TRUSTED AUTONOMOUS SYSTEMS

Australian Code of Practice

for the Design, Construction, Survey, and Operation of Autonomous and Remotely Operated Vessels

Edition 1 – April 2022

Cover of the Code: Photo of Australian Institute of Marine Science (AIMS) weather station at Davies Reef. Photo courtesy of AIMS.

Edition 1

Edition 1 was first published in April 2022.

Published by Trusted Autonomous Systems, PO Box 59, Toowong QLD 4066 Australia. All inquiries to be addressed to Assurance of Autonomy Activity Lead via info@tasdcrc.com.au.

FOREWORD

The Australian Code of Practice was developed to support the design, construction, survey and operation of autonomous and remotely operated vessels in Australian waters. It is intended to provide guidance for those who design, build, manufacture, own or operate vessels with autonomous or remotely operated systems, in order to support the certification of the vessel and its entry into service. It has been developed primarily for domestic commercial vessels, being vessels which operate commercially only within Australia's Exclusive Economic Zone. Guidance Materials are available to support the use of this Code.

The Australian Code of Practice was developed through the TAS Assurance of Autonomy Activity, which is a common good activity funded by the Queensland State Government.

The Australian Code of Practice has been developed in close collaboration with government, the maritime industry and with developers and operators of autonomous systems. A large number of organisations and individuals contributed to the development of the Code of Practice, including:

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The Australian Institute of Marine Science

Shoal Group

L3 Harris

OMC International

Ocean X Group

Cube Pilot

Chironix

Gibbs Cox

MM Services

Kedge Surveyors

Aktive Services

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CHAPTER 1 PRELIMINARY

This Code of Practice has been developed primarily for domestic commercial vessels, being vessels which operate commercially only within Australia's Exclusive Economic Zone.

1.1 Application and scope of the Code

(1) The Code of Practice is voluntary.

(2) Compliance with the Code of Practice may support an application to the Australian Maritime Safety Authority (AMSA) for a certificate or other approval to operate in Australian waters, including an application for an exemption from the requirements or standards that apply to the vessel under law.

Remote or autonomous operation

(3) The Code of Practice has been developed for vessels which are capable of operating without any persons on board.

(4) This includes vessels which operate:

(a) without any persons on board;

(b) with persons on board for limited, defined periods, such as during trials or while docking; and

(c) with crew, passengers or special personnel on board.

(5) However, the Code of Practice does not apply to a vessel which does not have any crew on board but does have passengers or special personnel on board.

NOTE 1 An autonomous or remotely operated vessel with no crew on board, which carries passengers or special personnel, has additional risks in the event of an emergency which have not been considered or addressed in this Code of Practice.

NOTE 2 This Code of Practice does apply to vessels with persons on board, including passengers and special personnel, provided the vessel also has crew on board. Vessels built to carry persons are subject to Chapter 4.

Surface and sub-surface vessels

(6) The Code of Practice has been developed for both surface and sub-surface vessels.

Commercial vessels

(7) The Code of Practice has been developed primarily for commercial vessels operating domestically in Australia (domestic commercial vessels), which includes vessels operated for research and government purposes.

NOTE Tethered vessels, such as tethered subsea vessels, may not be considered to be domestic commercial vessels – advice from AMSA should be sought on this issue. The Code of Practice does not specifically consider the risks and operations of tethered vessels. However, some aspects of the Code of Practice may be informative for tethered vessels.

(8) However, the Code of Practice does not apply to a domestic commercial vessel that is a:

(a) fast craft under the National Standard for Commercial Vessels (NSCV); or

(b) hire and drive vessel under the NSCV.

NOTE The risks of autonomous and remotely operated fast craft and hire and drive vessels have not been considered or addressed in the Code of Practice.

(9) The Code of Practice may be informative for the design, construction and operation of:

(a) a recreational vessel;

(b) a commercial vessel operating internationally (beyond Australia's Exclusive Economic Zone), including a regulated Australian vessel and a foreign vessel; and

(c) a defence vessel.

(10) However, regulated Australian vessels and foreign vessels will be subject to Australian regulations and international conventions and standards that have not been referenced or considered in this Code of Practice.

NOTE This Code of Practice applies modified domestic commercial vessel requirements and standards, such as the NSCV. The requirements for regulated Australian vessels and foreign vessels are based on international conventions such as the Convention for the Safety of Life at Sea (SOLAS), and generally the NSCV does not apply to these vessels. As a result, the sections of this Code which apply the NSCV, or other domestic commercial vessel standards and requirements, may not be appropriate for regulated Australian vessels and foreign vessels.

Design, construction, survey and operation

(11) The Code of Practice provides recommendations for the design, construction, survey and operation of commercial vessels operating domestically in Australia.

(12) Domestic commercial vessels must have a certificate, approval or exemption which allows the vessel to operate in Australian waters. The regulator may consider compliance with the Code of Practice when determining an application for a certificate, approval or exemption. However, compliance with additional requirements beyond the scope of the Code of Practice may also be required, depending on the vessel and its intended operation.

NOTE To confirm the requirements for a specific vessel and operation, the designer, builder, operator, or other applicant should contact AMSA. See Contact us (amsa.gov.au).

(13) All autonomous and remotely operated vessels must comply with the requirements of Australian laws implementing the International Convention for the Prevention of Pollution from Ships (MARPOL) and imposing other environmental protection requirements, as applicable to the vessel. This Code of Practice does not address the requirement for vessels to comply with environmental standards and conventions as these obligations are not affected by the vessel's autonomous or remotely operated status.

NOTE See Marine pollution (amsa.gov.au) for information on MARPOL and other environmental protection requirements.

1.2 Approach of the Code

(1) Three schemes of autonomous and remotely operated vessel are established under this Code of Practice, as follows.

(a) **Autonomous and remotely operated marine equipment**

Small, light surface and sub-surface vessels which are not capable of inflicting significant damage or causing significant safety risks.

NOTE Guidance on the size, weight and speed limitations of this scheme is provided in Chapter 2.

(b) **Survey-exempt vessels**

Vessels <12m in lower risk operations. In line with the general requirements for domestic commercial vessels, a lighter touch regime applies to these lower risk vessels.

NOTE 'Survey-exempt' vessels are exempt from a full survey process, but are still required to comply with specified standards – see Chapter 3.

(c) **Vessels in survey**

All other autonomous or remotely operated vessels.

(2) An overview of the approach and content of this Code of Practice is provided in ANNEX C.

(3) The risks of autonomous and remotely operated vessels must be minimised so far as reasonably practicable.

(4) Equivalent outcomes to the standards that apply to conventional crewed vessels must be achieved.

NOTE This Code of Practice identifies potential departures from crewed vessel standards where the requirement is redundant if there are no persons on board, as well as potential additional requirements where they are necessary to maintain the same level of performance (e.g. replacing a manual firefighting system with automatic systems).

1.3 Structure of the Code

The Code of Practice is structured as follows:

(a) Chapter 1: Application, approach, structure and definitions.

(b) Chapter 2: Autonomous and remotely operated marine equipment

(c) Chapter 3: Survey-exempt vessels

(d) Chapter 4: Vessels in survey

(e) Chapter 5: Navigation system and situational awareness

(f) Chapter 6: Control system

(g) Chapter 7: Communications system

(h) Chapter 8: Fire safety systems

(i) Chapter 9: Engineering, electrical and auxiliary systems

(j) Chapter 10: Anchor systems

(k) Chapter 11: Contingency planning and vessel recovery

(l) Chapter 12: Risk assessment, verification, testing and certification for novel systems

(m) Chapter 13: Surveys and review of risk assessment

(n) Chapter 14: Operations

1.4 Definitions

(1) In this Code of Practice:

autonomous or remotely operated vessel means a vessel capable of operating without a master or crew on board the vessel.

certificate of competency means a certificate of competency issued under the National Law Act.

COLREGs means the *Convention on the International Regulations for Preventing Collisions at Sea, 1972*.

commercial vessel means a domestic commercial vessel or a regulated Australian vessel or a foreign vessel.

control station means the place the officer in charge of navigation watch is at any point in time and from which the vessel is being controlled or monitored.

crew, for a vessel, means individuals employed or engaged in any capacity on board the vessel, or in the control station, on the business of the vessel, including the master and a pilot.

NOTE This definition is taken from the NSCV Part B, Edition 2.3, and modified to include crew members in the control station and not on board the vessel.

dangerous goods means those packaged dangerous goods that fall within the application of clause 4 of the *National Code of Practice for the Storage and Handling of Workplace Dangerous Goods* (NOHSC: 2017 (2001)).

NOTE 1 For the application of this standard, the definition of dangerous goods excludes fuels and oils used for the propulsion of the vessel. Dangerous goods carried in bulk are subject to standards applicable to tankers (see definition below) or are subject to the International Bulk Chemical Code.

NOTE 2 Cargo fuels, including those with a flash point > 60^{o}C are typically considered to be dangerous goods under NOHSC: 2017(2001).

NOTE 3 This definition, including Note 1 and Note 2, is taken from the NSCV Part C4, Edition 2.1.

defence vessel means:

(a) a warship or other vessel that:

  (i) is operated for naval or military purposes by the Australian Defence Force or the armed forces of a foreign country; and

  (ii) is under the command of a member of the Australian Defence Force or of a member of the armed forces of the foreign country; and

  (iii) bears external marks of nationality; and

  (iv) is manned by seafarers under armed forces discipline; or

(b) a Government vessel that is used only on government non-commercial service as a naval auxiliary.

NOTE This definition is taken from the National Law Act in force on 8 October 2021.

domestic commercial vessel has the same meaning as in the National Law Act.

NOTE Domestic commercial vessels are subject to the National Law Act.

Exclusive Economic Zone means a sea zone prescribed by the *1982 United Nations Convention on the Law of the Sea* over which a state has special rights.

foreign vessel means a vessel:

(a) that does not have Australian nationality; and

(b) that is not a recreational vessel.

NOTE This definition is taken from the Navigation Act in force on 8 October 2021.

length means measured length as defined in NSCV Part B.

NOTE See Schedule 2 of NSCV Part B.

Marine Order 503 means *Marine Order 503 (Certificates of survey – national law) 2018.*

Marine Order 504 means *Marine Order 504 (Certificates of operation and operation requirements — national law) 2018*.

master of a vessel means the person who has command or charge of the vessel, but does not include a pilot.

NOTE This definition is taken from the National Law Act in force on 8 October 2021.

National Law Act means the *Marine Safety (Domestic Commercial Vessel) National Law Act 2012*.

National Law – Marine Surveyors Accreditation Guidance Manual 2014 means the National Law – Marine Surveyors Accreditation Guidance Manual 2014 that is published by AMSA.

National Standard for Commercial Vessels or NSCV means the National Standard for Commercial Vessels adopted in accordance with the National Law Act and published by AMSA. The sections of the NSCV are listed in the following table.

Table 1 NSCV Sections

Sections of the NSCV	Available
Part B — *General requirements* Part C — *Design and construction* Part C, Section 1 — *Arrangement, accommodation and personal safety* Part C, Section 2 — *Watertight and weathertight integrity* Part C, Section 3 — *Construction* Part C, Section 4 — *Fire safety* Part C, Section 5A — *Machinery* Part C, Section 5B — *Electrical* Part C, Section 5C — *LPG systems for appliances* Part C, Section 5D — *LPG systems for engines* Part C, Section 6A — *Intact stability requirements* Part C, Section 6B — *Buoyancy and stability after flooding* Part C, Section 6C — *Intact stability tests and stability information* Part C, Subsection 7A — *Safety equipment* Part C, Subsection 7B — *Communications equipment* Part C, Subsection 7C — *Navigation equipment* Part C, Subsection 7D — *Anchor systems* Part D — *Crew competencies* Part F, Section 1 – *Fast craft* Part F, Section 2 – *Leisure craft* Part G — *Non-survey vessels*	AMSA website https://www.amsa.gov.au/

Navigation Act means the *Navigation Act 2012.*

operational area category means the geographical area in which a vessel is approved or certified to operate, or is designed to be operate, as defined in NSCV Part B.

operator means the human responsible for monitoring and control of the vessel. The operator may be the master of the vessel, or may be a member of crew who is responsible for operating the vessel at a point in time. The operator may be supported in their role by other members of crew or by electronic control systems.

owner of a vessel includes:

(a) a person who has a legal or beneficial interest in the vessel, other than as a mortgagee; and

(b) a person with overall general control and management of the vessel.

For this purpose, a person is not taken to have overall general control and management of a vessel merely because he or she is the master or pilot of the vessel.

NOTE This definition is taken from the National Law Act in force on 8 October 2021.

passenger, for a vessel, means any person other than:

(a) the master or a member of the crew; or

(b) special personnel; or

(c) a child not more than 1 year old; or

(d) a person on board the vessel because of the master's obligation to carry shipwrecked or distressed persons or because of circumstances the master or owner could not prevent.

NOTE This definition is taken from NSCV Part B, Edition 2.3.

Recognised Organisation means a classification society that has been prescribed as a Recognised Organisation in accordance with section 14 of the *Navigation Act 2012.*

recreational vessel means a vessel that is not a commercial vessel or a defence vessel.

regulated Australian vessel has the same meaning as in the Navigation Act.

NOTE Under the Navigation Act in force on 8 October 2021, a vessel is a regulated Australian vessel if:

(a) under the *Shipping Registration Act 1981*, the vessel is registered, required to be registered or exempt under section 13 of that Act from that requirement; and

(b) the vessel is not a recreational vessel; and

(c) any of the following apply:

  (i) the vessel is proceeding on an overseas voyage or is for use on an overseas voyage;

  (ii) a certificate issued under the Navigation Act, other than a non-Convention tonnage certificate or a certificate prescribed by the regulations, is in force for the vessel;

  (iii) an opt-in declaration is in force for the vessel.

In addition, a vessel is a regulated Australian vessel if the vessel is an Australian Border Force vessel. See section 15 of the Navigation Act for more information.

safe state for a vessel means a defined state for the vessel at which it poses the least risk to persons, property or the environment.

safe state for a system or component of a vessel means a defined state for the system or component which is intended to stop the system or component from causing harm.

station keeping or dynamic position systems mean systems which automatically maintain a vessel position and heading within required positioning limits.

1.5 Levels of autonomy

(1) It is expected that a vessel subject to this Code will have one of the levels of autonomy set out in the following table.

NOTE The levels of autonomy set out in Table 2 are based in part on the levels of autonomy adopted by the Central Commission for the Navigation of the Rhine (CCNR) by its resolution 2018-II-16.

(2) However:

(a) different systems on the vessel may operate with different levels of autonomy to other systems on the vessel; and

(b) a system on the vessel may operate with different levels of autonomy depending on the functions being undertaken and the circumstances of the operation.

Table 2 Levels of autonomy

Level	Summary	Full description used by CCNR*
No autonomation	All actions taken by human operator, possibly with decision support	The full-time performance by the human boatmaster of all aspects of the dynamic navigation tasks, even when enhanced by warning or intervention systems
Steering assistance	The context-specific performance by a steering automation system using certain information about the navigational environment and with the expectation that the human boatmaster performs all remaining aspects of the dynamic navigation tasks	
Partial automation	Decision support and some decisions made and/or actions taken by system	The context-specific performance by a navigation automation system of both steering and propulsion using certain information about the navigational environment and with the expectation that the human boatmaster performs all remaining aspects of the dynamic navigation tasks
Conditional automation	Large number of decisions made and actions taken by system, with human supervision. Human may also undertake some decisions and actions	The sustained context-specific performance by a navigation automation system of all dynamic navigation tasks, including collision avoidance, with the expectation that the human boatmaster will be receptive to requests to intervene and to system failures and will respond appropriately
High automation	Decisions made and actions taken by system, with opportunity for human to intervene. Human may also undertake some decisions and actions	The sustained context-specific performance by a navigation automation system of all dynamic navigation tasks and fallback performance, without expecting a human boatmaster responding to a request to intervene.
Full automation	Decisions made and actions taken by system. Human supervision is rare	The sustained and unconditional performance by a navigation automation system of all dynamic navigation tasks and fallback performance, without expecting a human boatmaster responding to a request to intervene.

*Central Commission for the Navigation of the Rhine. The levels of autonomy set out in the table are based in part on the levels of autonomy adopted by the CCNR by its resolution 2018-II-16

CHAPTER 2 AUTONOMOUS AND REMOTELY OPERATED MARINE EQUIPMENT

2.1 Application of chapter

(1) This chapter applies to vessels which:

(a) are small;

(b) are light;

(c) operate only at low speeds;

(d) do not carry any persons; and

(e) are unlikely, due to the area of operation, size and shape of the vessel, type of operation and fuel and equipment on the vessel, to compromise the safety of persons or cause damage to property or the environment.

NOTE 1 Vessels with large batteries or novel fuel systems, and vessels with hydraulic systems, may pose a risk to the environment and may not be suitable for this category.

NOTE 2 When considering whether or not a vessel is likely to compromise the safety of persons or cause damage to property, the potential impact and outcome of a collision between the vessel and another vessel or a person must be assessed.

(2) A vessel subject to this chapter is likely to be:

(a) less than 5 metres in length; and

(b) limited to an operational speed of 5 knots.

However, a vessel may be longer and operate at very low speeds, or may be very small and light and operate at a higher speed. Such a vessel may still fall within this category if the kinetic energy of the vessel is low, or if it can be demonstrated that the vessel is unlikely to compromise the safety of persons or cause damage to property or the environment.

NOTE Guidance materials developed to support this Code of Practice contain a kinetic energy matrix which provides guidance on when a vessel longer than 5 metres, or which operates at speeds higher than 5 knots, may still be considered to be autonomous or remotely operate marine equipment for the purposes of this Code. However, the limits contained in this Code, and the guidance materials, provide an indication of the scope of this category only.

2.2 Requirements

(1) A safety management system must be prepared and implemented for the vessel which:

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

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

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

(d) is kept in the control station for the vessel.

NOTE 1 These requirements align with the requirements of Marine Order 504 for there to be a safety management system in place for all domestic commercial vessels. Marine Order 504 also requires the operational requirements that apply to the vessel (under Marine Order 504) to be addressed in the safety management system.

NOTE 2 For the meaning of *reasonably practicable* — see section 27 of the National Law Act.

NOTE 3 The documentation may be in digital format, but it must be readily accessible at all times.

(2) The safety management system for the vessel must address the following:

(a) the need for a support vessel to manage the risks of the vessel to other persons, vessels and the environment;

(b) the means through which other waterway users will be alerted as to the presence of the vessel, including any permissions required from the relevant waterway manager or harbour master as well the need for a notice to mariners to be issued;

(c) the control and monitoring arrangements for the vessel, including the appropriate level of redundancy and diversity;

(d) the communication arrangements for the vessel, including the appropriate level of redundancy and diversity. Reversionary communication arrangements must be independently powered;

(e) emergency response planning, including:

(i) contingency planning and entry of the vessel into the appropriate safe state in certain circumstances, including where communication links between the vessel and control station are lost (including passive communication links); and

(ii) the means of collecting the vessel if it stops operating; and

(f) the visibility of the vessel to other waterway users.

NOTE for subclause (2)(a) This does not require all vessels to have a support vessel. The need for a support vessel must be considered as part of the safety management system for the vessel.

NOTE for subclause (2)(d) Communication and positioning systems should be designed with dual or multiple redundancy and diversity so that the vessel can be recovered if a failure occurs. It may be sufficient for the redundant communication arrangements to transmit signals from the vessel only, provided the vessel enters into the appropriate contingency plan or safe state once the primary means of communication is lost.

(3) The vessel must be operated in accordance with an appropriate crewing assessment undertaken by the owner in accordance with Marine Order 504.

NOTE 1 The appropriate crew assessment determines the appropriate number of person(s) operating or monitoring the vessel, and their qualifications, competencies and training.

NOTE 2 The minimum crewing table of Marine Order 504 applies to all domestic commercial vessels, unless an exemption is obtained from AMSA. Note that for a vessel <12m, the minimum crewing table identifies minimum crewing as 1 certificated person provided that person has both deck and engineering qualifications, see Crewing guidance for domestic commercial vessels (amsa.gov.au) for more information.

(4) The vessel must:

(a) not have the potential to leak fuel and other matter that may pose a risk to the environment should the vessel be lost or become irretrievable;

(b) not contain hazardous materials that may pose a risk to the environment or third parties should the vessel be lost or become irretrievable;

(c) be collected within a reasonable period if it stops operating; and

(d) not pose a significant danger to persons in the water.

COLREGs compliance

(5) The vessel must comply with the applicable light requirements of COLREGs when on the surface.

NOTE 1 Small autonomous and remotely operated marine equipment will be likely to be classified as an 'inconspicuous vessel' under COLREGs and as such are required to display a white all-round light which is visible for 3 miles.

NOTE 2 The light requirements of COLREGs generally only apply to vessels operating between sunset and sunrise. However, COLREGs also requires the lights to be displayed between sunrise and sunset in times of restricted visibility and *in other circumstances when deemed necessary*. If other waterway users may have difficulty seeing the vessel due to its size or because it is partially submerged, the lights should also be displayed between sunrise and sunset.

(6) Any other lights and sound signals used by the vessel must not be able to be confused with lights and signals defined in COLREGs. In particular, revolving or strobe lights should not be used, except in accordance with the requirements of COLREGs.

(7) Unless the vessel has the capabilities to comply with the requirements of COLREGs that apply to these scenarios, the vessel must:

(a) avoid narrow channels and fairways;

(b) avoid using or approaching traffic separation schemes;

(c) avoid inshore traffic zones;

(d) not cross a traffic separation scheme;

(e) if a sailing vessel, avoid other sailing vessels; and

(f) not operate in areas or conditions of restricted visibility.

NOTE Capabilities to comply with the requirements of COLREGs may be achieved through systems on and off the vessel.

(8) Unless there are persons on board or nearby the vessel who require assistance, the vessel must not use the distress signals specified in Rule 37 of COLREGs. It may signal "distress" in another way which cannot be confused with signals associated with harm to or loss of life.

(9) Guidance on compliance with COLREGs is provided in ANNEX A.

Vessel identification

(10) The vessel must be physically identified, so that persons nearby the vessel can contact the owner if necessary. Physical identification of the vessel must include one or more of the following:

(a) a unique vessel identifier;

(b) the name of the owner displayed on the outside of the vessel;

(c) a relevant contact phone number on the outside of the vessel.

NOTE for subclause (10)(a) The unique vessel identifier is issued by AMSA as part of the certification process. The unique vessel identifier must be displayed on the outside of the vessel in accordance with the requirements of the National Law Act, subject to any applicable exemptions.

NOTE for subclause (10)(c) The relevant contact number may be the contact number of the operator, the control station or the owner.

2.3 Guidance

(1) Vessels that fall within the category of 'autonomous and remotely operated marine equipment' are not required to comply with Chapters 5 to 14 of this Code, however the requirements of these chapters may be informative for designers, builders and owners of autonomous and remotely operated marine equipment.

(2) This section sets out guidance for the development of the safety management system required for vessels in this category.

Support vessel requirements

(3) Examples of where a support vessel may be required include:

(a) the vessel is operating in a waterway where there are likely to be other waterway users, and a support vessel is required to ensure that the vessel does not pose a danger to other waterway users;

(b) communicating with, and monitoring, the vessel is difficult or impossible from longer distances, and a support vessel is required in order to maintain appropriate communication links;

(c) a support vessel which remains nearby the vessel is required in order to retrieve the vessel within a reasonable period if the vessel stops operating or completes its mission.

Informing the waterway manager and other waterway users

(4) A key aspect of the safety management system is ensuring that the vessel does not pose a danger to other waterway users. Informing, and obtaining required permissions from, the waterway manager, and informing other waterway users of the presence of the vessel will be part of managing this risk.

(5) The safety management system must include processes for ensuring compliance with requirements for the owner of the vessel to inform, and if applicable, obtain permission from, the relevant waterway manager or harbour master and marine rescue agencies, of the vessel's intended operations.

NOTE The 'owner' includes the company or organisation that is operating the vessel if they are taken to have 'overall management and control of the vessel' – see the definition of 'owner' in clause 1.4 of this Code of Practice.

(6) The appropriate means of alerting other waterway users will depend on:

(a) the circumstances of the operation and the area in which the vessel is operating. For example, a vessel operating close to shore will be more likely to encounter recreational waterway users, who may not have an automatic identification system (AIS) and may be less experienced. A vessel operating out at sea, will encounter more commercially operated vessels which will be more likely to have AIS; and

(b) the requirements of the relevant waterway manager or harbour master.

(7) Means of informing of waterway users include:

(a) signs at boat ramps;

(b) notices to mariners; and

(c) AIS transceivers.

Communicating with stakeholders near the vessel

(8) It may be necessary for the vessel to have a means of communicating with persons nearby the vessel, for example through a loudspeaker.

Control and monitoring arrangements

(9) Most vessels will require constant, active monitoring.

NOTE 1 For many vessels, the human operator (and other members of the crew) will be responsible for the navigation of the vessel and COLREGs compliance. However, this will depend on where and how the vessel is operating, and the control and monitoring arrangements must be addressed through the safety management system.

NOTE 2 For sub-surface vessels with planned gaps in communications links, the control station still needs to provide assurance that it is in control of the vessel. This could, for example, be achieved by maintaining line of sight of the surface in the operations area so that interventions could be made to ensure that there is no conflict with other marine users.

(10) For some vessels, passive monitoring will be sufficient, particularly where:

(a) either:

(i) the vessel is operating in remote areas where the risks of collision are very low; or

(ii) the vessel is operating below the surface and the risks of collision are very low; and

(b) there are control systems in place for the vessel which manage alerts and make it possible for the operator to passively monitor one or more vessels and manage any situations requiring intervention, including any emergency situations, that may arise.

Communication and control system redundancy

(11) The safety management system must consider appropriate system redundancy and diversity for communications between the control station and the vessel and for maintaining the ability to control the vessel from the control station.

(12) In order to comply with the requirement to retrieve the vessel within a reasonable period, the operator must be able to monitor or track the vessel when the main communication links are lost.

(13) Redundant communication systems must be independently powered.

NOTE 1 It may be sufficient for the redundant communication arrangements to transmit signals from the vessel only, provided the vessel enters into the appropriate contingency plan or safe state once the primary means of communication is lost.

NOTE 2 This requires consideration to be given to the risks of a loss of power at the control station, as well as on the vessel.

Emergency planning

(14) A contingency plan must be defined for the whole voyage and all situations that may occur, including any deviation from normal operation. Each contingency plan involves placing the vessel into a state in which it poses the least risk to life, the environment and property. The contingency plans may involve entering the vessel, or its systems, into a safe state.

(15) The appropriate contingency plan will depend on where the vessel is operating and the type of failure or event that has occurred.

(16) The appropriate contingency plan must be able to be initiated:

(a) autonomously by the vessel in response to specified conditions, including where communications with the control station are lost; and

(b) by the operator at any time from the control station.

NOTE 1 For a sub-surface vessel, it may not be possible to initiate a contingency plan from the control station when the vessel is outside of communication links. In order to manage the risks of these vessels, a higher number of conditions or events may need to be programmed into the control system of the vessel, so that the vessel autonomously initiates the appropriate contingency plan where the conditions or events occur.

NOTE 2 The control station means the place the officer in charge of navigation watch is at any point in time, and from which the vessel is being controlled or monitored – see the definitions in Chapter 1. This may be onshore or on a support vessel.

NOTE 3 It may also be appropriate to include an emergency stop system on board the vessel.

NOTE 4 See below for guidance on when communications may be considered to be 'lost'.

(17) For a vessel operating on or below the surface, the contingency plan could involve one or more of the following:

(a) the vessel moving to a quieter or calmer area, or to deeper water;

(b) the vessel maintaining its position ('safe position hold');

(c) disabling the vessel's engines (stopping vessel propulsion); or

(d) full shut down of all systems on the vessel, for example in the case of a fire.

(18) For a sub-surface vessel, the contingency plan could also involve:

(a) the vessel floating to the surface, if it is unlikely to encounter other waterway users as a result of the location or area of operation, or if it can be collected within a short period (because, for example, it is accompanied by a support vessel);

(b) the vessel maintaining a specified distance below the surface until collected, if it is likely to encounter other waterway users or is unable to be collected within a short period; or

(c) the vessel sinking to the bottom if:

(i) it is capable of being collected from the bottom; and

(ii) it may be a danger to other waterway users if it floated to the surface or if it remained a specified distance below the surface.

(19) In some circumstances, the contingency plan could involve initiating a safe return for the vessel.

NOTE A vessel can encounter hazards, or may present a hazard to third parties, on the return journey. A safe return should only be initiated in appropriate circumstances.

(20) The safety management system must identify the means through which other waterway users will be informed if the vessel stops operating. This may involve one or more of the following:

(a) informing AMSA;

(b) informing marine rescue;

(c) informing the local Vessel Traffic Service (VTS) authority;

(d) alerting nearby vessels and persons through sound or light alerts; and

(e) alerting other waterway users of the navigational status of the vessel through AIS transceivers or VHF radio.

NOTE See Chapter 7 for guidance on using sound and light alerts to indicate the status of the vessel.

Lost communication

(21) When determining lost communication, the availability, integrity and continuity of the communications must be considered.

(22) For vessels which operate sub-surface and are not expected to be in constant communication with the control station, communications with the vessel are considered to be lost where planned communication windows with the control station are missed.

(23) For vessels in constant communications with the control station, communications are lost when all methods of communication fail for a period specified in the emergency response plan for the vessel.

NOTE 1 The appropriate period will depend on the risks of the vessel and its operations. The risk assessment must consider the period after which it would pose unacceptably high risks to other vessels, third parties or the environment for the vessel to be operating without communication with the control station. For example, for a remotely operated vessel in a waterway with other waterway users, communications may be considered lost after only a few seconds.

NOTE 2 The appropriate contingency plan may depend on how long communications are lost for. For example, the vessel may begin to slow down after a specified period of lost communication, and then position hold if communications remain lost after a further specified period. This needs to be considered and determined in the emergency response plan for the vessel.

Vessel retrieval

(24) In the event that the vessel stops operating, the vessel must be retrieved as soon as practicable, taking into account the location of the vessel, the risks posed by the vessel to other waterway users and the potential impact of the vessel on the environment.

NOTE Pollution and dumping laws prohibit autonomous or remotely operated vessels, including marine equipment, from being abandoned at sea in the case that they stop operating or where communication signals are lost. See for example: *Environment Protection (Sea Dumping) Act 1981*, Commonwealth, State and Territory marine safety laws and the Protection of the Sea Acts which provide AMSA with powers over wrecks that are causing environmental damage.

(25) For the purposes of this Code, a vessel ‘stops operating’ if:

(a) it is no longer capable of safely carrying out its mission, and is also not capable of safely returning to its point of departure; or

(b) communications with the vessel are lost; or

(c) a contingency plan is executed and the vessel is incapable of continuing the voyage or mission without intervention.

NOTE See above for guidance on when communications with the vessels may be considered to be ‘lost’.

Vessel visibility

NOTE Visibility requirements may not apply to defence vessels, provided the safety of other waterway users is managed through other arrangements.

(26) The visibility of the vessel needs to be considered, in order to ensure that other waterway users are alerted to the presence of the vessel and to reduce the risks posed by the vessel to other waterway users.

(27) This applies particularly to smaller vessels, vessels which are partially submerged, and vessels which generally operate sub-surface and which may not be easily seen when they return to the surface. A sub-surface vessel operating below the surface in shallow waters may also pose a danger to other waterway users.

(28) In order to ensure that the vessel is visible to other waterway users, it may be appropriate to:

(a) paint the vessel in high-visibility colours;

(b) comply with the applicable COLREGs requirements for lights during daylight hours; and

(c) have status lights to indicate operating mode, for example ‘safe mode’, ‘local control’, ‘remote control’, ‘failure mode’.

NOTE When determining the appropriate status lights, the requirements of COLREGs should be considered. For example, COLREGs includes requirements for a ‘vessel not under command’. In addition, any status lights used by the vessel that are not stipulated by COLREGs must not be able to be confused with signals defined in COLREGs. In particular, revolving or strobe lights should not be used, except in accordance with the requirements of COLREGs. See clause 2.2(6).

Appropriate crewing considerations

(29) Appropriate crew, for an autonomous or remotely operated vessel, means the number of persons operating or monitoring the vessel and their qualifications, competencies and training.

(30) Marine Order 504 includes the following requirements for the appropriate crewing determination – only those requirements relevant to autonomous and remotely operated vessels have been extracted here:

(a) The owner must:

(i) determine the appropriate crewing for each kind of operation of the vessel by evaluating the risks to the safety of the vessel, the environment and all persons near the vessel; and

(ii) ensure the vessel operates with the appropriate crewing that is determined.

NOTE 1 ‘Crew’ for an autonomous or remotely operated vessel with no persons on board refers to the person(s) responsible for operating or monitoring the vessel from the control station.

NOTE 2 The ‘owner’ includes the company or organisation that is operating the vessel if they are taken to have ‘overall management and control of the vessel’ – see the definition of ‘owner’ in clause 1.4 of this Code of Practice.

NOTE 3 These requirements are contained in Marine Order 504 as in force on 8 October 2021.

(b) The evaluation must take into account the following factors:

(i) the tasks or activities of the vessel and any particular demands on the master and crew that each task or activity will impose in addition to the safe navigation of the vessel;

(ii) the design characteristics of the vessel, including its general arrangements, machinery and equipment;

(iii) the competency required for the use of technological aids to safety and navigation fitted in addition to the mandatory requirements;

(iv) the area of operation of the vessel and expected conditions (e.g., weather, climate and water temperatures);

(v) the duration of the voyage;

(vi) the risk of fatigue of the master and crew;

(vii) the requirements for the vessel's emergency preparedness;

(viii) the maintenance requirements of the vessel, its machinery and its equipment;

(ix) the risks to the environment and all persons who will be on or near the vessel;

(x) the qualifications and competencies of the master and crew;

(xi) the external support available to the vessel; and

(xii) the requirements of key operations and systems of the vessel.

NOTE These requirements are based on the requirements of Marine Order 504 as in force on 8 October 2021.

(c) The appropriate crewing evaluation must also consider additional autonomous systems or vessels that are being operated from the vessel.

(d) The appropriate crewing that has been determined for each kind of operation of the vessel must be recorded in the vessel's documentation, together with reasons that address the factors mentioned in subclause (b) and (c).

Crew (operator) competencies

(31) Operators, including those responsible for passive monitoring of the vessel, will require knowledge of boat operations and waterways. They will need to understand the impact of the vessel on other waterway users, and how other waterway users are likely to respond to the vessel.

(32) The appropriate operator and crew competencies, certification and training will depend on the risks of the vessel and the location in which it is operating. A vessel in a busy waterway, for example, will have more interactions with other waterway users than a vessel operating in remote waters or a long way offshore.

(33) At minimum, the operator of autonomous and remotely operated marine equipment should have:

(a) either:

(i) a recreational boating licence (if an exemption from the minimum crewing requirements is obtained from AMSA); or

(ii) a certificate of competency (if an exemption from the minimum crewing requirements is not obtained from AMSA); and

(b) vessel-specific training.

NOTE 1 The minimum crewing table of Marine Order 504 applies to all domestic commercial vessels, unless an exemption is obtained from AMSA. The minimum crewing table requires the vessel to be operated by a certificated person.

NOTE 2 An application may be made to AMSA for a Specific Exemption from a requirement of the National Law, including from the requirement to comply with the minimum crewing requirements of Marine Order 504. The Guidance Materials developed to support this Code of Practice provide more information on the Specific Exemption(s) that autonomous and remotely operated vessels are likely to require in order to operate, including under this Code.

(34) Depending on the type of vessel and operation, it may also be necessary for the operator of autonomous and remotely operated marine equipment to have autonomous vessel training.

(35) The operator, or another member of crew, must have the appropriate training and qualifications to operate the radio or other communication equipment fitted on the vessel or in the control station.

NOTE Marine Order 504 requires the master or a deck watchkeeper to be qualified to operate the radio or other communication equipment fitted on the vessel. The owner of an autonomous or remotely operated vessel must ensure this requirement is met – for example, by ensuring that the operator is qualified to operate the radio or other communication equipment fitted on the vessel and/or in the control station.

Training

(36) In accordance with the requirements of Marine Order 504, the owner of the vessel (which includes the person or body with general control and management of the vessel) must ensure that the operator, and any other members of crew, receive the following training:

(a) sufficient training in key operations to establish, maintain and verify the competence and capacity of the person to safely carry out assigned duties; and

(b) sufficient training in emergency procedures to establish, maintain and verify the ability of the person to respond rapidly and effectively in an emergency and to follow the emergency plan.

(37) The owner of the vessel must ensure that a written record of any training mentioned in subclause (36) that is undertaken is made and signed by each person who undertook the training.

CHAPTER 3 SURVEY-EXEMPT VESSELS

3.1 Application of chapter

(1) This chapter applies to vessels which:

(a) are lower complexity in the physical design and construction of the vessel;

(b) operate only at moderate speeds;

NOTE See clause 3.1(2) below for guidance on what vessels may be considered to be low complexity and to operate only at moderate speeds.

(c) are not built to accommodate any persons. However:

(i) crew or special personnel may be on board for limited operations only, such as during trials, while the vessel is docking or to undertake repairs; and

(ii) where crew or special personnel are on board the vessel, their safety must be managed through systems outside of the design, construction and equipment of vessel. This may include personal protective equipment and the use of a support vessel, or, for a vessel which is docked, docking or operating near the shore, onshore support arrangements; and

(d) do not:

(i) carry dangerous goods, including petroleum or gas products (other than petroleum or gas products intended for use on the vessel);

(ii) engage in vessel towing operations or be set up for the purpose of towing other vessels;

(iii) have an inboard engine which operates on fuel that has a flashpoint of less than 60°C.

NOTE Products installed on the vessel, such as batteries, are generally not ‘carried’ on the vessel for the purposes of the dangerous goods codes. See the definition of dangerous goods in Chapter 1.

(2) A vessel subject to this chapter is likely to be:

(a) less than 12m in length; and

(b) limited to an operational speed of 10 knots.

However, a vessel may be longer and operate at low speeds, or may be small and operate at a higher speed. Such a vessel may still fall within this category if the kinetic energy of the vessel is low.

NOTE Guidance materials developed to support this Code of Practice contain a kinetic energy matrix which provides guidance on when a vessel longer than 12 metres, or which operates at speeds higher than 10 knots, may still be considered to be a survey-exempt vessel for the purposes of this Code. However, the limits contained in this Code, and the guidance materials, provide an indication of the scope of this category only.

(3) Although there are no operational area limitations on the kinds of vessels which are eligible for this category, the vessel must remain within the operational area constraints of its design and construction standard. For example, a vessel designed to operate only in smooth waters, must remain within operational area category E. In addition, AMSA may limit vessels in this category to operational areas C, D and E.

NOTE 1 See NSCV Part B for more information on the operational area categories. The NSCV is available on the AMSA website at National Standard for Commercial Vessels (NSCV) (amsa.gov.au). Operational area C generally extends to 30nm from the baseline of the Australian mainland (except

Queensland), the Tasmanian mainland and specified islands; 50nm from the baseline of the mainland of Queensland; and the Great Barrier Reef Region and the Torres Strait zone.

NOTE 2 The AMSA Guidance Notice – Small unmanned autonomous vessels dated 7 September 2021 applies to small, unmanned autonomous and remotely operated vessels in C, D and E waters.

Sub-surface vessels

(4) Complex sub-surface vessels may not fall within this vessel category, even where the vessel is <12m in length and limited to an operational speed of 10 knots. Where this is the case, they will be vessels in survey and subject to Chapter 4.

NOTE It is the responsibility of the designer, builder or operator to determine whether or not a sub-surface vessel is a complex sub-surface vessel. Advice could be sought on this issue from AMSA, an accredited marine surveyor, a Recognised Organisation or other competent person.

3.2 Requirements

(1) A vessel subject to this chapter must comply with the requirements set out in Table 3.

(2) Where a vessel departs from the requirements set out in Table 3, including through the use of novel fuels or power systems, the departure or alternative solution must be demonstrated to:

(a) be least as effective as compliance with the standards set out in Table 3, given the vessel and its intended operations; and

(b) not result in an increased risk to other vessels, third parties or the environment.

EXAMPLE The use of novel fuel or power systems would need to be justified by showing that the proposal does not result in an increased risk to other vessels, third parties or the environment.

NOTE Advice from AMSA should be sought on the verification and certification requirements for a vessel powered by novel fuels.

Table 3 Minimum design, construction, verification and operational requirements for survey-exempt vessels

NOTE These requirements are based on the AMSA Guidance Notice – Small unmanned autonomous vessels dated 7 September 2021

Aspect of vessel	Requirements
Construction	Must be fit for purpose for the intended operation of the vessel and must comply with all of the required outcomes of NSCV Section C3. Hazardous materials that may pose a risk to the environment or third parties should the vessel be lost or become irretrievable must be minimised and recorded in accordance with relevant legislation. Materials which are banned or restricted by national or international legislation due to their known hazards to humans or the environmental must not be used.
Flotation – surface vessels only	Must be arranged with a combination of watertight compartments or low-density flotation materials so that it is incapable of sinking, if the single largest compartment becomes damaged.
Stability – surface vessels only	Must, in all loading conditions, have stability characteristics fit for the purpose for the intended operations of the vessel.

Aspect of vessel	Requirements
Machinery — fuel tanks, pipes, shafting etc (applies only where fuel tanks or shafting etc are fitted)	If there is an underdeck fuel tank on-board the vessel, it must comply with clause 4.7 of NSCV Subsection C5A.
	Fuel piping for any non-portable fuel tank must be of seamless, heavy gauge metal. However, a flexible fuel line may be used: ➢ in accordance with clause 4.7.1.5 of NSCV Subsection C5A; and ➢ between the fuel shut-off valve or cock and the main engine. If a flexible fuel line is used, it must: ➢ comply with either: – the requirements for type A1 mentioned in ISO 7840:2013 *Small craft — Fire-resistant fuel hoses*; or – the requirements for type A mentioned in SAE J1527: *Marine fuel hoses*; and ➢ be securely installed to avoid chafing and allow regular inspection. However, a flexible fuel line from the fuel filter to the outboard engine, which is supplied by the engine manufacturer, is not required to comply with the standards mentioned above.
	There must be a remote fuel shutoff of a failsafe close type, as close to the tank as practicable.
	There must be a fuel filter, positioned after the shutoff valve mentioned above.
	If shafting is fitted, it must comply with one of the following standards: ➢ ABYC *Standards and Technical Information Reports for Small Craft, P-6 (ANS) Propeller Shafting Systems, July 2010*; or ➢ NSCV Subsection C5A.
Steering	Must be fit for purpose for the intended operations of the vessel.
Batteries (applies only where batteries are fitted)	Batteries must comply with: ➢ an applicable national or international standard, or the requirements of a Recognised Organisation, and be certified by the manufacturer as suitable for the application intended; and ➢ the requirements of NSCV Subsection C5B relevant to batteries. Battery ventilation arrangements must comply with the requirements of the applicable standard or manufacturer requirements. NOTE Advice from AMSA should be sought on the verification and certification requirements for a battery powered vessel, and for any vessel powered by novel fuels.

Aspect of vessel	Requirements
Watertight and weather tight integrity	The vessel must be designed and constructed to prevent, or limit to an acceptable level, the likelihood of the following in all reasonably foreseeable weather conditions: ➢ progressive flooding; ➢ disabling of essential or emergency systems; and ➢ excessive heel and/or trim.
	The vessel must be provided with a means to monitor bilge levels in: ➢ any propulsion machinery space; ➢ in all other compartments that contain seawater pumping systems; and ➢ any compartments that have penetrations to the sea. The vessel must have a bilge pump that is automatic or controllable from the control station, that can drain all bilges or closed under floor compartments other than airtight void spaces or spaces filled to more than 90% volume with low density flotation.
Electrical	The vessel must comply with NSCV Subsection C5B, with the following modifications: ➢ the requirement to have an emergency power supply located above the weather deck does not apply; ➢ electrical system monitoring requirements must be met through arrangements that allow the monitoring to be conducted from the control station; ➢ emergency power sources must automatically come into effect or be capable of being started or brought into service from the control station; ➢ emergency power sources must be capable of simultaneously supplying the following equipment and systems (in addition to the equipment and systems specified in NSCV Section C5B) with power for the periods specified for other equipment and systems in NSCV Section C5B: – telemetry and other location tracking equipment; and – the communication, control and other systems required to place and maintain the vessel in a safe state, and to receive and execute recovery commands if the vessel is positioned to recovery itself; and ➢ consideration should be given to whether the emergency lighting requirements of NSCV Section C5B are appropriate, or whether alternative or additional areas should be illuminated in order for the operator to obtain a sufficient situational awareness in an emergency situation.

Aspect of vessel	Requirements
Fire equipment	A vessel with a main engine that has an engine power of >120 kw, located in an enclosed space, must have: ➢ a fire detection system that can be monitored from the control station; and ➢ a means of smothering fire in the space that is initiated automatically or can be initiated from the control station. The fire safety risks of batteries installed on the vessel, and the charging arrangements for the battery, must be assessed and addressed in line with an appropriate national or international standard, or the requirements of a Recognised Organisation, and a risk assessment. This must include appropriate arrangements for battery housing, ventilation and fire detection and extinguishing systems. NOTE Advice from AMSA should be sought on the verification and certification requirements for a battery powered vessel and for any vessel powered by novel fuels.
Navigation system and situation awareness	The vessel must comply with Chapter 5.
Control system	The vessel must comply with Chapter 6.
Communications system	The vessel must comply with Chapter 7.
Anchor or station keeping system	The vessel must have a means of ensuring the vessel can station keep. Anchors or other station keeping or dynamic positioning systems for the vessel must comply with the contingency planning arrangements for the vessel. Any station keeping or dynamic positioning system must have separate means of power and appropriate system redundancy, determined in accordance with risk-based analysis.
Contingency planning and vessel recovery	The vessel must comply with Chapter 11.
Risk-analysis, testing, software integrity and cyber security	The vessel must comply with Chapter 12.
Surveys and verification	The vessel must comply with Chapter 13.
Operations	The vessel must comply with Chapter 14.

CHAPTER 4 VESSELS IN SURVEY

4.1 Application of chapter

(1) This chapter applies to all autonomous and remotely operated vessels which are not subject to Chapter 2 or Chapter 3.

(2) Any vessel may also elect to comply with this Chapter 4 in lieu of compliance with Chapter 2 or Chapter 3.

4.2 Requirements

(1) A vessel subject to this chapter must comply with the requirements set out in Table 4.

NOTE Advice from AMSA should be sought on the survey requirements for autonomous and remotely operated vessels in survey. AMSA may require the surveys to be undertaken by a Recognised Organisation, in which case the Recognised Organisation may require compliance with their own rules and requirements in addition to, or in lieu of, the requirements contained in Table 4.

(2) For the purposes of the requirements in Table 4, a vessel that is not built to accommodate any persons may have crew or special personnel on board for limited operations, such as during trials, while the vessel is docking or to undertake repairs. Where crew or special personnel are on board the vessel, their safety must be managed through systems outside of the design, construction and equipment of vessel. This may include personal protective equipment and the use of a support vessel or, for a vessel which is docked, docking or operating near the shore, onshore support arrangements.

(3) A vessel must not carry passengers or special personnel without also having crew on board.

NOTE See Chapter 1 of this Code of Practice. This Code of Practice does not apply to a vessel which does not have crew on board but does have passengers or special personnel on board. An autonomous or remotely operated vessel with no crew on board, which carries passengers or special personnel, has additional risks in the event of an emergency which have not been considered or addressed in this Code of Practice.

(4) Where a vessel departs from the requirements set out in Table 4, the departure or alternative solution must be demonstrated to:

(a) be least as effective as compliance with the standards set out in Table 4, given the vessel and its intended operations; and

(b) not result in an increased risk to other vessels, third parties or the environment.

EXAMPLE It may not be necessary for a vessel with a fixed payload, and no persons on board at any time, to comply with the stability requirements set out in Table 4. However, such a departure from Table 4 would need to be justified by showing that the proposed stability characteristics for the vessel are fit for purpose and do not result in an increased risk to other vessels, third parties or the environment.

Table 4 Design, construction, survey, verification and operational requirements for vessels in survey

Aspect of vessel	Requirements		
	Surface vessel not built to accommodate persons	Surface vessel built to accommodate persons	Sub-surface vessel
Arrangement, accommodation and personal safety	The vessel must comply with the NSCV Section C1 requirements relating to the field of vision and navigation signal arrangements. In addition, a vessel which may have persons on board while docked or at other times must be safe for those persons. The vessel must comply with the required outcomes of NSCV Section C1 covering access, exits, escapes and evacuation and personal safety.	The vessel must comply with NSCV Section C1.	The vessel must comply with the rules of a Recognised Organisation.
Watertight and weather tight integrity	The vessel must comply with NSCV Section C2. However, the equivalent requirements of the Uniform Shipping Laws (USL) Code apply until NSCV Section C2 commences. NOTE NSCV Section C2 is expected to commence in 2022 or 2023.		
Construction	A vessel <35m must comply with NSCV Section C3. A vessel ≥35m must comply with the rules of a Recognised Organisation.		
Fire safety	The vessel must comply with Chapter 8.		
Machinery, including electrical and auxiliary systems	A vessel <35m must comply with NSCV Section C5 as modified by Chapter 9. A vessel ≥35m must comply with the rules of a Recognised Organisation. Chapter 9 may be informative for these vessels.		
Stability	The vessel must comply with NSCV Section C6, including: ➢ Sub-section C6A: Intact stability requirements; ➢ Subsection C6B: Buoyancy and stability after flooding; and		

<table>
<tr><th rowspan="2">Aspect of vessel</th><th colspan="3">Requirements</th></tr>
<tr><th>Surface vessel not built to accommodate persons</th><th>Surface vessel built to accommodate persons</th><th>Sub-surface vessel</th></tr>
<tr><td></td><td colspan="2">➢ Subsection C6C: Stability tests and stability information.</td><td rowspan="7">The vessel must comply with the rules of a Recognised Organisation.</td></tr>
<tr><td>Safety equipment</td><td>No requirements.
NOTE AIS and other communication equipment is specified under the communications system requirements</td><td>Vessel must comply with NSCV Section C7A (Safety equipment).</td></tr>
<tr><td>Communications system</td><td colspan="2">The vessel must comply with Chapter 7.</td></tr>
<tr><td>Navigation system and situation awareness</td><td colspan="2">The vessel must comply with Chapter 5.</td></tr>
<tr><td>Control system</td><td colspan="2">The vessel must comply with Chapter 6.</td></tr>
<tr><td>Anchor system</td><td colspan="2">A vessel <35m must comply with NSCV Subsection C7D as modified by Chapter 10.
A vessel ≥35m must comply with the rules of a Recognised Organisation. Chapter 10 may be informative for these vessels.</td></tr>
<tr><td>Contingency planning and vessel recovery</td><td colspan="3">The vessel must comply with Chapter 11.</td></tr>
<tr><td>Risk-based analysis, testing, software integrity and cyber security</td><td colspan="3">The vessel must comply with Chapter 12 or the rules of a Recognised Organisation.</td></tr>
<tr><td>Surveys and verification</td><td colspan="2">The vessel must comply with Chapter 13.
NOTE Advice from AMSA should be sought on the survey requirements for autonomous and remotely operated vessels in survey. AMSA may require the surveys to be undertaken by a Recognised Organisation.</td><td>The vessel must comply with the rules of a Recognised Organisation.</td></tr>
<tr><td>Operations</td><td colspan="3">The vessel must comply with Chapter 14.</td></tr>
</table>

CHAPTER 5 NAVIGATION SYSTEM AND SITUATIONAL AWARENESS

This chapter covers the equipment and systems used to acquire information (i.e., 'detection'). The analysis of the information, planning based on the analysis, and execution of those plans, is covered in Chapter 6.

5.1 General requirements for the navigation system and situational awareness

Vessels subject to this Chapter under Table 3 and Table 4 are required to comply with:

(a) NSCV Subsection C7C as modified by clause 5.2; and

(b) the additional navigation system and situational awareness requirements contained in clauses 5.3 and 5.4.

5.2 Application of NSCV Subsection C7C – Navigation equipment

NSCV Subsection C7C required outcomes

(1) The vessel must comply with all of the required outcomes of NSCV Subsection C7C, subject to the following change:

(a) references to the 'main steering position' are replaced by 'control station'.

NOTE The control station means the place the officer in charge of navigation watch is at any point in time and from which the vessel is being controlled or monitored – see the definitions in Chapter 1. This may be on the vessel, onshore or on a support vessel.

NSCV Subsection C7C deemed-to-satisfy solutions

(2) The vessel must comply with all of the deemed-to-satisfy solutions of NSCV Subsection C7C, however:

(a) some aspects of the equipment requirements may be located off the vessel, as appropriate for the navigation and control system for the vessel;

(b) requirements relating to the arrangement of navigation equipment in a control station apply to the control station as defined in Chapter 1 of this Code of Practice; and

(c) the following deemed-to-satisfy requirements do not apply to a vessel which does not have any crew on board in a deck capacity:

(i) carriage of binoculars. However, the remote optics on the vessels must have zoom or PanTilt capabilities; and

(ii) wiper / clearview screen requirements.

NOTE 1 The wiper / clearview screen requirements contained in NSCV Subsection C7C will be relevant to the additional navigation and situational awareness requirements contained in clauses 5.3 and 5.4.

NOTE 2 Deck capacity means crew whose duties include performing tasks related to the navigation of a vessel – see NSCV Part D.

5.3 Additional navigation and situational awareness performance requirements

(1) The navigation and situation awareness systems for the vessel must be developed through risk-based analysis, conducted in accordance with Chapter 12, and must have appropriate system redundancy and diversity, as determined by the risk-based analysis.

(2) The performance requirements contained in this clause may be met through sensors and systems on the vessel, or a combination of sensors and systems and the operator and other members of crew in the control station.

COLREGs compliance

(3) The vessel must comply with the requirements of COLREGs as applicable to the vessel and its operations.

NOTE COLREGs includes requirements for a proper lookout to be maintained at all times, to understand and respond to actions and signals issued from other vessels and to act, signal and display lights and flags in specified circumstances.

(4) Guidance on compliance with COLREGs is provided in ANNEX A.

NOTE Many of the requirements of COLREGs apply on a situational basis. For example, some requirements of COLREGs only apply when a vessel is operating in a narrow channel or in a channel separation scheme. ANNEX A identifies the requirements of COLREGs and the situations to which they apply.

Information displayed at the control station

(5) The following information must be displayed at the control station, while the vessel is operating on the surface:

(a) the vessel's present time position, depth below keel, direction and speed, recorded at an appropriate interval and accuracy to ensure safe navigation, and in compliance with relevant international conventions and standards;

(b) nearby vessels, including their position, track and speed;

(c) environmental data, including wind speed, sea state, tide, current, weather, water depth and visibility;

(d) hazards in the physical environment; and

(e) nearby ships, aircraft or persons in distress.

NOTE Requirements for recording sensor data apply – see the Chapter 6 requirements for the control station.

(6) For a vessel which operates sub-surface, the risk-based analysis must determine the information required to be displayed at the control station while the vessel is sub-surface, and the frequency with which the information must be updated.

(7) An alert system must inform the operator of any deviations from normal or expected operation of the vessel.

5.4 Minimum requirements for achieving the performance requirements

(1) This clause contains the minimum requirements that must be met in order to achieve the performance requirements contained in clause 5.3.

(2) The vessel must be fitted with sensors, systems and equipment sufficient to:

(a) provide feedback to the operator or control system of the operating state, including proper visual near vessel information;

(b) ensure that the operator or control system is able to comply with COLREGs, to the extent to which COLREGs applies to the vessel and its operations;

(c) allow the operator or control system to comply with the field of vision requirements contained in NSCV Subsection C1;

(d) determine vessel position, and comply with position fixing requirements as specified in IMO circulars, based on at least two independent methods;

(e) provide the operator or control system with information on the effects of deadweight, draught, trim, speed and under-keel clearance on turning circles and stopping distances, rudder angle, propeller revolutions, propeller pitch and thrusters;

(f) monitor the vessel's mooring and docking operations. This may require awareness of:

(i) the sides of the vessel down to the waterline;

(ii) the area between the vessel's waterline and the pier;

(iii) the area close to the stern and bow;

(iv) the pier; and

(v) mooring gear; and

(g) provide substitutes for the human senses of crew on board a vessel, including sight (visual presentations), hearing (hazards that may be detected by sound information), and other senses (vessel movements, visibility, ambient conditions (such as strong wind), fire, temperature, vibrations).

NOTE for subclause (2)(b) See ANNEX A for guidance on compliance with COLREGs.

NOTE for subclause (2)(d) See MSC.1/Circ.1575 *Guidelines for shipborne position, navigation and timing (PNT) data processing*.

(3) Equipment used to achieve the requirements of this clause may be a combination of sensors (such as CCTV, radar and lasers) and other detection technology that either give true images or electronic reproduction of the surrounding area in real or near real time.

NOTE The *Maritime Autonomous Ship Systems (MASS) UK Industry Conduct Principles and Code of Practice* provides guidance on internal sensors and external sensors and sources of data that could be used to achieve the requirements of this clause.

(4) If the sensors or systems on the vessel do not operate effectively in certain conditions, then this will limit the conditions the vessels can operate in. The accuracy of sensors should be determined through testing and a means for monitoring the performance of the sensors should be implemented. The limitations on sensors should be established and declared.

EXAMPLE For example, some sensors do not operate effectively in fog, in which case the vessel should not be operated in fog. See Chapter 12 for verification, testing and certification requirements for novel systems and their components.

(5) Limitations on the ability for data to be transferred from the vessel to the control station need to be taken into account when designing the navigation and situational awareness systems.

(6) Appropriate licences must be in place for the use of spectrum bands by navigation, situational awareness, communication and control equipment supporting the operation of the vessel.

5.5 Additional sensors on the vessels

The requirements of this Chapter apply to the sensors and systems used to meet the situational awareness and navigation performance requirements. The requirements of this Chapter do not apply to additional sensors and systems on the vessel that are mission-related and do not support the achievement of the situational awareness and navigation performance requirements.

CHAPTER 6 CONTROL SYSTEM

This chapter covers the analysis of information obtained through the navigation and situational awareness systems, planning (decision making) and the execution of those plans.

6.1 General requirements for the control system

Vessels subject to this Chapter under Table 3 and Table 4 are required to comply with the:

(a) control system performance requirements contained in clause 6.2; and

(b) control station performance requirements contained in clause 6.3.

6.2 Performance requirements for the control system

(1) The control system for the vessel must be developed through risk-based analysis conducted in accordance with Chapter 12, and must have appropriate system redundancy and diversity, as determined by the risk-based analysis.

(2) The performance requirements contained in this clause may be met through:

(a) the control system on the vessel; or

(b) a combination of the control system on the vessel and one or both of the following:

(i) the control system in the control station;

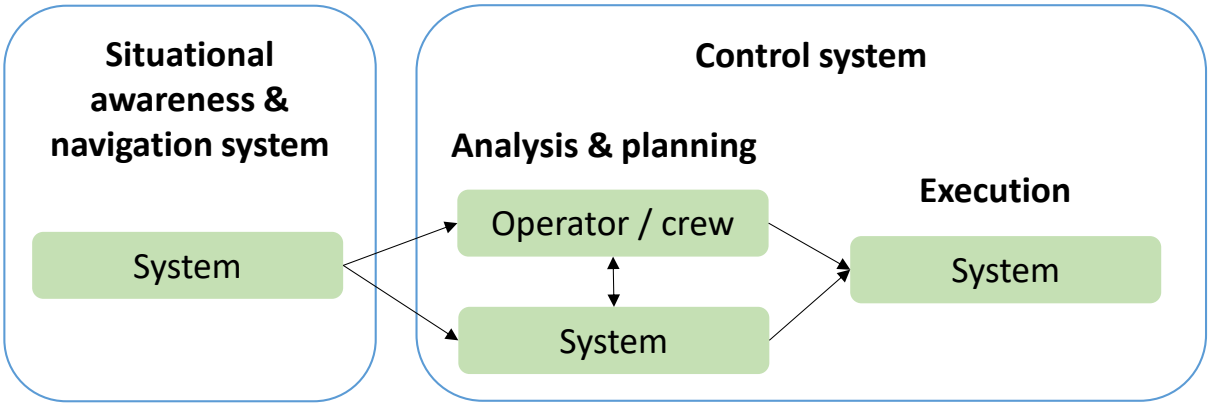
(ii) the operator and other members of crew in the control station.

NOTE The control system may be a combination of humans and systems, as shown in Figure 1. For example:

a. planning may be completed by a system but require verification (acknowledgement) by the operator before execution; or

b. the system may have limitations regarding what navigational complexities it is capable of handling, and may ask the operator to plan or execute certain actions.

Figure 1: Control system – example only



Analysis of navigation information

(3) The analysis of navigation and situational awareness information must be based on near real-time information.

(4) The operator or control system must be capable of:

(a) determining safe operating limits, safe speeds, permitted geographic areas, nearby shipping channels, nearby Green Zones and other areas of interest, expected water depth and expected water current speed and direction; and

(b) measuring hazards in the physical environment and determining the risk of collision, grounding and other dangers to navigation.

(5) The operator or control system must be able to de-conflict conflicting data provided by different sources.

Planning of navigation

(6) The mission or operation must be planned in advance.

(7) The vessel's route may be planned in advance or may be determined by the control system or operator based on the avoidance of hazards.

(8) Where the vessel's route is planned in advance, the operator or control system must enable the vessel to react to changes in its environment, including other vessels and moving objects.

NOTE The IMO Guidelines for Voyage Planning, adopted by the Organization by resolution A.893(21), provide guidance on the factors that need to be considered when mission and route planning. However, the IMO Guidelines may not include all factors relevant to mission planning for an autonomous or remotely operated vessel.

Compliance with COLREGs

(9) The control system must enable the vessel to comply with the requirements of COLREGs as applicable to the vessel and its operations.

NOTE COLREGs includes requirements for the vessel to proceed at a safe speed, determine if there is a risk of collision and take the actions required under COLREGs to avoid a collision, as well as other requirements governing the actions to be taken by the vessel in specified situations.

(10) Guidance on compliance with COLREGs is provided in ANNEX A.

NOTE Many of the requirements of COLREGs apply on a situational basis. For example, some requirements of COLREGs only apply when a vessel is operating in a narrow channel or in a channel separation scheme. ANNEX A identifies the requirements of COLREGs and the situations to which they apply.

Execution of navigation actions

(11) The control system must enable the vessel to respond in a timely, accurate and predictable manner in order to comply with COLREGs and avoid hazards or other dangers to navigation.

Role of the operator

(12) An operator must monitor the vessel at all times.

NOTE This requirement would not prevent an operator from passively monitoring the vessel, or monitoring multiple vessels. The appropriate monitoring arrangements must be determined through the risk-based analysis of the control system required to be undertaken in accordance with Chapter 12.

(13) When control system functions are completed by an operator, the operator must have the situational awareness and navigational information required to fulfil the function.

(14) Where the operator is required to acknowledge or verify a plan made by a system, the operator must have sufficient information for independent verification of the plan.

(15) When control system functions are undertaken by a system:

(a) the operator must be provided with sufficient information for independent analysis and supervision; and

(b) the operator must be able to override the autonomous control and initiate a corrective action at any time.

NOTE For a sub-surface vessel, communication limitations may prevent the operator from being able to override the autonomous control and initiate a corrective action at any time. In this case, the requirements apply when the vessel is within planned or expected communication links, including any point at which the vessel is on the surface.

Disabling and isolating the control system

(16) It must be possible to disable and isolate the control system to allow inspection and maintenance tasks to be safely performed on the vessel.

6.3 Performance requirements for the control station

(1) The control station is the set of equipment where the control and monitoring of the vessel is conducted. It may be on the vessel, on another vessel or onshore.

NOTE See also the definition of 'control station' contained in Chapter 1.

(2) The arrangements for the control station must be developed through risk-based analysis conducted in accordance with Chapter 12, and must have appropriate system redundancy and diversity, as determined by the risk-based analysis.

NOTE The arrangements of the control station must also comply with applicable work, health and safety laws. These requirements are outside of the scope of this Code of Practice.

Control station arrangements

(3) There must be a dedicated, physical area for the control station.

NOTE This does not require the location of the control station to be fixed. Control station arrangements must be determined in accordance with the risk-based analysis of the control system required to be undertaken in accordance with Chapter 12.

(4) All aspects of the control station and control system must be designed with consideration of the human-system interface:

(a) the control panel must be designed using human factors methodology; and

(b) controls must be easily identifiable and arranged in a logical way to reflect their function, means of operation and hierarchy of importance.

(5) The arrangements of the control station must be designed to eliminate or reduce to acceptable levels the risk of operator error and fatigue.

(6) For vessels in the survey, the arrangements of the control station must comply with the requirements of NSCV Section C1 that apply to the layout and design of the operating station, including the display of essential information in the operating station, and the arrangement of navigational systems and equipment in the operating station.

(7) It should not be possible for unauthorised persons to access controls located on the vessel. However, for vessels with crew on board and a remote control station, local control may be able to be initiated with approval from the control station in accordance with the communication protocols and other requirements of subclauses (14) to (16) and provided the crew member on board is appropriately qualified and trained. In addition, if appropriate under the risk assessment, it should be possible to perform emergency control on board the vessel, however on board control must not be necessary in order to bring the vessel into a safe state.

Control station data requirements

(8) Sufficient data must be provided to the control station in order for the operator to monitor the vessel and execute the analysis, planning and control functions undertaken by the operator.

(9) The data requirements for the control station must be determined in accordance with the risk-based analysis, and will include:

(a) data on the health status of the vessel and its systems;

(b) navigational and situational awareness data; and

(c) additional data needs as assessed.

NOTE See also clauses 5.3(5) and 5.3(6) on the navigational and situational awareness information that needs to be displayed at the control station.

(10) The following data must be recorded at appropriate intervals to allow for playback, must be time-stamped and must be protected from loss:

(a) the output of all sensors on which the control system is dependant; and

(b) propulsion and manoeuvring system activities.

Alerts

(11) Navigation related alerts should be managed in accordance with the Bridge Alert Management (BAM) concept as defined by the International Maritime Organisation (IMO).

(12) The operator must be alerted of any changes to normal operations, including:

(a) if the vessel exceeds the operating range limit;

(b) deviations from normal or expected operation of systems on and off the vessel, including of the navigation, situational awareness and control systems; and

(c) energy source failures.

(13) If there are persons on board the vessel, the on board crew should be alerted through alarms:

(a) where there are problems with the communications system with the control station;

(b) where a safe state for the vessel or any of its systems is being initiated; and

(c) prior to any sudden or violent manoeuvres of the vessel.

Hierarchy of control

(14) It must only be possible to control the vessel from one control station at any point in time.

(15) There must be clear processes for transfers of control between control stations and operators.

(16) There must be clear processes and communications between the control station operator and other operators or members of crew.

Managing control station risks

(17) The risk-based analysis for the control station must consider the hazards and failure risks within the control station, including the risks of power failures, fire and evacuation.

(18) Expected or anticipated failures in the control station, such as power failures, must not result in loss of normal control, supervision and situational awareness of the vessel functions under remote operation from the control station.

NOTE Appropriate system redundancy and diversity must be in place for anticipated failures. This may be achieved through the ability to hand over control to an alternative control station in the event of a failure at the control station.

(19) Potential or possible failures in the control station, such as the risk of fire and evacuation, must not prevent the appropriate contingency plan for the vessel from being determined and executed.

CHAPTER 7 COMMUNICATIONS SYSTEM

7.1 General requirements for the communications system

Vessels subject to this Chapter under Table 3 and Table 4 are required to comply with:

(a) NSCV Subsection C7B as modified by clause 7.2; and

(b) the additional communications system performance requirements contained in clause 7.3.

7.2 Application of NSCV Subsection C7B – Communications equipment

(1) A vessel with persons on board must comply with NSCV Subsection C7B in full.

(2) For a vessel without any persons on board:

(a) the required outcomes of NSCV Subsection C7B apply to the vessel, with the following modification:

(i) the methods of vessel to shore communication of a distress message or a request for assistance must be determined in accordance with the risk-based analysis required under clause 7.3; and

(b) the deemed-to-satisfy solutions of NSCV Subsection C7B apply to the vessel, with the following modifications:

(i) for type and quantity requirements, only the requirements relating to electrical energy source, antennas, ancillary equipment and signal lamps and lights, apply;

(ii) some requirements may be met through systems or arrangements off the vessel, as appropriate for the communications system for the vessel.

NOTE The type and quantity requirements of NSCV Subsection C7B that do not apply to vessels without persons on board will be informative for meeting the additional communications system performance requirements contained in clause 7.3.

7.3 Additional communications system performance requirements

NOTE For a vessel with crew on board, these performance requirements will be achieved through compliance in full with NSCV Subsection C7B and with the applicable COLREGs requirements.

(1) The communications systems for the vessel must be developed through risk-based analysis conducted in accordance with Chapter 12, and must have appropriate system redundancy and diversity, as determined by the risk-based analysis.

(2) The performance requirements contained in this clause may be met through:

(a) systems on the vessel; or

(b) a combination of systems on the vessel and one or both of the following:

(i) systems in the control station;

(ii) the operator or other personnel in the control station.

(3) The vessel must have a means of communicating with external stakeholders, including persons nearby the vessel, other vessels, mooring stations, pilot stations

and emergency services. These communication links may be provided by the control station, including a control station located on a nearby support vessel.

NOTE The methods of communication may align with the type and quantity requirements of NSCV Section C7B for an equivalent crewed vessel.

(4) The vessel must have the means to inform other vessels of its location, nature, size, course and status, while the vessel is operating on the surface. This includes the means to:

(a) display its manoeuvring limitations;

(b) control its illuminated appearance; and

(c) alert other vessels that it is in failure mode or in distress. However:

(i) any status lights used by the vessel that are not stipulated by COLREGs must not be able to be confused with signals defined in COLREGs. In particular, revolving or strobe lights should not be used except in accordance with the requirements of COLREGs; and

(ii) unless there are persons on board or nearby the vessel who require assistance, the vessel must not use the distress signals specified in Rule 37 of COLREGs. It may signal "distress" in another way which cannot be confused with signals associated with harm to or loss of life.

(5) The vessel must comply with the requirements of COLREGs as applicable to the vessel and its operations.

(6) Guidance on compliance with COLREGs is provided in ANNEX A.

NOTE The requirements of COLREGs apply on a situational basis. For example, many of the rules concerning lights apply to vessels operating between sunset and sunrise or in times of restricted visibility. ANNEX A identifies the requirements of COLREGs and the situations to which they apply.

(7) The communication link between the vessel and the control station should be available, secure and capable of supporting the functions undertaken by the operator. The risk of loss of communications, and the ability of the operator to undertake the functions assigned to the operator, including vessel monitoring, must be reduced to a level as low as reasonably practicable.

NOTE Where communication between the control station and the vessel is lost, including the loss of passive monitoring by the control station, the vessel must autonomously execute the appropriate contingency plan for the vessel. This may involve placing the vessel into a safe state, such as an emergency stop. See Chapter 11 for the contingency planning requirements.

7.4 Minimum requirements for achieving the performance requirements

Communicating with stakeholders near the vessel

(1) The vessel must be physically identified, so that persons nearby the vessel can contact the owner if necessary. Physical identification of the vessel must include one of more of the following:

(a) a unique vessel identifier;

(b) the name of the owner displayed on the outside of the vessel;

(c) a relevant contact phone number on the outside of the vessel.

NOTE for subclause (1)(a) The unique vessel identifier is issued by AMSA as part of the certification process. The unique vessel identifier must be displayed on the outside of the vessel in accordance with the requirements of the National Law Act, subject to any applicable exemption.

NOTE for subclause (1)(c) The relevant contact number may be the contact number of the operator, the control station or the owner.

(2) It may be necessary for the vessel to have a means of communicating with persons nearby the vessel, for example through a loudspeaker.

Communicating with other vessels

(3) The vessel should be fitted with AIS transceivers.

NOTE The AIS may be in the control station or on the vessel. Whether or not the vessel is capable of two-way communication will depend on the risk assessment undertaken as part of the development of the communications system on the vessel in accordance with Chapter 12. At minimum, the AIS should allow the vessel to broadcast information about its status to other vessels fitted with AIS.

Communicating with mooring stations, pilot stations and emergency services

(4) The means of communicating with mooring stations, pilot stations and emergency services must be two-way communication between the third parties and the vessel or the control station.

Communicating with the control station

(5) The means of communication between the vessel and the control station must consider maximum bandwidth, latency requirements, cyber security, interfaces, and prioritisation of data in case of insufficient bandwidth.

CHAPTER 8 FIRE SAFETY SYSTEMS

8.1 General requirements for fire safety systems

(1) A vessel subject to this Chapter under Table 4 must comply with NSCV Subsection C4.

(2) For a vessel with no persons on board, the modifications to NSCV Subsection C4 contained in clause 8.2 apply.

(3) All vessels powered by batteries or novel fuels must comply with clause 8.3.

8.2 Performance requirements for vessels with no persons on board

(1) The vessel must comply with all of the required outcomes of NSCV Subsection C4.

NOTE Vessels subject to clause 8.2 do not carry persons on board. As such, the required outcomes of NSCV Subsection C4 that relate to the reduction or elimination of the exposure of persons to the smoke or heat of a fire on board the vessel may be met partially through the removal of persons from the vessel. However, when addressing these required outcomes, consideration should be given to the risk of fire while persons are on board servicing the vessel, or on board for any other reason, and to the exposure of other persons nearby the vessel to smoke or heat generated by a fire on board the vessel.

(2) The vessel must comply with all applicable deemed-to-satisfy solutions of NSCV Subsection C4, with the following modifications:

(a) controls for remote shutoffs for fuel oil supply and for ventilation and exhaust fans must be located in the control station as defined in Chapter 1 of this Code of Practice, unless they are controlled autonomously by systems on the vessel;

(b) all fire dampers must either:

(i) be of a fail-safe automatic closing type; or

(ii) be capable of being remotely closed from the control station as defined in Chapter 1 of this Code of Practice; or

(iii) meet both (i) and (ii) if required under NSCV Subsection C4.

(c) fire alarms must be capable of being monitored from the control station as defined in Chapter 1 of this Code of Practice;

(d) the limitations on the automatic release of fire-extinguishing medium for a fixed fire extinguishing system do not apply. However, the automatic release of fire-extinguishing medium must be used only in accordance with the standard that applies to the fixed fire extinguishing system under NSCV Subsection C4 and a risk assessment which considers the safety of any persons who may be in the space while the vessel is docked or at any other time;

(e) controls for fixed fire extinguishing systems must be located in the control station as defined in Chapter 1 of this Code of Practice, in addition to the locations on the vessel required under NSCV Subsection C4; and

(f) a risk assessment must be undertaken to determine whether fixed fire extinguishing systems need to be installed in enclosed spaces containing fire hazards, beyond the requirements of NSCV Section C4, in order to achieve the same performance outcomes as the deemed-to-satisfy solutions of NSCV Section C4. The risk assessment must be reviewed by an accredited marine

surveyor or a Recognised Organisation. Fixed fire extinguishing systems must be installed in accordance with the NSCV Section C4 requirements and in any additional locations determined by the risk assessment.

NOTE The deemed-to-satisfy solutions of NSCV Section C4 include requirements for fire appliances (fire equipment that requires a human operator to deploy and control the item when manually fighting a fire). These arrangements rely on crew on board the vessel using the equipment to contain a fire when one is detected. In order to achieve the same performance outcomes on a vessel with no persons on board, fire appliances required under the deemed-to-satisfy solutions of NSCV Section C4 may need to be replaced with the installation of fixed fire extinguishing systems in more spaces on the vessel containing fire hazards than is required by the deemed-to-satisfy solutions of NSCV Section C4. The need for, and location of, fixed fire extinguishing systems beyond the requirements of NSCV Section C4, must be determined through a risk assessment. Input into, and review of, the risk assessment by an accredited marine surveyor or Recognised Organisation is required.

(3) Where a vessel departs from the deemed-to-satisfy requirements of NSCV Subsection C4, the departure or alternative solution must be:

(a) demonstrated to be least as effective as compliance with the deemed-to-satisfy solution of NSCV Subsection C4, given the vessel and its intended operations; and

(b) developed through risk-based analysis conducted in accordance with Chapter 12, and must have appropriate system redundancy, as determined by the risk-based analysis.

8.3 Vessels powered by batteries and novel fuels

Vessels powered by batteries or novel fuels are currently not accommodated in the standards for conventional vessels and may be considered to be novel vessels by AMSA. As a result, a Recognised Organisation may be required to certify the battery arrangements, including housing, ventilation and fire safety arrangements for the batteries.

NOTE Advice from AMSA should be sought on the requirements for a vessel powered by novel fuels, including batteries.

CHAPTER 9 ENGINEERING, ELECTRICAL AND AUXILIARY SYSTEMS

9.1 General requirements for engineering, electrical and auxiliary systems

(1) Vessels subject to this Chapter under Table 4 must comply with NSCV Subsection C5 as modified by clause 9.2.

(2) A vessel with no engineering crew on board must also meet the additional engineering, electrical and auxiliary system performance requirements contained in clause 9.3.

NOTE This chapter applies to vessels in survey that are <35m in length. A vessel ≥35m in length must comply with the requirements of a Recognised Organisation for engineering, electrical and auxiliary systems – see Table 4.

9.2 Application of NSCV Subsection C5 – Engineering

NSCV Subsection C5 required outcomes

(1) The vessel must comply with all of the required outcomes of NSCV Section C5.

NSCV Subsection C5 deemed-to-satisfy solutions

(2) The vessel must comply with all of the deemed-to-satisfy solutions of NSCV Subsection C5, subject to the following modifications for a vessel with no engineering crew on board:

(a) for NSCV Section C5A (Machinery):

(i) engine shutdown, as well as the override of the automatic shutdown system, must be able to be actioned from the control station, and by crew on board the vessel (in accordance with the requirements of NSCV Section C5A) where appropriate in accordance with risk-based analysis;

(ii) monitoring requirements must be met through arrangements that allow the monitoring to be conducted from the control station;

(iii) alarms required to indicate abnormal conditions must alert the operator and other crew in the control station, as well as any crew on board the vessel; and

(iv) steering arrangement requirements (view from the helm while in the normal steering position) may be met through compliance with Chapter 5 and Chapter 6 where there are no deck crew on board the vessel and the vessel is operated or monitored from a control station that is not on board the vessel;

(b) NSCV Section C5B (Electrical):

(i) electrical system monitoring requirements must be met through arrangements that allow the monitoring to be conducted from the control station; and

(ii) in addition to the requirements for emergency electrical installations contained in NSCV Section C5B, emergency power sources must be capable of:

A. automatically coming into effect or being started or brought into service from the control station;

B. simultaneously supplying the following equipment and systems (in addition to the equipment and systems specified in NSCV Section C5B) with power for the periods specified for other equipment and systems in NSCV Section C5B:

I. telemetry and other location tracking equipment;

II. the communication, control and other systems required to place and maintain the vessel in a safe state, and to receive and execute recovery commands if the vessel is positioned to recovery itself; and

C. for a vessel with no persons on board, consideration should be given to whether the emergency lighting requirements of NSCV Section C5B are appropriate, or whether alternative or additional areas should be illuminated in order for the operator to obtain a sufficient situational awareness in an emergency situation;

(c) NSCV Section C5C (LPG systems for appliances):

(i) system monitoring and alarm requirements (such as gas detection and alarm systems) must be met through arrangements that allow the monitoring to be conducted from the control station, as well as alerting any crew on board the vessel; and

(ii) valve shut-off requirements must be capable of being actioned at the control station as well as by crew on board the vessel where appropriate in accordance with risk-based analysis.

NOTE There are no changes to the deemed-to-satisfy requirements of NSCV Section C5D (LPG systems for engines).

9.3 Additional performance requirements for engineering, electrical and auxiliary systems

(1) The engineering electrical and auxiliary systems developed to meet the requirements of this clause must be developed through risk-based analysis conducted in accordance with Chapter 12, and must have appropriate redundancies, as determined by the risk-based analysis.

(2) All relevant engineering functions traditionally carried out by crew on board must either:

(a) be automated; or

(b) carried out by the operator or other members of crew in the control station where the responsible engineering watch is located.

NOTE For a vessel operating close to shore, the role of engineering crew on board the vessel may be managed through collection of the vessel within a reasonable period. This needs to be considered through the risk-based analysis of the engineering system. In addition, some functions of engineering crew on board, such as general maintenance, which do not need to be undertaken during a voyage, do not need to be automated or carried out from the control station.

(3) To compensate for the lack of engineering crew on board, the vessel must have:

(a) sophisticated diagnostic functions which monitor the condition of the engineering systems; and

(b) additional redundancies and function restorations.

NOTE for subclause (3)(a) Sophisticated diagnostic functions (beyond the requirements of the NSCV) may not be necessary for short duration voyages and other voyages where mission abort and vessel retrieval for repair is acceptable. This will need to be addressed in the risk-based analysis conducted in accordance with subclause (1) .

(4) Any automation systems for engineering functions traditionally carried out by crew on board must be located on board and must not be affected by communication failures.

9.4 Meeting the additional performance requirements for engineering, electrical and auxiliary systems

(1) The failure of active components of the engineering, electrical and auxiliary systems should not cause the significant loss of functions. Any failures of active components must be compensated for by redundancies, fault tolerance and automatic functionality, which allow the vessel to continue the planned voyage, possibly at a reduced speed or reduced capability.

NOTE Redundancies (beyond those required by the NSCV) may not be necessary where justified by compensating factors, such as where the vessel is used only for short duration voyages and other voyages where mission abort and vessel retrieval for repair is acceptable. This will need to be addressed in the risk-based analysis conducted in accordance with subclause 9.3(1).

(2) Where there is a failure caused by flooding, fire or external events, the control system on the vessel must be able to determine and execute the appropriate contingency plan.

9.5 Vessels powered by batteries and novel fuels

Vessels powered by batteries or novel fuels are currently not accommodated in the standards for conventional vessels, and may be considered to be novel vessels by AMSA. As a result, a Recognised Organisation may be required to certify the battery arrangements, including housing, ventilation and fire safety arrangements for the batteries.

NOTE Advice from AMSA should be sought on the requirements for a vessel powered by novel fuels, including batteries.

CHAPTER 10 ANCHOR SYSTEMS

10.1 General requirements for anchor systems

(1) Vessels subject to this Chapter under Table 4 must comply with NSCV Subsection C7D.

NOTE This Chapter applies to vessels in survey that are <35m in length. A vessel ≥35m in length must comply with the requirements of a Recognised Organisation for anchor systems – see Table 4.

(2) A vessel subject to this Chapter under Table 4 which does not have crew on board who are capable and qualified to operate anchoring systems must also comply with the additional performance requirements contained in clause 10.2.

(3) A vessel without any persons on board may apply for an equivalent solution to NSCV Subsection C7D and clause 10.2 provided it can be demonstrated that the alternative solution:

(a) is at least as effective as compliance with the requirements of NSCV Subsection C7D and clause 10.2, given the vessel and its intended operations;

(b) does not result in an increased risk to other vessels, third parties or the environment; and

(c) is capable of deployment:

(i) from the control station; and

(ii) through an automated system if deployment of the system is necessary in order to execute one of the defined contingency plans for the vessel.

EXAMPLE A vessel without any persons on board may have a ‘stay in place’ or ‘position keeping’ system in lieu of an anchor, provided the system has appropriate redundancies and will ensure that the vessel can maintain its position in an emergency situation, such electrical failure or loss of power.

10.2 Additional performance requirements for vessels without crew on board

(1) The anchor system developed to meet the requirements of this clause must be developed through risk-based analysis conducted in accordance with Chapter 12, and must have appropriate redundancy, as determined by the risk-based analysis.

(2) The anchor system on the vessel must be capable of deployment:

(a) from the control station; and

(b) through an automated system if deployment of the system is necessary in order to execute one of the defined contingency plans for the vessel.

CHAPTER 11 CONTINGENCY PLANNING AND VESSEL RECOVERY

11.1 General requirements for contingency planning

Vessels subject to this Chapter under Table 3 and Table 4 must comply with the performance requirements contained in clause 11.2.

11.2 Performance requirements for contingency planning

(1) The contingency plans for the vessel developed to meet the requirements of this clause must be developed through risk-based analysis conducted in accordance with Chapter 12, and must have appropriate redundancies, as determined by the risk-based analysis.

Contingency plans

(2) A contingency plan must be defined for the whole voyage and all situations that may occur, including any deviation from normal operation. Each contingency plan involves placing the vessel into a state in which it poses the least risk to life, the environment and property. The contingency plan may involve entering the vessel, or its systems, into a safe state.

NOTE The appropriate contingency plan will depend on the vessel, where its operating and the issue or fault that has occurred. See clause 11.3 for guidance on contingency planning.

(3) Where a contingency plan is executed, it should be accompanied by the appropriate sound and visual signals from the vessel, as required by Chapter 7.

(4) The operator must be able to initiate any contingency plan at any time from the control station.

NOTE 1 For a sub-surface vessel, it may not be possible to initiate a contingency plan from the control station when the vessel is outside of communication links. In order to manage the risks of these vessels, a higher number of conditions or events may need to be programmed into the control system of the vessel, so that the vessel autonomously executes the appropriate contingency plan where the conditions or events occur.

NOTE 2 The control station means the place the officer in charge of navigation watch is at any point in time and from which the vessel is being controlled or monitored – see the definitions in Chapter 1. This may be onshore or on a support vessel.

(5) The appropriate contingency plan for the whole of the voyage must be planned and implemented in the vessel's autonomous system prior to departure.

(6) The operating system on the vessel must be able to autonomously determine and execute the appropriate contingency plan in response to specified events, including:

(a) the loss of communication between the control station and the vessel, including the loss of passive supervision by the control station;

(b) any serious malfunctions of the navigation, situational awareness or control systems on the vessel; and

(c) if the vessel exceeds the operating range limit.

NOTE 1 Where a vessel is operating sub-surface, and communications are lost where expected communications do not occur – see clause 11.3 below.

NOTE 2 It may also be appropriate to include an emergency stop system on board the vessel.

Vessel retrieval

(7) In the event that the vessel stops operating, the vessel must be retrieved as soon as practicable, taking into account the location of the vessel, the risks posed by the vessel to other waterway users and the potential impact of the vessel on the environment.

NOTE 1 Pollution, dumping and wreck laws prohibit autonomous or remotely operated vessels from being abandoned at sea in the case that they stop operating or where communication signals are lost. See for example: *Environment Protection (Sea Dumping) Act 1981* and Commonwealth, State and Territory marine safety laws and the Protection of the Sea Acts which provide AMSA with powers over wrecks that are causing environmental damage.

NOTE 2 The vessel will likely need to provide some means for other vessels (such as tugs) to attach towing lines.

(8) For the purposes of this Code of Practice, a vessel 'stops operating' if:

(a) it is no longer capable of carrying out its mission, and also not capable of returning to its point of departure; or

(b) communications with the vessel are lost; or

(c) a contingency plan is executed and the vessel is incapable of continuing the voyage or mission without intervention.

NOTE See below for guidance on when communications with the vessels may be considered to be 'lost'.

(9) In order to comply with the requirement to retrieve the vessel within a reasonable period, the operator must be able to monitor or track the vessel when the main communication links are lost. Communication redundancies should be independently powered.

NOTE See also Chapter 7 which requires communications systems with the control station to have appropriate redundancies. This requires consideration to be given to the risks of a loss of power at the control station, as well as on the vessel.

(10) The safety management system must identify the means through which other waterway users will be informed if the vessel stops operating. This may involve one or more of the following:

(a) informing AMSA;

(b) informing marine rescue;

(c) informing the local Vessel Traffic Service (VTS) authority;

(d) alerting other waterway users of the navigational status of the vessel through AIS transceivers;

(e) alerting other waterway users through VHF.

NOTE The appropriate lights, sounds and signals must also be displayed indicating vessel status if the vessel stops operating – see Chapter 7.

(11) Unless there are persons on board or nearby the vessel who require assistance, the vessel must not use the distress signals specified in Rule 37 of COLREGs. It may signal "distress" in another way which cannot be confused with signals associated with harm to or loss of life.

11.3 Guidance on contingency planning

The appropriate contingency plan

(1) The appropriate contingency plan for the vessel will depend on where the vessel is operating and the type of failure that has occurred.

(2) For a vessel operating on or below the surface, the contingency plan could involve one or more of the following:

(a) the vessel moving to a quieter or calmer area, or to deeper water;

(b) the vessel maintaining its position ('safe position hold');

(c) disabling the vessel's engines (stopping vessel propulsion); or

(d) full shut down of all systems on the vessel, for example in the case of a fire.

(3) For a sub-surface vessel, the contingency plan could also involve:

(a) the vessel floating to the surface, if it is unlikely to encounter other waterway users as a result of the location or area of operation, or if it can be collected within a short period (because, for example, it is accompanied by a support vessel);

(b) the vessel maintaining a specified distance below the surface until collected, if it is likely to encounter other waterway users or is unable to be collected within a short period; or

(c) the vessel sinking to the bottom if:

(i) it is capable of being collected from the bottom; and

(ii) it may be a danger to other waterway users if it floated or if it remained a specified distance below the surface.

(4) In some circumstances, the contingency plan could involve initiating a safe return for the vessel.

NOTE A vessel can encounter hazards, or may present a hazard to third parties, on the return journey. A safe return should only be initiated in appropriate circumstances.

Lost communication

(5) When determining lost communication, the availability, integrity and continuity of the communications must be considered.

(6) For vessels which operate sub-surface and are not expected to be in constant communication with the control station, communications with the vessel are considered to be lost where planned communication windows with the control station are missed.

(7) For vessels in constant communications with the control station, communications are lost when all methods of communication fail for a period specified in the emergency response plan for the vessel.

NOTE 1 The appropriate period will depend on the risks of the vessel and its operations. The risk assessment must consider the period after which it would pose unacceptably high risks to other vessels, third parties or the environment for the vessel to be operating without communication with the control station. For example, for a remotely operated vessel in a waterway with other waterway users, communications may be considered lost after only a few seconds.

NOTE 2 The appropriate contingency plan may depend on how long communications are lost for. For example, the vessel may begin to slow down after a specified period of lost communication, and

then position hold if communications remain lost after a further specified period. This needs to be considered and determined in the emergency response plan for the vessel.

CHAPTER 12 RISK ASSESSMENT, VERIFICATION, TESTING AND CERTIFICATION FOR NOVEL SYSTEMS

12.1 General requirements

For vessels subject to this chapter under Table 3 and Table 4:

(a) all systems on and for the vessel which do not meet the conventional vessel standards, as well as the navigation and situational awareness system, control system, communications system, fire safety system, contingency system and any other system that is required to be developed through risk-based analysis, must be:

(i) developed in accordance with clause 12.2; and

(ii) tested in accordance with clause 12.3;

(b) any system on or for the vessel that includes software or complex electronic hardware must comply with the requirements of clause 12.4; and

(c) the cyber security requirements of clause 12.5 apply.

12.2 Risk-based analysis

(1) A risk assessment must be completed for the system and all sub-systems which identifies and assesses the likelihood and impact of potential system failures on the vessel, on other vessels, on third parties and on the environment, using an appropriate, recognised methodology.

(2) All relevant hazards should be identified in preparation of the risk assessment.

NOTE See IMO circular MSC-MEPC.2/Circ.12/Rev.2 *Revised Guidelines for Formal Safety Assessment (FSA) for use in the IMO Rule-Making Process* for guidance on hazard identification.

(3) Recognised methodologies for undertaking the risk assessment include:

(a) Failure Mode Effects Analysis (FMEA);

(b) Failure Mode Effects and Criticality Analysis (FMECA);

(c) Fault Tree Analysis (FTA);

(d) Event Tree Analysis (ETA);

(e) Crisis Intervention and Operations Analysis (CRIOP), for systems involving remote operations from a control station; and

(f) Operating and Support Hazard Analysis (O&SHA), for systems involving remote operations from a control station.

NOTE Examples and procedure for FMEA are included in the guidance materials provided to support this Code of Practice, Annex C of NSCV Subsection F1C and the High-Speed Craft Code Annex 4. Guidance on risk assessment techniques is also contained in IEC 31010 – Risk management – Risk assessment techniques.

(4) The risk assessment must assume that the system will fail in the following failure modes:

(a) complete loss of function;

(b) rapid change to maximum or minimum output;

(c) uncontrolled or varying output;

(d) premature operation;

(e) failure to operate at a prescribed time; and

(f) failure to cease operation at a prescribed time.

(5) The risk assessment must determine that the risks associated with any likely failure of any of the systems will remain within the acceptable range.

NOTE Engineered solutions for controlling risk are preferred over operational solutions.

12.3 Verification, testing and certification

(1) Testing must be conducted to ensure that the system, and its sub-systems, meets its design objectives and complies with the requirements of this Code.

(2) The level of verification, testing and certification required for a system or components of a system (including the software, materials and equipment of the system) must be determined through the risk assessment for that system and the impact of a failure of the system or its components.

(3) The guidance on the degree of testing, verification and certification required for different systems contained in one of the following codes must be considered when determining verification, testing and certification requirements:

(a) *Lloyd's Register Code for Unmanned Marine Systems*; and

(b) the *Maritime Autonomous Ship Systems (MASS) UK Industry Conduct Principles and Code of Practice*

NOTE 1 The LR Code is available on the Lloyd's Register website: Lloyd's Register – Assurance, Certification, Inspection, Training (lr.org). Section 6 and Annex B of the LR Code outlines the appropriate verification method for different systems on the vessel.

NOTE 2 The UK Code for MASS is available on the Maritime UK website at: https://www.maritimeuk.org. See Chapter 12 of the 2021 version of the UK Code for MASS.

(4) An accredited marine surveyor or Recognised Organisation with the knowledge and skills to verify the outcomes must witness tests or trials.

NOTE 1 The DNV GL Class Guidelines, *Autonomous and remotely operated ships*, provides information on the kinds of tests and trials that should be undertaken, and the tests and trials required to be witnessed.

NOTE 2 Where a survey-exempt vessel, due to its size, speed and shape, poses a very low risk to the safety of persons and other vessels should a failure occur, it may be appropriate for tests and trials to be witnessed by a competent person who is not an accredited marine surveyor or a Recognised Organisation. A competent person is a person who has acquired, through training, qualifications and/or experience, the knowledge and skills to verify the tests or trials for the vessel, or for one or more systems or sub-systems on the vessel. The competent person may be an employee of the organisation only where the organisation has a sufficient depth of expertise for the person witnessing the tests or trials to do so with a sufficient level of impartiality. However, for most survey-exempt vessels, the tests or trials must be witnessed by an accredited marine surveyor or a Recognised Organisation.

NOTE 3 Advice from AMSA should be sought on the survey and verification requirements for vessels in survey. AMSA may require the trials to be witnessed by a Recognised Organisation.

NOTE 4 Operators should also refer to the IMO MSC Interim Guidelines for MASS Trials, MSC.1/Circ.1604, when planning and conducting autonomous and remotely operated vessel trials.

(5) Guidance on testing requirements, and evidence of compliance, for compliance with the applicable COLREGs requirements is provided in ANNEX A.

12.4 Software integrity requirements

(1) Software used on the vessel or as part of the vessel's systems must be developed in accordance with one or more appropriate software development standard(s).

(2) The appropriate standard will depend on the risk assessment for the system in which the software is used and the impact of a failure of the system.

NOTE IMO Circular 1512 contains requirements for the development of software, and the management of the software throughout its life, for use in e-navigation. The guidance and standards specified in IMO Circular 1512 could also be applied to software development for maritime systems beyond e-navigation. In addition, IEC 61508 Functional safety of electrical/electronic/programmable electronic safety-related systems provides a standard for ensuring the functional safety of software.

(3) The standard(s) used must include requirements for:

(a) quality assurance processes for the development, production, installation and modification of software-based systems on the vessel;

(b) testing requirements and processes, including after production and post installation;

(c) configuration control;

(d) protection of the system against:

(i) intentional or unintentional viruses or unauthorised code;

(ii) corruption as a result of loss of power;

(iii) unauthorised installation, change, or deletion of software or associated data;

(iv) installation or use of unauthorised software;

(v) unauthorised modification of the software; and

(e) software failure and degradation analysis.

(4) Complex electronic hardware used on the vessel or as part of the vessel's systems must also be developed in accordance with one or more appropriate development standards.

12.5 Cyber security

(1) The vessel must have cyber security measures to protect navigation and situational awareness systems, control systems (including steering and routing / waypoint generation) communications systems and contingency systems, and any other vital or vulnerable systems on the vessel, as far as practicable and necessary.

(2) Protection against cyber security threats must be determined and implemented in accordance with a cyber security analysis which identifies:

(a) possible security vulnerabilities and their effects on the vital systems and the performance of the vessel; and

(b) measures to be undertaken to reduce risks as to an acceptably low level.

(3) The cyber security measures must address the vulnerabilities and threats, and contain the elements, described in the IMO Guidelines MSC-FAL.1/Circ.3 5 July 2017.

CHAPTER 13 SURVEYS AND REVIEW OF RISK ASSESSMENT

13.1 Survey requirements for vessels in survey

(1) Vessels subject to this Chapter under Table 4 must comply with the initial and periodic survey requirements contained in Part 2 of the *National Law – Marine Surveyors Accreditation Guidance Manual 2014*.

NOTE Advice from AMSA should be sought on the survey requirements for autonomous and remotely operated vessels in survey. AMSA may require the surveys to be undertaken by a Recognised Organisation.

(2) It is recommended that vessels subject to this Chapter under Table 4 prepare the documentation listed in ANNEX B to support the design and construction of the vessel and its systems, and to support the initial survey process.

13.2 Verification of risk assessments

For vessels subject to this Chapter under Table 3 and Table 4, the risk-based analysis undertaken in accordance with Chapter 12 must be reviewed and verified by an accredited marine surveyor or a Recognised Organisation who has the knowledge and skills to verify the risk-based analysis for the vessel, or for one or more systems or sub-systems on the vessel.

NOTE 1 Where a survey-exempt vessel, due to its size, speed and shape, poses a very low risk to the safety of persons and other vessels should a failure occur, it may be appropriate for the risk-based analysis to be reviewed by a competent person who is not an accredited marine surveyor or a Recognised Organisation. A competent person is a person who has acquired, through training, qualifications and/or experience, the knowledge and skills to verify the risk-based analysis for the vessel, or for one or more systems or sub-systems on the vessel. The competent person may be an employee of the organisation only where the organisation has a sufficient depth of expertise for the person undertaking the review to do so with a sufficient level of impartiality. However, for most survey-exempt vessels, the risk-based analysis must be verified by an accredited marine surveyor or a Recognised Organisation.

NOTE 2 Advice from AMSA should be sought on the verification requirements for vessels in survey. AMSA may require the risk assessments to be verified by a Recognised Organisation.

13.3 Maintenance and repair

(1) All vessels subject to this Chapter under Table 3 and Table 4 must have a maintenance plan which outlines how each system will be monitored, diagnosed, maintained and repaired.

(2) Independent verification should be undertaken to provide assurance that the vessel remains compliant to this Code throughout its life.

CHAPTER 14 OPERATIONS

14.1 General requirements

Vessels subject to this chapter under Table 3 and Table 4 are required to comply with the:

(a) safety management system requirements contained in clause 14.2;

(b) minimum crewing and crew competency requirements contained in clause 14.4; and

(c) voyage planning and allocation of responsibility contained in clause 14.5.

14.2 Safety management system requirements

(1) A safety management system must be prepared and implemented for the vessel which:

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

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

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

(d) is kept in the control station for the vessel.

NOTE 1 These requirements align with the requirements of Marine Order 504 (as in force on 8 October 2021) for there to be a safety management system in place for all domestic commercial vessels. Marine Order 504 also requires the operational requirements that apply to the vessel (under Marine Order 504) to be addressed in the safety management system.

NOTE 2 For the meaning of *reasonably practicable* — see section 27 of the National Law Act

(2) The safety management system for the vessel must comply with the following requirements of Marine Order 504 for a safety management system:

(a) vessel and contact detail requirements;

(b) risk assessment requirements;

(c) owner's responsibility and authority statement requirements;

(d) designated person requirements;

(e) master's responsibility and authority statement requirements;

(f) resources and personnel. However:

(i) the minimum crewing requirements are also considered in clause 14.4 below;

(ii) references to on board operations and on board duties include offboard operations and duties; and

(iii) the requirements relating to first aid certification do not apply to vessels which do not carry any persons;

(g) procedures for on board operations. However, the reference to 'on board operations' includes 'on board and offboard operations';

(h) emergency plan. However:

(i) the assembly station requirements do not apply to a vessel which does not carry any persons; and

(ii) procedures must also be developed for responding to the loss of control of the vessel;

(i) follow-up on hazardous occurrences and non-conformances;

(j) maintenance of vessel and equipment;

(k) documentation. However, 'crew members' includes operators and crew in the control station; and

(l) verification, review and evaluation.

NOTE for subclause (2)(f)(iii) Occupational health and safety laws contain requirements on the provision of first aid in the workplace. These requirements would apply to the control station.

NOTE for subclause (2)(h) The emergency plan will connect with the contingency planning requirements of Chapter 11.

(3) In addition to the requirements of Marine Order 504, the safety management system for the vessel must address the following:

(a) the need for a support vessel to manage the risks of the vessel to other persons, vessels and the environment;

(b) the means through which other waterway users will be alerted as to the presence of the vessel, including any permissions required from the relevant waterway manager or harbour master as well the need for a notice to mariners to be issued;

(c) for a vessel that is not built to carry persons, the safety of persons on board the vessel while it is docked or at any other time, including persons on board to undertake repairs or maintenance of the vessel;

(d) vessel data recording; and

(e) cyber security measures.

NOTE for subclause (3)(a) This does not require all vessels to have a support vessel. The need for a support vessel must be considered as part of the safety management system for the vessel.

NOTE for subclause (3)(d) The UK Code for MASS contains guidance on vessel data recording. It is available on the Maritime UK website at: https://www.maritimeuk.org. See Chapter 5 of the 2020 version of the UK Code for MASS.

14.3 Guidance on meeting the safety management system requirements

(1) This section sets out guidance for the development of the safety management system required for vessels in this category.

Informing the waterway manager and other waterway users

(2) A key aspect of the safety management system is ensuring that the vessel does not pose a danger to other waterway users. Informing, and obtaining required permissions from, the waterway manager, and informing other waterway users of the presence of the vessel will be part of managing this risk.

(3) The safety management system must include processes for ensuring compliance with requirements for the owner of the vessel to inform, and if applicable, obtain permission from, the relevant waterway manager or harbour master and marine rescue agencies, of the vessel's intended operations.

NOTE The 'owner' includes the company or organisation that is operating the vessel if they are taken to have 'overall management and control of the vessel' – see the definition of 'owner' in clause 1.4 of this Code of Practice.

(4) The appropriate means of alerting other waterway users will depend on:

(a) the circumstances of the operation and the area in which it is operating. For example, a vessel operating close to shore will be more likely to encounter recreational waterway users, who may not have AIS and may be less experienced. A vessel operating out at sea, will encounter more commercially operated vessels which will be more likely to have AIS; and

(b) the requirements of the relevant waterway manager or harbour master.

(5) Means of informing of waterway users include:

(a) signs at boat ramps;

(b) notices to mariners; and

(c) AIS transceivers. The AIS used to communicate with other waterway users may be on the vessel or on the parent or support vessel.

NOTE Also see Chapter 7 for communications system requirements, including AIS.

Vessel visibility

NOTE Visibility requirements may not apply to defence vessels, provided the safety of other waterway users is managed through other arrangements.

(6) The visibility of the vessel needs to be considered, in order to ensure that other waterway users are alerted to the presence of the vessel and to reduce the risks posed by the vessel to other waterway users.

(7) For a sub-surface vessel, these risks apply particularly to the vessel while it is operating on the surface, and when it is in the process of diving or surfacing. However, a sub-surface vessel operating below the surface in shallow waters may also pose a danger to other waterway users.

(8) In order to ensure that the vessel is visible to other waterway users, it may be appropriate to:

(a) paint the vessel in high-visibility colours. This will also make the vessel easier to retrieve;

(b) comply with the applicable COLREGs requirements for lights during daylight hours; and

(c) have status lights to indicate operating mode, for example 'safe mode', 'local control', 'remote control', 'failure mode'.

NOTE When determining the appropriate status lights, the requirements of COLREGs should be considered. For example, COLREGs includes requirements for a 'vessel not under command'. In addition, any status lights used by the vessel that are not stipulated by COLREGs must not be able to be confused with signals defined in COLREGs. In particular, revolving or strobe lights should not be used except in accordance with COLREGs. See clause 7.3(4)(c)(i).

14.4 Minimum crewing and crew competencies

Monitoring arrangements (minimum crew)

(1) The vessel must be monitored by an operator at all times.

(2) The level of monitoring, and number of crew responsible for operating and monitoring the vessel, must be determined through an appropriate crewing assessment undertaken by the owner in accordance with Marine Order 504.

NOTE The appropriate crewing assessment determines the appropriate training and qualifications for the person(s) operating or monitoring the vessel, as well as the number of persons required to safely operate the vessel. The minimum crewing table of Marine Order 504 (as at February 2022) identifies the minimum crewing for a vessel <12m as 1 certificated person, for a vessel 12m to <35m as 2 persons (including 1 to 2 certificated persons, depending on the certificates held and engine size) and for a vessel 35m to <55m as 3 persons (including 2 to 3 certificated persons, depending on the certificates held). This is subject to change, refer to Marine Order 504 for the latest requirements.

(3) In addition to the factors specified in Marine Order 504 that must be taken into account in the appropriate crewing determination, consideration must be given to the following factors:

(a) competence required for navigation planning;

(b) competence required for navigation watchkeeping, including any contingency required for complex and emergency situations;

(c) competence required for monitoring and ship handling, including any contingency required for complex situations;

(d) skills required to diagnose and maintain information technologies used on the vessel and on shore; and

(e) qualifications, experience and licences required to operate radio and other communication, situational awareness or navigation equipment fitted on, or forming part of the systems of, the vessel.

NOTE Marine Order 504 requires the master or a deck watchkeeper to be qualified to operate the radio or other communication equipment fitted on the vessel. The owner of an autonomous or remotely operated vessel must ensure this requirement is met – for example, by ensuring that the operator is qualified to operate the radio or other communication equipment fitted on the vessel and/or in the control station.

Crew qualifications and training

(4) The appropriate qualifications and training for the operator and any other members of crew must also be determined through the appropriate crewing assessment undertaken in accordance with Marine Order 504.

(5) At minimum, the operator must have:

(a) the certificate of competency that would permit the person to operate an equivalent crewed vessel; and

(b) additional training or certification relevant to the monitoring or control of an autonomous or remotely operated vessel; and

(c) vessel-specific operational training.

NOTE The requirement for the operator to hold a certificate of competency reflects the requirements of the National Law Act and Marine Order 504 for all domestic commercial vessels. Where a survey-exempt autonomous or remotely operated vessel, due to its size, speed and shape, and the area in which it is operating, poses a very low risk to the safety of persons and other vessels

should a failure occur, a commercial qualification may not be necessary. Advice should be sought on this issue from AMSA.

14.5 Voyage planning and allocation of responsibility

The division of control and responsibility between control systems, the operator and other members of crew must be defined for each stage in the voyage and each task involved in the operation of the vessel.

NOTE The UK Code for MASS contains guidance on tasking cycles for autonomous and remotely operated vessels, including an example tasking cycle, as well as the division of responsibility between different personnel involved in the operation of the vessel. The UK Code is available on the Maritime UK website at: https://www.maritimeuk.org. See Chapter 11 of the 2020 version of the UK Code for MASS.

ANNEX A COLREGS GUIDANCE FRAMEWORK

A1 Framework Use

The framework translates the stated and unstated capabilities described, and the terminology used, in the Rules of COLREGs into a vocabulary and format that is suitable for consideration of autonomous and remotely operated vessels. It is intended to be an enabling framework to:

- Help vessel designers understand what capabilities COLREGs requires vessels to have.
- Help operators understand what capabilities COLREGs requires and how mission planning can mitigate or remove the need for solving some of the more complex elements of COLREGs.
- Help regulators apply a consistent methodology for assessing the capability of a vessel with regards to COLREGs.

A2 Autonomous Surface Vessels (ASVs)

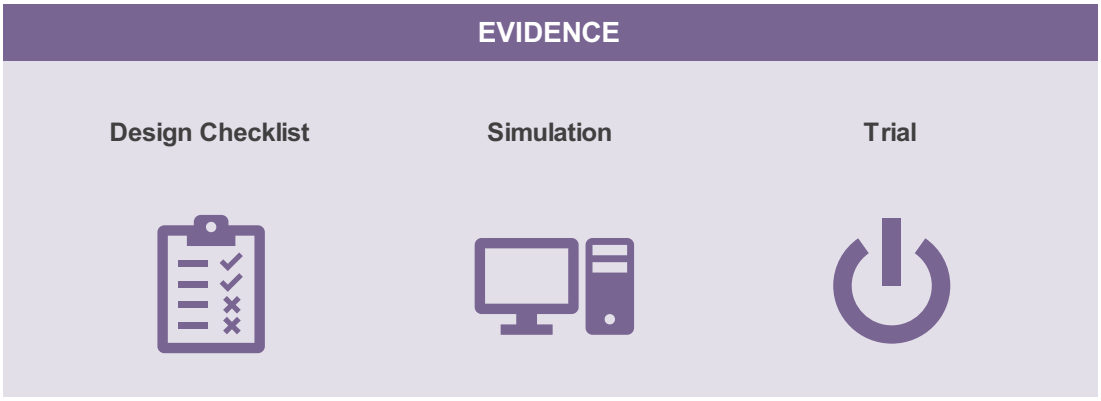
Information provided in the framework can be used by designers and operators to assess the capability of their vessel with regards to COLREGs and the mission types that they are considering. Designers and operators are free to choose whether a specific capability will be provided onboard, remotely through human oversight, or a combination of both.

Where capabilities cannot feasibly be achieved or by preference, then the framework proposes mission constraints which can be implemented to mitigate or eliminate scenario specific risk risks.

A3 Autonomous and Remotely Operated Marine Equipment

Autonomous and Remotely Operated Marine Equipment is a category of vessel that due to its size or form cannot feasibly respond to the Rules of COLREGs. COLREGs does consider this scenario and offers two vessel status exceptions which protect unable vessels from having to give-way, “vessels not under command” and “vessels restricted in their ability to manoeuvre”. This category is aimed at small, slow-moving vessels that are likely to be operating in littoral waters and which pose a low risk to other water users.

A4 Evidence Types Key



Design checklist

This symbol denotes Rules where it is proposed that an element of design appraisal could support a claim of compliance. The functional capabilities and the equipment and systems required to deliver them can be recorded and assessed as meeting the needs of that Rule. It is intended to publish a proforma checklist to assist stakeholders in making consistent judgements.

Simulation and land testing

Simulation is proposed as the primary evidence format used to observe and evaluate the situational awareness and subsequent logical decision making used to control the vessel. It is a readily available, system agnostic, and scalable method of observing system behaviour.

Sea trials

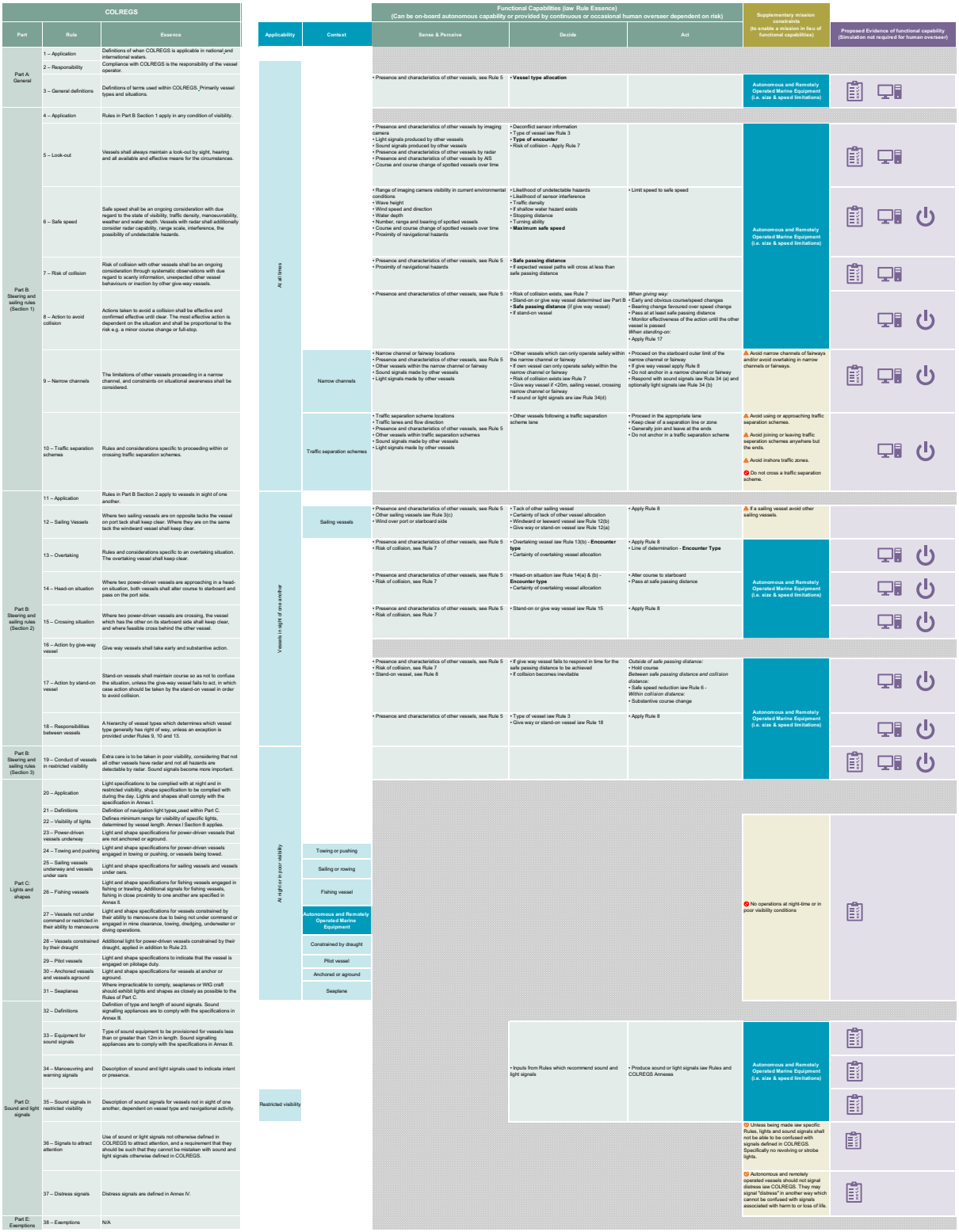
Sea trials are live trials that validate the vessels' ability to action the decisions made to avoid collision as required. The consistent, accurate, correct, and predictable actioning of the appropriate Rule items by the vessel would constitute a successful sea trial. Successful demonstration of these items provides confidence to operators and the broader maritime community that the vessel will act in a COLREGs compliant manner.

A5 COLREGs Guidance Framework

This framework supports a practical and appropriate level of compliance for autonomous vessels. The framework is best viewed as a standalone document with the accompanying key and printed at an A3 size. The COLREGs Guidance Framework is shown on the following page and is also downloadable online.

Snapshot of the COLREGs Guidance Framework

Full version available on the TAS website



COLREGS			Applicability	Context	Functional Capabilities (law Rule Essence) (Can be on-board autonomous capability or provided by continuous or occasional human overseer dependent on risk)			Supplementary mission constraints (to enable a mission in lieu of functional capabilities)	Proposed Evidence of functional capability (Simulation not required for human overseer)
Part	Rule	Essence			Sense & Perceive	Decide	Act		
Part A: General	1 – Application	Definitions of when COLREGS is applicable in national and international waters.							
	2 – Responsibility	Compliance with COLREGS is the responsibility of the vessel operator.							
	3 – General definitions	Definitions of terms used within COLREGS. Primarily vessel types and situations.	At all times		• Presence and characteristics of other vessels, see Rule 5	• **Vessel type allocation**		Autonomous and Remotely Operated Marine Equipment (i.e. size & speed limitations)	
Part B: Steering and sailing rules (Section 1)	4 – Application	Rules in Part B Section 1 apply in any condition of visibility.							
	5 – Look-out	Vessels shall always maintain a look-out by sight, hearing and all available and effective means for the circumstances.			• Presence and characteristics of other vessels by imaging camera • Light signals produced by other vessels • Sound signals produced by other vessels • Presence and characteristics of other vessels by radar • Presence and characteristics of other vessels by AIS • Course and course change of spotted vessels over time	• Deconflict sensor information • Type of vessel law Rule 3 • **Type of encounter** • Risk of collision - Apply Rule 7		Autonomous and Remotely Operated Marine Equipment (i.e. size & speed limitations)	
	6 – Safe speed	Safe speed shall be an ongoing consideration with due regard to the state of visibility, traffic density, manoeuvrability, weather and water depth. Vessels with radar shall additionally consider radar capability, range scale, interference, the possibility of undetectable hazards.			• Range of imaging camera visibility in current environmental conditions • Wave height • Wind speed and direction • Water depth • Number, range and bearing of spotted vessels • Course and course change of spotted vessels over time • Proximity of navigational hazards	• Likelihood of undetectable hazards • Likelihood of sensor interference • Traffic density • If shallow water hazard exists • Stopping distance • Turning ability • **Maximum safe speed**	• Limit speed to safe speed		
	7 – Risk of collision	Risk of collision with other vessels shall be an ongoing consideration through systematic observations with due regard to scanty information, unexpected other vessel behaviours or inaction by other give-way vessels.			• Presence and characteristics of other vessels, see Rule 5 • Proximity of navigational hazards	• **Safe passing distance** • If expected vessel paths will cross at less than safe passing distance			
	8 – Action to avoid collision	Actions taken to avoid a collision shall be effective and confirmed effective until clear. The most effective action is dependent on the situation and shall be proportional to the risk e.g. a minor course change or full-stop.			• Presence and characteristics of other vessels, see Rule 5	• Risk of collision exists, see Rule 7 • Stand-on or give way vessel determined iaw Part B • **Safe passing distance** (if give way vessel) • If stand-on vessel	*When giving way:* • Early and obvious course/speed changes • Bearing change favoured over speed change • Pass at least safe passing distance • Monitor effectiveness of the action until the other vessel is passed *When standing-on:* • Apply Rule 17		
	9 – Narrow channels	The limitations of other vessels proceeding in a narrow channel, and constraints on situational awareness shall be considered.		Narrow channels	• Narrow channel or fairway locations • Presence and characteristics of other vessels, see Rule 5 • Other vessels within the narrow channel or fairway • Sound signals made by other vessels • Light signals made by other vessels	• Other vessels which can only operate safely within the narrow channel or fairway • If own vessel can only operate safely within the narrow channel or fairway • Risk of collision exists iaw Rule 7 • Give way vessel if <20m, sailing vessel, crossing narrow channel or fairway • If sound or light signals are iaw Rule 34(d)	• Proceed on the starboard outer limit of the narrow channel or fairway • If give way vessel apply Rule 8 • Do not anchor in a narrow channel or fairway • Respond with sound signals iaw Rule 34 (a) and optionally light signals iaw Rule 34 (b)	⚠ Avoid narrow channels of fairways and/or avoid overtaking in narrow channels or fairways.	
	10 – Traffic separation schemes	Rules and considerations specific to proceeding within or crossing traffic separation schemes.		Traffic separation schemes	• Traffic separation scheme locations • Traffic lanes and flow direction • Presence and characteristics of other vessels, see Rule 5 • Other vessels within traffic separation schemes • Sound signals made by other vessels • Light signals made by other vessels	• Other vessels following a traffic separation scheme lane	• Proceed in the appropriate lane • Keep clear of a separation line or zone • Generally join and leave at the ends • Do not anchor in a traffic separation scheme	⚠ Avoid using or approaching traffic separation schemes. ⚠ Avoid joining or leaving traffic separation schemes anywhere but the ends. ⚠ Avoid inshore traffic zones. ⛔ Do not cross a traffic separation scheme.	
Part B: Steering and sailing rules (Section 2)	11 – Application	Rules in Part B Section 2 apply to vessels in sight of one another.	Vessels in sight of one another						
	12 – Sailing Vessels	Where two sailing vessels are on opposite tacks the vessel on port tack shall keep clear. Where they are on the same tack the windward vessel shall keep clear.		Sailing vessels	• Presence and characteristics of other vessels, see Rule 5 • Other sailing vessels iaw Rule 3(c) • Wind over port or starboard side	• Tack of other sailing vessel • Certainty of tack of other vessel allocation • Windward or leeward vessel iaw Rule 12(b) • Give way or stand-on vessel iaw Rule 12(a)	• Apply Rule 8	⚠ If a sailing vessel avoid other sailing vessels.	
	13 – Overtaking	Rules and considerations specific to an overtaking situation. The overtaking vessel shall keep clear.			• Presence and characteristics of other vessels, see Rule 5 • Risk of collision, see Rule 7	• Overtaking vessel iaw Rule 13(b) - **Encounter type** • Certainty of overtaking vessel allocation	• Apply Rule 8 • Line of determination - **Encounter Type**	Autonomous and Remotely Operated Marine Equipment (i.e. size & speed limitations)	
	14 – Head-on situation	Where two power-driven vessels are approaching in a head-on situation, both vessels shall alter course to starboard and pass on the port side.			• Presence and characteristics of other vessels, see Rule 5 • Risk of collision, see Rule 7	• Head-on situation iaw Rule 14(a) & (b) - **Encounter type** • Certainty of overtaking vessel allocation	• Alter course to starboard • Pass at safe passing distance		
	15 – Crossing situation	Where two power-driven vessels are crossing, the vessel which has the other on its starboard side shall keep clear, and where feasible cross behind the other vessel.			• Presence and characteristics of other vessels, see Rule 5 • Risk of collision, see Rule 7	• Stand-on or give way vessel iaw Rule 15	• Apply Rule 8		
	16 – Action by give-way vessel	Give way vessels shall take early and substantive action.							
	17 – Action by stand-on vessel	Stand-on vessels shall maintain course so as not to confuse the situation, unless the give-way vessel fails to act, in which case action should be taken by the stand-on vessel in order to avoid collision.			• Presence and characteristics of other vessels, see Rule 5 • Risk of collision, see Rule 7 • Stand-on vessel, see Rule 8	• If give way vessel fails to respond in time for the safe passing distance to be achieved • If collision becomes inevitable	*Outside of safe passing distance:* • Hold course *Between safe passing distance and collision distance:* • Safe speed reduction iaw Rule 6 - *Within collision distance:* • Substantive course change	Autonomous and Remotely Operated Marine Equipment (i.e. size & speed limitations)	
	18 – Responsibilities between vessels	A hierarchy of vessel types which determines which vessel type generally has right of way, unless an exception is provided under Rules 9, 10 and 13.			• Presence and characteristics of other vessels, see Rule 5	• Type of vessel law Rule 3 • Give way or stand-on vessel law Rule 18	• Apply Rule 8		
Part B: Steering and sailing rules (Section 3)	19 – Conduct of vessels in restricted visibility	Extra care is to be taken in poor visibility, considering that not all other vessels have radar and not all hazards are detectable by radar. Sound signals become more important.	At night or in poor visibility						
Part C: Lights and shapes	20 – Application	Light specifications to be complied with at night and in restricted visibility, shape specification to be complied with during the day. Lights and shapes shall comply with the specification in Annex I.							
	21 – Definitions	Definition of navigation light types used within Part C.							
	22 – Visibility of lights	Defines minimum range for visibility of specific lights, determined by vessel length. Annex I Section 8 applies.							
	23 – Power-driven vessels underway	Light and shape specifications for power-driven vessels that are not anchored or aground.							
	24 – Towing and pushing	Light and shape specifications for power-driven vessels engaged in towing or pushing, or vessels being towed.		Towing or pushing					
	25 – Sailing vessels underway and vessels under oars	Light and shape specifications for sailing vessels and vessels under oars.		Sailing or rowing					
	26 – Fishing vessels	Light and shape specifications for fishing vessels engaged in fishing or trawling. Additional signals for fishing vessels, fishing in close proximity to one another are specified in Annex II.		Fishing vessel					
	27 – Vessels not under command or restricted in their ability to manoeuvre	Light and shape specifications for vessels constrained by their ability to manoeuvre due to being not under command or engaged in mine clearance, towing, dredging, underwater or diving operations.		Autonomous and Remotely Operated Marine Equipment				⛔ No operations at night-time or in poor visibility conditions	
	28 – Vessels constrained by their draught	Additional light for power-driven vessels constrained by their draught, applied in addition to Rule 23.		Constrained by draught					
	29 – Pilot vessels	Light and shape specifications to indicate that the vessel is engaged on pilotage duty.		Pilot vessel					
	30 – Anchored vessels and vessels aground	Light and shape specifications for vessels at anchor or aground.		Anchored or aground					
	31 – Seaplanes	Where impracticable to comply, seaplanes or WIG craft should exhibit lights and shapes as closely as possible to the Rules of Part C.		Seaplane					
Part D: Sound and light signals	32 – Definitions	Definition of type and length of sound signals. Sound signalling appliances are to comply with the specifications in Annex III.							
	33 – Equipment for sound signals	Type of sound equipment to be provisioned for vessels less than or greater than 12m in length. Sound signalling appliances are to comply with the specifications in Annex III.							
	34 – Manoeuvring and warning signals	Description of sound and light signals used to indicate intent or presence.							
	35 – Sound signals in restricted visibility	Description of sound signals for vessels not in sight of one another, dependent on vessel type and navigational activity.	Restricted visibility			• Inputs from Rules which recommend sound and light signals	• Produce sound or light signals iaw Rules and COLREGS Annexes	Autonomous and Remotely Operated Marine Equipment (i.e. size & speed limitations)	
	36 – Signals to attract attention	Use of sound or light signals not otherwise defined in COLREGS to attract attention, and a requirement that they should be such that they cannot be mistaken with sound and light signals otherwise defined in COLREGS.						⚠ Unless being made iaw specific Rules, lights and sound signals shall not be able to be confused with signals defined in COLREGS. Specifically no revolving or strobe lights.	
	37 – Distress signals	Distress signals are defined in Annex IV.						⚠ Autonomous and remotely operated vessels should not signal distress iaw COLREGS. They may signal "distress" in another way which cannot be confused with signals associated with harm to or loss of life.	
Part E: Exemptions	38 – Exemptions	N/A							

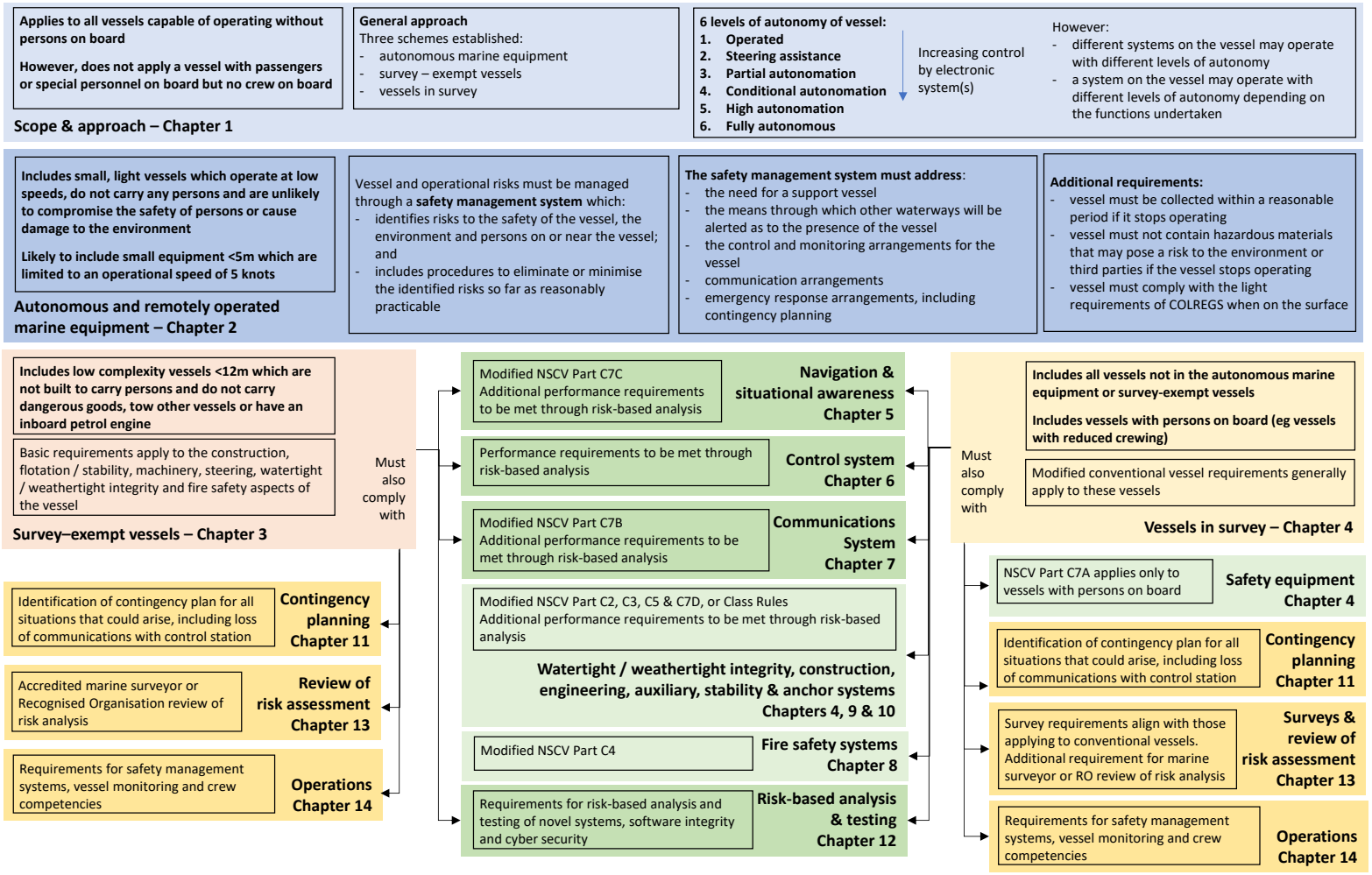
ANNEX B DOCUMENTATION REQUIREMENTS

B1 Concept of operations

For a vessel in survey, a concept of operations must be prepared which:

(a) defines the vessel, including:
  (i) ship type;
  (ii) mass;
  (iii) operational speed and maximum speed;
(b) identifies the intended operations of the vessel, including operation type;
(c) identifies the intended operational area for the vessel as well as its environmental limits, including:
  (i) operating depths;
  (ii) wave heights; and
  (iii) maximum and minimum sea and air temperatures;
(d) provides an overview of the following systems on the vessel, including:
  (i) means of propulsion;
  (ii) means of buoyancy control;
  (iii) means of navigation and collision avoidance;
  (iv) means of power generation;
  (v) means of power storage;
  (vi) methods of communications with the vessel;
(e) defines the tasks that will be covered by:
  (i) autonomous systems; or
  (ii) operators who are not on board the vessel;
(f) identifies the means of monitoring the health of on-board systems;
(g) details the presence of crew, special personnel or persons on board the vessel;
(h) defines the contingency plans for the vessel and means of recovery; and
(i) contains maintenance and survey plans.

ANNEX C OVERVIEW OF THE AUSTRALIAN CODE OF PRACTICE



TRUSTED AUTONOMOUS SYSTEMS

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