



Australian Government

DEFSU012 Navigate using celestial aids

Release 1

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Modification History

Release	TP Version	Comments
2	DEF12V2	Title changed forced code change. Equivalent to DEFSU006B Navigate using celestial aids in a survival situation.
1	DEF12V1	Primary release.

Unit Descriptor

This unit covers the competency required to navigate using celestial aids i.e. in the absence of standard navigational instruments such as maps, compass, protractor and satellite geo-positioning systems (GPS).

While the individual may not know the map coordinates of the start point, this unit covers the ability to navigate successfully relative to that start point. This is important because the start point may be a broken vehicle or downed aircraft, which, though immovable, still have critical survival resources, and will be the main focus of search and rescue agencies.

Alternatively, if an approximate position is known relative to a highway, waterway or coast, where either survival or rescue is better effected, the individual will have sufficient skills and knowledge to remain on a constant bearing and estimate distance travelled.

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication. In a Defence context, this means that there is no civilian need to hold this unit in order to meet licensing, legislative, regulatory or certification requirements.

Application of the Unit

This competency was developed for military personnel required to operate in a remote, deployed operational environment, but is applicable to any individual who is required to navigate using celestial aids.

Note: this unit of competency requires the individual to navigate by both day and night to a destination, within standard tolerances of accuracy, without the use of the normal range of navigation aids.

In a military context the navigation can be conducted on foot (for example; infantry) or by vehicle (for example; armour).

All activities are carried out in accordance with relevant organisational policies and procedures.

Licensing/Regulatory Information

Not applicable.

Pre-Requisites

Not applicable.

Employability Skills Information

This unit contains employability skills.

Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a Unit of Competency.

Performance Criteria describe the required performance needed to demonstrate achievement of the element. Where ***bold italicised*** text is used, further information is detailed in the Range Statement. Assessment of performance is to be consistent with the Evidence Guide.

Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Establish cardinal points by day using the sun	1.1 Complete movement of the sun is recorded over a solar day using a sun compass constructed in an open and level area. 1.2 True north, associated cardinal points and the arc of the sun are annotated on the sun compass. 1.3 True north and associated cardinal points are notated using a quick shadow stick method and allowance is made for the deviation arising from early morning or late afternoon siting.
2. Establish cardinal points by night using celestial aids	2.1 Celestial bodies are identified in the sky and used to extrapolate the location of cardinal points directly. 2.2 Celestial bodies are identified in the sky and used to extrapolate the location of the celestial pole. 2.3 Celestial pole is used to extrapolate true south (or north) on the earth/sky horizon and a compass showing all cardinal points is established on the ground.
3. Employ improvised direction measuring techniques	3.1 An analysis is conducted, based upon the survival situation, and an appropriate direction of travel (if any) is selected to optimise survival or rescue. 3.2 An improvised protractor is made using a multi-folded sheet of paper and the desired angle of direction is annotated. 3.3 Protractor is aligned with the established cardinal points of the compass, and the annotated angle is used to select a coincident recognisable feature in the distance. 3.4 Recognisable feature or interim way-point is approached in a direct line from the start-point.
4. Employ improvised time measuring techniques	4.1 Elapsed time is estimated by measuring the angle of a segment of the sun's transit and applying an angle by rate calculation. 4.2 Elapsed time is estimated by measuring the rotation of a celestial body around the celestial pole, and applying an angle by rate calculation.
5. Employ improvised distance measuring techniques	5.1 Distance is estimated by counting number of paces taken and applying a paces by length of pace calculation. 5.2 Distance is estimated by travelling at constant estimated velocity and applying a velocity by time calculation.

6. Determine overall position relative to start point and navigate back

- 6.1 Grid system using a standard scale is plotted on a sheet of paper, and cardinal points and start point are annotated.
- 6.2 **Physical navigation movements** are plotted as scaled vectors from the start point.
- 6.3 Individual navigation vectors are aggregated to determine final position relative to the start point.
- 6.4 **Return vector** is determined in order to return to the start point.

Required Skills and Knowledge

This describes the essential skills and knowledge and their level, required for this unit.

Required Skills

- identify celestial bodies
- basic mathematics:
 - distance travelled:
velocity x time
pace length x number of paces
 - elapsed time:
rate of (apparent) movement of sun (15 degrees/hour x solar angle subtended)
rate of (apparent) movement of night sky around the celestial pole (15 degrees/hour x angle subtended by nominated celestial body)

Required Knowledge

- angles (in degrees)
- basic physics (velocity/distance/time)
- cardinal points:
 - magnetic
 - true
- earth's orbit and rotation in relation to the sun and night sky including the celestial pole phenomenon

Evidence Guide

Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessment must confirm the ability to navigate:

- 5 km within a solar day, which may be broken into legs of not less than 1 km, but must include at least four legs, as part of a navigation circuit; on completion, navigators are to submit a vector diagram detailing their final position relative to their start point accurate to within 10 percent (of distance and direction)
- 5 km within 8 hours at night, which may be broken into legs of not less than 1 km, but must include at least four legs, as part of a navigation circuit; on completion, navigators are to submit a vector diagram detailing their final position relative to their start point accurate to within 10 percent (of distance and direction).

Assessment must also confirm the ability to:

- Day – make adjustments for the shadow arc, dependent upon the time, when using only a partial segment of a solar day (maximum 20 minute fix) to locate the cardinal points; and to indicate true north to within 10 percent with a sun compass, using a 20 minute fix
- Night – implement contingency skills when there is partial cloud in the night sky; and to employ five different celestial body indication techniques to locate the cardinal points, either directly or through extrapolation via the celestial pole.

Consistency in performance

Competency must be assessed in an area that has an unmodified landscape.

Context of and specific resources for assessment

Context of assessment

Competency must be assessed in a workplace environment.

Specific resources for assessment

Access is required to suitable area for navigation (unmodified landscape) and pen and paper.

Range Statement

The Range Statement relates to the Unit of Competency as a whole. It allows for different work environments and situations that may affect performance. <i>Bold italicised</i> wording in the Performance Criteria is detailed below.	
<i>Associated cardinal points</i> include:	• south • east • west
<i>Quick shadow stick method</i> includes:	• maximum of 20 minutes of solar transit
<i>Celestial bodies</i> may include:	• nebulae • Moon • planets • stars (including constellations of stars)
<i>Celestial pole</i> may be:	• north • south
<i>Recognisable features</i> may include:	• celestial body • prominent geographic feature
<i>Way-points</i> may include:	• distinguishable trees • hillocks/mounds
<i>Constant estimated velocity</i> includes:	• walking pace of 4 km/h
<i>Physical navigation movements</i> include:	• direction • distance
<i>Return vector</i> includes:	• bearing • distance

Unit Sector(s)

Not applicable.