Australian Government

Department of Education, Employment and Workplace Relations

# MEA349B Apply basic scientific principles and techniques in aeronautical engineering situations

**Release: 1**

# MEA349B Apply basic scientific principles and techniques in aeronautical engineering situations

## Modification History

Knowledge requirements expanded - equivalent to previous version.

## Unit Descriptor

This unit of competency covers applying basic scientific principles and techniques to appropriate aeronautical engineering situations.

## Application of the Unit

This unit requires application of basic aeronautical scientific principles and techniques as a member of a design and development team or similar in support of the design and development of aeronautical applications, or within the engineering department of an aircraft maintenance organisation.
Applications include identifying the range of basic aeronautical scientific principles and techniques relevant to aeronautical engineering, selecting aeronautical principles and techniques for particular applications, applying aeronautical principles and techniques appropriately to engineering tasks, quoting results appropriately.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

# Elements and Performance Criteria Pre-Content

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| Elements describe the essential outcomes of a unit of competency. | Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide. |

# Elements and Performance Criteria

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| 1 | Research and identify the range of basic scientific principles and techniques relevant to aeronautical engineering | 1.1 | The basic scientific principles relating to aeronautical engine and reported on from appropriate ***sources of information*** an applications |
| | | 1.2 | The basic aeronautical techniques and associated technologie hardware required to implement scientific principles relating ***engineering*** situations are identified |
| 2 | Select basic aeronautical scientific principles and techniques relevant to particular aeronautical engineering applications | 2.1 | For particular **aeronautical engineering** situations, the ***relev aeronautical scientific techniques and principles*** can be sel |
| | | 2.2 | For particular aeronautical engineering situations, the relevar techniques and associated technologies, software and hardwa |
| 3 | Apply the relevant basic aeronautical scientific principles and techniques appropriately | 3.1 | The basic aeronautical scientific principles are applied in a c appropriate manner to obtain any required solution |
| | | 3.2 | Appropriate calculations and coherent units are used in the s engineering calculations |
| | | 3.3 | Significant figures are used in engineering calculations |
| | | 3.4 | The basic aeronautical techniques and associated technologie hardware are applied in a consistent and appropriate manner solutions |
| 4 | Quote the results of the application of the basic aeronautical scientific principles and basic techniques correctly | 4.1 | For applications involving engineering calculations, the solu appropriate style |
| | | 4.2 | For applications not involving engineering calculations, the s an appropriate style |

# Required Skills and Knowledge

Look for evidence that confirms knowledge of:

- basic aeronautical scientific principles including:
  - statics – complete tasks requiring analysis and application of:
    - forces and moments of forces
    - systems of concurrent and non-concurrent forces
    - dry sliding friction
  - dynamics – complete tasks requiring analysis and application of:
    - Newton's Laws
    - kinematics and kinetics of uniformly accelerated linear motion
    - kinematics and kinetics of uniformly accelerated rotation
    - curvilinear motion and centrifugal force
    - work, energy, power and torque
    - mechanical advantage and efficiency
  - strength of materials:
    - axial tension and compression
    - direct shear
    - bolted, riveted, bonded and welded connections
    - shear in beams
    - bending stresses and bending deflections (by standard formulas only)
    - torsion
  - aerodynamics:
    - Bernoulli's Theorem
    - the atmosphere
    - aerodynamic forces (lift, drag, weight and thrust)
    - stability and control (to a level not requiring the application of calculus)
    - airscrews and propulsion (to a level not requiring the application of calculus)
    - aircraft performance (to a level not requiring the application of calculus)
  - fluid mechanics:
    - properties of fluids including mineral and synthetic hydraulic fluids
    - fluid statics, Archimedes' Principle and Pascal's Principle
    - fluid flow – continuity and energy conservation
    - fluid power – pumps
  - thermodynamics:
    - heat transfer principles (conduction, convection and radiation)
    - perfect gas laws
    - kinetic theory of gases
    - laws of thermodynamics
- control concepts including closed and open loop control

- electricity and electronics:
  - basic electrical concepts
  - Ohm's Law
  - Kirchhoff's Current and Voltage Laws
  - basic DC circuits
  - basic power supply, transformer, rectifier, filter and regulator
  - PLC concepts – I/O, timing, counting, programming
  - electronic devices (discrete) – resistors, diodes, capacitors, inductors, transistors and rectifiers
  - microprocessor concepts
- light, sound and vibration:
  - wave behaviour – standing vs travelling waves, transverse and longitudinal
  - light – reflection, absorption, refraction, diffraction, spectrum, infrared, visible, ultraviolet, transmissio engineering applications
  - sound – pitch, frequency, intensity (power), decibel scale, 'noise dose', spectrum, infrasound, audible, natural frequency, resonance, transmission medium and engineering applications
  - vibration – sources, balancing, shaft alignment, measurement, damping and engineering applications
- basic aeronautical techniques and related technologies, software and hardware associated with implement in mechanical engineering solutions
- the applicability and limitations of basic aeronautical scientific principles
- the applicability and limitations of basic aeronautical techniques and associated technologies, software an
- appropriateness of calculations
- fundamental and derived quantities
- common systems of units
- the procedure for converting between systems of units
- common prefixes used with units and their values
- the procedure for carrying out dimensional analysis
- the concept of significant figures
- the uncertainty of computations based on experimental data
- the procedures for determining the significance of figures in calculations
- the procedures for estimating errors in derived quantities

Look for evidence that confirms skills in:

- selecting appropriate basic aeronautical scientific principles to suit specific applications
- selecting appropriate basic aeronautical techniques and associated technologies, software and hardware to applications
- applying basic aeronautical scientific principles to particular engineering situations
- applying and manipulating appropriate formulas for applications involving engineering calculations
- applying appropriate calculations to engineering situations
- checking the validity of equations is using dimensional analysis
- applying basic aeronautical techniques and associated technologies, software and hardware in a manner a application and identified scientific principles
- referring solutions to the original aim of the application

- quoting solutions in appropriate units, using appropriate significant figures
- quoting limitations of solutions, due to assumptions, scientific principles and techniques used
- presenting solutions referring to the original aim of the application

# Evidence Guide

| The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package. | |
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| **Overview of assessment** | A person who demonstrates competency in this unit must be able to apply basic scientific principles and techniques in aeronautical engineering situations. |
| **Critical aspects for assessment and evidence required to demonstrate competency in this unit** | Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.<br>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. |
| **Context of and specific resources for assessment** | This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is, the candidate is not in productive work, an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.<br>The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials. |
| **Method of assessment** | This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with applying basic scientific principles and techniques in aeronautical engineering situations or other units requiring the exercise of the skills and knowledge covered by this unit. |
| **Guidance information for assessment** | |

# Range Statement

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| The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included. | |
| **Sources of information** | Sources of information include:<br>• reference texts<br>• manufacturer catalogues and industrial magazines<br>• international aerospace organisation publications<br>• websites<br>• use of phone, email and fax information gathering |
| **Aeronautical engineering** | Aeronautical engineering refers to:<br>• the engineering discipline concerned with the conceptual development, research, design, manufacture, implementation, installation, commissioning and maintenance of aerospace mechanical, hydraulic, pneumatic, fuel and fire products, processes, systems or services for civil and military applications |
| **Relevant basic aeronautical scientific techniques and principles** | Candidates should apply appropriate basic techniques supported by their mathematical skills and introductory knowledge of scientific principles to design, manufacturing, commissioning and maintenance related tasks and projects relating to metal and composite structure, aerodynamic loads, stability, control and performance, mechanical systems and related components, hydraulic systems and related components, pneumatic systems and related components, air cycle air conditioning and pressurisation systems and related components, power plant systems and components, and the application and interfacing of electrical and electronic system control.<br>The applications may require the use of one or two basic aeronautical scientific principles together with a fundamental mathematical calculation leading to process, resources and system choices from a limited range of options.<br>Basic techniques include:<br>• basic hand and power tool operations<br>• machining<br>• fitting<br>• welding |

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| | • moulding<br>• fabricating<br>• wiring and programming techniques |

## Unit Sector(s)

Engineering science

## Custom Content Section

Not applicable.