



**Australian Government**

# **Assessment Requirements for MARH032 Conduct advanced Autonomous Underwater Vehicles (AUV) 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.

## 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:

- analysing numerical and graphical Autonomous Underwater Vehicles (AUV) engineering and sensor data to assess performance against AUV benchmarks
- conducting an advanced AUV search and rescue operation with homing and a remotely operated vehicle
- conducting 10 AUV missions in Near Coastal (NC) waters, including a minimum of:
  - one mission in a highly stratified marine environment
  - one mission in water depth greater than 100 meters
  - one mission that demonstrates inertial navigation system (INS) drift with doppler velocity logger (DVL) off
  - consecutive AUV missions that build upon collected knowledge to improve a bathymetry survey
  - conducting consecutive AUV missions to collect and analyse vehicle engineering performance data
  - completing an AUV logbook for 10 missions
- producing and executing data workflow according to operational procedures
- producing a metadata record for one vehicle data parameter and one sensor data parameter.

## 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:

- acoustic communication, including:
  - amplitude-shift keying (ASK), frequency-shift keying (FSK) and phase-shift keying (PSK) data transfer
  - decibels
  - frequency, wavelength and amplitude
  - power usage
  - speed of sound in air and water

- the trade-off between range, bandwidth and frequency
- wave speed
- Pythagoras' theorem and fundamental trigonometry
- advanced AUV mission operations, including:
  - advanced target identification
  - bathymetry mission using sonar and bottom imaging
  - operating requirements when water depth is greater than 100 m
  - use of acoustic navigation with long baseline (LBL)
  - use of ballasting for a stratified water column
  - vertical and horizontal positioning
- AUV data management, including:
  - data redundancy
  - data security
  - data plan
  - data workflow
  - fundamental units of data
  - metadata
  - 'raw' and 'working' data
- AUV performance benchmarks, including:
  - acoustic doppler current profilers (ADCP) rejection rate
  - INS horizontal error
  - maximum climb angle
  - maximum dive angle
  - maximum revolutions per minute (RPM) and speed
  - minimum turn radius
  - position error
- environmental ocean dynamics and operational risks when conducting AUV operations, including:
  - coriolis, ekman transport and wind stress curl
  - estuary dynamics
  - langmuir circulations
  - ocean currents and tides
  - turbulent and laminar flows
  - upwelling and downwelling associated with fronts
  - waves
- methods and techniques used to determine AUV performance against standard benchmarks, including:
  - process for identifying anomalies in AUV sensor data
  - quality of AUV sensor data
  - vehicle performance analysis

- methods used to analyse data, including:
  - use of software packages
  - mean values, rates of change, turning points, minimum and maximum values
- operational data units and conversions, including:
  - distance in metres and nautical miles
  - speed in knots and metres per second
- process for conducting advanced search and rescue operations, including:
  - homing
  - remotely operated vehicle
- processes used to handle and store data, including:
  - completing AUV logbooks and metadata records
  - extraction and storage of AUV engineering data
  - extraction and storage of sensor payload
  - producing a data plan and data workflow.

## 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 Volume Implementation Guides are found in VETNet -

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