



**Australian Government**

# **MEA711 Apply avionic analogue design techniques**

**Release: 1**

# MEA711 Apply avionic analogue design techniques

## Modification History

Release 1 - New unit of competency

## Application

This unit of competency applies to design of avionic analogue systems and components for aircraft, design of modifications, test stations and development and update of test procedures and of repair requirements. It includes electrical, electronic and software design techniques and 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 as members of avionic system design teams and for those employed within maintenance engineering support departments or pursuing careers and qualifications as paraprofessionals in avionic engineering.

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

|        |                                                                                       |
|--------|---------------------------------------------------------------------------------------|
| MEA702 | Produce avionic engineering related graphics                                          |
| MEA708 | Select and test avionic engineering materials                                         |
| MEA714 | Integrate avionic fundamentals into an engineering task                               |
| MEA725 | Apply advanced scientific principles and techniques in avionic engineering situations |

## Competency Field

Avionic engineering

## Unit Sector

## Elements and Performance Criteria

Elements describe the essential outcomes.

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

1. Investigate requirements of avionic analogue 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 avionic 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 avionic design project
  - 1.6. Investigate the need for technical and professional assistance
2. Apply avionic analogue design techniques
  - 2.1. Plan, schedule and coordinate the design task
  - 2.2. Apply the design process and avionic 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. Integrate avionic analogue techniques, hardware and software, including mechanical, fluid, electrical, electronic, controller and networking
  - 2.6. Apply systems thinking, problem solving and decision making in dealing with contingencies and constraints for continuous improvement and development of design options
  - 2.7. Incorporate professional and technical assistance as required
  - 2.8. 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 avionic 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.

- |                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Avionic engineering refers to:</b>                   | <ul style="list-style-type: none"> <li>• The engineering discipline concerned with the conceptual development, research, design, manufacture, implementation, installation, commissioning and maintenance of aerospace electrical, instrument, radio and electronic systems and components and related test equipment for civil and military applications</li> </ul>                                                                                                                                                                                   |
| <b>Avionic analogue systems include:</b>                | <ul style="list-style-type: none"> <li>• Flight and measuring instruments</li> <li>• Communications</li> <li>• Navigation</li> <li>• Autopilot</li> <li>• Interface with electrical power generation, control and distribution systems</li> <li>• Interface with avionic digital systems</li> </ul>                                                                                                                                                                                                                                                    |
| <b>Context of engineering design activity includes:</b> | <ul style="list-style-type: none"> <li>• Competitive market</li> <li>• Geo political factors, such as access to materials and markets</li> <li>• Technological advantage/ disadvantage</li> <li>• Resources supply: materials, labour and skills</li> <li>• Sustainability issues relevant to design task, including:               <ul style="list-style-type: none"> <li>• social, economic and environmental considerations</li> <li>• material and energy resources</li> </ul> </li> <li>• WHS, risk, and applicable standards and code</li> </ul> |

|                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                               | requirements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Planning processes include:</b>            | <ul style="list-style-type: none"><li>• Establishing design parameters and design criteria</li><li>• Contributing to the negotiation and advice process</li><li>• Preliminary planning, design investigations and costing</li><li>• Identifying design, development, prototyping activities and skills requirements</li><li>• Planning and scheduling design activities</li><li>• Improving, adjusting, rescheduling as required by emergency contingencies and constraints</li></ul>                                                |
| <b>Design process includes:</b>               | <ul style="list-style-type: none"><li>• Establishing design parameters and criteria</li><li>• Researching, measuring, experimenting and investigating</li><li>• Generating ideas</li><li>• Synthesis, problem solving, decision making and addressing constraints</li><li>• Applying scientific principles, calculation and graphics, prototyping and mock-up techniques</li><li>• Evaluating solutions against design criteria</li><li>• Consultation, adjustments and agreement</li><li>• Finalising design and sign-off</li></ul> |
| <b>Design criteria includes:</b>              | <ul style="list-style-type: none"><li>• Function</li><li>• Aesthetics</li><li>• Manufacturability and maintainability</li><li>• Marketability</li><li>• Sustainability:<ul style="list-style-type: none"><li>• social, economic and environmental</li><li>• material and energy resources</li></ul></li><li>• Cost constraints</li><li>• Ergonomics and anthropometrics and physiology</li><li>• Facilities, plant and skills available</li><li>• Safety and risk</li></ul>                                                          |
| <b>Design analysis includes:</b>              | <ul style="list-style-type: none"><li>• Graphical and mathematical methods and software options associated with mechanical, electrical and electronic aspects of avionic analogue systems.</li></ul>                                                                                                                                                                                                                                                                                                                                 |
| <b>Sustainability considerations include:</b> | <ul style="list-style-type: none"><li>• Resources and energy required for design:</li><li>• Life-cycle design of product (manufacture to remanufacture or recycle)</li><li>• Environmental considerations in manufacturing and operation of design:<ul style="list-style-type: none"><li>• raw material, solids and hazardous waste, production by-products</li><li>• potential contamination of land, air and storm water pollutants, discharge to sewerage</li></ul></li></ul>                                                     |

- carbon pollution and reduction effects
- 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
- Prototyping includes:**
  - Any combination of:
    - mock-ups
    - physical and virtual modelling with post-processing for computer-numerically controlled (CNC) and rapid prototyping
- 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 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

- Relevant standards include:**
- 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
  - 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
  - NOHSC:1014 National standard for the control of major hazard facilities
  - AS/NZS ISO 14000 Basic Set:2007 Environmental Management Basic Set
  - ISO 14040:2006 Environmental management – Life cycle assessment – Principles and framework
  - AS 61508.1-2011 Functional safety of electrical/ electronic/ programmable electronic safety related systems – General requirements
  - AS 62061-2006 Safety of machinery - Functional safety of safety-related electrical, electronic and programmable electronic control systems
  - IEEE 802 Wireless PAN, LAN, MAN and WPAN standards
  - IEEE 1332, IEEE Standard reliability program for the development of electronic systems and equipment
  - MIL-STD 785 Reliability program for systems and equipment development and production
  - MIL-STD 1388-1A Logistic Support Analysis (LSA)
  - MIL-STD 1388-2B Requirements for a LSA record
  - MIL-STD 1629A Procedures for performing a failure mode, effects and criticality analysis (FMECA)
  - MIL-STD 1629B FMECA
  - MIL-STD 2173 Reliability centred maintenance requirements (superseded by NAVAIR 00-25-403)
  - OPNAVINST 4130.2A
- Relevant handbooks include:**
- Integrated Logistic Support Handbook, third edition – James V Jones
  - MIL-HDBK-217 Reliability prediction of electronic equipment
  - MIL-HDBK-338B Electronic reliability design

- handbook
- MIL-HDBK-781A Reliability test methods, plans and environments for engineering development, qualification and production
  - NASA PRA Probabilistic risk assessment handbook
  - NASA Fault tree assessment handbook
- 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

## Unit Mapping Information

Release 1 – new unit based on MEM14066A Plan and design avionic engineering projects – units not equivalent

## 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 MEA711 Apply avionic analogue 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 CM and/or ILS requirements
- planning, scheduling and coordinating the avionic analogue design task
- applying design process and scientific principles to component selection and design proposals for components and avionic analogue systems
- solving problems and make decisions with systems thinking for contingencies and constraints and continuous improvement
- integrating avionic analogue techniques, hardware, components and software into aircraft electrical, instrument and electronic systems
- 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.

## 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 avionic component and system designs
- CM and ILS requirements
- 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, decision making and continuous improvement methods
- WHS and regulatory requirements, codes of practice, standards, risk management and registration requirements
- professional and licensed technical assistance for engineering specialisations
- requirement for consultation and negotiation to establish design parameters and criteria
- procedures for planning, scheduling and coordination of design
- hardware requirements of typical avionic analogue component and system applications
- engineering avionic scientific principles and techniques required for analogue system design tasks
- design calculations techniques
- software for product planning and design, such as CAD layout, circuit design, system software and project management
- required documentation:
  - 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
- prototyping options, including mock-ups, simulation, 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 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 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
  - 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
  - integrate avionic analogue techniques, hardware and software
  - solve problems and make decisions with systems thinking for contingencies and constraints and continuous improvement
  - define designs, specify, 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.
- 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

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