Institute for Apprenticeships & Technical Education

End-point assessment plan for Space engineering technician apprenticeship standard

Apprenticeship standard reference number	Apprenticeship standard level	Integrated end-point assessment
ST0855	4	No

Contents

Introduction and overview

This document sets out the requirements for end-point assessment (EPA) for the Space engineering technician apprenticeship standard. It is for end-point assessment organisations (EPAOs) who need to know how EPA for this apprenticeship must operate.

It provides the EPA design requirements for end-point assessment organisations (EPAOs). It will also be useful for apprentices undertaking this apprenticeship, their employers and training providers.

EPA must be conducted by an EPAO approved to deliver EPA for this apprenticeship standard. Each employer should select an approved EPAO from the Register of end-point assessment organisations (RoEPAO).

Full time apprentices will typically spend 48 months on-programme (before the gateway) working towards the occupational standard. All apprentices must spend a minimum of 12 months on-programme. Apprentices must complete the required amount of off-the-job training specified by the apprenticeship funding rules.

Before starting EPA, an apprentice must meet the gateway requirements. For this apprenticeship they are:

- the employer must be content that the apprentice is working at or above the occupational standard
- apprentices must have compiled and submitted a portfolio of evidence to underpin the interview
- achieved English and mathematics qualification in line with the apprenticeship funding rules

The EPAO must confirm that all required gateway evidence has been provided and accepted as meeting the gateway requirements. The EPAO is responsible for confirming gateway eligibility. Once this has been confirmed, the EPA period starts.

This EPA should then be completed within an EPA period lasting typically for three months.

This EPA consists of three discrete assessment methods.

It will be possible to achieve the following grades in each assessment method:

Assessment method 1: Multiple-choice test

- fail
- pass
- distinction

Assessment method 2: Observation with questions

- fail
- pass
- distinction

Assessment method 3: Interview underpinned by a portfolio of evidence

- fail
- pass
- distinction

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

- fail
- pass
- merit
- distinction

EPA summary table

On-programme (typically, 48 months)	Training to develop the occupation standard's knowledge, skills and behaviours (KSBs). Complete training towards English and mathematics qualifications in line with the apprenticeship funding rules . Compiling a portfolio of evidence.
End-point assessment gateway	The employer must be content that the apprentice is working at or above the occupational standard. Achieved English and mathematics qualification in line with the apprenticeship funding rules. Apprentices must submit a portfolio of evidence to underpin the interview. The employer must provide the EPAO access to the relevant organisational policies and procedures, as required, to support the observation and interview to ensure the apprentice meets their requirements during EPA.
End-point assessment (typically, three months)	Assessment method 1: Multiple-choice test With the following grades: • fail • pass • distinction Assessment method 2: Observation with questions With the following grades: • fail • pass • distinction Assessment method 3: Interview underpinned by a portfolio of evidence With the following grades: • fail • pass • distinction Performance in these assessment methods will determine the overall apprenticeship standard grade of: • fail • pass

	• merit • distinction
Professional recognition	Aligns with recognition by: • Institute of Engineering and Technology (IET) – Engineering Technician • Institute of Mechanical Engineers (IMechE) – Engineering Technician • Royal Aeronautical Society – Engineering Technician

Length of end-point assessment period

The EPA will be completed within an EPA period lasting typically three months, starting when the EPAO has confirmed that all gateway requirements have been met.

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 starting the next.

Gateway

The apprentice should only enter the gateway once the employer is content that the apprentice is working at or above the occupational standard. 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.

The EPAO determines when all other gateway requirements have been met, and the EPA period will only commence once the EPAO has confirmed this.

In addition to the employer's confirmation that the apprentice is working at or above the level in the occupational standard, the apprentice must have completed the following gateway requirements prior to beginning EPA:

- Achieved English and mathematics qualification in line with the apprenticeship funding rules.

For the multiple-choice test:

- no specific requirements

For the observation with questions, the employer must provide access to:

- the relevant organisational policies and procedures, to ensure the apprentice meets their requirements during EPA

For the interview, the apprentice will be required to submit:

- a portfolio of evidence

For the interview, the employer must provide access to:

- the relevant organisational policies and procedures, to ensure the apprentice meets their requirements during EPA

Portfolio of evidence requirements:

- apprentices must compile a portfolio of evidence during the on-programme period of the apprenticeship
- it must contain evidence related to the KSBs that will be assessed by the interview
- the portfolio of evidence will typically contain ten discrete pieces of evidence
- evidence must be mapped by the apprentice against the KSBs
- evidence may be used to demonstrate more than one KSB; a qualitative as opposed to quantitative approach is suggested
- evidence sources may include:
    - performance review documentation
    - witness statements
    - training records or certificates
    - work products such as risk assessments, reports, meeting records, plans etc.

  This is not a definitive list; other evidence sources are possible.
- it should not include any methods of self-assessment
- any employer contributions should focus on direct observation of performance (for example witness statements) rather than opinions
- the evidence provided must be valid and attributable to the apprentice; the portfolio of evidence must contain a statement from the employer and apprentice confirming this
- the portfolio of evidence must be submitted to the EPAO at the gateway

The portfolio of evidence is not directly assessed. It underpins the interview and therefore should not be marked by the EPAO. EPAOs should review the portfolio of evidence in preparation for the interview but are not required to provide feedback after this review of the portfolio.

End-point assessment methods

The apprentice will be assessed against the KSBs assigned to the assessment methods outlined below, as shown in the mapping section of this EPA plan.

End-point assessment method 1: Multiple-choice test

Overview

This assessment method has one component.

A multiple-choice test is a controlled assessment, which consists of a series of questions in which apprentices are asked to provide a response.

The rationale for this assessment method is:

- it allows for the efficient testing of knowledge where there is a right or wrong answer
- it allows for flexibility in terms of when, where and how it is taken
- it allows larger volumes of apprentices to be assessed at one time
- it does not require independent assessor time, reducing cost

Delivery

Test Format

The test can be:

- computer based
- paper based

It will consist of 40 questions.

The multiple-choice questions will have four options, of which one will be correct. The questions must be varied, to avoid the test becoming too predictable, yet allow assessment of the relevant KSBs.

Test administration

Apprentices must have 90 minutes to complete the test.

The test is closed book which means that the apprentice cannot refer to reference books or materials except materials provided by the EPAO, which will be limited to a standard engineering data book such as the *IMechE Engineers' Data Book* (or similar) and a list of physical constants, both of which will be agreed with employers in advance of the EPA.

The following equipment is permitted during the test:

- pens/pencils/paper
- scientific calculator (non-programmable)

Assessment

Multiple-choice tests must be marked by independent assessors or markers employed by the EPAO following a marking guide produced by the EPAO. Alternatively, marking by computer is permissible where questions types allow this.

A correct response will be assigned one mark.

Any incorrect or missing answers must be assigned zero marks.

Grading boundaries

The following grade boundaries apply to the multiple-choice test:

Grade	Minimum mark	Maximum mark
Fail	0	27
Pass	28	35
Distinction	36	40

Assessment location

Apprentices must take the test in a suitably controlled environment that is a quiet space, free of distractions and influence, in the presence of an invigilator. The invigilator may be the independent assessor, or another external person employed by the EPAO or specialised (proctor) software, if the test can be taken online. The EPAO is required to have an invigilation policy that will set out how the test or examination is to be carried out. This will include specifying the most appropriate ratio of apprentices to invigilators to best take into account the setting and security required in administering the test or examination.

The EPAO is responsible for ensuring the security of testing they administer to ensure the test remains valid and reliable (this includes any arrangements made using online tools).

The EPAO is responsible for verifying the identity of the person taking the test. The EPAO must also verify the suitability of the venue for test-taking.

Question and resource development

Questions must be written by EPAOs and must be relevant to the occupation. It is recommended that this be done in consultation with employers of this occupation. EPAOs should maintain the security and confidentiality of their questions when consulting employers. EPAOs must develop ‘multiple-choice test specifications’ and ‘question banks’ of sufficient size to prevent predictability and review them regularly (and at least once a year) to ensure they, and the questions they contain, are fit for purpose. The specifications, including questions relating to underpinning KSBs must be varied, yet allow assessment of the relevant KSBs.

EPAOs must ensure that apprentices have a different set of questions in the case of re-sits or re-takes.

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

- a question bank
- a multiple-choice test specification
- sample multiple-choice tests and mark schemes

- live multiple-choice tests and mark schemes
- analysis reports which show areas of weakness for completed tests/exams and an invigilation policy

End-point assessment method 2: Observation with questions

Overview

This assessment method has one component.
An observation with questions involves an independent assessor observing and questioning an apprentice undertaking work as part of their normal duties, in the workplace. This allows for a demonstration of the KSBs through naturally occurring evidence. The observation must be of an apprentice completing their usual work and simulation is not permitted. Apprentices must be observed by the independent assessor completing work under normal working conditions. The independent assessor will ask questions in relation to underpinning knowledge or where an opportunity to observe an activity has not naturally occurred.

The rationale for this assessment method is:

- this is a practical role, best demonstrated through completing tasks in a real work setting
- observation makes use of employer resources and equipment, which will be familiar to the apprentice and thus allow them to perform at their best
- tasks completed during the observation should contribute to workplace productivity and are valid (for example, assembly of a product or subsystem for a spacecraft or element of ground support equipment)
- it is a holistic assessment method

Delivery

The observation and questioning must take a total of three hours (180 minutes), comprising 135 minutes of observation, and 45 minutes of questioning.

The observation with questions may be split into discrete sections held on the same working day.

EPAOs must manage invigilation of apprentices during breaks in order to maintain security of the assessment in line with their malpractice policy.

The independent assessor has the discretion to increase the time of each part of the observation with questions by up to 10% to allow the apprentice to complete a task or respond to a question.

The independent assessor may observe only one apprentice at any one time, to ensure quality and rigour.

Apprentices must be provided with information on the format of the observation with questions, including the timescales they will be working to, before the start of the observation with questions. The time taken to give this information is exclusive of the assessment time.

The following activities MUST be observed during the observation:

- performing a task which involves assembly, inspection and testing of a mechanical or electronic subsystem for use either in the space or ground segment
- compliance with health and safety requirements in the immediate working environment
- compliance with applicable standards and regulations relating to quality
- accessing and following the correct procedures for production, assembly or testing, and ensuring equipment is set up to run appropriately and safely during the task
- application of a joining process (for example bonding, plating, soldering or fastening), as part of the task
- inspection and testing of the completed assembly to verify quality and function, using optical, mechanical and/or electronic test and measurement equipment and techniques as appropriate to the specific task
- ensuring accurate recording of data and results in paper or electronic form as required by the business

The observation should be conducted in the following way, to take account of the occupational context in which the apprentice operates:

Typically, the observation will be covered within one task but can be covered in two tasks if required, to allow coverage of the KSBs.

The observation should only take place in an accessible area that does not require special clearance.

The independent assessor must be unobtrusive whilst conducting the observation.

Questions must be asked to assess the apprentice's breadth and depth of competence against the grading descriptors. The independent assessor must ask a minimum of ten questions.

They may ask follow-up questions where clarification is required

As only naturally occurring work is observed, those KSBs that the apprentice did not have the opportunity to demonstrate can be assessed via questioning, although these should be kept to a minimum.

Questioning occurring at the end of the 135-minute observation phase will have a fixed duration of 45 minutes. The independent assessor has the discretion to increase the duration by up to 10% to allow the apprentice to respond to a question. The independent assessor must use the full time available for questioning to allow the apprentice the opportunity to evidence occupational competence at the highest level available. Questioning must take place in a quiet area, free from distraction and influence.

Independent assessors must use the question bank as a source for questioning and are expected to use their professional judgment to tailor those questions appropriately. Independent assessors are responsible for generating suitable follow-up questions in line with the EPAO's training and standardisation process. The performance observed and responses to questions will be assessed holistically, using the grading descriptors for this assessment method.

KSBs observed, and answers to questions, must be recorded by the independent assessor.

The independent assessor will make all grading decisions.

Assessment location

The observation with questions should take place in the apprentice's workplace.

The venue must have all of the mechanical and electronic equipment required to support assembly, inspection and testing for the specific task being undertaken, for the apprentice to use for the full duration of the observation with questions. Examples may include digital voltage meters, soldering irons, drill presses, support jigs, cleaning equipment and visual inspection devices. Any required consumables (for example solder, adhesive, fasteners, cleaning solutions) must be available at or close to the location of the task. Where electronic methods are used for recording of data and results, or for accessing applicable documentation (such as standards, procedures and regulations), a suitable PC or laptop must be available with which the apprentice can access the required resources. Where paper-based documentation and recording methods are used, the required logbooks, standards, procedures and regulations must be available in hard copy at the location of the task.

The employer is responsible for ensuring that all necessary tools and equipment required for the observation are available and are in good working order.

Question and resource development

EPAOs will create and set open questions to assess related underpinning KSBs. They must develop 'question banks' of sufficient size to prevent predictability and review them regularly (and at least once a year) to ensure the questions they contain are fit for purpose. The questions relating to underpinning KSBs must be varied yet allow assessment of the relevant KSBs.

EPAOs must ensure that apprentices have a different set of questions in the case of re-sits or re-takes.

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

- independent assessor training materials
- grading guidance
- question banks
- outline of the assessment method's requirements
- marking materials
- guidance document for employers and apprentices on the process and timescales for the observation with questions as well as a description of the purpose
- guidance document for independent assessors on how to carry out the assessment

End-point assessment method 3: Interview underpinned by a portfolio of evidence

Overview

This assessment method has one component.

An interview consists of an independent assessor asking an apprentice a series of questions to assess their competence against the KSBs. The independent assessor leads this process to obtain information from the apprentice to enable a structured assessment decision-making process.

The rationale for this assessment method is:

- it allows for assessment of KSBs that do not occur on a predictable or regular basis
- it allows for testing of responses that may take too long to observe or where there are a range of potential answers that can't be tested through the multiple-choice test
- the interview is underpinned by a portfolio of evidence, enabling the apprentice to demonstrate the application of skill and behaviours as well as knowledge
- it is cost effective as apart from the venue does not need additional resources.

Delivery

The independent assessor will conduct and assess the interview underpinned by a portfolio of evidence.

The interview must last for 60 minutes. The independent assessor has the discretion to increase the time of the interview by up to 10% to allow the apprentice to complete their last answer.

The interview will have a minimum of 4 questions – one per topic. The independent assessor must combine questions from the EPAO's question bank and those generated by themselves.

The purpose of the questions will be to cover the following topics and themes:

- production & test
- quality, HSE & documentation
- work environment
- context

The interview will be conducted as follows:

An independent assessor must conduct and assess the interview on a one-to-one basis.

- the independent assessor must have a minimum of one week to review the portfolio ahead of the interview
- the portfolio of evidence must be available to the independent assessor and the apprentice during the interview
- the apprentice will have 5 working days' notice of the interview

KSBs met and answers to questions, must be recorded by the independent assessor.

The independent assessor will make all grading decisions.

Assessment location

The interview should take place in a quiet room, free from distractions and influence. Video conferencing can be used to conduct the interview, but the EPAO must have processes in place to verify the identity of the apprentice and ensure the apprentice is not being aided.

The interview can take place in any of the following:

- employer's premises
- a suitable venue selected by the EPAO, for example a training provider's premises

Question and resource development

A 'question bank' must be developed by EPAOs. The 'question bank' must be of sufficient size to prevent predictability and the EPAO must review it regularly (at least once a year) to ensure that it, and its content, are fit for purpose. The questions relating to the underpinning KSBs, must be varied yet allow assessment of the relevant KSBs. Independent assessors must use the question bank as a source for questioning and are expected to use their professional judgment to tailor those questions appropriately. Independent assessors are responsible for generating suitable questions in line with the EPAO's training and standardisation process.

EPAOs must ensure that apprentices have a different set of questions in the case of re-sits/re-takes.

It is recommended that sample questions are developed in consultation with employers of this occupation. EPAOs must maintain the security and confidentiality of their specifications when consulting with employers.

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

- question bank
- structured specification
- outline of the assessment method's requirements
- marking materials
- guidance document for employers and apprentices on the process and timescales for the interview supported by a portfolio of evidence as well as a description of the purpose
- guidance document for independent assessors on how to carry out the assessment

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 assessment plan.

Overall EPA grading

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

Performance in the EPA will determine the apprenticeship grade of fail, pass, merit or distinction.

Independent assessors must individually grade the observation and interview, according to the requirements set out in this plan.

EPAOs must combine the individual assessment method grades to determine the overall EPA grade.

Apprentices who fail one or more assessment method will be awarded an overall EPA fail.

In order to gain an overall EPA pass, apprentices must achieve a pass in all the assessment methods.

In order to achieve an overall EPA merit, apprentices must achieve a distinction in at least two assessment methods and a pass in the other assessment method.

In order to achieve an overall EPA distinction, apprentices must achieve a distinction in all three assessment methods.

Grades from individual assessment methods should be combined in the following way to determine the grade of the EPA as a whole:

Assessment method 1: Multiple-choice test	Assessment method 2: Observation with questions	Assessment method 3: Interview underpinned by a portfolio of evidence	Overall grading
Fail	Any grade	Any grade	Fail
Any grade	Fail	Any grade	Fail
Any grade	Any grade	Fail	Fail
Pass	Pass	Pass	Pass
Pass	Pass	Distinction	Pass
Pass	Distinction	Pass	Pass
Distinction	Pass	Pass	Pass
Pass	Distinction	Distinction	Merit
Distinction	Distinction	Pass	Merit
Distinction	Pass	Distinction	Merit
Distinction	Distinction	Distinction	Distinction

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 at the employer's discretion. The apprentice's employer will need to agree that either a re-sit or re-take is an appropriate course of action.

A re-sit does not require further learning, whereas a re-take does.

Apprentices should have a supportive action plan to prepare for a re-sit or a re-take.

An apprentice who fails one or more assessment methods, and therefore the EPA in the first instance, will be required to re-sit or re-take failed assessment methods only.

The timescale for a re-sit or re-take is agreed between the employer and EPAO. A re-sit is typically taken within two months of the EPA outcome notification. The timescale for a re-take is dependent on how much re-training is required and is typically taken within four months of the EPA outcome notification.

All assessment methods must be taken within a six-month period, otherwise the entire EPA will need to be re-sat or re-taken.

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

Where any assessment method has to be re-sat or re-taken, the apprentice will be awarded a grade no higher than pass for that assessment. In this case, the overall EPA grading structure limits the maximum overall grade for the apprenticeship to a merit. Where the EPAO determines that there are exceptional mitigating circumstances, the apprentice may re-sit or re-take the failed assessment, and no cap will be applied to the outcome.

Roles and responsibilities

Role	Responsibility
Apprentice	As a minimum, apprentices should: • participate in and complete on-programme training to meet the KSBs as outlined in the occupational standard for a minimum of 24 months • complete the required amount of off-the-job training specified by the apprenticeship funding rules and as arranged by the employer and training provider • understand the purpose and importance of EPA • undertake the EPA including meeting all gateway requirements • ensure that all supporting evidence required at the gateway is submitted in line with this EPA plan
Employer	As a minimum, employers should: • work with the training provider (where applicable) to support the apprentice in the workplace to provide the opportunities to develop the KSBs • arrange and support off-the-job training to be undertaken by the apprentice • decide when the apprentice is working at or above the occupational standard and so is ready for EPA • select the EPAO • ensure that all supporting evidence required at the gateway is submitted in accordance with this EPA plan • remain independent from the delivery of the EPA • confirm arrangements with the EPAO for the EPA (who, when, where) in a timely manner (including providing access to any employer specific documentations as required, for example company policies) • ensure that the EPA is scheduled with the EPAO for a date and time which allow appropriate opportunity for the KSBs to be met • ensure the apprentice is well prepared for the EPA • ensure the apprentice is given sufficient time away from regular duties to prepare for and complete

	any post-gateway elements of the EPA, and that any required supervision during this time (as stated within this EPA plan) is in place • where the apprentice is assessed in the workplace, ensure that the apprentice has access to the resources used on a daily basis
EPAO	As a minimum, EPAOs should: • make all necessary contractual arrangements, including agreeing the price of the EPA • understand the occupational standard • appoint administrators (and invigilators where required) to administer the EPA as appropriate • provide training for independent assessors in terms of good assessment practice, operating the assessment tools and grading • provide adequate information, advice and guidance documentation to enable apprentices, employers and training providers to prepare for the EPA • arrange for the EPA to take place, in consultation with the employer • conform to the requirements of this EPA plan and deliver its requirements in a timely manner • develop and provide appropriate assessment recording documentation to ensure a clear and auditable process is in place for providing assessment decisions and feedback to all relevant stakeholders • have no direct connection with the apprentice, their employer or training provider. In all instances including when the EPAO is the training provider (i.e. HEI) there must be no conflict of interest • have policies and procedures for internal quality assurance (IQA), and maintain records of regular and robust IQA activity and moderation for external quality assurance (EQA) purposes • conform to the requirements of the nominated external quality assurance provider (EQAP) • conform to the requirements of the Register of End-Point Assessment Organisations (RoEPAO)

	• deliver induction training for independent assessors, and for invigilators and markers where used • undertake standardisation activity on this apprenticeship standard for all independent assessors before they conduct an EPA for the first time, if the EPA is updated and periodically as appropriate (a minimum of annually) • manage invigilation of apprentices in order to maintain security of the assessment in line with their malpractice policy • verify the identity of the apprentice being assessed • use language in the development and delivery of the EPA that is appropriate to the level of the occupational standard • request certification via the Apprenticeship Service upon successful achievement of the EPA • develop and produce assessment materials including specifications and marking materials (for example mark schemes, practice materials, training material) • appoint suitably qualified and competent independent assessors • provide details of the independent assessor's name and contact details to the employer • have and apply appropriately an EPA appeals process
Independent assessor	As a minimum, an independent assessor should: • have the competence to assess the apprentice at this level and hold any required qualifications and experience in line with the requirements of the independent assessor as detailed in the IQA section of this EPA plan • understand the occupational standard and the requirements of this EPA • have, maintain and be able to evidence up to date knowledge and expertise of the subject matter • deliver the end-point assessment in-line with the EPA plan • comply with the IQA requirements of the EPAO • have no direct connection or conflict of interest with the apprentice, their employer or training

	provider; in all instances including when the EPAO is the training provider (i.e. HEI) • attend induction training • attend standardisation events when they begin working for the EPAO, before they conduct an EPA for the first time and a minimum of annually on this apprenticeship standard • assess each assessment method, as determined by the EPA plan, and without extending the EPA unnecessarily • assess against the KSBs assigned to each assessment method, as shown in the mapping of assessment methods and as determined by the EPAO, and without extending the EPA unnecessarily • make all grading decisions • record and report all assessment outcome decisions, for each apprentice, following instructions and assessment recording documentation provided by the EPAO in a timely manner • use language in the development and delivery of the EPA that is appropriate to the level of the occupational standard
Training provider	As a minimum, the training provider should: • work with the employer and support the apprentice during the off-the-job training to provide the opportunities to develop the knowledge, skills and behaviours as listed in the occupational standard • conduct training covering any knowledge, skill or behaviour requirement agreed as part of the Commitment Statement (often known as the Individual Learning Plan). • monitor the apprentice's progress during any training provider led on-programme learning • advise the employer, upon request, on the apprentice's readiness for EPA • remain independent from delivery of the EPA. Where the training provider is the EPA (i.e. HEI) there must be procedures in place to mitigate against any conflict of interest
Marker	As a minimum, the marker should:

	• attend induction training • have no direct connection or conflict of interest with the apprentice, their employer or training provider in all instances including when the EPAO is the training provider (i.e. HEI) • mark multiple-choice test answers accurately according to the EPAO's mark scheme
Invigilators	As a minimum, invigilators should: • attend induction training as directed by the EPAO • have no direct connection or conflict of interest with the apprentice, their employer or training provider; in all instances, including when the EPAO is the training provider (i.e. HEI) • invigilate and supervise apprentices during tests and in breaks during assessment methods to prevent malpractice in accordance with the EPAO's invigilation procedures

Internal Quality Assurance (IQA)

Internal quality assurance refers to the strategies, policies and procedures that EPAOs must have in place to ensure valid, consistent and reliable end-point assessment decisions. EPAOs for this EPA must adhere to all requirements within the Roles and Responsibilities section and:

- have effective and rigorous quality assurance systems and procedures that ensure fair, reliable and consistent assessment across employers, places, times and independent assessors
- appoint independent assessors who have recent relevant experience of the occupation or sector gained in the last three years or significant experience of the occupation or sector
- appoint independent assessors who are competent to deliver the end-point assessment and who meet the following minimum requirements:
    - knowledge and competence in space manufacturing engineering
    - evidence of continued professional development
- operate induction training for independent assessors, markers and invigilators
- provide training for independent assessors in terms of good assessment practice, operating the assessment tools and grading
- where appropriate:
    - provide ongoing training for markers
    - provide ongoing training for invigilators

- undertake standardisation activity on this apprenticeship standard for all independent assessors:
    - before they conduct an EPA for the first time
    - if the EPA is updated
    - periodically as appropriate (a minimum of annually)
- conduct effective moderation of assessment decisions and grades
- conduct appeals where required, according to the EPAO's appeals procedure, reviewing and making final decisions on assessment decisions and grades

Value for money

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

- using employers' premises and resources for the observation and questioning
- using an employer's premises for the interview underpinned by a portfolio of evidence and for the multiple-choice test
- using video conferencing for the interview underpinned by a portfolio of evidence
- scheduling more than one assessment method on the same day

Professional body recognition

This apprenticeship is designed to prepare successful apprentices to meet the requirements for registration as an Engineering Technician (EngTech) with

- IET
- IMechE
- Royal Aeronautical Society

Mapping of knowledge, skills and behaviours (KSBs)

Assessment method 1: Multiple-choice test

Knowledge
K1 Spacecraft systems including power, attitude control, thermal, communications, data handling and propulsion.
K2 Engineering mathematical techniques and scientific principles, methods, graphical expressions, symbols, formulae and calculations including: reference frame definitions, tolerancing, torque settings.
K5 Purpose of approved processes, components, parts and materials lists and verification control documentation.
K7 Mechanical, electrical and electronic analysis and testing principles, including space industry specific test standards.
K8 Properties, handling and application of space qualified materials including Electrostatic Discharge (ESD) precautions.
K10 Principles, processes and techniques for thermal vacuum, electromagnetic compatibility, shock, vibration and acoustic testing.
K11 Principles of additive manufacturing for application in space including powder quality and repeatability of build.
K14 The space environment including thermal, vacuum, radiation, atomic oxygen and launch operations.
K16 Vacuum and pressurised systems and measurement.

Assessment method 2: Observation with questions

Knowledge
K12 Configuration and document management control processes including issue control, incorporation of change and end item data pack.
K13 Adhesives, bonding, soldering and fastening techniques required to meet space qualification standards.
K15 Precision and uncertainty in measurement systems, including limitations and appropriate use.
K18 Application of risk assessment at point of work.

Skills
S1 Prepare and complete documentation including work instruction, build and change records, risk assessments and non-conformance reports in compliance with applicable space industry processes and standards.
S3 Assemble, integrate and test at equipment, subsystem and system level.

S4 Support and maintain ground support systems for spacecraft and subsystems.
S8 Use internal and external quality management systems including Non-Conformance Reports (NCRs), production documentation, and published standards applicable to space engineering and manufacture such as EN9100, ISO9001.
S9 Read, extract and interpret technical documentation (such as work plans, project plans, schedules, drawings, test plans, specifications, production data, quality reports, costing data, statistical information, assembly instructions and requirements) drawing accurate conclusions and making informed decisions, seeking clarification where required.
S10 Perform electrical and electronic measurement and testing using equipment such as voltmeters, spectrum analysers, oscilloscopes.
S11 Perform appropriate joining techniques for example using adhesives, bonding, plating, soldering and fastening, following procedures for space quality standards.
S12 Carry out assembly and functional testing of products such as electronics boards and mechanical assemblies, to design specifications and space industry standards.
S15 Apply space industry procedures in facilities such as cleanrooms, workshops and testing facilities (for example, ECSS-Q-ST-70-50C: Particles contamination monitoring for spacecraft systems and cleanrooms) in compliance with legislative and company health, safety and environment requirements.
S16 Measure, test and analyse, using instruments such as pressure gauges, micrometers, balances and non-contact approaches.

Behaviours
B2 Focuses on quality and problem solving. For example, demonstrates attention to detail and seeks opportunities to improve quality, speed and efficiency.
B7 Uses a safety first approach in order to comply with legislative and company health, safety and environment requirements.

Assessment method 3: Interview underpinned by a portfolio of evidence

Knowledge
K3 Relationships between customers, partners and suppliers in the international space engineering and manufacturing sector.
K4 Space system assembly, integration and test procedures, processes, techniques and tools such as vibration, thermal-vacuum, electromagnetic compatibility.
K6 Ground support equipment and systems including electrical and electronic test equipment and mechanical handling equipment.
K9 Quality and product assurance principles in space projects.
K17 Disciplines and handling in cleanliness and contamination controlled environments.

Skills
S2 Contribute to technical reviews such as assembly, integration and test readiness, and non-conformance reviews.
S5 Interpret outputs from manufacturing software such as Computer Aided Design (CAD) or Computer Aided Manufacture (CAM) and Product Data Management or Product Lifecycle Management (PDM,PLM).
S6 Solve problems using procedures and methodologies commonly applied in the space engineering sector, such as Failure Mode and Effects Analysis (FMEA), Plan-Do-Check-Act (PDCA) Cycle, 8-Disciplines (8D), Ishikawa fishbone diagrams.
S7 Contribute to the definition of space engineering process improvement plans.
S13 Inspect electrical, mechanical or electronic equipment for quality assurance purposes.
S14 Use CAD software to create 3D models and part drawings to enable manufacture of components for spacecraft systems and ground support equipment.
S17 Use and maintain vacuum and pressure systems for space applications (such as environmental test chambers, pressure-fed propulsion systems, and gas supply lines for manufacturing and testing) including associated processes and documentation such as piping and instrumentation diagrams.
S18 Use and maintain cryogenic systems for space applications (such as propulsion, subsystem thermal control and ground support activities) including associated processes and documentation, in compliance with legislative and company health, safety and environment requirements.
S19 Communicate using verbal and written methods such as for formal and informal presentations, written reports and electronic dissemination, adjusting approach to take account of equality and diversity considerations, and listen to others.

Behaviours
B1 Takes personal responsibility and is resilient. For example, disciplined and responsible approach to risk, works diligently regardless of how much they are being supervised, accepts responsibility for managing their own time and workload and stays motivated and committed when facing challenges.
B3 Committed to continuous personal improvement. For example, reflects on skills, knowledge and behaviours and seeks opportunities to develop, adapts to different situations, environments or technologies and has a positive attitude to feedback and advice.
B4 Is responsible and accountable. For example, is present in the workplace at the required times, completes all assigned tasks and takes responsibility for the duties assigned to the role. Shows a desire to succeed, approaches difficult or challenging problems with enthusiasm, shows initiative and supports the success of the team and organisation.
B5 Performs through co-operation and works effectively in teams. For example, has a clear understanding of role; voluntarily engages in open communication with team colleagues and line management; identifies individual contributions that can be made to reach collective goals; supports meetings and work sessions on request. Adopts a positive attitude to working with others, and supports discussion with facts and logic, and considers implications of their actions on other people and the business.
B6 Interacts appropriately with stakeholders. For example, works to understand stakeholder requirements and perspectives, and can present work positively and with confidence.

Grading descriptors

End-point assessment method 1: Multiple-choice test

KSBs	
K1 K2 K5 K7 K8 K10 K11 K14 K16	Test mark will determine whether the apprentice achieves fail, pass or distinction.

Assessment method 2: Observation with Questions

Theme / KSBs	Pass Apprentices must demonstrate all the pass descriptors	Distinction
Measurement (K15, S10, S16)	Selects the correct mechanical or electronic measuring equipment for the task, performs measurements in compliance with industry standards, procedures and techniques, and evaluates the results in the context of the task	At least one of the following: a) Explains how precision limits from discrete measurements combine to determine the overall uncertainty of a result b) Identifies alternative, measuring equipment and or methods, and discusses the limitations, risks and benefits of their chosen method or equipment in the task
Production & Test (K13, S3, S4, S11, S12)	Demonstrates the assembly and functional testing of products to design specifications and space industry standards Uses appropriate joining techniques such as using adhesives, bonding, soldering and	The following must be achieved: Justifies their choice of technique for joining or fastening with reference to space quality standards

	fastening techniques that meet space qualification standards to assemble, integrate and test at equipment, subsystem and system level, relevant to published standards for processes and quality Demonstrates support and maintenance of ground support equipment (for example vacuum pumps, mechanical hoists, electrical power supplies and measuring equipment)	
Quality, HSE & Documentation (K12, K18, S1, S8, S9, B2, B7)	Applies a safety-first approach for themselves and colleagues. Complies with workplace health, safety and environmental practices and regulations, maintaining a safe and secure working environment Prepares and completes documentation including work instructions, build and change records, risk assessments and non-conformance reports, in compliance with the business and applicable space industry processes and standards Uses Quality Management systems and procedures in compliance with the published standards adopted by the business Establishes an approach to tasks which reflects a focus on problem solving and quality as defined by standard operating procedures and the policies and procedures set out by the organisation	At least two of the following: a) Identifies the benefits that quality management systems deliver to stakeholders, with examples specific to their tasks, in the wider context of quality assurance and improvement in the business. b) Explains the internal processes which take place on raising of non-conformance reports after they have been raised, and any subsequent actions taken by or in collaboration with external stakeholders c) Justifies their approach to tasks to ensure they reflect a focus on problem solving and quality as defined by standard operating procedures and the policies and procedures set out by the organisation

	Reads, extracts and interprets relevant engineering and manufacturing-related data and information in the documentation and specification, to draw accurate conclusions and make informed decisions on the task(s) to be undertaken	
Work Environment (S15)	Applies space industry procedures in controlled work areas which comply with legislative and company health, safety and environment requirements	The following must be achieved: Evaluates the compliance (legislative and company HSE) requirements in controlled work areas
Fail: apprentices will fail if they do not meet all the pass criteria.		

Assessment method 3: Interview underpinned by a portfolio of evidence

Theme / KSBs	Pass Apprentices must demonstrate all the pass descriptors	Distinction
Production & Test (K4, K6)	Describes processes, techniques and tools used in space system assembly, integration and testing. (Examples may include the role of verification testing for space systems, including thermal vacuum, vibration and Electro-Magnetic Compatibility (EMC) testing procedures) Identifies and describes ground support equipment (GSE) and systems including electrical and electronic test equipment and mechanical handling equipment	Both of the following: a) Evaluates processes, techniques and tools used in space system assembly, integration and testing b) Analyses the use of GSE equipment to identify areas where damage risk could be minimised
Quality, HSE & Documentation (K9, S2, S6, S7, S13)	Identifies and explains the principles of quality and product assurance in space projects and describes when they have solved problems using procedures and methodologies applied in the sector thus making their own contribution to the definition of space engineering improvement plans Describes their participation in quality assurance inspections and technical reviews	Both of the following: a) Critically evaluates quality and product assurance principles in space projects b) Critically evaluates problem -solving procedures and methodologies for space engineering applications
Work Environment (K17, S17, S18, S19, B1, B3, B4, B5, B6)	Outlines and describes disciplines and handling procedures in cleanliness and contamination controlled environments Describes how they used and maintained low, vacuum and high pressure and cryogenic systems	At least three of the following: a) Analyses their occupational role and reviews their actions in the context of helping the business to meet its core objectives

	Describes their use of written methods of communication (for example reports or presentations) to communicate work and results with team members and other stakeholders and how they adjust their approach to take account of equality and diversity considerations Describes their overall contribution to the workplace in terms of ownership and delivery of tasks and response to challenges and opportunities Describes their engagement with stakeholders and how they work to better understand stakeholder requirements Explains how they sustain a high level of motivation, and resilience when facing challenges Describes their approach to working on tasks which shows involvement in CPD, collaborative engagement with colleagues and stakeholders and aligns with the ethical and behavioural policies set out by the organisation	b) Critically evaluates procedures for the inspection, maintenance and use of low vacuum and high pressure and cryogenic systems c) Critically evaluates procedures for maintaining the standard of controlled environments (for example, monitoring of cleanroom particle data and maintenance cycles for filtration replacement) d) Analyses specific professional development opportunities and their relevance in enabling the apprentice to benefit themselves and the business
Analysis and Design (S5, S10)	Explains how outputs from CAD or CAM and PDM or PLM are interpreted, and applies CAD to create 3-D models and part drawings to enable the manufacture of components	The following must be achieved: Critically evaluates the outputs of CAD or CAM and or PDM or PLM software to verify the outputs, demonstrating a critical approach to the use of software, verifying outputs from modelling

		and software-based approaches by for example estimating the mass of a part from geometric and density information, and comparing to model outputs
Context (K3)	Explains the importance of supply chains, customer relationships, and relationships between the members of collaborative project team (primes and sub-contractors). programmatic aspects of Government or agency-funded versus commercial projects	
Fail: apprentices will fail if they do not meet all the pass criteria.		