



Australian Government

MEA709 Apply aeronautical structure design techniques

Release: 1

MEA709 Apply aeronautical structure design techniques

Modification History

Release 1 - New unit of competency

Application

This unit of competency covers the skills needed to contribute to the design of aircraft structure and structural components, including modifications and repairs. It includes performance of the design process within the requirements of airworthiness regulators and documentation of the design process within management systems, such as configuration management (CM) and integrated logistic support (ILS).

It is suitable for people working within aircraft design teams or maintenance support engineering organisations and those pursuing careers and qualifications in aeronautical engineering at the paraprofessional level.

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
MEA703	Apply aeronautical modelling for computer-aided engineering
MEA705	Apply basic scientific principles and techniques in aeronautical engineering situations
MEA707	Select and test aeronautical engineering materials
MEM23004A	Apply technical mathematics
MEM23007A	Apply calculus to engineering tasks

Competency Field

Aeronautical engineering

Unit Sector

Elements and Performance Criteria

Elements describe the essential Performance criteria describe the performance needed to

outcomes.		demonstrate achievement of the element.
1.	Investigate requirements of aeronautical structural design projects	1.1 Review the context and negotiate parameters of the engineering design brief in consultation with stakeholders 1.2 Determine engineering scientific principles and design techniques required for design process 1.3 Investigate life-cycle design and sustainability implications of aeronautical structural design 1.4 Determine specification, documentation and graphical techniques required to define designs 1.5 Confirm work health and safety (WHS), regulatory requirements, codes of practice, standards, risk management and registration requirements relevant to aircraft structure design project 1.6 Investigate the need for technical and professional assistance
2.	Apply aeronautical structural design techniques	2.1 Plan, schedule and coordinate the design task 2.2 Apply the design process and aeronautical scientific principles to component selection and design proposals 2.3 Create adequate and accurate calculations, preliminary graphics and maintain design process records 2.4 Evaluate multiple solutions against design criteria, risk, sustainability and cost 2.5 Apply systems thinking to problem solving and decision making in dealing with contingencies and constraints for continuous improvement and development of design options 2.6 Incorporate professional and technical assistance as required 2.7 Apply specification, documentation and graphical techniques modelling, mock-up or prototyping techniques to define designs
3.	Report results	3.1 Report results of investigations, application and development of design

- 3.2 Provide documentation and records generated in the design process
- 3.3 Provide draft documentation required by CM plan and/or ILS process, where applicable

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.

Aeronautical engineering refers to:

- The engineering discipline concerned with the conceptual development, research, design, manufacture, implementation, installation, commissioning and maintenance of aerospace structure, mechanical, hydraulic, pneumatic, fuel and fire products, processes, systems or services for civil and military applications

Aircraft structure and structural components include:

- All primary, secondary and tertiary structures that may be made from metal or fibre composite

Context of engineering design activity includes:

- Competitive market
- Geo political factors, such as access to materials and markets
- Technological advantage/disadvantage
- Resources supply: materials, labour and skills
- Sustainability issues relevant to design task, including
 - social, economic and environmental considerations
 - material and energy resources
- WHS, risk, and applicable standards and code requirements
- Regulatory requirements and procedures associated with design, modification and repair of aircraft structure and structural components

Planning processes include:

- Establishing design parameters and design criteria
- Contributing to the negotiation and advice process

	• Preliminary planning, design investigations and costing • Identifying design, development, prototyping activities and skills requirements • Planning and scheduling design activities • Improving, adjusting, rescheduling as required by emergency contingencies and constraints
Design process includes:	• Establishing design parameters and criteria • Researching, measuring, experimenting and investigating • Generating ideas • Synthesis, problem solving, decision making and addressing constraints • Applying scientific principles, calculation and graphics, prototyping and mock-up techniques • Evaluating solutions against design criteria • Consultation, adjustments and agreement • Finalising design and sign-off
Design criteria includes:	• Regulatory requirements and associated standards • Function • Aesthetics • Manufacturability and maintainability • Marketability • Sustainability: • social, economic and environmental • material and energy resources • Cost constraints • Ergonomics and anthropometrics and physiology • Facilities, plant and skills available • Safety and risk
Design analysis includes:	• Static and dynamic analysis of loads • The stresses and deformations resulting • Graphical and mathematical methods and software options
Design application (under professional engineer guidance) includes:	• Design of structure and structural components • Design of structural modifications • Design of repair schemes • Extension of published repair schemes • Extension of corrosion removal limits
Configuration management (CM)	• CM is a process for control and documentation of the design and development process and for the management of system, component and software throughout the service life

Integrated logistic support (ILS)

- ILS is an integrated approach to the management of logistic disciplines originally developed for the management of military systems from design concept to final disposal at life-of-type. It covers:
 - reliability engineering, maintainability engineering and maintenance planning
 - supply and support
 - support and test equipment
 - manpower and personnel
 - training and training support
 - technical data and publications
 - computer resources support
 - facilities
 - packaging, handling, storage and transportation
 - design interface

Sustainability considerations include:

- Resources and energy required for design
- Life-cycle design of product (manufacture to remanufacture or recycle)
- Environmental considerations in manufacturing and operation of design, including:
 - raw material, solids and hazardous waste, and production by-products
 - potential contamination of land, air and stormwater pollutants, and discharge to sewerage
- Carbon pollution and reduction effects

Prototyping includes:

- Any combination of:
 - mock-ups
 - physical and virtual modelling with post-processing for computer-numerically controlled (CNC) and rapid prototyping

Systems thinking includes:

- The process of developing solutions within the context of an entire system
- Recognising that an improvement in one subsystem can adversely affect another subsystem

Appropriate technical and professional assistance includes:

- Assistance from individuals with CASA maintenance certification licences 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
- WHS, regulatory requirements and enterprise procedures include:**
- Engineers employed within organisations recognised by overseas airworthiness organisations
 - 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 4024.1-2006 Series Safety of machinery
 - 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
 - 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
 - AC21-15(1) Supplemental Type Certificates
 - AC21.16(0) Approval of Materials, Parts, Processes and Appliances
 - AC21.14 Production Certificates
 - AC21.20 Production Under a Type Certificate Only

- AC21.27 Manufacturing Approval – Overview
- AC21.145(0) Manufacture of Parts During the Course of Maintenance
- AC21-601(0) Australian Technical Standard Order
- CAAP35-7(0) Design Approval of Modifications and Repairs

Unit Mapping Information

Release 1 – new unit based on but not equivalent to MEM14065A Plan and design aeronautical engineering projects

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 MEA709 Apply aeronautical structure design techniques

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:

- communicating, negotiating and reviewing context and parameters of the engineering design brief with stakeholders
- determining or confirming scientific principles and design techniques, WHS and regulatory requirements, and design specification requirements
- evaluating multiple solutions against design criteria, risk, sustainability and cost
- investigating life-cycle design and sustainability, technical and professional assistance required
- investigating and applying CM and ILS requirements
- planning, scheduling and coordinating the design task
- applying design process and scientific principles to structure and structural component design proposals, including modifications and repairs to existing structure
- solving problems and making decisions with systems thinking for contingencies and constraints, including airworthiness regulatory requirements and continuous improvement (may be requirements of CM and ILS)
- defining designs, specifying, documenting and applying graphical techniques, modelling, mock-up or prototyping techniques
- creating and maintaining adequate and accurate calculations and design process records
- reporting and documenting results of investigations, application of principles and techniques, calculations, specifications, diagrams, computer-aided design (CAD) files, mock-ups or prototypes of designs
- complying with regulatory procedures for design, modification and repair approval.

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:

- life-cycle design and sustainability implications of aircraft structure designs (may be part of CM and ILS procedures)
- design processes and techniques to investigate, synthesise and develop proposals, evaluate feasibility against design criteria, review and revise in consultation with stakeholders, model, mock-up and prototype

- systems thinking, problem solving and decision making, and continuous improvement methods
- application of CM and ILS procedures
- WHS and regulatory requirements, codes of practice, standards, risk management and registration requirements
- The roles and relevance to the design process of professional and technical assistance for engineering specialisations
- procedures for planning, scheduling and coordination of design
- hardware requirements of typical aircraft structure and structural components
- engineering scientific principles required for design analysis
- design calculations techniques
- application of software for product planning and design, such as CAD, stress analysis and mould design and project management
- required documentation, including:
 - design brief and records of negotiation
 - planning and schedule
 - calculations and diagrams documentation for checking and design records
 - specifications and graphics required to define designs
 - risk analysis report
 - design process summary report
 - life cycle and sustainability reports
 - CM and ILS documentation
 - documentation required by Regulators for approval of designs, modifications and repairs
- prototyping options, including mock-ups, physical and virtual modelling, and rapid prototyping.

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 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.
- 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 can competently and consistently:
 - communicate, negotiate and review design brief with stakeholders
 - determine or confirm scientific principles and design techniques, WHS and regulatory requirements, and design specification requirements
 - evaluate multiple solutions
 - apply CM and ILS requirements
 - investigate life-cycle design and sustainability, technical and professional assistance required
 - plan, schedule and coordinate the design task
 - select design components using design process and scientific principles
 - solve problems and make decisions with systems thinking for contingencies and constraints and continuous improvement
 - define designs, specify and document and apply graphical techniques, modelling, mock-up or prototyping techniques
 - create and maintain adequate and accurate calculations and design process records
 - report and document, results and processes
 - follow regulatory requirements and procedures for design, modification or repair procedures.
- 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).

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