Australian Government

MEM234038A Apply systems engineering procedures to engineering design project management

Release: 1

INDUSTRY SKILLS COUNCILS
Creating Australia's Future

MEM234038A Apply systems engineering procedures to engineering design project management

Modification History

Release 1 (MEM05v9)

Unit Descriptor

This unit of competency covers the application of systems engineering procedures in the management of complex engineering design projects, in particular where extensive integration of subsystems and components is required. The system hardware, architecture and software design aspects of systems engineering are covered in specialist design units of competency which all include a requirement for the application of systems thinking.

Application of the Unit

Systems engineering procedures are applied in setting up management procedures for engineering design projects involving the design of complex systems that require the integration of subsystems and/or components by a multi-discipline engineering team. The management processes may relate to all design stages and may include the development of systems software. In the production and life cycle management stages, systems engineering design stage output data may be used in the application of configuration management (CM) procedures (refer to MEM234036A Apply configuration management procedures in engineering project management) and/or to support the application of integrated logistic support (ILS) (refer to MEM234037A Perform maintenance-related integrated logistic support management activities) where justified by system size and complexity or where required by contract.

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 performance needed to demonstrate achievement of the element.

Elements and Performance Criteria

1	Analyse and document system requirements	1.1	Identify and document customer or contractual system requirements
		1.2	Set up a systems engineering team and allocate responsibilities
		1.3	Analyse system requirements and define functional requirements and design constraints
2	Perform functional analysis and allocation	2.1	Decompose system functions to lower level functions applicable to system design
		2.2	Allocate design constraints to all functional levels
		2.3	Define and refine internal and external functional interfaces
		2.4	Define, refine and integrate functional architecture
		2.5	Review functional analysis outcomes against requirements and revise, where necessary
		2.6	Develop and document the functional baseline
3	Manage preliminary design activities	3.1	Coordinate the development of performance specifications for the system and components
		3.2	Define alternatives for system concepts, components and system elements
		3.3	Select preferred product and process solutions

		3.4	Define and refine internal and external physical interfaces
		3.5	Define and refine system software requirements
		3.6	Develop and document the allocated baseline
4	Manage the detail design activities	4.1	Coordinate the development of item, process and material specifications
		4.2	Coordinate the development of software specifications
		4.3	Coordinate the development of engineering drawings and associated material/component/hardware lists
		4.4	Coordinate the development of item performance specifications
		4.5	Determine product review and design verification procedures
		4.6	Develop and document the product baseline
5	Provide oversight of production and delivery	5.1	Apply product review and verification procedures and initiate action to remedy design or production deficiencies
		5.2	Ensure that all relevant regulatory requirements are being met
6	Provide for life cycle management of the system, components and software	6.1	Where there is a contractual requirement for application of CM, provide the technical data package and define the configuration items (CIs) and baselines
		6.2	Where there is a contractual requirement for ILS, provide the technical data package and data required for the development of the relevant ILS plans
		6.3	Where there are no contractual requirements regarding life cycle management, deliver the technical data package and develop procedures for the management of the configuration of the system, system components and software

Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

Required skills

Required skills include:

- setting up and managing procedures for systems analysis and control
- setting up and managing a systems engineering team
- developing and implementing procedures for identification of systems engineering process inputs
- managing and recording the outcomes of requirements analysis
- managing and recording the outcomes of functional analysis and allocation and applying the requirements loop process
- developing and documenting the functional baseline
- managing the development of the system specification and preliminary design
- developing and documenting the allocated baseline
- applying the design loop process
- managing the detail design process and using outputs to develop a technical data package
- developing and documenting the product baseline
- maintaining oversight of the production and delivery phase
- providing process outputs for the establishment of CM procedures or ILS plans
- determining requirements for life cycle management where CM or ILS is not required and setting up and documenting the life cycle management system

Required knowledge

Required knowledge includes:

- the systems engineering process and management procedures
- how to set up and manage the activities of a systems engineering design team
- development of specifications and standards
- identification of applicable published specifications and standards
- how to set up and manage a systems analysis and control database
- how to use process outputs to set up CM and ILS systems for through-life management
- how to develop and document an applicable life cycle management system where CM or ILS is not prescribed or is inappropriate
- ethical considerations in systems engineering

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.

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 managing the application of the systems engineering process.
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, 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. • Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.
Method of assessment	• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package. • Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge. • Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure 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 not only able to be satisfied under the particular circumstance, but is able to be transferred

	to other circumstances. • Assessment may be in conjunction with assessment of other units of competency where required.
Guidance information for assessment	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

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. 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.

Systems engineering process management	The systems engineering process is a comprehensive process for the design and integration of complex systems that cover a range of engineering disciplines. The actual design work will be performed by appropriately qualified specialist engineers and the management process ensures that the design activities are coordinated and integrated into a system that meets specified performance requirements
System requirements analysis	System requirements analysis involves inputs such as customer needs and objectives, regulatory requirements and the technology base. It must clarify and define functional requirements and design constraints
Functional analysis and allocation	Functional analysis and allocation provides a greater understanding of what the system has to do and allocates overall system performance requirements to lower level subsystem and component functions. In so doing, it provides information essential to optimising physical solutions
Baselines	The functional, allocated and product baselines document a product at a specific stage of design definition. The functional baseline describes system level requirements, the allocated baseline describes design requirements for items below systems level and the product baseline describes the product physical detail
Technical data package	Technical data packages may include: • engineering drawings and associated lists • technical manuals • manufacturing part programs • verification provisions • spares provisioning lists • specifications developed for the system and system components • specifications and standards from international and national bodies (government and non-government) • relevant regulatory standards and requirements

Reference material	Reference material includes: • System Engineering Fundamentals, Dept of Defence Systems Management College • NASA/SP-2007-6105 Rev 1 NASA Systems Engineering Handbook • Project Documentation Document SPEC-0064 Rev A, ATST System Engineering Plan • 7th Annual Conference on Systems Engineering Research 2009 (CSER 2009), Systems Thinking or Systems Engineering

Unit Sector(s)

Competency field

Unit sector Engineering science

Custom Content Section

Not applicable.