



Australian Government

MEA703 Apply aeronautical modelling for computer-aided engineering

Release: 1

MEA703 Apply aeronautical modelling for computer-aided engineering

Modification History

Release 1 - New unit of competency

Application

This unit of competency applies to modelling of aeronautical systems and components for civil or military aircraft. It is suitable for people working as design drafters and those pursuing paraprofessional careers and qualifications in aeronautical engineering at the paraprofessional level.

This unit of competency covers the application of aeronautical modelling techniques for aircraft, aircraft structure, systems and component design, modification or maintenance purposes. It includes consideration of the computer-aided engineering (CAE) purposes for which the model is required, such as initial design, modification design or maintenance and as a basis for generating orthogonal drawings and wiring, circuit and schematic diagrams.

This unit is used in workplaces that operate under the airworthiness regulatory systems of the Australian Defence Force (ADF) and the Civil Aviation Safety Authority (CASA).

Pre-requisite Unit

MEA701 Produce aeronautical engineering related graphics

Competency Field

Unit Sector

Elements and Performance Criteria

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

- | | |
|---|---|
| 1. Identify the fundamentals of aeronautical engineering modelling | 1.1 Investigate applications for aeronautical modelling |
| | 1.2 Identify sustainability issues related to modelling |
| | 1.3 Identify work health and safety (WHS) and regulatory requirements related to modelling processes and materials |

- | | | |
|----|----------------------------|--|
| | 1.4 | Identify the model parameters, form, function and features, virtual or physical |
| | 1.5 | Identify processes required which may include those for generating graphics, post-processing and physical modelling |
| | 1.6 | Identify technical and professional assistance for advice as required |
| 2. | Develop aeronautical model | |
| | 2.1 | Generate initial graphical model and adjust in consultation with stakeholders in accordance with procedures or agreement |
| | 2.2 | Prepare model for intended purpose |
| | 2.3 | Use model for purpose and complete investigative analysis or produce physical model |
| | 2.4 | Evaluate model against design criteria and with stakeholders and make adjustments as required |
| | 2.5 | Engage appropriate technical and professional assistance for advice as required |
| 3. | Finalise model | |
| | 3.1 | Report and demonstrate results |
| | 3.2 | Provide documentation, instructions, models and files as required |
| | 3.3 | Obtain sign-off |

Foundation Skills

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

Range of Conditions

This field allows for different work environments and conditions that may affect performance. Essential operating conditions that may be present (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) are included.

Models include:

- Virtual, such as computer generated solids models
- Physical models developed from the virtual model data

Model purpose includes:	• Software models • Aircraft design, including performance and power required • Component design (structural, mechanical, hydraulic and pneumatic) • System design and performance simulation (mechanical, hydraulic and pneumatic)
Features, functions and context of engineering mechanical modelling include:	• Techniques used for mechanical modelling • Sustainability implications of modelling • WHS and regulatory requirements related to modelling processes and materials • Model parameters, form, function and features, virtual or physical • Processes required which may include those for generating graphics, post-processing, and physical modelling • Required licensed technical and professional assistance
Post-processor	• A post-processor or code generator converts programmed instructions generated by computer-aided manufacture (CAM) software or computer-aided design (CAD) package into computer numerically controlled (CNC) program code to control a machine tool
Post-processing model for analysis or physical modelling includes:	• Setting up component, system and system software models • Processing dimensional data to create 2-D or 3-D code for CAM operations, such as printed circuit board manufacture
Rapid prototyping processes include:	• Selective laser sintering (SLS) which uses thermoplastics and metal powders • Fused deposition modelling (FDM) which uses thermoplastics and eutectic metals • Stereolithography (SL) which uses a photopolymer • Laminated paper manufacturing (LOM) which uses paper • Electron beam melting (EBM) which uses titanium alloys • 3-D printing (3DP) which uses a variety of materials
Criteria for aeronautical designs include:	• Safety and risk • Function • Aesthetics • Compliance with relevant regulations and standards • Manufacturability and maintainability • Marketability

Appropriate technical and professional assistance includes:

- Sustainability:
 - social, economic and environmental
 - material and energy resources
- Cost constraints
- Ergonomics, anthropometrics and physiology
- Facilities, plant and skills available
- Assistance from individuals with CASA maintenance certification licenses or those with supervisory authorisations in the ADF regulatory system
- Professional support from engineers employed within:
 - organisations with CASA design, continuing airworthiness management or maintenance approvals
 - approved engineering organisations under the ADF regulatory system
- Engineers employed within organisations recognised by overseas airworthiness organisations

WHS, regulatory requirements and enterprise procedures include:

- WHS Acts and regulations
- Relevant standards
- Industry codes of practice
- Risk assessments
- Registration requirements
- Safe work practices
- State and territory regulatory requirements applying to electrical work
- Civil Aviation Safety Regulations (CASRs)
- AAP7001.053 ADF Technical Airworthiness Management Manual
- Overseas airworthiness authorities where applicable e.g. Federal Aviation Administration, Transport Canada, European Aviation Safety Agency

Relevant standards include:

- AS 1100.101-1992 Technical drawing – General principles
- AS 1102.101-1989 Graphical symbols for electrotechnical documentation - General information and general index
- AS/NZS ISO 31000 Set:2013 Risk Management Set
- British Defence Standard 00-970 Design and Airworthiness Requirements for Service Aircraft
- US Military Specifications and Standards relevant to aircraft design
- ADF AAP7001.054 Airworthiness Design Requirements Manual

Modelling and related software includes:

- FAR Part 23 Airworthiness Standards for Airplanes in the Normal, Utility, Aerobatic or Commuter Categories
- FAR Part 25 Airworthiness Standards for Airplanes in the Transport Category
- EASA CS-23 Certification Specifications for Aeroplanes in the Normal, Utility, Aerobatic or Commuter Categories
- EASA CS-25 Certification Specifications for Airplanes in the Transport Category
- CASA AC 21-99 Aircraft Wiring and Bonding
- FAA AC 43-13-1B Acceptable Methods, Techniques and Practices – Aircraft Inspection and Repair
- Lumped parameter model
- Empirical, random data tested model
- Finite element analysis (FEA) software
- Model based design

Unit Mapping Information

Release 1 – new unit based on and equivalent to MEM09153A Apply computer-aided modelling and data management techniques to aeronautical engineering designs

Links

Companion Volume implementation guides are found in VETNet -

<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=ce216c9c-04d5-4b3b-9bcf-4e81d0950371>

Assessment Requirements for MEA703 Apply aeronautical modelling for computer-aided engineering

Modification History

Release 1 - New unit of competency

Performance Evidence

Evidence required to demonstrate competency in this unit must be relevant to and satisfy all of the requirements of the elements and performance criteria under the specified conditions of assessment, and must include:

- investigating the uses of aeronautical models for aircraft, structure, aircraft systems and components
- reviewing features, functions and context of aeronautical modelling
- comparing available software, functions and features
- communicating, participating and negotiating with:
 - stakeholders, team, cross-function support groups and experts
 - appropriate licensed technicians and professionals
- performing modelling using a comprehensive range of techniques, such as:
 - creating and manipulating 3-D entities
 - using library files and adaptations
 - top down system simulation
- comparing available software, functions and features
- creating dimensioned orthographic projections from model
- extracting dimensional properties from model
- using post-processing model for analysis or physical modelling
- modelling aeronautical component and system hardware and software
- finalising modelling by:
 - completing work
 - gaining approval and commissioning work
 - providing documentation and reports as required
 - obtaining sign-off.
-

Knowledge Evidence

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

- engineering and market context for aeronautical component and systems modelling:
 - relative speed compared to traditional methods related to quantities
 - market demand speed, standardisation, quality and flexibility through data

- sustainability implications of modelling: economic, social and environmental
- aeronautical models, such as:
 - aircraft design, including performance and power requirements
 - aircraft structure and components
 - mechanical systems and components
 - hydraulic systems and components
 - pneumatic systems and components
 - flight control systems and components
 - electrical and electronic control interfaces
- software functions and features:
 - modelling software
 - model analysis software (e.g. FEA)
 - post-processor, CNC/CAM and rapid prototyping
 - regulations relating to the design of aeronautical software
- model creation techniques, such as:
 - using and manipulating coordinate systems
 - creating 3-D entities, ruled and revolved surfaces
 - creating solids, editing and combining solids
 - manipulating entities and solids
 - library files
 - manipulations of solids and library files
 - 3-D graphics from models, including rotated views and sections
 - dimensioned orthographic representations from models
 - top down system simulation
 - construction of artwork for printed circuit boards
- typical modelling processes, including:
 - computer modelling
 - post-processing
 - prototyping and model manufacture
- virtual model options, such as automated systems simulation
- physical modelling options, such as:
 - post-processing to create NC data files to CNC circuit board assembly
 - rapid prototyping options
- WHS requirements:
 - WHS Acts and regulations, which recognise that stakeholders in workplace activities include the workforce exposed to worksite conditions, materials and processes of the activity and also recognise the broader community exposed to environmental effects of the activity. Competence in designing for and implementation of the Act, regulations, codes, directives, risk management and standards is required by other units
 - relevant standards that give guidance to complying with the WHS Act

- codes of practice, risk assessment and registration requirements
- requirement for licensed technical and professional services
- modelling compared to traditional methods, such as:
 - pen and pencil graphics compared to wire frame, surface and solid models
 - computer animations compared to transparent overlay mobiles to test clearances and motions
 - solid models compared to isometric representations
 - computer library files compared to the use of reference charts and catalogue information
- future developments in modelling and related engineering software:
 - new developments in computer aided engineering
 - dynamic response of models
 - new developments in rapid prototyping and manufacturing
- animations and simulations.

Assessment Conditions

- 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, then a simulated working environment must be used that reflects realistic workplace situations and conditions.
- The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.
- Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.
- Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.
- Assessment may be applied under project related conditions (real or simulated) and require evidence of process.
- Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.
- Assessors must be satisfied that the candidate competently and consistently:
 - review features, functions and context of aeronautical modelling
 - compare available software, functions and features
 - communicate, participate and negotiate with stakeholders, team, cross-function support groups and experts, appropriate licensed technicians and professionals
 - model using a comprehensive range of techniques
 - create dimensioned orthographic projections from model
 - extract dimensional properties from model
 - post-process model for analysis or physical modelling
 - complete work, commission and gain approval, document and report, obtain sign-off
 - identify future developments in modelling.

- Assessment may be in conjunction with assessment of other units of competency where required.
- Assessors must satisfy the requirements of the National Vocational Education and Training Regulator (Australian Skills Quality Authority, or its successors).

Links

Companion Volume implementation guides are found in VETNet -

<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=ce216c9c-04d5-4b3b-9bcf-4e81d0950371>