summary, the National Law provides for AMSA to regulate DCVs. It does this through four key requirements: a national registration scheme through unique vessel identifiers, the requirement that the vessel has a certificate of survey relating to construction and 'seaworthiness',[77] the requirement for the vessel to be listed on a certificate of operation relating to operations of the vessel and planned risked minimalisation,[78] and the vessel must be crewed by persons holding the required certificate of competency. The underlying paradigm of human-crewed vessels is evident in these requirements, especially in relation to crewing and by implications of survey requirements directed at ships that have crew (and possibly passengers) on board. Considering the vessels that are currently being tested or are in-service in Australian domestic waters (as represented in Figure 1), it would seem difficult for autonomous vessels to directly meet many of the core requirements of domestic maritime regulation. This would suggest a need to explore exemptions and EMOCs further. However, a threshold question remains on whether autonomous vessels can fit the National Law's definition of a DCV.

### C *Autonomous Vessels as Domestic Commercial Vessels*

Determining whether a vessel satisfies the definition of a 'domestic commercial vessel'[79] is a two-stage test. The first test is determining whether the craft fits the definition of 'vessel'. The second test is whether the use of the craft fits within the definition of 'domestic commercial vessel'.

First, the primary definition of 'vessel' in the National Law is expansive: 'a craft for use, or that is capable of being used, in navigation by water, however propelled or moved, and includes an air-cushion vehicle, a barge, a lighter, a submersible, a ferry in chains and a wing-in-ground effect craft'.[80] An extended list is provided in the *Marine Safety (Domestic*

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[76] Ibid div 4.
[77] *Marine Safety (Domestic Commercial Vessel) National Law Act 2012* (Cth) sch 1 pt 4 div 2 ss 37–46.
[78] Ibid sch 1 pt 4 div 3 ss 47–57.
[79] Ibid sch 1 pt 1 s 7.
[80] Ibid sch 1 pt 1 s 8(1).

*Commercial Vessel) National Law Regulation 2013* (Cth) ('National Law Regulation') which specifically includes 'a boat, a canoe, a dinghy, a dragon boat, a kayak, a pontoon and a tinnie'.[81] From this expansive definition, specific crafts and things are excluded, such as aircraft and offshore facilities that are regulated by the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (Cth).[82]

Within the National Law's expansive definition of 'vessel', it is commonly considered that autonomous vessels, whether surface or subsurface, are vessels.[83] Indeed, the vessels represented in Figure 1 are all likely to be vessels for the purposes of the National Law, except the tethered crawler vessel.[84]

Second, the National Law defines a 'domestic commercial vessel' as a 'vessel that is for use in connection with a commercial, governmental or research activity'.[85] The operative phrase 'commercial, governmental or research activity' is not defined in the National Law. It is assumed that Parliament intended 'commercial, governmental or research activity' to be understood in usual everyday meanings. This facilitates a pragmatic approach where AMSA has a degree of latitude to decide in specific instances what can be considered a commercial, governmental, or research activity. As such, AMSA regularly makes policy decisions on whether a vessel is within the definition. There has not been a recorded Administrative Appeals Tribunal (AAT) decision nor judicial review decision in which there has been review, commentary, or guidance given

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[81] *Marine Safety (Domestic Commercial Vessel) National Law Regulation 2013* (Cth) s 11.

[82] *Marine Safety (Domestic Commercial Vessel) National Law Act 2012* (Cth) sch 1 pt 1 s 8(2). This list includes 'an aquaculture pen, an aquaplane, a boogie board, a floating structure permanently connected to shore, an unpowered inflatable raft, an inner tube, a kiteboard, a paddleboard, a plank of wood, a pontoon connected to the mainland, a sailboard, a surf ski, a surfboard, towed recreational equipment, and a waterski'.

[83] Humphries et al (n 2), 322.

[84] Remotely Operated Vessels (ROVs) are distinguished from other types of autonomous vessels because they are physically tethered. In private discussion with AMSA officials they have indicated that ROVs are not considered 'vessels' because they are not considered to be capable of navigation due to their tether. The further emergence of digitally tethered ROVs is a further development but it may be that they are also considered 'not capable of navigation' and therefore not 'vessels'.

[85] *Marine Safety (Domestic Commercial Vessel) National Law Act 2012* (Cth) sch 1 pt 1 s 7(1).

to AMSA on the phrase 'commercial, governmental or research activity' within the National Law.[86]

There are four major exclusions from the definition of DCVs. The first is 'regulated Australian vessels' ('RAVs'),[87] which are vessels that operate predominately in international waters under the *Navigation Act 2012* (Cth).[88] The second exclusion is foreign vessels.[89] The National Law adopts the definition of 'foreign vessels' used in the *Navigation Act 2012* (Cth).[90] The third exclusion is defence vessels.[91] This includes a warship or other vessel that 'bears the external marks of nationality' of the Australian Defence Force or from the armed forces of another country that is under the command[92] of a member of the Australian Defence Force or a member of the armed forces and is crewed by seafarers under armed force discipline.[93] This also includes government vessels used only in non-commercial government service as a naval auxiliary.[94] Australian Border Force vessels are also excluded from the definition of DCV as they are declared to be 'RAVs' under the *Navigation Act 2012* (Cth).[95] There is no formal policy issued by AMSA indicating whether an autonomous vessel can be considered a 'defence vessel' or not, and no relevant decision clarifying this definition by the AAT or the courts. However, there are

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[86] There is obiter in a Victorian sentencing decision that a 22-metre passenger vessel used for sight-seeing, diving and off-shore swimming was accepted as a 'domestic commercial vessel.' *The Queen v MacKinnon* [2015] VSC 619 (Croucher J) 16.

[87] *Marine Safety (Domestic Commercial Vessel) National Law Act 2012* (Cth) sch 1 pt 1 s 7(3)(a).

[88] Ibid sch 1 pt 1 s 6 definition *regulated Australian vessel*.

[89] Ibid sch 1 pt 1 s 7(3)(b).

[90] Ibid sch 1 pt 1 s 6 definition *foreign vessel*.

[91] Ibid sch 1 pt 1 s 7(3)(c).

[92] McKenzie considered whether an autonomous vessel can be considered 'under command' for the purposes of the definition of warship in UNCLOS (*United Nations Convention on the Law of the Sea*), and concluded that it is a stretch to interpret it that way, but it is open to States to do so. Simon McKenzie, 'When Is a Ship a Ship? Use by State Armed Forces of Un-crewed Maritime Vehicles and the United Nations Convention on the Law of the Sea' (2020) 21(2) *Melbourne Journal of International Law* 373.

[93] *Marine Safety (Domestic Commercial Vessel) National Law Act 2012* (Cth) sch 1 pt 1 s 6 definition *defence vessel* (a).

[94] What is an auxiliary is not defined in the National Law. *Marine Safety (Domestic Commercial Vessel) National Law Act 2012* (Cth) sch 1 pt 1 s 6 definition *defence vessel* (b).

[95] *Navigation Act 2021* (Cth) ss 15(2), 17.

examples of autonomous vessels considered 'defence vessels' operating for defence exercises, which suggests that this is plausible.[96] Whether the current definition of 'defence vessel' is appropriate in the changing technology environment, where industry is designing, building, and testing vessels for defence use but under the commercial regulatory framework, requires further consideration.[97]

The fourth exclusion relates to the use and ownership of vessels; for example, vessels owned by primary and secondary schools[98] and not-for-profit community groups.[99] However, if the vessel is used for search and rescue (other than by a lifesaving organisation in sheltered water or within 2 nautical miles from the shore)[100] or is available for use, charter, or training of people other than members of the school or community group, it is deemed a DCV while being used for that purpose.[101]

Autonomous vessels used in connection with a commercial, governmental, or research purpose are capable of being a DCV, provided they are not excluded as a regulated Australian vessel or foreign vessel (regulated under the *Navigation Act 2012* (Cth) or defence vessel or the specific exemptions for schools, surf and rescue, and community groups and institutes of sport. Having determined that a vessel is a DCV, the substantive requirements of the National Law apply to the craft and its use.

In summary, the expansive definition of 'domestic commercial vessel' and 'vessel' means that a broad range of autonomous vessels fall under the National Law and regulatory oversight of AMSA. Indeed, most of the

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[96] For example, in the Royal Australian Navy exercise Autonomous Warrior 2022, approximately 14 autonomous vessels of varying types participated, with one of these vessels being operated by the Royal Australian Navy. See 'Naval News', *An inside look at Autonomous Warrior 2022* (Web Page, 6 June 2022) <https://www.navalnews.com/naval-news/2022/06/an-inside-look-at-autonomous-warrior-2022>.

[97] 'Trusted Autonomous Systems', *Submission to Independent Review of Domestic Commercial Vessel Safety Legislation* (Web Page, 20 March 2022) 12 <www.infrastructure.gov.au/sites/default/files/documents/dcvir-submission-7-trusted-autonomous-systems.pdf>.

[98] *Marine Safety (Domestic Commercial Vessel) National Law Regulation 2013* (Cth) pt 1 s 7(3)(d)(i).

[99] Ibid pt 1 s 7(3)(d)(ii); *Marine Safety (Domestic Commercial Vessel) National Law Regulation 2013* (Cth) pt 1, s 6.

[100] *Marine Safety (Domestic Commercial Vessel) National Law Regulation 2013* (Cth) pt 1, ss 7(a), 9.

[101] Ibid pt 1, ss 7(b), (c), 8, 10(2)(c).

vessels in Figure 1 were considered DCVs subject to AMSA regulation and the National Law. How that regulation could be achieved is the focus of the next part of this article.

## IV Are Autonomous vessels capable of compliance with the maritime regulatory framework?

This part argues that autonomous vessels are capable of complying with the maritime regulatory framework but only through reliance on flexibility mechanisms. The National Law sets out four main areas of compliance: unique vessel identifier, certificate of survey, certificate of operation (which includes crewing), and crew holding the required certificate of competency. Much of the specific details of these requirements are set out in Marine Orders. The traditional paradigm of crewed vessels that underpins the regulatory framework generated by the National Law and the Marine Orders is particularly evident in relation to the certificate of survey and operation requirements. It is this limitation that means autonomous vessels require flexibility mechanisms to be regulated under the National Law.

The one requirement that is unproblematic for autonomous vessels relates to the unique vessel identifier regime. Under the National Law, the owner and master of a DCV commit an offence if they operate the vessel without a unique vessel identifier and without displaying the unique vessel identifier unless an exemption applies.[102] AMSA issues unique vessel identifiers on application.[103] *Marine Order 502 (Vessel identifiers — national law) 2017* (Cth) details that the unique vessel identifier must be 'displayed clearly and prominently on the vessel'.[104] Autonomous vessels, however configured and constructed, are still craft, can still be issued with a number within a registry, and can formally comply with the 'displayed clearly and prominently' requirements. This final requirement might be problematic in practice though; numbers clearly and prominently attached to a vessel of 0.5 metres in length are unlikely to be as discernible as numbers on the hull of a traditional human-carrying craft. However, the

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[102] *Marine Safety (Domestic Commercial Vessel) National Law Act 2012* (Cth) sch 1 pt 4 div 1 ss 32-5. The offences are strict liability with a maximum penalty of 60 penalty units. Exemptions may include *Marine safety (Vessel identifiers) Exemption 2020* (EX01).

[103] *Marine Safety (Domestic Commercial Vessel) National Law Act 2012* (Cth) sch 1 pt 4 div 1 ss 30, 31.

[104] *Marine Order 502 (Vessel identifiers — national law) 2017* s 4(1).

unique vessel identifier placement rules seemingly are framed in terms of clarity and prominence in relation to the vessel, not visibility for other water users. In this context, compliance with the unique vessel identifier is the least problematic for owners and operators of autonomous DCVs. This is not the situation for the certificate of survey or certificate of operation.

### A *Certificate of Survey*

The owner and master of a DCV commit offences if they operate a vessel without a certificate of survey or operate the vessel in breach of a condition of the certificate of survey.[105] AMSA is responsible for issuing certificates of survey on application.[106] Certificates of survey can be issued with conditions mandated by regulation and/or imposed by AMSA and can include conditions relating to the surveying of the vessels or conditions relating to standards.[107]

There are multiple requirements applicable under the certificate of survey regime depending on whether the vessel is a 'new vessel', 'transitional vessel', or an 'existing vessel'. A lot of the provisions in the National Law, National Law Regulation, and *Marine Order 503 (Certificates of survey — national law) 2018* (Cth) relate to survey of existing vessels or survey of existing vessels where there has been a change in equipment, specification, or use. While retrofitting autonomous systems into an existing DCV is possible, the current focus for the autonomous vessels industry in Australia and the vessels presented in Figure 1 is with new builds of bespoke autonomous vessels. As such, the primary regulatory focus for survey is on the new vessel pathway.[108]

Surveys of new vessels are conducted by accredited marine surveyors or by a 'recognised organisation'.[109] Surveyors are accredited by AMSA[110] in accordance with the accreditation processes and standards provided by National Law Regulation and the 'National Law — Marine Surveyors

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[105] *Marine Safety (Domestic Commercial Vessel) National Law Act 2012* (Cth) sch 1 pt 4 div 2 ss 44–6.
[106] Ibid sch 1 pt 4 div 2 s 38.
[107] Ibid sch 1 pt 4 div 2 ss 38(3), (4).
[108] *Marine Safety (Domestic Commercial Vessel) National Law Regulation 2013* (Cth) pt div 3.1 s 21.
[109] *Marine Order 503 (Certificates of survey — national law)* 2018 s 6(1).
[110] *Marine Safety (Domestic Commercial Vessel) National Law Act 2012* (Cth) sch 1 pt 1 div 1 ss 10(ca), (d).

Accreditation Guidance Manual 2014'.[111] A critical distinction is that vessels equal to or greater than 35 metres in length must be surveyed by a recognised organisation,[112] whereas vessels less than 35 metres can be surveyed by accredited marine surveyors or a recognised organisation.[113]

The applicable standards for the vessel design, construction, equipment, and survey that marine surveyors or recognised organisations need to consider when issuing a certificate of survey are provided by *Marine Order 503 (Certificates of survey — national law) 2018* (Cth). The technical standards regarding vessel construction are contained within the NSCV. At its core the NSCV determines how vessels should be constructed considering the use of the vessel (use category) and range and environmental conditions that the vessel is expected to operate in (operational area category).[114] This is common sense. An offshore fishing boat has different design requirements than an inland water passenger ferry.

The vessel-use categories[115] are:

(1) Passenger vessel;

(2) Non-passenger vessel (includes a vessel carrying less than 12 people);

(3) Fishing vessel;

(4) Hire and drive vessel used by the hirer only for recreational purposes.[116]

There is no specific use category for autonomous vessels, but existing autonomous vessels have been categorised as non-passenger vessels to date.

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[111] Australian Government and Australian National Maritime Safety Authority, *National Law - Marine Surveyors Accreditation Guidance Manual 2014* (2018).
[112] *Marine Order 503 (Certificates of survey — national law)* 2018 s 6(2).
[113] Ibid s 6.
[114] NSCV Part B General requirements, s 2.4.
[115] Ibid s 2.1.
[116] Ibid pt B ch 2.

The operational area categories[117] are:

(A) Unlimited domestic operations;

(B extended) Extended offshore operations;

(B) Offshore operations;

(C) Restricted offshore operations;

(C Restricted) Restricted offshore operations — specified areas;

(D) Partially smooth water operations;

(E) Smooth water operations.

For example, a vessel to be used for fishing in smooth waters would be a Class 3E vessel. Part C of the NSCV provides the bulk of the requirement for DCVs. Part C is highly directive and specific regarding all aspects of a vessel's design, construction, and equipment. Specific standards apply to certain types of vessels, uses, hull material, construction, machinery, equipment, and fit-out. As such, the application to autonomous vessels depends on the specific characteristics of it as a vessel. The crew-centric expectation of vessels is particularly evident in Part C of the NSCV. For example, NSCV Part C Section 1 Chapter 2 concerns the design of 'Operating Stations' in vessels.[118] This chapter provides specific guidance on the design for 'wheelhouses' and the like. The standard is to provide 'that the person operating the vessel has sufficient information to identify navigational hazards, assess the risks and take appropriate measures to control the risks in both normal and abnormal conditions of operation'[119] and 'to comply at all times with the person's obligations under COLREGS [*Convention on the International Regulations for Preventing Collisions at Sea, 1972*]'.[120] Very specific directions are then provided about what is deemed to satisfy these requirements, modified by vessel length, powered or sail, and use[121] (see, for example, Figure 2 drawn from the NSCV).

[117] Ibid pt B General requirements, s 2.2.
[118] Ibid pt C s 1 ch 2.
[119] Ibid pt C ss 1, 2.3.
[120] Ibid pt C ss 1, 2.4.
[121] Ibid pt C ss 1, 2.6–2.12.

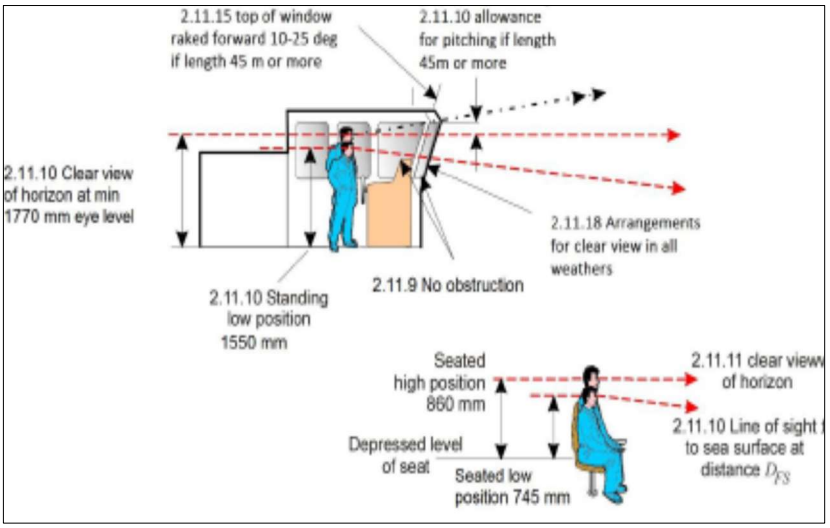


*Figure 2: Field of vision from the operating station (clause 2.11)* [122]

As the NSCV was written without envisaging its application to a vessel without persons onboard, there are no specifically tailored provisions nor flexibility to *not apply* provisions that are irrelevant and impossible for such vessels to satisfy. Formally the NSCV dictates that DCVs need to be built with a wheelhouse to meet this expectation. A wheelhouse is not a feature of a small autonomous vessel. This immediately highlights the problem of autonomous vessels to achieve a certificate of survey.

Another example of the inflexibility of the requirements imposed by NSCV is Part C, Section 3, which relates to the design, construction, and materials used in the construction and maintenance of a vessel particularly in relation to the hull.[123] Part C, Section 3, involves very specific guidance on the type of vessel and length. For vessels equal to or over 35 metres in length, the vessel is 'deemed to satisfy' the relevant required outcome in Part C, Section 3 if it is constructed and maintained in accordance with the rules of a recognised organisation.[124] For vessels less than 35 metres in length — which following current trends, is assumed most autonomous vessels are and will be — there is a detailed set of requirements, as extracted in Figure 3.

[122] Ibid pt C s 1, Figure 1.
[123] Ibid pt C ss 3, 2.1–2.9.
[124] Ibid pt C ss 3, 3.1.

| Measured length | Robust operations | Light operations |
|---|---|---|
| < 35 m and > 13 m | The relevant Lloyds Rules (Clause 3.3) USLC Subsection 5M | The relevant Lloyds Rules (Clause 3.3) |
| ≤ 13 m and > 7.5 m | The relevant Lloyds Rules (Clause 3.3) USLC Subsection 5M | The relevant Lloyds Rules (Clause 3.3) ISO 12215 (Clause 3.4.4) |
| ≤ 7.5 m | The relevant Lloyds Rules (Clause 3.3) USLC Subsection 5M | The relevant Lloyds Rules (Clause 3.3) ISO 12215 (Clause 3.4.4) (1) AS1799 (Clause 3.5) |

*Figure 3: NSCV Part C Section 3 less than 35 metres construction and maintenance*[125]

The reference to Lloyds Rules concerns the various specifications and requirements developed and maintained by Lloyds Registry.[126] USLC refers to the previous Uniform Shipping Law Code, which was largely replaced by the NSCV.[127] ISO 12215 refers to the international standards for small craft hull construction and scantlings,[128] and AS1799 refers to the Australian standard for powered boats.[129] Part C, Section 3, also specifies standards for materials used in vessel construction incorporating the requirements under Lloyds Rules or in the alternative Australian standards for specific materials such as steel, fibre-reinforced plastic and wood.[130] There are also provisions on the standards within manufacturing facilities

[125] Ibid pt C ss 3, 3.2.2 Table 1.
[126] Ibid pt C ss 3, 3.3.1–3.3.3. Lloyd's rules are available for download at <https://www.lr.org/en-au/rules-and-regulations-for-the-classification-of-ships/>.
[127] *National Standard for Commercial Vessels* Part C, Section 3, forward <https://www.amsa.gov.au/about/regulations-and-standards/national-standard-commercial-vessels/nscv-section-c3-construction. The USL is available at *Uniform Shipping Law Code* Section 5C and 5D <https://www.amsa.gov.au/about/regulations-and-standards/uniform-shipping-laws-code>.
[128] NSCV pt C ss 3, 3.4.2.
[129] Ibid pt C ss 3, 3.4.
[130] Part C ss 3, 3.5.1–3.5.2.

and welding.[131] In addition to the hull-focused requirements in this section, there are also general standards with respect to fire safety[132] and stability.[133] Autonomous vessels, freed of the requirements to provide a safe platform for on board humans, utilise novel construction processes and materials.[134] These create complexity in relation to the highly prescriptive technical requirements imposed by NSCV Part C, Section 3.

Further, NSCV Part C, Section 7 provides specific guidance on the safety, communication, navigation, and anchoring equipment that must be carried by specific vessels.[135] The vessel's classification is significant when determining the exact standard and type of equipment that it must have. Many of these requirements relate to the safety and survivability of human crew and passengers, such as medical supplies and rescue equipment. Autonomous vessels that do not carry humans would still need to comply with applicable carry requirements.

The non-survey vessels specification in NSCV Section G might be a pathway for owners and operators of certain autonomous DCVs to bypass the certificate of survey requirement. This section sets out a variety of vessel types that do not require a certificate of survey, such as dragon boats, paddle boats, canoes, and various vessels less than 12 metres in length.[136] An example is a smooth water hire mobile party pontoon. Section G provides detailed guidance regarding various international and national design standards with respect to the construction, safety, machinery, and equipment of these vessels.[137] It is possible that a small autonomous vessel might be considered a non-survey vessel under NSCV Section G.

In summary, unless they fit within the definition of a non-survey vessel, autonomous vessels will need a certificate of survey. This is generally problematic for autonomous vessels, which are often built quite differently from traditional vessels in terms of their shape and materials, and which need to enable autonomous or remote operation rather than on board

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[131] Ibid pt C ss 3, Chapter 5.
[132] Ibid pt C ss 4.
[133] Ibid pt C ss 6.
[134] A Łebkowski, 'Design of an Autonomous Transport system for Coastal Areas' (2018) 12(1) *TransNav: International Journal on Marine Navigation and Safety of Sea Transportation* 117, 121.
[135] NSCV pt C s 7.
[136] Ibid pt G chs 2, 2.1.
[137] Ibid pt G chs 2 and 3.

control. This means it can be difficult to comply with standards relating to the construction, material, and maintenance of the vessel. There is also an absolute assumption within the NSCV that vessels carry humans and, particularly, that vessels are operated by on board humans. The relevant requirements, for example regarding providing adequate spaces for human control of a vessel or the safety of humans on board vessels, pose difficulties when an autonomous vessel is not designed to carry humans at all; for example, small autonomous submersibles to be deployed for seabed or reef monitoring such as the Coral AUV pictured in Figure 1.[138] The highly directive standards within the NSCV that anticipate the survey of a crewed vessel that carries humans make it impossible for autonomous vessels to directly achieve a certificate of survey. This means that compliance is only achievable through flexibility mechanisms.

### B *Certificate of Operation*

DCV owners and masters commit offences if they operate a vessel without a certificate of operation or operate the vessel in breach of a condition of the certificate of operation.[139] Certificates of operation set out where and how a vessel can be operated.[140]

The required content in a certificate of operation is set out in *Marine Order 504 (Certificates of operation and operation requirements — national law) 2018* (Cth).[141] The central component of a certificate of operation is ensuring that the vessel is covered by a 'safety management system'.[142] Under this Order, s 4(3) a safety management system:

> (a) identifies the risks to the safety of the vessel, the environment and persons on or near the vessel; and

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[138] For more information on the use of underwater autonomous vessels for the purposes of reef monitoring, and the accompanying regulatory challenges, see Humphries et al (n 2), 328.

[139] *Marine Safety (Domestic Commercial Vessel) National Law Act 2012* (Cth) sch 1 pt 4 div 3 ss 53–6. These are strict liability offences with 60 penalty units. On a prosecution of an owner see *Gold Coast Boats Pty Ltd v Nixon* [2018] QCA 221.

[140] AMSA, *Certificates of operation* (Web Page) <https://www.amsa.gov.au/vessels-operators/domestic-commercial-vessels/certificates-operation>.

[141] *Marine Order 504 (Certificates of operation and operation requirements — national law) 2018* (Cth).

[142] Ibid s 4(2).

(b) includes procedures to eliminate or minimise the identified risks so far as is reasonably practicable; and

(c) addresses the operation requirements that apply for the vessel; and

(d) is documented and readily accessible for a person who uses the system; and

(e) is kept on board the vessel if it is reasonably practicable to do so given the size and use of the vessel.[143]

*Marine Order 504 (Certificates of operation and operation requirements — national law) 2018* (Cth) goes on to specify that Class 1 (passenger), 2 (non-passenger) and 3 (fishing) vessels must comply with requirements in Schedule 1 of the Order.[144] Schedule 1 is highly directive. It requires that the vessel's owner conduct and maintain an up-to-date risk assessment of the vessel's operation.[145] It is specified that the risk assessment identifies:

(a) the key daily tasks to be performed by the master and all crew;

(b) any potential risks involved in the conduct of any task that may expose the following to unacceptable risks:

(i) the vessel;

(ii) the operational environment of the vessel;

(iii) persons on or near the vessel;

(c) the appropriate crewing for the vessel;

(d) a person to be responsible for ensuring that actions needed to eliminate or minimise any risk are carried out.[146]

The crewing requirement in Schedule 1, 2.3(c) is elaborated according to the matrix determined by the vessel's length. The larger a vessel, the more crew mandated. For vessels under 12 metres the minimum crew is one. The

[143] Ibid s 4(3).
[144] Ibid s 4(4). Schedule 2 provides additional and alternative requirements in relation to Class 4 (hire) vessels.
[145] Ibid sch 1 s 2.
[146] Ibid sch 1 s 2(3).

process for crew certification is under the National Law, within *Marine Order 505 (Certificates of competency — national law) 2022* (Cth).[147] There are several specialisations available in the certification classification and levels. For example, for DCV, there are four categories of masters (Master (Inland waters) NC (Near Coastal), Master <24 m NC, Master <45 m NC, Master <100 m NC).[148] Certification requires a mix of coursework, qualifying sea service, qualifications, and a medical examination, with the type of certificate determining the requirements applicants must meet.[149] Crewing is distinctly conceived as a human-centric activity focused on ensuring vessel safety through minimum requirements for human crew relating to age, language, knowledge, experience, and good health (especially eyesight, hearing, and speech).[150]

In addition to maintaining a risk assessment and adequate crewing, under the certificate of operation regime, owners must maintain safety procedures, emergency plans, and a logbook recording crew illness, marine incidents, assistance rendered, and communication during an emergency or other such occurrences.[151] In the logbook, which can be kept electronically,[152] the master may also include details that the master considered relevant about the vessel's key activities, its position, its navigation track and general weather experienced.[153]

The current requirements relating to certificates of operation are a barrier to autonomous vessel adoption and use. The concerns of risk identification and utilising a safety management system are as applicable and relevant to an autonomous vessel as they are to a human-crewed vessel. However, the requirements impose notions of crew and also crew competency as central to a safety management system and, as such, the strict requirement of compliance with the certificate of operation is difficult to achieve in relation to autonomous vessels.

A primary obstacle is the way that crew are conceived as humans in the current regime. The National Law defines crew as 'individuals employed

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[147] *Marine Order 505 (Certificates of competency — national law) 2022* (Cth).
[148] Ibid s 8.
[149] Ibid sch 3.
[150] Ibid s 8.
[151] *Marine Order 504 (Certificates of operation and operation requirements — national law) 2018* sch 1.
[152] Ibid sch 1 s 11(3).
[153] Ibid sch 1 s 11(5).

or engaged in any capacity on board the vessel on the business of the vessel, other than the master of the vessel or a pilot'.[154] Master is defined in the National Law as 'the person who has command or charge of the vessel, but does not include a pilot',[155] while 'pilot' is defined as 'a person who does not belong to, but has the conduct of, a vessel'.[156] The *Acts Interpretation Act 1901* (Cth) defines an individual as a 'natural person'.[157] The phrase 'natural person' is not directly defined, although 'person' is defined to include a body politic and a body corporate.[158] It seems likely that the phrase 'natural persons' is used to distinguish biological humans from other entities with legal personality.[159] As such, the use of the term 'individual' in relation to crew in the National Law appears directed and limited to 'natural persons'; that is, biological humans specifically and not the broader range of entities with legal personality like corporations.[160] That crew is considered as limited to humans is reinforced by the human-centric training, experience, and health requirements for crew certification under the NSCV. Further, reference to crew, master, and pilot in the

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[154] *Marine Safety (Domestic Commercial Vessel) National Law Act 2012* (Cth) sch 1 pt 1 div 1 s 6 definition *crew*.

[155] Ibid sch 1 pt 1 div 1 s 6 definition *master*.

[156] Ibid sch 1 pt 1 div 1 s 6 definition *pilot*.

[157] *Acts Interpretation Act 1901* (Cth) s 2B definition *individual*.

[158] Ibid s 2C.

[159] This understanding of 'natural persons' as biological humans in distinction to other entities that can have legal personality was highlighted recently by the High Court in *Davis v Minister for Immigration, Citizenship, Migrant Services and Multicultural Affairs*. In a passage concerning powers of the Commonwealth to hold a Royal Commission, Edelman J used the phrase 'natural person' to distinguish between the capacity of an individual human to make inquires and the Commonwealth's powers: *Davis v Minister for Immigration, Citizenship, Migrant Services and Multicultural Affairs* (2023) 97 ALJR 214 at 243 [133]. This follows a small line of judicial consideration of the meaning of the phrase 'natural person' by the High Court. In *Essendon v Criterion Theatres Ltd* (1947) 74 CLR 1 McTiernan J referred directly to the then *Victorian Acts Interpretation Act* to distinguish a natural person as a category distinct from the Crown or a corporation. *Essendon v Criterion Theatres Ltd* (1947) 74 CLR 1 at 28.

[160] This is also a problem with the conception of the driver in Australian road traffic laws, which define driver as a person in control of a vehicle and person as limited to natural persons. See Mark Brady et al, 'Automated Vehicles and Australian Personal Injury Compensation Schemes' (2017) 24(1) *Torts Law Journal* 32, 51; National Transport Commission *Changing Driving Laws to Support Automated Vehicles: Policy Paper* (May 2018), 16; National Transport Commission *On-road Enforcement for Automated Vehicles: Discussion Paper* (July 2022), 23.

National Law definitions suggests that these humans are on board the vessel. This generates a foundational obstacle for autonomous vessels because control systems within autonomous vessels cannot be considered crew. As such, the general understanding is that a vessel controlled by an autonomous system rather than humans on board will not, under the current requirements, comply with certificate of operation requirements related to crewing.

To date, AMSA's interpretation of the minimum crewing requirement is that it requires a human crew to be on board. The effect of this interpretation is that all autonomous vessels require a specific exemption from the minimum crewing requirement. It may be that the interpretation is too general and that in some circumstances a specific exemption should not be required. This argument is based on the concept that the master and crew could be located in a remote operations centre or support vessel rather than on board the vessel, and still be discharging their duties. If this argument were accepted by AMSA, it would mean that specified autonomous vessels, likely including most in Figure 1, would not require a specific exemption from minimum crewing requirements. However, this would require a substantive change in AMSA's operational understanding of the term 'crew', bringing it into line with the definition of master which does not reference being on board a vessel.[161] Ultimately, autonomous vessels do not prima facie meet the certificate of operations requirements. This is because of the centrality of 'crew' for certificate of operation requirements. This leaves flexibility mechanisms as the only pathway for compliance.

### C *Flexibility Mechanisms*

Autonomous DCVs fall outside of the established pathways within the National Law, especially in relation to achieving certificates of survey and operation. However, under the National Law, AMSA has a degree of flexibility in how it manages the risks of specific vessels and operations. Autonomous vessels are currently being tested and put in-service as DCVs under the National Law through a combination of general and specific exemptions and EMOCs.

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[161] *Marine Safety (Domestic Commercial Vessel) National Law Act 2012* (Cth) sch 1 pt 1 div 1 s 6 definition *master*.

1 *Specific Exemptions*

The National Law provides a threshold that must be met before AMSA can grant an exemption. This threshold is that AMSA 'is satisfied that the exemption concerned, taken together with the conditions to which it is subject, will not jeopardise the safety of a vessel or a person on board a vessel'.[162] Relevantly, the reference to 'a vessel' rather than 'the vessel' means consideration must be given to the impact of other vessels interacting with the subject vessel rather than just the impact on the vessel itself.

Specific exemptions are granted on a case-by-case basis, either on application under *Marine Order 501 (National Law — Administration) 2013* (Cth)[163] or on the initiative of AMSA.[164] A decision made in relation to a specific exemption application is subject to internal review.[165] Specific exemption decisions that have gone to internal review are then subject to external merits review at the AAT.[166] Specific exemptions are not treated as public documents and are not generally published or available from AMSA.

To date, all developers and owners of autonomous vessels which are DCVs have required a specific exemption from either the requirement to hold a certificate of survey or the requirement to comply with specific parts of the applicable standards and potentially from the requirement to hold a certificate of operation or from the requirements related to crewing.[167] The difficulty with relying on specific exemptions is that they often involve a slow, complex process from both the operator's and AMSA's perspective, especially if there is not a clear baseline level of expectation established for autonomous vessels. For example, the operator needs to determine what exemption to apply for and what evidence to provide, and then AMSA must assess this and consider if the threshold in s143(6) of the National Law[168]

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[162] Ibid sch 1 pt 8 div 2 s 143(5).
[163] *Marine Order 501 (Administration — national law) 2013* div 3 s 8(3).
[164] *Marine Safety (Domestic Commercial Vessel) National Law Act 2012* (Cth) sch 1 pt 8 div 2 s 143(4)(b).
[165] Ibid sch 1 pt 8 div 1 ss 139(1)(p), (q).
[166] Ibid sch 1 pt 8 div 1 s 141.
[167] Humphries et al (n 2), 336.
[168] *Marine Safety (Domestic Commercial Vessel) National Law Act 2012* (Cth) sch 1 pt 8 div 2 s 143(6): 'That the exemption concerned, taken together with the conditions to which it is subject, will not jeopardise the safety of a vessel or a person on board a vessel'.

is met. Currently, how that is to be established will be a discrete matter to be worked out between the applicant and AMSA on a case-by-case basis. There is a further risk of regulatory inconsistency for case-by-case specific exemptions in that like vessels will be subject to different conditions imposed by different officers within AMSA. There is some evidence that this might already be experienced by Australian autonomous vessel operators.[169] A more consistent approach could be achieved through the general exemption mechanisms. There is also a significant administrative cost to AMSA in needing to devote administrative and technical resources to considering specific exemption applications.

2 *General Exemptions*

General exemptions are issued on AMSA's initiative[170] and can apply to vessels, persons, and operations that meet the relevant criteria and conditions. General exemptions are treated as public documents and are published on AMSA's website.[171] Currently there are 32 general exemptions under the National Law[172] concerned with vessel identifiers,[173] certificates of survey,[174] certificates of operation,[175] recreational use,[176]

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[169] Humphries et al (n 2), 336–7.

[170] *Marine Safety (Domestic Commercial Vessel) National Law Act 2012* (Cth) sch 1 pt 8 div 1 ss 143(1)(4).

[171] 'AMSA', *General and specific exemptions* (Web Page) <https://www.amsa.gov.au/vessels-operators/domestic-commercial-vessels/general-and-specific-exemptions>.

[172] 'AMSA', *National Law Act exemptions for marine orders* (Web Page) <https://www.amsa.gov.au/about/regulations-and-standards/national-law-act-exemptions-marine-orders>.

[173] Chief Executive Officer of the Australian Maritime Safety Authority, *Marine Safety (Vessel identifiers) Exemption 2020* (AMSA EX01, 29 June 2020) <www.amsa.gov.au/sites/default/files/ex01-in-force-1-july-2020.pdf>.

[174] Chief Executive Officer of the Australian Maritime Safety Authority, *Marine Safety (Certificates of survey) Exemption 2021* (AMSA EX02, 23 February 2021) <www.amsa.gov.au/sites/default/files/ex02-march-2021.pdf>.

[175] Chief Executive Officer of the Australian Maritime Safety Authority, *Marine Safety (Certificates of operation) Exemption 2020* (AMSA EX03, 29 June 2020) <www.amsa.gov.au/sites/default/files/ex03-in-force-1-july-2020.pdf>.

[176] Chief Executive Officer of the Australian Maritime Safety Authority, *Marine Safety (Recreational use) Exemption 2020 No 2* (AMSA EX04, 27 August 2020) <www.amsa.gov.au/sites/default/files/ex04-august-2020.pdf>.

temporary operations,[177] sea rangers,[178] and scientific research and educational activities.[179] In relation to autonomous vessels, there are three exemptions that are particularly relevant: Exemption 02 (Certificates of survey), Exemption 03 (Certificates of operation), and Exemption 07 (Temporary operations).

*Marine Safety (Certificates of survey) Exemption 2021*[180] (EX02) provides an exemption for specified categories of vessels from the requirement to hold a certificate of survey, subject to conditions. Eligible vessels include some types of tenders (including auxiliaries), vessels operating in sheltered waters (less than 12 metres long), sailing vessels, human-powered vessels, personal watercraft, volunteer marine-rescue vessels, fire service vessels, and vessels that were not required to have a certificate of survey on 30 June 2013.[181] Access to EX02 is by application unless the vessel is a small, human-powered vessel, a school training sailing vessel for inshore operations, a personal watercraft or an existing (grandfathered) vessel.[182] It is unlikely that an autonomous vessel would fit within these current categories.

However, it is possible that an autonomous vessel could come within one of the categories of vessels covered by EX02 Division 2, especially a vessel operating in sheltered waters which is less than 12 metres long and is a

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[177] Chief Executive Officer of the Australian Maritime Safety Authority, *Marine Safety (Temporary operations) Exemption 2020* (AMSA EX07, 29 June 2020) <www.amsa.gov.au/sites/default/files/ex07-in-force-1-july-2020.pdf>.

[178] Chief Executive Officer of the Australian Maritime Safety Authority, *Marine Safety (Sea rangers) Exemption 2020* (AMSA EX14, 29 June 2020) <www.amsa.gov.au/sites/default/files/ex14-in-force-1-july-2020.pdf>.

[179] Chief Executive Officer of the Australian Maritime Safety Authority, *Marine Safety (Scientific research and educational activities) Exemption 2020* (AMSA EX15, 29 June 2020) <www.amsa.gov.au/sites/default/files/ex15-in-force-1-july-2020.pdf>.

[180] Chief Executive Officer of the Australian Maritime Safety Authority, *Marine Safety (Certificates of survey) Exemption 2021* (AMSA EX02, 23 February 2021) <www.amsa.gov.au/sites/default/files/ex02-march-2021.pdf>.

[181] Ibid sch 1 divs 1–6.

[182] Ibid item 5(3).

sailing vessel.[183] If it does, an application to AMSA is still required.[184] Notably, while the default condition is compliance with specified elements of NSCV Part G,[185] the condition also states 'unless the National Regulator determines otherwise'.[186] This means AMSA has broad power to approve partial compliance with the specific parts of NSCV Part G or compliance with a different standard. However, there is no further guidance in EX02 on the processes or standards to be used in exercising this discretion. In such a circumstance, it is possible that applications under EX02 for non-survey vessels not seeking to meet NSCV Part G requirements would require consideration of the threshold in s 143(6) of the National Law in terms of satisfying AMSA 'that the exemption concerned, taken together with the conditions to which it is subject, will not jeopardise the safety of a vessel or a person on board a vessel'.[187] In approving the application, AMSA may impose further conditions.[188]

EX02 reduces the resource burden involved in accrediting specific vessels by allowing for operation without the necessity (and cost) of an application and assessment of a certificate of survey. As such, the types of vessels authorised by EX02 are highly specific, and exempted vessels still need to comply with the substantive provisions of NSCV Section G.

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[183] There is a long history of the development and deployment of autonomous sailing vessels; see, for example, Lian Giger et al, 'Design and Construction of the Autonomous Sailing Vessel Avalon' *Proceedings of The World Robotic Sailing Championship and International Robotic Sailing Conference* (Eidgenössische Technische Hochschule Zürich, 2009).

[184] Chief Executive Officer of the Australian Maritime Safety Authority, *Marine Safety (Certificates of survey) Exemption 2021* Item 5(3) <www.amsa.gov.au/sites/default/files/ex02-march-2021.pdf>.

[185] Chief Executive Officer of the Australian Maritime Safety Authority, *Marine Safety (Certificates of survey) Exemption 2021* (AMSA EX02, 23 February 2021) sch 1 div 2 <www.amsa.gov.au/sites/default/files/ex02-march-2021.pdf>.

[186] Ibid div 2.

[187] *Marine Safety (Domestic Commercial Vessel) National Law Act 2012* (Cth) sch 1 pt 8 div 2 s 143(5).

[188] Chief Executive Officer of the Australian Maritime Safety Authority, *Marine Safety (Certificates of survey) Exemption 2021* (AMSA EX02, 23 February 2021) Item 5(5) <www.amsa.gov.au/sites/default/files/ex02-march-2021.pdf>.

*Marine Safety (Certificates of operation) Exemption 2020* (EX03)[189] provides an exemption for specified categories of vessels from the requirement to hold a certificate of operation. Specifically for autonomous vessels, this can include non-passenger or fishing vessels under 7.5 metres in length operating in sheltered waters that do not carry passengers or dangerous cargo.[190] EX03 specifies that provided such vessels 'have and comply with a safety management system that addresses the operation requirements in Schedules 1 and 2 of *Marine Order 504 (Certificates of operation and operation requirements — national law) 2018* (Cth) that apply for the vessel',[191] a certificate of operation is not required. [192] As for EX02, EX03 exempts selected vessels from the cost and process of needing to apply to AMSA for a certificate of operation.[193] It does not exempt from the substantive requirements of *Marine Order 504 (Certificates of operation and operation requirements — national law) 2018* (Cth).[194] For autonomous vessels that fall within the category of vessels covered by EX03, the problematic requirements around crewing and the safety management system would remain. EX03 does enable AMSA to approve operation in a way that does not comply with a condition of the exemption, but the maximum period this may apply for is 90 days.[195] This 90-day limit reduces this exemption's usefulness for autonomous vessels. EX03 specifies that further exemptions under the National Law could further remove conditions associated with operation.[196] This means that owners

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[189] Chief Executive Officer of the Australian Maritime Safety Authority, *Marine Safety (Certificates of operation) Exemption 2020* (AMSA EX03, 29 June 2020) <www.amsa.gov.au/sites/default/files/ex03-in-force-1-july-2020.pdf>.

[190] Ibid sch 1 item 2.1.

[191] Ibid.

[192] Chief Executive Officer of the Australian Maritime Safety Authority, *Marine Safety (Certificates of operation) Exemption 2020* (AMSA EX03, 29 June 2020) sch 1 items 4(1), (2) <www.amsa.gov.au/sites/default/files/ex03-in-force-1-july-2020.pdf>.

[193] Ibid.

[194] *Marine Order 504 (Certificates of Operation and Operation Requirements — National Law) 2018* (Cth).

[195] Chief Executive Officer of the Australian Maritime Safety Authority, *Marine Safety (Certificates of operation) Exemption 2020* (AMSA EX03, 29 June 2020) sch 1 item 4(4) <www.amsa.gov.au/sites/default/files/ex03-in-force-1-july-2020.pdf>.

[196] Ibid sch 1 item 4(3).

might still need to apply for a specific exemption or rely upon other general exemptions.

*Marine Safety (Temporary operations) Exemption 2020* (EX07) allows a number of temporary operations to occur, including operating without a certificate of survey and a certificate of operation or operation of a vessel beyond the scope of its current certificates.[197] It also enables a DCV to operate while the owner is rectifying minor non-conformances found during survey or while AMSA is considering applications.[198] For autonomous vessels, there are two relevant divisions of EX07, Division 2 in relation to temporary operations and Division 3 in relation to sea trials.[199]

Division 2 of EX07 enables a vessel to operate for up to 90 days without certification, where approval is granted by the National Regulator. This is the most used Division of EX07 for autonomous vessels and is extremely useful for enabling testing and trialling prior to applying for certification.[200] There is currently no published guidance on the evidence AMSA expects to support an application under EX07 for autonomous vessels. Division 3 enables a vessel to undertake sea trials without certification for up to 14 days.[201] A sea trial is defined as 'a trial, test or demonstration, at sea, of the seaworthiness or any other operational aspect of a vessel or its equipment'.[202] There are strict conditions on this exemption, including that the vessel has been surveyed by an accredited marine surveyor who has stated in the approved form that the vessel 'may be safely operated during the period taking into account the intended service category and operation of the vessel'.[203] This includes the surveyor considering the 'passage plan' for the sea trial. Second, the approval must

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[197] Chief Executive Officer of the Australian Maritime Safety Authority, *Marine Safety (Temporary operations) Exemption 2020* (AMSA EX07, 29 June 2020) divs 2 and 8 <www.amsa.gov.au/sites/default/files/ex07-in-force-1-july-2020.pdf>.

[198] Ibid div 3.

[199] Ibid.

[200] Humphries et al (n 2), 341.

[201] Chief Executive Officer of the Australian Maritime Safety Authority, *Marine Safety (Temporary operations) Exemption 2020* (AMSA EX07, 29 June 2020) div 3 item 6(3)(b) <www.amsa.gov.au/sites/default/files/ex07-in-force-1-july-2020.pdf>.

[202] Ibid div 1 item 3 definitions and interpretation *sea trials* <www.amsa.gov.au/sites/default/files/ex07-in-force-1-july-2020.pdf>.

[203] Ibid div 3 item 6(1)(b)(i). The approved form is 'Sea Trial Document' (AMSA 592) <https://www.amsa.gov.au/forms/sea-trial-document>.

remain on the vessel,[204] and a copy must be provided to AMSA.[205] The sea trial exemption in EX07 does not require a prior application to AMSA and seems to be 'as of right', provided there has been an approved survey that has been provided to AMSA. For autonomous vessel testing, this exemption seems reasonably adaptable, although the approved form does seem to require the surveyor to indicate the number of crew for the class of operation being tested.[206] The cost of requiring a surveyor, particularly one with expertise in autonomous vessels for the trials of very small vessels, will likely impede use of this provision.

In summary, the current situation is that owners and operators must rely upon exemptions under the National Law to trial, test and have in-service an autonomous DCV. Given the diversity of possible and experimental autonomous vessels, specific exemptions relating to an autonomous vessel and its intended operations are an option, albeit a resource-intensive one. The existing general exemptions do not specifically consider autonomous vessels. While some autonomous vessels might meet the hull, use, and power criteria for an exemption from certificates of survey and operation under EX02 or EX03, those exemptions still expect the substantive requirements of the Marine Orders and the NSCV to be fulfilled, including requirements that autonomous vessels by design will have difficulty achieving. For autonomous vessel tests and trials, EX07 does seem adaptable, noting the timeframe of up to 90 days or up to 14 days, depending on the Division applied. However, for organisations developing multiple small autonomous vessels periodically, the requirement to apply for new specific exemptions or EX07 temporary operations permits is onerous, particularly for a 90-day period.[207]

There is considerable opportunity for AMSA to develop a general exemption for autonomous vessels, noting there are already other 'types of vessel' exemptions. For example, the *Marine Safety (Unpowered barges) Exemption 2020* (EX41)[208] allows for exemptions from the Marine Orders

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[204] Ibid div 3 item 7.
[205] Ibid div 3 item 6(1)(b)(ii).
[206] 'Sea Trial Document' (AMSA 592) <https://www.amsa.gov.au/forms/sea-trial-document>.
[207] Humphries et al (n 2), 328–9.
[208] Chief Executive Officer of the Australian Maritime Safety Authority, *Marine Safety (Unpowered barges) Exemption 2020* (AMSA EX41, 29 June 2020) <www.amsa.gov.au/sites/default/files/ex41-in-force-1-july-2020.pdf>.

and the NSCV,[209] including crewing-related requirements,[210] provided the barge meets certain basic conditions.[211] An autonomous vessel exemption, developed in conjunction with autonomous vessel developers and operators, would be a significant reform that could dramatically reduce the cost and time for autonomous vessels to undertake in-water testing and be put in-service. While the diverse and dynamic nature of autonomous vessel design and development would mean that a general exemption might not provide a streamlined process for all autonomous vessels, by fundamentally not assuming a human-crewed vessel as the underlying paradigm, it could provide a substantially more efficient accreditation pathway for the Australian autonomous vessel sector. This could also benefit AMSA in simplifying the regulation of autonomous vessels by reducing administrative and technical resources needed to consider what otherwise would be applications for a specific exemption.

3 *Equivalent Means of Compliance*

A further flexibility mechanism that could be of benefit to autonomous vessel developers and operators is the EMOC. An EMOC is used when there is a need to meet a required outcome in the NSCV by an alternative means to the listed 'deemed to satisfy' solutions. EMOC applications and approvals are in Division 4 of *Marine Order 503 (Certificates of survey — national law) 2018*.[212] The key criterion is that AMSA needs to be satisfied that the EMOC 'is at least as effective as any part of the standards that it replaces'.[213] Applications for an EMOC must be supported by:

> (a) details of the standards in this Order [Marine Order 503] that apply to the vessel, to which the application relates; and
>
> (b) a statement explaining how the proposed EMOC is at least as effective as compliance with the standards applying to the vessel, that it is to replace; and

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[209] Ibid Item 4 <www.amsa.gov.au/sites/default/files/ex41-in-force-1-july-2020.pdf>.
[210] Chief Executive Officer of the Australian Maritime Safety Authority, *Marine Safety (Unpowered barges) Exemption 2020* (AMSA EX41, 29 June 2020) <www.amsa.gov.au/sites/default/files/ex41-in-force-1-july-2020.pdf>.
[211] Ibid sch 1.
[212] *Marine Order 503 (Certificates of survey — national law)* 2018 div 4.
[213] Ibid div 4 s 17(2).

> (c) at least one document supporting the statement mentioned in paragraph (b).[214]

The EMOC provisions relate to survey requirements — hull, decks and openings, machinery, equipment, maintenance, and so on — and not certificate of operation requirements involving crewing and use. A decision by AMSA on an EMOC application is a 'reviewable decision'.[215] This means that an applicant can have an EMOC decision internally reviewed by AMSA,[216] and the internal review decision can be subject to a full merits review at the AAT.[217] The main impediment to using EMOCs for autonomous vessels is where the relevant 'required outcome' is wholly inapplicable to the vessel, as opposed to there being a suitable alternative equivalent way of meeting it. In these cases, an EMOC will not apply, and an operator must instead rely on exemptions.

EMOCs, like exemptions, have limitations in the context of autonomous vessels. First, they only apply to alternative ways of meeting the standards in the NSCV. The EMOC process does not allow AMSA to exempt a vessel from a standard in the NSCV. Rather, it requires proving that the vessel can meet the standard in a different, equivalent way. This is not useful where the vessel is designed in such a way that the standard (like wheelhouses) is not relevant. Second, the NSCV's strength is that it provides clear technical guidance on what meets a standard. With EMOCs, the onus is on an applicant to present relevant supporting evidence that the proposed alternative meets the anticipated function. This creates additional costs. It also leads to uncertainty as there is no clear official guidance regarding the evidence that AMSA has accepted in proving similar past EMOC applications. Finally, an EMOC is a separate decision-making process and only relates to specific elements within the certificate of survey process. It adds time to the approval process and complexity as it is another process that needs to be undertaken in conjunction with other applications.

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[214] Ibid div 4 s 18(2).
[215] *Marine Order 503 (Certificates of survey — national law)* 2018 div 4 s 17(4); *Marine Order 504 (Certificates of operation and operation requirements — national law) 2018* s 6(11).
[216] *Marine Order 501 (Administration — national law) 2013* s 16.
[217] Ibid s 17.

### D *Adequacy of the National Law for Autonomous Vessels*

In summary the market and use cases for autonomous vessels in Australia relate to commercial, research or government uses within domestic waters. As such these autonomous vessels are DCVs and must be regulated by AMSA under the National Law. This means formal compliance with a highly prescriptive and crewed vessel paradigm relating to certificates of survey and operation. Autonomous vessels, especially the small, innovative craft being developed, tested, and deployed in Australian, are unable to secure certificates of survey and operation through the normal pathways under the National Law. This means that autonomous DCVs can only be trialled and used in Australia through bespoke engagement with AMSA to utilise flexibility mechanisms such as specific exemptions, general exemptions and EMOCs. As identified by Humphries et al, this is creating cost and delay for developers and operators of autonomous vessels.[218] They also identified administrative uncertainty where similar vessels are being subject to different exemptions processes within AMSA.[219] The existing regulatory framework for DCVs is not fit for an automated future.

The next section details proposed reforms to the National Law that could provide more efficient and effective regulatory pathways for autonomous DCVs.

## V Changing Australia's Domestic Maritime Law for Autonomous Vessels

This section outlines suggestions for reforming the National Law and processes for the regulation of autonomous DCVs. A primary reform would be development by AMSA of a dedicated general exemption for autonomous vessels. A further reform would be the updating of the National Law to directly provide for a regulatory pathway and standards for autonomous DCVs. However, before these changes are canvassed directly, a significant issue needs to be dealt with that relates to a perspective that Australian law and regulation relating to domestic autonomous vessels cannot progress until there has been reforms at the international maritime level with regards to autonomy.

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[218] Humphries et al (n 2), 331.
[219] Ibid.

### A *Australian Domestic Maritime Law Can Be Reformed Without Waiting for International Maritime Law*

In the context of reforms to laws regarding domestic commercial vessels a consideration that is often raised is an assumption that international maritime law must develop further in relation to autonomous vessels prior to domestic law progressing. In thinking and scholarship on maritime law, the international frameworks are often dominant, with the national regulation of vessels in domestic waters often a minor aside. This is understandable, the economic value of international shipping, the environmental risks from accidents from large ocean-going vessels and the need for a coherent and functional global framework for navigation and shipping means it is often the international conventions and entities that are the focus.

In the context of increased maritime autonomy many commentators suggest existing international maritime legal frameworks do not fully accommodate autonomous vessels and make various proposals for reform (which is beyond the scope of this article).[220] This suggests, that if Australia must wait for international maritime law to address autonomy before updating its domestic national law, these reforms recede to the horizon. However, as we have shown in Part II of this article Australian developers and operators are testing and using autonomous vessels in Australian domestic waters and AMSA is already being called upon to regulate these vessels as DCVs. In the alternative we argue that there are few constraints under the United Nations Convention on the Law of the Sea (UNCLOS)[221] for coastal states to make national laws that accommodate autonomous vessels operating *within* their national jurisdiction, including their exclusive economic zones ('EEZ'). As noted in Part III, autonomous vessels in Australia may be either DCVs subject to the National Law or RAVs and foreign vessels subject to the *Navigation Act 2012* (Cth). While

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[220] See, eg, David Molina Coello, 'Is UNCLOS Ready for the Era of Seafaring Autonomous Vessels?' (2023) 10(1) *Journal of Territorial and Maritime Studies* 2; Natalie Klein et al, 'Maritime Autonomous Vehicles: New Frontiers in the Law of the Sea' (2020) 69(3) *International & Comparative Law Quarterly* 719; Sabrina Hasan, 'Analysing the Definition of "Ship" to Facilitate Marine Autonomous Surface Ships as Ship under the Law of the Sea' (2023) 15(3) *Australian Journal of Maritime & Ocean Affairs* 268; Yen-Chiang Chang, Chao Zhang and Nannan Wang, 'The International Legal Status of the Unmanned Maritime Vehicles' (2020) 113 *Marine Policy* 103830.

[221] *United Nations Convention on the Law of the Sea,* opened for signature 10 December 1982, 1833 UNTS 397 (entered into force 16 November 1994).

the National Law is framed by international conventions, the *Navigation Act 2012* (Cth) directly applies them.[222] This is critical to acknowledge because an argument that Australian domestic law could develop prior to international law is only plausible in relation to DCVs and the National Law and not regulated Australian vessels and foreign vessels under the *Navigation Act 2012* (Cth).

Determining limits on a state's authority to regulate autonomous vessels may depend on the zone they are operating within, such as its internal waters, territorial waters or EEZ or on the 'nationality' of the vessel.[223] UNCLOS recognises the plenary sovereignty of a coastal state within its internal waters (landward of the territorial sea baseline) and its sovereignty in the territorial sea (from the low water mark to a maximum of 12 nautical miles), subject to foreign ships' right of innocent passage.[224] So long as the passage is not prejudicial to the peace, good order or security of the coastal state[225] then the coastal state cannot interfere with passage, though it may regulate in respect of certain matters such as safety of navigation.[226] A coastal state has exclusive sovereign rights (not sovereignty) in the EEZ for the purpose of exploring, exploiting, conserving and managing of natural resources as well as jurisdiction in respect of certain other matters under UNCLOS (principally artificial islands, marine scientific research and marine environmental protection).[227] In other words, a coastal State's rights between 12-200 nautical miles are limited. Other foreign states have rights such as the right of navigation and non-economic uses of the EEZ of the coastal State,[228] however they must respect a coastal state's exercise of

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[222] Humphries, (n 4). 321–3.

[223] Other zones are relevant such as the Contiguous Zone, the Continental Shelf, and zones concerning Archipelagic States.

[224] UNCLOS arts 2, 3, 5, 8 and 17.

[225] Ibid 19 (setting out a list of such activities).

[226] While the coastal State may adopt laws and regulations relating to innocent passage through the territorial sea, such as safety issues, they cannot apply to the 'design, construction, manning or equipment' of foreign ships unless they are giving effect to generally accepted international rules or standards (UNCLOS article 21), which has not yet happened for autonomous vessels; Alexander Proelss, Amber Rose Maggio, Eile Blitza, and Oliver Daum (eds.). *United Nations Convention on the Law of the Sea a Commentary*. (München, C.H. Beck Publishers, 2017) 32. See art 17.

[227] UNCLOS art 56.

[228] Ibid arts 58 and 87.

its sovereign rights and jurisdiction in this zone.[229] But to the extent rights and jurisdiction have not been allocated to the coastal state, the law of the high seas applies within the EEZ.[230]

The nationality principle grants a flag state jurisdiction over its ships or vessels wherever they may be. On the high seas this jurisdiction is said to be exclusive, but in the territorial sea a coastal state could exercise its jurisdiction over a vessel destined for port or engaged in non-innocent passage, or for violation of EEZ laws and regulations (with respect to the coastal state's limited sovereign rights and jurisdiction in the EEZ).[231] UNCLOS, however, does not contain a definition of 'ship' or 'vessel' (terms it uses interchangeably), nor is there any 'universal definition…in public international law'.[232] UNCLOS only requires that flag states set the conditions 'for the grant of its nationality to ships, for the registration of ships in its territory, and for the right to fly its flag'. Thus, it may be that a flag state can effectively bestow the status of 'ship' on an object through a grant of nationality. While this is normally done via registration, '[m]any States' national legal systems allow smaller vessels owned by a national to fly their flag and only require formal registration of vessels of a certain size'.[233] Thus anything a flag state grants its nationality under national law is arguably a vessel for the purposes of UNCLOS, which could include autonomous vessels.[234]

In short, as a flag State, a State has general power to regulate 'ships' enjoying its nationality, which could include autonomous vessels registered in that state or owned by its nationals, wherever they are located. If such 'ships' are engaged in international navigation, the question of whether they fall within international maritime conventions arises. This would normally only be the case if the vessels were in excess of 500 gross tonnes (which seems unlikely) or were navigating on the high seas. There would thus appear to be no problem in principle with a system of national regulation that applied principally in the territorial sea to autonomous

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[229] See, eg, Anne Bardin 'Coastal State's Jurisdiction over Foreign Vessels' (2002) 14(1) *Pace International Law Review* 27, 76.
[230] UNCLOS art 58(2).
[231] Ibid arts 25, 27, 73, and 92.
[232] Ibid 691 (commentary to art 90).
[233] Ibid 694 (commentary to art 91).
[234] See, eg, Zuzanna Pepłowska-Dąbrowska and Justyna Nawrot, 'Revolution or Evolution? Challenges Posed by Autonomous Vessels for National and International Legal Framework' (2019) 25(1) *Comparative Law Review* 239.

vessels enjoying the coastal State's nationality.[235] That same regulatory framework could equally apply to foreign autonomous vessels, to the extent they are not considered 'ships' engaged in innocent passage. Similarly, a coastal State's regulatory regime could apply to foreign autonomous vessels in its EEZ to the extent they are engaged in activities over which it has sovereign rights or jurisdiction. For example, a foreign autonomous vessel engaging in marine scientific research in the territorial sea or EEZ falls within coastal state jurisdiction.

In the alternative to an internationalist perspective it has been suggested that the international arena can benefit from domestic state law innovations when it comes to regulating autonomous vessels.[236] Stepién, after highlighting the slow development of reforms at the International Maritime Organization identifies domestic law innovations such as in the UK that can 'serve as exemplary practices to be used internationally'.[237] This perspective is shared by Dean and Clack who identify:

> The terms "ships" and "vessels" are used interchangeably in UNCLOS; however, neither term is explicitly defined. However, UNCLOS provides that each state shall fix the conditions for the grant of its nationality to ships (Article 91). The implication therefore is that the national laws of each flag state will be critical for the definitions used.[238]

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[235] There could be a question as to whether certain high seas maritime conventions apply equally in the EEZ, and thus should apply in respect of objects considered 'ships' under national law. While UNCLOS art 86 defines the high seas as that area beyond the territorial sea and EEZ, and while UNCLOS art 58(2) preserves certain benefits of the high seas regime within the EEZ only in favour of *foreign ships*, it is generally presumed conventions such as COLREGs apply generally in the EEZ including to the vessels of the coastal state. Alfredo C Robles, *Vessel Collisions in the Law of the Sea* (Singapore, Palgrave Macmillan, 2022) 77–118.

[236] Robert Veal, Michael Tsimplis and Andrew Serdy, 'The Legal Status and Operation of Unmanned Maritime Vehicles' (2019) 50(1) *Ocean Development & International Law* 23, 40.

[237] Barbara Stępień, 'Can a Ship Be Its Own Captain? Safe Manning of Autonomous and Uncrewed Vessels' (2023) 148 *Marine Policy* 105451, 6.

[238] Paul Dean and Henry Clack, 'Autonomous Shipping and Maritime Law' in Baris Soyer and Andrew Tettenborn (eds) *New Technologies, Artificial Intelligence and Shipping Law in the 21st Century* (Abingdon, Informa Law by Routledge, 2020) 67, 73.

A similar argument has been made in relation to regulating autonomous defence vessels. In discussing the status of autonomous vessels used for defence purposes, McKenzie calls on nations to publicly establish their position on the legal status of autonomous vessels:

> The increased use of these devices and the ambiguous legal situation make it more important for states to be public with their interpretation of UNCLOS. The best way to reduce the risk of future conflict, or at least understand when it is likely to occur, is for states to follow the lead of the US and make their view of the legal position clear.[239]

Australia needs to publicly establish its approach to classifying autonomous vessels that are DCVs used for commercial purposes; in doing so, it will assist with ongoing international law development:

> While Australia may not rank as a major maritime power, it does have one of the largest exclusive economic zones (EEZs) in the world, with a total area of 10 million square kilometres. Therefore, it is critical to… clarify…[the] nation's approach to autonomous vessels, thereby enabling further regulatory development at an international level.[240]

These conclusions contrast to the perspective that domestic law should not progress until international law is more settled to ensure consistency of approach. This internationalist argument is valid for vessels in-service in international waters because consistent standards for vessels accessing international ports is important.[241] However, for DCVs, which must be regulated within the national operating environment, waiting for international law reform has less merit. Nations should continue to progress their own domestic law and policy approaches to autonomous vessels alongside international developments. While domestic maritime law must comply with the broad framework for coastal states powers and responsibilities under UNCLOS, it does not prevent national regulatory innovations within waters that it recognises as within the purview of state lawmaking. In short, Australian has the authority to reform how it regulates autonomous vessels as DCVs without waiting for international development. Further, clarification and development in how nations like

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[239] McKenzie (n 99), 375–6.
[240] Horne et al (n 4), 504 (notes omitted).
[241] See Coello (n 297).

Australia regulate autonomous vessels could feedback and assist developments in the international arena.

### B *Reforms to the National Law and Regulation of Autonomous DCV*

There are two primary reform proposals that flow from our analysis that, while autonomous vessels are being regulated under the National Law as DCVs, this process is costly in terms of time and resources for developers, operators and AMSA and needs to be improved. These relate firstly to the introduction of a new general exemption and related regulatory amendments by AMSA, and secondly to amendments to the National Law, with the aim of providing a more tailored, risk-based regulatory approach.

The first reform proposal is for AMSA and relates to the introduction of a new general exemption and amendments to the NSCV. AMSA should consider, in consultation with the autonomous vessel industry and other stakeholders:

- developing a new general exemption that could apply to many of the emerging forms and uses of autonomous vessels. This new general exemption would provide a dedicated alternative pathway for owners and operators to be compliant with the National Law and put their vessels into service. Such an exemption would also develop AMSA's expertise and capacity to assess autonomous DCVs;

- assisting developers in allowing for testing of autonomous vessels, either as a division within a dedicated autonomous vessel exemption or within the existing *Marine Safety (Temporary operations) Exemption 2020* (EXO7). The advantage of a dedicated autonomous vessels exemption is that AMSA already has the authority to develop and implement general exemptions and, using *Marine Safety (Unpowered barges) Exemption 2020* (EX41) as an example, AMSA has developed exemptions that cover specific types of vessels; and

- investigating a dedicated set of service categories and technical standards within the NSCV for autonomous vessels. This would enable a distinguishing between crewed and uncrewed, surface and subsurface, and enable a tailored, risk-based approach to be implemented. It would provide a clear articulation of AMSA's requirements for these vessels, including those related to issues such as artificial intelligence ('AI') supported operating systems and collision avoidance. It would also enable clearer data to be collected

> on the number of surface and subsurface autonomous vessels operating in Australia.

The second reform proposal is for the Department of Infrastructure, Transport, Regional Development, Communications and the Arts, and relates to amendments to the National Law. The Commonwealth should consider taking the lead and working with the states and territories on revising the National Law to better accommodate the emerging autonomous DCV fleet. This could involve consideration of reforming the underlying paradigm of the National Law, reducing its 'technological obsolescence'[242] of enacting expectation around human-crewed vessels. A further factor that needs to be considered is the emerging concern and agenda of regulating for safe and responsible AI.[243] As complex cyber-physical systems autonomous vessels are being developed through use of AI systems and could operate using AI systems.[244] Additionally, autonomous vessels operate in high-risk contexts where there is the potential not just for data risks, but physical harm to humans, property and the environment if an AI enabled autonomous vessel fails. The National Law needs to address these issues.

Reforms relating to autonomous vessels will also require consideration of whether AMSA and accredited marine surveyors have the capacity to assess the technical standards and functions of AI-enabled vessels or whether such assessments are best handled by a national AI regulator, with AMSA's role just focused on the certification and regulation of the material vessel.

While the two reform proposals set out above would address some of the current inefficiencies with the existing regulatory pathways, there are

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[242] Lyria Bennett Moses, 'Recurring Dilemmas: The Law's Race to Keep Up with Technological Change' (2007) 7 *Journal of Law, Technology and Policy* 239, 266.

[243] Australian Government, Department of Industry, Science and Resources, 'Safe and Responsible AI in Australia: Proposal Paper for Introducing Mandatory Guardrails for AI in High-Risk Settings' (September 2024). See generally, Natalia Díaz-Rodríguez et al, 'Connecting the Dots in Trustworthy Artificial Intelligence: From AI Principles, Ethics, and Key Requirements to Responsible AI Systems and Regulation' (2023) 99 *Information Fusion* 101896.

[244] Klemens Katterbauer, 'Shipping of the Future-Cybersecurity Aspects for Autonomous AI-driven Ships' (2023) 36(1) *Australian and New Zealand Maritime Law Journal* 1, 2–3.

substantial additional issues for Australian law to resolve in relation to the widespread deployment of autonomous vessels. This includes consideration of liability for autonomous vessel incidents and technical issues, for example methods to assure autonomous vessels, cyber security requirements, and requisite skills and qualifications of operators.[245] Further research and collaborative projects between industry, regulators, government and researchers would greatly assist in exploring those issues and working to resolve them and, in doing so, would pave the way for more suitable regulation of emerging technology in Australia.

## VI Conclusion

By examining the Australian domestic maritime regulatory framework, this article has demonstrated that: (A) an autonomous vessel can be a DCV; (B) an autonomous vessel is capable of compliance with the maritime regulatory framework (although the current regulatory pathways of utilising existing flexibility mechanisms are slow, costly, and uncertain); and (C) that domestic law and policy can be updated independent of progress being made at the international level. An obvious immediate reform is for AMSA to implement a general exemption in relation to autonomous vessels. Regulatory change, which aims for efficiency and consistency by integrating novel technology into suitable regulatory frameworks, is critical to ensure Australia can access the many benefits of emerging technology. This reform agenda can start with domestic law and policy in relation to domestic vessels, can progress independently of the international maritime space, and could help to inform reforms at the international level.

[245] Rachel Horne (n 6).