End-point Assessment Plan for Systems Engineer Degree Apprenticeship Standard

Apprenticeship standard reference number	Apprenticeship standard level	Integrated end-point assessment
ST0107	7	No

Contents

Introduction and overview

This document sets out the requirements for End-Point Assessment (EPA) for the systems engineer degree apprenticeship standard. It is for End-Point Assessment Organisations (EPAOs) who need to know how EPA for this apprenticeship must operate. It will also be of interest to systems engineer degree apprentices, their employers and training providers.

Full time apprentices will typically spend 48-months on-programme (before the gateway) working towards the occupational standard. All apprentices must require a minimum of 12-months on-programme training.

The EPA period must only start, and the EPA be arranged, once the employer is satisfied that the apprentice is consistently working at or above the level set out in the occupational standard, all of the pre-requisite gateway requirements for EPA have been met and that they can be evidenced/available to an EPAO. As gateway requirements, apprentices must have achieved a Master's in systems engineering. They must have completed a report on up to three work-based projects and portfolio of evidence, which will underpin the EPA. In addition, apprentices without English and mathematics at level 2, must achieve level 2 prior to taking their EPA[1].

The EPA must be completed within an EPA period lasting typically four-months, after the apprentice has met the EPA gateway requirements.

EPA must be conducted by an organisation approved to offer services against this apprenticeship standard, as selected by the employer, from the Education & Skills Funding Agency's Register of End-Point Assessment Organisations (RoEPAO).

The EPA consists of two discrete assessment methods, with the following grades:

Assessment method 1 – project report, presentation and questioning

- pass
- distinction
- fail

Assessment method 2 – professional discussion, underpinned by portfolio of evidence

- pass
- distinction
- fail

Performance in the EPA will determine the overall apprenticeship grade of:

- pass
- distinction
- fail

[1] For those with an education, health and care plan or a legacy statement the apprenticeships English and mathematics minimum requirement is Entry Level 3 and British Sign Language qualification are an alternative to English qualifications for whom this is their primary language.

The INCOSE Competency Framework[2], which reflects the Systems and Software Engineering Lifecycle Standard[3], underpins this apprenticeship standard.

Table 1 EPA Summary

On-programme (typically 48-months)	Training to develop the systems engineer occupation standard's knowledge, skills, and behaviours (KSBs) Training towards Master's in systems engineering Compilation of a portfolio of evidence Undertaking up to three work-based projects that develop and demonstrate the required KSBs Training towards English and mathematics level 2, if required
End-point assessment gateway	Employer is satisfied the apprentice is consistently working at, or above, the level of the systems engineer occupational standard Achieved Master's in systems engineering Apprentices must have completed up to three work-based projects, to underpin the project report, presentation and questioning Apprentices must have completed a portfolio of evidence, to underpin the professional discussion Achieved English and mathematics at Level 2, as a minimum
End-point assessment (typically four-months)	Assessment method 1: report, presentation and questioning, graded pass, distinction, fail Assessment method 2: professional discussion, underpinned by portfolio of evidence, graded pass, distinction, fail Overall EPA/apprenticeship graded pass, distinction, fail

[2] INCOSE 2018. Systems Engineering Competency Framework
[3] ISO/IEC/IEEE. (2015). Systems and software engineering — System life cycle Processes (Vol. 15288:2015). London.

Length of end-point assessment period

The EPA (including all assessment methods) will typically be completed within four-months of the first part of the EPA commencing.

Order of assessment methods

The assessment methods can be delivered in any order. The result of one assessment method does not need to be known before an apprentice starts the next one. It is anticipated that the project presentation and questioning components and professional discussion, underpinned by a portfolio of evidence will be conducted on the same day to aide efficiency.

Gateway

The EPA period should only start once the employer is satisfied that the apprentice is consistently working at or above the level set out in the occupational standard, that is to say they have achieved occupational competence. In making this decision, the employer may take advice from the apprentice's training provider(s), but the decision must ultimately be made solely by the employer.

In addition, an apprentice must have completed the following gateway requirements prior to beginning EPA:

- achieved a Master's in systems engineering (i.e. 180 CATS[4] credits at level 7)
- for the project report, presentation and questioning, the apprentice will be required to select up to three completed work-based projects – see requirements below
- for the professional discussion, underpinned by a portfolio, the apprentice will be required to have completed and submitted a portfolio of evidence for the independent assessor to review – see requirements below
- apprentices without English and mathematics at level 2 must achieve level 2, as a minimum. For those with an education, health and care plan or a legacy statement the apprenticeships English and mathematics minimum requirement is Entry Level 3 and British Sign Language qualification are an alternative to English qualifications for whom this is their primary language

Work-based project requirements:

- application of Systems Engineering to a project in the workplace
- in order to demonstrate examples and evidence across the required set of KSBs the apprentice may select up to three projects undertaken during the on-programme period
- the Master's dissertation project could be used provided it relates to the apprentice's work domain, but the report for EPA assessment must be a separate report started after the gateway. In general, projects that are completely theoretical would be unsuitable for consideration in the EPA.

[4] Credit Accumulation and Transfer Scheme (UK)

- an apprentice's selected project(s) may or may not underpin Master's work completed on-programme (i.e. the work may have been undertaken as part of the apprentice's work for their employer) however, the report must be produced post gateway and must not be marked in relation to the Master's degree
- the project(s) must enable the report to demonstrate and clearly reference the following KSBs to the levels defined in the assessment criteria – see Table 4 through to Table 9:
    - K1, K2, K3, K4, K8, K11, K12, K17, K19
    - S1, S2, S3, S4, S10, S12, S16, S20
    - B1, B3
- typically, the project(s) will cover aspects of duties: 1, 2, 3, 5, 8, and 13
- although the project(s) may be conducted within a team, the apprentice must be able to evidence direct experience in all the required knowledge, skills and behaviours (KSBs)
- typically, the selected project(s) would have required a total of at least 500 person-hours effort by the apprentice

Example project titles include:

- Development of a system to…
- Upgrade of system to…
- Performance improvement through system development of…
- Service support system development for…
- Development of a prototype…
- Redesign of a system to…
- A Systems approach to improving…

The choice of work-based project(s) will be agreed by the apprentice with the employer using EPAO guidance. Due attention must be paid to the need to demonstrate the required KSBs.

Portfolio of evidence requirements:

- apprentices must compile a portfolio of evidence during the on-programme period of the apprenticeship
- the portfolio of evidence should contain no more than 10 discrete pieces of work
    - the project artefacts used in assessment method 1 may be included as one of the 10 pieces of work, if it is also needed for KSBs assessed in assessment method 2
- it must contain sufficient evidence to explicitly demonstrate the following KSBs that will be assessed by the professional discussion to the levels defined in the assessment criteria - see Table 4 through to Table 9:
    - K5, K6, K7, K9, K10, K13, K14, K15, K16, K18, K20, K21
    - S5, S6, S7, S8, S9, S11, S13, S14, S15, S17, S18, S19, S21, S22
    - B2, B4, B5, B6, B7

- evidence must be mapped against the KSBs
- evidence may be used to demonstrate more than one KSB; a qualitative as opposed to quantitative approach is required
- evidence sources may include:
    - management and technical reports
    - documents
    - presentations
    - journal/logbook entries
    - systems engineering artefacts
    - published articles
    - annotated photographs
    - webpages
    - media associated with a developed system

  This is not a definitive list, other evidence sources are allowable.
- it cannot include any methods of self-assessment or witness testimonies
- a table mapping the KSBs to be assessed and referencing the evidence sources must be provided
- the evidence provided must be valid and attributable to the apprentice; the portfolio of evidence must contain a statement from the employer confirming this
- the portfolio of evidence must be submitted to the EPAO at the gateway point
- in exceptional circumstances, where national security clearance is required to review the information within the portfolio, the independent assessor should review the portfolio on the employer's premises in advance of the assessment method commencing. In these circumstances, the portfolio does not need to be submitted to the EPAO at the gateway.

Assessment methods

Assessment method 1: project report, presentation and questioning

Overview

This assessment method has three components: report, presentation and questioning.

Apprentices must produce a report, prepare and present a presentation and undertake questioning in relation to a work-based project. The work-based project will be completed during the on-programme period; report and presentation production must take place post-gateway.

The evidence from the report, presentation and questioning components must be assessed holistically against the KSBs assigned to this assessment method by an independent assessor who will determine the grade, using the grading criteria in Table 4 through to Table 9 (see end of document).

The rationale for this assessment method is:

- a work-based project enables demonstration of practitioner abilities in a real setting, and also has business benefits
- end-to-end knowledge of systems development will be tested
- systemic and systematic thinking must be demonstrated practically
- presentation and questioning components enable the checking of underpinning knowledge and aspects not covered in sufficient depth in the report

Requirements for the report and presentation and questioning components are detailed below.

Delivery

a) Report

Apprentices must produce a report of up to 7,500 words (maximum) excluding references, diagrams, and attachments, based on a work-based project, which relates to their particular domain.

All work relating to the report write-up, must be completed during the EPA period.

The general form of the report is a commentary on attached evidence (from the project) and reflections on its execution. The project report will include:

- Project overview
  - describing aims, objectives, scope, and principal outcomes
- Commentary on evidence
  - referring to attachments the rationale and execution of the various project elements is discussed
- Reflection on the systems approach used in the project
  - An holistic view of the project and the way that its various elements were combined
- KSB table
  - A table of all 19 KSBs assessed in this assessment method with references to the paragraphs and attachments that are relevant to each
- Employer Annexe
  - A statement from the employer authenticating the apprentice's evidence and achievements
- All paragraphs in the report must be numbered
- All attachments must be numbered

The apprentice must provide supporting evidence relating to the project in attachments. Evidence could include Systems Engineering Management Plan (SEMP), project plan, risk management plan, Systems Engineering artefacts, costings, diagrams, requirements documents, etc. This list is not definitive and other relevant sources are permissible. It is expected that some pieces of evidence will cover multiple KSBs.

The project report must be submitted by the end of month three of the apprentice's EPA period at the latest, to allow for review ahead of the presentation and questioning components.

In exceptional circumstances, where national security clearance is required to review the information within the project, the independent assessor should review the project on the employer's premises in advance of the presentation and questioning commencing. In these circumstances, the project does not need to be submitted to the EPAO, though the employer must confirm it was completed by the appropriate date.

b) Presentation and questioning

Apprentices must prepare and deliver a presentation on their work-based project. The presentation must be prepared after the gateway and generally will be prepared after submission of the project report. Apprentices must have at least two-weeks to prepare the presentation after the submission of the project report.

The presentation will be made to their independent assessor, in the presence of a representative from the apprentice's employer. The employer representative's role is only to provide technical input in relation to the apprentice's workplace policy and procedures and confirm authenticity of their apprentice's work. They must not provide information on behalf of the apprentice, ask the apprentice questions or influence the apprentice in any way. The EPA judgement lies solely with the independent assessor.

The presentation must cover: the project scope, outcomes/achievements, any difficulties faced/lessons learnt and recommendations.

The presentation must last 30-minutes. The independent assessor has the discretion to increase the time of the presentation by up to 10% to allow the apprentice to complete the presentation.

There are no restrictions on how apprentices deliver the presentation or support resources/materials used. However, any equipment requirements for example PowerPoint, whiteboard, flip chart facilities must be agreed with the EPAO, at least two weeks in advance of the date of the presentation.

Following the presentation, the independent assessor will ask a minimum of five open questions to confirm that the apprentice has achieved the KSBs assigned to this assessment method and to confirm the apprentice's depth of understanding to assess performance against the grading criteria. The independent assessor may ask follow up open questions to probe further or seek clarification. Independent assessors will devise the questions according to the evidence presented via the report and presentation; the EPAO will provide guidance on the scope and typical examples of questions to support consistency.

The duration of the questions and answers will be up to 30-minutes. The independent assessor has the discretion to increase the time of the questioning by up to 10% to allow the apprentice to complete an answer.

The independent assessor must record questions and responses, using EPAO documentation.

Venue

The work-based project presentation and questioning components must take place in a controlled environment; a room free from distractions and influence, with sufficient space for all present. It is anticipated a room will be sourced at training providers' or employers' premises to minimise cost.

It may be conducted in-person or via a suitable online platform, for example video-conferencing. EPAOs must ensure appropriate methods to prevent misrepresentation are in place. For example, screen share and 360-degree camera function with an independent assessor when the presentation and questioning is conducted remotely.

Supporting material

EPAOs must produce the following material to support this assessment method:

- assessment recording documentation including a matrix for recording the assessed levels of competence achieved
- guidance for apprentices and employers
- guidance for independent assessors on the scope and typical examples of questions

Assessment method 2: professional discussion, underpinned by portfolio of evidence

Overview

The evidence from the professional discussion must be assessed against the KSBs assigned to this assessment method, by an independent assessor who will determine the grade, using the grading criteria in Table 4 through to Table 9.

The rationale for this assessment method is:

- That it enables the apprentice to demonstrate the application of KSBs tailored to their workplace domain
- Using the portfolio, the apprentice can discuss evidence from several projects, if not all KSBs have been addressed in a single project
- That it enables domain-specific aspects of systems engineering to be assessed effectively

Requirements for the professional discussion are detailed below.

Delivery

An independent assessor will conduct the professional discussion, in the presence of a representative from the apprentice's employer. The employer representative's role is only to provide technical input in relation to the apprentice's workplace policy and procedures and confirm authenticity of their apprentice's work. They must not provide information on behalf of the apprentice, ask the apprentice questions or influence the apprentice in any way. The EPA judgement lies solely with the independent assessor.

Apprentices must refer to evidence in their portfolio of evidence – see above, when answering questions.

The professional discussion will last 60-minutes. The independent assessor has the discretion to increase the time of the professional discussion by up to 10%, to allow the apprentice to complete an answer.

The independent assessor must ask twelve open questions, covering the KSB groups specified in Table 4 through to Table 9.

The independent assessor must formulate the questions, following the review of the portfolio of evidence, so as to address the KSBs assessed by this assessment method. Independent assessors may ask additional open follow up questions to probe further or seek clarification where required. The EPAO will provide guidance on the scope and typical examples of questions to support consistency.

The independent assessor must record questions and responses, using EPAO documentation.

The EPAO must be provided with a copy of the apprentice's portfolio of evidence at the gateway.

Venue

The professional discussion must take place in a controlled environment; a room free from distractions and influence, with sufficient space for all present. It is anticipated a room will be sourced at training providers' or employers' premises to minimise cost.

It may be conducted in-person or via a suitable online platform, for example video-conferencing. EPAOs must ensure appropriate methods to prevent misrepresentation are in place. For example, screen share and 360-degree camera function with an independent assessor when the professional discussion is conducted remotely.

Supporting material

EPAOs must produce the following material to support this assessment method:

- assessment recording documentation including a matrix for recording the assessed levels of competence achieved
- guidance for apprentices and employers
- guidance for independent assessors on the scope and typical examples of questions
- training of assessors in the devising of open, holistic, and competency-based questions

Reasonable adjustments

The EPAO must have in place clear and fair arrangements for making reasonable adjustments for this apprenticeship standard. This should include how an apprentice qualifies for reasonable adjustment and what reasonable adjustments will be made. The adjustments must maintain the validity, reliability and integrity of the assessment methods outlined in this EPA plan.

Weighting of assessment methods

All assessment methods are weighted equally in their contribution to the overall EPA pass and distinction grade.

Grading

The grading criteria are shown in Table 4 through to Table 9 for the two assessment methods.

The occupation duties and associated KSBs are mapped to INCOSE competencies, which are graded in the INCOSE framework at five levels: awareness, supervised practitioner, practitioner, lead practitioner, and expert (attainment at lead practitioner or expert levels is not required for this assessment plan). At least Awareness level must be achieved for all KSBs[5]. The assessment criteria are based on those defined by INCOSE[6].

The KSBs have been assigned to six groups of competencies (see Table 2). Both assessment methods assess KSBs across the six groups of competencies. These are listed in Table 4 through to Table 9.

To pass the assessment, apprentices must demonstrate the awareness, supervised practitioner and practitioner grading criteria in the combinations as indicated in Table 2.

Performance in a group of competencies across both assessment methods will determine whether a distinction is awarded for that group of competencies. Distinction must be demonstrated in all groups of competencies for a distinction to be awarded overall.

Apprentices will fail the assessment where they do not demonstrate the minimum grading criteria required for a group of competencies.

The minimum requirements for pass and distinction grades are summarised in Table 2. To achieve a Distinction, the candidate must achieve the minimum levels as defined for a pass plus any additional levels as defined for the Distinction.

Table 2 Minimum Requirements for Pass and Disctinction

Competency	**Pass**	**Distinction**
Group 1 (Table 4)		
Systems Thinking	Practitioner	Practitioner
Requirements Definition	Practitioner	Practitioner
Ethics and Professionalism	Supervised Practitioner	Practitioner
Group 2 (Table 5)		
Lifecycles	1 at Practitioner	As per minimum profile for a Pass with an additional competency at Supervised
Capability Engineering	1 at Supervised Practitioner	
Critical Thinking	1 at Awareness	

[5] Note that Awareness criteria are not listed for KSBs which <u>must</u> be achieved at either supervised practitioner or practitioner level

[6] INCOSE 2018. Systems Engineering Competency Framework

Competency	**Pass**	**Distinction**
Systems Modelling and analysis	1 at Practitioner	Practitioner instead of Awareness level
General Engineering	1 at Awareness	
Group 3 (Table 6)		
Communications	Supervised Practitioner	As per minimum profile for a Pass with any of the three competencies increased to Practitioner level
Technical Leadership	1 at Supervised Practitioner	
Negotiation	1 at Awareness	
Group 4 (Table 7)		
Design for...	1 at Practitioner	As per minimum profile for a Pass with selected competencies increased resulting in: 4 at Practitioner 2 at Supervised Practitioner 2 at Awareness
Verification	1 at Awareness	
System Architecting	1 at Practitioner 2 at Supervised Practitioner 3 at Awareness	
Integration		
Interfaces		
Validation		
Transition		
Operation and Support		
Group 5 (Table 8)		
Planning	1 at Practitioner	As per minimum profile for a Pass
Risk and Opportunity	1 at Supervised Practitioner	
Monitoring and Control	1 at Practitioner 1 at Supervised Practitioner 1 at Awareness	As per minimum profile for a Pass with an additional competency at Supervised Practitioner instead of Awareness level
Information Management		
Configuration Management		
Group 6 (Table 9)		
Project Management	Supervised Practitioner	
Finance	3 at Awareness	
Logistics		

Competency	Pass	Distinction
Quality		As per minimum profile for a Pass with selected competencies increased resulting in: 1 at Practitioner 1 at Supervised Practitioner 2 at Awareness

Re-sits and re-takes

Apprentices who fail one or more assessment method will be offered the opportunity to take a re-sit or a re-take. A re-sit does not require further learning, whereas a re-take does.

Apprentices should have a supportive action plan to prepare for the re-sit or a re-take. The apprentice's employer will need to agree that either a re-sit or re-take is an appropriate course of action.

An apprentice who fails an assessment method, and therefore the EPA, will be required to re-sit/re-take any failed assessment methods only.

Re-sits and re-takes are not offered to apprentices wishing to move from pass to distinction.

Where any assessment method has to be re-sat or re-taken, the apprentice will be awarded a maximum EPA grade of pass, unless the EPAO determines there are exceptional circumstances requiring a re-sit or re-take.

Roles and responsibilities

Table 3 Roles and Responsibilities

Role	Responsibility
Apprentice	• complete the on-programme requirements of the apprenticeship • prepare for and complete the EPA
Employer	• identify when the apprentice is ready to pass the gateway and undertake their EPA • notify the EPAO that the apprentice has passed the gateway
EPAO	As a minimum EPAOs should:

	• appoint independent assessors • provide training and CPD to independent assessors • have no direct connection with the apprentice, their employer or training provider i.e. there must be no conflict of interest • have processes in place to conduct internal quality assurance and do this on a regular basis • organise standardisation events and activities • organise and conduct moderation of independent assessors' marking • have, and operate, a complaints and appeals process
Independent assessor	As a minimum an independent assessor should: • be independent of the apprentice, their employer and training provider(s) i.e. there must be no conflict of interest • meet the experience and qualification requirements in accordance with this plan and have had training from their EPAO in terms of good assessment practice, operating the assessment tools and grading • attend EPAOs standardisation and training events
Training provider (University)	As a minimum the training provider should: • work with the employer to ensure that the apprentice is given the opportunities to develop the KSBs outlined in the occupational standard and monitor their progress during the on-programme period • advise the employer, upon request, on the apprentice's readiness for EPA prior to the gateway • plays no part in the EPA itself

Internal Quality Assurance (IQA)

EPA must be conducted by an organisation approved to offer services against this apprenticeship standard, as selected by the employer, from the Education & Skills Funding Agency's Register of End-Point Assessment Organisations (RoEPAO).

Internal quality assurance refers to the requirements that EPAOs must have in place to ensure consistent (reliable) and accurate (valid) assessment decisions. EPAOs for this EPA must:

- appoint independent assessors who:
  - are senior systems engineers currently working in industry or Government, or have recent experience (within the last three-years) and can evidence current knowledge and skills i.e. through continued professional development (CPD). As such, they will usually be chartered engineers and have sufficient

experience to be considered as an 'expert' level systems engineer, according to the description provided in the INCOSE Competency Framework.

- provide training for independent assessors in terms of good assessment practice, operating the assessment tools and grading to ensure consistency across the independent assessors. Mandatory induction and standardisation training will be provided before the independent assessor undertakes an assessment for the first time with mandatory standardisation training made available annually.
- have robust quality assurance systems and procedures that support fair, reliable and consistent assessment across the organisation and over time.
  operate moderation of assessment decisions based on risk, with a minimum of 20% of an independent assessors' decisions moderated.

Affordability

Affordability of the EPA will be ensured by using at least some of the following practice:

- using an employers' or training providers' premises for presentation and questioning components and professional discussion
- project should be of benefit to the apprentice's workplace

Assessment Criteria for Knowledge, Skills and Behaviours

In Table 4 through to Table 9 below the criteria for assessing KSBs at different levels of competence are presented. These are grouped by the assessment method to be used to assess these competencies. Note that Table 2 defines the minimum attainment levels required for Pass and Distinction grades.

Definitions

In Table 4 through to Table 9 below, the following definitions apply:

- “Working under supervision” means that the apprentice carries out the task in full, but with supervisory guidance to set the task and timeline, to define activities, and inform decision criteria
- “Working under a mentor” means that the apprentice carries out the task in full and, possibly, sets their own timelines and activity plan, but that technical guidance is provided by the mentor
- “Working independently, or supervising others, means that the apprentice has carried out the task with authority to make all decisions and set activities and expected outcomes
- “Can describe” means that a detailed description of the task, process, entity, etc. can be provided by the apprentice but without necessarily being able to explain the reasoning or theory that underpins the task, process, entity, etc.
- “Can identify” means that using an example system (usually one upon which the apprentice has worked) particular features can be distinguished and named
- “Can explain” means that the entity can be described in detail with well-argued reasons for choices or decisions and references to theory or practice where appropriate
- “Can evidence” means that based on the portfolio content, the apprentice can show their contribution clearly and explain it in detail
- “Can justify” means that the apprentice can list alternatives and provide a reasoned argument for the choice of one alternative over others
- “Can show” means that based on the portfolio content the relationships between entities or parts of a process can be mapped
- The terms “small problem/system” and “complex problem/system” must be determined according to the typical level of complexity in the business sector. In general, a small problem/system is likely to be a system element entirely managed by the apprentice and a complex or large problem/system will be a system of system element being addressed by a team (usually multi-disciplinary)

Table 4 Group 1 Competencies

Group 1. Assessment 1: Report, Presentation and Questions			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
Systems Thinking S2 Define context of a system from a range of viewpoints including system boundaries and external interfaces	• N/a	• N/a	Has • Selected and applied appropriate systems thinking approaches to demonstrate this skill • Lead a team systems thinking activity aligned to purpose of an activity in which they were involved
B1 Adopt an holistic thinking approach to system development	• N/a	• N/a	Can explain • Enterprise and technology issues affecting design of a system and their application of systems thinking techniques to address them

			Can identify • Systems concepts in the behaviour of a complex project or system and identify and apply systems methods to resolve issues Can evidence • Leadership of systems thinking activities in a complex project
Requirements definition K3 The characteristics of good quality requirements and the need for traceability	• N/a	• N/a	Can define • Governing requirements elicitation and management plans, processes and appropriate tools Can explain • Elicitation and validation of stakeholder requirements • How to establish acceptance criteria for requirements • How to establish a complete and consistent

			requirement set for the system of interest. • How to assess the impact of changes to requirements on the solution and program. Can describe • Qualities of good, consistent requirements
S3 Use appropriate methods to analyse stakeholder needs to produce good quality, consistent requirements with acceptance criteria and manage them throughout system development			Has • Demonstrated this skill independently or has managed others. • Written good quality and consistent requirements for a system of interest, including resolution and negotiation where applicable

Group 1, Assessment 2: Professional Discussion			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
Ethics and Professionalism K15 How to take account of health and safety legislation and sustainable development requirements in the relevant industry	• N/a	Can describe • How systems engineering activities are performed with integrity • Health and safety considerations relevant to systems development	Can identify • Appropriate health and safety legislation relevant to development of a specific system or system element
B4 Take personal responsibility for health and safety practices and sustainable development	• N/a	Evidence of • Health and safety considerations and sustainable development considerations in system design activities, carried out under supervision	Evidence of • Health and safety considerations and sustainable development considerations in system design activities, carried out independently or supervising others
B5 Operate with integrity and in an ethical manner, and ensure that team members perform with integrity and in an ethical manner	• N/a	Can describe • Ethical considerations and appropriate behaviours with reference to real or hypothetical projects in employer's business domain	Can explain with reasoned argument • Ethical considerations and appropriate behaviours with reference to real or hypothetical projects in employer's business domain

Table 5 Group 2 Competencies

Group 2, Assessment 1: Report, Presentation and Questions			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
Lifecycles K1 Systems engineering lifecycle processes	Can describe • Different lifecycles and their characteristics	Can describe • Systems Engineering lifecycle processes Can identify • Life cycle processes on a project upon which they are working and the suitable activities at system or systems element level Can explain • Advantages and disadvantages of different systems development lifecycles and where to apply them advantageously • Importance of considering future	Can identify • Project, enterprise and technology needs that affect choice of lifecycle model governing a project • Dependencies between lifecycle stages of different system elements requiring alignment in a project Can explain • Plans for transitions between lifecycle stages in a project • Application of enterprise-level policies, procedures, guidance, and best practice to lifecycle selection in a project

		lifecycle stages during the current stage	• Preparation of future lifecycle phases, taking into account the impact on current phase and improvement of current activities
S1 Select appropriate lifecycle for a system or element of a system and establish its lifecycle stages and the relationships between them	Can explain • Why selection of lifecycle is important • Why an appropriate lifecycle process model should be defined • Why different engineering approaches are required in different lifecycle phases	Has • Demonstrated this skill under supervision or in the role of assistant	Has • Demonstrated this skill independently or has managed others • Used enterprise-level policies, procedures, guidance and/or best practice to select lifecycles governing the project and defined dependencies and transitions between lifecycle stages

Capability Engineering K2 The role a system plays in the super system of which it is a part	Can explain • The concept of capability and how it is useful to characterise systems • How capability requirements may be satisfied by integrating several systems • How super system capability needs may impact the development of contributing systems	Can identify • Capability issues from the wider system that will affect the design of the system of interest Can explain • How super system capability needs impact on the development of each system that contributes to the capability. Can describe • Different elements that make up capability within a project	Can identify • Capability issues of the wider (super) system which affect the design of a system and translate them into system requirements Can describe • Assessment of existing super system capability and identification of gaps, leading to recommendations for reduction or elimination of deficit
Critical Thinking B3 Adopt a critical thinking approach using a logical critique of work including assumptions, approaches, arguments, conclusions, and decisions	Can explain • Why ideas, arguments, and solutions need to be critically evaluated • Why bias may occur in arguments	Evidence in technical approach of • Clear statement of assumptions • Careful selection of methods • Logical deductions and conclusions	Evidence in technical approach of • Examination of impact of assumptions or weak logic and looks for substantive arguments • Effective challenging of team assumptions, decisions and/or conclusions

			• Constructs robust and detailed logical argument
Group 2. Assessment 2: Professional Discussion			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
Systems Modelling and Analysis K5 The benefits and risks associated with modelling and analysis	 Can explain • Why systems representations are needed and the benefits they offer • Relevance of model outputs and how these relate to system development Can describe • Scope and limitations of models • Different types of modelling and simulation	 Can explain • Why models are developed for a specific purpose or use and provides examples • Why models and simulations have a limit of valid use, and the risks of using models and simulations outside those limits. • How modelling or simulation have been used to represent a specific system or system element, including choice of tools and techniques, model development, analysis and interpretation	 Can define • Governing modelling and analysis plans, processes and appropriate tools for a project, and explain their use to monitor and control systems modelling and analysis activities for a system or system element • Management strategy for models produced within a project Can explain • Selection of appropriate representation of a specific systems or systems element and appropriate tools and techniques for its modelling and analysis

S5 Generate a physical, mathematical, or logical representation of a system entity, phenomenon or process	Can describe • a variety of system analysis techniques which can be used to derive information about a system.	Has • Demonstrated this skill by applying scientific or engineering principles under supervision or mentor	Has • Demonstrated this skill independently, as leader of a team, or as a technical mentor to others
General Engineering K14 Scientific, technical, engineering, and mathematics fundamentals and a broad technical domain knowledge for the relevant industry	Has • Knowledge of core principles of science and engineering	Can describe • Application of suitable scientific or engineering theory, methods, and tools for system development	Can explain and justify • Determination of scientific and mathematical theory for use in system development • Application of suitable scientific or engineering theory, methods, and tools for system development • Engineering decisions underpinned by engineering principles and theory

Table 6 Group 3 Competencies

Group 3. Assessment 1: Report, Presentation and Questions			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
Communications S12 Communicates effectively with all stakeholders of the project	• N/a	Can provide evidence of • Effective communication using appropriate media and means to influence project outcomes	Can provide evidence of • Effective communication using appropriate media and means to influence project outcomes • Development of communicating culture within team or stakeholder group
Group 3. Assessment 2: Professional Discussion			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
Technical Leadership K6 How creativity, ingenuity, experimentation and accidents or errors, often lead to technological and	Can explain • The role of technical leadership in systems engineering	Can describe • How creativity, ingenuity, experimentation, an accidents or error has led	Can describe and explain • An exemplar of their use of creativity, innovation, or problem solving techniques to develop

engineering successes and advances	• The importance of collaboration in systems engineering • Why understanding strategy is important to systems engineering leadership	them to a solution or engineering success • How their innovative ideas have been communicated to peers and other stakeholders • How ideas have been modified or developed as a result of peer review or criticism	strategies or resolve team or project issues Can explain • The interpretation of a vision for a project team and how to gain acceptance across the team • How constructive criticism enabled self-improvement and modification or development of strategy or ideas
S6 Apply creativity, innovation and problem solving techniques to system development or operation	Can explain • How creativity, ingenuity, and experimentation leads to technological and engineering success	Has • Demonstrated this skill for a small project or systems, within the context of the business and can identify the creative, innovative, or key problem solving steps	Has • Demonstrated this skill for a complex project or system within the context of the business, or led an innovation team. • Can identify the creative, innovative, or key problem solving steps
S21. Identify concepts and ideas in sciences, technologies and engineering disciplines beyond their own discipline	Can explain • How different sciences impact the technology and engineering domain	Evidence of • Maintaining knowledge of across engineering and/or scientific disciplines	• Not required at practitioner level; use same criterion as supervised practitioner

that could benefit the project solution B7. Maintain awareness of developments in sciences, technologies and related engineering disciplines	Can describe • How to keep abreast of science and technology advances	Can evidence • Ongoing technical learning, drawing on examples from logbook	• Not required at practitioner level; use same criterion as supervised practitioner
Negotiation B2 Perform negotiations with stakeholders recognizing different styles of negotiating parties and adapts own style accordingly	Can describe • When negotiation may be necessary and what it entails	• Not Applicable: this is required at practitioner level where claimed	Evidence of • Successful negotiations conducted within a system development or operation activity, conducted independently or in a leadership role

Table 7 Group 4 Competencies

Group 4. Assessment 1: Report, Presentation and Questions			
Competency/KSB	Awareness	Supervised Practitioner	Practitioner
Design for… K8 Non-functional design attributes such as manufacturability, testability, reliability, maintainability, affordability, safety, security, human factors, environmental impacts, robustness and resilience, flexibility, interoperability, capability growth, disposal, cost, natural variations, etc	Can explain • Why the requirements of all lifecycle stages must be accommodated • The importance of integrating design specialties into the solution and how this may lead to conflicting requirements Can describe • Relationships between "ilities"	Can explain • The process and tools selection to manage and control selected specialty engineering activities • Selection and balancing of design attributes in support of specialty engineering needs • How techniques and tools are used to ensure design meets specialty needs Can identify • Design attributes and how they influence the design • Relationships pertinent to the integration of specialisms within a project Can describe	Can explain • Definition of governing specialty engineering plans, processes and appropriate tools to monitor and control specialty engineering activities • How to select and balance design attributes throughout the design process in support of specialty engineering needs • Selection and application of appropriate techniques to characterize the operational environment and trade studies to determine and characterize specialty characteristics of proposed solutions

		• The operational environment in ways appropriate to support specialty engineering activities • How trade studies influence characteristics of proposed solutions	• The integration of specialisms within a project Can justify • Trade-offs involving conflicting demands from design specialisms
Verification K11 Systems verification against specified requirements and characteristics and the need to execute it in a logical sequence.	Can explain • The purpose of verification • Why there is a need to verify a system in a logical sequence	Can describe • The verification environment Can identify • Required evidence for verification of small projects Can explain • Verification plans, including selection of standards, methods, and definition of timing for small projects, in context of business domain • How evidence establishes that a system meets requirements	Can explain • How to define governing verification plans, processes and select tools to monitor and control verification activities • How to write verification plans, including selection of standards, methods, and definition of timing for complex systems or projects, in context of business domain • How to write detailed verification procedures Can identify • Suitable verification environment

S10 Define verification plans (including tests) to obtain objective evidence that a system of system element fulfils its specified requirements and characteristics	Can explain • Why verification should be planned	Has • Assisted with the development of verification plans • Written verification plans independently for small projects of systems • Carried out verification tasks under supervision	• Required evidence for verification of complex projects Can show • Traceability between verification requirements and system requirements Has • Developed verification plans independently or as supervisor to others • Written verification plans and procedures for complex systems • Carried out verification tasks independently or as supervisor of others
Group 4. Assessment 2: Professional Discussion			
Competency/KSB	Awareness	Supervised Practitioner	Practitioner
Systems Architecting K7 Different types of systems architecture and techniques used to support the architectural design process (i.e. the specification of systems elements and their relationships)	Can describe • The principles of architectural design • Different types of architecture	Can explain • The choice of architecture type and techniques used for a specific system or systems element • How analysis techniques have been used in the	Can explain • How to define governing systems architecting plans, processes, and appropriate tools for system architectural design activities.

		architectural design process • How architectural attributes relate to requirements • How functional analysis is conducted for a specific system Can describe • Concept feasibility and design trade-off applied to a system or systems element	• How to partition a system into realizable system elements that can be brought together to meet the requirements • Monitoring or an evolving design solution and how key aspects are used to adjust the architecture of a system Can justify • Choice of techniques, architectural analysis and selection of an optimum solution based on an example system
S7 Define the systems architecture and derived requirements to produce an implementable solution that enables a balanced and optimum result that considers all stakeholder requirements across all stages of the lifecycle	Can explain • The need for functional models of a system • The process and key artefacts of functional analysis • How outputs from functional analysis lead to overall system design	Has • Contributed to the architectural design process through provision of solely produced artefacts as a team member or under supervision	Has • Contributed substantially to the architectural design process, offering alternative designs, and conducting analysis to support decision making. Works independently or supervises others

S22 Partition between discipline technologies and work with specialists to derive discipline specific requirements	Can explain • Why alternative discipline technologies can be used to satisfy the same requirement	Has • Applied systems architecting approaches to derive discipline specific requirements	• Not required at practitioner level; use same criterion as supervised practitioner
Integration K9 Integration as a logical sequence to confirm the system design, architecture, and interfaces	Can explain • Why integration is important and how it confirms the systems design, architecture and interfaces • Why a system should be integrated in a logical sequence	Can explain • The development of integration plans for a small project, within the context of their business domain, including applicable methods and timing Can identify • Evidence to be gathered during integration in support of downstream test and acceptance activities • Simple faults typically found during integration activities and describe how they will be documented and communicated to stakeholders	Can explain • How to define governing integration plans, processes and appropriate tools to monitor and control integration activities • How to develop integration plans for larger, more complex systems or projects, within the context of their business domain including applicable methods and timing and how standards influence the plans • The management of integration activities for a system, product or service Can identify

		• Appropriate corrective actions for typical faults found during integration activities Can describe • The integration environment for a small project within the context of their business domain	• Evidence to be gathered during integration in support of downstream test and acceptance activities • Complex faults typically found during integration activities and describe how they will be documented and communicated to stakeholders • Appropriate corrective actions for typical faults found during integration activities Can describe • The integration environment for a more complex systems or projects, within the context of their business domain
S9 Assemble a set of system elements and aggregate into the realised system, product, or service using appropriate techniques to test interfaces,	Can explain • Why planning and management of integration is necessary	Has • Assisted in the development of integration plans and	Has • Developed integration plans and carried out integration tasks

manage data flows, implement control mechanisms, and verify that elements and aggregates perform as expected		carried out integration tasks under supervision	independently or as supervisor of others
Interfaces K10 Interface management and its potential impact on the integrity of the system solution	Can explain • The impact of interface definition on the system solution	Can explain • How to identify and define simple interfaces Can describe • Governing processes to manage and control interfaces	Can explain • Definition of governing interface management plans, processes, and tools to monitor and control interface management activities Can describe • Possible sources of complexity for interface definition and management Can identify • System element interfaces and define and them • Consequences of changes to interfaces at systems element, system, or systems of systems level

S8 Identify, define, and control interactions across system or system element boundaries	Can describe • How an interface may be defined	Has • Identified and defined simple interfaces	Has Identified and defined multiple types of interface in complex systems
Validation K12 The relationship between verification, validation, and acceptance	Can describe • The relationship between verification, validation, and acceptance	Can describe • Appropriate verification, validation, and acceptance tests for a system • How evidence gathered in verification and validation testing supports qualification, certification, and acceptance testing	• Not required at practitioner level; use same criterion as supervised practitioner
K13 The purpose and importance of system validation in relevant commercial context	Can explain • The purpose of validation	Can describe • Development of validation plans based on standards and corporate processes Can explain • Use of terminology for validation to engage customer and end user appropriately • Procedures used to record results, identify anomalies, and resolve failures during validation	Can explain • How to define governing validation plans, processes and select tools to monitor and control validation activities • How to write validation plans, including selection of standards, methods, and definition of timing for complex systems or projects, in

			• context of business domain • How to write detailed validation procedures • Use of terminology for validation to engage customer and end user appropriately Can show • Traceability between validation requirements and user and customer requirements
S11 Provide objective evidence that the operational system fulfils its business or mission objectives and stakeholder requirements and expectations	Can explain • How validation should be planned	Has • Assisted with the development of validation plans • Conducted validation activities under supervision	Has • Developed validation plans independently or as supervisor of others • Interacted with customer effectively • Carried out validation activities independently or as the supervisor of others

Transition K12 The relationship between verification, validation, and acceptance	Can describe • The relationship between verification, validation, and acceptance	Can describe • Appropriate verification, validation, and acceptance tests for a system • How evidence gathered in verification and validation testing supports qualification, certification, and acceptance testing	• Not required at practitioner level; use same criterion as supervised practitioner
S13 Integrate a system into its operational environment, including the provision of support activities (e.g. specification of site preparation, training, logistics, etc.)	Can explain • How transition may be performed Can list • Activities and work products required for transition	Has • Carried out transition activities in accordance with plan and under supervision	Has • Developed transition plan independently or as supervisor to others • Interacted with user effectively • Carried out transition activities independently or as supervisor to others
Operation and Support K16 The relationship of service quality to user satisfaction and cost, risk, and availability of the operational system	Can describe • Support needed for systems or products in service • Management of obsolescence and upgrade	Can describe • The governing processes and tools to plan and control a system, product or service operations, maintenance and support related activities	Can explain how to • Define governing operation and support plans, processes and appropriate tools to monitor and control system, product or

		Can identify • Appropriate operational data for collection in order to assess system performance • Design changes to improve system performance or overcome system failure Can identify and evaluate • Evolving user needs, new technologies, and obsolescence issues, and recommend system updates in response	service operation, maintenance and support activities • Monitor and address changes to system operational environment or external interfaces • Ensure technical support data (e.g. procedures, guidelines, checklists, training and maintenance materials) remain current Can identify • Data to be collected in order to assess system, product or service operational performance • System elements approaching obsolescence and explain how to conduct studies to identify suitable replacements

S15 Initiate design change proposals in response to system failure or degradation	Can describe • Difference between preventative and corrective maintenance	Has • Assisted in operation and support activities to assess systems performance, failures, and obsolescence, and evolving user needs, and new technology opportunities to initiate system design changes and update.	Has • Managed, independently or as supervisor of others, operation and support activities to assess systems performance, failures, and obsolescence, and evolving user needs, and new technology opportunities to initiate system design changes and update.
S14 Define and collect operational data for monitoring and control of a system	Can identify • Data needs and collection methods for operational support	Has • Assisted with monitoring and control of systems engineering activities, including measurement assessment and reporting of tasks against plans • Identified corrective actions if necessary	Has • Monitored and controlled systems engineering activities, including measurement assessment and reporting of tasks against plans independently or as supervisor of others • Identified and applied corrective action if necessary

			• Managed and traded technical margins horizontally and/or vertically through the project hierarchy, if needed
B6 Take a proactive and systematic approach to resolving operational issues	Can explain • How to identify and rectify system faults	Can evidence • Examples of activities during operation carried out to identify in advance and avoid operational issues, under supervision Can describe • Key system features or behaviours that ensure user satisfaction	• Not required at practitioner level; use same criterion as supervised practitioner

Table 8 Group 5 Competencies

Group 5. Assessment 1: Report, Presentation and Questions			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
Planning K19 The role of systems engineering planning as part of an overall project/programme plan	• N/a	Can describe • Development of systems engineering plan for a project • Linkage of systems engineering plan to project management plan Can identify • Key design parameters required to track critical aspects of design during development	• Not required at practitioner level; use same criterion as supervised practitioner
S20 Coordinate and maintain effective and workable plans across multiple disciplines	• N/a	Has • Assisted in the development and implementation of systems engineering plans under supervision	Has • Developed and implemented systems engineering plans independently or as a supervisor of others
Risk and Opportunity K4 The distinction between risk, issue, and opportunity and the different forms of treatment available	• N/a	Can describe • Governing processes for risk and opportunity management	Can explain • The definition of risk and opportunity management plans, processes, and

		• Communication of risk and opportunity status to affected stakeholders. Can explain • Application of risk and opportunity processes (including identification, assessment, analysis, treatment) to a specific project • Monitoring and management of systems engineering risks and opportunities to a specific project	tools used to control and monitor risk and opportunity management activities in a specific project • The project risk and opportunity profile including context, likelihood,, consequences, thresholds, priority and risk action and status of a specific project • The generation of a risk action plan for risks that exceed the threshold for a specific project •
S4 Identify, analyse, recommend treatment, and monitor and communicate risks and opportunities throughout project	• N/a	Has • Assisted with preparation of risk and opportunity processes • Assisted with risk and opportunity management activities, including identification, assessment, analysis, treatment, mitigation, monitoring, and	Has • Established a project risk and opportunity profile including context, probability, consequences, thresholds, priority and risk action and status • Carried out risk and opportunity management

		communication of risk and opportunity status.	activities independently or has managed others
Group 5. Assessment 2: Professional Discussion			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
Monitoring and Control K14 Scientific, technical, engineering, and mathematics fundamentals and a broad technical domain knowledge for the relevant industry	Can explain • The role of monitoring and control in a project Can describe • Typical systems engineering metrics • Different types of technical and non-technical review across the system lifecycle	Can describe • Application of suitable scientific or engineering theory, methods, and tools for system development	Can explain and justify • Determination of scientific and mathematical theory for use in system development • Application of suitable scientific or engineering theory, methods, and tools for system development • Engineering decisions underpinned by

			engineering principles and theory
Information Management K20 The legal, commercial, and security constraints that affect the management of data and information (e.g. General Data Protection Regulation, handling of specific commercial contract restrictions)	Can identify • Relevant legal and commercial constraints on information management	Can describe • The principles for obtaining, transferring, distributing, maintaining, and transforming data in accordance with integrity, security, privacy requirements and data rights • The principles and methods through which valid sources of information and associated authorities are defined • The principles through which data and information is retired, archived and curated	• Not required at practitioner level; use same criterion as supervised practitioner

S19 Plan, execute, and control the storage and provision of information to stakeholders	Can describe • Various types of information that should be managed in a systems engineering process and how it should be managed	Has • Assisted with information management at all stages of information lifecycle • Assisted with provision of information to stakeholders • Assisted with sharing lessons learned beyond the project boundary	Has • Conducted information management at all stages of the information lifecycle, working independently or supervising others • Determined appropriate media choices and processes for information provision • Provided lessons learned beyond the project boundary
Configuration Management K20 The legal, commercial, and security constraints that affect the management of data and information (e.g. General Data Protection Regulation, handling of specific commercial contract restrictions)	Can identify • Relevant legal and commercial constraints on information management	Can describe • The principles for obtaining, transferring, distributing, maintaining, and transforming data in accordance with integrity, security, privacy requirements and data rights • The principles and methods through which valid sources of information and	• Not required at practitioner level; use same criterion as supervised practitioner

		associated authorities are defined • The principles through which data and information is retired, archived and curated	
S18 Manage and control system elements and configuration over the project or programme lifecycle ensuring overall coherence of the design is maintained in a verifiable manner throughout the lifecycle	Can explain • How configuration management supports design integrity Can describe • Key activities performed as part of configuration management	Has • Assisted with configuration management under supervision or with mentor support. • Generated documentation for change control activities	Has • Lead configuration control activities, including selection of configuration items and associated documentation, conducting change control review with customer, and configuration status accounting reports and audits

Table 9 Group 6 Competencies

Group 6. Assessment 1: Report, Presentation and Questions			
Competency/KSB	Awareness	Supervised Practitioner	Practitioner
Project Management K17 The elements of a project management plan (including	• N/a	Can describe	Can explain

statement of work, work breakdown structure, resource allocation, scheduling, management plan, monitoring, risk management, change requests, record keeping, and acceptance)		• Project scheduling and resourcing, work breakdown structure, monitoring and control, initiating and terminating project	• How to conduct project scheduling and resourcing, work breakdown structure, monitoring and control, initiating and terminating project
K19 The role of systems engineering planning as part of an overall project/programme plan	• N/a	Can describe • Development of systems engineering plan for a project • Linkage of systems engineering plan to project management plan Can identify • Key design parameters required to track critical aspects of design during development	Can explain • How to define governing process and appropriate tools to plan and control systems engineering activities for a project • Linkage of systems engineering plan to overall project management plan • How to estimate and secure sufficient systems engineering effort for a project Can identify • Key design parameters required to track critical aspects of design during development

S16 Create and maintain project management plan, including work breakdown structure, scheduling, and risk management	• N/a	Has • Assisted with development of a project plan for a substantial project and with implementation of the plan including monitoring, control, and reviews	• Not required at practitioner level; use same criterion as supervised practitioner
Group 6. Assessment 2: Professional Discussion			
Competency/KSB	Awareness	Supervised Practitioner	Practitioner
Finance K18 The commercial and financial environment in which a project is being executed (e.g. procurement model, interest rates, exchange rates)	Can explain • Why it is necessary to estimate budgets and control costs • Impact of project decisions on costs	Can describe • Cost estimation, budget determination and funding requirements, life-cycle cost planning, cost monitoring, and corrective actions to manage finance	• Not required at practitioner level; use same criterion as supervised practitioner
Logistics			

K21 Support and sustainability needs of a deployed system or product	Can explain • The importance of considering logistics support during system design • The concept of life cycle costs Can list • Key logistics support activities	Can describe • How to analyse supportability requirements for a system, or system element • How to manage and control spares, repairs, and supplies for a deployed system • How to assess packing, handling and transportation required for system sustainment Can identify and analyse • Data and documentation needed for sustainment of a system	• Not required at practitioner level; use same criterion as supervised practitioner
Quality S17 Balance project scope, time, cost, risk, and resources to optimise product or service quality and return on investment	Can list • Appropriate quality standards Can describe • Purpose and importance of quality assurance Can explain	Has • Assisted with identification, measurement, monitoring, and analysis of quality measures and characteristics to improve project quality	• Not required at practitioner level; use same criterion as supervised practitioner

	• Impact of project decisions on system or product quality	• Assisted with verification of product or system conformity to appropriate standard	