City & Guilds Level 3 Diploma in Aviation Maintenance (Military Development Competence) (4608-60)

Version 1.5 (March 2024)

Qualification Handbook

Qualification at a glance

Subject area	Mechanical
City & Guilds number	4608
Age group approved	16-19, 19+
Entry requirements	None
Assessment types	Portfolio
Approvals	Automatic approval
Registration and certification	Consult the Walled Garden/Online Catalogue for last dates

Title and level	GLH	TQT	City & Guilds qualification number	Ofqual accreditation number
Level 3 Diploma in Aviation Maintenance (Military Development Competence) - Avionic Maintenance	922	922	4608-60	603/2068/0
Level 3 Diploma Aviation Maintenance (Military Development Competence) - Avionic Component Overhaul	278	446	4608-60	603/2068/0

Version and date	Change detail	Section
Version 1.5 March 2024	Update of Quality Assurance Statement	Centre Requirements

Contents

1 Introduction

This document tells you what you need to do to deliver the qualification:

Area	Description
Who is the qualification for?	It is aimed at anyone over the age of 16 who has an interest in working and progressing in the Aerospace and Aviation sector. It offers progression from Level 2 Diploma in Aerospace and Aviation Engineering (Military Foundation Competence). It is designed to train and qualify the next generation of Aviation maintenance technicians to meet and identified gap in the market and minimise the potential loss of skills and knowledge over the next 5-10 years.
What does the qualification cover?	This qualification allows learners to learn, develop and practice the skills required for employment and/or career progression in the Advanced Aviation Maintenance and Engineering sector in general.
What opportunities for progression are there?	This qualification will allow learners to access employment as Aircraft Maintenance Fitters/Technicians and provides a pathway into Higher Education.
Who did we develop the qualification with?	The Aerospace and Aviation Apprenticeship Employer Group which consists of the following organisations: - BAE Systems - Airbus - Gama Aviation - Harrods Aviation - Marshall ADG - Inflite MRO Services - Virgin - Rizon Jet UK - MOD Professional Engineering Institutions and SEMTA.
Is it part of an apprenticeship framework or initiative?	Yes.

Level 3 Diploma in Aviation Maintenance (Military Development Competence) - Avionic Maintenance

City & Guilds unit number	Unit title	GLH
Structure		
Leaners must complete 301, 302, 304, 354, 355, 455 plus two from 356-366 and two from 367-374		
Mandatory		
301	Complying with statutory regulations and organisational safety requirements	35
302	Using and interpreting engineering data and documentation	25
304	Reinstating the work area on completion of activities	25
354	Carrying out fault diagnosis on aircraft avionics components or systems	126
355	Undertaking scheduled maintenance of aircraft avionics equipment/systems	98
455	Working efficiently and effectively in engineering	25
Optional		
356	Removing and replacing avionic indication and gauging components in aircraft systems	175
357	Removing and replacing components of aircraft electrical power control, distribution and protection	175
358	Removing and replacing components of aircraft pitot static systems	175
359	Removing and replacing components of aircraft armament systems	175
360	Removing and replacing components of aircraft communication systems	175
361	Removing and replacing components of aircraft passive warning and optical/surveillance systems	175
362	Removing and replacing components of aircraft radar systems	175
363	Removing and replacing components of aircraft navigational and computing systems	175

Optional

364	Removing and replacing components of aircraft flight guidance and control systems	175
365	Removing and replacing components of aircraft internal and external lighting systems	175
366	Modifying aircraft avionic systems	175
367	Carrying out tests on avionic indication and gauging components of aircraft systems	119
368	Carrying out tests on aircraft electrical power control, distribution and protection systems	119
369	Carrying out tests on aircraft pitot static systems	119
370	Carrying out tests on aircraft communication systems	119
371	Carrying out tests on aircraft passive warning and optical/surveillance systems	119
372	Carrying out tests on aircraft radar systems	119
373	Carrying out tests on aircraft navigational and computing systems	119
374	Carrying out tests on aircraft flight guidance and control systems	119

Level 3 Diploma in Aviation Maintenance (Military Development Competence) - Avionic Component Overhaul

City & Guilds unit number	Unit title	GLH

Learners must complete 301,302, 304 & 455 plus one of 413 - 422

Mandatory

301	Complying with statutory regulations and organisational safety requirements	35
302	Using and interpreting engineering data and documentation	25
304	Reinstating the work area on completion of activities	25
455	Working efficiently and effectively in engineering	25

Optional

413	Overhauling components of aircraft navigational and computing equipment	336
414	Overhauling components of aircraft communication equipment	336
415	Overhauling components of aircraft radar equipment	336
416	Overhauling components of aircraft indication and gauging equipment	336
417	Overhauling components of aircraft electrical equipment	336
419	Overhauling components of aircraft passive warning and optical/surveillance systems	336
420	Overhauling components of aircraft flight guidance and control equipment	336
421	Overhauling components of aircraft internal and external lighting equipment	336
422	Overhauling components of aircraft avionic equipment	336

Total Qualification Time

Total Qualification Time (TQT) is the number of notional hours which represents an estimate of the total amount of time that could reasonably be expected for a learner to achieve and demonstrate the achievement of the level of attainment necessary for the award of a qualification.

TQT is comprised of the following two elements:

1) The number of hours which an awarding organisation has assigned to a qualification for Guided Learning, and
2) an estimate of the number of hours a Learner will reasonably be likely to spend in preparation, study or any other form of participation in education or training, including assessment, which takes place as directed by - but, unlike Guided Learning, not under the Immediate Guidance or Supervision of - a lecturer, supervisor, tutor or other, appropriate provider of education or training.

Title and level	GLH	TQT
Level 3 Diploma in Aviation Maintenance (Military Development Competence) - Avionic Maintenance	922	922
Level 3 Diploma in Aviation Maintenance (Military Development Competence) - Avionic Component Overhaul	278	446

2 Centre requirements

Approval

If your Centre is approved to offer the qualification Level 3 NVQ Diploma in Aeronautical Engineering then you can apply for automatic approval for the new Level 3 Diploma in Aviation Maintenance (Military Development Competence).

To offer these qualifications, new centres will need to gain both centre and qualification approval. Please refer to the Centre Manual - Supporting Customer Excellence for further information.

Centre staff should familiarise themselves with the structure, content and assessment requirements of the qualifications before designing a course programme.

Resource requirements

Centre staffing

Staff delivering these qualifications must be able to demonstrate that they meet the following occupational expertise requirements. They should:

- be occupationally competent or technically knowledgeable in the areas for which they are delivering training and/or have experience of providing training. This knowledge must be to the same level as the training being delivered
- have recent relevant experience in the specific area they will be assessing
- have credible experience of providing training.

Centre staff may undertake more than one role, eg tutor and assessor or internal verifier, but cannot internally verify their own assessments.

Quality assurance

Approved centres must have effective quality assurance systems to ensure optimum delivery and assessment of qualifications. Quality assurance includes initial centre approval, qualification approval and the centre's own internal procedures for monitoring quality. Centres are responsible for internal quality assurance and City & Guilds is responsible for external quality assurance. All external quality assurance processes reflect the minimum requirements for verified and moderated assessments, as detailed in the Centre Assessment Standards Scrutiny (CASS), section H2 of Ofqual's General Conditions. For more information on both CASS and City and Guilds Quality Assurance processes visit: the What is CASS? and Quality Assurance Standards documents on the City & Guilds website.

Learner entry requirements

City & Guilds does not set entry requirements for these qualifications. However, centres must ensure that candidates have the potential and opportunity to gain the qualifications successfully.

Individual employers will set the criteria, but most candidates will have four GCSEs at grade C (or equivalent) or above on entry (including English, Maths & Science). Employers who recruit learners without English, Maths and Science at Grade C or above, must ensure that the learner achieves this requirement, or an equivalent Level 2, prior to completion of the Apprenticeship.

This qualification is a mandatory component of the Development Phase of the following Apprenticeship Standard:
- Aircraft Maintenance Fitter/Technician (Fixed and Rotary Wing)

The Standard has been designed by Employers. Centres should make themselves familiar with the Standard, Assessment Plan and Employer Occupational Brief requirements, details of which can be found at:
https://www.gov.uk/government/collections/apprenticeship-standards

Age restrictions

City & Guilds cannot accept any registrations for learners under 16 as these qualifications are not approved for learners under 16.

3 Delivering the qualification

Initial assessment and induction

An initial assessment of each candidate should be made before the start of their programme to identify:

- if the candidate has any specific training needs
- support and guidance they may need when working towards their qualifications
- any units they have already completed, or credit they have accumulated which is relevant to the qualifications
- the appropriate type and level of qualification.

We recommend that centres provide an induction programme so the learner fully understands the requirements of the qualification, their responsibilities as a learner, and the responsibilities of the centre. This information can be recorded on a learning contract.

Support materials

Recording documents

Candidates and centres may decide to use a paper-based or electronic method of recording evidence.

City & Guilds endorses several ePortfolio systems, including our own, Learning Assistant, an easy-to-use and secure online tool to support and evidence learners' progress towards achieving qualifications. Further details are available at: www.cityandguilds.com/eportfolios.

City & Guilds has developed a set of *Recording forms* including examples of completed forms, for new and existing centres to use as appropriate. Recording forms are available on the City & Guilds website.

Although new centres are expected to use these forms, centres may devise or customise alternative forms, which must be approved for use by the external verifier, before they are used by candidates and assessors at the centre. Amendable (MS Word) versions of the forms are available on the City & Guilds website.

4 Assessment

Summary of assessment methods

Candidates must:

- have a completed portfolio of evidence for each unit

Assessment strategy

Access to assessment
There are no entry requirements required for the Units of Competence unless this is a legal requirement of the process or the environment in which the Apprentice is working in. Assessment is open to any Apprentice who has the potential to reach the assessment requirements set out in the relevant units.

Aids or appliances, which are designed to alleviate disability, may be used during assessment, providing they do not compromise the standard required.

Carrying out assessments
The Units of Competence have been specifically developed to cover a wide range of activities. The evidence produced for the units will, therefore, depend on the skills and knowledge required by employer and specified in the Apprentice's Training Plan. The Skills section of the Units of Competence makes reference to a number of optional items listed (for example 'any three from five'). This is the minimum standard set by employers.
Where the unit requirements gives a choice of optional areas, Assessors should note that Apprentices do not need to provide evidence of the other areas to complete the unit, unless specified by the employer (in this example above, two items) particularly where these additional items may relate to other activities or methods that are not part of the Apprentice's normal workplace activities or required by the employer.

Performance evidence requirements
Performance evidence must be the main form of evidence gathered. In order to demonstrate consistent competent performance for a unit, a minimum of three different examples of performance of the unit activity will be required. Items of performance evidence often contain features that apply to more than one unit, and can be used as evidence in any unit where they are suitable.
Performance evidence must be:

- products of the Apprentice's work, such as items that have been produced or worked on, plans, charts, reports, standard operating procedures, documents produced as part of a work activity, records or photographs of the completed activity

  together with:

- evidence of the way the Apprentice carried out the activities, such as witness testimonies, assessor observations or authenticated Apprentice reports of the activity undertaken.

Competent performance is more than just carrying out a series of individual set tasks. Many of the units in the Development Phase contain statements that require the Apprentice to provide evidence that proves they are capable of combining various features and techniques. Where this is the case, separate fragments of evidence would not provide this combination of features and techniques and, therefore, will not be acceptable as demonstrating competent performance.
If there is any doubt as to what constitutes suitable evidence the Internal/External Quality Assurer should be consulted.

Assessing knowledge and understanding requirements
Knowledge and understanding are key components of competent performance, but it is unlikely that performance evidence alone will provide enough evidence in this area. Where the Apprentice's knowledge and understanding is not apparent from performance evidence, it must be assessed by other means and be supported by suitable evidence.

Knowledge and understanding can be demonstrated in a number of different ways. It is recommended that oral questioning and practical demonstrations are used perhaps whilst observing the apprentice undertake specific tasks, as these are considered the most appropriate for these units. Assessors should ask enough questions to make sure that the Apprentice has an appropriate level of knowledge and understanding, as required by the unit.

Evidence of knowledge and understanding will **not** be required for those items in the skills section of the Units of Competence that have not been selected by the employer.

Where oral questioning is used the assessor must retain a record of the questions asked, together with the Apprentice's answers.

Witness testimony
Where observation is used to obtain performance evidence, this must be carried out against the unit assessment criteria. Best practice would require that such observation is carried out by a qualified assessor. If this is not practicable, then alternative sources of evidence may be used.

For example, the observation may be carried out against the assessment criteria by someone else that is in close contact with the Apprentice. This could be a team leader, supervisor, mentor or line manager who may be regarded as a suitable witness to the Apprentice's competency. However, the witness must be technically competent in the process or skills that they are providing testimony for, to at least the same level of expertise as that required of the Apprentice. It will be the responsibility of the assessor to make sure that any witness testimonies accepted as evidence of the Apprentice's competency are reliable, auditable and technically valid.

Maximising opportunities to use assessment evidence
One of the critical factors required in order to make this Assessment Strategy as efficient and effective as possible and to ease the burden of assessment, is the Assessor's ability and expertise to work in partnership with the apprentice and their employer to provide advice and guidance on how to maximise opportunities to cross reference performance and knowledge evidence to all relevant Units of Competence. For example if a knowledge statement is repeated in a number of separate Units of Competence and the expected evidence/response to that statement is the same including the context, then the same piece of evidence should be cross referenced to the appropriate units.

Recognition of prior learning (RPL)

Recognition of prior learning means using a person's previous experience, or qualifications which have already been achieved, to contribute to a new qualification.

For this qualification, RPL is allowed and is not sector specific.

5 Units

Structure of the units

These units each have the following:

- City & Guilds reference number
- Title
- Level
- Guided learning hours (GLH)
- Learning outcomes, which are comprised of a number of assessment criteria

Centres must deliver the full breadth of the range. Specialist equipment or commodities may not be available to all centres, so centres should ensure that their delivery covers their use. This may be covered by a practical demonstration (e.g. video). For the practical assessments for this qualification, centres should ensure that there are sufficient resources to complete the task but are not required to use all the equipment or commodities in the range.

Unit 301 Complying with statutory regulations and organisational safety requirements

Unit level:	Level 3
GLH:	35
Unit aim:	This Employer Unit of Competence (EUC) has been developed by employers in the Advanced Manufacturing and Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief. This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to deal with statutory regulations and organisational safety requirements, in accordance with approved procedures. They will be required to comply with all relevant regulations that apply to their area of work as well as their general responsibilities as defined in the Health and Safety at Work Act. They must also be able to identify the relevant qualified first aiders or appointed person, and know the location of the first aid facilities. They will have an understanding of the procedures to be adopted in the case of accidents involving injury and in situations where there are dangerous occurrences or hazardous malfunctions of equipment, processes or machinery. They will also need to be fully conversant with the organisation's procedures for fire alerts and the evacuation of premises. They will be required to identify the hazards and risks that are associated with their job. Typically, these will focus on their working environment, the tools and equipment that they use, materials and substances that they use, working practices that do not follow laid down procedures, and manual lifting and carrying techniques. Their responsibilities will require them to comply with organisational policy and procedures for the statutory regulations and organisational safety activities undertaken, and to report any problems with the safety activities that they cannot

personally resolve, or that are outside their permitted authority, to the relevant people.

They will be expected to work with minimal supervision, taking personal responsibility for their own actions, and for the way in which they carry out the required manufacturing/engineering activities. Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying statutory regulations and organisational safety requirements and procedures.

They will understand the safety requirements and their application, and will know about the safety requirements in adequate depth to provide a sound basis for carrying out the activities safely and correctly.

They will be able to apply the occupational behaviours required in the workplace to meet the job profile and overall company objectives, including being able to demonstrate; personal responsibility and resilience, working effectively in teams, effective communication and interpersonal skills, focus on quality and problem solving and continuous development.

Performance requirements

The learner can:

P1 comply with their duties and obligations as defined in the Health and Safety at Work Act

P2 demonstrate the required occupational behaviours in line with the job role and company objectives

P3 present themselves in the workplace suitably prepared for the activities to be undertaken

P4 follow organisational accident and emergency procedures

P5 recognise and control hazards in the workplace

P6 use correct manual lifting and carrying techniques

P7 apply safe working practices and procedures

Learning outcome

1 Demonstrate their understanding of their duties and obligations to health and safety by carrying out all of the following:

Assessment criteria

1.1 apply in principle their duties and responsibilities as an individual under the Health and Safety at Work Act and relevant current legislation

1.2 identifying within their organisation, appropriate sources of information and guidance on health and safety issues, to include:

i) eye protection and personal protective equipment
ii) COSHH regulations
iii) risk assessments

1.3 identifying the warning signs and labels of the main groups of hazardous or dangerous substances

1.4 complying with the appropriate statutory regulations at all times

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Learning outcome

2 Comply with all emergency requirements, to include:

Assessment criteria

2.1 identifying the appropriate qualified first aiders or appointed person and the location of first aid facilities

2.2 identifying the procedures to be followed in the event of injury to self or others

2.3 following organisational procedures in the event of fire and the evacuation of premises

2.4 identifying the procedures to be followed in the event of dangerous occurrences or hazardous malfunctions

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Learning outcome

The learner will:

3 identify hazards and risks associated with all of the following:

Assessment criteria

3.1 their working environment

3.2 the tools and equipment that they use

3.3 materials and substances that they use

3.4 using working practices that do not follow laid down procedures

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Learning outcome

The learner will:

4 Demonstrate two of the following methods of manual lifting and carrying techniques:

Assessment criteria

4.1 lifting alone

4.2 with assistance of others

4.3 with mechanical assistance

Learning outcome

The learner will:

5 Apply safe working practices in an industrial environment, to include all of the following:

Assessment criteria

5.1 maintaining a tidy workplace with exits and gangways free from obstructions

5.2 using tools and equipment safely and only for the purpose intended

5.3 observing organisational safety rules, signs and hazard warnings

5.4 taking measures to protect others from harm by any work they are carrying out

Knowledge and understanding.

K1 describe the roles and responsibilities of themselves and others under the Health and Safety at Work Act 1974 and current legislation (such as The Management of Health and Safety at Work Regulations; Workplace Health and Safety and Welfare Regulations; Personal Protective Equipment at Work Regulations 1992; Manual Handling Operations Regulations; Provision and Use of Work Equipment Regulations; Display Screen at Work Regulations; The Electricity at Work Regulations)

K2 describe the specific regulations and safe working practices and procedures that apply to their work activities

K3 describe the warning signs for the nine main groups of hazardous substances defined by Classification, Packaging and Labelling of Dangerous Substances Regulations

K4 explain how to locate relevant health and safety information for their tasks and the sources of expert assistance when help is needed

K5 explain what constitutes a hazard in the workplace (such as moving parts of machinery, electricity, slippery and uneven surfaces, dust and fumes, handling and transporting, contaminants and irritants, material ejection, fire, working at height, environment, pressure/stored energy systems, volatile or toxic materials, unshielded processes)

K6 describe their responsibilities for dealing with hazards and reducing risks in the workplace (such as hazard spotting and safety inspections; the use of hazard check lists, carrying out risk assessments, COSHH assessments and safe systems of working)

K7 describe the risks associated with their working environment, the tools, materials and equipment that they use, spillages of oil and chemicals, not reporting accidental breakages of tools or equipment and not following laid-down working practices and procedures

K8 describe the importance of applying the appropriate occupational behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to

K9 describe first aid facilities that exist within their work area and within the organisation in general and the procedures to be followed in the case of accidents involving injury

K10 explain what constitutes dangerous occurrences and hazardous malfunctions, and why these must be reported even when no one was injured

K11 describe the procedures for sounding the emergency alarms, evacuation procedures and escape routes to be used and the need to report their presence at the appropriate assembly point

K12 describe the organisational policy with regard to firefighting procedures, the common causes of fire and what they can do to help prevent them

K13 describe the protective clothing and equipment that is available for their areas of activity

K14 explain how to lift and carry loads safely, and the manual and mechanical aids available

K15 explain how to prepare and maintain safe working areas, standards and procedures to ensure good housekeeping

K16 describe the importance of safe storage of tools, equipment, materials and products

K17 describe the extent of their own authority and to whom they should report in the event of problems that they cannot resolve

Unit 301 Complying with statutory regulations and organisational safety requirements

Supporting Information

Unit guidance

Assessment Requirements

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set out in the relevant Qualification Assessment Strategy available from Semta. Please contact Customer.Services@semta.org.uk quoting Advanced Manufacturing and Engineering Qualification Assessment Strategy and specify the title of the relevant Trailblazer Standard

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme whilst meeting their own requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

Unit 302 Using and interpreting engineering data and documentation

Unit level:	Level 3
GLH:	25
Unit aim:	This Employer Unit of Competence (EUC) has been developed by employers in the Advanced Manufacturing and Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief. This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to make effective use of text, numeric and graphical information by interpreting and using technical information extracted from engineering drawings, technical manuals, reference tables, specifications and charts, in accordance with approved procedures. They will be required to extract the necessary information from the various drawings and related documents in order to establish and carry out the maintenance requirements and to make valid decisions about the quality and accuracy of the equipment being maintained. Their responsibilities will require them to comply with organisational policy and procedures for obtaining and using the drawings and related specifications. They will be expected to report any problems with the use and interpretation of the drawings and specifications that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They will be expected to work with minimal supervision, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out. Their underpinning knowledge will provide a good understanding of the types of drawings and documents used within a maintenance environment, and will provide an informed approach to applying instructions and procedures. They will be able to read and interpret the drawings and documents used and will know about the conventions, symbols and abbreviations, in adequate depth to provide a sound basis for carrying out the maintenance activities to the required specification. They will be able to apply the occupational behaviours required in the workplace to meet the job profile and overall company objectives, including being able to demonstrate; personal responsibility and resilience, working effectively in teams, effective communication and interpersonal skills, focus on quality and problem solving and continuous development.

Performance requirements

The learner can:

P1 use the approved source to obtain the required data, documentation or specifications

P2 demonstrate the required occupational behaviours in line with the job role and company objectives

P3 extract and interpret the required information from the data, documentation or specifications

P4 use the information obtained to establish work requirements

P5 deal promptly and effectively with any problems within their control and report those which cannot be solved

P6 record and/or communicate technical data and information using approved methods

P7 report any inaccuracies or discrepancies in drawings and specifications

P8 use the approved source to obtain the required data, documentation or specifications

Learning outcome

The learner will:

1 use approved sources to obtain the necessary drawings and related specifications, and carry out all of the following:

Assessment criteria

1.1 check the currency and validity of the documentation used

1.2 exercise care and control over the documentation at all times

1.3 correctly extract all necessary data in order to carry out the required tasks

1.4 seek out additional information where there are gaps or deficiencies in the information obtained

1.5 deal with and/or report any problems found with the data and documentation

1.6 make valid decisions based on the evaluation of the information extracted from the documentation

1.7 return all documentation to the approved location on completion of the work

1.8 complete all necessary work related documentation such as production documentation, installation documentation, maintenance documentation, planning documentation

Learning outcome

The learner will:

2 use information extracted from engineering drawings and related documentation, to include two of the following:

Assessment criteria

2.1 drawings (such as component drawings, general assembly drawings, modification drawings, repair drawings, welding/fabrication drawings, distribution and installation drawings)
2.2 diagrams (such as schematic, fluid power diagrams, piping, wiring/circuit, layout diagrams)
2.3 manufacturers manuals/drawings
2.4 approved sketches
2.5 technical illustrations
2.6 photographic images/representations
2.7 visual display screen information
2.8 technical sales/marketing documentation
2.9 contractual documentation
2.10 other specific drawings/documents

Learning outcome

The learner will:

3 use information extracted from related documentation to include three from the following:

Assessment criteria

3.1 standard operating procedures
3.2 instructions (such as job instructions, drawing instructions, manufacturers instructions)
3.3 specifications (such as material, finish, process, contractual, calibration)
3.4 reference materials (such as manuals, tables, charts, fault diagnosis guides)
3.5 schedules
3.6 operation sheets
3.7 maintenance log reports
3.8 service/test information/schedules/results
3.9 planning documentation
3.10 quality control documents
3.11 company specific technical instructions
3.12 national, international and organisational standards
3.13 health and safety standards relating to the activity (such as COSHH)

3.14 environmental requirements/information
3.15 other specific related documentation

Learning outcome

The learner will:

4 Extract information that includes three of the following:

Assessment criteria

4.1 materials or components required
4.2 dimensions
4.3 tolerances
4.4 quality requirements
4.5 installation requirements
4.6 customer requirements
4.7 time scales
4.8 financial information
4.9 operating parameters
4.10 surface texture requirements
4.11 location/orientation of parts
4.12 process or treatments required
4.13 dismantling/assembly sequence
4.14 inspection/testing requirements
4.15 number/volumes required
4.16 repair/service methods
4.17 method of manufacture
4.18 weld type and size
4.19 operations required
4.20 connections to be made
4.21 surface finish required
4.22 shape or profiles
4.23 fault finding procedures
4.24 test points
4.25 safety/risk factors
4.26 environmental controls
4.27 technical data (such as component data, maintenance data, electrical data, fluid data)
4.28 resources (such as tools, equipment, personnel)
4.29 utility supply details (such as electricity, water, gas, air)
4.30 location of services, including standby and emergency backup systems
4.31 circuit characteristics (such as pressure, flow, current, voltage, speed)

4.32 protective arrangements and equipment (such as containment, environmental controls, warning and evacuation systems and equipment)

4.33 other specific related information (such as financial delivery or contractual data)

Knowlegde and understanding

K1 explain what information sources are used for the documentation and specifications that they use in their work activities

K2 explain how the required documentation is obtained, and how to check that it is current and valid

K3 explain the importance of applying the appropriate occupational behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to

K4 explain how to use other sources of information to support the activity (such as manuals, tables, charts, planning and quality documentation, national and international standards)

K5 describe the procedure for reporting discrepancies, lost or damaged documentation

K6 explain the care and control procedures for the documentation, and the importance of returning them to the designated location on completion of the work activities

K7 explain what basic drawing conventions are used, and why there needs to be different types of drawings

K8 explain what types of drawings/diagrams used, and how they interrelate (such as isometric and orthographic, first and third angle, assembly drawings, circuit and wiring diagrams, block and schematic diagrams)

K9 explain why technical information is presented in different forms

K10 explain the meaning of common symbols and abbreviations used within the working environment/work area

K11 explain the imperial and metric systems of measurement, tolerancing and fixed reference points

K12 describe the meaning of the different symbols and abbreviations found on the documentation that they use (such as wiring and component symbols, surface finish, electronic components, weld symbols, linear and geometric tolerances, pressure and flow characteristics)

K13 describe the extent of their own responsibility, when to act on their own initiative to find, clarify and evaluate information, and to whom they should report if they have problems that they cannot resolve

Unit 302 Using and interpreting engineering data and documentation

Supporting Information

Unit guidance

Assessment Requirements

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set out in the relevant Qualification Assessment Strategy available from Semta. Please contact Customer.Services@semta.org.uk quoting Advanced Manufacturing and Engineering Qualification Assessment Strategy and specify the title of the relevant Trailblazer Standard

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme whilst meeting their own requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

Unit 455 Working efficiently and effectively in engineering

Unit level:	Level 3
GLH:	25
Unit aim:	This Employer Unit of Competence (EUC) has been developed by employers in the Advanced Manufacturing and Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief. This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to work efficiently and effectively in the workplace, in accordance with approved procedures and practices. Prior to undertaking the engineering activity, they will be required to carry out all necessary preparations within the scope of their responsibility. This may include preparing the work area and ensuring that it is in a safe condition to carry out the intended activities, ensuring they have the appropriate job specifications and instructions and that any tools, equipment, materials and other resources required are available and in a safe and usable condition. On completion of the engineering activity, they will be required to return their immediate work area to an acceptable condition before recommencing further work requirements. This may involve placing completed work in the correct location, returning and/or storing any tools and equipment in the correct area, identifying any waste and/or scrapped materials and arranging for their disposal, and reporting any defects or damage to tools and equipment used. Their responsibilities will require them to comply with organisational policy and procedures for the engineering activities undertaken, and to report any problems with the activities, tools or equipment that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They will be expected to take personal responsibility for their own actions and for the quality and accuracy of the work that they carry out. Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to working efficiently and effectively in an engineering environment. They will understand the need to work efficiently and effectively, and will know about the things they need to consider when preparing and tidying up the work area, how to contribute to improvements, deal with problems, maintain effective working relationships, and agree their development objectives and targets, in adequate depth to

	provide a sound basis for carrying out the activities safely and correctly. They will understand the safety precautions required when carrying out engineering activities. They will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace. They will be able to apply the occupational behaviours required in the workplace to meet the job profile and overall company objectives, including being able to demonstrate; personal responsibility and resilience, working effectively in teams, effective communication and interpersonal skills, focus on quality and problem solving and continuous development.
Endorsed by	SEMTA

Performance Requirments

The learner can:

P1 work safely at all times, complying with health and safety and environmental legislation, regulations and other relevant guidelines

P2 demonstrate the required occupational behaviours in line with the job role and company objectives/values

P3 plan the engineering activities before they start them

P4 prepare the work area for carrying out the engineering activity

P5 obtain all necessary consumables, tools and equipment and check that they are in a safe and usable condition

P6 deal promptly and effectively with any engineering problems within their control, and seek help and guidance from the relevant people if they have problems that they cannot resolve

P7 maintain effective working relationships with colleagues and supervisors

P8 review personal training and development, as appropriate to the job role

P9 clean, tidy up and restore the work area on completion of the engineering activity

Learning outcome

The learner will:

1 ensure that they apply all the following checks and practices at all times:

Assessment criteria

The learner can:

1.1 adhere to procedures or systems in place for risk assessment, COSHH, Personal Protective Equipment (PPE) and other relevant safety regulations

1.2 wear the appropriate personal protective equipment for the work area and specific activity being carried out

1.3 use all tools and equipment safely and correctly, and only for their intended purpose

1.4 ensure that the work area is maintained and left in a safe and tidy condition

Learning outcome

The learner will:

2 demonstrate and apply all the following occupational behaviours:

Assessment criteria

2.1 Personal responsibility and resilience:

- 2.1a comply with health and safety guidance and procedures,
- 2.1b be disciplined and have a responsible approach to risk
- 2.1c work diligently regardless of how much they are being supervised
- 2.1d stay motivated and committed when facing challenges

2.2 Working effectively in teams:

- 2.2a make an effort to integrate with the team
- 2.2b support other people
- 2.2c consider implications of their own actions on other people and activities
- 2.2d work effectively to get the task completed

2.3 Effective communication and interpersonal skills:

- 2.3a is an open and honest communicator
- 2.3b communicate clearly using appropriate methods
- 2.3c listen well to others
- 2.3d have a positive and respectful attitude

2.4 Focus on quality and problem solving:

- 2.4a follow instructions and guidance
- 2.4b demonstrates attention to detail
- 2.4c follow a logical approach to problem solving

2.5 Continuous development:

2.5a reflect on skills, knowledge and behaviours and seeks opportunities to develop

2.5b adapt to different situations, environments or technologies

2.5c has a positive attitude to feedback and advice

Learning outcome

The learner will:

3 prepare to carry out the engineering activity, ensuring all the following as applicable to the activity to be undertaken:

Assessment criteria

3.1 the work area is free from hazards and is suitably prepared for the activities to be undertaken

3.2 any required safety procedures are implemented

3.3 any necessary personal protection equipment is obtained, and is in a usable condition

3.4 all necessary drawings, specifications and associated documents are obtained

3.5 job instructions are obtained and understood

3.6 tools and equipment required are obtained and checked that they are in a safe and useable condition

3.7 the correct materials or components are obtained

3.8 appropriate authorisation to carry out the work is obtained

Learning outcome

The learner will:

4 complete the work activities to include all of the following:

Assessment criteria

4.1 returning tools and equipment to the designated location

4.2 returning drawings and work instructions

4.3 disposing of waste materials, in line with organisational and environmental requirements

4.4 completing all necessary documentation accurately and legibly

4.5 identifying, where appropriate, any damaged or unusable tools or equipment

Learning outcome

The learner will:

5 recognise and deal with problems affecting the engineering activity to include two of the following:

Assessment criteria

5.1 materials

5.2 job specification

5.3 timescales
5.4 tools and equipment
5.5 quality
5.6 safety
5.7 drawings
5.8 people
5.9 work activities or procedures
5.10 other

Learning outcome

The learner will:

6 contribute to developing their own Continuous Development Plan (CPD) relevant to their career aspirations to include all the following:

Assessment criteria

6.1 describing the levels of skill, knowledge and understanding needed for competence in the areas of work expected of them
6.2 describing their development objectives/program, and how these were identified
6.3 providing information on their expectations and progress towards their identified objectives
6.4 using feedback and advice to improve their personal development and performance objectives

Knowledge and understanding

K1 the safe working practices and procedures to be followed whilst preparing and tidying up your work area
K2 the importance of applying the appropriate occupational behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
K3 how to present themselves in the workplace suitably dressed for the activities to be undertaken (such as being neat, clean and dressed in clothes appropriate to the area of activity)
K4 the importance of reporting to work on time and returning from breaks on time and the potential consequences if this is not adhered to
K5 the types of attitudes and behaviours that are likely to create conflict or negative responses
K6 the benefits of team working and understanding of team objectives.
K7 the roles of individual team members and the strengths they bring to the team.
K8 the importance of clear communication both oral and written, using appropriate language and format.

K9 the need to change communication styles to meet the needs of the target audience

K10 the need to adhere to timescales set for work, whilst maintaining appropriate quality standards and the implications if these are not adhered to.

K11 the importance of seeking additional support and guidance when required.

K12 why it is important to be open and honest and admit to any errors and/or mistakes

K13 the need to be flexible in their approach to work, responding positively to changes or amendments required by the business.

K14 the importance of taking an active and positive part in the implementation of any amendments or changes to work requirements

K15 their individual responsibility to work in an ethical manner and the organisations policies relating to ethical working and behaviours .

K16 the importance of respecting others, including an awareness of diversity and inclusion.

K17 the personal protective equipment (PPE) to be worn for the engineering activities undertaken (such as correctly fitting overalls, safety shoes, eye protection, ear protection)

K18 the correct use of any equipment used to protect the health and safety of themselves and their colleagues

K19 planning and preparing to carry out the engineering activity (such as obtaining the appropriate drawings/documentation to be used, determining the materials required, determining the tools and equipment required, determining a suitable sequence of operations, determining the quality checks to be made and equipment to be used)

K20 the procedure for ensuring that all documentation relating to the work being carried out is available, prior to starting the activity

K21 the procedure for ensuring that all tools and equipment are available prior to undertaking the activity

K22 the checks to be carried out to ensure that tools and equipment are in full working order, prior to undertaking the activity

K23 the checks to be carried out to ensure that all materials required are correct and complete, prior to undertaking the activity

K24 how to deal effectively with problems that could arise with areas such as quality, safety, people, drawings and other documentation, tools and equipment or if material are incomplete or do not meet the requirements of the activity and the action that should be taken

K25 their role in helping to develop their own skills and knowledge (such as checking with their supervisor about the work they are expected to carry out and the standard required to achieve; the safety points to be aware of and the skills and knowledge you will need to develop)

K26 the benefits of continuous personal development, and the training opportunities that are available in the workplace

K27 the importance of reviewing their training and development with trainers and supervisors, of comparing the skills, setting objectives to overcome any shortfall or address any development needs

K28 their responsibilities for providing evidence of your performance and progress (such as submitting work for assessment or the completion of assignments or tests)

K29 the importance of maintaining effective working relationships within the workplace (such as listening attentively to instructions from their supervisor, making sure they ask for help and advice in a polite and courteous manner, responding positively to requests for help from others)

K30 the reason for informing others of their activities which may have impact on their work (such as the need to temporarily disconnect a shared resource like electricity or compressed air supply; making undue noise or creating sparks, fumes or arc flashes from welding)

K31 dealing with disagreements with others in ways which will help to resolve difficulties and maintain long term relationships

K32 the organisational procedures to deal with and report any problems that can affect working relationships

K33 the difficulties that can occur in working relationships, and how to resolve them

K34 the current legislation covering discrimination in the workplace on the ground of race, religion sex, age and disability

K35 the need to dispose of waste materials and consumables (such as oils and chemicals) in a safe and environmentally friendly way

K36 where tools and equipment should be stored and located, and the importance of returning all tools and documentation to their designated area on completion of your work activities

K37 when to act on their own initiative and when to seek help and advice from others

K38 the importance of leaving the work area in a safe condition on completion of your activities (such as equipment correctly isolated, cleaning the work area and removing and disposing of waste)

Unit 455 Working efficiently and effectively in engineering

Supporting Information

Unit guidance

Assessment Requirements

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set out in the relevant Qualification Assessment Strategy available from Semta. Please contact Customer.Services@semta.org.uk quoting Advanced Manufacturing and Engineering Qualification Assessment Strategy and specify the title of the relevant Trailblazer Standard

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme whilst meeting their own requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

Unit 304 Reinstating the work area on completion of activities

Unit level:	Level 3
GLH:	25
Unit aim:	This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief. This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to reinstate the work area, in accordance with approved procedures. They will be required to follow the correct procedures for the safe storage of finished products and surplus materials and to correctly identify and separate all waste materials and ensure that they are removed to their designated locations. They will also need to ensure that all tools, equipment and documents used are accounted for and returned to the appropriate places. Tidying of the work area will be of prime importance and includes office and clean working area environments, workshops, staging and platforms, internal areas of aircraft such as wings, tanks and fuselage sections and areas that are airside. Their responsibilities will require them to comply with organisational policy and procedures for the activities undertaken and to report any problems with the reinstatement activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality of the work they carry out. Their underpinning knowledge will provide a good understanding of their work and provide an informed approach to applying the required procedures. They will understand the need for reinstating the work areas and will know about the storage requirements of the products, equipment, materials, documentation and consumables, in adequate depth to provide a sound basis for carrying out the activities to the required standard and ensuring

that the work area is reinstated satisfactorily. They will understand the safety precautions required when reinstating the work area. They will be required to demonstrate safe working practices throughout and will understand the responsibility they owe to themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

Performance requirements

The learner can:

P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines

P2 demonstrate the required behaviours in line with the job role and company objectives

P3 separate equipment, components and materials for re-use from waste items and materials

P4 store reusable materials and equipment in an appropriate location

P5 dispose of waste materials in line with organisational and environmental safe procedures

P6 restore the work areas to a safe condition in accordance with agreed requirements and schedules

P7 deal promptly and effectively with problems within their control and report those that cannot be solved

Learning outcome

1 Carry out all of the following activities during reinstatement of the work area

Assessment criteria

The learner must be able to:

1.1 work to current schedules

1.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work

1.3 report any loss or damage to equipment (where applicable)

1.4 report any identified hazards within the work area (where applicable)

1.5 return all consumables and materials to their correct location

1.6 complete any documentation as required

Learning outcome

The learner will:

2 carry out reinstatement activities on two work areas from

Assessment criteria

2.1 workshops/hangers
2.2 airside
2.3 areas at height (such as platforms, staging, lifts)
2.4 internal areas of aircraft (such as wings, tanks, fuselage sections)
2.5 office environment
2.6 Computer Aided Design (CAD) environment
2.7 technical/clean room environment
2.8 other specific environment

Learning outcome

The learner will:

3 correctly label and store four the following resources:

Assessment criteria

3.1 finished products/components
3.2 scrap components
3.3 components requiring overhaul/repair
3.4 measuring and test instruments
3.5 surplus materials/components
3.6 finished drawings
3.7 tooling, jigs, fixtures or other equipment used
3.8 finished documentation
3.9 drawings requiring actioning/adjusting
3.10 documentation requiring actioning/adjusting

Learning outcome

The learner will:

4 deal with waste materials, in line with company and environmental regulations, to include two of the following:

Assessment criteria

4.1 correctly segregating waste materials
4.2 correctly dispose of waste materials
4.3 disposing of joining compounds, sealants and adhesives

4.4 disposing of other chemical products

4.5 removing non-hazardous materials

4.6 disposing of fluid waste (such as oil, hydraulic fluids, fuel)

Knowledge and understanding

The learner can:

K1 explain the specific safety practices and procedures that they need to observe when reinstating the work area (such as any specific legislation, regulations/codes of practice for the activities, equipment or materials) and the responsibility these requirements place on them

K2 describe the hazards associated with reinstating the work area and how to minimise them and reduce any risks

K3 explain the safe working practices and procedures to be followed when carrying out the various activities (such as lifting and handling techniques)

K4 explain what Personal Protective Clothing and Equipment (PPE) needs to be worn and where this can be obtained

K5 explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to

K6 explain why work areas need to be restored to a set standard and what these requirements are

K7 describe the types of work area that will need to be restored (such as office environments, Computer Aided Design (CAD) environment, technical/clean room environment, workshops, test areas, stages and platforms and aircraft areas such as wing, tank, fuselage, airside section areas)

K8 explain the importance of tool and equipment control and why this is critical within the aerospace industry

K9 explain the meaning of `Foreign Object Debris' (FOD) and why it is vital to ensure that this does not occur or is removed

K10 describe the stores procedures for tools and equipment, documentation and surplus or waste materials

K11 explain what materials will need to be stored and disposed of and why they need to be segregated, correctly identified and labelled

K12 explain how the various disposal bins can be identified (such as colour coded, labelled)

K13 explain the procedures for disposing of hazardous materials (such as chemicals, adhesives, oil, hydraulic fluids, fuel)

K14 explain what documentation to be used on completion of reinstatement

K15 describe the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve

Unit 304 Reinstating the work area on completion of activities

Supporting Information

Unit guidance

Assessment Requirements

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set out in the relevant Qualification Assessment Strategy available from Semta. Please contact Customer.Services@semta.org.uk quoting Advanced Manufacturing and Engineering Qualification Assessment Strategy and specify the title of the relevant Trailblazer Standard

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme whilst meeting their own requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

Unit 354 Carrying out fault diagnosis on aircraft avionics components or systems

GLH:	126
Unit aim:	This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief. This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to carry out fault diagnosis on aircraft avionics systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft and covers a range of avionics systems such as electrical power generation and distribution, internal and external lighting, indication and gauging equipment, pitot static, armament management, communication, passive warning and electronic countermeasure, infra-red and optical systems, radar, navigational, flight guidance and control, to sub-assembly or component level, as applicable. They will be expected to use a variety of fault diagnosis methods and techniques and to utilise a range of diagnostic aids and equipment. From the fault evidence obtained, they will be expected to identify the fault and its probable cause and to determine appropriate action to remedy the problem. Their responsibilities will require them to comply with organisational policy and procedures for the fault diagnostic activities undertaken and to report any problems with these activities, or with the tools and equipment used, that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out. They must ensure that all tools, equipment and materials used in the maintenance activities are removed from the aircraft on completion of the activities and that all necessary job/task documentation is completed, accurately and legibly. Their underpinning knowledge will provide a good understanding of their work and will provide an informed approach to applying

appropriate fault diagnostic procedures for aircraft avionics systems.

They will understand the various fault diagnostic methods and techniques used and their application. They will know how to interpret and apply information obtained from diagnostic aids and equipment, in adequate depth to provide a sound basis for carrying out the activities and for identifying faults or conditions that are outside the required specification. They will understand the safety precautions required when carrying out the fault diagnostic activities, especially those for isolating the equipment.

They will be required to demonstrate safe working practices throughout and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace. They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall objectives of the organisation, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

Performance Requirments

The learner can:

P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines

P2 demonstrate the required behaviours in line with the job role and organisational objectives

P3 review and use all relevant information on the symptoms and problems associated with the product or asset

P4 investigate and establish the most likely causes of the fault or faults

P5 select, use and apply diagnostic techniques, tools and aids to locate faults

P6 complete the fault diagnosis within the agreed time and inform the appropriate people when this cannot be achieved

P7 determine the implications of the fault for other work and for safety considerations

P8 use the evidence gained to draw valid conclusions about the nature and probable cause of the fault or faults

P9 record details on the extent and location of the fault or faults in an appropriate format

Learning outcome

The learner will:

1 carry out all of the following during the fault diagnostic activities:

Assessment criteria

1.1 plan the fault diagnostic activities prior to beginning the work

1.2 obtain and use the appropriate documentation (such as job instructions, drawings, technical instructions, and other relevant maintenance documentation)

1.3 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work

1.4 obtain clearance to work on the aircraft, and observe all relevant isolation and safety procedures (such as mechanical, electricity, gas, air or fluids)

1.5 obtain the correct tools and equipment for the activity and check that they are in a safe, tested and usable condition and within current certification/calibration date

1.6 where appropriate, apply Electrostatic Discharge (ESD) protection procedures

1.7 provide and maintain a safe working environment for the diagnostic activities

1.8 carry out the fault diagnostic activities, using approved techniques and procedures

1.9 collect equipment fault diagnostic evidence from live and isolated systems

1.10 disconnect or isolate components or parts of the system, when appropriate, to confirm the diagnosis

1.11 identify the fault and determine the appropriate corrective action

1.12 return all tools and equipment to the correct location on completion of the activities

1.13 leave the aircraft and system in a safe and appropriate condition, free from foreign object debris on completion of the activities

Learning outcome

The learner will:

2 carry out fault diagnosis on four of the following aircraft avionic systems, to sub-assembly or component level, as appropriate:

Assessment criteria

2.1 electrical power generation and distribution

2.2 armament management

2.3 internal and external lighting

2.4 passive warning and electronic countermeasure

2.5 indication and gauging

2.6 infra-red and optical systems
2.7 pitot static
2.8 radar
2.9 communication
2.10 flight guidance and control
2.11 aircraft computer system
2.12 navigational
2.13 other specific system

Learning outcome

The learner will:

3 collect information about the fault from four of the following sources:

Assessment criteria

3.1 the person who reported the fault
3.2 approved sensory checks (such as sight, sound, smell, touch)
3.3 monitoring equipment or gauges
3.4 aircraft log/documentation
3.5 recording devices
3.6 operation of the equipment
3.7 aircraft self-diagnostics
3.8 fault records

Learning outcome

The learner will:

4 use a range of fault diagnostic techniques, to include three of the following:

Assessment criteria

4.1 half-split technique
4.2 soak test
4.3 unit substitution
4.4 input-to-output
4.5 injection and sampling
4.6 six point technique
4.7 functional testing
4.8 Built-in Test Equipment (BITE)
4.9 other specific avionic system test

Learning outcome

The learner will:

5 use a variety of diagnostic aids and equipment, to include two of the following:

Assessment criteria

5.1 Aircraft Maintenance Manual (AMM)
5.2 algorithms/flow charts
5.3 equipment self-diagnostics
5.4 fault analysis charts (such as fault trees)
5.5 circuit diagrams/specifications
5.6 troubleshooting guides
5.7 other specific diagnostic equipment

Learning outcome

The learner will:

6 use two of the following types of test equipment to help in the fault diagnosis:

Assessment criteria

6.1 mechanical measuring equipment (such as measuring instruments, dial test indicators, torque instruments)
6.2 electrical/electronic measuring instruments (such as multi meters, watt meters, oscilloscopes)
6.3 fluid power test equipment (such as test rigs, flow meters, pressure gauges)
6.4 Built-in Test Equipment (BITE)
6.5 'special-to-type' test equipment

Learning outcome

The learner will:

7 diagnose faults from two of the following breakdown categories:

Assessment criteria

7.1 intermittent problem
7.2 partial failure or reduced performance
7.3 complete breakdown

Learning outcome

The learner will:

8 provide a record of the outcome of the fault diagnosis, using one of the following:

Assessment criteria

8.1 step-by-step analytical report
8.2 aircraft service/flight log
8.3 aircraft log book
8.4 corrective action report
8.5 company-specific reporting procedure
8.6 computer records

Knowledge and understanding

The learner must know and understand:

K1 the health and safety requirements of the area in which you are carrying out the fault diagnostic activities and the responsibility these requirements place on them
K2 the specific safety precautions to be taken when carrying out the fault diagnosis of the particular aircraft avionics system
K3 the isolation and lock-off procedure or permit-to-work procedure that applies
K4 The importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to
K5 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
K6 the importance of wearing protective clothing and other appropriate safety equipment (PPE) during the fault diagnostic activities, the type of safety equipment to be used and where to obtain it
K7 hazards associated with carrying out fault diagnosis on aircraft avionics systems (such as electrical contact, using faulty or damaged tools and equipment, using practices and procedures that do not follow laid-down procedures) and how to minimise them and reduce any risks
K8 where to obtain and how to interpret drawings, circuit diagrams, specifications, manufacturers' manuals and other documents needed for the fault diagnostic activities
K9 the basic principles of how the avionics system functions and the working purpose of the various units and components
K10 the various fault finding techniques that can be used and how they are applied (such as half-split, input-to-output, six point technique, functional testing, unit substitution, injection and sampling techniques, equipment self-diagnostics and soak tests)
K11 the importance of applying Electrostatic Discharge (ESD) procedures when working on sensitive equipment or devices
K12 what constitutes a hazardous voltage and how to recognise victims of electric shock

K13 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)

K14 how to evaluate the various types of information available for fault diagnosis (such as pilot reports, monitoring equipment, aircraft history records, function of the equipment/system)

K15 how to evaluate sensory information from sight, sound, smell, touch

K16 the procedures to be followed to investigate faults and how to deal with intermittent conditions

K17 how to use the various aids and reports available for fault diagnosis

K18 the types of equipment that can be used to aid fault diagnosis (such as mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices) and how to check the equipment is calibrated or configured correctly for the intended use and that it is free from damage and defects

K19 the application of specific fault finding methods and techniques that are best suited to the problem

K20 how to analyse and evaluate possible characteristics and causes of specific faults/problems

K21 how to make use of previous reports/records of similar fault conditions

K22 how to evaluate the likely risk of running the aircraft with the displayed fault and the effects the fault could have on the aircraft performance and safety

K23 how to prepare a report which complies with the organisation policy on fault diagnosis

K24 the extent of your own authority and to whom you should report if you have problems that you cannot resolve

Unit 354 Carrying out fault diagnosis on aircraft avionics components or systems

Supporting Information

Unit guidance

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme whilst meeting their own requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

Unit 355 Undertaking scheduled maintenance of aircraft avionics equipment/systems

GLH:	98
Unit aim:	This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief. This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to carry out scheduled maintenance activities on aircraft avionics equipment/systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft and covers a range of avionic equipment and systems such as electrical power generation and distribution, internal and external lighting, indication and gauging equipment, pitot static, armament, communication, passive warning and electronic countermeasure, infra-red and optical systems, radar, navigational and flight guidance and control equipment. They will need to organise and carry out the maintenance activities to minimise down time and ensure that the maintained equipment/system meets airworthiness standards, and performs at operational levels and to the required specification. Their responsibilities will require them to comply with organisational policy and procedures for the maintenance activities undertaken and to report any problems with the maintenance activities, tools or equipment used that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used in the maintenance activities are removed from the work area on completion of the work and that all necessary job/task documentation is completed, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

	Their underpinning knowledge will provide a good understanding of their work and will provide an informed approach to applying scheduled maintenance procedures to aircraft avionics equipment. They will know how the system and equipment functions and the potential problems or defects that may occur. They will understand the process of developing scheduled maintenance and its application and will know about the maintenance criteria, in adequate depth to provide a sound basis for carrying out the activities safely and effectively and for ensuring that the equipment is maintained to the required specification. In addition, they will be expected to report where the outcome of the maintenance activity identifies the need for further investigation or maintenance work. They will understand the safety precautions required when carrying out the maintenance activities, especially those for isolating the equipment. They will be required to demonstrate safe working practices throughout and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace. They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall objectives of the organisation, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.
Endorsed by	SEMTA

Performance Requirements

The learner can:

P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines

P2 demonstrate the required behaviours in line with the job role and organisational objectives

P3 follow the relevant maintenance schedules to carry out the required work

P4 carry out the maintenance activities within the limits of their personal authority

P5 carry out the maintenance activities in the specified sequence and in an agreed timescale

P6 report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule

P7 complete the relevant maintenance records accurately and pass them on to the appropriate person

P8 dispose of waste materials in accordance with safe working practices and approved procedures

Learning outcome

The learner will:

1 carry out all of the following during the scheduled maintenance activities:

Assessment criteria

1.1 plan the scheduled maintenance activities to cause minimal disruption to normal working

1.2 obtain and use the appropriate documentation (such as job instructions, aircraft manuals, technical instructions, and other relevant maintenance documentation)

1.3 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work

1.4 obtain clearance to work on the aircraft and observe all relevant isolation and safety procedures (such as mechanical, electricity, gas, air or fluids)

1.5 provide and maintain a safe working environment for the maintenance activities

1.6 obtain the correct tools and equipment for the activity and check that they are in a safe, tested and usable condition and within current certification/ calibration date

1.7 carry out the maintenance activities, using approved techniques and procedures

1.8 where appropriate, apply Electrostatic Discharge (ESD) protection procedures

1.9 re-connect and return the system to service on completion of the maintenance activities

1.10 dispose of waste items in a safe and environmentally acceptable manner

1.11 return all tools and equipment to the correct location on completion of the activities

1.12 leave the aircraft and system in a safe and appropriate condition, free from foreign object debris on completion of the activities

Learning outcome

The learner will:

2 carry out the scheduled maintenance on four of the following aircraft avionics systems:

Assessment criteria

2.1 electrical power generation and distribution

2.2 armament equipment and systems

2.3 internal and external lighting

2.4 passive warning and electronic countermeasure

2.5 indication and gauging
2.6 infra-red and optical systems
2.7 pitot static
2.8 radar
2.9 communication
2.10 flight guidance and control
2.11 navigational
2.12 other specific system

Learning outcome

The learner will:

3 carry out twelve of the following planned maintenance activities:

Assessment criteria

3.1 removing excessive dirt and dust from panels or equipment
3.2 replacing 'lifed' consumables (such as filters, desiccant, protection devices)
3.3 checking the operation of gauges and sensors
3.4 replacing 'lifed' components
3.5 carrying out specified visual inspections
3.6 carrying out system self-analysis checks
3.7 carrying out testing of equipment against the maintenance schedule
3.8 inspecting and cleaning sensors
3.9 checking and adjusting shock mountings
3.10 making visual checks of equipment and cables
3.11 tuning and adjusting components
3.12 checking the integrity of connections
3.13 servicing back-up battery systems
3.14 replacing damaged or defective connectors
3.15 reviewing equipment/system operation
3.16 monitoring the condition of switches and contactors
3.17 equipment/component calibration
3.18 making approved sensory checks (such as sight, sound, smell, touch)
3.19 replacing missing or damaged locking and retaining devices (such as cable ties, clips, proprietary fasteners)

Including the following:

3.20 recording the results of the maintenance activity and reporting any defects found

Learning outcome

The learner will:

4 carry out two of the following checks during the maintenance activities:

Assessment criteria

4.1 off-load checks (such as insulation, continuity, earth bonding, resistance)
4.2 input/output checks (voltage, power)
4.3 frequency checks
4.4 receiver sensitivity
4.5 BITE
4.6 distant object test
4.7 Voltage Standing Wave Ratio (VSWR) checks
4.8 other specific check

Learning outcome

The learner will:

5 ensure that the maintained equipment/system meets all of the following:

Assessment criteria

5.1 all components and units are fit for purpose
5.2 equipment static checks, after maintenance, meet specification
5.3 the equipment operates within acceptable limits for successful continuous operation
5.4 any potential defects are identified and reported for future action
5.5 all relevant documentation is completed, accurately and legibly

Learning outcome

The learner will:

6 ensure that the maintained equipment complies with one of the following:

Assessment criteria

6.1 Military Aviation Authority (MAA)
6.2 Civil Aviation Authority (CAA) / European Aviation Safety Agency (EASA)
6.3 BS, ISO or BSEN standards and procedures
6.4 Aerospace Quality Management Standards (AS)
6.5 specific system requirements
6.6 Federal Aviation Authority (FAA)
6.7 organisation standards and procedures
6.8 manufacturer's standards and procedures

Learning outcome

The learner will:

7 complete the relevant documentation, to include one of the following and pass it to the appropriate people:

Assessment criteria

7.1 computer records

7.2 job cards

7.3 aircraft service/flight log

7.4 aircraft log

7.5 permit to work/formal risk assessment

Knowledge and understanding

The learner must know and understand:

K1 the specific safety precautions and procedures to be observed whilst carrying out the scheduled maintenance (including any specific legislation, regulations or codes of practice relating to the activities, equipment or materials)

K2 the importance of maintenance on and impact upon ETOpS (Extended Twin Operations Procedures) systems, legislation and local procedures

K3 the health and safety requirements of the area in which the scheduled maintenance activity is to take place and the responsibility these requirements place on you

K4 the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to

K5 the isolation and lock-off procedure or permit-to-work procedure that applies to the aircraft system being maintained

K6 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to

K7 the importance of wearing protective clothing and other appropriate safety equipment (PPE) during the maintenance activities and where it may be obtained

K8 hazards associated with carrying out maintenance activities on aircraft electrical/avionic equipment (such as exposure to live conductors, handling fluids, electrical supplies, using damaged or badly maintained tools and equipment, not following laid-down maintenance procedures) and how to minimise them and reduce any risks

K9 how to obtain and interpret drawings, charts, specifications, aircraft manuals, history/maintenance reports and other documents needed for the maintenance activities

K10 the various planned maintenance schedules that are generally used (such as condition based maintenance, scheduled maintenance, and Total Preventative Maintenance (TPM)) and the methods to be followed to comply with company procedures for the maintenance of the aircraft electrical/avionic equipment

K11 the equipment operating and control procedures and how to apply them in order to carry out the scheduled maintenance activities

K12 the basic principle of operation of the equipment or system being maintained and the purpose of individual units/components and how they interact

K13 the importance of applying Electrostatic Discharge (ESD) procedures when working on sensitive equipment or devices

K14 what constitutes a hazardous voltage and how to recognise victims of electric shock

K15 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)

K16 the application and use of a range of electrical components (such as module blocks, terminal blocks, multi-pin plugs/sockets, tray-mounted sockets, earth bonding points) and the likely functions that will require checking

K17 the different types of wiring enclosure that are used (to include conduit, trunking, tray work systems and bulkhead penetrations) and what to check during the maintenance activities

K18 methods of checking that components are fit for purpose and the need to replace 'lifed' items

K19 how to recognise defects in aircraft electrical/avionic equipment (such as under or over performance)

K20 the adjustments/corrections/tuning required to maintain the equipment/system at operational standard through full range parameters

K21 the testing methods and procedures to be used to check that the system conforms to acceptable limits

K22 how to make sensory checks by sight, sound, smell, touch

K23 company policy on repair/replacement of components during the maintenance activities

K24 the importance of ensuring that the equipment is maintained to the prescribed category of cleanliness

K25 the generation of maintenance documentation and/or reports on completion of the maintenance activity

K26 the problems that can occur whilst carrying out the maintenance activities and how they can be avoided

K27 the organisational procedure to be adopted for the safe disposal of waste of all types of materials

K28 the extent of your own authority and to whom you should report if you have a problem that you cannot resolve

Unit 355 Undertaking scheduled maintenance of aircraft avionics equipment/systems

Supporting Information

Unit guidance

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme whilst meeting their own requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

Unit 356 Removing and replacing avionic indication and gauging components in aircraft systems

GLH:	175
Unit aim:	This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief. This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to carry out the removal and replacement of avionic indication and gauging components in aircraft systems, in accordance with approved procedures They will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the components to be removed or replaced. The aircraft components will include items such as gauges, actuators and motors, indicating devices, position transmitters and selectors. Their responsibilities will require them to comply with organisational policy and procedures for the removal and replacement activities undertaken, and to report any problems with these activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out. Their underpinning knowledge will provide a good understanding of their work and will provide an informed approach to applying the appropriate removal and replacement techniques and procedures for the indication and gauging components in the relevant aircraft systems. They will understand the removal and

	replacement methods and procedures and their application, along with the systems maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the removal and replacement activities and for ensuring that the equipment is replaced to the required standard. In addition, they will have sufficient knowledge of these components to ensure that they are fit for purpose and meet the specifications, thus providing a sound basis for carrying out the replacement to the required specification. They will understand the safety precautions required when working on the various aircraft systems and when using the associated tools and equipment. They will be required to demonstrate safe working practices throughout and will understand the responsibility they owe to themselves and others in the workplace. They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall objectives of the organisation, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment. **Note:** To display competence in this standard, it is necessary to both remove and replace avionic indication and gauging components. They must remove components; however, they may fit a replacement component where the original was previously removed by another person.
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Performance Requirments

The learner can:

P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines

P2 demonstrate the required behaviours in line with the job role and organisational objectives

P3 follow the relevant aircraft manuals and publications to carry out the required work

P4 establish and where appropriate, mark component orientation for re-assembly

P5 carry out the removal and replacement activities, within the limits of their personal authority

P6 remove and replace the required components, using approved tools and techniques

P7 take suitable precautions to prevent damage to components and the surrounding structure

P8 complete the relevant documentation, in accordance with organisational requirements

P9 label and store (in an appropriate location) components that require repair

P10 dispose of waste materials and scrap components, in accordance with approved procedures

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Learning outcome

The learner will:

1 carry out all of the following during the removal and replacement activity:

Assessment criteria

1.1 obtain clearance to work on the aircraft and observe all relevant isolation and safety procedures

1.2 obtain and use the appropriate documentation (such as job instructions, aircraft manuals, technical instructions and other relevant maintenance documentation)

1.3 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work

1.4 ensure that all relevant safety devices and mechanical/physical locks are in place (where appropriate)

1.5 obtain the correct tools and equipment for the activity and check that they are in a safe, tested and usable condition and within current certification/calibration date

1.6 use approved removal and replacement techniques and procedures at all times

1.7 where appropriate, apply Electrostatic Discharge (ESD) protection procedures

1.8 ensure that components and surrounding structures are maintained free from damage and foreign objects

1.9 return all tools and equipment to the correct location on completion of the activities

1.10 leave the aircraft and the indication and gauging system in a safe and appropriate condition, free from foreign object debris and in a condition ready for testing

Learning outcome

The learner will:

2 remove avionic indication and gauging components from three of the following aircraft systems and replace avionic indication and gauging components in three of the following aircraft systems:

Assessment criteria

2.1 power plant (such as main engine power, auxiliary power, thrust reverse, propeller, starting, monitoring, fire)

2.2 engine fuel, lubrication, air, cooling and control systems

2.3 fluid power (such as hydraulic power generation, undercarriage, pneumatic or vacuum pressure)

2.4 flying controls (such as flaps, elevators, ailerons/tailerons, spoilers, wing sweep, reaction controls, rudder, rotor)

2.5 wheels, brakes and steering

2.6 transmission systems (such as main and auxiliary gearboxes)

2.7 navigation systems

2.8 aircraft fuel systems (such as supply, contents, transfer, venting system, fuel jettison, refuelling and defuelling)

2.9 environmental control systems (such as pressure control, heating and ventilation equipment, air conditioning)

2.10 ice and rain protection systems (such as windshield, engine protection, pitot static protection, ice accretion)

2.11 fuselage (such as access panels, cargo doors, boundary layer and suction doors)

2.12 other suitable indication and gauging system

Learning outcome

The learner will:

3 during the activities identified at learning outcome 2, they must cover the removal and replacement of the following:

Assessment criteria

3.1 major avionic components: Remove and replace three of the following:

- 3.1a transmitters (such as position, flow, pressure, level)
- 3.1b generators (such as pulse, speed/taco)
- 3.1c actuators
- 3.1d computers
- 3.1e capacitance units
- 3.1f motors
- 3.1g gauges/indicators

3.1h displays

3.2 other system components: Remove and replace two of the following:

3.2a switches (such as micro, proximity)

3.2b circuit breakers

3.2c wires/cables

3.2d relays

3.2e input and follow-up potentiometers

3.2f plugs/sockets

3.2g transducers/sensors

3.2h software

3.2i other specific system component

Learning outcome

The learner will:

4 carry out twelve of the following removal and replacement activities:

Assessment criteria

4.1 disconnecting electrical connections

4.2 positioning and aligning replaced components

4.3 removal of earth bonding

4.4 making mechanical connections

4.5 removing cable securing devices

4.6 making electrical connections

4.7 removing bolt securing devices and mechanical fasteners

4.8 carrying out earth bonding

4.9 software loading

4.10 installing cable securing devices

4.11 applying and removing covering/protection to exposed components, wires, pipe work or vents

4.12 tightening fastenings to the required torque

4.13 making 'off-load' checks before re-connecting power

4.14 checking components for serviceability

4.15 replacing all 'lifed' items (seals, filters, gaskets)

4.16 labelling (and storing in the correct location) components that require repair or overhaul

4.17 setting, and adjusting replaced components (such as zero, range, travel, clearance)

4.18 applying bolt locking methods (such as split pins, wire locking, lock nuts)

Learning outcome

The learner will:

5 remove and replace aircraft avionic indication and gauging system components, in accordance with one of the following:

Assessment criteria

5.1 Military Aviation Authority (MAA)
5.2 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
5.3 BS, ISO or BSEN standards and procedures
5.4 Aerospace Quality Management Standards (AS)
5.5 Specific system requirements
5.6 Federal Aviation Authority (FAA)
5.7 organisation standards and requirements
5.8 manufacturers standards and procedures

Learning outcome

The learner will:

6 complete the relevant documentation, to include one from the following and pass it to the appropriate people:

Assessment criteria

6.1 job cards
6.2 computer records
6.3 aircraft service/flight log
6.4 aircraft log
6.5 permit to work/formal risk assessment

Knowledge and understanding

The learner must know and understand:

K1 the specific safety practices and procedures that you need to observe when working with aircraft control, indication and gauging systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
K2 the importance of maintenance on and impact upon ETOpS (Extended Twin Operations procedures) systems, legislation and local procedures
K3 the hazards associated with removing and replacing aircraft control, indication and gauging system components and with the tools and equipment used and how to minimise them and reduce any risks
K4 the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to

K5 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to

K6 the protective equipment that you need to use for both personal protection (PPE) and protection of the aircraft

K7 how to extract and use information from aircraft manuals, history/maintenance reports, flight logs, charts, circuit and physical layouts, specifications, symbols used in aircraft control, indication and gauging systems, and other documents needed in the maintenance process

K8 how to carry out currency/issue checks on the specifications you are working with

K9 the basic principles of operation of the control, indication and gauging system being worked on, and the performance characteristics and function of the components within the system

K10 the importance of applying Electrostatic Discharge (ESD) procedures when working on sensitive equipment or devices

K11 what constitutes a hazardous voltage and how to recognise victims of electric shock

K12 the various mechanical fasteners that are used and their method of removal and replacement (such as threaded fasteners, special securing devices)

K13 the importance of using the specified fasteners for the installation and why you must not substitute others

K14 why securing devices need to be locked and labelled, and the different methods that are used to remove and install them

K15 the torque loading requirements of the fasteners and what to do if these loadings are exceeded or not achieved

K16 the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections

K17 the techniques used to remove components from aircraft control, indication and gauging systems, without damage to the components or surrounding structure (such as release of pressures/force, draining of fluids, proof marking, the need to protect the circuit integrity by covering and labelling exposed circuits)

K18 the need to correctly label and store components that require repair or overhaul and to check that replaced components have the correct part/identification markings

K19 the techniques used to position, align, adjust and secure the replaced components to the aircraft, without damage to the components or surrounding structure

K20 the quality control procedures to be followed during the removal and replacement operations

K21 procedures for ensuring that you have the correct tools, equipment, components and fasteners for the activities

K22 methods of lifting, handling and supporting the components/equipment during the removal and replacement activities

K23 the use of seals, sealant, adhesives and anti-electrolysis barriers and the precautions to be taken

K24 why electrical bonding is critical and why it must be both mechanically and electrically secure

K25 how to conduct any necessary checks to ensure the system integrity and the accuracy and quality of the removal and replacement

K26 the tools and equipment used in the removal and replacement activities and their calibration/care and control procedures

K27 why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities

K28 the problems that can occur with the removal and replacement operations and how these can be overcome

K29 how to recognise defects (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)

K30 the recording documentation to be completed for the activities undertaken and where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation

K31 terminology used in aircraft control, indication and gauging systems and the use of system diagrams and associated symbols

K32 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)

K33 the procedure for the safe disposal of waste materials and scrap components the extent of your own responsibility and to whom you should report if you have problems that you cannot resolve

K34 the extent of your own responsibility and to whom you should report if you have problems that you cannot resolve

Unit 356 Removing and replacing avionic indication and gauging components in aircraft systems

Supporting Information

Unit guidance

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme whilst meeting their own requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

Unit 357 Removing and replacing components of aircraft electrical power control, distribution and protection

GLH:	175
Unit aim:	This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief. This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to carry out the removal and replacement of components in aircraft electrical power control, distribution and protection systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft and includes units and components associated with AC main power generation, DC power generation, secondary/standby power generation, emergency power back-up equipment and power distribution, as applicable to the aircraft type. They will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the components to be removed or replaced. The removal and replacement activities will include making all necessary checks to ensure that the components are safely and correctly removed and replaced and that the equipment is left in a safe condition and ready for testing. Their responsibilities will require them to comply with organisational policy and procedures for the removal and replacement activities undertaken and to report any problems with these activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities and that all necessary job/task documentation is completed, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out. They will understand the safety precautions required when working on the aircraft electrical power control,

	distribution and protection systems and when using the associated tools and equipment. They will be required to demonstrate safe working practices throughout and will understand the responsibility they owe to themselves and others in the workplace. They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall objectives of the organisation, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment. **Note:** To display competence in this standard it is necessary to both remove and replace aircraft electrical power control, distribution and protection components. They must remove components; however, they may fit a replacement component where the original was previously removed by another person.
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Performance Requirements

The learner can:

P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines

P2 demonstrate the required behaviours in line with the job role and organisational objectives

P3 follow the relevant aircraft manuals and publications to carry out the required work

P4 establish and where appropriate, mark component orientation for re-assembly

P5 carry out the removal and replacement activities, within the limits of their personal authority

P6 remove and replace the required components, using approved tools and techniques

P7 take suitable precautions to prevent damage to components and the surrounding structure

P8 complete the relevant documentation, in accordance with organisational requirements

P9 label and store (in an appropriate location) components that require repair

P10 dispose of waste materials and scrap components, in accordance with approved procedures

Learning outcome

The learner will:

1 carry out all of the following during the removal and replacement activity:

Assessment criteria

1.1 obtain clearance to work on the aircraft and observe all relevant isolation and safety procedures

1.2 obtain and use the appropriate documentation (such as job instructions, aircraft manuals, technical instructions and other relevant maintenance documentation)

1.3 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work

1.4 ensure that all relevant safety devices and mechanical/physical locks are in place (where appropriate)

1.5 obtain the correct tools and equipment for the activity and check that they are in a safe, tested and usable condition and within current certification/calibration date

1.6 use approved removal and replacement techniques and procedures at all times

1.7 where appropriate, apply Electrostatic Discharge (ESD) protection procedures

1.8 ensure that components and surrounding structures are maintained free from damage and foreign objects

1.9 return all tools and equipment to the correct location on completion of the activities

1.10 leave the aircraft and the electrical power system in a safe and appropriate condition, free from foreign object debris and in a condition ready for testing

Learning outcome

The learner will:

2 remove aircraft electrical power control, distribution and protection components from three of the following aircraft systems and replace aircraft electrical power control, distribution and protection components in three of the following aircraft systems:

Assessment criteria

2.1 AC main power generation equipment

2.2 DC power generation equipment

2.3 emergency power back-up equipment

2.4 secondary/standby power generation equipment

2.5 power distribution equipment

2.6 other specific equipment

Learning outcome

3 During the activities identified in learning outcome 2 above, they must cover the removal and replacement of the following:

Assessment criteria

3.1 major electrical components: Remove and replace three of the following:
- 3.1a generators
- 3.1b regulators
- 3.1c inverters
- 3.1d change-over relays
- 3.1e alternators
- 3.1f transformer
- 3.1g rectifier units
- 3.1h main contactors
- 3.1i batteries (such as one-shot or flight control DC batteries)
- 3.1j electrical power control units

3.2 other system components: Remove and replace two of the following:
- 3.2a switches
- 3.2b batteries (other types)
- 3.2c under-voltage phase sequence units
- 3.2d wires/cables
- 3.2e relays
- 3.2f circuit breakers
- 3.2g plugs/sockets
- 3.2h transducers/sensors
- 3.2i other specific components

Learning outcome

The learner will:

4 carry out ten of the following removal and replacement activities:

Assessment criteria

4.1 disconnecting electrical connections
4.2 checking components for serviceability
4.3 removal of earth bonding
4.4 positioning and aligning replaced components
4.5 removing cable securing devices
4.6 making mechanical connections

4.7 removing bolt securing devices and mechanical fasteners
4.8 making electrical connections
4.9 carrying out earth bonding
4.10 applying and removing covering/protection to exposed components, wires, pipe work or vents
4.11 installing cable securing devices
4.12 tightening fastenings to the required torque
4.13 labelling (and storing in the correct location) components that require repair or overhaul
4.14 applying bolt locking methods (such as split pins, wire locking, lock nuts)

Learning outcome

The learner will:

5 remove and replace aircraft electrical power control, distribution and protection system components, in accordance with one of the following:

Assessment criteria

5.1 Military Aviation Authority (MAA)
5.2 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
5.3 BS, ISO or BSEN standards and procedures
5.4 Aerospace Quality Management Standards (AS)
5.5 specific system requirements
5.6 Federal Aviation Authority (FAA)
5.7 organisation standards and procedures
5.8 manufacturers standards and procedures

Learning outcome

The learner will:

6 Complete the relevant documentation, to include one from the following and pass it to the appropriate people:

Assessment criteria

6.1 job cards
6.2 computer records
6.3 aircraft service/flight log
6.4 aircraft log
6.5 permit to work/formal risk assessment

Knowledge and understanding

The learner must know and understand:

K1 the specific safety practices and procedures that they need to observe when working with aircraft electrical power control, distribution and protection systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

K2 the importance of maintenance on and impact upon ETOpS (Extended Twin Operations Procedures) systems, legislation and local procedures

K3 the hazards associated with removing and replacing aircraft electrical power control, distribution and protection system components and with the tools and equipment used and how to minimise them and reduce any risks

K4 The importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to

K5 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to

K6 the protective equipment that they need to use for both personal protection (PPE) and protection of the aircraft

K7 how to extract and use information from aircraft manuals, history/maintenance reports, flight logs, charts, circuit and physical layouts, specifications, symbols used in aircraft electrical power control, distribution and protection systems and other documents needed in the maintenance process

K8 how to carry out currency/issue checks on the specifications they are working with

K9 terminology used in aircraft electrical power control, distribution and protection systems and the use of system diagrams and associated symbols

K10 the basic principles of operation of the electrical power system being worked on and the performance characteristics and function of the components within the system

K11 the importance of applying Electrostatic Discharge (ESD) procedures when working on sensitive equipment or devices

K12 what constitutes a hazardous voltage and how to recognise victims of electric shock

K13 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)

K14 the various mechanical fasteners that are used and their method of removal and replacement (such as threaded fasteners, special securing devices)

K15 the importance of using the specified fasteners for the installation and why they must not substitute others

K16 why securing devices need to be locked and labelled and the different methods that are used to remove and install them

K17 the torque loading requirements of the fasteners and what to do if these loadings are exceeded or not achieved

K18 the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking in of the connections

K19 the techniques used to remove components from aircraft electrical power control, distribution and protection systems, without damage to the components or surrounding structure (such as release of pressures/force, proof marking, the need to protect the circuit integrity by covering and labelling exposed circuits)

K20 the need to correctly label and store components that require repair or overhaul and to check that replaced components have the correct part/identification markings

K21 the techniques used to position, align, adjust and secure the replaced components to the aircraft, without damage to the components or surrounding structure

K22 the quality control procedures to be followed during the removal and replacement operations

K23 procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities

K24 methods of lifting, handling and supporting the components/equipment during the removal and replacement activities

K25 the use of seals, sealant and adhesives and anti-electrolysis barriers, and the precautions to be taken

K26 why electrical bonding is critical and why it must be both mechanically and electrically secure

K27 how to conduct any necessary checks to ensure the system integrity, accuracy and quality of the removal and replacement

K28 the tools and equipment used in the removal and replacement activities, and their calibration/care and control procedures

K29 why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities

K30 the problems that can occur with the removal and replacement operations, and how these can be overcome

K31 how to recognise defects (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)

K32 the recording documentation to be completed for the activities undertaken and where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation

K33 the procedure for the safe disposal of waste materials and scrap components

K34 the extent of their own authority and to whom they should report if they have problems that they cannot resolve

Unit 357 Removing and replacing components of aircraft electrical power control, distribution and protection

Supporting Information

Unit guidance

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme whilst meeting their own requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

Unit 358 Removing and replacing components of aircraft pitot static systems

GLH:	175
Unit aim:	This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief. This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to carry out the removal and replacement of components in aircraft pitot static systems and associated instrumentation, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft and includes units and components associated with height, speed, rate of climb, navigation, auto-pilot, flying control surfaces, ice and rain protection, as applicable to the aircraft type. They will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the components to be removed or replaced. The removal and replacement activities will include making all necessary checks to ensure that the components are safely and correctly removed and replaced and that the component is left in a safe condition and ready for testing. Their responsibilities will require them to comply with organisational policy and procedures for the removal and replacement activities undertaken and to report any problems with these activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. Their underpinning knowledge will provide a good understanding of their work and will provide an informed approach to applying the appropriate removal and replacement techniques and procedures for the pitot static components in the relevant aircraft systems. They will understand the removal and replacement methods and procedures, and their application, along with the systems maintenance requirements. They will know how the pitot static equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in

	adequate depth to provide a sound basis for carrying out the removal and replacement activities and for ensuring that the equipment is replaced to the required standard. They will understand the safety precautions required when working on the various pitot static systems and when using the associated tools and equipment. They will be required to demonstrate safe working practices throughout and will understand the responsibility they owe to themselves and others in the workplace. They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall objectives of the organisation, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment. **Notes:** To display competence in this standard it is necessary to both remove and replace pitot static components. They must remove components; however, they may fit a replacement component where the original was previously removed by another person.
Endorsed by	SEMTA

Performance Requirements

The learner can:

P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines

P2 demonstrate the required behaviours in line with the job role and organisational objectives

P3 follow the relevant aircraft manuals and publications to carry out the required work

P4 establish and where appropriate, mark component orientation for re-assembly

P5 carry out the removal and replacement activities, within the limits of their personal authority

P6 remove and replace the required components, using approved tools and techniques

P7 take suitable precautions to prevent damage to components and the surrounding structure

P8 complete the relevant documentation, in accordance with organisational requirements

P9 label and store (in an appropriate location) components that require repair

P10 dispose of waste materials and scrap components, in accordance with approved procedures

Learning outcome

The learner will:

1 carry out all of the following during the removal and replacement activity:

Assessment criteria

1.1 obtain clearance to work on the aircraft and observe all relevant isolation and safety procedures

1.2 obtain and use the appropriate documentation (such as job instructions, aircraft manuals, technical instructions and other relevant maintenance documentation)

1.3 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work

1.4 ensure that all relevant safety devices and mechanical/physical locks are in place (where appropriate)

1.5 obtain the correct tools and equipment for the activity and check that they are in a safe, tested and usable condition and within current certification/calibration date

1.6 use approved removal and replacement techniques and procedures at all times

1.7 where appropriate, apply Electrostatic Discharge (ESD) protection procedures

1.8 ensure that components and surrounding structures are maintained free from damage and foreign objects

1.9 return all tools and equipment to the correct location on completion of the activities

1.10 leave the aircraft and the pitot static system in a safe and appropriate condition, free from foreign object debris and in a condition ready for testing

Learning outcome

The learner will:

2 remove pitot static components from three of the following aircraft systems and replace pitot static components in three of the following aircraft systems:

Assessment criteria

2.1 rate of climb

2.2 aircraft height indication

2.3 auto-pilot

2.4 air speed indication

2.5 navigation

2.6 oxygen drop out

2.7 flying controls (such as flaps, elevators, ailerons/tailerons, spoilers, wing sweep, reaction controls, rudder, rotor, airbrakes, horizontal stabiliser, artificial feel, gust alleviation, modal suppression)

2.8 engine control systems (such as FADEC, FAFC, EEC)

2.9 environmental control systems (such as pressure control)

2.10 ice and rain protection systems (such as pitot static protection, ice accretion)

Learning outcome

3 During the activities identified in learning outcome 2 above, they must cover the removal and replacement of the following:

Assessment criteria

3.1 major pitot static components: Remove and replace three of the following:

- 3.1a airspeed indicators
- 3.1b heaters
- 3.1c analogue/digital converters
- 3.1d altitude indicators
- 3.1e static ports
- 3.1f pitot probes/pressure heads
- 3.1g rate of climb indicators
- 3.1h transducer units
- 3.1i air data computers/modules
- 3.1j cabin altitude alerter
- 3.1k digital displays
- 3.1l mach meters

3.2 other system components: Remove and replace two of the following:

- 3.2a wires/cables
- 3.2b plugs/sockets
- 3.2c rigid pipes
- 3.2d switches
- 3.2e circuit breakers
- 3.2f flexi-pipes
- 3.2g relays
- 3.2h moisture drains/traps
- 3.2i other specific system component

Learning outcome

The learner will:

4 carry out twelve of the following removal and replacement activities:

Assessment criteria

4.1 disconnecting electrical connections
4.2 positioning and aligning replaced components
4.3 removal of earth bonding
4.4 making mechanical connections
4.5 removing cable/pipe/tube securing devices
4.6 making electrical connections
4.7 removing bolt securing devices and mechanical fasteners
4.8 carrying out earth bonding
4.9 installing cable/pipe/tube securing devices
4.10 applying and removing covering/protection to exposed components, wires, pipe work or vents
4.11 tightening fastenings to the required torque
4.12 replacing all `lifed' items (seals, filters, gaskets)
4.13 checking components for serviceability
4.14 carrying out pre-disconnection leak checks
4.15 labelling (and storing in the correct location) components that require repair or overhaul
4.16 setting, and adjusting replaced components (such as zero, range, travel, clearance)
4.17 applying bolt locking methods (such as split pins, wire locking, lock nuts)

Learning outcome

The learner will:

5 remove and replace aircraft pitot static system components in compliance with one of the following:

Assessment criteria

5.1 Military Aviation Authority (MAA)
5.2 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
5.3 BS, ISO or BSEN standards and procedures
5.4 Aerospace Quality Management Standards (AS)
5.5 specific system requirements
5.6 Federal Aviation Authority (FAA)
5.7 organisation standards and procedures
5.8 manufacturers standards and procedures

Learning outcome

The learner will:

6 complete the relevant documentation, to include one from the following and pass it to the appropriate people:

Assessment criteria

6.1 job cards

6.2 computer records

6.3 aircraft service/flight log

6.4 aircraft log

6.5 permit to work/formal risk assessment

Knowledge and understanding

The learner must know and understand:

K1 the specific safety practices and procedures that they need to observe when working with aircraft pitot static systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

K2 the importance of maintenance on and impact upon (Extended Twin Operations Procedures) ETOpS systems, legislation and local procedures

K3 the hazards associated with removing and replacing aircraft pitot static system components and with the tools and equipment used and how to minimise them and reduce any risks

K4 The importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to

K5 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to

K6 the protective equipment that they need to use for both personal protection (PPE) and protection of the aircraft

K7 how to extract and use information from aircraft manuals, history/maintenance reports, flight logs, charts, circuit and physical layouts, specifications, symbols used in aircraft pitot static systems and other documents needed in the maintenance process

K8 how to carry out currency/issue checks on the specifications they are working with

K9 terminology used in aircraft pitot static systems and the use of system diagrams and associated symbols

K10 the basic principles of operation of the pitot static system being worked on and the performance characteristics and function of the components within the system

K11 the various mechanical fasteners that are used and their method of removal and replacement (such as threaded fasteners, special securing devices)

K12 the importance of using the specified fasteners for the installation and why they must not substitute others

K13 why securing devices need to be locked and labelled and the different methods that are used to remove and install them

K14 the torque loading requirements of the fasteners and what to do if these loadings are exceeded or not achieved

K15 the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking in of the connections

K16 the importance of applying Electrostatic Discharge (ESD) procedures when working on sensitive equipment or devices

K17 what constitutes a hazardous voltage and how to recognise victims of electric shock

K18 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)

K19 the techniques used to remove components from aircraft pitot static systems, without damage to the components or surrounding structure (such as release of pressures/force, draining of fluids, proof marking, the need to protect the circuit integrity by covering and labelling exposed circuits)

K20 the need to correctly label and store components that require repair or overhaul and to check that replaced components have the correct part/identification markings

K21 the techniques used to position, align, adjust and secure the replaced components to the aircraft without damage to the components or surrounding structure

K22 the quality control procedures to be followed during the removal and replacement operations

K23 procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities

K24 methods of lifting, handling and supporting the components/equipment during the removal and replacement activities

K25 the use of seals, sealant and adhesives and anti-electrolysis barriers and the precautions to be taken

K26 why electrical bonding is critical and why it must be both mechanically and electrically secure

K27 how to conduct any necessary checks to ensure the system integrity, accuracy and quality of the removal and replacement

K28 the tools and equipment used in the removal and replacement activities and their calibration/care and control procedures

K29 why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities

K30 the problems that can occur with the removal and replacement operations and how these can be overcome

K31 why it is important not to apply surface finishes/coverings to aircraft static vents

K32 how to recognise defects (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)

K33 the recording documentation to be completed for the activities undertaken and where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation

K34 the procedure for the safe disposal of waste materials and scrap components

K35 the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve

Unit 358 Removing and replacing components of aircraft pitot static systems

Supporting Information

Unit guidance

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme whilst meeting their own requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

Unit 359 Removing and replacing components of aircraft armament systems

GLH:	175
Unit aim:	This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief. This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to carry out the removal and replacement of components of aircraft armament systems, in accordance with approved procedures. They will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the components to be removed or replaced. The aircraft components will include items such as control units, computers, power supply units, dispensers, pylons, umbilical's, switches, relays and solenoids. The removal and replacement activities will include making all necessary checks to ensure that the components are safely and correctly removed and replaced and that the equipment is left in a safe condition and ready for testing. Their responsibilities will require them to comply with organisational policy and procedures for the removal and replacement activities undertaken and to report any problems with these activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. Their underpinning knowledge will provide a good understanding of their work and will provide an informed approach to applying the appropriate removal and replacement techniques and procedures for aircraft armament components, in the relevant aircraft systems. They will understand the removal and replacement methods and procedures and their application, along with the systems maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the removal and replacement activities and for ensuring

	that the equipment is replaced to the required standard. They will understand the safety precautions required when working on the aircraft armament systems and when using the associated tools and equipment. They will be required to demonstrate safe working practices throughout and will understand the responsibility they owe to themselves and others in the workplace. They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall objectives of the organisation, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment. Notes To display competence in this standard it is necessary to both remove and replace aircraft armament system components. They must remove components; however, they may fit a replacement component where the original was previously removed by another person.
Endorsed by	SEMTA

Performance Requirements

The learner can:

P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines

P2 demonstrate the required behaviours in line with the job role and organisational objectives

P3 follow the relevant aircraft manuals and publications to carry out the required work

P4 establish and where appropriate, mark component orientation for re-assembly

P5 carry out the removal and replacement activities, within the limits of their personal authority

P6 remove and replace the required components, using approved tools and techniques

P7 take suitable precautions to prevent damage to components and the surrounding structure

P8 complete the relevant documentation, in accordance with organisational requirements

P9 label and store (in an appropriate location) components that require repair

P10 dispose of waste materials and scrap components, in accordance with approved procedures

Learning outcome

The learner will:

1 carry out all of the following during the removal and replacement activity:

Assessment criteria

1.1 obtain clearance to work on the aircraft and observe all relevant isolation and safety procedures

1.2 obtain and use the appropriate documentation (such as job instructions, aircraft manuals, technical instructions and other relevant maintenance documentation)

1.3 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work

1.4 ensure that all relevant safety devices and mechanical/physical locks are in place (where appropriate)

1.5 obtain the correct tools and equipment for the activity and check that they are in a safe, tested and usable condition and within current certification/calibration date

1.6 use approved removal and replacement techniques and procedures at all times

1.7 where appropriate, apply Electrostatic Discharge (ESD) protection procedures

1.8 ensure that components and surrounding structures are maintained free from damage and foreign objects

1.9 return all tools and equipment to the correct location on completion of the activities

1.10 leave the aircraft and the armament system in a safe and appropriate condition, free from foreign object debris and in a condition ready for testing

Learning outcome

The learner will:

2 remove components from three of the following aircraft armament systems and replace components in three of the following aircraft armament systems:

Assessment criteria

2.1 defensive aids

2.2 missile

2.3 armament role equipment

2.4 weapon release equipment

2.5 depth charge

2.6 torpedoes

2.7 guns

2.8 pylons
2.9 other specific system

Learning outcome

The learner will:

3 during the activities identified in learning outcome 2, they must cover the removal and replacement of the following:

Assessment criteria

3.1 Major armament components: Remove and replace three of the following:
- 3.1a umbilicals
- 3.1b guns
- 3.1c sequence units
- 3.1d computers
- 3.1e motors
- 3.1f flare magazines
- 3.1g missiles
- 3.1h power supply units
- 3.1i clock units
- 3.1j relay units
- 3.1k control units
- 3.1l dispensers

3.2 other system components: Remove and replace two of the following:
- 3.2a switches
- 3.2b solenoids
- 3.2c safety devices
- 3.2d plugs/sockets
- 3.2e relays
- 3.2f indicators/gauges
- 3.2g wires/cables
- 3.2h other specific component

Learning outcome

The learner will:

4 carry out twelve of the following removal and replacement activities:

Assessment criteria

4.1 disconnecting electrical connections
4.2 replacing all 'lifed' items (seals, filters, gaskets)
4.3 removal of earth bonding

4.4 positioning and aligning replaced components
4.5 removing cable securing devices
4.6 setting, and adjusting replaced components
4.7 removing bolt securing devices and mechanical fasteners
4.8 making mechanical connections
4.9 making electrical connections
4.10 applying and removing covering/protection to exposed components, wires, pipework or vents
4.11 carrying out earth bonding
4.12 installing cable securing devices
4.13 checking components for serviceability
4.14 tightening fastenings to the required torque
4.15 labelling and storing all removed equipment in the correct location
4.16 applying bolt locking methods (such as split pins, wire locking, lock nuts)

Learning outcome

The learner will:

5 remove and replace components of aircraft armament systems in accordance with one of the following standards:

Assessment criteria

5.1 Military Aviation Authority (MAA)
5.2 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
5.3 BS, ISO or BSEN standards and procedures
5.4 Aerospace Quality Management Standards (AS)
5.5 specific system requirements
5.6 Federal Aviation Authority (FAA)
5.7 organisation standards and procedures
5.8 manufacturers standards and procedures

Learning outcome

The learner will:

6 complete the relevant documentation, to include one from the following and pass it to the appropriate people:

Assessment criteria

6.1 computer records
6.2 record/history cards
6.3 job cards
6.4 aircraft service/flight log

6.5 other specific recording method

Knowledge and understanding

The learner must know and understand:

K1 the specific safety practices and procedures that they need to observe when working with aircraft armament systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

K2 the hazards associated with removing and replacing aircraft armament system components and with the tools and equipment used and how to minimise them and reduce any risks

K3 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to

K4 The importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to

K5 the protective equipment that they need to use for both personal protection (PPE) and protection of the aircraft

K6 what constitutes a hazardous voltage and how to recognise victims of electric shock

K7 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)

K8 how to extract and use information from aircraft manuals, history/maintenance reports, flight logs, charts, circuit and physical layouts, specifications, symbols used and other documents needed in the maintenance process

K9 how to carry out currency/issue checks on the specifications they are working with

K10 terminology used in aircraft armament systems and the use of system diagrams and associated symbols

K11 the basic principles of operation of the armament system being worked on, and the performance characteristics and function of the components within the system

K12 the various mechanical fasteners that are used and their method of removal and replacement (such as threaded fasteners, special securing devices)

K13 the importance of using the specified fasteners for the installation and why they must not substitute others

K14 why securing devices need to be locked and labelled and the different methods that are used to remove and install them

K15 the torque loading requirements of the fasteners and what to do if these loadings are exceeded or not achieved

K16 the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking in of the connections

K17 the techniques used to remove components from aircraft armament systems, without damage to the components or surrounding structure (such as proof marking, the need to protect the circuit integrity by covering and labelling exposed circuits)

K18 the importance of applying Electrostatic Discharge (ESD) procedures when working on sensitive equipment or devices

K19 the need to correctly label and store components that require repair or overhaul and to check that replaced components have the correct part/identification markings

K20 the techniques used to position, align, adjust and secure the replaced components to the aircraft, without damage to the components or surrounding structure

K21 the quality control procedures to be followed during the removal and replacement operations

K22 procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities

K23 methods of lifting, handling and supporting the components/equipment during the removal and replacement activities

K24 the use of seals, sealant and adhesives and anti-electrolysis barriers, and the precautions to be taken

K25 why electrical bonding is critical and why it must be both mechanically and electrically secure

K26 how to conduct any necessary checks to ensure the system integrity, accuracy and quality of the removal and replacement

K27 the tools and equipment used in the removal and replacement activities, and their calibration/care and control procedures

K28 why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities

K29 the problems that can occur with the removal and replacement operations and how these can be overcome

K30 how to recognise defects (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)

K31 the recording documentation to be completed for the activities undertaken and where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation

K32 the procedure for the safe disposal of waste materials and scrap components

K33 the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve

Unit 359 Removing and replacing components of aircraft armament systems

Supporting Information

Unit guidance

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme whilst meeting their own requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

Unit 360 Removing and replacing components of aircraft communication systems

GLH:	175
Unit aim:	This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief. This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to carry out the removal and replacement of components in aircraft communication systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft, and includes equipment and components associated with intercom (clear), intercom (secure), High Frequency (HF) radio, Very High Frequency (VHF) radio, Ultra High Frequency (UHF) radio, cockpit voice recorder, Aircraft Communication Address Reporting System (ACARS), crash position indicators, digital data links, secure radio links, flight entertainment systems, Satellite Communications (SATCOM) and Selective Calling (SELCAL), as applicable to the aircraft type. They will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the components to be removed or replaced. The aircraft components will include items such as aerials, receiver units, transmitter units, satellite beacons, transponders, antenna switching units, tuning units, control units, intercom station boxes, cables, indicators and switches. The removal and replacement activities will include making all necessary checks to ensure that the components are removed and replaced safely and correctly and that the equipment is left in a safe condition and ready for testing. Their responsibilities will require them to comply with organisational policy and procedures for the removal and replacement activities undertaken and to report any problems with these activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly

	accounted for on completion of the activities, and that all necessary job/task documentation is completed, accurately and legibly. Their underpinning knowledge will provide a good understanding of their work and will provide an informed approach to applying the appropriate removal and replacement techniques and procedures for aircraft communication components, in the relevant aircraft systems. They will understand the removal and replacement methods and procedures and their application, along with the systems maintenance requirements. They will understand the safety precautions required when working on the aircraft communication systems and when using the associated tools and equipment. They will be required to demonstrate safe working practices throughout and will understand the responsibility they owe to themselves and others in the workplace. They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall objectives of the organisation, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.
Endorsed by	SEMTA

Performance Requirments

The learner can:

P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines

P2 demonstrate the required behaviours in line with the job role and organisational objectives

P3 follow the relevant aircraft manuals and publications to carry out the required work

P4 establish and where appropriate, mark component orientation for re-assembly

P5 carry out the removal and replacement activities, within the limits of their personal authority

P6 remove and replace the required components, using approved tools and techniques

P7 take suitable precautions to prevent damage to components and the surrounding structure

P8 complete relevant documentation, in accordance with organisational requirements

P9 label and store (in an appropriate location) components that require repair

P10 dispose of waste materials and scrap components, in accordance with approved procedures

Learning outcome

The learner will:

1 carry out all of the following during the removal and replacement activity:

Assessment criteria

1.1 obtain clearance to work on the aircraft and observe all relevant isolation and safety procedures

1.2 obtain and use the appropriate documentation (such as job instructions, aircraft manuals, technical instructions and other relevant maintenance documentation)

1.3 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work

1.4 ensure that all relevant safety devices and mechanical/physical locks are in place (where appropriate)

1.5 obtain the correct tools and equipment for the activity and check that they are in a safe, tested and usable condition and within current certification/calibration date

1.6 use approved removal and replacement techniques and procedures at all times

1.7 where appropriate, apply Electrostatic Discharge (ESD) protection procedures

1.8 ensure that components and surrounding structures are maintained free from damage and foreign objects

1.9 return all tools and equipment to the correct location on completion of the activities

1.10 leave the aircraft and the communication system in a safe and appropriate condition, free from foreign object debris and in a condition ready for testing

Learning outcome

The learner will:

2 remove components from three of the following aircraft communication systems, and replace components in three of the following aircraft communication systems:

Assessment criteria

2.1 VHF radio

2.2 cockpit voice recorder

2.3 flight entertainment systems

2.4 intercom (clear)

2.5 SATCOM
2.6 SELCAL
2.7 secure radio links
2.8 intercom (secure speech)
2.9 crash position indicators
2.10 HF radio
2.11 digital data links
2.12 telecommunications
2.13 UHF radio
2.14 satellite position systems
2.15 cabin interphone systems
2.16 Identification Friend or Foe (IFF)
2.17 Aircraft Communication Address Reporting System (ACARS)

Learning outcome

3 During the activities identified in learning outcome 2 above, they must cover the removal and replacement of the following:

Assessment criteria

3.1 Major communication components: Remove and replace three of the following:
- 3.1a aerials
- 3.1b transponders
- 3.1c transmitter units (inc cockpit voice recorder)
- 3.1d control units
- 3.1e receiver units
- 3.1f antenna switching units
- 3.1g transformers
- 3.1h intercom station boxes
- 3.1i satellite beacons
- 3.1j crypto unit
- 3.1k tuning units

3.2 Other system components: Remove and replace two of the following:
- 3.2a software
- 3.2b batteries
- 3.2c unit trays
- 3.2d plugs/sockets
- 3.2e switches
- 3.2f headsets
- 3.2g speakers
- 3.2h relays

3.2i microphone units
3.2j circuit breakers
3.2k wires/cables

Learning outcome

The learner will:

4 carry out 10 of the following removal and replacement activities:

Assessment criteria

4.1 disconnecting electrical connections
4.2 replacing all 'lifed' items (seals, filters, gaskets)
4.3 removal of earth bonding
4.4 positioning and aligning replaced components
4.5 removing cable securing devices
4.6 making mechanical connections
4.7 removing bolt securing devices and mechanical fasteners
4.8 making electrical connections
4.9 carrying out earth bonding
4.10 applying and removing covering/protection to exposed components, wires, pipework or vents
4.11 installing cable securing devices
4.12 tightening fastenings to the required torque
4.13 checking components for serviceability
4.14 labelling (and storing in the correct location) components that require repair or overhaul
4.15 setting, and adjusting/tuning replaced components (such as power output, voltage, frequency pre-sets)
4.16 applying bolt locking methods (such as split pins, wire locking, lock nuts)

Learning outcome

The learner will:

5 remove and replace components of aircraft communication systems in accordance with one of the following standards:

Assessment criteria

5.1 Military Aviation Authority (MAA)
5.2 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
5.3 BS, ISO or BSEN standards and procedures
5.4 Aerospace Quality Management Standards (AS)
5.5 specific system requirements

5.6 Federal Aviation Authority (FAA)

5.7 organisation standards and procedures

5.8 manufacturers standards and procedures

Learning outcome

The learner will:

6 complete the relevant documentation, to include one from the following and pass it to the appropriate people:

Assessment criteria

6.1 computer records

6.2 record/history cards

6.3 job cards

6.4 aircraft service/flight log

6.5 other specific recording method

Knowledge and understanding

The learner must know and understand:

K1 the specific safety practices and procedures that they need to observe when working with aircraft communication systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

K2 The importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to

K3 the importance of maintenance on, and impact upon (Extended Twin Operations Procedures) ETOpS systems, legislation and local procedures

K4 the hazards associated with removing and replacing aircraft communication system components and with the tools and equipment used and how to minimise them and reduce any risks

K5 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to

K6 the protective equipment that they need to use for both personal protection (PPE) and protection of the aircraft

K7 what constitutes a hazardous voltage and how to recognise victims of electric shock

K8 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)

K9 how to extract and use information from aircraft manuals, history/maintenance reports, flight logs, charts, circuit and physical layouts, specifications, symbols

used in aircraft communication systems and other documents needed in the maintenance process

K10 how to carry out currency/issue checks on the specifications they are working with

K11 terminology used in aircraft communication systems and the use of system diagrams and associated symbols

K12 the basic principles of operation of the communication system being worked on and the performance characteristics and function of the components within the system

K13 the various mechanical fasteners that are used and their method of removal and replacement (such as threaded fasteners, special securing devices)

K14 the importance of using the specified fasteners for the installation and why they must not substitute others

K15 why securing devices need to be locked and labelled and the different methods that are used to remove and install them

K16 the torque loading requirements of the fasteners and what to do if these loadings are exceeded or not achieved

K17 the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking in of the connections

K18 the techniques used to remove components from aircraft communication systems, without damage to the components or surrounding structure (such as proof marking, the need to protect the circuit integrity by covering and labelling exposed circuits)

K19 the importance of applying Electrostatic Discharge (ESD) procedures when working on sensitive equipment or devices

K20 the need to correctly label and store components that require repair or overhaul and to check that replaced components have the correct part/identification markings

K21 the techniques used to position, align, adjust and secure the replaced components to the aircraft, without damage to the components or surrounding structure

K22 the quality control procedures to be followed during the removal and replacement operations

K23 procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities

K24 methods of lifting, handling and supporting the components/equipment during the removal and replacement activities

K25 the use of seals, sealant and adhesives and anti-electrolysis barriers and the precautions to be taken

K26 why electrical bonding is critical and why it must be both mechanically and electrically secure

K27 how to conduct any necessary checks to ensure the system integrity, accuracy and quality of the removal and replacement

K28 the tools and equipment used in the removal and replacement activities, and their calibration/care and control procedures

K29 why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities

K30 the problems that can occur with the removal and replacement operations and how these can be overcome

K31 how to recognise defects (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)

K32 the recording documentation to be completed for the activities undertaken and where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation

K33 the procedure for the safe disposal of waste materials and scrap components

K34 the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve

Unit 360 Removing and replacing components of aircraft communication systems

Supporting Information

Unit guidance

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme whilst meeting their own requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

Unit 361 Removing and replacing components of aircraft passive warning and optical/surveillance systems

GLH:	175
Unit aim:	This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief. This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to carry out the removal and replacement of components in aircraft passive warning and optical/surveillance systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft and includes equipment and components associated with acoustics, Sound Navigation and Ranging (SONAR), Radar Homing and Warning Receivers (RHWR), collision and ground avoidance, wet, digital, video and infra-red cameras, recording and LASER systems, as applicable to the aircraft type. They will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the components to be removed or replaced. The removal and replacement activities will include making all necessary checks to ensure that the components are safely and correctly removed and replaced, and that the equipment is left in a safe condition and ready for testing. Their responsibilities will require them to comply with organisational policy and procedures for the removal and replacement activities undertaken and to report any problems with these activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities and that all necessary job/task documentation is completed, accurately and legibly.

	Their underpinning knowledge will provide a good understanding of their work and will provide an informed approach to applying the appropriate removal and replacement techniques and procedures to aircraft passive warning and optical/surveillance system components, in the relevant aircraft systems. They will understand the removal and replacement methods and procedures and their application, along with the systems maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the removal and replacement activities and for ensuring that the equipment is replaced to the required standard They will understand the safety precautions required when working on the aircraft passive warning and optical/surveillance systems and when using the associated tools and equipment. They will be required to demonstrate safe working practices throughout and will understand the responsibility they owe to themselves and others in the workplace. They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall objectives of the organisation, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.
Endorsed by	SEMTA

Performance Requirements

The learner can:

P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines

P2 demonstrate the required behaviours in line with the job role and organisational objectives

P3 follow the relevant aircraft manuals and publications to carry out the required work

P4 establish and where appropriate, mark component orientation for re-assembly

P5 carry out the removal and replacement activities, within the limits of their personal authority

P6 remove and replace the required components, using approved tools and techniques

P7 take suitable precautions to prevent damage to components and the surrounding structure

P8 complete the relevant documentation, in accordance with organisational requirements

P9 label and store (in an appropriate location) components that require repair

P10 dispose of waste materials and scrap components in accordance with approved procedures

P11 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines

Learning outcome

The learner will:

1 carry out all of the following during the removal and replacement activity:

Assessment criteria

1.1 obtain clearance to work on the aircraft and observe all relevant isolation and safety procedures

1.2 obtain and use the appropriate documentation (such as job instructions, aircraft manuals, technical instructions and other relevant maintenance documentation)

1.3 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work

1.4 ensure that all relevant safety devices and mechanical/physical locks are in place (where appropriate)

1.5 obtain the correct tools and equipment for the activity and check that they are in a safe, tested and usable condition and within current certification/calibration date

1.6 use approved removal and replacement techniques and procedures at all times

1.7 where appropriate, apply Electrostatic Discharge (ESD) protection procedures

1.8 ensure that components and surrounding structures are maintained free from damage and foreign objects

1.9 return all tools and equipment to the correct location on completion of the activities

1.10 leave the aircraft and the passive warning and optical surveillance system in a safe and appropriate condition, free from foreign object debris and in a condition ready for testing

Learning outcome

The learner will:

2 remove components from three of the following aircraft passive warning and optical/surveillance systems and replace components in three of the following aircraft passive warning and optical/surveillance systems:

Assessment criteria

2.1 acoustics
2.2 collision avoidance
2.3 video recording systems
2.4 air data recording
2.5 ground avoidance
2.6 LASER systems
2.7 cockpit recording systems
2.8 Radar Homing and Warning Receivers (RHWR)
2.9 Sound Navigation and Ranging (SONAR)
2.10 camera systems (wet film, digital or infra-red)
2.11 other specific passive warning or optical/surveillance system

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Learning outcome

3 During the activities identified in learning outcome 2 above, they must cover the removal and replacement of the following:

Assessment criteria

3.1 major passive warning and optical/surveillance components: Remove and replace three of the following:
- 3.1a buoys
- 3.1b transformers
- 3.1c processors
- 3.1d aerials
- 3.1e recording devices (cockpit, video, air data)
- 3.1f cameras
- 3.1g satellite beacons
- 3.1h receiver units
- 3.1i Power Supply Unit (PSU)
- 3.1i transponders
- 3.1k transmitter units
- 3.1l control units

3.2 other system components: Remove and replace two of the following:
- 3.2a batteries
- 3.2b relays
- 3.2c instruments/gauges/indicators
- 3.2d plugs/sockets
- 3.2e switches
- 3.2f circuit breakers
- 3.2g wires/cables
- 3.2h film or digital modules

3.2i software

3.2j other specific components

Learning outcome

The learner will:

4 carry out 10 of the following removal and replacement activities:

Assessment criteria

4.1 disconnecting electrical connections

4.2 replacing all 'lifed' items (seals, filters, gaskets)

4.3 removal of earth bonding

4.4 positioning and aligning replaced components

4.5 removing cable securing devices

4.6 making mechanical connections

4.7 removing bolt securing devices and mechanical fasteners

4.8 making electrical connections

4.9 carrying out earth bonding

4.10 applying and removing covering/protection to exposed components, wires, pipework or vents

4.11 installing cable securing devices

4.12 tightening fastenings to the required torque

Including the following:

4.13 checking components for serviceability

Learning outcome

The learner will:

5 overhaul aircraft gun systems in accordance with one of the following standards:

Assessment criteria

5.1 Military Aviation Authority (MAA)

5.2 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)

5.3 BS, ISO or BSEN standards and procedures

5.4 Aerospace Quality Management Standards (AS)

5.5 specific system requirements

5.6 Federal Aviation Authority (FAA)

5.7 organisation standards and procedures

5.8 manufacturers standards and procedures

Learning outcome

The learner will:

6 complete the relevant documentation, to include one from the following and pass it to the appropriate people:

Assessment criteria

6.1 computer records

6.2 record/history cards

6.3 job cards

6.4 aircraft service/flight log

6.5 other specific recording method

Knowledge and understanding

The learner must know and understand:

K1 the specific safety practices and procedures that they need to observe when working with aircraft passive warning and optical/surveillance systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

K2 The importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to

K3 the importance of maintenance on, and impact upon (Extended Twin Operations Procedures) ETOpS systems, legislation and local procedures

K4 the hazards associated with removing and replacing aircraft passive warning and optical/surveillance system components and with the tools and equipment used and how to minimise them and reduce any risks

K5 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to

K6 the protective equipment that they need to use for both personal protection (PPE) and protection of the aircraft

K7 what constitutes a hazardous voltage and how to recognise victims of electric shock

K8 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)

K9 how to extract and use information from aircraft manuals, history/maintenance reports, flight logs, charts, circuit and physical layouts, specifications, symbols used in aircraft passive warning and optical surveillance systems, distribution and protection systems, and other documents needed in the maintenance process

K10 how to carry out currency/issue checks on the specifications they are working with

K11 terminology used in aircraft passive warning and optical/surveillance systems and the use of system diagrams and associated symbols

K12 the basic principles of operation of the passive warning and optical/surveillance system being worked on and the performance characteristics and function of the components within the system

K13 the various mechanical fasteners that are used and their method of removal and replacement (such as threaded fasteners, special securing devices)

K14 the importance of using the specified fasteners for the installation and why they must not substitute others

K15 why securing devices need to be locked and labelled and the different methods that are used to remove and install them

K16 the torque loading requirements of the fasteners and what to do if these loadings are exceeded or not achieved

K17 the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking in of the connections

K18 the techniques used to remove components from aircraft passive warning and optical/surveillance systems, without damage to the components or surrounding structure (such as proof marking, the need to protect the circuit integrity by covering and labelling exposed circuits)

K19 the importance of applying Electrostatic Discharge (ESD) procedures when working on sensitive equipment or devices

K20 the need to correctly label and store components that require repair or overhaul and to check that replaced components have the correct part/identification markings

K21 the techniques used to position, align, adjust and secure the replaced components to the aircraft, without damage to the components or surrounding structure

K22 the quality control procedures to be followed during the removal and replacement operations

K23 procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities

K24 methods of lifting, handling and supporting the components/equipment during the removal and replacement activities

K25 the use of seals, sealant and adhesives and anti-electrolysis barriers and the precautions to be taken

K26 why electrical bonding is critical and why it must be both mechanically and electrically secure

K27 how to conduct any necessary checks to ensure the system integrity, accuracy and quality of the removal and replacement

K28 the tools and equipment used in the removal and replacement activities and their calibration/care and control procedures

K29 why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities

K30 the problems that can occur with the removal and replacement operations and how these can be overcome

K31 how to recognise defects (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)

K32 the recording documentation to be completed for the activities undertaken and where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation

K33 the procedure for the safe disposal of waste materials and scrap components

K34 the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve

Unit 361 Removing and replacing components of aircraft passive warning and optical/surveillance systems

Supporting Information

Unit guidance

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme whilst meeting their own requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

Unit 362 Removing and replacing components of aircraft radar systems

GLH:	175
Unit aim:	This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief. This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to carry out the removal and replacement of components in aircraft radar systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft and includes units and components associated with surveillance radar (including supplementary surveillance radar), weather radar, and obstacle warning systems (such as Enhanced Ground Proximity Warning Systems - EGPWS), Traffic Collision and Avoidance Systems (TCAS), towed radar decoys, radar (radio) altimeter, tactical air navigation (TACAN), Identification Friend or Foe (IFF), Doppler and radar jamming devices, as applicable to the aircraft type. They will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the components to be removed or replaced. The aircraft components will include items such as scanners, aerials, transponders, transmitters, receiver units, microwave generators, processors, power supply units, wave guides, intermediate frequency units, indicator units, radar displays, winches, coolant units and control units. The removal and replacement activities will include making all necessary checks to ensure that the components are safely and correctly removed and replaced, and that the equipment is left in a safe condition and ready for testing. Their responsibilities will require them to comply with organisational policy and procedures for the removal and replacement activities undertaken and to report any problems with these activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people.

	Their underpinning knowledge will provide a good understanding of the removal and replacement methods and procedures and their application, along with the system maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the removal and replacement activities and for ensuring that the equipment is replaced to the required standard. They will understand the safety precautions required when working on the aircraft radar systems and when using the associated tools and equipment. They will be required to demonstrate safe working practices throughout and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace. They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall objectives of the organisation, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.
Endorsed by	SEMTA

Performance Requirements

The learner can:

P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines

P2 demonstrate the required behaviours in line with the job role and organisational objectives

P3 follow the relevant aircraft manuals and publications to carry out the required work

P4 establish and where appropriate, mark component orientation for re-assembly

P5 carry out the removal and replacement activities, within the limits of their personal authority

P6 remove and replace the required components, using approved tools and techniques

P7 take suitable precautions to prevent damage to components and the surrounding structure

P8 complete the relevant documentation, in accordance with organisational requirements

P9 label and store (in an appropriate location) components that require repair

P10 dispose of waste materials and scrap components, in accordance with approved procedures

Learning outcome

The learner will:

1 carry out all of the following during the removal and replacement activity:

Assessment criteria

1.1 obtain clearance to work on the aircraft and observe all relevant isolation and safety procedures

1.2 obtain and use the appropriate documentation (such as job instructions, aircraft manuals, technical instructions and other relevant maintenance documentation)

1.3 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work

1.4 ensure that all relevant safety devices and mechanical/physical locks are in place (where appropriate)

1.5 obtain the correct tools and equipment for the activity and check that they are in a safe, tested and usable condition and within current certification/calibration date

1.6 use approved removal and replacement techniques and procedures at all times

1.7 where appropriate, apply Electrostatic Discharge (ESD) protection procedures

1.8 ensure that components and surrounding structures are maintained free from damage and foreign objects

1.9 return all tools and equipment to the correct location on completion of the activities

1.10 leave the aircraft and the radar system in a safe and appropriate condition, free from foreign object debris and in a condition ready for testing

Learning outcome

The learner will:

2 remove components from the following aircraft radar systems, and replace components of the following aircraft radar systems:

Assessment criteria

2.1 either one of the following:

- 2.1a surveillance radar
- 2.1b radar jamming

2.2 **OR** three of the following:

- 2.2a towed radar decoys
- 2.2b obstacle warning systems

2.2c Radar (radio) Altimeter (RADALT)
2.2d Identification Friend or Foe (IFF)
2.2e Doppler
2.2f Tactical Air Navigation (TACAN)
2.2g Enhanced Ground Proximity Warning System (EGPWS)
2.2h weather radar/predictive wind shear
2.2i supplementary surveillance radar
2.2j Traffic Collision Avoidance System (TCAS)
2.2k other specific radar system

Learning outcome

3 During the activities identified in learning outcome 2 above, they must cover the removal and replacement of the following:

Assessment criteria

3.1 major radar components: Remove and replace three of the following:
- 3.1a scanners
- 3.1b radar displays
- 3.1c Power Supply Units (PSU)
- 3.1d aerials
- 3.1e receiver units
- 3.1f winches
- 3.1g transformers
- 3.1h processors
- 3.1i waveguides
- 3.1j transmitter units
- 3.1k control units
- 3.1l radar packs
- 3.1m computers
- 3.1n microwave generators
- 3.1o coolant units
- 3.1p transponders
- 3.1q Intermediate Frequency Unit (IFU)

3.2 other system components: Remove and replace two of the following:
- 3.2a batteries
- 3.2b circuit breakers
- 3.2c wires/cables
- 3.2d switches
- 3.2e plugs/sockets
- 3.2f relays
- 3.2g desiccant units

3.2h coolant
3.2i software
3.2j other specific component

Learning outcome

The learner will:

4 carry out 10 of the following removal and replacement activities:

Assessment criteria

4.1 disconnecting electrical connections
4.2 replacing all `lifed' items (seals, filters, gaskets)
4.3 removal of earth bonding
4.4 positioning and aligning replaced components
4.5 removing cable securing devices
4.6 making mechanical connections
4.7 removing bolt securing devices and mechanical connections
4.8 making electrical connections fasteners
4.9 carrying out earth bonding
4.10 applying and removing covering/protection
4.11 installing cable securing devices exposed components, wires, pipework or vents
4.12 tightening fastenings to the required torque
4.13 checking components for serviceability
4.14 labelling (and storing in the correct location) components that require repair or overhaul
4.15 setting, and adjusting/tuning replaced components (such as power output, voltage)
4.16 applying bolt locking methods (such as split pins, wire locking, lock nuts)

Learning outcome

The learner will:

5 remove and replace aircraft radar system components, in compliance with one of the following

Assessment criteria

5.1 Military Aviation Authority (MAA)
5.2 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
5.3 BS, ISO or BSEN standards and procedures
5.4 Aerospace Quality Management Standards (AS)
5.5 specific system requirements

5.6 Federal Aviation Authority (FAA)

5.7 organisation standards and procedures

5.8 manufacturers standards and procedures

Learning outcome

The learner will:

6 complete the relevant documentation, to include one from the following and pass it to the appropriate people:

Assessment criteria

6.1 computer records

6.2 record/history cards

6.3 job cards

6.4 aircraft service/flight log

6.5 other specific recording method

Knowledge and understanding

The learner must know and understand:

K1 the specific safety practices and procedures that they need to observe when working with aircraft radar systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

K2 The importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to

K3 the importance of maintenance on and impact upon (Extended Range Twin-Engine Operations Procedures) ETOPS systems, legislation and local procedures

K4 the hazards associated with removing and replacing aircraft radar system components and with the tools and equipment used and how to minimise them and reduce any risk

K5 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to

K6 the protective equipment that they need to use for both personal protection (PPE) and protection of the aircraft

K7 what constitutes a hazardous voltage and how to recognise victims of electric shock

K8 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)

K9 how to extract and use information from aircraft manuals, history/maintenance reports, flight logs, charts, circuit and physical layouts, specifications, symbols

used in aircraft radar systems and other documents needed in the maintenance process

K10 how to carry out currency/issue checks on the specifications they are working with

K11 terminology used in aircraft radar systems and the use of system diagrams and associated symbols

K12 the basic principles of operation of the radar system being worked on and the performance characteristics and function of the components within the system

K13 the various mechanical fasteners that are used and their method of removal and replacement (such as threaded fasteners, special securing devices)

K14 the importance of using the specified fasteners for the installation and why they must not substitute others

K15 why securing devices need to be locked and labelled and the different methods that are used to remove and install them

K16 the torque loading requirements on the fasteners and what to do if these loadings are exceeded or not achieved

K17 the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections

K18 the techniques used to remove components from aircraft radar systems, without damage to the components or surrounding structure (such as proof marking, the need to protect the circuit integrity by covering and labelling exposed circuits)

K19 the importance of applying Electrostatic Discharge (ESD) procedures when working on sensitive equipment or devices

K20 the need to label and store correctly components that require repair or overhaul and to check that replaced components have the correct part/identification markings

K21 the techniques used to position, align, adjust and secure the replaced components to the aircraft, without damage to the components or surrounding structure

K22 the quality control procedures to be followed during the removal and replacement operations

K23 procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities

K24 methods of lifting, handling and supporting the components/equipment during the removal and replacement activities

K25 the use of seals, sealant and adhesives and anti-electrolysis barriers and the precautions to be taken

K26 why electrical bonding is critical and why it must be both mechanically and electrically secure

K27 how to conduct any necessary checks to ensure the system integrity, accuracy and quality of the removal and replacement

K28 the tools and equipment used in the removal and replacement activities and their calibration/care and control procedures

K29 why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities

K30 the problems that can occur with the removal and replacement operations and how these can be overcome

K31 how to recognise defects (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)

K32 the recording documentation to be completed for the activities undertaken and where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation

K33 the procedure for the safe disposal of waste materials and scrap components

K34 the extent of their own authority and to whom they should report if they have problems that they cannot resolve

Unit 362 Removing and replacing components of aircraft radar systems

Supporting Information

Unit guidance

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme whilst meeting their own requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

Unit 363 Removing and replacing components of aircraft navigational and computing systems

GLH:	175
Unit aim:	This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief. This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to carry out the removal and replacement of components in aircraft navigational and computing systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft and includes equipment and components associated with navigational and computing systems as applicable to the aircraft type. They will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the components to be removed or replaced. The aircraft components will include items such as aerials, receiver units, unit trays, indicator units and control units. The removal and replacement activities will include making all necessary checks to ensure that the components are safely and correctly removed and replaced and that the equipment is left in a safe condition and ready for testing. Their responsibilities will require them to comply with organisational policy and procedures for the removal and replacement activities undertaken and to report any problems with these activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. Their underpinning knowledge will provide a good understanding of their work and will provide an informed approach to applying the appropriate removal and replacement techniques and procedures for aircraft navigational components, in the relevant aircraft systems. They will understand the removal and replacement methods and procedures and their

	application, along with the systems maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the removal and replacement activities and for ensuring that the equipment is replaced to the required standard. In addition, they will have sufficient knowledge of these components to ensure that they are fit for purpose and meet the specifications, thus providing a sound basis for carrying out the replacement to the required specification. They will understand the safety precautions required when working on the aircraft navigational systems and when using the associated tools and equipment. They will be required to demonstrate safe working practices throughout and will understand the responsibility they owe to themselves and others in the workplace. They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall objectives of the organisation, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.
Endorsed by	SEMTA

Performance Requirements

The learner can:

P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines

P2 demonstrate the required behaviours in line with the job role and organisational objectives

P3 follow the relevant aircraft manuals and publications to carry out the required work

P4 establish and where appropriate, mark component orientation for re-assembly

P5 carry out the removal and replacement activities, within the limits of their personal authority

P6 remove and replace the required components, using approved tools and techniques

P7 take suitable precautions to prevent damage to components and the surrounding structure

P8 complete the relevant documentation, in accordance with organisational requirements

P9 label and store (in an appropriate location) components that require repair

P10 dispose of waste materials and scrap components, in accordance with approved procedures

Learning outcome

The learner will:

1 carry out all of the following during the removal and replacement activity:

Assessment criteria

1.1 obtain clearance to work on the aircraft and observe all relevant isolation and safety procedures

1.2 obtain and use the appropriate documentation (such as job instructions, aircraft manuals, technical instructions and other relevant maintenance documentation)

1.3 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work

1.4 ensure that all relevant safety devices and mechanical/physical locks are in place (where appropriate)

1.5 obtain the correct tools and equipment for the activity and check that they are in a safe, tested and usable condition and within current certification/calibration date

1.6 use approved removal and replacement techniques and procedures at all times

1.7 where appropriate, apply Electrostatic Discharge (ESD) protection procedures

1.8 ensure that components and surrounding structures are maintained free from damage and foreign objects

1.9 return all tools and equipment to the correct location on completion of the activities

1.10 leave the aircraft and the navigational and computing system in a safe and appropriate condition, free from foreign object debris and in a condition ready for testing

Learning outcome

The learner will:

2 remove components from three of the following aircraft navigational systems, and replace components in three of the following aircraft navigational systems:

Assessment criteria

2.1 Distance Measuring Equipment (DME)

2.2 re-transmission systems

2.3 Very High Frequency Omnidirectional Range (VOR)

2.4 Doppler

2.5 Instrument Landing System (ILS)
2.6 homing
2.7 Auto Direction Finder (ADF)
2.8 gyro
2.9 Global Positioning System (GPS)
2.10 Decca
2.11 Long Range Navigation (LORAN)
2.12 compass
2.13 inertial navigation system
2.14 computing sub-systems
2.15 Tactical Air Communication and Navigation System (TACAN)
2.16 Microwave Landing System (MLS)

Learning outcome

The learner will:

3 During the activities identified in learning outcome 2 above, they must cover the removal and replacement of the following:

Assessment criteria

The learner can:

3.1 Major navigational components: Remove and replace three of the following:
- 3.1a aerials
- 3.1b Analogue/Digital Converters (A-D/D-A)
- 3.1c control units
- 3.1d receiver units
- 3.1e compensation units
- 3.1f navigation display units (including head-up)
- 3.1g satellite beacons
- 3.1h transmitter units
- 3.1i transponders
- 3.1j transformers
- 3.1k computers
- 3.1l interface units

3.2 Other system components: Remove and replace two of the following:
- 3.2a batteries
- 3.2b unit trays
- 3.2c plugs/sockets
- 3.2d switches
- 3.2e vacuum pump
- 3.2f software

3.2g relays
3.2h instruments/gauges/indicators
3.2i circuit breakers
3.2j wires/cables
3.2k other specific system components

Learning outcome

The learner will:

4 carry out 10 the following removal and replacement activities:

Assessment criteria

4.1 disconnecting electrical connections
4.2 replacing all `lifed' items (seals, filters, gaskets)
4.3 removal of earth bonding
4.4 positioning and aligning replaced components
4.5 removing cable securing devices
4.6 making mechanical connections
4.7 removing bolt securing devices and mechanical fasteners
4.8 making electrical connections
4.9 carrying out earth bonding
4.10 applying and removing covering/protection to exposed components, wires, pipework or vents
4.11 installing cable securing devices
4.12 tightening fastenings to the required torque
4.13 checking components for serviceability
4.14 labelling (and storing in the correct location) components that require repair or overhaul
4.15 setting, and adjusting/tuning replaced components (such as power output, voltage)
4.16 applying bolt locking methods (such as split pins, wire locking, lock nuts)

Learning outcome

The learner will:

5 remove and replace aircraft navigational system components in compliance with one of the following:

Assessment criteria

5.1 Military Aviation Authority (MAA)
5.2 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
5.3 BS, ISO or BSEN standards and procedures

5.4 Aerospace Quality Management Standards (AS)
5.5 specific system requirements
5.6 Federal Aviation Authority (FAA)
5.7 organisation standards and procedures
5.8 manufacturers standards and procedures

Learning outcome

The learner will:

6 complete the relevant documentation, to include one from the following and pass it to the appropriate people:

Assessment criteria

6.1 computer records
6.2 record/history cards
6.3 job cards
6.4 aircraft service/flight log
6.5 other specific recording method

Knowledge and understanding

The learner must know and understand:

K1 the specific safety practices and procedures that they need to observe when working with aircraft navigational and computing systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
K2 the importance of maintenance on, and impact upon (Extended Twin Operations Procedures) ETOpS systems, legislation and local procedures
K3 The importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to
K4 the hazards associated with removing and replacing aircraft navigational and computing system components and with the tools and equipment used and how to minimise them and reduce any risks
K5 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
K6 the protective equipment that they need to use for both personal protection (PPE) and protection of the aircraft
K7 what constitutes a hazardous voltage and how to recognise victims of electric shock
K8 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)

K9 how to extract and use information from aircraft manuals, history/maintenance reports, flight logs, charts, circuit and physical layouts, specifications, symbols used in aircraft navigational systems, and other documents needed in the maintenance process

K10 how to carry out currency/issue checks on the specifications they are working with

K11 terminology used in aircraft navigational and computing systems and the use of system diagrams and associated symbols

K12 the basic principles of operation of the navigational or computing system being worked on and the performance characteristics and function of the components within the system

K13 the various mechanical fasteners that are used and their method of removal and replacement (such as threaded fasteners, special securing devices)

K14 the importance of using the specified fasteners for the installation and why they must not substitute others

K15 why securing devices need to be locked and labelled and the different methods that are used to remove and install them

K16 the torque loading requirements of the fasteners and what to do if these loadings are exceeded or not achieved

K17 the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking in of the connections

K18 the techniques used to remove components from aircraft navigational and computing systems, without damage to the components or surrounding structure (such as proof marking, the need to protect the circuit integrity by covering and labelling exposed circuits)

K19 the importance of applying Electrostatic Discharge (ESD) procedures when working on sensitive equipment/devices

K20 the need to correctly label and store components that require repair or overhaul and to check that replaced components have the correct part/identification markings

K21 the techniques used to position, align, adjust and secure the replaced components to the aircraft, without damage to the components or surrounding structure

K22 the quality control procedures to be followed during the removal and replacement operations

K23 procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities

K24 methods of lifting, handling and supporting the components/equipment during the removal and replacement activities

K25 the use of seals, sealant, adhesives and anti-electrolysis barriers and the precautions to be taken

K26 why electrical bonding is critical and why it must be both mechanically and electrically secure

K27 how to conduct any necessary checks to ensure the system integrity, accuracy and quality of the removal and replacement

K28 the tools and equipment used in the removal and replacement activities and their calibration/care and control procedures

K29 why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities

K30 the problems that can occur with the removal and replacement operations and how these can be overcome

K31 how to recognise defects (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)

K32 the recording documentation to be completed for the activities undertaken and where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation

K33 the procedure for the safe disposal of waste materials and scrap components the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve

Unit 363 Removing and replacing components of aircraft navigational and computing systems

Supporting Information

Unit guidance

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme whilst meeting their own requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

Unit 364 Removing and replacing components of aircraft flight guidance and control systems

GLH:	175
Unit aim:	This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief. This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to carry out the removal and replacement of components in aircraft flight guidance and control systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft and includes equipment and components associated with fly-by-wire, gyros, autopilot, flight director, angle of attack, turn and slip, and AFCS (Automatic Flying Control System), as applicable to the aircraft type. They will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the components to be removed or replaced. The removal and replacement activities will include making all necessary checks, to ensure that the components are safely and correctly removed and replaced and that the equipment is left in a safe condition and ready for testing. Their responsibilities will require them to comply with organisational policy and procedures for the removal and replacement activities undertaken and to report any problems with these activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. Their underpinning knowledge will provide a good understanding of their work and will provide an informed approach to applying the appropriate removal and replacement techniques and procedures for aircraft flight guidance and control components, in the relevant aircraft systems. They will understand the removal and replacement methods and procedures and their application, along with the systems maintenance requirements. They will know how the equipment

	functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the removal and replacement activities and for ensuring that the equipment is replaced to the required standard. In addition, they will have sufficient knowledge of these components to ensure that they are fit for purpose and meet the specifications, thus providing a sound basis for carrying out the replacement to the required specification. They will understand the safety precautions required when working on the aircraft flight guidance and control systems and when using the associated tools and equipment. They will be required to demonstrate safe working practices throughout and will understand the responsibility they owe to themselves and others in the workplace. They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall objectives of the organisation, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.
Endorsed by	SEMTA

Performance Requirements

The learner can:

P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines

P2 demonstrate the required behaviours in line with the job role and organisational objectives

P3 follow the relevant aircraft manuals and publications to carry out the required work

P4 establish and where appropriate, mark component orientation for re-assembly

P5 carry out the removal and replacement activities, within the limits of their personal authority

P6 remove and replace the required components, using approved tools and techniques

P7 take suitable precautions to prevent damage to components and the surrounding structure

P8 complete the relevant documentation, in accordance with organisational requirements

P9 label and store (in an appropriate location) components that require repair

P10 dispose of waste materials and scrap components, in accordance with approved procedures

Learning outcome

The learner will:

1 carry out all of the following during the removal and replacement activity:

Assessment criteria

1.1 obtain clearance to work on the aircraft and observe all relevant isolation and safety procedures

1.2 obtain and use the appropriate documentation (such as job instructions, aircraft manuals, technical instructions and other relevant maintenance documentation)

1.3 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work

1.4 ensure that all relevant safety devices and mechanical/physical locks are in place (where appropriate)

1.5 obtain the correct tools and equipment for the activity and check that they are in a safe, tested and usable condition and within current certification/calibration date

1.6 use approved removal and replacement techniques and procedures at all times

1.7 where appropriate, apply Electrostatic Discharge (ESD) protection procedures

1.8 ensure that components and surrounding structures are maintained free from damage and foreign objects

1.9 return all tools and equipment to the correct location on completion of the activities

1.10 leave the aircraft and the flight guidance and control system in a safe and appropriate condition, free from foreign object debris and in a condition ready for testing

Learning outcome

The learner will:

2 remove components from three of the following aircraft flight guidance and control systems, and replace components in three of the following aircraft flight guidance and control systems:

Assessment criteria

2.1 fly-by-wire

2.2 Automatic Flying Control System (AFCS)

2.3 auto-pilot

2.4 angle of attack/stall warning
2.5 flight director
2.6 nose wheel steering
2.7 turn and slip indication
2.8 main gear steering
2.9 gyros
2.10 other specific flight guidance and control system

Learning outcome

3 During the activities identified in learning outcome 2 above, they must cover the removal and replacement of the following:

Assessment criteria

3.1 major flight guidance and control components: Remove and replace three of the following:
- 3.1a computers
- 3.1b trim units
- 3.1c controllers
- 3.1d actuators
- 3.1e air data units
- 3.1f transformers
- 3.1g detectors/position sensors
- 3.1h stick position cancellers
- 3.1i receiver units
- 3.1j Attitude Heading and Reference System (AHRS)
- 3.1k gyros (rate and vertical)
- 3.1l Inertial Reference Unit (IRUs) primary or secondary
- 3.1m compass computers
- 3.1n embedded GPS and INS (EGI)

3.2 other system components: Remove and replace two of the following:
- 3.2a batteries
- 3.2b aerials
- 3.2c software
- 3.2d wires/cables
- 3.2e switches
- 3.2f instruments/gauges/indicators
- 3.2g plugs/sockets
- 3.2h relays
- 3.2i other specific system component

Learning outcome

The learner will:

5 carry out 10 of the following removal and replacement activities, where applicable:

Assessment criteria

4.1 disconnecting electrical connections
4.2 replacing all `lifed' items (seals, filters, gaskets)
4.3 removal of earth bonding
4.4 positioning and aligning replaced components
4.5 removing cable securing devices
4.6 making mechanical connections
4.7 removing bolt securing devices and mechanical fasteners
4.8 making electrical connections
4.9 carrying out earth bonding
4.10 applying and removing covering/protection to exposed components, wires, pipework or vents
4.11 installing cable securing devices
4.12 tightening fastenings to the required torque
4.13 checking components for serviceability
4.14 labelling (and storing in the correct location) components that require repair or overhaul
4.15 setting, and adjusting/tuning replaced components (such as power output, voltage)

Learning outcome

The learner will:

5 remove and replace aircraft flight guidance and control system components in compliance with one of the following:

Assessment criteria

5.1 Military Aviation Authority (MAA)
5.2 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
5.3 BS, ISO or BSEN standards and procedures
5.4 Aerospace Quality Management Standards (AS)
5.5 specific system requirements
5.6 Federal Aviation Authority (FAA)
5.7 organisation standards and procedures
5.8 manufacturers standards and procedures

Learning outcome

The learner will:

6 complete the relevant documentation, to include one from the following and pass it to the appropriate people:

Assessment criteria

6.1 computer records

6.2 record/history cards

6.3 job cards

6.4 aircraft service/flight log

6.5 other specific recording method

Knowledge and understanding

The learner must know and understand:

K1 the specific safety practices and procedures that they need to observe when working with aircraft flight guidance and control systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

K2 The importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to

K3 the importance of maintenance on and impact upon (Extended Range Twin-Engine Operations Procedures) ETOPS systems, legislation and local procedures

K4 the hazards associated with removing and replacing aircraft flight guidance and control system components and with the tools and equipment used and how to minimise them and reduce any risk

K5 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to

K6 the protective equipment that they need to use for both personal protection (PPE) and protection of the aircraft

K7 what constitutes a hazardous voltage and how to recognise victims of electric shock

K8 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)

K9 how to extract and use information from aircraft manuals, history/maintenance reports, flight logs, charts, circuit and physical layouts, specifications, symbols used in aircraft flight guidance and control systems and other documents needed in the maintenance process

K10 how to carry out currency/issue checks on the specifications they are working with

K11 terminology used in aircraft flight guidance and control systems and the use of system diagrams and associated symbols

K12 the basic principles of operation of the flight guidance and control system being worked on and the performance characteristics and function of the components within the system

K13 the various mechanical fasteners that are used and their method of removal and replacement (such as threaded fasteners, special securing devices)

K14 the importance of using the specified fasteners for the installation and why they must not substitute others

K15 why securing devices need to be locked and labelled and the different methods that are used to remove and install them

K16 the torque loading requirements on the fasteners and what to do if these loadings are exceeded or not achieved

K17 the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections

K18 the techniques used to remove components from aircraft flight guidance and control systems, without damage to the components or surrounding structure (such as proof marking, the need to protect the circuit integrity by covering and labelling exposed circuits)

K19 the importance of applying Electrostatic Discharge (ESD) procedures when working on sensitive equipment or devices

K20 the need to label and store correctly components that require repair or overhaul and to check that replaced components have the correct part/identification markings

K21 the techniques used to position, align, adjust and secure the replaced components to the aircraft, without damage to the components or surrounding structure

K22 the quality control procedures to be followed during the removal and replacement operations

K23 procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities

K24 methods of lifting, handling and supporting the components/equipment during the removal and replacement activities

K25 the use of seals, sealant and adhesives and anti-electrolysis barriers and the precautions to be taken

K26 why electrical bonding is critical and why it must be both mechanically and electrically secure

K27 how to conduct any necessary checks to ensure the system integrity, accuracy and quality of the removal and replacement

K28 the tools and equipment used in the removal and replacement activities and their calibration/care and control procedures

K29 why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities

K30 the problems that can occur with the removal and replacement operations and how these can be overcome

K31 how to recognise defects (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)

K32 the recording documentation to be completed for the activities undertaken and where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation

K33 the procedure for the safe disposal of waste materials and scrap components

K34 the extent of their own authority and to whom they should report if they have problems that they cannot resolve

Unit 364 Removing and replacing components of aircraft flight guidance and control systems

Supporting Information

Unit guidance

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme whilst meeting their own requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

Unit 365 Removing and replacing components of aircraft internal and external lighting systems

GLH:	175
Unit aim:	This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief. This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to carry out the removal and replacement of components in aircraft lighting systems, in accordance with approved procedures. They will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the components to be removed or replaced. The aircraft components will include items such as power supplies, batteries, invertors, transformers, rectifier units, terminal blocks and connecting devices, lighting units, switches and circuit breakers. The removal and replacement activities will include making all necessary checks, to ensure that the components are safely and correctly removed and replaced and that the equipment is left in a safe condition and ready for testing. Their responsibilities will require them to comply with organisational policy and procedures for the removal and replacement activities undertaken and to report any problems with these activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. Their underpinning knowledge will provide a good understanding of their work and will provide an informed approach to applying the appropriate removal and replacement techniques and procedures for the aircraft lighting equipment and components, in the relevant aircraft systems. They will understand the removal and replacement methods and procedures and their application, along with the systems maintenance requirements. They will know how the lighting equipment

	functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the removal and replacement activities and for ensuring that the equipment is replaced to the required standard. In addition, they will have sufficient knowledge of these components to ensure they are fit for purpose and meet the specifications, thus providing a sound basis for carrying out the replacement to the required specification. They will understand the safety precautions required when working on the aircraft lighting systems and when using the associated tools and equipment. They will be required to demonstrate safe working practices throughout and will understand the responsibility they owe to themselves and others in the workplace. They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall objectives of the organisation, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.
Endorsed by	SEMTA

Performance Requirements

The learner can:

P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines

P2 demonstrate the required behaviours in line with the job role and organisational objectives

P3 follow the relevant aircraft manuals and publications to carry out the required work

P4 establish and where appropriate, mark component orientation for re-assembly

P5 carry out the removal and replacement activities, within the limits of their personal authority

P6 remove and replace the required components, using approved tools and techniques

P7 take suitable precautions to prevent damage to components and the surrounding structure

P8 complete the relevant documentation in accordance with organisational requirements

P9 label and store (in an appropriate location) components that require repair

P10 dispose of waste materials and scrap components, in accordance with approved procedures

Learning outcome

The learner will:

1 carry out all of the following during the removal and replacement activity:

Assessment criteria

1.1 obtain clearance to work on the aircraft and observe all relevant isolation and safety procedures

1.2 obtain and use the appropriate documentation (such as job instructions, aircraft manuals, technical instructions and other relevant maintenance documentation)

1.3 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work

1.4 ensure that all relevant safety devices and mechanical/physical locks are in place (where appropriate)

1.5 obtain the correct tools and equipment for the activity and check that they are in a safe, tested and usable condition and within current certification/calibration date

1.6 use approved removal and replacement techniques and procedures at all times

1.7 where appropriate, apply Electrostatic Discharge (ESD) protection procedures

1.8 ensure that components and surrounding structures are maintained free from damage and foreign objects

1.9 return all tools and equipment to the correct location on completion of the activities

1.10 leave the aircraft and the lighting system in a safe and appropriate condition, free from foreign object debris and in a condition ready for testing

Learning outcome

The learner will:

2 remove aircraft lighting system components from three of the following lighting systems, and replace aircraft lighting system components in three of the following aircraft systems:

Assessment criteria

2.1 Electro-Luminescence (EL)

2.2 spot/search lighting

2.3 flood lighting

2.4 emergency lighting

2.5 anti-dazzle lighting
2.6 cabin lighting
2.7 Night Vision Goggles (NVG)
2.8 external lighting systems
2.9 utility lighting
2.10 other specific lighting system

Learning outcome

3 During the activities identified in learning outcome 2 above, they must cover the removal and replacement of the following:

Assessment criteria

3.1 major lighting system components: Remove and replace three of the following:
- 3.1a power supplies
- 3.1b transformer
- 3.1c rectifier units
- 3.1d junction box
- 3.1e inverters
- 3.1f control units
- 3.1g spot/search light (complete unit)
- 3.1h rheostats
- 3.1i strobe light/beacon light
- 3.1j taxi/landing lamp (complete unit)
- 3.1k utility light
- 3.1l navigation light

3.2 other system components: Remove and replace two of the following:
- 3.2a switches
- 3.2b batteries
- 3.2c filaments
- 3.2d wires/cables
- 3.2e relays
- 3.2f circuit breakers
- 3.2g light emitting diodes
- 3.2h plugs/sockets
- 3.2i transducers/sensors
- 3.2j terminal blocks
- 3.2k strip lights
- 3.2l other specific components

Learning outcome

The learner will:

4 carry out 10 of the following removal and replacement activities:

Assessment criteria

4.1 disconnecting electrical connections
4.2 checking components for serviceability
4.3 removal of earth bonding
4.4 positioning and aligning replaced components
4.5 removing cable securing devices
4.6 making mechanical connections
4.7 removing bolt securing devices and mechanical fasteners
4.8 making electrical connections
4.9 carrying out earth bonding
4.10 applying and removing covering/protection to exposed components, wires, pipework or vents
4.11 installing cable securing devices
4.12 weather sealing of lighting unit assemblies
4.13 labelling (and storing in the correct location) components that require repair or overhaul
4.14 applying bolt locking methods (such as split pins, wire locking, lock nuts)

Learning outcome

The learner will:

5 remove and replace aircraft lighting system components in compliance with one of the following:

Assessment criteria

5.1 Military Aviation Authority (MAA)
5.2 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
5.3 BS, ISO or BSEN standards and procedures
5.4 Aerospace Quality Management Standards (AS)
5.5 specific system requirements
5.6 Federal Aviation Authority (FAA)
5.7 organisation standards and procedures
5.8 manufacturers standards and procedures

Learning outcome

The learner will:

6 complete the relevant documentation, to include one from the following and pass it to the appropriate people:

Assessment criteria

6.1 computer records

6.2 record/history cards

6.3 job cards

6.4 aircraft service/flight log

6.5 other specific recording method

Knowledge and understanding

The learner must know and understand:

K1 the specific safety practices and procedures that they need to observe when working with aircraft internal and external lighting systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

K2 The importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to

K3 the importance of maintenance on, and impact upon (Extended Twin Operations Procedures) ETOpS systems, legislation and local procedures

K4 the hazards associated with removing and replacing aircraft lighting system components and with the tools and equipment used, and how to minimise them and reduce any risks

K5 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to

K6 the protective equipment that they need to use for both personal protection (PPE) and protection of the aircraft

K7 what constitutes a hazardous voltage and how to recognise victims of electric shock

K8 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)

K9 how to extract and use information from aircraft manuals, history/maintenance reports, flight logs, charts, circuit and physical layouts, specifications, symbols used in aircraft lighting systems and other documents needed in the maintenance process

K10 how to carry out currency/issue checks on the specifications they are working with

K11 terminology used in aircraft lighting systems and the use of system diagrams and associated symbols

K12 the basic principles of operation of the aircraft lighting system being worked on and the performance characteristics and function of the components within the system

K13 the various mechanical fasteners that are used and their method of removal and replacement (such as threaded fasteners, special securing devices)

K14 the importance of using the specified fasteners for the installation and why they must not substitute others

K15 why securing devices need to be locked and labelled, and the different methods that are used to remove and install them

K16 the torque loading requirements of the fasteners, and what to do if these loadings are exceeded or not achieved

K17 the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking in of the connections

K18 the techniques used to remove components from aircraft lighting systems, without damage to the components or surrounding structure (such as release of pressures/force, proof marking, the need to protect the circuit integrity by covering and labelling exposed circuits)

K19 the importance of applying Electrostatic Discharge (ESD) procedures when working on sensitive equipment or devices

K20 the need to correctly label and store components that require repair or overhaul and to check that replaced components have the correct part/identification markings

K21 the techniques used to position, align, adjust and secure the replaced components to the aircraft, without damage to the components or surrounding structure

K22 the quality control procedures to be followed during the removal and replacement operations

K23 procedures for ensuring they have the correct tools, equipment, components and fasteners for the activities

K24 methods of lifting, handling and supporting the components/equipment during the removal and replacement activities

K25 the use of seals, sealant and adhesives and anti-electrolysis barriers and the precautions to be taken

K26 why electrical bonding is critical and why it must be both mechanically and electrically secure

K27 how to conduct any necessary checks to ensure the system integrity, accuracy and quality of the removal and replacement

K28 the tools and equipment used in the removal and replacement activities and their calibration/care and control procedures

K29 why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities

K30 the problems that can occur with the removal and replacement operations and how these can be overcome

K31 how to recognise defects (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)

K32 the recording documentation to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation

K33 the procedure for the safe disposal of waste materials and scrap components

K34 the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve

Unit 365 Removing and replacing components of aircraft internal and external lighting systems

Supporting Information

Unit guidance

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme whilst meeting their own requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

Unit 366 Modifying aircraft avionic systems

GLH:	175
Unit aim:	This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief. This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to modify aircraft electrical/avionic systems, in accordance with approved procedures. In carrying out the modification operations, they will be required to follow laid-down procedures and to use specific modification leaflets, service bulletins and latest issue drawings and standards. It covers both fixed wing and rotary winged aircraft and they will be required to change, modify and update aircraft avionic systems, electrical power generation and distribution, internal and external lighting, indication and gauging, pitot static, communication, navigational, armament, passive warning and electronic countermeasure, infra-red and optical systems, radar, and flight guidance and control, as applicable to the aircraft type. They will be expected to remove and replace existing cables, add new cables, change breakout points and change the routeing of cables. They will also be expected to change components such as units and trays. They will need to show proficiency using various tools for cutting, stripping, crimping and soldering, and for the installation of the avionic systems. Their responsibilities will require them to comply with organisational policy and procedures for the modifications undertaken, and to report any problems with the modification activities, components or equipment that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They will be expected to work with a minimum of supervision, taking full responsibility for their own actions and for the quality and accuracy of the work that they carry out. Their underpinning knowledge will provide a good understanding of their work, and will provide an informed

	approach to applying modification procedures to aircraft avionic systems. They will understand the modifications to be carried out, and their application, and will know about the modification methods, tools and equipment to be used, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring that the modification is carried out to the required specification. They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall objectives of the organisation, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment. Note This standard is intended to cover avionic modifications of a significant or complex nature. The level of complexity will include the size and timescale of the modification, the tolerances required, the variety of equipment, techniques and materials required and the difficulty of access. It must not be used solely for simple modifications, such as changes to, or the addition of, a single wire/cable or termination.
Endorsed by	SEMTA

Performance Requirements

The learner can:

P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines

P2 demonstrate the required behaviours in line with the job role and organisational objectives

P3 obtain and follow the relevant modification specifications and job instructions

P4 confirm and agree what modifications are to be carried out to meet the specification

P5 prepare the avionic system for the required modification

P6 carry out the system modification, using approved materials, methods and procedures

P7 complete the modification within the agreed timescale

P8 ensure that the modified avionic system meets the specified operating conditions

P9 produce accurate and complete records of all modification work carried out

P10 deal promptly and effectively with problems within their control, and report those that cannot be solved

Learning outcome

The learner will:

1 carry out all of the following during the modification activities:

Assessment criteria

1.1 obtain and use the appropriate documentation (such as job instructions, aircraft modification drawings, wiring diagrams, technical instructions, planning and quality control documentation, aircraft standards and specifications)

1.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work

1.3 provide and maintain a safe working environment for the modification activities

1.4 obtain the correct tools and equipment for the activity and check that they are in a safe, tested and usable condition and within current calibration date

1.5 obtain clearance to work on the aircraft, and observe the power isolation and safety procedures

1.6 use safe and approved modification techniques and procedures at all times

1.7 where appropriate, apply Electrostatic Discharge (ESD) protection procedures

1.8 return all tools and equipment to the correct location on completion of the activities

1.9 dispose of waste items in a safe and environmentally acceptable manner

1.10 leave the work area in a safe and appropriate condition, free from foreign object debris on completion of the activities

Learning outcome

The learner will:

2 carry out modifications to three of the following aircraft avionic systems:

Assessment criteria

2.1 indication and gauging

2.2 navigational

2.3 infra-red and optical

2.4 pitot static

2.5 armament

2.6 flight guidance and control

2.7 radar

2.8 communication

2.9 electrical power generation and distribution

2.10 passive warning and electronic countermeasure

2.11 internal and external lighting

2.12 ground proximity/obstacle avoidance

2.13 other specific system

Learning outcome

The learner will:

3 carry out six of the following types of modification:

Assessment criteria

3.1 replacing cables of different size or length
3.2 software
3.3 adding new looms
3.4 changing or adding components to panels or sub-assemblies
3.5 making changes to looms
3.6 changing the position or angle of breakout points
3.7 changing the position of electrical/avionic units
3.8 making changes to cable terminations
3.9 making changes to structure (such as framework, casings, panels)
3.10 fitting new electrical/avionic systems
3.11 changing the routes of cables
3.12 removing cables
3.13 adding/removing/replacing pitot static pipes
3.14 adding cables

Learning outcome

The learner will:

4 carry out 10 of the following modification activities:

Assessment criteria

4.1 soldering and de-soldering
4.2 dismantling and re-assembling
4.3 heat shrinking (devices and boots)
4.4 stage checks of installed components (includes continuity checking)
4.5 crimping (tags and pins)
4.6 electrical bonding
4.7 changing electrical/avionic trays
4.8 updating firmware/software
4.9 repositioning units
4.10 stripping cable insulation
4.11 removal cable protection
4.12 removing and replacing cable end fittings
4.13 adjusting or tuning/calibrating components
4.14 changing components

4.15 repositioning pitot static pipes security devices

4.16 other specific process

Learning outcome

The learner will:

5 modify avionic systems in compliance with one of the following:

Assessment criteria

5.1 Military Aviation Authority (MAA)

5.2 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)

5.3 BS, ISO or BSEN standards and procedures

5.4 Aerospace Quality Management Standards (AS)

5.5 specific system requirements

5.6 Federal Aviation Authority (FAA)

5.7 organisation standards and procedures

5.8 manufacturers standards and procedures

Learning outcome

The learner will:

6 complete the relevant documentation, to include one from the following and pass it to the appropriate people:

Assessment criteria

6.1 computer records

6.2 record/history cards

6.3 job cards

6.4 aircraft service/flight log

6.5 other specific recording method

Knowledge and understanding

The learner must know and understand:

K1 the specific safety precautions and procedures to be observed whilst carrying out the modifications to aircraft electrical/avionic systems (including any specific legislation, regulations or codes of practice relating to the activities, equipment or materials)

K2 The importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to

K3 the importance of maintenance on and impact upon (Extended Twin Operations Procedures) ETOpS systems, legislation and local procedures

K4 the health and safety requirements of the work area in which they are carrying out the modification activities and the responsibility these requirements place on them

K5 the hazards associated with carrying out modifications to aircraft electrical/avionic systems and how to minimise them and reduce any risks

K6 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to

K7 the personal protective equipment and clothing (PPE) to be worn during the modification activities

K8 what constitutes a hazardous voltage and how to recognise victims of electric shock

K9 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)

K10 the various types of drawing and specification that are used during the modification

K11 how to identify the components to be used; component identification systems (such as codes and component orientation indicators)

K12 preparations to be undertaken on the system prior to modification

K13 the importance of applying Electrostatic Discharge (ESD) procedures when working on sensitive equipment or devices

K14 the methods and techniques to be used for soldering and de-soldering, and the importance of adhering to the procedures

K15 the methods and techniques to be used for crimping and heat shrinking, and the importance of adhering to them

K16 the methods and techniques to be used for the assembly of screened and unscreened plugs and sockets

K17 how to identify the difference between composite and metal plugs and sockets

K18 the different types of cable protection, and reasons for each type

K19 the various mechanical fasteners that will be used and their method of installation

K20 the importance of using the specified fasteners for the modification and why they must not use substitutes

K21 the quality control procedures to be followed during the modification operations

K22 how to conduct any necessary checks to ensure the accuracy and quality of the modification

K23 how to recognise defects (such as misalignment, ineffective fasteners, foreign object damage or contamination)

K24 the importance of ensuring that the completed modification is free from dirt, swarf and foreign object damage

K25 the methods and equipment used to transport, handle and lift components/looms into position and how to check that the equipment is within its current certification dates

K26 why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities

K27 the problems that can occur with the modification operations and how these can be overcome

K28 the recording documentation to be completed for the activities undertaken and where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation

K29 the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve

Unit 366 Modifying aircraft avionic systems

Supporting Information

Unit guidance

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme whilst meeting their own requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

Unit 367 Carrying out tests on avionic indication and gauging components of aircraft systems

Unit aim:

This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.

This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to test avionic indication and gauging components of aircraft systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft and includes aircraft systems associated with powerplant and auxiliary power units engine fuel and lubrication, flying controls, fluid power, wheels, brakes and steering, transmission systems, aircraft fuel systems, environmental control systems, ice and rain protection, and airframe systems and components, as applicable to the aircraft type. They will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the systems to be tested. The testing activities will include making all necessary checks and adjustments to ensure that components are correctly positioned and secured, and have the required range of movement, and will also include carrying out continuity and voltage checks, insulation checks, Built-In Test Equipment (BITE) tests, fuel gauging checks, content/level checks, comparison and functional checks.

Their responsibilities will require them to comply with organisational policy and procedures for the testing activities undertaken and to report any problems with these activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They will ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities and that all necessary job/task documentation is completed, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

	Their underpinning knowledge will provide a good understanding of their work and will provide an informed approach to applying appropriate testing techniques and procedures for aircraft indication and gauging systems. They will understand the indication or gauging system under test and its application, and will know about the tools and equipment used, and the testing requirements, in adequate depth to provide a sound basis for carrying out the activities, and ensuring that the tested system performs to the required specification. They will understand the safety precautions required when carrying out the testing activities and when using the associated tools and equipment. They will be required to demonstrate safe working practices throughout and will understand the responsibility they owe to themselves and others in the workplace. They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall objectives of the organisation, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.
Endorsed by	SEMTA

Performance Requirements

The learner can:

P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines

P2 demonstrate the required behaviours in line with the job role and organisational objectives

P3 follow the appropriate procedures for use of tools and equipment to carry out the required tests

P4 set up and carry out the tests using the correct procedures and within agreed timescales

P5 record the results of the tests in the appropriate format

P6 review the results and carry out further tests if necessary

Learning outcome

The learner will:

1 carry out all of the following during the testing of the avionic indication and gauging components:

Assessment criteria

1.1 obtain and use the appropriate documentation (such as job instructions, aircraft avionic test procedures, quality control documentation, history sheets, flight logbook, aircraft standards and specifications)

1.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work

1.3 provide and maintain a safe working environment for the testing activities

1.4 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration date

1.5 obtain clearance to work on the aircraft and observe all relevant isolation and safety procedures

1.6 ensure that safe working distance procedures are set up (where appropriate)

1.7 where appropriate, apply Electrostatic Discharge (ESD) protection procedures

1.8 carry out the tests using the specified techniques and procedures

1.9 make any permitted adjustments to components and equipment, to bring the system up to specification

1.10 return all tools and equipment to the correct location on completion of the testing activities

1.11 leave the aircraft and work area in a safe and appropriate condition, free from foreign object debris on completion of the activities

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Learning outcome

The learner will:

2 carry out testing on three of the following aircraft indication and gauging systems:

Assessment criteria

2.1 power plant (such as main engine power, auxiliary power, thrust reverse, propeller, starting, monitoring, fire)

2.2 engine fuel, lubrication, air, cooling, control systems

2.3 fluid power (such as hydraulic power generation, undercarriage, pneumatic or vacuum pressure)

2.4 flying controls (such as flaps/slats, elevators, ailerons/tailerons, horizontal stabiliser, spoilers/speed brakes, wing sweep, reaction controls, rudder, rotor)

2.5 wheels, brakes, steering

2.6 transmission systems (such as main/auxiliary gear boxes)

2.7 navigation systems

2.8 aircraft fuel systems (such as supply, contents, transfer, venting system, fuel jettison, refuelling/de-fuelling)

2.9 environmental control systems (such as pressure control, heating and ventilation, equipment air conditioning)

2.10 ice and rain protection systems (such as windshield, engine protection, pitot static protection, ice accretion)
2.11 fuselage (such as access panels, cargo doors, boundary layer, suction doors)
2.12 other suitable indication and gauging system

Learning outcome

The learner will:

3 test aircraft indication and gauging systems, using three of the following:

Assessment criteria

3.1 external power supply source (electrical/hydraulic)
3.2 'special-to-type' test sets
3.3 internal power supply source (electrical/hydraulic)
3.4 measuring equipment (such as multimeters, insulation testers)
3.5 other test equipment (such as internal aircraft equipment)

Learning outcome

The learner will:

4 carry out three of the following types of test/check:

Assessment criteria

4.1 soak test
4.2 contents/level check
4.3 comparison check
4.4 functional check
4.5 voltage check
4.6 'special-to-type' tests
4.7 continuity check
4.8 BITE test

Including the following:

4.9 a full system test that incorporates three of the above tests

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Learning outcome

The learner will:

5 carry out tests in compliance with one of the following:

Assessment criteria

5.1 Military Aviation Authority (MAA)
5.2 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
5.3 BS, ISO or BSEN standards and procedures

5.4 Aerospace Quality Management Standards (AS)
5.5 specific system requirements
5.6 Federal Aviation Authority (FAA)
5.7 organisation standards and procedures
5.8 manufacturers standards and procedures

Learning outcome

The learner will:

6 complete the relevant documentation, to include one from the following and pass it to the appropriate people:

Assessment criteria

6.1 computer records
6.2 record/history cards
6.3 job cards
6.4 aircraft service/flight log
6.5 other specific recording method

Knowledge and understanding

The learner must know and understand:

K1 the specific safety practices and procedures that they need to observe when testing aircraft indication and gauging systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
K2 The importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to
K3 the importance of maintenance on and impact upon (Extended Twin Operations Procedures) ETOpS systems, legislation and local procedures
K4 the health and safety requirements of the work area where they are carrying out the activities, and the responsibility these requirements place on them
K5 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
K6 the safety procedures that must be carried out before work is started on the aircraft
K7 the protective clothing and equipment (PPE) to be worn and where it can be obtained
K8 what constitutes a hazardous voltage and how to recognise victims of electric shock

K9 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)

K10 hazards associated with testing aircraft indication and gauging systems, and with the tools and equipment used, and how to minimise them and reduce any risks

K11 the correct operating procedures of the indication and gauging system being tested

K12 electrical bonding specifications and their importance

K13 how to extract and use information from engineering drawings and related specifications

K14 how to obtain the required test schedules and specifications for the system and aircraft type being tested and how to check their currency and validity

K15 how to read and interpret the test schedules and specifications, and from whom they can seek assistance if they have problems or issues regarding the test schedules or specifications

K16 the methods and procedures to be used to carry out the various tests on the aircraft indication or gauging system and its system components

K17 the importance of applying electrostatic discharge (ESD) procedures when working on sensitive equipment or devices

K18 the test equipment to be used and its selection and application for particular tests

K19 the calibration of test equipment (where applicable), and the requirement for currency/issue checks

K20 the techniques, methods and procedures to be used during the tests

K21 why equipment control is critical and what to do if a piece of equipment is unaccounted for on completion of the testing activities

K22 the basic principles of operation of the indication and gauging system under test and the function of the individual components within the system

K23 the importance of carrying out the tests in the specified sequence, checking all readings, movements and levels at each stage

K24 from whom to seek authorisation if they need to alter or change the test procedures

K25 how to record the results of each individual test and the documentation that must be used

K26 how to analyse the test results and how to make valid decisions about the acceptability of the system

K27 the procedures to be followed if the equipment or system fails to meet the test specification

K28 problems that can occur with the testing activities and how they can be overcome

K29 the problems that may cause errors or discrepancies with the test results and how to avoid these

K30 any required environmental controls relating to the testing

K31 the documentation to be completed at the end of the testing activities

K32 the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve

Unit 367 Carrying out tests on avionic indication and gauging components of aircraft systems

Supporting Information

Unit guidance

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme whilst meeting their own requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

Unit 368 Carrying out tests on aircraft electrical power control, distribution and protection systems

GLH:	119
Unit aim:	This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief. This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to test aircraft electrical power control, distribution and protection systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft, and includes aircraft electrical systems associated with AC main power generation, DC power generation, secondary/standby power generation, emergency power backup equipment and power distribution, as applicable to the aircraft type. They will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the systems to be tested. The testing activities will include making all necessary checks and adjustments to ensure that components are correctly and securely positioned, and have the required range of movement, and will also include carrying out continuity and voltage checks, Built-In Test Equipment (BITE) tests, emergency power failure, comparison and functional checks. Their responsibilities will require them to comply with organisational policy and procedures for the testing activities undertaken and to report any problems with these activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They will ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

	Their underpinning knowledge will provide a good understanding of their work and will provide an informed approach to applying appropriate testing techniques and procedures to aircraft electrical power control, distribution and protection systems. They will understand the electrical system under test and its application, and will know about the tools and equipment used, and the testing requirements, in adequate depth to provide a sound basis for carrying out the activities, and for ensuring that the tested system performs to the required specification. They will understand the safety precautions required when carrying out the testing activities and when using the associated tools and equipment. They will be required to demonstrate safe working practices throughout and will understand the responsibility they owe to themselves and others in the workplace. They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall objectives of the organisation, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.
Endorsed by	SEMTA

Performance Requirements

The learner can:

P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines

P2 demonstrate the required behaviours in line with the job role and organisational objectives

P3 follow the appropriate procedures for use of tools and equipment to carry out the required tests

P4 set up and carry out the tests using the correct procedures and within agreed timescales

P5 record the results of the tests in the appropriate format

P6 review the results and carry out further tests if necessary

Learning outcome

The learner will:

1 carry out all of the following during the testing of the aircraft electrical power control, distribution and protection systems:

Assessment criteria

1.1 obtain and use the appropriate documentation (such as job instructions, aircraft electrical test procedures, quality control documentation, history sheets, flight logbook, aircraft standards and specifications)

1.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work

1.3 provide and maintain a safe working environment for the testing activities

1.4 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration date

1.5 obtain clearance to work on the aircraft, and observe all relevant isolation and safety procedures

1.6 ensure that safe working distance procedures are set up (where appropriate)

1.7 where appropriate, apply Electrostatic Discharge (ESD) protection procedures

1.8 carry out the tests using the specified techniques and procedures

1.9 make any permitted adjustments to components and equipment, to bring the system to the specification requirements

1.10 return all tools and equipment to the correct location on completion of the testing activities

1.11 leave the aircraft and work area in a safe and appropriate condition, free from foreign object debris on completion of the activities

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Learning outcome

The learner will:

2 carry out testing on three of the following aircraft electrical power control, distribution and protection systems:

Assessment criteria

2.1 AC main power generation equipment

2.2 DC power generation

2.3 emergency power backup equipment

2.4 secondary/standby power generation equipment

2.5 power distribution equipment

2.6 other specific equipment

Learning outcome

The learner will:

3 test aircraft electrical power control, distribution and protection systems, using three of the following:

Assessment criteria

3.1 external power supply source
3.2 'special-to-type' test sets
3.3 internal power supply source
3.4 measuring equipment (such as multimeters, insulation testers)
3.5 other test equipment (such as internal aircraft equipment)

Learning outcome

The learner will:

4 carry out three of the following types of test/check:

Assessment criteria

4.1 soak test
4.2 voltage check
4.3 comparison check
4.4 functional check
4.5 BITE test
4.6 'special-to-type' tests
4.7 continuity check
4.8 emergency power failure checks

Including the following:

4.9 a full system test that incorporates three of the above tests

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Learning outcome

The learner will:

5 carry out tests in compliance with one of the following

Assessment criteria

5.1 Military Aviation Authority (MAA)
5.2 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
5.3 BS, ISO or BSEN standards and procedures
5.4 Aerospace Quality Management Standards (AS)
5.5 specific system requirements
5.6 Federal Aviation Authority (FAA)
5.7 organisation standards and procedures
5.8 manufacturers standards and procedures

Learning outcome

The learner will:

6 complete the relevant documentation, to include one from the following and pass it to the appropriate people:

Assessment criteria

6.1 computer records

6.2 record/history cards

6.3 job cards

6.4 aircraft service/flight log

6.5 other specific recording method

Knowledge and understanding

The learner must know and understand:

K1 the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to

K2 the specific safety practices and procedures that they need to observe when testing aircraft electrical power control, distribution and protection systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

K3 the importance of maintenance on and impact upon (Extended Twin Operations Procedures) ETOpS systems, legislation and local procedures

K4 the health and safety requirements of the work area where they are carrying out the activities and the responsibility these requirements place on them

K5 the safety procedures that must be carried out before work is started on the aircraft

K6 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to

K7 the protective clothing and equipment (PPE) to be worn and where it can be obtained

K8 hazards associated with testing aircraft electrical power control, distribution and protection systems, and with the tools and equipment used, and how to minimise them and reduce any risks

K9 what constitutes a hazardous voltage and how to recognise victims of electric shock

K10 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)

K11 the correct operating procedures of the electrical power control, distribution and protection systems being tested

K12 electrical bonding specifications and their importance

K13 how to extract and use information from engineering drawings and related specifications

K14 how to obtain the required test schedules and specifications for the system and aircraft type being tested and how to check their currency and validity

K15 how to read and interpret the test schedules and specifications, and from whom they can seek assistance if they have problems or issues regarding the test schedules or specifications

K16 the methods and procedures to be used to carry out the various tests on the aircraft electrical power control, distribution and protection systems and its system components

K17 the importance of applying Electrostatic Discharge (ESD) procedures when working on sensitive equipment or devices

K18 the test equipment to be used and its selection and application for particular tests

K19 the calibration of test equipment (where applicable) and the requirement for currency/issue checks

K20 the techniques, methods and procedures to be used during the tests

K21 why equipment control is critical and what to do if a piece of equipment is unaccounted for on completion of the testing activities

K22 the basic principle of operation of the electrical power control, distribution and protection systems under test, and the function of the individual components within the system

K23 the importance of carrying out the tests in the specified sequence, checking all readings, movements and levels at each stage

K24 from whom to seek authorisation if they need to alter or change the test procedures

K25 how to record the results of each individual test and the documentation that must be used

K26 how to analyse the test results and how to make valid decisions about the acceptability of the system

K27 the procedures to be followed if the equipment or system fails to meet the test specification

K28 problems that can occur with the testing activities and how they can be overcome

K29 the problems that may cause errors or discrepancies with the test results and how to avoid these

K30 any required environmental controls relating to the testing

K31 the documentation to be completed at the end of the testing activities

K32 the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve

Unit 368 Carrying out tests on aircraft electrical power control, distribution and protection systems

Supporting Information

Unit guidance

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme whilst meeting their own requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

Unit 369 Carrying out tests on aircraft pitot static systems

GLH:	119
Unit aim:	This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief. This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to test aircraft pitot static systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft, and includes pitot static systems associated with height, speed, rate of climb, navigation, auto-pilot, flying control surfaces, ice and rain protection components, as applicable to the aircraft type. They will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the systems to be tested. The testing activities will include making all necessary checks and adjustments to ensure that components are correctly positioned and aligned and have the required range of movement, and carrying out Built-In Test Equipment (BITE) tests, functional checks, sense and leak tests and independent sense and leak tests. Their responsibilities will require them to comply with organisational policy and procedures for the testing activities undertaken and to report any problems with these activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They will ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out. Their underpinning knowledge will provide a good understanding of their work and will provide an informed approach to applying appropriate testing techniques and procedures for aircraft pitot static systems. They will understand the pitot static system under test and its

	application, and will know about the tools and equipment used, and the testing requirements, in adequate depth to provide a sound basis for carrying out the activities, and for ensuring that the tested system performs to the required specification. They will understand the safety precautions required when carrying out the testing activities and when using the associated tools and equipment. They will be required to demonstrate safe working practices throughout and will understand the responsibility they owe to themselves and others in the workplace. They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall objectives of the organisation, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.
Endorsed by	SEMTA

Performance Requirements

The learner can:

P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines

P2 demonstrate the required behaviours in line with the job role and organisational objectives

P3 follow the appropriate procedures for use of tools and equipment to carry out the required tests

P4 set up and carry out the tests using the correct procedures and within agreed timescales

P5 record the results of the tests in the appropriate format

P6 review the results and carry out further tests if necessary

Learning outcome

The learner will:

1 carry out all of the following during the testing of the pitot static systems:

Assessment criteria

1.1 obtain and use the appropriate documentation (such as job instructions, aircraft pitot static test procedures, quality control documentation, history sheets, flight logbook, aircraft standards and specifications)

1.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work

1.3 provide and maintain a safe working environment for the testing activities

1.4 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration date

1.5 obtain clearance to work on the aircraft and observe all relevant isolation and safety procedures

1.6 ensure that safe working distance procedures are set up (where appropriate)

1.7 where appropriate, apply Electrostatic Discharge (ESD) protection procedures

1.8 carry out the tests using the specified techniques and procedures

1.9 make any permitted adjustments to components and equipment, to bring the system to the specification requirements

1.10 return all tools and equipment to the correct location on completion of the testing activities

1.11 leave the aircraft and work area in a safe and appropriate condition, free from foreign object debris on completion of the activities

Learning outcome

The learner will:

2 carry out testing on three of the following aircraft pitot static systems:

Assessment criteria

2.1 rate of climb

2.2 aircraft height indication

2.3 auto-pilot

2.4 air speed indication

2.5 navigation

2.6 oxygen drop out

2.7 flying controls (such as flaps, elevators, ailerons/tailerons, spoilers, wing sweep, reaction controls, rudder, rotor, airbrakes, horizontal stabilisers, artificial feel, gust alleviation, modal suppression)

2.8 engine control systems (such as FADEC, FAFC, EEC)

2.9 environmental control systems (such as pressure control)

2.10 ice and rain protection systems (such as pitot static protection, ice accretion)

Learning outcome

The learner will:

3 test aircraft pitot static systems, using three of the following:

Assessment criteria

3.1 external power supply source

3.2 'special-to-type' test sets

3.3 internal power supply source

3.4 measuring equipment (such as multimeters)

3.5 other test equipment (such as pressure/suction equipment, internal aircraft equipment)

Learning outcome

The learner will:

4 carry out three of the following types of test/check:

Assessment criteria

4.1 s oak test
4.2 BITE test
4.3 'special-to-type' tests
4.4 functional check
4.5 comparison check
4.6 sense and leak tests
4.7 independent sense and leak test

Including the following:

4.8 a full system test that incorporates three of the above tests

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Learning outcome

The learner will:

5 carry out tests in compliance with one of the following:

Assessment criteria

5.1 Military Aviation Authority (MAA)
5.2 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
5.3 BS, ISO or BSEN standards and procedures
5.4 Aerospace Quality Management Standards (AS)
5.5 specific system requirements
5.6 Federal Aviation Authority (FAA)
5.7 organisation standards and procedures
5.8 manufacturers standards and procedures

Learning outcome

The learner will:

6 complete the relevant documentation, to include one from the following and pass it to the appropriate people:

Assessment criteria

6.1 job cards
6.2 computer records

6.3 aircraft service/flight log

6.4 aircraft log

6.5 permit to work/formal risk assessment

Knowledge and understanding

The learner must know and understand:

K1 The importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to

K2 the specific safety practices and procedures that they need to observe when testing aircraft pitot static systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

K3 the importance of maintenance on and impact upon (extended twin operations procedures) ETOpS systems, legislation and local procedures

K4 the health and safety requirements of the work area where they are carrying out the activities and the responsibility these requirements place on them

K5 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to

K6 the safety procedures that must be carried out before work is started on the aircraft

K7 the protective clothing and equipment (PPE) to be worn and where it can be obtained

K8 hazards associated with testing aircraft pitot static systems and with the tools and equipment used, and how to minimise them and reduce any risks

K9 what constitutes a hazardous voltage and how to recognise victims of electric shock

K10 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)

K11 the correct operating procedures of the pitot static system being tested

K12 electrical bonding specifications and their importance

K13 how to extract and use information from engineering drawings and related specifications

K14 how to obtain the required test schedules and specifications for the system and aircraft type being tested and how to check their currency and validity

K15 how to read and interpret the test schedules and specifications and from whom they can seek assistance if they have problems or issues regarding the test schedules or specifications

K16 the methods and procedures to be used to carry out the various tests on the aircraft pitot static system and its system components

K17 the test equipment to be used and its selection and application for particular tests

K18 the calibration of test equipment (where applicable) and the requirement for currency/issue checks

K19 the techniques, methods and procedures to be used during the tests

K20 the importance of applying Electrostatic Discharge (ESD) procedures when working on sensitive equipment or devices

K21 why equipment control is critical and what to do if a piece of equipment is unaccounted for on completion of the testing activities

K22 the basic principle of operation of the pitot static system under test and the function of the individual components within the system

K23 the importance of carrying out the tests in the specified sequence, checking all readings, movements and levels at each stage

K24 from whom to seek authorisation if they need to alter or change the test procedures

K25 how to record the results of each individual test and the documentation that must be used

K26 how to analyse the test results and how to make valid decisions about the acceptability of the system

K27 the procedures to be followed if the equipment or system fails to meet the test specification

K28 problems that can occur with the testing activities and how they can be overcome

K29 the problems that may cause errors or discrepancies with the test results and how to avoid these

K30 any required environmental controls relating to the testing

K31 the documentation to be completed at the end of the testing activities

K32 the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve

Unit 369 Carrying out tests on aircraft pitot static systems

Supporting Information

Unit guidance

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme whilst meeting their own requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

Unit 370 Carrying out tests on aircraft communication systems

Unit level:	Level 3
GLH:	119
Unit aim:	This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief. This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to test aircraft communication systems, in accordance with approved procedures. It includes communication systems associated with intercom (clear), intercom (secure), high frequency (HF) radio, very high frequency (VHF) radio, ultra high frequency (UHF) radio, cockpit voice recorder, aircraft communication address reporting system (ACARS), cabin interphone systems, crash position indicators, digital data links, secure radio links, flight entertainment systems, Satellite Communications (SATCOM) and Selective Calling (SELCAL), as applicable to the aircraft type. They will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the systems to be tested. The testing activities will include making all necessary checks and adjustments, to ensure that components are correctly positioned and aligned and have the required range of movement, and will also include carrying out voltage checks, Built-In Test Equipment (BITE) tests, continuity checks, soak tests, distortion and sensitivity tests, power output and functional checks. Their responsibilities will require them to comply with organisational policy and procedures for the testing activities undertaken and to report any problems with these activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out. Their underpinning knowledge will provide a good understanding of their work and will provide an informed approach to applying appropriate testing techniques and procedures to aircraft communication systems. They will understand the communication system under test and its application, and will know about the tools and equipment

used, and the testing requirements, in adequate depth to provide a sound basis for carrying out the activities, and for ensuring that the tested system performs to the required specification.

They will understand the safety precautions required when carrying out the testing activities and when using the associated tools and equipment. They will be required to demonstrate safe working practices throughout and will understand the responsibility they owe to themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall objectives of the organisation, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

Performance Requirements

The learner can:

P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines

P2 demonstrate the required behaviours in line with the job role and organisational objectives

P3 follow the appropriate procedures for use of tools and equipment to carry out the required tests

P4 set up and carry out the tests using the correct procedures and within agreed timescales

P5 record the results of the tests in the appropriate format

P6 review the results and carry out further tests if necessary

Learning outcome

The learner will:

1 carry out all of the following during the testing of the aircraft communication systems:

Assessment criteria

1.1 obtain and use the appropriate documentation (such as job instructions, aircraft communication equipment test procedures, quality control documentation, history sheets, flight logbook, aircraft standards and specifications)

1.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work

1.3 provide and maintain a safe working environment for the testing activities
1.4 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration date
1.5 obtain clearance to work on the aircraft and observe all relevant isolation and safety procedures
1.6 ensure that safe working distance procedures are set up (where appropriate)
1.7 where appropriate, apply electrostatic discharge (ESD) protection procedures
1.8 carry out the tests using the specified techniques and procedures
1.9 make any permitted adjustments to components and equipment, to bring the system to the specification requirements
1.10 return all tools and equipment to the correct location on completion of the testing activities
1.11 leave the aircraft and work area in a safe and appropriate condition, free from foreign object debris on completion of the activities

Learning outcome

The learner will:

2 carry out testing on three of the following aircraft communication systems:

Assessment criteria

2.1 VHF radio
2.2 cockpit voice recorder
2.3 flight entertainment systems
2.4 intercom (clear)
2.5 SATCOM
2.6 SELCAL
2.7 secure radio links
2.8 intercom (secure speech)
2.9 crash position indicators
2.10 HF radio
2.11 digital data links
2.12 telecommunications
2.13 UHF radio
2.14 satellite position systems
2.15 cabin interphone systems
2.16 identification friend or foe (IFF)
2.17 aircraft communication address reporting system (ACARS)

Learning outcome

The learner will:

3 test aircraft communication systems, using three of the following:

Assessment criteria

3.1 external power supply source
3.2 'special-to-type' test sets
3.3 internal power supply source
3.4 measuring equipment (such as multimeters, SINAD meters)
3.5 other test equipment (such as headset, voltage standing wave ratio (VSWR) equipment, signal generator, databus test equipment, internal aircraft equipment)

Learning outcome

The learner will:

4 carry out three of the following types of test/check:

Assessment criteria

4.1 soak test
4.2 BITE test
4.3 receiver sensitivity
4.4 functional check
4.5 distortion checks
4.6 signal-to-noise checks
4.7 continuity check
4.8 VSWR checks
4.9 pressure checks
4.10 bonding tests
4.11 power output
4.12 'special-to-type' tests

Including the following:

4.13 a full system test that incorporates three of the above tests

Learning outcome

The learner will:

5 carry out tests in compliance with one of the following:

Assessment criteria

5.1 Military Aviation Authority (MAA)

5.2 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
5.3 BS, ISO or BSEN standards and procedures
5.4 Aerospace Quality Management Standards (AS)
5.5 specific system requirements
5.6 Federal Aviation Authority (FAA)
5.7 organisation standards and procedures
5.8 manufacturers standards and procedures

Learning outcome

The learner will:

6 complete the relevant documentation, to include one from the following and pass it to the appropriate people:

Assessment criteria

6.1 job cards
6.2 computer records
6.3 aircraft service/flight log
6.4 aircraft log
6.5 permit to work/formal risk assessment

Knowledge and understanding

The learner must know and understand:

K1 the specific safety practices and procedures that they need to observe when testing aircraft communication systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
K2 The importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to
K3 the importance of maintenance on, and impact upon (extended twin operations procedures) ETOpS systems, legislation and local procedures
K4 the health and safety requirements of the work area where they are carrying out the activities and the responsibility these requirements place on them
K5 the safety procedures that must be carried out before work is started on the aircraft
K6 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
K7 the protective clothing and equipment (PPE) to be worn and where it can be obtained
K8 hazards associated with testing aircraft communication systems, and with the tools and equipment used, and how to minimise them and reduce any risks

K9 what constitutes a hazardous voltage and how to recognise victims of electric shock

K10 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)

K11 the correct operating procedures of the communication system being tested

K12 electrical bonding specifications and their importance

K13 how to extract and use information from engineering drawings and related specifications

K14 how to obtain the required test schedules and specifications for the system and aircraft type being tested and how to check their currency and validity

K15 how to read and interpret the test schedules and specifications, and from whom they can seek assistance if they have problems or issues regarding the test schedules or specifications

K16 the methods and procedures to be used to carry out the various tests on the aircraft communication system and its system components

K17 the importance of applying electrostatic discharge (ESD) procedures when working on sensitive equipment or devices

K18 the test equipment to be used and its selection and application for particular tests

K19 the calibration of test equipment (where applicable) and the requirement for currency/issue checks

K20 the techniques, methods and procedures to be used during the tests

K21 why equipment control is critical and what to do if a piece of equipment is unaccounted for on completion of the testing activities

K22 the basic principle of operation of the communication system under test and the function of the individual components within the system

K23 the importance of carrying out the tests in the specified sequence, checking all readings, movements and levels at each stage

K24 from whom to seek authorisation if they need to alter or change the test procedures

K25 how to record the results of each individual test and the documentation that must be used

K26 how to analyse the test results and how to make valid decisions about the acceptability of the system

K27 the procedures to be followed if the equipment or system fails to meet the test specification

K28 problems that can occur with the testing activities and how they can be overcome

K29 the problems that may cause errors or discrepancies with the test results and how to avoid these

K30 any required environmental controls relating to the testing

K31 the documentation to be completed at the end of the testing activities

K32 the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve

Unit 370 Carrying out tests on aircraft communication systems

Supporting Information

Unit guidance

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme whilst meeting their own requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

Unit 371 Carrying out tests on aircraft passive warning and optical/surveillance systems

Unit level:	Level 3
GLH:	119
Unit aim:	This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief. This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to test aircraft passive warning and electronic optical/surveillance systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft, and includes passive warning and optical surveillance systems associated with acoustics, sound navigation and ranging (SONAR), radar homing and warning receivers (RHWR), collision and ground avoidance, wet, digital, video and infra-red cameras, recording and LASER systems, as applicable to the aircraft type. They will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the systems to be tested. The testing activities will include making all necessary checks and adjustments to ensure that components are correctly positioned and aligned and have the required range of movement, and will also include carrying out voltage checks, receiver sensitivity, range checks, video/media playback, Built-In Test Equipment (BITE) tests, continuity checks, and functional checks. Their responsibilities will require them to comply with organisational policy and procedures for the testing activities undertaken, and to report any problems with these activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They will ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

Their underpinning knowledge will provide a good understanding of their work and will provide an informed approach to applying appropriate testing techniques and procedures to aircraft passive warning and optical/surveillance systems. They will understand the passive warning and optical surveillance system under test, and its application, and will know about the tools and equipment used, and the testing requirements, in adequate depth to provide a sound basis for carrying out the activities, and for ensuring that the tested system performs to the required specification. They will understand the safety precautions required when carrying out the testing activities and when using the associated tools and equipment. They will be required to demonstrate safe working practices throughout and will understand the responsibility they owe to themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall objectives of the organisation, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

Performance Requirments

The learner can:

P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines

P2 demonstrate the required behaviours in line with the job role and organisational objectives

P3 follow the appropriate procedures for use of tools and equipment to carry out the required tests

P4 set up and carry out the tests using the correct procedures and within agreed timescales

P5 record the results of the tests in the appropriate format

P6 review the results and carry out further tests if necessary

Learning outcome

The learner will:

1 carry out all of the following during the testing of the aircraft passive warning and optical/surveillance systems:

Assessment criteria

1.1 obtain and use the appropriate documentation (such as job instructions, aircraft passive warning and optical surveillance test procedures, quality control documentation, history sheets, flight logbook, aircraft standards and specifications)

1.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work

1.3 provide and maintain a safe working environment for the testing activities

1.4 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration date

1.5 obtain clearance to work on the aircraft, and observe all relevant isolation and safety procedures

1.6 ensure that safe working distance procedures are set up (where appropriate)

1.7 where appropriate, apply electrostatic discharge (ESD) protection procedures

1.8 carry out the tests using the specified techniques and procedures

1.9 make any permitted adjustments to components and equipment, to bring the system to the specification requirements

1.10 return all tools and equipment to the correct location on completion of the testing activities

1.11 leave the aircraft and work area in a safe and appropriate condition, free from foreign object debris on completion of the activities

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Learning outcome

The learner will:

2 carry out testing on three of the following aircraft passive warning and optical/surveillance systems:

Assessment criteria

2.1 acoustics

2.2 collision avoidance

2.3 video/media recording systems

2.4 air data recording

2.5 ground avoidance

2.6 LASER systems

2.7 cockpit voice recording systems

2.8 radar homing and warning receivers (RHWR)

2.9 sound navigation and ranging (SONAR)

2.10 camera systems (wet film, digital or infra-red)

Learning outcome

The learner will:

3 test aircraft passive warning and optical/surveillance systems, using three of the following:

Assessment criteria

3.1 external power supply source (Electrical/Hydraulic)
3.2 'special-to-type' test sets
3.3 internal power supply source (Electrical/Hydraulic)
3.4 measuring equipment (such as multimeters)
3.5 other test equipment (such as headset, clinometer, databus test equipment, video playback, photographic developers, internal aircraft equipment)

Learning outcome

The learner will:

4 carry out three of the following types of test/check:

Assessment criteria

4.1 voltage standing wave ratio (VSWR) checks
4.2 bonding tests
4.3 continuity checks
4.4 alignment checks
4.5 voltage checks
4.6 'special-to-type' tests
4.7 soak test
4.8 range checks
4.9 receiver sensitivity
4.10 functional check
4.11 BITE test
4.12 video/media playback
4.13 safety interlock checks
4.14 signal injection tests
4.15 photographic development

Including the following:

4.16 a full system test that incorporates three of the above tests

Learning outcome

The learner will:

5 carry out tests in compliance with one of the following:

Assessment criteria

5.1 Military Aviation Authority (MAA)
5.2 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
5.3 BS, ISO or BSEN standards and procedures
5.4 Aerospace Quality Management Standards (AS)
5.5 specific system requirements
5.6 Federal Aviation Authority (FAA)
5.7 organisation standards and procedures
5.8 manufacturers standards and procedures

Learning outcome

The learner will:

6 complete the relevant documentation, to include one from the following and pass it to the appropriate people:

Assessment criteria

6.1 job cards
6.2 computer records
6.3 aircraft service/flight log
6.4 aircraft log
6.5 permit to work/formal risk assessment

Knowledge and understanding

The learner must know and understand:

K1 the specific safety practices and procedures that they need to observe when testing aircraft passive warning and optical/surveillance systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
K2 The importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to
K3 the importance of maintenance on, and impact upon (extended twin operations procedures) ETOpS systems, legislation and local procedures
K4 the health and safety requirements of the work area where they are carrying out the activities and the responsibility these requirements place on them
K5 the safety procedures that must be carried out before work is started on the aircraft
K6 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to

K7 the protective clothing and equipment (PPE) to be worn and where it can be obtained

K8 hazards associated with testing aircraft passive warning and optical/surveillance systems, and with the tools and equipment used, and how to minimise them and reduce any risks

K9 what constitutes a hazardous voltage and how to recognise victims of electric shock

K10 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)

K11 the correct operating procedures of the passive warning and optical/surveillance system being tested

K12 electrical bonding specifications and their importance

K13 how to extract and use information from engineering drawings and related specifications

K14 how to obtain the required test schedules and specifications for the system and aircraft type being tested, and how to check their currency and validity

K15 how to read and interpret the test schedules and specifications, and from whom they can seek assistance if they have problems or issues regarding the test schedules or specifications

K16 the methods and procedures to be used to carry out the various tests on the aircraft passive warning and optical/surveillance system components

K17 the importance of applying electrostatic discharge (ESD) procedures when working on sensitive equipment or devices

K18 the test equipment to be used, and its selection and application for particular tests

K19 the calibration of test equipment (where applicable) and the requirement for currency/issue checks

K20 the techniques, methods and procedures to be used during the tests

K21 why equipment control is critical and what to do if a piece of equipment is unaccounted for on completion of the testing activities

K22 the basic principle of operation of the passive warning and optical/surveillance system under test and the function of the individual components within the system

K23 the importance of carrying out the tests in the specified sequence, checking all readings, movements and levels at each stage

K24 from whom to seek authorisation if they need to alter or change the test procedures

K25 how to record the results of each individual test and the documentation that must be used for this

K26 how to analyse the test results and how to make valid decisions about the acceptability of the system

K27 the procedures to be followed if the equipment or system fails to meet the test specification

K28 problems that can occur with the testing activities and how they can be overcome

K29 the problems that may cause errors or discrepancies with the test results and how to avoid these

K30 any required environmental controls relating to the testing

K31 the documentation to be completed at the end of the testing activities

K32 the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve

Unit 371 Carrying out tests on aircraft passive warning and optical/surveillance systems

Supporting Information

Unit guidance

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme whilst meeting their own requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

Unit 372 Carrying out tests on aircraft radar systems

GLH:	119
Unit aim:	This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief. This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to test aircraft radar systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft, and includes systems associated with surveillance radar, weather radar, obstacle warning systems (such as enhanced ground proximity warning systems - EGPWS), towed radar decoys, radar (radio) altimeter, tactical air navigation (TACAN), identification friend or foe (IFF), Doppler, and radar jamming devices, as applicable to the aircraft type. They will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the systems to be tested. The testing activities will include making all necessary checks and adjustments, to ensure that components are correctly positioned and aligned and have the required range of movement, and will also include carrying out tests such as Built-In Test Equipment (BITE) tests, continuity checks, distortion and range checks, receiver sensitivity, voltage standing wave ratio (VSWR) checks and functional checks. Their responsibilities will require them to comply with organisational policy and procedures for the testing activities undertaken and to report any problems with these activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They will ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

Their underpinning knowledge will provide a good understanding of their work and will provide an informed approach to applying appropriate testing techniques and procedures to aircraft radar systems. They will understand the radar system under test and its application, and will know about the tools and equipment used, and the testing requirements, in adequate depth to provide a sound basis for carrying out the activities, and for ensuring that the tested system performs to the required specification.
They will understand the safety precautions required when carrying out the testing activities and when using the associated tools and equipment. They will be required to demonstrate safe working practices throughout and will understand the responsibility they owe to themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall objectives of the organisation, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

Performance Requirements

The learner can:

P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines

P2 demonstrate the required behaviours in line with the job role and organisational objectives

P3 follow the appropriate procedures for use of tools and equipment to carry out the required tests

P4 set up and carry out the tests using the correct procedures and within agreed timescales

P5 record the results of the tests in the appropriate format

P6 review the results and carry out further tests if necessary

Learning outcome

The learner will:

1 carry out all of the following during the testing of the aircraft radar systems:

Assessment criteria

1.1 obtain and use the appropriate documentation (such as job instructions, aircraft radar test procedures, quality control documentation, history sheets, flight logbook, aircraft standards and specifications)

1.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work

1.3 provide and maintain a safe working environment for the testing activities

1.4 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration date

1.5 obtain clearance to work on the aircraft and observe all relevant isolation and safety procedures

1.6 ensure that safe working distance procedures are set up (where appropriate)

1.7 where appropriate, apply electrostatic discharge (ESD) protection procedures

1.8 carry out the tests using the specified techniques and procedures

1.9 make any permitted adjustments to components and equipment, to bring the system to the specification requirements

1.10 return all tools and equipment to the correct location on completion of the testing activities

1.11 leave the aircraft and work area in a safe and appropriate condition, free from foreign object debris on completion of the activities

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Learning outcome

The learner will:

2 carry out testing on three of the following aircraft radar systems:

Assessment criteria

2.1 surveillance radar

2.2 radar jamming

2.3 towed radar decoys

2.4 obstacle warning systems

2.5 radar (radio) altimeter (RADALT)

2.6 identification friend or foe (IFF)

2.7 Doppler

2.8 tactical air navigation (TACAN)

2.9 enhanced ground proximity warning system (EGPWS)

2.10 weather radar/predictive wind shear

2.11 supplementary surveillance radar

2.12 traffic collision avoidance system (TCAS)

Learning outcome

The learner will:

3 test aircraft radar systems, using three of the following:

Assessment criteria

3.1 external power supply source (Electrical/Hydraulic)
3.2 'special-to-type' test sets
3.3 internal power supply source (Electrical/Hydraulic)
3.4 measuring equipment (such as multimeters)
3.5 other test equipment (such as dummy load, delay lines, pressure tester (hydraulic, pneumatic, coolant), databus test equipment, internal aircraft equipment)

Learning outcome

The learner will:

4 carry out three of the following types of test/check:

Assessment criteria

4.1 soak test
4.2 distortion checks
4.3 receiver sensitivity
4.4 functional check
4.5 voltage standing wave ratio (VSWR) checks
4.6 signal to noise checks
4.7 continuity check
4.8 range checks
4.9 continuity checks
4.10 bonding tests
4.11 LRU replacement test
4.12 'special-to-type' tests
4.13 BITE test

Including the following:

4.14 a full system test that incorporates three of the above tests

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Learning outcome

The learner will:

5 carry out tests on aircraft radar systems in compliance with one of the following:

Assessment criteria

5.1 Military Aviation Authority (MAA)
5.2 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
5.3 BS, ISO or BSEN standards and procedures
5.4 Aerospace Quality Management Standards (AS)
5.5 specific system requirements

5.6 Federal Aviation Authority (FAA)

5.7 organisation standards and procedures

5.8 manufacturers standards and procedures

Learning outcome

The learner will:

6 complete the relevant documentation, to include one from the following and pass it to the appropriate people:

Assessment criteria

6.1 job cards

6.2 computer records

6.3 aircraft service/flight log

6.4 aircraft log

6.5 permit to work/formal risk assessment

Knowledge and understanding

The learner must know and understand:

K1 the specific safety practices and procedures that they need to observe when testing aircraft radar systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

K2 the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to

K3 the importance of maintenance on, and impact upon (extended twin operations procedures) ETOpS systems, legislation and local procedures

K4 the health and safety requirements of the work area where they are carrying out the activities and the responsibility these requirements place on them

K5 the safety procedures that must be carried out before work is started on the aircraft

K6 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to

K7 the protective clothing and equipment (PPE) to be worn and where it can be obtained

K8 hazards associated with testing aircraft radar systems, and with the tools and equipment used, and how to minimise them and reduce any risks

K9 what constitutes a hazardous voltage and how to recognise victims of electric shock

K10 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)

K11 the correct operating procedures of the radar system being tested

K12 electrical bonding specifications and their importance

K13 how to extract and use information from engineering drawings and related specifications

K14 how to obtain the required test schedules and specifications for the system and aircraft type being tested and how to check their currency and validity

K15 how to read and interpret the test schedules and specifications, and from whom they can seek assistance if they have problems or issues regarding the test schedules or specifications

K16 the methods and procedures to be used to carry out the various tests on the aircraft radar system and its system components

K17 the importance of applying electrostatic discharge (ESD) procedures when working on sensitive equipment or devices

K18 the test equipment to be used and its selection and application for particular tests

K19 the calibration of test equipment (where applicable) and the requirement for currency/issue checks

K20 the techniques, methods and procedures to be used during the tests

K21 why equipment control is critical and what to do if a piece of equipment is unaccounted for on completion of the testing activities

K22 the basic principle of operation of the radar system under test and the function of the individual components within the system

K23 the importance of carrying out the tests in the specified sequence, checking all readings, movements and levels at each stage

K24 from whom to seek authorisation if they need to alter or change the test procedures

K25 how to record the results of each individual test and the documentation that must be used

K26 how to analyse the test results and how to make valid decisions about the acceptability of the system

K27 the procedures to be followed if the equipment or system fails to meet the test specification

K28 problems that can occur with the testing activities and how they can be overcome

K29 the problems that may cause errors or discrepancies with the test results and how to avoid these

K30 any required environmental controls relating to the testing

K31 the documentation to be completed at the end of the testing activities

K32 the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve

Unit 372 Carrying out tests on aircraft radar systems

Supporting Information

Unit guidance

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme whilst meeting their own requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

Unit 373 Carrying out tests on aircraft navigational and computing systems

GLH:	119
Unit aim:	This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief. This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to test aircraft navigational and computing systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft and includes navigational systems associated with distance measuring equipment (DME), very high frequency omnidirectional range (VOR), instrument landing system (ILS), auto direction finder (ADF), global positioning system (GPS), Doppler, long range aid navigation (LORAN), homing, radio altimeter, inertial navigation system, Decca, and compass, as applicable to the aircraft type. They will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the systems to be tested. The testing activities will include making all necessary checks and adjustments, to ensure that components are correctly positioned and aligned and have the required range of movement, and will also include carrying out voltage checks, Built-In Test Equipment (BITE) tests, continuity checks, power output, distortion checks, distant object test, standard serviceability and functional checks. Their responsibilities will require them to comply with organisational policy and procedures for the testing activities undertaken and to report any problems with these activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They will ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for your own actions and for the quality and accuracy of the work that they carry out.

Their underpinning knowledge will provide a good understanding of their work and will provide an informed approach to applying appropriate testing techniques and procedures to aircraft navigational systems. They will understand the navigational system under test, and its application, and will know about the tools and equipment used, and the testing requirements, in adequate depth to provide a sound basis for carrying out the activities, and for ensuring that the tested system performs to the required specification.

They will understand the safety precautions required when carrying out the testing activities and when using the associated tools and equipment. They will be required to demonstrate safe working practices throughout and will understand the responsibility they owe to themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall objectives of the organisation, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

Performance Requirements

The learner can:

P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines

P2 demonstrate the required behaviours in line with the job role and organisational objectives

P3 follow the appropriate procedures for use of tools and equipment to carry out the required tests

P4 set up and carry out the tests using the correct procedures and within agreed timescales

P5 record the results of the tests in the appropriate format

Learning outcome

The learner will:

1 carry out all of the following during the testing of the aircraft navigational and computing systems:

Assessment criteria

1.1 obtain and use the appropriate documentation (such as job instructions, aircraft radar test procedures, quality control documentation, history sheets, flight logbook, aircraft standards and specifications)

1.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work

1.3 provide and maintain a safe working environment for the testing activities

1.4 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration date

1.5 obtain clearance to work on the aircraft and observe all relevant isolation and safety procedures

1.6 ensure that safe working distance procedures are set up (where appropriate)

1.7 where appropriate, apply electrostatic discharge (ESD) protection procedures

1.8 carry out the tests using the specified techniques and procedures

1.9 make any permitted adjustments to components and equipment, to bring the system to the specification requirements

1.10 return all tools and equipment to the correct location on completion of the testing activities

1.11 leave the aircraft and work area in a safe and appropriate condition, free from foreign object debris on completion of the activities

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Learning outcome

The learner will:

2 carry out testing on three of the following aircraft navigational and computing systems:

Assessment criteria

2.1 distance measuring equipment (DME)

2.2 re-transmission systems

2.3 very high frequency omni-directional range (VOR)

2.4 Doppler

2.5 instrument landing system (ILS)

2.6 homing

2.7 auto direction finder (ADF)

2.8 gyro

2.9 global positioning system (GPS)

2.10 Decca

2.11 long range navigation (LORAN)

2.12 compass

2.13 inertial navigation system

2.14 computing sub-systems
2.15 tactical air communication and navigation system (TACAN)
2.16 microwave landing system (MLS)

Learning outcome

The learner will:

3 test aircraft navigational and computing systems, using three of the following:

Assessment criteria

3.1 external power supply source (electrical/hydraulic)
3.2 'special-to-type' test sets
3.3 internal power supply source (electrical/hydraulic)
3.4 measuring equipment (such as multimeters, SINAD Meters)
3.5 other test equipment (such as oscilloscope, signal generator, databus test equipment, internal aircraft equipment)

Learning outcome

The learner will:

4 carry out three of the following types of test/check:

Assessment criteria

4.1 soak test
4.2 BITE test
4.3 signal-to-noise checks
4.4 functional check
4.5 distortion checks
4.6 continuity checks
4.7 bonding tests
4.8 power output
4.9 'special-to-type' tests
4.10 standard serviceability checks
4.11 compass swing
4.12 TDR checks
4.13 LRU alignment
4.14 distant object test
4.15 databus test
4.16 receiver sensitivity
4.17 applying a dummy load
4.18 signal injection tests
4.19 voltage standing wave ratio (VSWR) checks

Including the following:

4.20 a full system test that incorporates three of the above tests

Learning outcome

The learner will:

5 carry out tests on aircraft radar systems in compliance with one of the following:

Assessment criteria

5.1 Military Aviation Authority (MAA)
5.2 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
5.3 BS, ISO or BSEN standards and procedures
5.4 Aerospace Quality Management Standards (AS)
5.5 specific system requirements
5.6 Federal Aviation Authority (FAA)
5.7 organisation standards and procedures
5.8 manufacturers standards and procedures

Learning outcome

The learner will:

6 complete the relevant documentation, to include one from the following and pass it to the appropriate people:

Assessment criteria

6.1 job cards
6.2 computer records
6.3 aircraft service/flight log
6.4 aircraft log
6.5 permit to work/formal risk assessment

Knowledge and understanding

The learner must know and understand:

K1 the specific safety practices and procedures that they need to observe when testing aircraft navigational and computing systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

K2 The importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to

K3 the importance of maintenance on, and impact upon (extended twin operations procedures) ETOpS systems, legislation and local procedures

K4 the health and safety requirements of the work area where they are carrying out the activities and the responsibility these requirements place on them

K5 the safety procedures that must be carried out before work is started on the aircraft

K6 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to

K7 the protective clothing and equipment (PPE) to be worn and where it can be obtained

K8 hazards associated with testing aircraft navigational and computing systems, and with the tools and equipment used, and how to minimise them and reduce any risks

K9 what constitutes a hazardous voltage and how to recognise victims of electric shock

K10 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)

K11 the correct operating procedures of the navigational and computing system being tested

K12 electrical bonding specifications and their importance

K13 how to extract and use information from engineering drawings and related specifications

K14 how to obtain the required test schedules and specifications for the system and aircraft type being tested and how to check their currency and validity

K15 how to read and interpret the test schedules and specifications, and from whom they can seek assistance if they have problems or issues regarding the test schedules or specifications

K16 the methods and procedures to be used to carry out the various tests on the aircraft radar navigational and computing system and its system components

K17 the importance of applying electrostatic discharge (ESD) procedures when working on sensitive equipment or devices

K18 the test equipment to be used and its selection and application for particular tests

K19 the calibration of test equipment (where applicable) and the requirement for currency/issue checks

K20 the techniques, methods and procedures to be used during the tests

K21 why equipment control is critical and what to do if a piece of equipment is unaccounted for on completion of the testing activities

K22 the basic principle of operation of the radar system under test and the function of the individual components within the system

K23 the importance of carrying out the tests in the specified sequence, checking all readings, movements and levels at each stage

K24 from whom to seek authorisation if they need to alter or change the test procedures

K25 how to record the results of each individual test and the documentation that must be used

K26 how to analyse the test results and how to make valid decisions about the acceptability of the system

K27 the procedures to be followed if the equipment or system fails to meet the test specification

K28 problems that can occur with the testing activities and how they can be overcome

K29 the problems that may cause errors or discrepancies with the test results and how to avoid these

K30 any required environmental controls relating to the testing

K31 the documentation to be completed at the end of the testing activities

K32 the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve

Unit 373 Carrying out tests on aircraft navigational and computing systems

Supporting Information

Unit guidance

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme whilst meeting their own requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

Unit 374 Carrying out tests on aircraft flight guidance and control systems

Unit level:	Level 3
GLH:	119
Unit aim:	This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief. This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to test aircraft flight guidance and control systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft, and includes flight guidance and control systems associated with fly-by-wire, gyros, autopilot, flight director, and AFCS (Automatic Flying Control System), angle of attack and nose wheel steering, as applicable to the aircraft type. They will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the systems to be tested. The testing activities will include making all necessary checks and adjustments, to ensure that components are correctly positioned and aligned and have the required range of movement, and will also include carrying out voltage checks, Built-In Test Equipment (BITE) tests, continuity checks, `special-to-type' tests and functional checks. Their responsibilities will require them to comply with organisational policy and procedures for the testing activities undertaken and to report any problems with these activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They will ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities and that all necessary job/task documentation is completed, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

Their underpinning knowledge will provide a good understanding of their work and will provide an informed approach to applying appropriate testing techniques and procedures to aircraft flight guidance and control systems. They will understand the flight guidance and control system under test, and its application, and will know about the tools and equipment used, and the testing requirements, in adequate depth to provide a sound basis for carrying out the activities, and for ensuring that the tested system performs to the required specification.

They will understand the safety precautions required when carrying out the testing activities and when using the associated tools and equipment. They will be required to demonstrate safe working practices throughout and will understand the responsibility they owe to themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall objectives of the organisation, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

Performance Requirements

The learner can:

P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines

P2 demonstrate the required behaviours in line with the job role and organisational objectives

P3 follow the appropriate procedures for use of tools and equipment to carry out the required tests

P4 set up and carry out the tests using the correct procedures and within agreed timescales

P5 record the results of the tests in the appropriate format

Learning outcome

The learner will:

1 carry out all of the following during the testing of the aircraft flight guidance and control systems:

Assessment criteria

1.1 obtain and use the appropriate documentation (such as job instructions, aircraft flight guidance and control test procedures, quality control documentation, history sheets, flight logbook, aircraft standards and specifications)

1.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work

1.3 provide and maintain a safe working environment for the testing activities

1.4 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration date

1.5 obtain clearance to work on the aircraft and observe all relevant isolation and safety procedures

1.6 ensure that safe working distance procedures are set up (where appropriate)

1.7 where appropriate, apply electrostatic discharge (ESD) protection procedures

1.8 carry out the tests using the specified techniques and procedures

1.9 make any permitted adjustments to components and equipment, to bring the system to the specification requirements

1.10 return all tools and equipment to the correct location on completion of the testing activities

1.11 leave the aircraft and work area in a safe and appropriate condition, free from foreign object debris on completion of the activities

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Learning outcome

The learner will:

2 carry out testing on three of the following aircraft flight guidance and control systems:

Assessment criteria

2.1 fly-by-wire

2.2 automatic flying control system (AFCS)

2.3 auto-pilot

2.4 angle of attack/stall warning

2.5 flight director

2.6 nose wheel steering

2.7 turn and slip indication

2.8 main gear steering

2.9 gyros

Learning outcome

The learner will:

3 test aircraft flight guidance and control systems, using three of the following:

Assessment criteria

The learner can:

3.1 external power supply source (electrical/hydraulic)
3.2 'special-to-type' test sets
3.3 internal power supply source (electrical/hydraulic)
3.4 measuring equipment (such as multimeters)
3.5 other test equipment (such as headset, clinometer, databus test equipment, pantographs, tilt tables, internal aircraft equipment)

Learning outcome

The learner will:

4 carry out three of the following types of test/check:

Assessment criteria

4.1 soak test
4.2 BITE test
4.3 audio warning
4.4 'special-to-type' tests
4.5 functional check
4.6 signal injection tests
4.7 visual warning
4.8 rate of movement
4.9 bonding tests
4.10 range/sense of movement
4.11 continuity checks
4.12 voltage checks

Including the following:

4.13 a full system test that incorporates three of the above tests

Learning outcome

The learner will:

5 Carry out tests on aircraft flight guidance and control systems in compliance with one of the following:

Assessment criteria

5.1 Military Aviation Authority (MAA)
5.2 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
5.3 BS, ISO or BSEN standards and procedures
5.4 Aerospace Quality Management Standards (AS)
5.5 specific system requirements
5.6 Federal Aviation Authority (FAA)
5.7 organisation standards and procedures
5.8 manufacturers standards and procedures

Learning outcome

The learner will:

6 complete the relevant documentation, to include one from the following and pass it to the appropriate people:

Assessment criteria

6.1 job cards
6.2 computer records
6.3 aircraft service/flight log
6.4 aircraft log
6.5 permit to work/formal risk assessment

Knowledge and understanding

The learner must know and understand:

K1 the specific safety practices and procedures that they need to observe when testing aircraft flight guidance and control systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
K2 The importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to
K3 the importance of maintenance on, and impact upon (extended twin operations procedures) ETOpS systems, legislation and local procedures
K4 the health and safety requirements of the work area where they are carrying out the activities and the responsibility these requirements place on them
K5 the safety procedures that must be carried out before work is started on the aircraft
K6 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to

K7 the protective clothing and equipment (PPE) to be worn and where it can be obtained

K8 hazards associated with testing aircraft flight guidance and control systems, and with the tools and equipment used, and how to minimise them and reduce any risks

K9 what constitutes a hazardous voltage and how to recognise victims of electric shock

K10 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)

K11 the correct operating procedures of the flight guidance and control system being tested

K12 electrical bonding specifications and their importance

K13 how to extract and use information from engineering drawings and related specifications

K14 how to obtain the required test schedules and specifications for the system and aircraft type being tested and how to check their currency and validity

K15 how to read and interpret the test schedules and specifications, and from whom they can seek assistance if they have problems or issues regarding the test schedules or specifications

K16 the methods and procedures to be used to carry out the various tests on the aircraft flight guidance and control system and its system components

K17 the importance of applying electrostatic discharge (ESD) procedures when working on sensitive equipment or devices

K18 the test equipment to be used and its selection and application for particular tests

K19 the calibration of test equipment (where applicable) and the requirement for currency/issue checks

K20 the techniques, methods and procedures to be used during the tests

K21 why equipment control is critical and what to do if a piece of equipment is unaccounted for on completion of the testing activities

K22 the basic principle of operation of the flight guidance and control system under test and the function of the individual components within the system

K23 the importance of carrying out the tests in the specified sequence, checking all readings, movements and levels at each stage

K24 from whom to seek authorisation if they need to alter or change the test procedures

K25 how to record the results of each individual test and the documentation that must be used

K26 how to analyse the test results and how to make valid decisions about the acceptability of the system

K27 the procedures to be followed if the equipment or system fails to meet the test specification

K28 problems that can occur with the testing activities and how they can be overcome

K29 the problems that may cause errors or discrepancies with the test results and how to avoid these

K30 any required environmental controls relating to the testing

K31 the documentation to be completed at the end of the testing activities

K32 the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve

Unit 374 Carrying out tests on aircraft flight guidance and control systems

Supporting Information

Unit guidance

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme whilst meeting their own requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

Unit 413 Overhauling components of aircraft navigational and computing equipment

Unit level:	Level 3
GLH:	336
Unit aim:	This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief. This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to carry out overhauling activities on components of aircraft navigational and computing equipment, in accordance with approved procedures. The equipment to be overhauled will have been removed from the aircraft and the overhauling activities may take place in a workshop or hangar. It covers equipment used in both fixed wing and rotary winged aircraft, and covers a range of equipment such as distance measuring equipment (DME), very high frequency omnidirectional range (VOR), instrument landing system (ILS), auto direction finder (ADF), global positioning system (GPS), Doppler, tactical air navigation (TACAN), homing, inertial navigation system, Decca and compass, as applicable to the aircraft types. The overhauling activities will include carrying out all necessary safety checks, dismantling the equipment to unit or component level, inspecting and checking all components for damage and wear, replacing all `lifed' items and worn/faulty components or units, reassembling the equipment and carrying out all necessary tests/checks. Their responsibilities will require them to comply with organisational policy and procedures for the overhauling activities undertaken and to report any problems with the overhauling activities, or with the tools and equipment used that they cannot personally resolve or that is outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used in the overhauling activities are removed from the work area and that all

necessary job/task documentation is completed accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

Their underpinning knowledge will provide a good understanding of their work and will provide an informed approach to applying overhauling procedures to aircraft navigational and computing equipment. They will understand the dismantling and reassembly methods and procedures used, and their application. They will know how the equipment functions, the common faults encountered, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the overhauling activities and ensuring that the overhauled equipment meets the required specification.

They will understand the safety precautions required when carrying out the overhauling activities. They will be required to demonstrate safe working practices throughout and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall objectives of the organisation, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

Performance Requirements

The learner can:

P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines

P2 demonstrate the required behaviours in line with the job role and organisational objectives

P3 follow the relevant overhauling schedules to carry out the required work

P4 establish the components to be removed and where appropriate, mark/label components to aid re-assembly

P5 carry out the overhaul to the agreed level, using the correct tools and techniques

P6 ensure that all removed components are correctly identified and stored in the correct location

P7 report any instances where the overhauling activities cannot be fully met, or where there are identified defects outside the planned overhauling schedule

P8 complete the relevant documentation, in accordance with organisational requirements

P9 dispose of unwanted components, waste materials and substances, in accordance with safe working practices and approved procedures

P10 deal promptly and effectively with problems within their control and report those that cannot be solved

Learning outcome

The learner will:

1 carry out all of the following during the overhaul:

Assessment criteria

1.1 obtain and use the appropriate documentation (such as job instructions, aircraft manuals and overhauling documentation, technical instructions and other relevant maintenance documentation)

1.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work

1.3 provide and maintain safe access and working arrangements for the overhauling area

1.4 obtain the correct tools and equipment for the activity and check that they are in a safe, tested and usable condition and within current certification/calibration date

1.5 where appropriate, apply electrostatic discharge (ESD) protection procedures

1.6 carry out the overhauling activities, using approved techniques and procedures at all times

1.7 return all tools and equipment to the correct location on completion of the activities

1.8 leave the work area and the navigational and computing equipment in a safe and appropriate condition, free from foreign object debris on completion of the activities

Learning outcome

The learner will:

2 carry out the overhauling activities to unit level on three of the following types of aircraft navigational equipment:

Assessment criteria

2.1 Distance Measuring Equipment (DME)

2.2 re-transmission systems

2.3 very high frequency omnidirectional range (VOR)
2.4 Doppler
2.5 Instrument Landing System (ILS)
2.6 homing
2.7 Auto Direction Finder (ADF)
2.8 gyro
2.9 Global Positioning System (GPS)
2.10 Decca
2.11 Tactical Air Navigation (TACAN)
2.12 compass
2.13 inertial navigation system
2.14 computing sub-systems
2.15 Microwave Landing System (MLS)

Learning outcome

3 carry out all of the following activities, as applicable to the equipment being overhauled:

Assessment criteria

3.1 cleaning parts prior to dismantling
3.2 checking components for serviceability
3.3 pre-disassembly checks and tests
3.4 replacing all `lifed' items (seals, dust caps)
3.5 disconnecting and de-soldering electrical connections
3.6 replacing all damaged or defective components
3.7 reassembling equipment
3.8 removal of earth bonding
3.9 setting and adjusting/calibrating replaced components (such as power output, voltage)
3.10 removal of conformal coating
3.11 removing cable securing devices
3.12 making mechanical connections
3.13 removing bolt securing devices and mechanical fasteners
3.14 soldering electrical connections
3.15 carrying out earth bonding
3.16 dismantling equipment to unit/sub-assembly level
3.17 installing cable securing devices
3.18 dismantling units to component level
3.19 tightening fastenings to the required torque
3.20 marking/labelling of components to aid reassembly
3.21 re-instating conformal coating

3.22 securing components using mechanical fasteners and threaded devices
3.23 applying locking and retaining devices (such as circlips, pins, wire locking)

Learning outcome

The learner will:

4 carry out overhauling activities to component level on three of the following navigational equipment components:

Assessment criteria

4.1 aerials
4.2 satellite beacons
4.3 control units
4.4 transmitter units
4.5 transponders
4.6 navigation display units (including `head-up')
4.7 receiver units
4.8 analogue/digital converters (A- D/D-A)
4.9 power supply units
4.10 computers
4.11 microwave/acoustic generators
4.12 compensation units
4.13 interface units
4.14 processors
4.15 transducers
4.16 amplifiers

Learning outcome

The learner will:

5 replace a range of navigational equipment components, to include eight of the following:

Assessment criteria

5.1 switches
5.2 plugs/sockets/terminations
5.3 armatures
5.4 relays
5.5 batteries
5.6 wires/cables
5.7 gaskets
5.8 fuses

5.9 wiring harness (complete)
5.10 breakers/contacts
5.11 desiccant
5.12 fairings/panels
5.13 printed circuit boards
5.14 filament lamps/light emitting diodes
5.15 chassis components
5.16 electronic components (such as resistors, capacitors)
5.17 transparencies/lenses
5.18 transformers
5.19 screws/bolts/washers
5.20 other specific component

Learning outcome

The learner will:

6 carry out checks and tests on the overhauled equipment, to include three of the following:

Assessment criteria

6.1 visual inspection for completeness and freedom
6.2 signal injection tests from damage or foreign objects
6.3 power output
6.4 soak test
6.5 continuity checks
6.6 bonding tests
6.7 standard serviceability test
6.8 voltage standing wave ratio (VSWR) checks
6.9 'special-to-type' tests

Learning outcome

The learner will:

7 overhaul aircraft navigational equipment in compliance with one of the following:

Assessment criteria

7.1 Military Aviation Authority (MAA)
7.2 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
7.3 BS, ISO or BSEN standards and procedures
7.4 Aerospace Quality Management Standards (AS)
7.5 specific system requirements

7.6 Federal Aviation Authority (FAA)

7.7 organisation standards and procedures

7.8 manufacturers standards and procedures

Learning outcome

The learner will:

8 complete the relevant documentation, to include one from the following and pass it to the appropriate people:

Assessment criteria

8.1 computer records

8.2 record/history cards

8.3 job cards

8.4 aircraft service/flight log

8.5 other specific recording method

Knowledge and understanding

The learner must know and understand:

K1 the safe working practices and procedures and the specific safety precautions to be taken when overhauling aircraft navigational equipment (to include wearing protective clothing and equipment; lifting and handling techniques; safe working practices and procedures with regard to working on aircraft navigational equipment; procedures and guidelines which satisfy current regulations such as HASAWA, COSHH and other work related legislation and guidelines)

K2 the hazards associated with overhauling aircraft navigational equipment, and with the tools and equipment used, and how to minimise them and reduce any risks

K3 The importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to

K4 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to

K5 the protective equipment that they need to use for both personal protection (PPE) and protection of the navigational equipment

K6 what constitutes a hazardous voltage and how to recognise victims of electric shock

K7 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)

K8 how to extract and use information from equipment manuals, history/maintenance reports, charts, circuit and physical layouts, specifications,

symbols used in aircraft navigational systems and other documents needed in the overhauling process

K9 how to carry out currency/issue checks on the specifications they are working with

K10 terminology used in aircraft navigational equipment, and the use of system diagrams and associated symbols

K11 the basic principles of operation of the aircraft navigational equipment being overhauled, and the performance characteristics and function of the components within the equipment

K12 the techniques used to remove components from aircraft navigational equipment, without damage to the components or surrounding structure (such as de-soldering components, applying electrostatic discharge (ESD) protection procedures)

K13 the various types of electrical connector that are used, methods of unlocking, orientation indicators, and locating and locking in of the connections

K14 the various mechanical fasteners that are used and their method of removal and replacement (such as threaded fasteners, special securing devices)

K15 the importance of using the specified fasteners for the particular installation and why they must not substitute others

K16 why securing devices need to be locked and labelled, and the different methods that are used to remove and install them

K17 the torque loading requirements of the fasteners and what to do if these loadings are exceeded or not achieved

K18 the need to correctly label and store components, and to check that replaced components have the correct part/identification markings

K19 the procedure for obtaining replacement parts, materials and other consumables necessary for the overhaul

K20 the techniques used to position, align, adjust and secure the replaced components to the equipment, without damage to the components or surrounding structure

K21 the quality control procedures to be followed during the overhauling operations

K22 procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities

K23 methods of lifting, handling and supporting the components/equipment during the removal and replacement activities

K24 the use of seals, sealant and adhesives and anti-electrolysis barriers and the precautions to be taken

K25 why electrical bonding is critical and why it must be both mechanically and electrically secure

K26 how to conduct any necessary checks and adjustments to ensure the system integrity, accuracy and quality of the overhaul

K27 the tools and equipment used in the overhauling activities and their calibration/care and control procedures

K28 why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the overhauling activities

K29 the problems that can occur with the overhauling operations and how these can be overcome

K30 how to recognise defects (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)

K31 the recording documentation to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation

K32 the procedure for the safe disposal of waste materials and scrap components

K33 the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve

Unit 413 Overhauling components of aircraft navigational and computing equipment

Supporting Information

Unit guidance

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme whilst meeting their own requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

Unit 414 Overhauling components of aircraft communication equipment

Unit level:	Level 2
GLH:	336
Unit aim:	This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief. This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to carry out overhauling activities on components of aircraft communication equipment, in accordance with approved procedures. The equipment to be overhauled will have been removed from the aircraft and the overhauling activities may take place in a workshop or hangar. It covers equipment used in both fixed wing and rotary winged aircraft, and covers a range of equipment such as intercom (clear), intercom (secure), all radios, cockpit voice recorder, crash position indicators, digital data links, secure radio links, flight entertainment systems, Satellite Communications (SATCOM), and Selective Calling (SELCAL), as applicable to the aircraft type. The overhauling activities will include carrying out all necessary safety checks, dismantling the equipment to unit or component level, inspecting and checking all components for damage and wear, replacing all `lifed' items and worn/faulty components or units, reassembling the equipment and carrying out all necessary tests/checks. Their responsibilities will require them to comply with organisational policy and procedures for the overhauling activities undertaken, and to report any problems with the overhauling activities, or with the tools and equipment used that they cannot personally resolve or that is outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used in the overhauling activities are removed from the work area, and that all necessary job/task documentation is completed accurately and legibly. They will be expected to work

with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

Their underpinning knowledge will provide a good understanding of their work and will provide an informed approach to applying appropriate overhauling procedures to aircraft communication equipment. They will understand the dismantling and reassembly methods and procedures used, and their application. They will know how the equipment functions, the common faults encountered, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the overhauling activities and ensuring that the overhauled equipment meets the required specification.

They will understand the safety precautions required when carrying out the overhaul activities. They will be required to demonstrate safe working practices throughout and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall objectives of the organisation, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

Performance Requirements

The learner can:

P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines

P2 demonstrate the required behaviours in line with the job role and organisational objectives

P3 follow the relevant overhauling schedules to carry out the required work

P4 establish the components to be removed and where appropriate, mark/label components to aid re-assembly

P5 carry out the overhaul to the agreed level, using the correct tools and techniques

P6 ensure that all removed components are correctly identified and stored in the correct location

P7 report any instances where the overhauling activities cannot be fully met, or where there are identified defects outside the planned overhauling schedule

P8 complete the relevant documentation in accordance with organisational requirements

P9 dispose of unwanted components, waste materials and substances in accordance with safe working practices and approved procedures

P10 deal promptly and effectively with problems within their control and report those that cannot be solved

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Learning outcome

The learner will:

1 carry out all of the following during the overhauling activities:

Assessment criteria

The learner can:

1.1 obtain and use the appropriate documentation (such as job instructions, aircraft manuals and overhauling documentation, technical instructions and other relevant maintenance documentation)

1.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work

1.3 provide and maintain safe access and working arrangements for the overhauling area

1.4 obtain the correct tools and equipment for the activity and check that they are in a safe, tested and usable condition and within current certification/calibration date

1.5 where appropriate, apply electrostatic discharge (ESD) protection procedures

1.6 carry out the overhauling activities, using approved techniques and procedures at all times

1.7 return all tools and equipment to the correct location on completion of the activities

1.8 leave the work area and the communication equipment in a safe and appropriate condition, free from foreign object debris on completion of the activities

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Learning outcome

The learner will:

2 carry out the overhauling activities to unit level on three of the following types of aircraft communication equipment:

Assessment criteria

2.1 VHF radio

2.2 cockpit voice recorder

2.3 intercom (clear)
2.4 SATCOM
2.5 intercom (secure speech)
2.6 digital data links
2.7 secure radio links
2.8 flight entertainment systems
2.9 HF radio
2.10 SELCAL
2.11 UHF radio
2.12 crash position indicators
2.13 aircraft communication address reporting system (ACARS)
2.14 telecommunications

Learning outcome

The learner will:

3 carry out all of the following activities, as applicable to the equipment being overhauled:

Assessment criteria

3.1 cleaning parts prior to dismantling
3.2 checking components for serviceability
3.3 pre-disassembly checks and tests
3.4 replacing all 'lifed' items (such as seals, dust caps)
3.5 disconnecting and de-soldering electrical connections
3.6 replacing all damaged or defective components
3.7 reassembling equipment
3.8 removal of earth bonding
3.9 setting and adjusting/calibrating replaced components (such as power output, voltage)
3.10 removal of conformal coating
3.11 removing cable securing devices
3.12 making mechanical connections
3.13 removing bolt securing devices and mechanical fasteners
3.14 soldering electrical connections
3.15 carrying out earth bonding
3.16 dismantling equipment to unit/sub-assembly level
3.17 installing cable securing devices
3.18 dismantling units to component level
3.19 tightening fastenings to the required torque
3.20 marking/labelling of components to aid reassembly
3.21 re-instating conformal coating
3.22 securing components using mechanical fasteners and threaded devices

3.23 applying locking and retaining devices (such as circlips, pins, wire locking)

Learning outcome

The learner will:

4 carry out overhauling activities to component level on three of the following communication equipment components:

Assessment criteria

4.1 power supply units
4.2 tuning units
4.3 aerials
4.4 transmitter units
4.5 receiver units
4.6 transformers
4.7 satellite beacons
4.8 control units
4.9 transponders
4.10 intercom station boxes
4.11 antenna switching units

Learning outcome

The learner will:

5 replace a range of communication equipment components, to include eight of the following:

Assessment criteria

5.1 batteries
5.2 transformers
5.3 plugs/sockets/terminations
5.4 switches
5.5 unit trays
5.6 speakers
5.7 fuses
5.8 headsets
5.9 microphone units
5.10 relays
5.11 instruments/gauges/ indicators
5.12 chassis components
5.13 circuit breakers
5.14 gaskets/seals
5.15 printed circuit boards
5.16 filament lamps/light emitting diodes
5.17 screws/bolts/washers

5.18 electronic components (such as resistors, capacitors)
5.19 wires/cables
5.20 other specific components

Learning outcome

The learner will:

6 carry out checks and tests on the overhauled equipment, to include three of the following:

Assessment criteria

6.1 visual inspection for completeness and freedom from damage or foreign objects
6.2 signal injection tests
6.3 power output
6.4 soak test
6.5 continuity checks
6.6 bonding tests
6.6. standard serviceability test
6.8 voltage standing wave ratio (VSWR) checks
6.9 `special-to-type' tests

Learning outcome

The learner will:

7 overhaul aircraft communication equipment in compliance with one of the following:

Assessment criteria

7.1 Military Aviation Authority (MAA)
7.2 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
7.3 BS, ISO or BSEN standards and procedures
7.4 Aerospace Quality Management Standards (AS)
7.5 specific system requirements
7.6 Federal Aviation Authority (FAA)
7.7 organisation standards and procedures
7.8 manufacturers standards and procedures

Learning outcome

The learner will:

8 complete the relevant documentation, to include one from the following and pass it to the appropriate people

Assessment criteria

8.1 computer records

8.2 record/history cards

8.3 job cards

8.4 aircraft service/flight log

8.5 other specific recording method

Knowledge and understanding

The learner must know and understand:

K1 the safe working practices and procedures and the specific safety precautions to be taken when overhauling aircraft communication equipment (to include wearing protective clothing and equipment; lifting and handling techniques; safe working practices and procedures with regard to working on aircraft communication equipment; procedures and guidelines which satisfy current regulations such as HASAWA, COSHH and other work related legislation and guidelines)

K2 the hazards associated with overhauling aircraft communication equipment, and with the tools and equipment used, and how to minimise them and reduce any risks

K3 The importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to

K4 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to

K5 the protective equipment that they need to use for both personal protection (PPE) and protection of the communication equipment

K6 what constitutes a hazardous voltage and how to recognise victims of electric shock

K7 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)

K8 how to extract and use information from equipment manuals, history/maintenance reports, charts, circuit and physical layouts, specifications, symbols used in aircraft communication systems and other documents needed in the overhauling process

K9 how to carry out currency/issue checks on the specifications they are working with

K10 terminology used in aircraft communication equipment, and the use of system diagrams and associated symbols

K11 the basic principles of operation of the aircraft communication equipment being overhauled, and the performance characteristics and function of the components within the equipment

K12 the techniques used to remove components from aircraft communication equipment, without damage to the components or surrounding structure (such as de-soldering components, applying electrostatic discharge (ESD) protection procedures)

K13 the various types of electrical connector that are used, methods of unlocking, orientation indicators, and locating and locking in of the connections

K14 the various mechanical fasteners that are used and their method of removal and replacement (such as threaded fasteners, special securing devices)

K15 the importance of using the specified fasteners for the particular installation and why they must not substitute others

K16 why securing devices need to be locked and labelled, and the different methods that are used to remove and install them

K17 the torque loading requirements of the fasteners and what to do if these loadings are exceeded or not achieved

K18 the need to correctly label and store components, and to check that replaced components have the correct part/identification markings

K19 the procedure for obtaining replacement parts, materials and other consumables necessary for the overhaul

K20 the techniques used to position, align, adjust and secure the replaced components to the equipment, without damage to the components or surrounding structure

K21 the quality control procedures to be followed during the overhauling operations

K22 procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities

K23 methods of lifting, handling and supporting the components/equipment during the removal and replacement activities

K24 the use of seals, sealant and adhesives and anti-electrolysis barriers and the precautions to be taken

K25 why electrical bonding is critical and why it must be both mechanically and electrically secure

K26 how to conduct any necessary checks and adjustments to ensure the system integrity, accuracy and quality of the overhaul

K27 the tools and equipment used in the overhauling activities and their calibration/care and control procedures

K28 why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the overhauling activities

K29 the problems that can occur with the overhauling operations and how these can be overcome

K30 how to recognise defects (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)

K31 the recording documentation to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation

K32 the procedure for the safe disposal of waste materials and scrap components

K33 the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve

Unit 414 Overhauling components of aircraft communication equipment

Supporting Information

Unit guidance

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme whilst meeting their own requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

Unit 415 Overhauling components of aircraft radar equipment

Unit level:	Level 3
GLH:	336
Unit aim:	This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief. This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to carry out overhauling activities on components of aircraft radar equipment, in accordance with approved procedures. The equipment to be overhauled will have been removed from the aircraft and the overhauling activities may take place in a workshop or hangar. It covers equipment used in both fixed wing and rotary winged aircraft and covers a range of equipment such as surveillance radar , weather radar, and obstacle warning systems, traffic collision and avoidance systems (TCAS), towed radar decoys, radar (radio) altimeter, tactical air navigation (TACAN), identification friend or foe (IFF), Doppler and radar jamming devices, as applicable to the aircraft types. The overhauling activities will include carrying out all necessary safety checks, dismantling the equipment to unit or component level, inspecting and checking all components for damage and wear, replacing all `lifed' items and worn/faulty components or units, reassembling the equipment and carrying out all necessary tests/checks. Their responsibilities will require you to comply with organisational policy and procedures for the overhauling activities undertaken and to report any problems with the overhauling activities, or with the tools and equipment used that they cannot personally resolve or that is outside of their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used in the overhauling activities are removed from the work area, and that all necessary job/task documentation is completed

accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

Their underpinning knowledge will provide a good understanding of their work and will provide an informed approach to applying appropriate overhauling procedures to aircraft radar equipment. They will understand the dismantling and reassembly methods and procedures used and their application. They will know how the equipment functions, the common faults encountered, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the overhauling activities and for ensuring that the overhauled equipment meets the required specification.

They will understand the safety precautions required when carrying out the overhauling activities. They will be required to demonstrate safe working practices throughout and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall objectives of the organisation, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

Performance Requirements

The learner can:

P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines

P2 demonstrate the required behaviours in line with the job role and organisational objectives

P3 follow the relevant overhauling schedules to carry out the required work

P4 establish the components to be removed and where appropriate, mark/label components to aid re-assembly

P5 carry out the overhaul to the agreed level, using the correct tools and techniques

P6 ensure that all removed components are correctly identified and stored in the correct location

P7 report any instances where the overhauling activities cannot be fully met, or where there are identified defects outside the planned overhauling schedule

P8 complete the relevant documentation in accordance with organisational requirements

P9 dispose of unwanted components, waste materials and substances in accordance with safe working practices and approved procedures

P10 deal promptly and effectively with problems within their control and report those that cannot be solved

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Learning outcome

The learner will:

1 carry out all of the following during the overhauling activities:

Assessment criteria

1.1 obtain and use the appropriate documentation (such as job instructions, aircraft manuals and overhauling documentation, technical instructions and other relevant maintenance documentation)

1.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work

1.3 provide and maintain safe access and working arrangements for the overhauling area

1.4 obtain the correct tools and equipment for the activity and check that they are in a safe, tested and usable condition and within current certification/calibration date

1.5 where appropriate, apply electrostatic discharge (ESD) protection procedures

1.6 carry out the overhauling activities, using approved techniques and procedures at all times

1.7 return all tools and equipment to the correct location on completion of the activities

1.8 leave the work area and the radar equipment in a safe and appropriate condition, free from foreign object debris on completion of the activities

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Learning outcome

The learner will:

2 carry out the overhauling activities to unit level on the following types of aircraft radar equipment:

Assessment criteria

Either one of the following:

2.1 surveillance radar

2.2 radar jamming

OR three of the following:

2.3 towed radar decoys
2.4 obstacle warning systems
2.5 radar (radio) altimeter
2.6 identification friend or foe (IFF)
2.7 Doppler
2.8 tactical air navigation (TACAN)
2.9 enhanced ground proximity warning system (EGPWS)
2.10 weather radar/predictive wind shear
2.11 supplementary surveillance radar
2.12 traffic collision avoidance system (TCAS)

Learning outcome

The learner will:

3 carry out all of the following activities, as applicable to the equipment being overhauled:

Assessment criteria

3.1 cleaning parts prior to dismantling
3.2 checking components for serviceability
3.3 pre-disassembly checks and tests
3.4 replacing all 'lifed' items (such as seals, dust caps)
3.5 disconnecting and de-soldering electrical connections
3.6 replacing all damaged or defective components
3.7 reassembling equipment
3.8 removal of earth bonding
3.9 setting and adjusting/calibrating replaced components (such as power output, voltage)
3.10 removal of conformal coating
3.11 removing cable securing devices
3.12 making mechanical connections
3.13 removing bolt securing devices and mechanical fasteners
3.14 soldering electrical connections
3.15 carrying out earth bonding
3.16 dismantling equipment to unit/sub-assembly level
3.17 installing cable securing devices
3.18 dismantling units to component level
3.19 tightening fastenings to the required torque
3.20 marking/labelling of components to aid reassembly
3.21 re-instating conformal coating
3.22 securing components using mechanical fasteners and threaded devices
3.23 applying locking and retaining devices (such as circlips, pins, wire locking)

Learning outcome

The learner will:

4 carry out overhauling activities to component level on three of the following radar equipment components:

Assessment criteria

4.1 scanners
4.2 control units
4.3 aerials
4.4 microwave generators
4.5 transformers
4.6 intermediate frequency unit (IFU)
4.7 transmitter units
4.8 power supply units (PSU)
4.9 computers
4.10 winches
4.11 transponders
4.12 waveguides
4.13 radar displays
4.14 radar packs
4.15 receiver units
4.16 coolant units
4.17 processors

Learning outcome

The learner will:

5 replace a range of radar equipment components, to include eight of the following:

Assessment criteria

5.1 batteries
5.2 instruments/gauges/indicators
5.3 switches
5.4 desiccant units
5.5 fuses
5.6 filament lamps/light emitting diodes
5.7 relays
5.8 wires/cables
5.9 transformers
5.10 plugs/sockets/terminations
5.11 circuit breakers

5.12 chassis components
5.13 printed circuit boards
5.14 screws/bolts/washers
5.15 electronic components (such as resistors, capacitors)
5.16 coolants
5.17 gaskets and seals
5.18 other specific components

Learning outcome

The learner will:

6 carry out checks and tests on the overhauled equipment, to include three of the following:

Assessment criteria

6.1 visual inspection for completeness and freedom from damage or foreign objects
6.2 signal injection tests
6.3 power output
6.4 soak test
6.5 continuity checks
6.6 bonding tests
6.7 standard serviceability test
6.8 voltage standing wave ratio (VSWR) checks
6.9 pressure/leak test
6.10 `special-to-type' tests

Learning outcome

The learner will:

7 overhaul aircraft radar equipment in compliance with one of the following:

Assessment criteria

7.1 Military Aviation Authority (MAA)
7.2 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
7.3 BS, ISO or BSEN standards and procedures
7.4 Aerospace Quality Management Standards (AS)
7.5 specific system requirements
7.6 Federal Aviation Authority (FAA)
7.7 organisation standards and procedures
7.8 manufacturers standards and procedures

Learning outcome

The learner will:

8 complete the relevant documentation, to include one from the following and pass it to the appropriate people:

Assessment criteria

8.1 computer records

8.2 record/history cards

8.3 job cards

8.4 aircraft service/flight log

8.5 other specific recording method

Knowledge and understanding

The learner must know and understand:

K1 the safe working practices and procedures and the specific safety precautions to be taken when overhauling radar equipment (to include wearing protective clothing and equipment; lifting and handling techniques; safe working practices and procedures with regard to working on aircraft radar equipment; procedures and guidelines which satisfy current regulations such as HASAWA, COSHH and other work related legislation and guidelines)

K2 the hazards associated with overhauling aircraft radar equipment, and with the tools and equipment used, and how to minimise them and reduce any risks

K3 The importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to

K4 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to

K5 the protective equipment that they need to use for both personal protection (PPE) and protection of the radar equipment

K6 what constitutes a hazardous voltage and how to recognise victims of electric shock

K7 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)

K8 how to extract and use information from equipment manuals, history/maintenance reports, charts, circuit and physical layouts, specifications, symbols used in aircraft radar systems and other documents needed in the overhauling process

K9 how to carry out currency/issue checks on the specifications they are working with

K10 terminology used in aircraft radar equipment, and the use of system diagrams and associated symbols

K11 the basic principles of operation of the aircraft radar equipment being overhauled, and the performance characteristics and function of the components within the equipment

K12 the techniques used to remove components from aircraft radar equipment, without damage to the components or surrounding structure (such as de-soldering components, applying electrostatic discharge (ESD) protection procedures)

K13 the various types of electrical connector that are used, methods of unlocking, orientation indicators, and locating and locking in of the connections

K14 the various mechanical fasteners that are used and their method of removal and replacement (such as threaded fasteners, special securing devices)

K15 the importance of using the specified fasteners for the particular installation and why they must not substitute others

K16 why securing devices need to be locked and labelled, and the different methods that are used to remove and install them

K17 the torque loading requirements of the fasteners and what to do if these loadings are exceeded or not achieved

K18 the need to correctly label and store components, and to check that replaced components have the correct part/identification markings

K19 the procedure for obtaining replacement parts, materials and other consumables necessary for the overhaul

K20 the techniques used to position, align, adjust and secure the replaced components to the equipment, without damage to the components or surrounding structure

K21 the quality control procedures to be followed during the overhauling operations

K22 procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities

K23 methods of lifting, handling and supporting the components/equipment during the removal and replacement activities

K24 the use of seals, sealant and adhesives and anti-electrolysis barriers and the precautions to be taken

K25 why electrical bonding is critical and why it must be both mechanically and electrically secure

K26 how to conduct any necessary checks and adjustments to ensure the system integrity, accuracy and quality of the overhaul

K27 the tools and equipment used in the overhauling activities and their calibration/care and control procedures

K28 why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the overhauling activities

K29 the problems that can occur with the overhauling operations and how these can be overcome

K30 how to recognise defects (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)

K31 the recording documentation to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation

K32 the procedure for the safe disposal of waste materials and scrap components

K33 the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve

Unit 415 Overhauling components of aircraft radar equipment

Supporting Information

Unit guidance

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme whilst meeting their own requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

Unit 416 Overhauling components of aircraft indication and gauging equipment

Unit level:	Level 3
GLH:	336
Unit aim:	This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief. This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to carry out overhauling activities on components of aircraft indication and gauging equipment in accordance with approved procedures. The equipment to be overhauled will have been removed from the aircraft and the overhauling activities may take place in a workshop or hangar. It covers equipment used in both fixed wing and rotary winged aircraft and covers a range of indication and gauging equipment associated with powerplant and auxiliary power; engine fuel and lubrication; flying controls; fluid power; wheels, brakes and steering; transmission systems;environmental control systems; ice and rain protection and airframe systems and components, as applicable to the aircraft type. The overhauling activities will include carrying out all necessary safety checks, dismantling the equipment to unit or component level, inspecting and checking all components for damage and wear, replacing all `lifed' items and worn/faulty components or units, reassembling the equipment and carrying out all necessary tests/checks. Their responsibilities will require them to comply with organisational policy and procedures for the overhauling activities undertaken, and to report any problems with the overhauling activities, or with the tools and equipment used that they cannot personally resolve or that is outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used in the overhauling activities are removed from the work area, and that all

necessary job/task documentation is completed accurately and legibly.

They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

Their underpinning knowledge will provide a good understanding of their work and will provide an informed approach to applying appropriate overhauling procedures to aircraft indication and gauging equipment. They will understand the dismantling and reassembly methods and procedures used, and their application. They will know how the equipment functions, the common faults encountered, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the overhauling activities and ensuring that the overhauled equipment meets the required specification.

They will understand the safety precautions required when carrying out the overhauling activities. They will be required to demonstrate safe working practices throughout and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall objectives of the organisation, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

Performance Requirements

The learner can:

P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines

P2 demonstrate the required behaviours in line with the job role and organisational objectives

P3 follow the relevant overhauling schedules to carry out the required work

P4 establish the components to be removed and where appropriate, mark/label components to aid re-assembly

P5 carry out the overhaul to the agreed level, using the correct tools and techniques

P6 ensure that all removed components are correctly identified and stored in the correct location

P7 report any instances where the overhauling activities cannot be fully met, or where there are identified defects outside the planned overhauling schedule

P8 complete the relevant documentation in accordance with organisational requirements

P9 dispose of unwanted components, waste materials and substances in accordance with safe working practices and approved procedures

P10 deal promptly and effectively with problems within their control and report those that cannot be solved

Learning outcome

The learner will:

1 carry out all of the following during the overhauling activities:

Assessment criteria

1.1 obtain and use the appropriate documentation (such as job instructions, aircraft manuals and overhauling documentation, technical instructions and other relevant maintenance documentation)

1.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work

1.3 provide and maintain safe access and working arrangements for the overhauling area

1.4 obtain the correct tools and equipment for the activity and check that they are in a safe, tested and usable condition and within current certification/calibration date

1.5 where appropriate, apply electrostatic discharge (ESD) protection procedures

1.6 carry out the overhauling activities, using approved techniques and procedures at all times

1.7 return all tools and equipment to the correct location on completion of the activities

1.8 leave the work area and the indication and gauging equipment in a safe and appropriate condition, free from foreign object debris on completion of the activities

Learning outcome

The learner will:

2 carry out the overhauling activities to unit level on three of the following types of indication and gauging equipment:

Assessment criteria

2.1 power plant (such as main engine power, auxiliary power, thrust reverse, propeller, starting, monitoring, fire)

2.2 engine fuel, lubrication, air, cooling, control systems

2.3 fluid power (such as hydraulic power generation, undercarriage, pneumatic or vacuum pressure)

2.4 flying controls (such as flaps/slats, elevators, ailerons/tailerons, horizontal stabiliser, spoilers/speed brakes, wing sweep, reaction controls, rudder, rotor)

2.5 wheels, brakes, steering

2.6 transmission systems (such as main and auxiliary gear boxes)

2.7 aircraft fuel systems (such as supply, contents, transfer, venting system, fuel jettison, refuelling and defuelling)

2.8 environmental control systems (such as pressure control, heating and ventilation, equipment air conditioning)

2.9 ice and rain protection systems (such as windshield, engine protection, pitot static protection, ice accretion)

2.10 fuselage (such as access panels, cargo doors, boundary layer and suction doors)

Learning outcome

The learner will:

3 carry out all of the following activities, as applicable to the equipment being overhauled:

Assessment criteria

3.1 cleaning parts prior to dismantling

3.2 replacing all 'lifed' items (seals, dust caps)

3.3 pre-disassembly checks and tests

3.4 replacing all damaged/defective components

3.5 disconnecting and de-soldering electrical connections

3.6 reassembling equipment

3.7 removal of earth bonding

3.8 setting and adjusting/calibrating replaced components (such as power output, voltage)

3.9 removing cable securing devices

3.10 removing bolt securing devices and mechanical fasteners

3.11 making mechanical connections

3.12 dismantling equipment to unit/sub-assembly level

3.13 soldering electrical connections

3.14 dismantling units to component level

3.15 carrying out earth bonding

3.16 marking/labelling of components to aid reassembly
3.17 installing cable securing devices
3.18 checking components for serviceability
3.19 tightening fastenings to the required torque
3.20 securing components using mechanical fasteners and threaded devices
3.21 applying locking and retaining devices (such as circlips, pins, wire locking)

Learning outcome

The learner will:

4 carry out overhauling activities to component level on three of the following indication and gauging equipment components:

Assessment criteria

4.1 transmitters (such as position, flow, pressure, level)
4.2 displays
4.3 actuators
4.4 generators (such as pulse, speed/tacho)
4.5 motors
4.6 computers
4.7 capacitance units
4.8 gauges/indicators

Learning outcome

The learner will:

5 replace a range of indication and gauging equipment components, to include eight of the following:

Assessment criteria

5.1 switches (such as micro, proximity)
5.2 plugs/sockets/terminations
5.3 fuses
5.4 circuit breakers
5.5 relays
5.6 input and follow-up potentiometers
5.7 transformers
5.8 batteries
5.9 printed circuit boards
5.10 desiccant units
5.11 electronic components (such as resistors, capacitors)
5.12 filament lamps/light emitting diodes

5.13 screws/bolts/washers
5.14 transducers/sensors
5.15 wires/cables
5.16 gaskets and seals
5.17 chassis components
5.18 other specific components

Learning outcome

The learner will:

6 carry out checks and tests on the overhauled equipment, to include three of the following:

Assessment criteria

6.1 visual inspection for completeness and freedom from damage or foreign objects
6.2 comparison check
6.3 continuity checks
6.4 soak test
6.5 standard serviceability test
6.6 bonding tests
6.7 'special-to-type' tests
6.8 signal injection tests

Learning outcome

The learner will:

7 overhaul aircraft indication and gauging equipment in compliance with one of the following:

Assessment criteria

7.1 Military Aviation Authority (MAA)
7.2 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
7.3 BS, ISO or BSEN standards and procedures
7.4 Aerospace Quality Management Standards (AS)
7.5 specific system requirements
7.6 Federal Aviation Authority (FAA)
7.7 organisation standards and procedures
7.8 manufacturers standards and procedures

Learning outcome

The learner will:

8 complete the relevant documentation, to include one from the following and pass it to the appropriate people:

Assessment criteria

8.1 computer records

8.2 record/history cards

8.3 job cards

8.4 aircraft service/flight log

8.5 other specific recording method

Knowledge and understanding

The learner must know and understand:

K1 the safe working practices and procedures and the specific safety precautions to be taken when overhauling indication and gauging equipment (to include wearing protective clothing and equipment; lifting and handling techniques; safe working practices and procedures with regard to working on aircraft indication and gauging equipment; procedures and guidelines which satisfy current regulations such as HASAWA, COSHH and other work related legislation and guidelines)

K2 the hazards associated with overhauling aircraft indication and gauging equipment, and with the tools and equipment used, and how to minimise them and reduce any risks

K3 The importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to

K4 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to

K5 the protective equipment that they need to use for both personal protection (PPE) and protection of the indication and gauging equipment

K6 what constitutes a hazardous voltage and how to recognise victims of electric shock

K7 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)

K8 how to extract and use information from equipment manuals, history/maintenance reports, charts, circuit and physical layouts, specifications, symbols used in aircraft indication and gauging systems and other documents needed in the overhauling process

K9 how to carry out currency/issue checks on the specifications they are working with

K10 terminology used in aircraft indication and gauging equipment, and the use of system diagrams and associated symbols

K11 the basic principles of operation of the aircraft indication and gauging equipment being overhauled, and the performance characteristics and function of the components within the equipment

K12 the techniques used to remove components from aircraft indication and gauging equipment, without damage to the components or surrounding structure (such as de-soldering components, applying electrostatic discharge (ESD) protection procedures)

K13 the various types of electrical connector that are used, methods of unlocking, orientation indicators, and locating and locking in of the connections

K14 the various mechanical fasteners that are used and their method of removal and replacement (such as threaded fasteners, special securing devices)

K15 the importance of using the specified fasteners for the particular installation and why they must not substitute others

K16 why securing devices need to be locked and labelled, and the different methods that are used to remove and install them

K17 the torque loading requirements of the fasteners and what to do if these loadings are exceeded or not achieved

K18 the need to correctly label and store components, and to check that replaced components have the correct part/identification markings

K19 the procedure for obtaining replacement parts, materials and other consumables necessary for the overhaul

K20 the techniques used to position, align, adjust and secure the replaced components to the equipment, without damage to the components or surrounding structure

K21 the quality control procedures to be followed during the overhauling operations

K22 procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities

K23 methods of lifting, handling and supporting the components/equipment during the removal and replacement activities

K24 the use of seals, sealant and adhesives and anti-electrolysis barriers and the precautions to be taken

K25 why electrical bonding is critical and why it must be both mechanically and electrically secure

K26 how to conduct any necessary checks and adjustments to ensure the system integrity, accuracy and quality of the overhaul

K27 the tools and equipment used in the overhauling activities and their calibration/care and control procedures

K28 why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the overhauling activities

K29 the problems that can occur with the overhauling operations and how these can be overcome

K30 how to recognise defects (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)

K31 the recording documentation to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation

K32 the procedure for the safe disposal of waste materials and scrap components

K33 the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve

Unit 416 Overhauling components of aircraft indication and gauging equipment

Supporting Information

Unit guidance

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme whilst meeting their own requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

Unit 417 Overhauling components of aircraft electrical equipment

Unit level:	Level 3
GLH:	336
Unit aim:	This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief. This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to carry out overhauling activities on components of aircraft electrical equipment, in accordance with approved procedures. The equipment to be overhauled will have been removed from the aircraft and the overhauling activities may take place in a workshop or hangar. It covers equipment used in both fixed wing and rotary winged aircraft and covers a range of equipment associated with power generation, emergency power backup equipment, power distribution, flying controls, environmental control systems (ECS), fuel systems, undercarriage, pitot/static, lighting, weapons, engine control and countermeasures, as applicable to the aircraft type. The overhauling activities will include carrying out all necessary safety checks, dismantling the equipment to unit or component level, inspecting and checking all components for damage and wear, replacing all `lifed' items and worn/faulty components or units, reassembling the equipment and carrying out all necessary tests/checks. Their responsibilities will require them to comply with organisational policy and procedures for the overhauling activities undertaken and to report any problems with the overhauling activities, or with the tools and equipment used that they cannot personally resolve or that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used in the overhauling activities are removed from the work area and that all necessary job/task documentation is completed accurately and legibly.

They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

Their underpinning knowledge will provide a good understanding of their work and will provide an informed approach to applying appropriate overhauling procedures to aircraft electrical equipment. They will understand the dismantling and reassembly methods and procedures used, and their application. They will know how the equipment functions, the common faults encountered, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the overhauling activities and ensuring that the overhauled equipment meets the required specification.
They will understand the safety precautions required when carrying out the overhauling activities. They will be required to demonstrate safe working practices throughout and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall objectives of the organisation, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

Performance Requirements

The learner can:

P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines

P2 demonstrate the required behaviours in line with the job role and organisational objectives

P3 follow the relevant overhauling schedules to carry out the required work

P4 establish the components to be removed and where appropriate, mark/label components to aid re-assembly

P5 carry out the overhaul to the agreed level, using the correct tools and techniques

P6 ensure that all removed components are correctly identified and stored in the correct location

P7 report any instances where the overhauling activities cannot be fully met, or where there are identified defects outside the planned overhauling schedule

P8 complete the relevant documentation in accordance with organisational requirements

P9 dispose of unwanted components, waste materials and substances in accordance with safe working practices and approved procedures

P10 deal promptly and effectively with problems within their control and report those that cannot be solved

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Learning outcome

The learner will:

1 Carry out all of the following during the overhauling activities:

Assessment criteria

1.1 obtain and use the appropriate documentation (such as job instructions, aircraft manuals and overhauling documentation, technical instructions and other relevant maintenance documentation)

1.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work

1.3 provide and maintain safe access and working arrangements for the overhauling area

1.4 obtain the correct tools and equipment for the activity and check that they are in a safe, tested and usable condition and within current certification/calibration date

1.5 where appropriate, apply electrostatic discharge (ESD) protection procedures

1.6 carry out the overhauling activities, using approved techniques and procedures at all times

1.7 return all tools and equipment to the correct location on completion of the activities

1.8 leave the work area and the electrical equipment in a safe and appropriate condition, free from foreign object debris on completion of the activities

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Learning outcome

The learner will:

2 carry out the overhauling activities to unit level on three of the following types of electrical equipment:

Assessment criteria

2.1 fuel systems

2.2 lighting

2.3 pitot/static

2.4 environmental control systems

2.5 undercarriage
2.6 engine control
2.7 weapons
2.8 countermeasures
2.9 flying controls
2.10 AC main power generation equipment
2.11 DC power generation equipment
2.12 emergency power backup equipment
2.13 secondary/standby power generation equipment
2.14 power distribution equipment

Learning outcome

The learner will:

3 carry out all of the following activities, as applicable to the equipment being overhauled:

Assessment criteria

3.1 cleaning parts prior to dismantling
3.2 replacing all 'lifed' items (seals, dust caps)
3.3 pre-disassembly checks and tests
3.4 replacing all damaged/defective components
3.5 disconnecting and de-soldering electrical connections
3.6 reassembling equipment
3.7 removal of earth bonding
3.8 setting and adjusting/calibrating replaced components (such as power output, voltage)
3.9 removal of conformal coating
3.10 removing cable securing devices
3.11 making mechanical connections
3.12 removing bolt securing devices and mechanical fasteners
3.13 soldering electrical connections
3.14 dismantling equipment to unit/sub-assembly level
3.15 carrying out earth bonding
3.16 dismantling units to component level
3.17 installing cable securing devices
3.18 marking/labelling of components to aid reassembly
3.19 tightening fastenings to the required torque
3.20 checking components for serviceability
3.21 reinstating conformal coating
3.22 securing components using mechanical fasteners and threaded devices
3.23 applying locking and retaining devices (such as circlips, pins, wire locking)

Learning outcome

The learner will:

4 carry out overhauling activities to component level on three of the following electrical equipment components:

Assessment criteria

4.1 generators
4.2 rectifier units
4.3 regulators
4.4 main contactors
4.5 alternators
4.6 actuator motors
4.7 transformer
4.8 air conditioning equipment
4.9 inverters
4.10 controllers
4.11 changeover relays
4.12 other specific equipment components

Learning outcome

The learner will:

5 replace a range of electrical equipment components, to include eight of the following:

Assessment criteria

5.1 switches
5.2 electronic components (such as resistors, capacitors)
5.3 fuses
5.4 batteries (such as one shot or flight control DC batteries)
5.5 batteries (other types)
5.6 relays
5.7 transformers
5.8 circuit breakers
5.9 transducers/sensors
5.10 wires/cables
5.11 under-voltage phase sequence units
5.12 plugs/sockets/terminations
5.13 printed circuit boards
5.14 screws/bolts/washers
5.15 gaskets and seals

5.16 chassis components
5.17 other specific electrical components

Learning outcome

The learner will:

6 carry out checks and tests on the overhauled equipment, to include three of the following:

Assessment criteria

6.1 visual inspection for completeness and freedom
6.2 signal injection tests from damage or foreign objects
6.3 comparison check
6.4 soak test
6.5 continuity checks
6.6 bonding tests
6.7 standard serviceability test
6.8 voltage checks
6.9 'special-to-type' tests

Learning outcome

The learner will:

7 overhaul aircraft indication and gauging equipment in compliance with one of the following:

Assessment criteria

7.1 Military Aviation Authority (MAA)
7.2 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
7.3 BS, ISO or BSEN standards and procedures
7.4 Aerospace Quality Management Standards (AS)
7.5 specific system requirements
7.6 Federal Aviation Authority (FAA)
7.7 organisation standards and procedures
7.8 manufacturers standards and procedures

Learning outcome

The learner will:

8 complete the relevant documentation, to include one from the following and pass it to the appropriate people:

Assessment criteria

8.1 computer records

8.2 record/history cards

8.3 job cards

8.4 aircraft service/flight log

8.5 other specific recording method

Knowledge and understanding

The learner must know and understand:

K1 the safe working practices and procedures and the specific safety precautions to be taken when overhauling electrical equipment (to include wearing protective clothing and equipment; lifting and handling techniques; safe working practices and procedures with regard to working on aircraft electrical equipment; procedures and guidelines which satisfy current regulations such as HASAWA, COSHH and other work related legislation and guidelines)

K2 the hazards associated with overhauling aircraft electrical equipment, and with the tools and equipment used, and how to minimise them and reduce any risks

K3 The importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to

K4 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to

K5 the protective equipment that they need to use for both personal protection (PPE) and protection of the electrical equipment

K6 what constitutes a hazardous voltage and how to recognise victims of electric shock

K7 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)

K8 how to extract and use information from equipment manuals, history/maintenance reports, charts, circuit and physical layouts, specifications, symbols used in aircraft electrical systems and other documents needed in the overhauling process

K9 how to carry out currency/issue checks on the specifications they are working with

K10 terminology used in aircraft electrical equipment, and the use of system diagrams and associated symbols

K11 the basic principles of operation of the aircraft electrical equipment being overhauled, and the performance characteristics and function of the components within the equipment

K12 the techniques used to remove components from aircraft electrical equipment, without damage to the components or surrounding structure (such as de-soldering components, applying electrostatic discharge (ESD) protection procedures)

K13 the various types of electrical connector that are used, methods of unlocking, orientation indicators, and locating and locking in of the connections

K14 the various mechanical fasteners that are used and their method of removal and replacement (such as threaded fasteners, special securing devices)

K15 the importance of using the specified fasteners for the particular installation and why they must not substitute others

K16 why securing devices need to be locked and labelled, and the different methods that are used to remove and install them

K17 the torque loading requirements of the fasteners and what to do if these loadings are exceeded or not achieved

K18 the need to correctly label and store components, and to check that replaced components have the correct part/identification markings

K19 the procedure for obtaining replacement parts, materials and other consumables necessary for the overhaul

K20 the techniques used to position, align, adjust and secure the replaced components to the equipment, without damage to the components or surrounding structure

K21 the quality control procedures to be followed during the overhauling operations

K22 procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities

K23 methods of lifting, handling and supporting the components/equipment during the removal and replacement activities

K24 the use of seals, sealant and adhesives and anti-electrolysis barriers and the precautions to be taken

K25 why electrical bonding is critical and why it must be both mechanically and electrically secure

K26 how to conduct any necessary checks and adjustments to ensure the system integrity, accuracy and quality of the overhaul

K27 the tools and equipment used in the overhauling activities and their calibration/care and control procedures

K28 why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the overhauling activities

K29 the problems that can occur with the overhauling operations and how these can be overcome

K30 how to recognise defects (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)

K31 the recording documentation to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation

K32 the procedure for the safe disposal of waste materials and scrap components

K33 the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve

Unit 417 Overhauling components of aircraft electrical equipment

Supporting Information

Unit guidance

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme whilst meeting their own requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

Unit 418 Overhauling components of aircraft pitot staticequipment

Unit level:	Level 3
GLH:	336
Unit aim	This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief. This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to carry out overhauling activities on components of aircraft pitot static equipment, in accordance with approved procedures. The equipment to be overhauled will have been removed from the aircraft and the overhauling activities may take place in a workshop or hangar. It covers equipment used in both fixed wing and rotary winged aircraft, and covers a range of equipment associated with height, speed, rate of climb, navigation, auto-pilot, flying control surfaces, ice and rain protection, as applicable to the aircraft type. The overhauling activities will include carrying out all necessary safety checks, dismantling the equipment to unit or component level, inspecting and checking all components for damage and wear, replacing all `lifed' items and worn/faulty components or units, reassembling the equipment and carrying out all necessary tests/checks. Their responsibilities will require them to comply with organisational policy and procedures for the overhauling activities undertaken, and to report any problems with the overhauling activities, or with the tools and equipment used that they cannot personally resolve or that is outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used in the overhauling activities are removed from the work area, and that all necessary job/task documentation is completed accurately and legibly.

They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

Their underpinning knowledge will provide a good understanding of their work and will provide an informed approach to applying appropriate overhauling procedures to aircraft pitot static equipment. They will understand the dismantling and reassembly methods and procedures used, and their application. They will know how the equipment functions, the common faults encountered, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the overhauling activities and ensuring that the overhauled equipment meets the required specification.

They will understand the safety precautions required when carrying out the overhauling activities. They will be required to demonstrate safe working practices throughout and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall objectives of the organisation, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

Performance Requirements

The learner can:

P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines

P2 demonstrate the required behaviours in line with the job role and organisational objectives

P3 follow the relevant overhauling schedules to carry out the required work

P4 establish the components to be removed and where appropriate, mark/label components to aid re-assembly

P5 carry out the overhaul to the agreed level, using the correct tools and techniques

P6 ensure that all removed components are correctly identified and stored in the correct location

P7 report any instances where the overhauling activities cannot be fully met, or where there are identified defects outside the planned overhauling schedule

P8 complete the relevant documentation in accordance with organisational requirements

P9 dispose of unwanted components, waste materials and substances in accordance with safe working practices and approved procedures

P10 deal promptly and effectively with problems within their control and report those that cannot be solved

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Learning outcome

The learner will:

1 carry out all of the following during the overhauling activities:

Assessment criteria

1.1 obtain and use the appropriate documentation (such as job instructions, aircraft manuals and overhauling documentation, technical instructions and other relevant maintenance documentation)

1.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work

1.3 provide and maintain safe access and working arrangements for the overhauling area

1.4 obtain the correct tools and equipment for the activity and check that they are in a safe, tested and usable condition and within current certification/calibration date

1.5 where appropriate, apply electrostatic discharge (ESD) protection procedures

1.6 carry out the overhauling activities, using approved techniques and procedures at all times

1.7 return all tools and equipment to the correct location on completion of the activities

1.8 leave the work area and the pitot static equipment in a safe and appropriate condition, free from foreign object debris on completion of the activities

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Learning outcome

The learner will:

2 carry out the overhauling activities to unit level on three of the following types of pitot static equipment:

Assessment criteria

2.1 rate of climb

2.2 aircraft height indication

2.3 auto-pilot

2.4 air speed indication

2.5 navigation
2.6 oxygen drop-out
2.7 flying controls (such as flaps, elevators, ailerons/tailerons, spoilers, wing sweep, reaction controls, rudder, rotor, airbrakes, horizontal stabiliser, artificial feel, gust alleviation, modal suppression)
2.8 engine control systems (such as FADEC, FAFC, EEC)
2.9 environmental control systems (such as pressure control)
2.10 ice and rain protection systems (such as pitot static protection, ice accretion)

Learning outcome

The learner will:

3 carry out all of the following activities, as applicable to the equipment being overhauled:

Assessment criteria

3.1 cleaning parts prior to dismantling
3.2 replacing all damaged/defective components
3.3 pre-disassembly checks and tests
3.4 reassembling equipment
3.5 disconnecting and de-soldering electrical connections
3.6 setting and adjusting/calibrating replaced components (such as pressure, flow, voltage)
3.7 removal of earth bonding
3.8 removing cable securing devices
3.9 removing bolt securing devices and mechanical fasteners
3.10 making mechanical connections
3.11 dismantling equipment to unit/sub-assembly level
3.12 soldering electrical connections
3.13 dismantling units to component level
3.14 carrying out earth bonding
3.15 marking/labelling of components to aid reassembly
3.16 installing cable securing devices
3.17 checking components for serviceability
3.18 tightening fastenings to the required torque
3.19 replacing all `lifed' items (such as seals, dust caps)
3.20 securing components using mechanical fasteners and threaded devices
3.21 applying locking and retaining devices (such as circlips, pins, wire locking)

Learning outcome

The learner will:

4 carry out overhauling activities to component level on three of the following pitot static equipment components:

Assessment criteria

4.1 airspeed indicators
4.2 heaters
4.3 analogue/digital converters
4.4 altitude indicators
4.5 static ports
4.6 pitot probes/pressure heads
4.7 rate of climb indicators
4.8 transducer units
4.9 air data computers/modules
4.10 cabin altitude alerter
4.11 digital displays
4.12 mach meters

Learning outcome

The learner will:

5 replace a range of pitot static equipment components, to include eight of the following:

Assessment criteria

The learner can:

5.1 switches (such as micro, proximity)
5.2 plugs/sockets/terminations
5.3 fuses
5.4 circuit breakers
5.5 relays
5.6 moisture drains/traps
5.7 printed circuit boards
5.8 rigid pipes
5.9 electronic components (such as resistors, capacitors)
5.10 flexi-pipes/hoses
5.11 batteries
5.12 transformers
5.13 desiccant units
5.14 transducers/sensors
5.15 screws/bolts/washers
5.16 filament lamps/light emitting diodes
5.17 wires/cables
5.18 gaskets and seals
5.19 other specific components

Learning outcome

The learner will:

6 carry out checks and tests on the overhauled equipment, to include three of the following:

Assessment criteria

6.1 visual inspection for completeness and freedom
6.2 signal injection tests from damage or foreign objects
6.3 comparison check
6.4 soak test
6.5 continuity checks
6.6 bonding tests
6.7 standard serviceability test
6.8 sense and leak tests
6.9 'special-to-type' tests

Learning outcome

The learner will:

7 overhaul aircraft indication and gauging equipment in compliance with one of the following:

Assessment criteria

7.1 Military Aviation Authority (MAA)
7.2 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
7.3 BS, ISO or BSEN standards and procedures
7.4 Aerospace Quality Management Standards (AS)
7.5 specific system requirements
7.6 Federal Aviation Authority (FAA)
7.7 organisation standards and procedures
7.8 manufacturers standards and procedures

Learning outcome

The learner will:

8 complete the relevant documentation, to include one from the following and pass it to the appropriate people:

Assessment criteria

8.1 computer records
8.2 record/history cards

8.3 job cards

8.4 aircraft service/flight log

8.5 other specific recording method

Knowledge and understanding

The learner must know and understand:

K1 the safe working practices and procedures and the specific safety precautions to be taken when overhauling pitot static equipment (to include wearing protective clothing and equipment; lifting and handling techniques; safe working practices and procedures with regard to working on aircraft pitot static equipment; procedures and guidelines which satisfy current regulations such as HASAWA, COSHH and other work related legislation and guidelines)

K2 the hazards associated with overhauling aircraft pitot static equipment, and with the tools and equipment used, and how to minimise them and reduce any risks

K3 The importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to

K4 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to

K5 the protective equipment that they need to use for both personal protection (PPE) and protection of the pitot static equipment

K6 what constitutes a hazardous voltage and how to recognise victims of electric shock

K7 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)

K8 how to extract and use information from equipment manuals, history/maintenance reports, charts, circuit and physical layouts, specifications, symbols used in aircraft pitot static systems and other documents needed in the overhauling process

K9 how to carry out currency/issue checks on the specifications they are working with

K10 terminology used in aircraft pitot static equipment, and the use of system diagrams and associated symbols

K11 the basic principles of operation of the aircraft pitot static equipment being overhauled, and the performance characteristics and function of the components within the equipment

K12 the techniques used to remove components from aircraft pitot static equipment, without damage to the components or surrounding structure (such as de-soldering components, applying electrostatic discharge (ESD) protection procedures)

K13 the various types of electrical connector that are used, methods of unlocking, orientation indicators, and locating and locking in of the connections

K14 the various mechanical fasteners that are used and their method of removal and replacement (such as threaded fasteners, special securing devices)

K15 the importance of using the specified fasteners for the particular installation and why they must not substitute others

K16 why securing devices need to be locked and labelled, and the different methods that are used to remove and install them

K17 the torque loading requirements of the fasteners and what to do if these loadings are exceeded or not achieved

K18 the need to correctly label and store components, and to check that replaced components have the correct part/identification markings

K19 the procedure for obtaining replacement parts, materials and other consumables necessary for the overhaul

K20 the techniques used to position, align, adjust and secure the replaced components to the equipment, without damage to the components or surrounding structure

K21 the quality control procedures to be followed during the overhauling operations

K22 procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities

K23 methods of lifting, handling and supporting the components/equipment during the removal and replacement activities

K24 the use of seals, sealant and adhesives and anti-electrolysis barriers and the precautions to be taken

K25 why electrical bonding is critical and why it must be both mechanically and electrically secure

K26 how to conduct any necessary checks and adjustments to ensure the system integrity, accuracy and quality of the overhaul

K27 the tools and equipment used in the overhauling activities and their calibration/care and control procedures

K28 why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the overhauling activities

K29 the problems that can occur with the overhauling operations and how these can be overcome

K30 how to recognise defects (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)

K31 the recording documentation to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation

K32 the procedure for the safe disposal of waste materials and scrap components

K33 the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve

Unit 418 Overhauling components of aircraft pitot staticequipment

Supporting Information

Unit guidance

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme whilst meeting their own requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

Unit 419 Overhauling components of aircraft passive warning and optical/surveillance systems

GLH:	336
Unit aim:	This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief. This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to carry out overhauling activities on components of aircraft passive warning and optical surveillance equipment, in accordance with approved procedures. The equipment to be overhauled will have been removed from the aircraft and the overhauling activities may take place in a workshop or hangar. It covers equipment used in both fixed wing and rotary winged aircraft and covers a range of equipment associated with acoustics, SONAR, radar homing & warning receivers (RHWR), collision and ground avoidance, wet, digital, video and infra-red cameras, recording and LASER systems, as applicable to the aircraft types. The overhauling activities will include carrying out all necessary safety checks, dismantling the equipment to unit or component level, inspecting and checking all components for damage and wear, replacing all `lifed' items and worn/faulty components or units, reassembling the equipment and carrying out all necessary tests/checks. Their responsibilities will require them to comply with organisational policy and procedures for the overhauling activities undertaken and to report any problems with the overhauling activities, or with the tools and equipment used that they cannot personally resolve or that is outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used in the overhauling activities are removed from the work area, and that all necessary job/task documentation is completed accurately and legibly. They will be expected to work with a minimum of supervision, taking personal

	responsibility for their own actions and for the quality and accuracy of the work that they carry out. Their underpinning knowledge will provide a good understanding of their work and will provide an informed approach to applying overhauling procedures on aircraft passive warning and optical surveillance equipment. They will understand the dismantling and reassembly methods and procedures used, and their application. They will know how the equipment functions, the common faults encountered, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the overhauling activities and ensuring that the overhauled equipment meets the required specification. They will understand the safety precautions required when carrying out the overhauling activities. They will be required to demonstrate safe working practices throughout and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace. They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall objectives of the organisation, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.
Endorsed by	SEMTA

Performance Requirements

The learner can:

P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines

P2 demonstrate the required behaviours in line with the job role and organisational objectives

P3 follow the relevant overhauling schedules to carry out the required work

P4 establish the components to be removed and where appropriate, mark/label components to aid re-assembly

P5 carry out the overhaul to the agreed level, using the correct tools and techniques

P6 ensure that all removed components are correctly identified and stored in the correct location

P7 report any instances where the overhauling activities cannot be fully met, or where there are identified defects outside the planned overhauling schedule

P8 complete the relevant documentation in accordance with organisational requirements

P9 dispose of unwanted components, waste materials and substances in accordance with safe working practices and approved procedures

P10 deal promptly and effectively with problems within their control and report those that cannot be solved.

Learning outcome

The learner will:

1 carry out all of the following during the overhauling activities:

Assessment criteria

1.1 obtain and use the appropriate documentation (such as job instructions, aircraft manuals and overhauling documentation, technical instructions and other relevant maintenance documentation)

1.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work

1.3 provide and maintain safe access and working arrangements for the overhauling area

1.4 obtain the correct tools and equipment for the activity and check that they are in a safe, tested and usable condition and within current certification/calibration date

1.5 where appropriate, apply Electrostatic Discharge (ESD) protection procedures

1.6 carry out the overhauling activities, using approved techniques and procedures at all times

1.7 return all tools and equipment to the correct location on completion of the activities

1.8 leave the work area and the passive warning and optical surveillance equipment in a safe and appropriate condition, free from foreign object debris on completion of the activities

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Learning outcome

The learner will:

2 carry out the overhauling activities to unit level on three of the following types of passive warning and optical surveillance equipment:

Assessment criteria

2.1 acoustics

2.2 collision avoidance (radar)

2.3 video recording systems

2.4 air data recording

2.5 ground avoidance (radio altimeter)
2.6 LASER systems
2.7 Sound Navigation and Ranging (SONAR)
2.8 camera systems (wet film, digital or infra-red)
2.9 Radar Homing and Warning Receivers (RHWR)

Learning outcome

The learner will:

3 carry out all of the following activities, as applicable to the equipment being overhauled:

Assessment criteria

3.1 cleaning parts prior to dismantling
3.2 checking components for serviceability
3.3 pre-disassembly checks and tests
3.4 replacing all `lifed' items (seals, dust caps)
3.5 disconnecting and de-soldering electrical connections
3.6 replacing all damaged or defective components
3.7 reassembling equipment
3.8 removal of earth bonding
3.9 setting and adjusting/calibrating replaced components (such as power output, voltage)
3.10 removal of conformal coating
3.11 removing cable securing devices
3.12 making mechanical connections
3.13 removing bolt securing devices and mechanical fasteners
3.14 soldering electrical connections
3.15 carrying out earth bonding
3.16 dismantling equipment to unit/sub-assembly level
3.17 installing cable securing devices
3.18 dismantling units to component level
3.19 tightening fastenings to the required torque
3.20 marking/labelling of components to aid reassembly
3.21 re-instating conformal coating
3.22 securing components using mechanical fasteners and threaded devices
3.23 applying locking and retaining devices (such as circlips, pins, wire locking)

Learning outcome

The learner will:

4 carry out overhauling activities to component level on three of the following passive warning and optical surveillance equipment components:

Assessment criteria

4.1 buoys
4.2 recording devices (cockpit, video, air data)
4.3 cameras
4.4 aerials
4.5 Power Supply Unit (PSU)
4.6 satellite beacons
4.7 receiver units
4.8 interface units
4.9 transponders
4.10 transmitter units
4.11 control units
4.12 display units
4.13 processors
4.14 transformers
4.15 other specific components

Learning outcome

5 replace a range of passive warning and optical surveillance equipment components, to include eight of the following:

Assessment criteria

5.1 switches
5.2 plugs/sockets/terminations
5.3 wires/cables
5.4 relays
5.5 batteries
5.6 wiring harness (complete)
5.7 gaskets
5.8 fuses
5.9 instruments/gauges/indicators
5.10 filament lamps/light emitting diodes
5.11 desiccant
5.12 fairings/panels
5.13 printed circuit boards

5.14 breakers/contacts
5.15 chassis components
5.16 electronic components (such as resistors, capacitors)
5.17 transformers
5.18 film or digital modules
5.19 armatures
5.20 screws/bolts/washers
5.21 other specific components

Learning outcome

The learner will:

6 carry out checks and tests on the overhauled equipment, to include three of the following:

Assessment criteria

6.1 visual inspection for completeness and freedom from damage or foreign objects
6.2 signal injection tests
6.3 continuity checks
6.4 soak test
6.5 standard serviceability test
6.6 bonding tests
6.7 'special-to-type' tests
6.8 Voltage Standing Wave Ratio (VSWR) checks

Learning outcome

The learner will:

7 overhaul aircraft indication and gauging equipment in compliance with one of the following:

Assessment criteria

7.1 Military Aviation Authority (MAA)
7.2 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
7.3 BS, ISO or BSEN standards and procedures
7.4 Aerospace Quality Management Standards (AS)
7.5 specific system requirements
7.6 Federal Aviation Authority (FAA)
7.7 organisation standards and procedures
7.8 manufacturers standards and procedures

Learning outcome

The learner will:

8 complete the relevant documentation, to include one from the following and pass it to the appropriate people:

Assessment criteria

8.1 computer records

8.2 record/history cards

8.3 job cards

8.4 aircraft service/flight log

8.5 other specific recording method

Knowledge and understanding

The learner must know and understand:

K1 the safe working practices and procedures and the specific safety precautions to be taken when overhauling passive warning and optical/surveillance equipment (to include wearing protective clothing and equipment; lifting and handling techniques; safe working practices and procedures with regard to working on aircraft passive warning and optical/surveillance equipment; procedures and guidelines which satisfy current regulations such as HASAWA, COSHH and other work related legislation and guidelines)

K2 the hazards associated with overhauling aircraft passive warning and optical/surveillance equipment, and with the tools and equipment used, and how to minimise them and reduce any risks

K3 The importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to

K4 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to

K5 the protective equipment that they need to use for both personal protection (PPE) and protection of the passive warning and optical/surveillance equipment

K6 what constitutes a hazardous voltage and how to recognise victims of electric shock

K7 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)

K8 how to extract and use information from equipment manuals, history/maintenance reports, charts, circuit and physical layouts, specifications, symbols used in aircraft passive warning and optical/surveillance systems and other documents needed in the overhauling process

K9 how to carry out currency/issue checks on the specifications they are working with

K10 terminology used in aircraft passive warning and optical/surveillance equipment, and the use of system diagrams and associated symbols

K11 the basic principles of operation of the aircraft passive warning and optical/surveillance equipment being overhauled, and the performance characteristics and function of the components within the equipment

K12 the techniques used to remove components from aircraft passive warning and optical/surveillance equipment, without damage to the components or surrounding structure (such as de-soldering components, applying Electrostatic Discharge (ESD) protection procedures)

K13 the various types of electrical connector that are used, methods of unlocking, orientation indicators, and locating and locking in of the connections

K14 the various mechanical fasteners that are used and their method of removal and replacement (such as threaded fasteners, special securing devices)

K15 the importance of using the specified fasteners for the particular installation and why they must not substitute others

K16 why securing devices need to be locked and labelled, and the different methods that are used to remove and install them

K17 the torque loading requirements of the fasteners and what to do if these loadings are exceeded or not achieved #

K18 the need to correctly label and store components, and to check that replaced components have the correct part/identification markings

K19 the procedure for obtaining replacement parts, materials and other consumables necessary for the overhaul

K20 the techniques used to position, align, adjust and secure the replaced components to the equipment, without damage to the components or surrounding structure

K21 the quality control procedures to be followed during the overhauling operations

K22 procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities

K23 methods of lifting, handling and supporting the components/equipment during the removal and replacement activities

K24 the use of seals, sealant and adhesives and anti-electrolysis barriers and the precautions to be taken

K25 why electrical bonding is critical and why it must be both mechanically and electrically secure

K26 how to conduct any necessary checks and adjustments to ensure the system integrity, accuracy and quality of the overhaul

K27 the tools and equipment used in the overhauling activities and their calibration/care and control procedures

K28 why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the overhauling activities

K29 the problems that can occur with the overhauling operations and how these can be overcome

K30 how to recognise defects (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)

K31 the recording documentation to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation

K32 the procedure for the safe disposal of waste materials and scrap components

K33 the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve

Unit 419 Overhauling components of aircraft passive warning and optical/surveillance systems

Supporting Information

Unit guidance

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme whilst meeting their own requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

Unit 420 Overhauling components of aircraft flight guidance and control equipment

GLH:	336
Unit aim:	This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief. This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to carry out overhauling activities on components of aircraft flight guidance and control equipment, in accordance with approved procedures. The equipment to be overhauled will have been removed from the aircraft and the overhauling activities may take place in a workshop or hangar. It covers equipment used in both fixed wing and rotary winged aircraft, and covers a range of equipment associated with fly by wire, gyros, autopilot, flight director, angle of attack, turn and slip, and AFCS (Automatic Flying Control System), as applicable to the aircraft types. The overhauling activities will include carrying out all necessary safety checks, dismantling the equipment to unit or component level, inspecting and checking all components for damage and wear, replacing all `lifed' items and worn/faulty components or units, reassembling the equipment and carrying out all necessary tests/checks. Their responsibilities will require them to comply with organisational policy and procedures for the overhauling activities undertaken and to report any problems with the overhauling activities, or with the tools and equipment used that they cannot personally resolve or that is outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used in the overhauling activities are removed from the work area, and that all necessary job/task documentation is completed accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own

	actions and for the quality and accuracy of the work that they carry out. Their underpinning knowledge will provide a good understanding of their work and will provide an informed approach to applying overhauling procedures to aircraft flight guidance and control equipment. They will understand the dismantling and reassembly methods and procedures used, and their application. They will know how the equipment functions, the common faults encountered, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the overhauling activities and ensuring that the overhauled equipment meets the required specification. They will understand the safety precautions required when carrying out the overhauling activities. They will be required to demonstrate safe working practices throughout and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace. They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall objectives of the organisation, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.
Endorsed by	SEMTA

Performance Requirements

The learner can:

P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines

P2 demonstrate the required behaviours in line with the job role and organisational objectives

P3 follow the relevant overhauling schedules to carry out the required work

P4 establish the components to be removed and where appropriate, mark/label components to aid re-assembly

P5 carry out the overhaul to the agreed level, using the correct tools and techniques

P6 ensure that all removed components are correctly identified and stored in the correct location

P7 report any instances where the overhauling activities cannot be fully met, or where there are identified defects outside the planned overhauling schedule

P8 complete the relevant documentation in accordance with organisational requirements

P9 dispose of unwanted components, waste materials and substances in accordance with safe working practices and approved procedures

P10 deal promptly and effectively with problems within their control and report those that cannot be solved

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Learning outcome

The learner will:

1 carry out all of the following during the overhauling activities:

Assessment criteria

1.1 obtain and use the appropriate documentation (such as job instructions, aircraft manuals and overhauling documentation, technical instructions and other relevant maintenance documentation)

1.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work

1.3 provide and maintain safe access and working arrangements for the overhauling area

1.4 obtain the correct tools and equipment for the activity and check that they are in a safe, tested and usable condition and within current certification/calibration date

1.5 where appropriate, apply Electrostatic Discharge (ESD) protection procedures

1.6 carry out the overhauling activities, using approved techniques and procedures at all times

1.7 return all tools and equipment to the correct location on completion of the activities

1.8 leave the work area and the guidance and control equipment in a safe and appropriate condition, free from foreign object debris on completion of the activities

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Learning outcome

The learner will:

2 carry out the overhauling activities to unit level on three of the following types of aircraft flight guidance and control equipment:

Assessment criteria

2.1 fly by wire

2.2 Automatic Flying Control System (AFCS)

2.3 autopilot

2.4 angle of attack/stall warning

2.5 flight director
2.6 nose wheel steering
2.7 turn and slip indication
2.8 main gear steering
2.9 gyros

Learning outcome

3 carry out all of the following activities, as applicable to the equipment being overhauled:

Assessment criteria

3.1 cleaning parts prior to dismantling
3.2 checking components for serviceability
3.3 pre-disassembly checks and tests
3.4 replacing all `lifed' items (seals, dust caps)
3.5 disconnecting and de-soldering electrical connections
3.6 replacing all damaged or defective components
3.7 reassembling equipment
3.8 removal of earth bonding
3.9 setting and adjusting/calibrating replaced components (such as power output, voltage)
3.10 removal of conformal coating
3.11 removing cable securing devices
3.12 making mechanical connections
3.13 removing bolt securing devices and mechanical fasteners
3.14 soldering electrical connections
3.15 carrying out earth bonding
3.16 dismantling equipment to unit/sub-assembly level
3.17 installing cable securing devices
3.18 dismantling units to component level
3.19 tightening fastenings to the required torque
3.20 marking/labelling of components to aid reassembly
3.21 re-instating conformal coating
3.22 securing components using mechanical fasteners and threaded devices
3.23 applying locking and retaining devices (such as circlips, pins, wire locking)

Learning outcome

The learner will:

4 carry out overhauling activities to component level on three of the following passive flight guidance and control equipment components:

Assessment criteria

4.1 computers
4.2 actuators
4.3 controllers
4.4 transformers
4.5 air data units
4.6 stick position cancellers
4.7 detectors/position sensors
4.8 Attitude Heading and Reference System (AHRS)
4.9 receiver units
4.10 Inertial Reference Unit (IRUs)
4.11 gyros (rate and vertical)
4.12 primary or secondary embedded GPS and INS (EGI)
4.13 trim units

Learning outcome

The learner will:

5 replace a range of flight guidance and control equipment components, to include eight of the following:

Assessment criteria

5.1 switches
5.2 instruments/gauges/indicators
5.3 armatures
5.4 relays
5.5 plugs/sockets/terminations
5.6 wires/cables
5.7 gaskets
5.8 batteries
5.9 wiring harness (complete)
5.10 breakers/contacts
5.11 fuses
5.12 fairings/panels
5.13 filament lamps/light emitting diodes
5.14 desiccant
5.15 chassis components
5.16 electronic components (such as resistors, capacitors)
5.17 printed circuit boards
5.18 aerials
5.19 transformers

5.20 screws/bolts/washers

5.21 other specific components

Learning outcome

The learner will:

6 carry out checks and tests on the overhauled equipment, to include three of the following:

Assessment criteria

6.1 visual inspection for completeness and freedom from damage or foreign objects

6.2 power output from damage or foreign objects

6.3 continuity checks

6.4 soak test

6.5 standard serviceability test

6.6 bonding tests

6.7 'special-to-type' tests

6.8 signal injection tests

Learning outcome

7 overhaul aircraft flight guidance and control equipment in compliance with one of the following:

Assessment criteria

7.1 Military Aviation Authority (MAA)

7.2 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)

7.3 BS, ISO or BSEN standards and procedures

7.4 Aerospace Quality Management Standards (AS)

7.5 specific system requirements

7.6 Federal Aviation Authority (FAA)

7.7 organisation standards and procedures

7.8 manufacturers standards and procedures

Learning outcome

The learner will:

8 complete the relevant documentation, to include one from the following and pass it to the appropriate people:

Assessment criteria

8.1 computer records

8.2 record/history cards

8.3 job cards

8.4 aircraft service/flight log

8.5 other specific recording method

Knowledge and understanding

The learner must know and understand:

K1 the safe working practices and procedures and the specific safety precautions to be taken when overhauling flight guidance and control equipment (to include wearing protective clothing and equipment; lifting and handling techniques; safe working practices and procedures with regard to working on aircraft flight guidance and control equipment; procedures and guidelines which satisfy current regulations such as HASAWA, COSHH and other work related legislation and guidelines)

K2 the hazards associated with overhauling flight guidance and control equipment, and with the tools and equipment used, and how to minimise them and reduce any risks

K3 The importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to

K4 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to

K5 the protective equipment that they need to use for both personal protection (PPE) and protection of the flight guidance and control equipment

K6 what constitutes a hazardous voltage and how to recognise victims of electric shock

K7 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)

K8 how to extract and use information from equipment manuals, history/maintenance reports, charts, circuit and physical layouts, specifications, symbols used in aircraft flight guidance and control systems and other documents needed in the overhauling process

K9 how to carry out currency/issue checks on the specifications they are working with

K10 terminology used in aircraft flight guidance and control equipment, and the use of system diagrams and associated symbols

K11 the basic principles of operation of the aircraft flight guidance and control equipment being overhauled, and the performance characteristics and function of the components within the equipment

K12 the techniques used to remove components from aircraft flight guidance and control equipment, without damage to the components or surrounding

structure (such as de-soldering components, applying Electrostatic Discharge (ESD) protection procedures)

K13 the various types of electrical connector that are used, methods of unlocking, orientation indicators, and locating and locking in of the connections

K14 the various mechanical fasteners that are used and their method of removal and replacement (such as threaded fasteners, special securing devices)

K15 the importance of using the specified fasteners for the particular installation and why they must not substitute others

K16 why securing devices need to be locked and labelled, and the different methods that are used to remove and install them

K17 the torque loading requirements of the fasteners and what to do if these loadings are exceeded or not achieved

K18 the need to correctly label and store components, and to check that replaced components have the correct part/identification markings

K19 the procedure for obtaining replacement parts, materials and other consumables necessary for the overhaul

K20 the techniques used to position, align, adjust and secure the replaced components to the equipment, without damage to the components or surrounding structure

K21 the quality control procedures to be followed during the overhauling operations

K22 procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities

K23 methods of lifting, handling and supporting the components/equipment during the removal and replacement activities

K24 the use of seals, sealant and adhesives and anti-electrolysis barriers and the precautions to be taken

K25 why electrical bonding is critical and why it must be both mechanically and electrically secure

K26 how to conduct any necessary checks and adjustments to ensure the system integrity, accuracy and quality of the overhaul

K27 the tools and equipment used in the overhauling activities and their calibration/care and control procedures

K28 why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the overhauling activities

K29 the problems that can occur with the overhauling operations and how these can be overcome

K30 how to recognise defects (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)

K31 the recording documentation to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation

K32 the procedure for the safe disposal of waste materials and scrap components

K33 the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve

Unit 420 Overhauling components of aircraft flight guidance and control equipment

Supporting Information

Unit guidance

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme whilst meeting their own requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

Unit 421 Overhauling components of aircraft internal and external lighting equipment

GLH:	315
Unit aim:	This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief. This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to carry out overhauling activities on components of aircraft internal and external lighting equipment, in accordance with approved procedures. The equipment to be overhauled will have been removed from the aircraft and the overhauling activities may take place in a workshop or hangar. It covers equipment used in both fixed wing and rotary winged aircraft, and covers a range of equipment associated with Electro-Luminescence (EL), emergency lighting, Night Vision (NVG), utility lighting, spot/search lighting, anti-dazzle lighting, external lighting systems, flood lighting and cabin lighting, as applicable to the aircraft type. The overhauling activities will include carrying out all necessary safety checks, dismantling the equipment to unit or component level, inspecting and checking all components for damage and wear, replacing all `lifed' items and worn/faulty components or units, reassembling the equipment and carrying out all necessary tests/checks. Their responsibilities will require them to comply with organisational policy and procedures for the overhauling activities undertaken and to report any problems with the overhauling activities, or with the tools and equipment used that they cannot personally resolve or that is outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used in the overhauling activities are removed from the work area and that all necessary job/task documentation is completed accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own

	actions and for the quality and accuracy of the work that they carry out. Their underpinning knowledge will provide a good understanding of their work and will provide an informed approach to applying appropriate overhauling procedures to aircraft lighting equipment. They will understand the dismantling and reassembly methods and procedures used and their application. They will know how the equipment functions, the common faults encountered, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the overhauling activities and ensuring that the overhauled equipment meets the required specification. They will understand the safety precautions required when carrying out the overhauling activities. They will be required to demonstrate safe working practices throughout and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace. They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall objectives of the organisation, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.
Endorsed by	SEMTA

Performance Requirements

The learner can:

P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines

P2 demonstrate the required behaviours in line with the job role and organisational objectives

P3 follow the relevant overhauling schedules to carry out the required work

P4 establish the components to be removed and where appropriate, mark/label components to aid re-assembly

P5 carry out the overhaul to the agreed level, using the correct tools and techniques

P6 ensure that all removed components are correctly identified and stored in the correct location

P7 report any instances where the overhauling activities cannot be fully met, or where there are identified defects outside the planned overhauling schedule

P8 complete the relevant documentation in accordance with organisational requirements

P9 dispose of unwanted components, waste materials and substances in accordance with safe working practices and approved procedures

P10 deal promptly and effectively with problems within their control and report those that cannot be solved

Learning outcome

The learner will:

1 carry out all of the following during the overhauling activities:

Assessment criteria

1.1 obtain and use the appropriate documentation (such as job instructions, aircraft manuals and overhauling documentation, technical instructions and other relevant maintenance documentation)

1.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work

1.3 provide and maintain safe access and working arrangements for the overhauling area

1.4 obtain the correct tools and equipment for the activity and check that they are in a safe, tested and usable condition and within current certification/calibration date

1.5 where appropriate, apply Electrostatic Discharge (ESD) protection procedures

1.6 carry out the overhauling activities, using approved techniques and procedures at all times

1.7 return all tools and equipment to the correct location on completion of the activities

1.8 leave the work area and the lighting equipment in a safe and appropriate condition, free from foreign object debris on completion of the activities

Learning outcome

The learner will:

2 carry out the overhauling activities to unit level on three of the following types of aircraft lighting equipment:

Assessment criteria

2.1 Electro-Luminescence (EL)

2.2 spot/search lighting

2.3 flood lighting

2.4 emergency lighting

2.5 anti-dazzle lighting
2.6 cabin lighting
2.7 Night Vision Goggles (NVG)
2.8 external lighting systems
2.9 utility lighting

Learning outcome

The learner will:

3 carry out all of the following activities, as applicable to the equipment being overhauled:

Assessment criteria

3.1 cleaning parts prior to dismantling
3.2 replacing all damaged/defective components
3.3 pre-disassembly checks and tests
3.4 reassembling equipment
3.5 disconnecting and de-soldering electrical connections
3.6 setting and adjusting/calibrating replaced components (such as power output, voltage)
3.7 removal of earth bonding
3.8 removal of conformal coating
3.9 making mechanical connections
3.10 removing cable securing devices
3.11 soldering electrical connections
3.12 removing bolt securing devices and mechanical fasteners
3.13 carrying out earth bonding
3.14 dismantling equipment to unit/sub-assembly level
3.15 installing cable securing devices
3.16 dismantling units to component level
3.17 tightening fastenings to the required torque
3.18 marking/labelling of components to aid reassembly
3.19 weather sealing lighting unit assemblies
3.20 checking components for serviceability
3.21 re-instating conformal coating
3.22 replacing all `lifed' items (seals, dust caps)
3.23 securing components using mechanical fasteners and threaded devices
3.24 applying locking and retaining devices (such as circlips, pins, wire locking)

Learning outcome

The learner will:

4 carry out overhauling activities to component level on three of the following lighting equipment components:

Assessment criteria

4.1 spot/search light (complete unit)
4.2 power supplies
4.3 rheostats
4.4 inverters
4.5 taxi/landing lamp (complete unit)
4.6 junction box
4.7 utility light
4.8 control units
4.9 strobe light/beacon light
4.10 transformer
4.11 rectifier units
4.12 navigation light

Learning outcome

The learner will:

5 replace a range of lighting equipment components, to include eight of the following:

Assessment criteria

5.1 switches
5.2 printed circuit boards
5.3 plugs/sockets/terminations
5.4 fuses
5.5 terminal blocks
5.6 filament lamps
5.7 relays
5.8 batteries (such as one shot or flight control DC batteries)
5.9 batteries (other types)
5.10 light emitting diodes
5.11 transformers
5.12 circuit breakers
5.13 strip lights
5.14 transducers/sensors
5.16 wires/cables

5.16 screws/bolts/washers
5.17 electronic components (such as resistors, capacitors)
5.18 under-voltage phase sequence units
5.19 other specific components

Learning outcome

The learner will:

6 carry out checks and tests on the overhauled equipment, to include three of the following:

Assessment criteria

6.1 visual inspection for completeness and freedom from damage or foreign objects
6.2 comparison check
6.3 continuity checks
6.4 soak test
6.5 standard serviceability test
6.6 bonding tests
6.7 'special-to-type' tests
6.8 voltage checks

Learning outcome

The learner will:

7 overhaul aircraft lighting equipment in compliance with one of the following:

Assessment criteria

7.1 Military Aviation Authority (MAA)
7.2 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
7.3 BS, ISO or BSEN standards and procedures
7.4 Aerospace Quality Management Standards (AS)
7.5 specific system requirements
7.6 Federal Aviation Authority (FAA)
7.7 organisation standards and procedures
7.8 manufacturers standards and procedures

Learning outcome

The learner will:

8 complete the relevant documentation, to include one from the following and pass it to the appropriate people:

Assessment criteria

8.1 computer records

8.2 record/history cards

8.3 job cards

8.4 aircraft service/flight log

8.5 other specific recording method

Knowledge and understanding

The learner must know and understand:

K1 the safe working practices and procedures and the specific safety precautions to be taken when overhauling lighting equipment (to include wearing protective clothing and equipment; lifting and handling techniques; safe working practices and procedures with regard to working on aircraft lighting equipment; procedures and guidelines which satisfy current regulations such as HASAWA, COSHH and other work related legislation and guidelines)

K2 the hazards associated with overhauling lighting equipment, and with the tools and equipment used, and how to minimise them and reduce any risks

K3 the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to

K4 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to

K5 the protective equipment that they need to use for both personal protection (PPE) and protection of the lighting equipment

K6 what constitutes a hazardous voltage and how to recognise victims of electric shock

K7 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)

K8 how to extract and use information from equipment manuals, history/maintenance reports, charts, circuit and physical layouts, specifications, symbols used in aircraft lighting systems and other documents needed in the overhauling process

K9 how to carry out currency/issue checks on the specifications they are working with

K10 terminology used in aircraft lighting equipment, and the use of system diagrams and associated symbols

K11 the basic principles of operation of the aircraft lighting equipment being overhauled, and the performance characteristics and function of the components within the equipment

K12 the techniques used to remove components from aircraft lighting equipment, without damage to the components or surrounding structure (such as de-

soldering components, applying Electrostatic Discharge (ESD) protection procedures)

K13 the various types of electrical connector that are used, methods of unlocking, orientation indicators, and locating and locking in of the connections

K14 the various mechanical fasteners that are used and their method of removal and replacement (such as threaded fasteners, special securing devices)

K15 the importance of using the specified fasteners for the particular installation and why they must not substitute others

K16 why securing devices need to be locked and labelled, and the different methods that are used to remove and install them

K17 the torque loading requirements of the fasteners and what to do if these loadings are exceeded or not achieved

K18 the need to correctly label and store components, and to check that replaced components have the correct part/identification markings

K19 the procedure for obtaining replacement parts, materials and other consumables necessary for the overhaul

K20 the techniques used to position, align, adjust and secure the replaced components to the equipment, without damage to the components or surrounding structure

K21 the quality control procedures to be followed during the overhauling operations

K22 procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities

K23 methods of lifting, handling and supporting the components/equipment during the removal and replacement activities

K24 the use of seals, sealant and adhesives and anti-electrolysis barriers and the precautions to be taken

K25 why electrical bonding is critical and why it must be both mechanically and electrically secure

K26 how to conduct any necessary checks and adjustments to ensure the system integrity, accuracy and quality of the overhaul

K27 the tools and equipment used in the overhauling activities and their calibration/care and control procedures

K28 why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the overhauling activities

K29 the problems that can occur with the overhauling operations and how these can be overcome

K30 how to recognise defects (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)

K31 the recording documentation to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation

K32 the procedure for the safe disposal of waste materials and scrap components

K33 the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve

Unit 421 Overhauling components of aircraft internal and external lighting equipment

Supporting Information

Unit guidance

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme whilst meeting their own requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

Unit 422 Overhauling components of aircraft avionic equipment

GLH:	336
Unit aim:	This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief. This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to carry out overhauling activities on components of aircraft avionic equipment, in accordance with approved procedures. The equipment to be overhauled will have been removed from the aircraft and the overhauling activities may take place in a workshop or hangar. It covers equipment used in both fixed wing and rotary winged aircraft, and includes a range of equipment such as communication, radar, electrical, pitot static, passive warning and optical surveillance, flight guidance and control, navigation and computing and lighting systems as applicable to the aircraft type. The overhauling activities will include carrying out all necessary safety checks, dismantling the equipment to unit or component level, inspecting and checking all components for damage and wear, replacing all `lifed' items and worn/faulty components or units, reassembling the equipment and carrying out all necessary tests/checks. Their responsibilities will require them to comply with organisational policy and procedures for the overhauling activities undertaken, and to report any problems with the overhauling activities, or with the tools and equipment used that they cannot personally resolve or that is outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used in the overhauling activities are removed from the work area, and that all necessary job/task documentation is completed accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

	Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying appropriate overhauling procedures to aircraft avionic equipment. They will understand the dismantling and reassembly methods and procedures used, and their application. They will know how the equipment functions, the common faults encountered, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the overhauling activities and for ensuring that the overhauled equipment meets the required specification. They will understand the safety precautions required when carrying out the overhauling activities. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace. They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall objectives of the organisation, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.
Endorsed by	SEMTA

Performance Requirements

The learner can:

P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines

P2 demonstrate the required behaviours in line with the job role and organisational objectives

P3 follow the relevant overhauling schedules to carry out the required work

P4 establish the components to be removed and where appropriate, mark/label components to aid re-assembly

P5 carry out the overhaul to the agreed level, using the correct tools and techniques

P6 ensure that all removed components are correctly identified and stored in the correct location

P7 report any instances where the overhauling activities cannot be fully met, or where there are identified defects outside the planned overhauling schedule

P8 complete the relevant documentation in accordance with organisational requirements

P9 dispose of unwanted components, waste materials and substances in accordance with safe working practices and approved procedures

P10 deal promptly and effectively with problems within their control and report those that cannot be solved

Learning outcome

The learner will:

1 carry out all of the following during the overhauling activities:

Assessment criteria

1.1 obtain and use the appropriate documentation (such as job instructions, aircraft manuals and overhauling documentation, technical instructions and other relevant maintenance documentation)

1.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work

1.3 provide and maintain safe access and working arrangements for the overhauling area

1.4 obtain the correct tools and equipment for the activity and check that they are in a safe, tested and usable condition and within current certification/calibration date

1.5 where appropriate, apply Electrostatic Discharge (ESD) protection procedures

1.6 carry out the overhauling activities, using approved techniques and procedures at all times

1.7 return all tools and equipment to the correct location on completion of the activities

1.8 leave the work area and the avionic equipment in a safe and appropriate condition, free from foreign object debris on completion of the activities

Learning outcome

The learner will:

2 carry out the overhauling activities to unit level on three of the following types of aircraft avionic equipment:

Assessment criteria

2.1 communication

2.2 passive warning and optical/surveillance

2.3 radar

2.4 flight guidance and control

2.5 electrical
2.6 navigation and computing
2.7 pitot static
2.8 internal and external lighting

Learning outcome

The learner will:

3 carry out all of the following activities, as applicable to the equipment being overhauled:

Assessment criteria

3.1 cleaning parts prior to dismantling
3.2 replacing all damaged/defective components
3.3 pre-disassembly checks and tests
3.4 reassembling equipment
3.5 disconnecting and de-soldering electrical connections
3.6 setting and adjusting/calibrating replaced components (such as power output, voltage)
3.7 removal of earth bonding
3.8 removal of conformal coating
3.9 making mechanical connections
3.10 removing cable securing devices
3.11 soldering electrical connections
3.12 removing bolt securing devices and mechanical fasteners
3.13 carrying out earth bonding
3.14 dismantling equipment to unit/sub-assembly level
3.15 installing cable securing devices
3.16 dismantling units to component level
3.17 tightening fastenings to the required torque
3.18 marking/labelling of components to aid reassembly
3.19 checking components for serviceability
3.20 re-instating conformal coating
3.21 replacing all `lifed' items (seals, dust caps)
3.22 securing components using mechanical fasteners and threaded devices
3.23 applying locking and retaining devices (such as circlips, pins, wire locking)

Learning outcome

The learner will:

4 carry out overhauling activities to component level on three of the following avionic equipment components:

Assessment criteria

4.1 transmitter/receiver
4.2 transducer
4.3 computer
4.4 lighting unit
4.5 recorder/camera
4.6 transformer
4.7 scanner
4.8 rectifier
4.9 aerial
4.10 inverters
4.11 displays/indicators
4.12 amplifier
4.13 control unit
4.14 inertial navigation/gyros
4.15 signal generator
4.16 actuators
4.17 interface unit
4.18 generator/alternator
4.19 power supply
4.20 contactor
4.21 switching unit
4.22 tuning unit
4.23 other specific avionic component

Learning outcome

The learner will:

5 replace a range of avionic equipment components, to include eight of the following:

Assessment criteria

5.1 batteries
5.2 desiccant units
5.3 switches
5.4 filament lamps/light emitting diodes
5.5 breakers/contacts
5.6 wires/cables
5.7 fuses
5.8 plugs/sockets/terminations
5.9 relays

5.10 speakers
5.11 transformers
5.12 microphone units
5.13 circuit breakers
5.14 chassis components
5.15 printed circuit boards
5.16 screws/bolts/washers
5.17 electronic components (such as resistors, capacitors)
5.18 coolants
5.19 unit trays
5.20 gaskets/seals
5.21 instruments/gauges/indicators
5.22 headsets
5.23 transducers/sensors
5.24 pipes/hoses
5.25 moisture drains/traps
5.26 film/digital modules
5.27 aerials
5.28 transparencies/lenses
5.29 terminal blocks
5.30 other specific components

Learning outcome

The learner will:

6 carry out checks and tests on the overhauled equipment, to include three of the following:

Assessment criteria

6.1 visual inspection for completeness and freedom from damage or foreign objects
6.2 signal injection tests
6.3 power output
6.4 soak test
6.5 continuity checks
6.6 bonding tests
6.7 standard serviceability test
6.8 Voltage Standing Wave Ratio (VSWR) checks
6.9 `special-to-type' tests
6.10 pressure/leak test
6.11 voltage checks
6.12 comparison check

6.13 other specific checks

Learning outcome

The learner will:

7 overhaul aircraft avionic equipment in compliance with one of the following:

Assessment criteria

The learner can:

7.1 Military Aviation Authority (MAA)
7.2 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
7.3 BS, ISO or BSEN standards and procedures
7.4 Aerospace Quality Management Standards (AS)
7.5 specific system requirements
7.6 Federal Aviation Authority (FAA)
7.7 organisation standards and procedures
7.8 manufacturers standards and procedures

Learning outcome

The learner will:

8 complete the relevant documentation, to include one from the following and pass it to the appropriate people:

Assessment criteria

8.1 computer records
8.2 record/history cards
8.3 job cards
8.4 aircraft service/flight log
8.5 other specific recording method

Knowledge and understanding

The learner must know and understand:

K1 the safe working practices and procedures and the specific safety precautions to be taken when overhauling avionic equipment (to include wearing protective clothing and equipment; lifting and handling techniques; safe working practices and procedures with regard to working on aircraft avionic equipment; procedures and guidelines which satisfy current regulations such as HASAWA, COSHH and other work related legislation and guidelines)

K2 the hazards associated with overhauling avionic equipment, and with the tools and equipment used, and how to minimise them and reduce any risks

K3 The importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to

K4 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to

K5 the protective equipment that they need to use for both personal protection (PPE) and protection of the avionic equipment

K6 what constitutes a hazardous voltage and how to recognise victims of electric shock

K7 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)

K8 how to extract and use information from equipment manuals, history/maintenance reports, charts, circuit and physical layouts, specifications, symbols used in aircraft avionic systems and other documents needed in the overhauling process

K9 how to carry out currency/issue checks on the specifications they are working with

K10 terminology used in aircraft avionic equipment, and the use of system diagrams and associated symbols

K11 the basic principles of operation of the aircraft avionic equipment being overhauled, and the performance characteristics and function of the components within the equipment

K12 the techniques used to remove components from aircraft avionic equipment, without damage to the components or surrounding structure (such as de-soldering components, applying electrostatic discharge (ESD) protection procedures)

K13 the various types of electrical connector that are used, methods of unlocking, orientation indicators, and locating and locking in of the connections

K14 the various mechanical fasteners that are used and their method of removal and replacement (such as threaded fasteners, special securing devices)

K15 the importance of using the specified fasteners for the particular installation and why they must not substitute others

K16 why securing devices need to be locked and labelled, and the different methods that are used to remove and install them

K17 the torque loading requirements of the fasteners and what to do if these loadings are exceeded or not achieved

K18 the need to correctly label and store components, and to check that replaced components have the correct part/identification markings

K19 the procedure for obtaining replacement parts, materials and other consumables necessary for the overhaul

K20 the techniques used to position, align, adjust and secure the replaced components to the equipment, without damage to the components or surrounding structure

K21 the quality control procedures to be followed during the overhauling operations

K22 procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities

K23 methods of lifting, handling and supporting the components/equipment during the removal and replacement activities

K24 the use of seals, sealant and adhesives and anti-electrolysis barriers and the precautions to be taken

K25 why electrical bonding is critical and why it must be both mechanically and electrically secure

K26 how to conduct any necessary checks and adjustments to ensure the system integrity, accuracy and quality of the overhaul

K27 the tools and equipment used in the overhauling activities and their calibration/care and control procedures

K28 why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the overhauling activities

K29 the problems that can occur with the overhauling operations and how these can be overcome

K30 how to recognise defects (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)

K31 the recording documentation to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation

K32 the procedure for the safe disposal of waste materials and scrap components

K33 the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve

Unit 422 Overhauling components of aircraft avionic equipment

Supporting Information

Unit guidance

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme whilst meeting their own requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

Appendix 1 Relationships to other qualifications

Links to other qualifications

Centres are responsible for checking the different requirements of all qualifications they are delivering and ensuring that candidates meet requirements of all units/qualifications.

Literacy, language, numeracy and ICT skills development

This [these] qualification[s] can develop skills that can be used in the following qualifications:

- Functional Skills (England) – see www.cityandguilds.com/functionalskills
- Essential Skills (Northern Ireland) – see www.cityandguilds.com/essentialskillsni
- Essential Skills Wales – see www.cityandguilds.com/esw

Appendix 2 Sources of general information

The following documents contain essential information for centres delivering City & Guilds qualifications. They should be referred to in conjunction with this handbook. To download the documents and to find other useful documents, go to the Centres and Training Providers homepage on www.cityandguilds.com.

Centre Manual - Supporting Customer Excellence contains detailed information about the processes which must be followed and requirements which must be met for a centre to achieve 'approved centre' status, or to offer a particular qualification, as well as updates and good practice exemplars for City & Guilds assessment and policy issues.

Specifically, the document includes sections on:

- The centre and qualification approval process
- Assessment, internal quality assurance and examination roles at the centre
- Registration and certification of candidates
- Non-compliance
- Complaints and appeals
- Equal opportunities
- Data protection
- Management systems
- Maintaining records
- Assessment
- Internal quality assurance
- External quality assurance.

Our Quality Assurance Requirements encompasses all of the relevant requirements of key regulatory documents such as:

- SQA Awarding Body Criteria (2007)
- NVQ Code of Practice (2006)

and sets out the criteria that centres should adhere to pre and post centre and qualification approval.

Access to Assessment & Qualifications provides full details of the arrangements that may be made to facilitate access to assessments and qualifications for candidates who are eligible for adjustments in assessment.

The **centre homepage** section of the City & Guilds website also contains useful information on such things as:

- **Walled Garden**: how to register and certificate candidates on line
- **Events:** dates and information on the latest Centre events
- **Online assessment**: how to register for e-assessments.

Centre Guide – Delivering International Qualifications contains detailed information about the processes which must be followed and requirements which must be met for a centre to achieve 'approved centre' status, or to offer a particular qualification.

Specifically, the document includes sections on:

- The centre and qualification approval process and forms
- Assessment, verification and examination roles at the centre
- Registration and certification of candidates
- Non-compliance
- Complaints and appeals
- Equal opportunities
- Data protection
- Frequently asked questions.

Appendix 3 Useful contacts

UK learners General qualification information	**E: learnersupport@cityandguilds.com**
International learners General qualification information	F: +44 (0)20 7294 2413 **E: intcg@cityandguilds.com**
Centres Exam entries, Certificates, Registrations/enrolment, Invoices, Missing or late exam materials, Nominal roll reports, Results	F: +44 (0)20 7294 2413 **E: centresupport@cityandguilds.com**
Single subject qualifications Exam entries, Results, Certification, Missing or late exam materials, Incorrect exam papers, Forms request (BB, results entry), Exam date and time change	F: +44 (0)20 7294 2413 F: +44 (0)20 7294 2404 (BB forms) **E: singlesubjects@cityandguilds.com**
International awards Results, Entries, Enrolments, Invoices, Missing or late exam materials, Nominal roll reports	F: +44 (0)20 7294 2413 **E: intops@cityandguilds.com**
Walled Garden Re-issue of password or username, Technical problems, Entries, Results, e-assessment, Navigation, User/menu option, Problems	F: +44 (0)20 7294 2413 **E: walledgarden@cityandguilds.com**
Employer Employer solutions, Mapping, Accreditation, Development Skills, Consultancy	T: +44 (0)121 503 8993 **E: business@cityandguilds.com**
Publications Logbooks, Centre documents, Forms, Free literature	F: +44 (0)20 7294 2413

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As the UK's leading vocational education organisation, City & Guilds is leading the talent revolution by inspiring people to unlock their potential and develop their skills. We offer over 500 qualifications across 28 industries through 8500 centres worldwide and award around two million certificates every year. City & Guilds is recognised and respected by employers across the world as a sign of quality and exceptional training.

City & Guilds Group

The City & Guilds Group is a leader in global skills development. Our purpose is to help people and organisations to develop their skills for personal and economic growth. Made up of City & Guilds, City & Guilds Kineo, The Oxford Group and ILM, we work with education providers, businesses and governments in over 100 countries.

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