



**Australian Government**

**MARF061 Apply knowledge of  
Autonomous Underwater Vehicles (AUV)  
technical management**

## **MARF061 Apply knowledge of Autonomous Underwater Vehicles (AUV) technical management**

### **Modification History**

| Release | Comments                                                                                  |
|---------|-------------------------------------------------------------------------------------------|
| 1       | This unit of competency was first released in MAR Maritime Training Package Release 12.0. |

### **Application**

This unit involves the skills and knowledge required to apply knowledge of Autonomous Underwater Vehicles (AUV) technical management.

This includes applying technical knowledge of AUV battery technology, AUV operations and systems, AUV systems in the design and execution of diagnostic missions; and conducting technical post-mission and vehicle performance analysis.

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

- AUV Technician.

This unit applies to AUV operations being conducted in Near Coastal (NC) waters within the limits of the operators Australian Maritime Safety Authority Certificate of Competency.

### **Licensing/Regulatory Information**

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

### **Pre-requisite unit(s)**

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

MARH035 Demonstrate fundamental knowledge of Autonomous Maritime Systems (AMS)

MARH040 Apply knowledge of core Autonomous Underwater Vehicles (AUV) operations

MARH042 Conduct advanced Autonomous Underwater Vehicles (AUV) operations.

## Competency field(s)

F - Operational Quality and Safety

## Unit sector(s)

Autonomous Maritime Sector

## Elements and Performance Criteria

| Elements                                  |                                                                                                    | Performance criteria                                                                            |                                                                                                               |
|-------------------------------------------|----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|
| Elements describe the essential outcomes. |                                                                                                    | Performance criteria describe the performance needed to demonstrate achievement of the element. |                                                                                                               |
| <b>1</b>                                  | <b>Apply technical knowledge of AUV battery technology</b>                                         | <b>1</b><br>.<br><b>1</b>                                                                       | AUV battery performance is logged and assessed according to operating procedures                              |
|                                           |                                                                                                    | <b>1</b><br>.<br><b>2</b>                                                                       | AUV ground fault detection procedures are conducted                                                           |
| <b>2</b>                                  | <b>Apply technical knowledge of AUV operations and systems</b>                                     | <b>2</b><br>.<br><b>1</b>                                                                       | Technical analysis of AUV acoustic communication systems is conducted                                         |
|                                           |                                                                                                    | <b>2</b><br>.<br><b>2</b>                                                                       | Technical analysis of AUV networks and security systems is conducted                                          |
|                                           |                                                                                                    | <b>2</b><br>.<br><b>3</b>                                                                       | Technical analysis of an AUV's internal state and decision-making processes is conducted                      |
|                                           |                                                                                                    | <b>2</b><br>.<br><b>4</b>                                                                       | AUV calibrations for inertial navigation systems (INS), pitch-fin and rudder-fin control is conducted         |
|                                           |                                                                                                    | <b>2</b><br>.<br><b>5</b>                                                                       | Advanced principles of electromagnetic (EM) and radio frequency (RF) communications are outlined              |
| <b>3</b>                                  | <b>Apply technical knowledge of AUV systems in the design and execution of diagnostic missions</b> | <b>3</b><br>.<br><b>1</b>                                                                       | AUV mission with faulty navigation involving doppler velocity logger (DVL) and INS is conducted and diagnosed |

|   |                                                                        |             |                                                                                                                    |
|---|------------------------------------------------------------------------|-------------|--------------------------------------------------------------------------------------------------------------------|
|   |                                                                        | 3<br>.<br>2 | AUV mission with faulty control is conducted and diagnosed                                                         |
|   |                                                                        | 3<br>.<br>3 | AUV mission with faulty long baseline (LBL) array is conducted and diagnosed                                       |
|   |                                                                        | 3<br>.<br>4 | AUV mission with poor ballast is conducted and diagnosed                                                           |
|   |                                                                        | 3<br>.<br>5 | AUV mission with untuned proportional-integral-derivative (PID) control is conducted and diagnosed                 |
|   |                                                                        | 3<br>.<br>6 | AUV mission aided with ultrashort baseline (USBL) is conducted and diagnosed                                       |
| 4 | <b>Conduct technical post-mission and vehicle performance analysis</b> | 4<br>.<br>1 | Technical post-mission analysis and vehicle performance analysis is conducted using graphical and numeric analysis |
|   |                                                                        | 4<br>.<br>2 | Technical reports for diagnostic missions are completed according to operating procedures                          |

## 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.

## Unit Mapping Information

| Current Code and Title | Previous Code and Title | Comments | Equivalence |
|------------------------|-------------------------|----------|-------------|
|------------------------|-------------------------|----------|-------------|

|                                                                                      |                                                                                      |                                                                                                                               |            |
|--------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|------------|
| MARF061 Apply knowledge of Autonomous Underwater Vehicles (AUV) technical management | MARF058 Apply knowledge of Autonomous Underwater Vehicles (AUV) technical management | This unit replaces and is equivalent to MARF058 Apply knowledge of Autonomous Underwater Vehicles (AUV) technical management. | Equivalent |
|--------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|------------|

# Assessment Requirements for MARF061 Apply knowledge of Autonomous Underwater Vehicles (AUV) technical management

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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 and include:

- completing numerical and graphical analysis of Autonomous Underwater Vehicle (AUV) technical operation data to assess performance against AUV benchmarks
- following operational procedures
- planning, executing and analysing six diagnostic AUV missions in Near Coastal (NC) waters, including a minimum of:
  - one mission that is conducted using faulty navigation involving doppler velocity logger (DVL) and inertial navigation systems (INS)
  - one mission that is conducted using faulty control
  - one mission that is conducted using a faulty long baseline (LBL) array
  - one mission that is conducted using poor ballast
  - one mission that is conducted using untuned proportional-integral-derivative (PID) control
  - completing a post-mission analysis and vehicle performance analysis which includes a diagnostic report for each mission.

## 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:

- AUV calibrations, including:
  - INS

- pitch-fin control
  - rudder-fin control
- battery technology, including:
  - battery maintenance
  - process for assessing battery performance
  - process for logging battery performance
- design principles and process for executing diagnostic AUV missions
- diagnostic missions to identify problems and improve performance, including:
  - identify navigation issues involving DVL and INS
  - identifying control issues
  - identifying faulty LBL array
  - improving ballast
  - tuning PID control
  - using ultrashort baseline (USBL) to aid navigation during dives
- ground fault detection procedures
- process for completing technical post-mission analysis and vehicle performance analysis for reporting of diagnostic missions
- technical diagnosis of AUV systems, including:
  - acoustic communication systems
  - AUV networks
  - AUV security
  - AUV internal state and decision-making processes
  - electromagnetic (EM) and radio frequency (RF) communications
- use of graphical and numerical analysis to inform technical post-mission analysis and vehicle performance analysis.

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

Simulated workplace may be used to augment real-world operational situations and does not replace real-world operations in prescribed water conditions.

Resources for assessment must include access to:

- applicable documentation such as workplace procedures, regulations, codes of practice, operation manuals, manufacturer instructions and procedures
- tools, equipment, machinery, materials and relevant personal protective equipment (PPE) currently used in industry, including:
  - AUV aligned with the required size and class that a seafarer will need to operate
  - AUV with minimum depth rating of 100 m and INS
  - water conditions consistent with mission requirements as outlined in this unit of competency and must include access to water in excess of 100 m, high energy tidal waters and permanently stratified waters.

## Links

Companion volumes, including implementation guides, are found in TGA - <https://training.gov.au/training/details/MAR/summary>