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AUSTRALIAN NAVAL CLASSIFICATION AUTHORITY MANUAL (VOLUME 2)

DIVISION 5: REMOTE AND AUTONOMOUS SYSTEMS

SECTION 0: GENERAL

CHAPTER 01: GENERAL REQUIREMENTS

PART 1: ANC RULES

This document is issued for use by Defence and Defence Industry personnel and is effective forthwith.

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[1]   https://www.legislation.gov.au/Series/C1968A00063

[2]   https://www.legislation.gov.au/Series/C2004A04868

[3]   https://www.legislation.gov.au/Series/C2004A03712

[4]   http://drnet/AssociateSecretary/security/policy/Pages/dspf.aspx

AUSTRALIAN NAVAL CLASSIFICATION RULES

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[5] https://www.defence.gov.au/business-industry/industry-governance/australian-naval-classification-authority/australian-naval-classification-rules

AMENDMENTS

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Division 5, Section 0, Chapter 01,
Part 1

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Division 5: Remote and Autonomous Systems (RAS) Rules
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Chapter 01: General Requirements

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Rule 0.　　Scope and Application

0.1　　This Section details the structure for Remote and Autonomous Systems (RAS) and the system design requirements which apply to all other Sections of this Division.

0.2　　If there is a conflict between the requirements of this Division and the requirements in another Division or Chapter of the ANC Rules, the ANC Authority shall decide which requirements take precedence.

0.3　　This Division applies to Naval Vessels, as defined in Division 1 Annex A *Definitions and Abbreviations*. Where the term RAS vessel is used, it is taken as meaning a Naval Vessel capable of being remotely operated or operating autonomously without crew members onboard.

Rule 1.　　Definitions of RAS Vessel Types

1.1　　Sections of this Division apply to the definitions of RAS vessel types as presented in Table 1 below.

Table 1: Applicability of Division 5 Sections to Remote and Autonomous Systems vessel types

RAS Vessel Type	Definition	Applicable Section of Division 5
Remotely Operated Vehicle	An uncrewed vessel designed to operate via a physical tether on the surface of the water, in the water column or on the sea floor.	Section 1
Autonomous Underwater Vehicle	A self-propelled vessel designed to operate underwater without a tether and whose operation is either fully autonomous or under minimal supervisory control.	Section 2
Small Uncrewed Surface Vessel	A self-propelled vessel of less than 24m in length overall, designed to operate on the surface of the water without a physical tether and whose operation is either fully autonomous, under minimal supervisory control or remotely operated.	Section 3
Large Uncrewed Surface Vessel	A self-propelled vessel of 24m in length overall or greater, designed to operate on the surface of the water without a physical tether and whose operation is either fully autonomous, under minimal supervisory control or remotely operated.	Section 4
Novel RAS	Any RAS vessel with an unconventional design, construction, installation, or operation. Example - a RAS system that operates in the water column or water surface and transition into the air for a minor component of its mission.	Acceptance of the arrangements shall be agreed with the ANC Authority

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1.2   The Naval Vessel Operator (NVO) shall, based on the RAS system's main mode of operation and primary function, present and justify the RAS vessel type as per Table 1 and the corresponding Section of Division 5 to which compliance will be demonstrated.

1.3   Examples.

1.3.1   A RAS system of 6m in length overall that operates for a majority of its mission on the surface of the water but partially submerges for a limited timeframe shall be defined as a Small USV and therefore comply with Section 3 and shall not be defined as an AUV and comply with Section 2.

1.3.2   A RAS system of 25m length overall shall be defined as a Large USV and shall therefore comply with Section 4.

1.4   In the event a RAS vessel that is of novel construction, design or mode of operation does not fully accord to a specific RAS type defined in Table 1, the NVO shall present and justify the requirements of a Recognised Organisation to which compliance will be demonstrated.

1.5   The ANC Authority shall have the final approval of the NVO's RAS vessel type and compliance requirements.

1.6   The following RAS systems are not within the scope of Division 5:

1.6.1   AUV with embarked personnel.

Note: AUVs with embarked personnel are considered to be submersible craft and are therefore subject to Division 7 *Submarine and Submersible Craft*.

1.6.2   RAS systems that operate entirely in the air domain or operates in the air domain for the majority of its mission. Such systems shall refer to *Defence Aviation Safety Design Requirements Manual* and *Defence Aviation Safety Authority regulations*.

1.6.3   Consumer-grade RAS vessels that are used for non-military purposes. For example:

1.6.3.1 A briefcase ROV used for inspection of a ship's underwater fittings or the identification of an object fouling a ship's anchor or propeller, or similar purpose.

Rule 2.   RAS Maturity Level

2.1   The RAS Maturity Level that define the capabilities of RAS vessels are presented in Tables 2, 3 and 4 below. The RAS Maturity Level of a RAS vessel is determined by the NVO from information listed in the Operating and Support Intent (OSI) and it is used elsewhere in the Division to specify performance requirements. The RAS Maturity Level of a RAS vessel is comprised of three components: Remote Monitoring, Remote Control and Autonomy.

2.2   Remote Monitoring. The ability of the end user to remotely monitor the RAS vessel's system performance and status (on-board), and occurrences in the external (off-board) environment surrounding the vessel from a remote command station or interface. Remote Monitoring Levels of RAS Vessels are listed below in Table 2.

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Table 2: Remote Monitoring Levels of RAS Vessels

Remote Monitoring Level	Description
RM0 - No remote monitoring	It is not possible to remotely monitor operation of the RAS vessel. For example: a "set and forget" disposable AUV.
RM1 - Critical Monitoring	Remote monitoring of the RAS vessel is possible for the systems critical information only. For example: heartbeat signals, system status (normal operations, error, emergency mode).
RM2 - Internal Systems Monitoring	In addition to critical monitoring functionality, it is possible to remotely monitor the RAS vessel's sub-systems. For example, fire monitoring system, bilge or pressure vessel status, battery or fuel levels.
RM3 - Basic Situational Awareness	In addition to monitoring of internal systems, it is possible to remotely monitor the basic situational awareness of the RAS vessel through obtaining data such as its GPS position, heading, speed, depth, or basic information on tracks and contacts detected by onboard sensors such and contact heading, speed and relative position from RAS vessel.
RM4 - Advanced Situational Awareness	In addition to monitoring basic situational awareness information, it is possible to remotely monitor the advanced situational awareness of the RAS vessel through obtaining data such as sensor feeds, additional contact information such as video and audio feeds.

2.3   Remote Control: The ability for an end-user to control the RAS vessel's navigation, engineering, sensors and operation. Remote Control Levels of RAS Vessels are listed below in Table 3.

Table 3: Remote Control Levels of RAS Vessels

Remote Control Level	Description
RC0 – No Remote Control	There is no ability for remote control of the RAS vessel.
RC1 - Remote Operations - Emergency Mode	An end user only has the ability to initiate an emergency mode of operation for the RAS vessel to ensure safety. For example: Cancel an AUV mission, stop the propulsion of a USV.
RC2 - Remote Manoeuvring	In addition to emergency mode functionality, an end user is able to remotely control the basic manoeuvring of the RAS vessel through systems including steering and propulsion. For example: When on the surface, an AUV can be given basic commands (forward, reverse, turn to port and starboard) from a short-range transmitter.
RC3 – Partial Remote Operations	In addition to remote manoeuvring functionality, an end user is able to remotely control intermediate level functionality of the RAS vessel's navigation and operation. For example: turn navigation lights on and off (if fitted), change settings of onboard sensors.
RC4 – Full Remote Operations.	In addition to remote partial operations functionality, an end user is able to remotely control all aspects of the RAS vessel's navigation and operations.

	For example: starting auxiliary generators, bow thrusters, launching or recovery of sensors or equipment.

2.4   Autonomy: The context-specific ability of the RAS vessel to autonomously perform dynamic navigation tasks and to operate in a navigational environment without monitoring, supervision, or input from a human end user. For this purpose, the following terms and definitions are applied:

2.4.1   "Context-specific": Confined navigational conditions such as navigation in confined waters such as riverine areas, harbours or identified shipping channels through areas of protected reefs as well as the vessel arrangements to support autonomous operations. The context includes the infrastructure relevant for autonomous vessels, for example, the type and capacity of available communications networks.

2.4.2   "Dynamic navigation tasks": The set of tactical RAS vessel operations, such as operation of the rudder apparatus, propulsion or anchor winches. The complexity of these tasks depends upon the context considered (for example, the manipulation of anchor winches can be excluded where the use of anchors is forbidden anyway).

2.4.3   "Navigational environment": Fixed and dynamic conditions affecting navigation, such as the shape of a waterway, the water level, weather conditions, visibility, amount and frequency of vessel traffic, and other factors.

2.4.4   "Collision avoidance": The critical task in responding to environmental conditions (other vessels, bridges, navigational hazards etc.).

2.4.5   "Onboard system automation": The ability of the RAS to autonomously control or interact with other systems onboard essential to meeting the OSI.

2.4.6   Autonomy Levels of RAS Vessels are listed below in Table 4.

Table 4: Autonomy Levels of RAS Vessels

Autonomy Level	Description
A0 - No autonomous capability	All aspects of RAS vessel's dynamic navigation and operation are performed by a human end user even if enhanced by warning or decision support tools. For example: A small ROV requiring end user inputs for all navigation and control from a Human Machine Interface (HMI).
A1 - Partial autonomous capability	The context-specific performance of navigation and operational tasks by the RAS vessel using certain information about the navigational and operational environment, with the expectation that the end user performs all remaining aspects of the dynamic navigation and operation of the RAS Vessel. For example: waypoint navigation and track-keeping particularly with regards to adherence to specified times.
A2 - Conditional autonomous capability	The sustained context-specific performance of all dynamic navigation tasks, including collision avoidance, and certain operational tasks by the RAS vessel with the expectation that the end user will be receptive to the vessel's requests to intervene and to system failures, and will respond appropriately. For example: A USV conducting a waypoint mission that actively analyses its environment and changes path planning or waypoints to avoid a collision.
A3 - High autonomous capability	The sustained context-specific performance of all dynamic navigation tasks and operations with limited expectation of an end user responding to a request to intervene. For example: A USV with goal-based missions, human starts the loop and monitors the status of multiple systems.
A4 – Fully Autonomous	The sustained and unconditional performance of all dynamic navigation tasks and operations, without expecting an end user will respond to a request to intervene. For example, an end user starts the loop system where the RAS is given a goal and trusted to complete it without intervention.

Rule 3.   Application of RAS Maturity Level

3.1   The capability of a RAS vessel increases with higher levels of RAS Maturity Level. For example:

3.1.1   A USV system, less than 24m in length, with a Remote Monitoring level of 4 - Advanced Situational Awareness, shall also provide end users with the functionality provided by Remote Monitoring levels 1 - Critical Monitoring, 2 - Internal Systems Monitoring and 3 - Basic Situational Awareness.

3.2   Minimum RAS levels

3.2.1   The NVO shall ensure that the RAS Maturity Level of the RAS vessel and its supporting command and control system allows safe achievement of the operations listed in the vessel's OSI.