DRAFT END-POINT ASSESSMENT PLAN FOR THE SPACE SYSTEMS ENGINEER APPRENTICESHIP STANDARD

<table>
<thead>
<tr>
<th>APPRENTICESHIP STANDARD REFERENCE NUMBER</th>
<th>LEVEL OF THIS END-POINT ASSESSMENT (EPA)</th>
<th>INTEGRATED</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST0856</td>
<td>6</td>
<td>Yes</td>
</tr>
</tbody>
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**Introduction and overview**

This document explains the requirements for end-point assessment (EPA) for space systems engineer apprentices. End-point assessment organisations (EPAOs) must follow this when designing and delivering their EPA.

This document provides the EPA design requirements for Higher Education Institutions (HEIs) in their role as end-point assessment organisations (EPAOs) for this apprenticeship standard.

Space systems engineer apprentices, their employers and training providers should read this document.

An approved EPAO must conduct the EPA for this apprenticeship. Employers must select an approved EPAO from the Education and Skills Funding Agency’s Register of end-point assessment organisations (RoEPAO).

In an integrated degree apprenticeship standard, the degree incorporates on-programme learning and assessment with an EPA to test the occupational standard’s knowledge, skills, and behaviours (KSBs). The Degree required for this apprenticeship standard is a space engineering or space science degree or other space degree that directly aligns to the KSBs on the apprenticeship. The level of credits that makes up the degree may vary across universities; however, the EPA must contribute one-twelfth of the total.

A full-time apprentice typically spends 48 months on-programme (this means in training before the gateway) working towards competence as a space systems engineer. All apprentices must spend at least 12 months on-programme. All apprentices must spend at least 20% of their on-programme time completing o-the-job training.

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

- the employer must be content that the apprentice is working at or above the occupational standard
- the apprentice must complete and pass all credit carrying modules of a space engineering or space science degree or other space degree that directly aligns to the KSBs on the apprenticeship, apart from the final module which will form the EPA
- the apprentice must agree the subject, title, and scope for their EPA project with their employer and EPAO to confirm its suitability at the gateway
- the apprentice must compile and submit a portfolio of evidence to their EPAO, which will underpin the EPA professional discussion
- The apprentice must have achieved English and mathematics at Level 2.
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 seven months.

This EPA has 2 assessment methods.

The grades available for each EPA method are:

EPA method 1 - project: report and presentation with questions:
- fail
- pass
- distinction

EPA method 2 - professional discussion underpinned by a portfolio of evidence:
- fail
- pass

The result from each EPA method is combined to decide the overall apprenticeship grade. The following grades are available for the apprenticeship:

- fail
- pass
- distinction

¹For those with an education, health and care plan or a legacy statement, the apprenticeship’s English and mathematics minimum requirement is Entry Level 3. British Sign Language (BSL) qualifications are an alternative to English qualifications for those who have BSL as their primary language.

**EPA summary table**
| **On-programme (typically 48 months)** | Training to develop the knowledge, skills and behaviours (KSBs) of the occupational standard.  
Training towards English and mathematics qualifications at Level 2\(^1\), if required.  
Completing on programme modules of a space engineering or space science degree or other space degree that directly aligns to the KSBs on the apprenticeship  
Compiling a portfolio of evidence. |
|---|---|
| **End-point assessment gateway** | The employer must be content that the apprentice is working at or above the level of the occupational standard.  
The apprentice’s employer must confirm that they think the apprentice:  
• is working at or above the occupational standard as a space systems engineer  
• has the evidence required to pass the gateway and is ready to take the EPA  
Apprentices must have achieved English and mathematics at Level 2\(^1\).  
The apprentice must complete and pass all credit carrying modules of a space engineering or space science degree or other space degree that directly aligns to the KSBs on the apprenticeship apart from the final module which will form the EPA.  
An apprentice must submit all gateway evidence to the EPAO. The EPAO must review the evidence. When the EPAO confirms the gateway requirements have been met, the EPA period starts and typically takes 7 months to complete. The expectation is that the EPAO will confirm the gateway requirements have been met as quickly as possible.  
For the project: report and presentation with questions, the apprentice will be required to submit the following supporting material: an abstract or summary of the proposed subject, title and scope for the EPA project.  
requirements. To ensure the project allows the apprentice to meet the KSBs mapped to this EPA method to the highest available grade, the EPAO should sign-off the project’s title and scope at the gateway to confirm it is suitable. A brief project summary must be submitted to the EPAO. It should |
End-point assessment (typically 7 months)

Grades available for each method:

Project: report and presentation with questions
- fail
- pass
- distinction

Professional Discussion underpinned by a Portfolio of Evidence
- fail
- pass

Overall EPA and apprenticeship can be graded:
- fail
- pass
- distinction

Professional recognition

This apprenticeship standard aligns with the Institute of Engineering & Technology (IET) for Incorporated Engineer (IEng). The experience gained and responsibility held by the apprentice on completion of the apprenticeship will either wholly or partially satisfy the requirements for registration at this level.

This apprenticeship standard aligns with the Royal Aeronautical Society for Incorporated Engineer (IEng). The experience gained and responsibility held by the apprentice on completion of the apprenticeship will either wholly or partially satisfy the requirements for registration at this level.
Re-sits and re-takes

- Re-take and re-sit grade cap: pass
- Re-sit timeframe: typically 6 month(s)
- Re-take timeframe: typically 6 month(s)

1 For those with an education, health and care plan or a legacy statement, the apprenticeship’s English and mathematics minimum requirement is Entry Level 3. British Sign Language (BSL) qualifications are an alternative to English qualifications for those who have BSL as their primary language.

Length of end-point assessment period

The EPA will be taken within the EPA period. The EPA period begins when the EPAO confirms the gateway requirements are met and is typically 7 months.

The expectation is that the EPAO will confirm the gateway requirements are met and the EPA begins as quickly as possible.

EPA gateway

The apprentice’s employer must confirm that they think the apprentice is working at or above the occupational standard as a space systems engineer. They will then enter the gateway. The employer may take advice from the apprentice’s training provider(s), but the employer must make the decision.

Apprentices must meet the following gateway requirements before starting their EPA.

These are:

- achieved English and mathematics at Level 2 1.
- the apprentice must complete and pass all credit carrying modules of a space engineering or space science degree or other space degree that directly aligns to the KSBs on the apprenticeship apart from the final module which will form the EPA.
- for the project: report and presentation with questions apprentices must submit: an abstract or summary of the proposed subject, title and scope for the EPA project.
- the apprentice must agree the subject, title and scope for their project with their employer and EPAO.
- for the professional discussion underpinned by a portfolio of evidence apprentices must submit: Portfolio of evidence.

Portfolio of evidence requirements:
Apprentices must compile a portfolio of evidence during the on-programme period of the apprenticeship. It should contain evidence related to the KSBs that will be assessed by this assessment method. The portfolio of evidence will typically contain 6 discrete pieces of evidence. Evidence should be mapped 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:

- workplace documentation/records, for example:
  - workplace policies/procedures, records
  - witness statements
  - annotated photographs
  - video clips (maximum total duration 10 minutes); the apprentice must be in view and identifiable
- examples of work, work-based training, development activities and performance reviews that the apprentice has undertaken during the "on-programme" apprenticeship period
- details of the work, tasks or projects undertaken including a high-level overview, key objectives, deliverables, time periods for the work and a detailed description of the activities and apprentice's contributions

This is not a definitive list; other evidence sources can be included.

The portfolio should not include reflective accounts or 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 should be valid and attributable to the apprentice; the portfolio of evidence should contain a statement from the employer and apprentice confirming this.

The EPAO should not assess the portfolio of evidence directly as it underpins the discussion. Independent assessors should review the portfolio of evidence to prepare questions for the discussion assessment method. They are not required to provide feedback after this review.

Apprentices must submit any policies and procedures as requested by the EPAO.

The EPA period starts when the EPAO confirms all gateway requirements have been met. The expectation is they will do this as quickly as possible.

**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.

**Project: report and presentation with questions**

**Overview**
A project involves the apprentice completing a significant and defined piece of work that has a real business application and benefit. The project must start after the apprentice has gone through the gateway.

The project: report and presentation with questions must be structured to give the apprentice the opportunity to demonstrate the KSBs mapped to this EPA method to the highest available grade.

The project must meet the needs of the employer's business and be relevant to the apprentice's occupation and apprenticeship. The EPAO must confirm that it provides the apprentice with the opportunity to demonstrate the KSBs mapped to this EPA method to the highest available grade. The EPAO must refer to the grading descriptors to ensure that projects are pitched appropriately.

This EPA method includes 2 components:

- a project with a project output
- a presentation with questions and answers

The project and any components must be assessed holistically by the independent assessor when they are deciding the grade for this EPA method.

**Rationale**

This EPA method is being used because

- it is a holistic assessment method, allowing the apprentice to demonstrate KSBs in an integrated way
- it allows for a range of space systems engineering activities to be demonstrated
- it provides a cost-effective assessment, as it minimises independent assessor time and makes use of the apprentice's employer's workplace, equipment and resources, and should contribute to workplace productivity.

**Component 1: Project with a project output**

**Delivery**

Apprentices must complete a project which may be based on any of the following:

- a specific problem
- a recurring issue
- an idea or opportunity.

The project may also be based on:

- top-level analysis of the requirements of a specific programme and generation of standard space project management constructs such as work package breakdowns and descriptions, project plans (for example Gantt charts with critical path), organograms and risk registers
- research to establish the characteristics of the operating environments within which the system must operate, resulting in quantitative specifications that drive system design (for
example, establishing orbital requirements and subsequent thermal limits, particle radiation levels)

• undertaking detailed trade-off studies to identify the optimum design of mechanical components, mechanical/electronic assemblies and subsystems, control systems and mission architectures (for example communications link budgets, spacecraft radiator design)

• using appropriate mathematical models and commercial analysis packages to carry out detailed analysis of particular aspects of a space mission, system, sub-system or instrument. For example, application of finite element analysis to determine thermally-induced stress and deformation in a mechanical component as a result of exposure to the expected environment, documenting outputs and recommendations.

• devising test plans and procedures in compliance with the relevant standards adopted by the business, necessary to verify the expected operation and performance of a subsystem (e.g. prescribing vibration testing of a mechanical assembly with levels appropriate to the intended launch vehicle and model philosophy)

• leading practical test and verification activities in the workshop or laboratory (for example, a vibration test of a structure, or functional test of an electronic subsystem that the apprentice has been involved in designing), including comparison with expected performance, analysis of deviations from expected performance, and documentation of results and recommendations

• management of a small design and build project to include budget and schedule control (for example, designing and building a mechanical sub-assembly, element of ground support equipment, or rapid-prototyping proof-of-concept model, which provides the apprentice with the opportunity to demonstrate knowledge, skills and behaviours relating to project management)

• reviewing previous projects and missions delivered by the business, including analysis of overall systems engineering and management approaches, critical assessment of lessons learned and rationale for subsequent implementation of changes to processes to improve quality and efficiency

• undertaking manufacture and assembly of mechanical or electrical and electronic subsystems followed by integration and functional testing with the wider system

• desk based research into new technologies and practices being adopted in the sector (e.g. New Space approaches to access space, increased adoption of off the shelf solutions, increased onboard autonomy), and applications or implications for future programmes within the business

• maintenance and operation of ground support equipment including vacuum, cryogenic and electronic systems as a means of improving understanding of the design and role of GSE in mission development and the importance of interfaces in a system of systems

The project must require:

• apprentices to utilise each of the following: experimental approaches, numerical approaches, and drawing on existing data through desk studies
• a literature review to develop a thorough understanding of the problem, to firm up proposed aims and objectives, to develop a suitable methodology for the project and, if undertaking a desk-based study identify suitable datasets to underpin data analysis. However, a literature review alone cannot meet the needs of the project assessment due to the lack of data interpretation and engineering decision making.

• data collection phase (for example, from site-based operations, laboratory sourced data, numerically sourced data or data from the literature – if undertaking a desk-based study)

• analysis and interpretation of data to develop an engineering understanding for the basis of engineering decisions

• application of practical skills including working with ground support equipment, and components in the space segment.

• application of practices relating to Health and Safety considerations such as risk assessment prior to an activity, followed by implementation of necessary procedures and precautions during the practical activity.

To ensure the project allows the apprentice to meet the KSBs mapped to this EPA method to the highest available grade, the EPAO should sign-off the project’s title and scope at the gateway to confirm it is suitable.

The project output must be in the form of a report.

The apprentice must start the project after the gateway. They must complete and submit the report to the EPAO after a maximum of 32 weeks. The employer should ensure the apprentice has the time and resources within this period, to plan and complete their project. The apprentice must complete their project and the production of all its components unaided.

The apprentice may work as part of a team which could include technical internal or external support. However, the project output must be the apprentice’s own work and will be reflective of their own role and contribution. The apprentice and their employer must confirm that the project output(s) is the apprentice’s own work when it is submitted.

The report must include at least:

• a 200-word executive summary (or abstract)
• an introduction
• the scope of the project (including key performance indicators, aims and objectives)
• a project plan that includes:
  • a Gantt chart
  • a brief commentary on how the research method will be implemented and the aims and objectives met
• the required administrative forms, which can be stored within an appendix (for example: risk assessments, ethical reviews, budgetary requirements)
• research outcomes
• data analysis outcomes
• literature review findings
• discussion and reflections on practical laboratory/workshop activities
• project outcomes
• discussion of findings
• recommendations and conclusions
• references (cited using one of the standard referencing styles)
• appendix containing mapping of KSBs to the report

The project report has a maximum word count of 10000 words. A tolerance of 10% above or below the word count is allowed at the apprentice's discretion. Appendices, references and diagrams are not included in this total. The project report must map, in an appendix, how it evidences the relevant KSBs mapped to this EPA method.

Component 2: Presentation with questioning

Delivery

This is a formal presentation where an apprentice will present to an independent assessor on a set subject. The independent assessor must ask questions. Apprentices must prepare, submit and deliver a presentation. The presentation is restricted to the KSBs allocated to this EPA method as shown in the mapping section of this document.

The purpose of the independent assessor's questions will be to allow the apprentice the opportunity to evidence occupational competence at the highest level available, unless the apprentice has already achieved the highest grade available.

The presentation and questioning must last 60 minutes. This will typically include a presentation of 15 minutes and questioning lasting 45 minutes.

The independent assessor must ask at least 5 questions. They must use the questions from the EPAO's question bank or create their own questions in-line with the EPAO's training. Follow up questions are allowed where clarification is required.

The presentation will provide an overview of the apprentice's project and the presentation with questions and answers. Independent assessors will ask questions after the presentation. All presentations must include at least:

• an overview of the project
• the project scope (including key performance indicators)
• summary of actions undertaken by the apprentice
• project outcomes and how these were achieved.

The apprentice must prepare and submit their presentation to the EPAO at the same time as the report which is a maximum of 32 weeks after the gateway.
The apprentice must notify the EPAO, at the submission of the presentation, of any technical requirements for the presentation. For the presentation, the apprentice will have access to:

- Audio-visual presentation equipment
- Flip chart or whiteboard and writing and drawing materials
- Computer

The independent assessor must have at least 2 weeks to review the project output(s) and presentation before the presentation is delivered by the apprentice, to allow them to prepare appropriate questions.

Apprentices must be given at least 0 week(s) notice of the date and time of the presentation or question and answer session.

**Assessment location**

The presentation with questioning must take place in a suitable venue selected by the EPAO for example the EPAO's or employer's premises. The presentation with questioning should take place in a quiet room, free from distractions and influence.

The presentation with questioning can be conducted by video conferencing. The EPAO must have processes in place to verify the identity of the apprentice and ensure the apprentice is not being aided.

**Question and resource development**

EPAOs must write an assessment specification and question bank. The specification must be relevant to the occupation and demonstrate how to assess the KSBs mapped to this assessment method. It is recommended this is done in consultation with employers of this occupation. EPAOs should maintain the security and confidentiality of EPA materials when consulting employers. The questions must be unpredictable. A question bank of sufficient size will support this. The assessment specification and questions must be reviewed at least once a year to ensure they remain fit-for-purpose.

EPAOs must develop purpose-built question banks and ensure that appropriate quality assurance procedures are in place, for example, considering standardisation, training and moderation. EPAOs must ensure that questions are refined and developed to a high standard.

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

- independent assessor EPA materials which include:
  - training materials
  - administration materials
  - moderation and standardisation materials
  - guidance materials
  - grading guidance
Professional Discussion underpinned by a Portfolio of Evidence

Overview
In the professional discussion, an independent assessor and apprentice have a formal two-way conversation. It gives the apprentice the opportunity to demonstrate their competency across the KSBs as shown in the mapping.

Rationale
- the professional discussion offers an efficient, cost-effective method of assessing those KSBs that are not likely to occur in the post gateway project.
- it can be carried out in person or remotely, and it is representative of the way a space systems engineer would work in practice. The professional discussion will draw on the content of the portfolio of evidence to support reviews, discuss findings and results of work-based tasks in detail within a formal setting. Comment #1.
- it allows for assessment of KSBs that do not occur on a predictable or regular basis and may not naturally be assessed as part of the project
- it allows for testing of responses where there are a range of potential answers

Delivery
The professional discussion must be structured to give the apprentice the opportunity to demonstrate the KSBs mapped to this EPA method to the highest available grade.

The purpose of the independent assessor's questions will be to assess the following topics:
- knowledge of the space environment
- engineering principles in the specific context of the space application and the demands for quality
- analysis and design solutions for space applications
- project management
- teamwork and communication
- continued professional development (CPD)

The EPAO must give an apprentice 2 weeks notice of the professional discussion. The independent assessor must have at least 2 week(s) to review the supporting documentation.

Apprentices must have access to their portfolio of evidence during the professional discussion.
Apprentices can refer to and illustrate their answers with evidence from their portfolio of evidence, however the portfolio of evidence is not directly assessed.

The professional discussion must last for 90 minutes. The independent assessor can increase the time of the professional discussion by up to 10%. This time is to allow the apprentice to respond to a question if necessary.

For the professional discussion, the independent assessor must ask at least 9 questions. Follow-up questions are allowed. The independent assessor must use the questions from the EPAO’s question bank or create their own questions in-line with the EPAO’s training. The professional discussion must allow the apprentice the opportunity to demonstrate the KSBs mapped to this EPA method at the highest possible grade.

The independent assessor conducts and assesses the professional discussion.

The independent assessor must keep accurate records of the assessment. The records must include the KSBs met, the grade achieved and answers to questions.

The independent assessor will make all grading decisions.

**Assessment location**

The professional discussion must take place in a suitable venue selected by the EPAO (for example the EPAO’s or employer’s premises).

The professional discussion can be conducted by video conferencing. The EPAO must have processes in place to verify the identity of the apprentice and ensure the apprentice is not being aided.

The professional discussion should take place in a quiet room, free from distractions and influence.

**Question and resource development**

EPAOs must write an assessment specification and question bank. The specification must be relevant to the occupation and demonstrate how to assess the KSBs shown in the mapping. It is recommended this is done in consultation with employers of this occupation. EPAOs should maintain the security and confidentiality of EPA materials when consulting employers. The questions must be unpredictable. A question bank of sufficient size will support this. The assessment specification and questions must be reviewed at least once a year to ensure they remain fit-for-purpose.

EPAOs will develop purpose-built question banks and ensure that appropriate quality assurance procedures are in place, for example, considering standardisation, training and moderation. EPAOs will ensure that questions are refined and developed to a high standard.

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

EPAOs must produce the following materials to support the professional discussion underpinned by a portfolio of evidence:

- independent assessor assessment materials which include:
• training materials
• administration materials
• moderation and standardisation materials
• guidance materials
• grading guidance
• question bank
• EPA guidance for the apprentice and employer

Mapping of KSBs to grade themes

Project: report and presentation with questions - Project
<table>
<thead>
<tr>
<th>KSBS GROUPED BY THEMES</th>
<th>KNOWLEDGE</th>
<th>SKILLS</th>
<th>BEHAVIOUR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Space Systems K1 K6 K7 K11 K14 S8 S17</td>
<td>Spacecraft Dynamics and Control Techniques: two-body orbital motion and perturbations, sources of disturbance, spacecraft attitude control, manoeuvres, station keeping and rendezvous operations. (K1) Structural analysis for static and dynamic loads. (K6) Design, analysis and operation of thermal control systems. (K7) Design of mechanisms and deployable structures in a space context. (K11) Properties, handling and application of space qualified materials. (K14)</td>
<td>Perform design and mechanical-structural, thermal and dynamic-vibration analysis, for deployable structures (S8) Mission Analysis techniques using numerical analysis and simulation tools such as AGI-Systems Toolkit or NASA-GMAT. (S17)</td>
<td>N/A</td>
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**Project: report and presentation with questions - Project**
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<tbody>
<tr>
<td>Systems Engineering K20 K26 K29 S5 S6 S7 S10 S13 S14</td>
<td>Principles of Systems Engineering (K20) Application of Factory 4.0: Digital devices, digital technologies and information systems (Automation, Additive Layer Manufacturing, Connected Technologies, Cyber, Industrial Internet of Things, Cyber Security Resilience, Industry and Autonomous Robotics – Cobotics, Virtual Augmented Reality, Artificial Intelligence (AI) and its applications). (K26) Engineering Drawing principles: development drawings, qualification drawings and production drawings using Computer Aided Design (CAD) software for creating 3D models and 2D drawings including schematics and circuit diagrams. (K29)</td>
<td>Produce space engineering designs, specifications and drawings. For example, for tender and manufacturing stages. (S5) Contribute to the preparation of technical proposals. For example by providing the lead engineer with technical input. (S6) Contribute to technical reviews with stakeholders. For example explaining proposed solutions to the customer. (S7) Use scientific and engineering data. For example, to support decision making during design, build and operations phases of a mission or project. (S10) Research technical solutions to problems. For example, use peer-reviewed literature and technical publications to research technical solutions with awareness of patent rules. (S13)</td>
<td>N/A</td>
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Use information technology including digital tools for presentation of data, digital communication, collaboration, design and analysis. (S14)

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**Project: report and presentation with questions - Project**

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<tbody>
<tr>
<td>Quality, Management and Compliance</td>
<td>Configuration and Document Management Control Processes: issue control, incorporation of change and End Item Data Pack. (K18)</td>
<td>Prepare and apply technical documentation. For example, schedules, test plans, test reports, quality reports, and the digital tools used for their preparation. (S12)</td>
<td>Act as a role model and advocate for the environment, and sustainability. (B1)</td>
</tr>
<tr>
<td></td>
<td>Legal requirements: Health and Safety at Work, Environmental Protection and Sustainability, General Data Protection Regulation, Space Industry Act (Background, Range control, Licences, Safety, Security, Liabilities, Indemnities and Insurance) (K25)</td>
<td></td>
<td>Act as a role model and advocate for health and safety. (B7)</td>
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**Project: report and presentation with questions - Project**
### Teamwork and Communication

**Knowledge:** Communication and presentation techniques: verbal and written. (K28)

**Skills:** Communicate with colleagues and stakeholders: verbal and written. (S2)

- Present information. For example, presenting project progress and key performance information (KPI's) such as cost, quality, time, risk and opportunities, contributing to technical publications, conveying information to technical and non-technical audiences. (S3)

**Behaviour:** Apply a professional approach (B3)

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**Professional Discussion underpinned by a Portfolio of Evidence - Discussion**
<table>
<thead>
<tr>
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</table>
| Space Systems K2 K3 K4 K5 K10 K12 K17 K22 K23 K24 | Architecture of ground and space-based communications subsystems. (K2)  
Mission Concept of Operations: mission phasing, operational scenarios and modes, timelines, ground and space segments, communications and data handling architecture. (K3)  
The role of the ground station in mission operations. (K4)  
Principles of electric or chemical propulsion systems. (K5)  
Practical and theoretical requirements of electrical, electronic, electromechanical and mechanical equipment and systems in the space context. (K10)  
The space environment: vacuum, thermal, radiation, particulate, atmospheres, vibration and thermal | N/A    | N/A       |
| Environment during launch. (K12)  
Principles, processes and techniques for thermal-vacuum, electromagnetic compatibility, shock, vibration and acoustic testing, reporting and post-test procedures and actions (K17)  
Techniques and strategies used for the manufacture and fabrication of Space hardware, and impact of manufacturing processes on material properties. (K22)  
The upstream space sector, its applications, and the typical characteristics of spacecraft used in different mission types (K23)  
The role of software in the function and control of spacecraft and ground facilities. (K24) |
|---|---|

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<tr>
<td>Systems Engineering</td>
<td>Application of Finite Element Analysis and system modelling software for mechanical, electrical and electromechanical sub-systems. (K8) Automation of Engineering Processes. (K9)</td>
<td>Identify and implement technical engineering solutions. For example, by using trade studies. (S1) Review and interpret customer requirements for the function and performance of their spacecraft or subsystem. (S4) Calculate and model the performance of electronic, mechanical and thermal subsystems using approved industry techniques. For example, communications, power, data handling and thermal control. (S9)</td>
<td>N/A</td>
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<tr>
<td>Quality, Management and Compliance K13 K15 K16 K19 K21 K30 S11 B4</td>
<td>Purpose of approved processes, components, parts and materials lists. (K13) Principles of Quality Assurance and quality standards in space projects. (K15) Test standards in the space context. (K16) Principles of Project Management in space projects. (K19) Life cycles of Space instrumentation for near Earth and Deep Space missions. (K21) Events and activities in the launch and commissioning phases of a mission, for example monitoring diagnostic information from the spacecraft before launch, or interpreting performance data during commissioning phase of the mission. (K30)</td>
<td>Identify and apply test standards and procedures. For example, identify and apply test standards for a specific project or mission. (S11)</td>
<td>Adapt to, and resilient in challenging or changing situation. (B4)</td>
</tr>
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### Professional Discussion underpinned by a Portfolio of Evidence - Discussion

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<tr>
<th>KSBS GROUPED BY THEME</th>
<th>KNOWLEDGE</th>
<th>SKILLS</th>
<th>BEHAVIOUR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teamwork and Communication</td>
<td>Teamwork and leadership: negotiation techniques, conflict management, mentoring and development techniques, diversity, equality and inclusivity considerations. (K27)</td>
<td>Work with and lead others including, negotiation, conflict management, mentoring and developing others; taking account of diversity, equality and inclusivity. (S16)</td>
<td>Collaborate and promote teamwork across disciplines. (B2)</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>Commit to their own and supports others' professional development. (B5)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Act as an advocate for accessibility, diversity, and inclusion. (B6)</td>
</tr>
</tbody>
</table>

### Grading

**Project: report and presentation with questions**

Fail - does not meet pass criteria
<table>
<thead>
<tr>
<th>THEME KSBs</th>
<th>PASS Apprentice must demonstrate all the pass descriptors</th>
<th>DISTINCTION Apprentice must demonstrate all the pass descriptors and all of the distinction descriptors</th>
</tr>
</thead>
</table>
| **Space Systems**  
K1, K6, K7, K11, K14, S8, S17 | Uses sector-specific analysis and simulation tools to represent and evaluate the overall mission concept, identifying a set of design solutions that meet requirements. (K1, S17)  
Constructs numerical models representing the system structure being designed. Uses software tools to model and analyse the thermal and mechanical performance of mechanisms to determine their fitness-for-purpose. (K6, K7, K11, K14, S8) | Optimises the mission design and operations concepts through critical evaluation of spaceflight dynamics and ground segment design. Evaluates and selects the optimal solution against the brief. (K1, S17)  
Validates results by utilising and critically analysing a range of design principles, techniques and numerical models. (K6, K7, K11, K14, S8) |
| **Systems Engineering**  
K20, K26, K29, S5, S6, S7, S10, S13, S14 | Uses scientific and engineering data relevant to a task or requirement, and uses the data as a key input into calculations, models, system designs and performance analysis to enable assessment of system compliance with requirements. (K20, S7, S10, S13)  
Uses information technology to support the design, analysis, manufacture, collaboration and communication to ensure the project brief is satisfied. (K26, S14)  
Translates customer requirements into technical proposals, designs, specifications, models and drawings that meet the project brief. (K29, S5, S6) | Justifies solutions to technical problems within system compliance, using scientific and engineering data and research to support justifications. (K20, S7, S10, S13) |
<p>| <strong>Quality</strong> | Prepares and applies technical | Evaluates how legal and statutory |</p>
<table>
<thead>
<tr>
<th>Management and Compliance</th>
<th>documentation, applying configuration and document management control processes (K18, S12)</th>
<th>Complies with all relevant legal and statutory requirements. (K25, S15, B1, B7)</th>
</tr>
</thead>
</table>

| Teamwork and Communication | Identifies and applies varied methods of communication for different audiences, presenting information in formats most appropriate to their content and audience. Demonstrates a professional approach to communication which achieves collaboration across multiple stakeholders and audiences. (K28, S2, S3, B3) | Justifies how their approach to presenting information, communication and collaboration has improved the quality of outcomes. (K28, S2, S3, B3) |

**Professional Discussion underpinned by a Portfolio of Evidence**

Fail - does not meet pass criteria
<table>
<thead>
<tr>
<th>THEME KSBs</th>
<th>PASS Apprentices must demonstrate all the pass descriptors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Space Systems K2 K3 K4 K5 K10 K12 K17 K22 K23 K24</td>
<td>Describes the purpose of the Mission Concept of Operations (ConOps) in space systems engineering (K3). Identifies the key components of round and space-based communication sub-systems (K2, K4). Explains the principles of electric or chemical propulsion systems and the implications for mission design. (K5) Describes the space environment and its implications for the requirements of systems in the space context. Relates these requirements to testing of spacecraft subsystems. (K10, K12, K17) Explains the range of processes used in fabrication and their impact on materials properties, in order to meet manufacturing quality requirements. (K22) Describes the upstream space sector, its applications, and the typical characteristics of spacecraft used in different mission types. (K23) Explains the role of software in the function and control of spacecraft and ground facilities in order to fulfill the functional requirements of the mission. (K24)</td>
</tr>
<tr>
<td>Systems Engineering K8 K9 S1 S4 S9</td>
<td>Justifies their technical engineering solutions, explaining how they use tools and techniques for modelling and analysis of subsystems, to ensure customer requirements are met. (K8, S1, S4, S9) Explains the advantages of process automation in order to achieve efficiency and reproducibility, and discusses the requirements for automation including monitoring and controlling of machinery and processes. (K9)</td>
</tr>
<tr>
<td>Quality, Management and Compliance K13 K15 K16 K19 K21 K30 S11 B4</td>
<td>Explains how they use test standards to design and conduct test procedures applying the principles of quality and product assurance in space manufacturing. Explains how they manage challenging situations during preparation and delivery of test campaigns. (K13, K15, K16, S11, B4) Explains the phases of a space project from initial concept to disposal, and the purpose of reviews at each stage. Identifies the key elements of project planning. Explains the development and operation of space instrumentation in the context of project phrasing. (K10, K21, K30)</td>
</tr>
<tr>
<td>Teamwork and</td>
<td>Explains how they work with and lead others, justifying their approach to teamwork and the impact this has on individuals, teams or business.</td>
</tr>
</tbody>
</table>
Overall EPA grading

The EPA methods contribute equally to the overall EPA grade.

Performance in the EPA will determine the apprenticeship grade of:

- fail
- pass
- distinction

Independent assessors must individually grade the: **project: report and presentation with questions and professional discussion underpinned by a portfolio of evidence** according to the requirements set out in this EPA 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.

Apprentices must achieve at least a pass in all the EPA methods to get an overall pass. **In order to achieve an overall EPA 'distinction', apprentices must achieve a pass in the 'Professional Discussion underpinned by a portfolio of evidence' assessment method, and a distinction in the 'Project: report and presentation with questions' assessment method.**

Grades from individual assessment methods should be combined in the following way to determine the grade of the EPA as a whole.
### Re-sits and re-takes

Apprentices who fail one or more EPA method(s) can take a re-sit or a re-take at the employer’s discretion. The apprentice’s employer needs to agree that a re-sit or re-take is appropriate. A re-sit does not need further learning, whereas a re-take does.

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

The employer and EPAO agree the timescale for a re-sit or re-take. A re-sit is typically taken within 6 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 6 months of the EPA outcome notification.

If the apprentice fails the project assessment method, they will be required to amend the project output in line with the independent assessor’s feedback. The apprentice will be given 4 weeks to rework and submit the amended report.

Failed EPA methods must be re-sat or re-taken within a 6-month period from the EPA outcome notification, otherwise the entire EPA will need to be re-sat or re-taken in full.

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

An apprentice will get a maximum EPA grade of pass for a re-sit or re-take, unless the EPAO determines there are exceptional circumstances.

### Roles and responsibilities
<table>
<thead>
<tr>
<th>ROLES</th>
<th>RESPONSIBILITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apprentice</td>
<td>As a minimum, apprentices should:</td>
</tr>
<tr>
<td></td>
<td>• participate in and complete on-programme training to meet the KSBs as outlined in the occupational standard for a minimum of 12 months</td>
</tr>
<tr>
<td></td>
<td>• undertake 20% off-the-job training as arranged by the employer and training provider</td>
</tr>
<tr>
<td></td>
<td>• understand the purpose and importance of EPA</td>
</tr>
<tr>
<td></td>
<td>• undertake the EPA including meeting all gateway requirements</td>
</tr>
<tr>
<td>Employer</td>
<td>As a minimum, employers must:</td>
</tr>
<tr>
<td></td>
<td>• select the EPAO and training provider</td>
</tr>
<tr>
<td></td>
<td>• work with the training provider (where applicable) to support the apprentice in the workplace and to provide the opportunities for the apprentice to develop the KSBs</td>
</tr>
<tr>
<td></td>
<td>• arrange and support a minimum of 20% off-the-job training to be undertaken by the apprentice</td>
</tr>
<tr>
<td></td>
<td>• decide when the apprentice is working at or above the level required by the occupational standard and so is ready for EPA</td>
</tr>
<tr>
<td></td>
<td>• ensure that all supporting evidence required at the gateway is submitted in accordance with this EPA plan</td>
</tr>
<tr>
<td></td>
<td>• remain independent from the delivery of the EPA</td>
</tr>
<tr>
<td></td>
<td>• confirm arrangements with the EPAO for the EPA (who, when, where) in a timely manner (including providing access to any employer-specific documentation as required, for example company policies)</td>
</tr>
<tr>
<td></td>
<td>• ensure that the EPA is scheduled with the EPAO for a date and time which allows appropriate opportunity for the apprentice to meet the KSBs</td>
</tr>
<tr>
<td></td>
<td>• ensure the apprentice is well prepared for the EPA</td>
</tr>
<tr>
<td></td>
<td>• require the training provider and EPAO to ensure the EPA is booked in a timely manner</td>
</tr>
<tr>
<td></td>
<td>Post-gateway, employers must:</td>
</tr>
<tr>
<td></td>
<td>• confirm arrangements with the EPAO for the EPA (who, when, where) in a timely manner (including providing</td>
</tr>
<tr>
<td>EPAO</td>
<td>As a minimum, EPAOs must:</td>
</tr>
<tr>
<td>------</td>
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</tr>
<tr>
<td></td>
<td>• conform to the requirements of this EPA plan and deliver its requirements in a timely manner</td>
</tr>
<tr>
<td></td>
<td>• conform to the requirements of the Register of End-Point Assessment Organisations (RoEPAO)</td>
</tr>
<tr>
<td></td>
<td>• conform to the requirements of the external quality assurance provider (EQAP) for this apprenticeship</td>
</tr>
<tr>
<td></td>
<td>• understand the occupational standard</td>
</tr>
<tr>
<td></td>
<td>• make all necessary contractual arrangements, including agreeing the price of the EPA</td>
</tr>
<tr>
<td></td>
<td>• develop and produce assessment materials including specifications and marking materials (for example mark schemes, practice materials, training material)</td>
</tr>
<tr>
<td></td>
<td>• appoint suitably qualified and competent independent assessors and oversee their working</td>
</tr>
<tr>
<td></td>
<td>• appoint administrators (and invigilators where required) to administer the EPA as appropriate</td>
</tr>
<tr>
<td></td>
<td>• provide training for independent assessors in terms of good assessment practice, operating the assessment tools and grading</td>
</tr>
<tr>
<td></td>
<td>• provide adequate information, advice and guidance documentation to enable apprentices, employers and training providers to prepare for the EPA</td>
</tr>
</tbody>
</table>

- access to any employer-specific documentation as required, for example company policies
- ensure that the EPA is scheduled with the EPAO for a date and time which allows appropriate opportunity for the KSBs to be met
- remain independent from the delivery of the EPA
- ensure the apprentice is given sufficient time away from regular duties to prepare for, and complete all 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
- pass the certificate to the apprentice upon receipt from the EPAO
- conform to the requirements of the Register of End-Point Assessment Organisations (RoEPAO)
- conform to the requirements of the external quality assurance provider (EQAP) for this apprenticeship
- understand the occupational standard
- make all necessary contractual arrangements, including agreeing the price 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 and oversee their working
- 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

where the apprentice is not assessed in the workplace, ensure that the apprentice has access to the required resources and liaise with the employer to agree this if necessary

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

deliver induction training for independent assessors, and for invigilators and/or 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 the EPAO’s 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

Pre-gateway, EPAOs must:

make all necessary contractual arrangements, including agreeing the price of the EPA

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.

At the gateway, EPAOs must:
Post-gateway, EPAOs must:

- confirm all gateway requirements have been met as quickly as possible.

**Post-gateway, EPAOs must:**

- where the apprentice is not assessed in the workplace, ensure that the apprentice has access to the required resources and liaise with the employer to agree this if necessary.

<table>
<thead>
<tr>
<th>Independent assessor</th>
<th>As a minimum, independent assessors must:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• 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</td>
</tr>
<tr>
<td></td>
<td>• understand the occupational standard and the requirements of this EPA</td>
</tr>
<tr>
<td></td>
<td>• have, maintain and be able to evidence, up-to-date knowledge and expertise of the subject matter</td>
</tr>
<tr>
<td></td>
<td>• deliver the end-point assessment in-line with the EPA plan</td>
</tr>
<tr>
<td></td>
<td>• comply with the IQA requirements of the EPAO</td>
</tr>
<tr>
<td></td>
<td>• 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)</td>
</tr>
<tr>
<td></td>
<td>• attend induction training</td>
</tr>
<tr>
<td></td>
<td>• 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</td>
</tr>
<tr>
<td></td>
<td>• assess each assessment method, as determined by the EPA plan, and without extending the EPA unnecessarily</td>
</tr>
<tr>
<td></td>
<td>• 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</td>
</tr>
<tr>
<td></td>
<td>• make all grading decisions</td>
</tr>
<tr>
<td></td>
<td>• record and report all assessment outcome decisions, for each apprentice, following instructions and using assessment recording documentation provided by the EPAO, in a timely manner</td>
</tr>
</tbody>
</table>
|                      | • use language in the development and delivery of the EPA that is appropriate to the level of the occupational
Training provider

As a minimum, training providers 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 the delivery of the EPA. Where the training provider is the EPAO (i.e. a HEI), there must be procure in place to mitigate against any conflict of interest.

<table>
<thead>
<tr>
<th>Training provider</th>
<th>As a minimum, training providers should:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- 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</td>
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<td></td>
<td>- conduct training covering any knowledge, skill or behaviour requirement agreed as part of the Commitment Statement (often known as the Individual Learning Plan)</td>
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<tr>
<td></td>
<td>- monitor the apprentice’s progress during any training provider led on-programme learning</td>
</tr>
<tr>
<td></td>
<td>- advise the employer, upon request, on the apprentice’s readiness for EPA</td>
</tr>
<tr>
<td></td>
<td>- remain independent from the delivery of the EPA. Where the training provider is the EPAO (i.e. a HEI), there must be procure in place to mitigate against any conflict of interest.</td>
</tr>
</tbody>
</table>

**Reasonable adjustments**

The EPAO must have reasonable adjustments arrangements for the EPA.

This should include:

- how an apprentice qualifies for reasonable adjustment
- what reasonable adjustments may be made

Adjustments must maintain the validity, reliability and integrity of the EPA as outlined in this EPA plan.

**Internal quality assurance (IQA)**

Internal quality assurance refers to how EPAOs ensure valid, consistent and reliable EPA decisions. EPAOs must adhere to the requirements within the roles and responsibilities section and:

- have effective and rigorous quality assurance systems and procedures that ensure fair, reliable and consistent EPA regardless of employer, place, time or independent assessor
- appoint independent assessors who are competent to deliver the EPA and who:
• have recent relevant experience of the occupation or sector to at least occupational level 6 gained in the last 3 years or significant experience of the occupation or sector

• operate induction training for anyone involved in the delivery and/or assessment of the EPA

• provide training for independent assessors in good assessment practice, operating the assessment tools and making grading decisions

• provide ongoing training for markers and invigilators

• provide standardisation activity for 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 EPA decisions and grades

• conduct appeals where required, according to the EPAO’s appeals procedure, reviewing and making final decisions on EPA decisions and grades

• have no direct connection with the apprentice, their employer or training provider. In all instances, including when the EPAO is the training provider (for example a higher education institution)

**Value for money**

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

• utilising digital remote platforms to conduct applicable assessment methods

• assessing multiple apprentices simultaneously where the method of assessment permits this

• using the employer’s premises

• conducting assessment methods on the same day

**Professional recognition**

This apprenticeship standard is designed to prepare successful apprentices to meet the requirements for registration as a:

*The Institute of Engineering & Technology (IET) for Incorporated Engineer (IEng)*

*Royal Aeronautical Society for Incorporated Engineer (IEng)*

**Mapping of KSBs to assessment methods**
<table>
<thead>
<tr>
<th>KNOWLEDGE</th>
<th>ASSESSMENT METHODS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>K1</strong></td>
<td>Spacecraft Dynamics and Control Techniques: two-body orbital motion and perturbations, sources of disturbance, spacecraft attitude control, manoeuvres, station keeping and rendezvous operations.</td>
</tr>
<tr>
<td><strong>K2</strong></td>
<td>Architecture of ground and space-based communications subsystems.</td>
</tr>
<tr>
<td><strong>K3</strong></td>
<td>Mission Concept of Operations: mission phasing, operational scenarios and modes, timelines, ground and space segments, communications and data handling architecture.</td>
</tr>
<tr>
<td><strong>K4</strong></td>
<td>The role of the ground station in mission operations.</td>
</tr>
<tr>
<td><strong>K5</strong></td>
<td>Principles of electric or chemical propulsion systems.</td>
</tr>
<tr>
<td><strong>K6</strong></td>
<td>Structural analysis for static and dynamic loads.</td>
</tr>
<tr>
<td><strong>K7</strong></td>
<td>Design, analysis and operation of thermal control systems.</td>
</tr>
<tr>
<td><strong>K8</strong></td>
<td>Application of Finite Element Analysis and system modelling software for mechanical, electrical and electromechanical sub-systems.</td>
</tr>
<tr>
<td><strong>K9</strong></td>
<td>Automation of Engineering Processes.</td>
</tr>
<tr>
<td><strong>K10</strong></td>
<td>Practical and theoretical requirements of electrical, electronic, electromechanical and mechanical equipment and systems in the space context.</td>
</tr>
<tr>
<td>K11</td>
<td>Design of mechanisms and deployable structures in a space context.</td>
</tr>
<tr>
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<td>---------------------------------------------------------------</td>
</tr>
<tr>
<td>K12</td>
<td>The space environment: vacuum, thermal, radiation, particulate, atmospheres, vibration and thermal environment during launch.</td>
</tr>
<tr>
<td>K13</td>
<td>Purpose of approved processes, components, parts and materials lists.</td>
</tr>
<tr>
<td>K14</td>
<td>Properties, handling and application of space qualified materials.</td>
</tr>
<tr>
<td>K15</td>
<td>Principles of Quality Assurance and quality standards in space projects.</td>
</tr>
<tr>
<td>K16</td>
<td>Test standards in the space context.</td>
</tr>
<tr>
<td>K17</td>
<td>Principles, processes and techniques for thermal-vacuum, electromagnetic compatibility, shock, vibration and acoustic testing, reporting and post-test procedures and actions</td>
</tr>
<tr>
<td>K19</td>
<td>Principles of Project Management in space projects.</td>
</tr>
<tr>
<td>K20</td>
<td>Principles of Systems Engineering</td>
</tr>
<tr>
<td>K21</td>
<td>Life cycles of Space instrumentation for near Earth and Deep Space missions.</td>
</tr>
<tr>
<td>K22</td>
<td>Techniques and strategies used for the manufacture and fabrication of Space hardware, and impact of manufacturing processes on material properties.</td>
</tr>
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</tr>
<tr>
<td>K23</td>
<td>The upstream space sector, its applications, and the typical characteristics of spacecraft used in different mission types.</td>
</tr>
<tr>
<td>K24</td>
<td>The role of software in the function and control of spacecraft and ground facilities.</td>
</tr>
<tr>
<td>K25</td>
<td>Legal requirements: Health and Safety at Work, Environmental Protection and Sustainability, General Data Protection Regulation, Space Industry Act (Background, Range control, Licences, Safety, Security, Liabilities, Indemnities and Insurance).</td>
</tr>
<tr>
<td>K27</td>
<td>Teamwork and leadership: negotiation techniques, conflict management, mentoring and development techniques, diversity, equality and inclusivity considerations.</td>
</tr>
<tr>
<td>K28</td>
<td>Communication and presentation techniques: verbal and written.</td>
</tr>
<tr>
<td>K29</td>
<td>Engineering Drawing principles: development drawings, qualification drawings and production drawings using Computer Aided Design (CAD) software for creating 3D models and 2D drawings including schematics and circuit diagrams.</td>
</tr>
<tr>
<td><strong>K30</strong></td>
<td>Professional Discussion underpinned by a Portfolio of Evidence</td>
</tr>
<tr>
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<tr>
<td>Events and activities in the launch and commissioning phases of a mission, for example monitoring diagnostic information from the spacecraft before launch, or interpreting performance data during commissioning phase of the mission.</td>
<td></td>
</tr>
<tr>
<td>SKILL</td>
<td>ASSESSMENT METHODS</td>
</tr>
<tr>
<td>-------</td>
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</tr>
<tr>
<td>S1</td>
<td>Identify and implement technical engineering solutions. For example, by using trade studies. Professional Discussion underpinned by a Portfolio of Evidence</td>
</tr>
<tr>
<td>S2</td>
<td>Communicate with colleagues and stakeholders: verbal and written. Project: report and presentation with questions</td>
</tr>
<tr>
<td>S3</td>
<td>Present information. For example, presenting project progress and key performance information (KPI's) such as cost, quality, time, risk and opportunities, contributing to technical publications, conveying information to technical and non-technical audiences. Project: report and presentation with questions</td>
</tr>
<tr>
<td>S4</td>
<td>Review and interpret customer requirements for the function and performance of their spacecraft or subsystem. Professional Discussion underpinned by a Portfolio of Evidence</td>
</tr>
<tr>
<td>S5</td>
<td>Produce space engineering designs, specifications and drawings. For example, for tender and manufacturing stages. Project: report and presentation with questions</td>
</tr>
<tr>
<td>S6</td>
<td>Contribute to the preparation of technical proposals. For example by providing the lead engineer with technical input. Project: report and presentation with questions</td>
</tr>
<tr>
<td>S7</td>
<td>Contribute to technical reviews with stakeholders. For example explaining proposed solutions to the customer. Project: report and presentation with questions</td>
</tr>
<tr>
<td>S8</td>
<td>Perform design and mechanical-structural, thermal and dynamic-vibration analysis, for deployable structures Project: report and presentation with questions</td>
</tr>
<tr>
<td>S9</td>
<td>Calculate and model the performance of electronic, mechanical and thermal subsystems using approved industry techniques. For example, communications, power, data handling and thermal control. Professional Discussion underpinned by a Portfolio of Evidence</td>
</tr>
<tr>
<td>S10</td>
<td>Project: report and presentation with</td>
</tr>
</tbody>
</table>
Use scientific and engineering data. For example, to support decision making during design, build and operations phases of a mission or project.

<p>| S11 | Identify and apply test standards and procedures. For example, identify and apply test standards for a specific project or mission. | Professional Discussion underpinned by a Portfolio of Evidence |
| S12 | Prepare and apply technical documentation. For example, schedules, test plans, test reports, quality reports, and the digital tools used for their preparation. | Project: report and presentation with questions |
| S13 | Research technical solutions to problems. For example, use peer-reviewed literature and technical publications to research technical solutions with awareness of patent rules. | Project: report and presentation with questions |
| S14 | Use information technology including digital tools for presentation of data, digital communication, collaboration, design and analysis. | Project: report and presentation with questions |
| S15 | Identify and comply with legal and statutory requirements. For example, health and safety, Environmental protection, sustainability, space certification requirements and data protection. | Project: report and presentation with questions |
| S16 | Work with and lead others including, negotiation, conflict management, mentoring and developing others; taking account of diversity, equality and inclusivity | Professional Discussion underpinned by a Portfolio of Evidence |
| S17 | Mission Analysis techniques using numerical analysis and simulation tools such as AGI-Systems Toolkit or NASA-GMAT. | Project: report and presentation with questions |</p>
<table>
<thead>
<tr>
<th>BEHAVIOUR</th>
<th>ASSESSMENT METHODS</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1 Act as a role model and advocate for the environment, and sustainability.</td>
<td>Project: report and presentation with questions</td>
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<td>B2 Collaborate and promote teamwork across disciplines.</td>
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<td>B3 Apply a professional approach</td>
<td>Project: report and presentation with questions</td>
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<td>B4 Adapt to, and resilient in challenging or changing situation.</td>
<td>Professional Discussion underpinned by a Portfolio of Evidence</td>
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<tr>
<td>B5 Commits to their own and supports others' professional development.</td>
<td>Professional Discussion underpinned by a Portfolio of Evidence</td>
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<tr>
<td>B6 Act as an advocate for accessibility, diversity, and inclusion.</td>
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<tr>
<td>B7 Act as a role model and advocate for health and safety.</td>
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