



Australian Government

MARH034 Demonstrate fundamental knowledge of Autonomous Maritime Systems (AMS) operations

Release: 1

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Modification History

Release 1. This is the first release of this unit of competency in the MAR Maritime Training Package.

Application

This unit involves the skills and knowledge required to demonstrate fundamental knowledge of Autonomous Maritime Systems (AMS) operations.

This includes explaining elements of risk that apply to AMS operations, critical elements involved in AMS operations, elements and process of mission planning, importance of and interplay between post-mission analysis and vehicle performance analysis; outlining regulatory framework and rules that govern AMS operations and best-practices for data management; and determining immediate and longer-term future for AMS.

This unit applies to people working in the maritime industry in the capacity of:

- Autonomous Underwater Vehicles (AUV) and Autonomous Surface Vessel (ASV) Operators
- AUV and ASV Technicians
- a person managing, leading, or supporting AMS operations.

This unit applies to AUV and ASV operations being conducted in Near Coastal (NC) waters within the limits of the operators AMSA Certificate of Competency.

Licensing/Regulatory Information

No licensing, legislative or certification requirements apply to this unit at the time of publication.

Pre-requisite Unit

Not applicable.

Competency Field

H – Navigation

Unit Sector

Not applicable.

Elements and Performance Criteria

ELEMENTS

PERFORMANCE CRITERIA

Elements describe the essential outcomes.

Performance criteria describe the performance needed to demonstrate achievement of the element.

1. Explain elements of risk that apply to AMS operations

1.1 Hazards for AMS operations are identified

1.2 Key challenges for AMS insurance and liability are identified

1.3 Important lessons learned from historical case studies of AMS loss and/or damage are outlined

2. Outline regulatory framework and rules that govern AMS operations

2.1 Regulatory framework for the Australian Maritime Safety Authority (AMSA) and AMS operations is outlined

2.2 Implementation of AMSA regulations for 'autonomous operation' is explained

2.3 Implementation of AMSA regulations for 'underwater' operations is explained

3. Explain critical elements involved in AMS operations

3.1 Key personnel and roles in AMS operations are outlined

3.2 Key equipment and key phases in AMS operations are outlined

3.3 Critical factors in AMS search and rescue are explained

4. Explain elements and process of mission planning

4.1 Sources of navigational charts are identified, and key information extracted

4.2 Core elements of mission planning software are outlined

4.3 Principles of depth-controlled (ASV and AUV) and altitude-controlled (AUV) missions are explained

4.4 Key elements of mission execution and monitoring are outlined

5. Explain the importance of

5.1 Use of post-mission analysis to assess mission success

and interplay between post-mission analysis and vehicle performance analysis		and refine data collection is explained
	5.2	Use of vehicle performance analysis to assess AMS behaviour and improve mission outcomes is explained
6. Apply practical approaches to undertaking complex AMS missions	6.1	Best practises for planning AMS operations around infrastructure are determined and outlined
	6.2	Best practises for planning AMS operations in strong currents are determined and outlined
	6.3	Best practises for planning AUV missions over submerged riverbeds are determined and outlined
	6.4	Best practises for planning AUV missions over steep terrain are determined and outlined
7. Outline best-practices for data management	7.1	Fundamental principles of documenting metadata are identified
	7.2	Fundamental principles of data storage and backup are identified.
8. Determine immediate and longer-term future for AMS	8.1	Next generation of AMS, including sensors, are identified
	8.2	Challenges for multi-platform campaigns are determined

Foundation Skills

Foundation skills essential to performance are explicit in the performance criteria of this unit of competency.

Range of Conditions

Range is restricted to essential operating conditions and any other variables essential to the work environment.

Non-essential conditions may be found in the MAR Maritime Training Package Companion Volume Implementation Guide.

Unit Mapping Information

This is a new unit. No equivalent unit.

Links

Companion Volume Implementation Guides are found in VETNet -

<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=772efb7b-4cce-47fe-9bbd-ee3b1d1eb4c2>

Assessment Requirements for MARH034 Demonstrate fundamental knowledge of Autonomous Maritime Systems (AMS) operations

Modification History

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Performance Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements and performance criteria on at least one occasion and include:

- describing best practise Autonomous Underwater Vehicles (AUV) mission planning to account for submerged riverbeds, steep terrain, strong currents and maritime infrastructure
- describing the complexities around Autonomous Maritime Systems (AMS) insurance and the concept of 'self-insurance'
- describing the core functions of mission planning software, including key interactions with AMS
- describing the key phases, equipment requirements and personnel roles in AMS operations
- describing the process for obtaining standard navigational charts, maps and navigation aids and how to read critical information to inform mission planning
- explaining the different rationales for depth-controlled vs altitude-controlled transects/missions for AUV operations
- identifying factors that can result in AMS mission failure and loss, including weather, currents, navigation, support vessel, traffic, obstacles, power, sensors, propulsion and developing a contingency plan addressing these factors
- identifying potential liabilities associated with AMS operations
- outlining fundamental work health and safety (WHS)/occupational health and safety (OHS) risks associated with the standard operating procedures for AMS
- outlining the importance of post-mission analysis and vehicle performance analysis and their interplay
- outlining the key challenges that will face AMS operators with multi-platform and cross-platform operations
- outlining the principles underpinning best practise data management
- using charts to support mission planning.

Knowledge Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements and performance criteria and include knowledge of:

- best practice data management techniques, including:

- backup and storage
- intra-mission data quality checks
- metadata records
- sensor calibration files
- best practise mission planning techniques to account for:
 - maritime infrastructure
 - steep terrain for AUV operations
 - strong currents
 - submerged riverbeds for AUV operations
- core elements of mission planning software for commonly used for AMS operations, including:
 - depth and altitude settings for AUV operations
 - importing navigational charts
 - mow-the-lawn surveys
 - setting start and endpoints
 - setting waypoints and transects
 - speed settings
 - target acquisition surveys
- critical team elements and roles for AMS operations, including:
 - deck operations (launch and recovery) specialist
 - lead mission controller
 - operator
 - payload specialist
 - technical specialist
- critical elements of search and rescue, including:
 - additional location sources
 - cost
 - currents
 - drop-weight release timing
 - last known position
 - operational window for support vessel
 - remotely operated vehicle support
- documentation and records for AMS operations, including the content and purpose of:
 - Australian Maritime Safety Authority (AMSA) requirements
 - incident reports
 - logbooks, including fault logs
 - metadata
 - risk assessment
- evolution and current state of AMSA's regulatory framework for AMS, including:
 - autonomous operations

- underwater operations
- factors to be included in contingency plans where applicable, including:
 - AMS failures
 - compromised survey area or recovery point
 - emergency departure of support vessel
 - position reference failures
 - unknown terrain
 - weather and sea state
- hazards and risks to be considered when conducting AMS operations, including:
 - currents and tides
 - launch and recovery
 - lithium polymer batteries and recharging
 - manager error
 - maritime infrastructure
 - operator error
 - other vessels including other AMS
 - overhead objects
 - seafloor and submerged objects
 - weather and sea-state
- key historical AMS case studies involving damage, liability, loss and recovery and total loss
- key challenges for AMS operators in the future, including:
 - conducting cross-platform campaigns
 - conducting multi-platform campaigns
 - integrating new and emerging AMS technologies, including sensors
- key information from charts to inform mission planning, including:
 - confidence levels
 - depths
 - maritime infrastructure
 - slope angles
- post-mission analysis and vehicle performance analysis, including:
 - techniques to assess mission success and refine data collection
 - techniques used to troubleshoot and improve the behaviour of AMS.

Assessment Conditions

Assessors must hold credentials specified within the Standards for Registered Training Organisations current at the time of assessment.

Assessment must satisfy the Principles of Assessment and Rules of Evidence and all regulatory requirements included within the Standards for Registered Training Organisations current at the time of assessment.

Assessment processes and techniques must be appropriate to the language, literacy and numeracy requirements of the work being performed and the needs of the candidate.

Assessment must occur in workplace operational situations, where this is not appropriate, assessment must occur in simulated workplace operational situations that replicate workplace conditions.

Resources for assessment must include access to:

- applicable documentation such as workplace policies and procedures, regulations, codes of practice, operation manuals, and operating procedures
- tools, equipment, machinery, materials, and relevant personal protective equipment (PPE) currently used in industry.

Links

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<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=772efb7b-4cce-47fe-9bbd-ee3b1d1eb4c2>