QUALIFICATION HANDBOOK

Level 3 NVQ Diploma in Aeronautical Engineering (Avionics Maintenance) (1789-31)

September 2018 version 1.2

City & Guilds

Qualification at a glance

Subject area	**Engineering**
City & Guilds number	1789
Age group approved	16-18, 19+
Entry requirements	Level 3
Assessment	Portfolio
Fast track	Available
Support materials	Centre handbook
Registration and certification	Consult the Walled Garden/Online Catalogue for last dates

Title and level	City & Guilds number	Accreditation number
Level 3 NVQ Diploma in Aeronautical Engineering (Avionics Maintenance) (1789-31)	1789-31	600/1575/5

Version and date	Change detail	Section
1.1 November 2012	Formatting (not allowing sentences to split between two pages)	Units 001, 403 and 404
1.2 September 2018	Changed from a seven to a nine	Unit 001 assessment criteria 2.3

Contents

1 Introduction

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

Area	Description
Who is the qualification for?	It is for candidates who work or want to work in the engineering sector
What does the qualification cover?	It allows candidates to learn, develop and practise the skills required for employment and/or career progression in the engineering sector.
Is the qualification part of a framework or initiative?	It serves as a technical certificate, in the engineering Apprenticeship framework.

Structure

To achieve the **Level 3 Diploma in Aeronautical Engineering (Avionics Maintenance)**, learners must achieve **20** credits from the mandatory units, **93** credits from Mandatory Group 2, **161** credits from Optional Group 1 and **106** credits from Optional Group 2.

Unit accreditation number	City & Guilds unit	Unit title	Credit value
Mandatory			
A/601/5013	001	Complying with statutory regulations and organisational safety requirements	5
Y/601/5102	002	Using and interpreting engineering drawings and documents	5
K/601/5055	403	Working efficiently and effectively in engineering	5
K/601/4228	404	Reinstating the work area on completion of activities	5
Mandatory		**Group 2**	
F/601/4753	520	Carrying out fault diagnosis on aircraft avionics components or systems	53
J/601/4754	521	scheduled maintenance of aircraft avionics equipment/systems	40
Optional		**Group 1**	
R/601/4756	522	Removing and replacing avionic indication and gauging components in aircraft systems	86

Unit accreditation number	City & Guilds unit	Unit title	Credit value
H/601/4759	523	Removing and replacing components of aircraft electrical power control, distribution and protection systems	86
D/601/4761	524	Removing and replacing components of aircraft pitot static systems	86
H/601/4762	525	Removing and replacing components of aircraft armament systems	86
K/601/4763	526	Removing and replacing components of aircraft communication systems	86
T/601/4765	527	Removing and replacing components of aircraft passive warning and optical/surveillance systems	86
F/601/4767	528	Removing and replacing components of aircraft radar systems	86
L/601/4769	529	Removing and replacing components of aircraft navigational and computing systems	86
J/601/4771	530	Removing and replacing components of aircraft flight guidance and control systems	86
L/601/4772	531	Removing and replacing components of aircraft internal and external lighting systems	84
R/601/4773	532	Modifying aircraft avionic systems	77
Optional		**Group 2**	
Y/601/4774	533	Carrying out tests on avionic indication and gauging components of aircraft systems	53
H/601/4776	534	Carrying out tests on aircraft electrical power control, distribution and protection systems	53
M/601/4781	535	Carrying out tests on aircraft pitot static systems	53
A/601/4783	536	Carrying out tests on aircraft communication systems	53
F/061/4784	537	Carrying out tests on aircraft passive warning and optical/surveillance systems	53
R/601/4787	538	Carrying out tests on aircraft radar systems	53
D/601/4789	539	Carrying out tests on aircraft navigational and computing systems	53
Y/601/4791	540	Carrying out tests on aircraft flight guidance and control systems	53

2 Centre requirements

Approval

Centres currently offering the City & Guilds NVQ in Aeronautical Engineering (1689) will be automatically approved to run this new qualification.

To offer this qualification 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 qualification before designing a course programme.

Resource requirements

Physical resources and site agreements

Centres can use specially designated areas within a centre to assess, for example, the installation of specialised electrical systems, alignment and setting up of electric motors and driven devices (pumps, compressors and generators). The equipment, systems and machinery must meet industrial standards and be capable of being used under normal working conditions, for example electric motors must have a method of applying sufficient power and not be connected up to show movement.

Centre staffing

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

- be occupationally competent or technically knowledgeable in the area 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.

Assessors and internal verifier

Assessor requirements to demonstrate effective assessment practice

Assessment must be carried out by competent Assessors that as a minimum must hold the QCF Level 3 Award in Assessing Competence in the Work Environment**.** Current and operational assessors that hold units

D32 and/or D33 or A1 and/or A2 as appropriate for the assessment requirements set out in this Unit Assessment Strategy. However, they will be expected to regularly review their skills, knowledge and understanding and where applicable undertake continuing professional development to ensure that they are carrying out workplace assessment to the most up to date National Occupational Standards (NOS)

Assessor technical requirements

Assessors must be able to demonstrate that they have verifiable, relevant and sufficient technical competence to evaluate and judge performance and knowledge evidence requirements as set out in the relevant QCF unit learning outcomes and associated assessment criteria.

This will be demonstrated either by holding a relevant technical qualification or by proven industrial experience of the technical areas to be assessed. The assessor's competence must, at the very least, be at the same level as that required of the learner(s) in the units being assessed.

Assessors must also be:

- Fully conversant with the Awarding Organisation's assessment recording documentation used for the QCF NVQ units against which the assessments and verification are to be carried out, other relevant documentation and system and procedures to support the QA process.

Verifier requirements (internal and external)

Internal quality assurance (Internal Verification) must be carried out by competent Verifiers that as a minimum must hold the QCF Level 4 Award in the Internal Quality Assurance of Assessment Processes and Practices. Current and operational Internal Verifiers that hold internal verification units V1 or D34 will not be required to achieve the QCF Level 4 Award as they are still appropriate for the verification requirements set out in this Unit Assessment Strategy. Verifiers must be familiar with, and preferably hold, either the nationally recognised Assessor units D32 and/or D33 or A1 and/or A2 or the QCF Level 3 Award in Assessing Competence in the Work Environment.

External quality assurance **(external verification)** must be carried out by competent External Verifiers that as a minimum must hold the QCF Level 4 Award in the External Quality Assurance of Assessment Processes and Practices**.** Current and operational External Verifiers that hold external verification units V2 or D35 will not be required to achieve the QCF Level 4 Award as they are still appropriate for the verification requirements set out in this Unit Assessment Strategy. Verifiers must be familiar with, and preferably hold, either the nationally recognised Assessor units D32 and/or D33 or A1 and/or A2 or the QCF Level 3 Award in Assessing Competence in the Work Environment.

External and Internal Verifiers will be expected to regularly review their skills, knowledge and understanding and where applicable undertake continuing professional development to ensure that they are carrying out workplace Quality Assurance (verification) of Assessment Processes and Practices to the most up to date National Occupational Standards (NOS) Verifiers, both Internal and External, will also be expected to be fully conversant with the terminology used in the QCF NVQ units against which the assessments and verification are to be carried out, the appropriate

Regulatory Body's systems and procedures and the relevant Awarding Organisation's documentation.

Continuing professional development (CPD)

Centres must support their staff to ensure that they have current knowledge of the occupational area, that delivery, mentoring, training, assessment and verification is in line with best practice, and that it takes account of any national or legislative developments.

Candidate entry requirements

City & Guilds does not set entry requirements for this qualification. However, centres must ensure that candidates have the potential and opportunity to gain the qualification successfully so should have the opportunity to gather work based evidence.

The Semta Engineering Manufacture apprenticeship framework suggests that:

- Employers would be interested in candidates that:
    - Are keen and motivated to work in an engineering environment
    - Are willing to undertake a course of training both on-the-job and off-the-job and apply this learning in the workplace
    - Have previous work experience or employment in the sector
    - Have completed a 14 to 19 Diploma in Engineering or Manufacturing
    - Have completed a Young Apprenticeship in Engineering or other related area
    - Have GCSEs in English, Maths and Science
    - Have completed tests in basic numeracy, literacy and communication skills and have spatial awareness.

As a guide, the Engineering Manufacturing framework is suitable for applicants who have five GCSEs grades D to E in English, Maths and Science. The selection process on behalf of employers may include initial assessment where applicants will be asked if they have any qualifications or experience that can be accredited against the requirements of the apprenticeship. They may also be required to take tests in basic numeracy and literacy, communications skills and spatial awareness. There may also be an interview to ensure applicants have selected the right occupational sector and are motivated to become an apprentice, as undertaking an apprenticeship is a major commitment for both the individual and the employer.'

Assessment environment (extract from Semta QCF Unit Assessment Strategy 1 January 2011)

The evidence put forward for this qualification can only be regarded valid, reliable, sufficient and authentic if achieved and obtained in the working environment and be clearly attributable to the learner. However, in certain circumstances, simulation/replication of work activities may be acceptable.

The use of high quality, realistic simulations/replication, which impose pressures which are consistent with workplace expectations, should only be used in relation to the assessment of the following:

- rare or dangerous occurrences, such as those associated with health, safety and the environment issues, emergency scenarios and rare operations at work;
- the response to faults and problems for which no opportunity has presented for the use of naturally occurring workplace evidence of learners competence;
- aspects of working relationships and communications for which no opportunity has presented for the use of naturally occurring workplace evidence of learners competence.

Simulations/replications will require prior approval from centres City & Guilds external verifier/qualification consultant and should be designed in relation to the following parameters:

- the environment in which simulations take place must be designed to match the characteristics of the working environment
- competencies achieved via simulation/replication must be transferable to the working environment
- simulations which are designed to assess competence in dealing with emergencies, accidents and incidents must be verified as complying with relevant health, safety and environmental legislation by a competent health and safety/environmental control officer before being used
- simulated activities should place learners under the same pressures of time, access to resources and access to information as would be expected if the activity was real
- simulated activities should require learners to demonstrate their competence using plant and/or equipment used in the working environment
- simulated activities which require interaction with colleagues and contacts should require the learner to use the communication media that would be expected at the workplace
- for health and safety reason simulations need not involve the use of genuine substances/materials. Any simulations which require the learner to handle or otherwise deal with materials substances/should ensure that the substitute take the same form as in the workplace.

Age restrictions

There is no age restriction for this qualification unless this is a legal requirement of the process or the environment.

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 qualification.
- any units they have already completed, or credit they have accumulated which is relevant to the qualification.
- the appropriate type and level of qualification.

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

Support materials

The following resources are available for this these qualifications

Description	How to access
Personal Learning and Thinking skills (required for apprenticeship)	**www.cityandguilds.com**, 1789 product documentation pages
Centre approval forms	**www.cityandguilds.com**
Semta QCF Assessment Strategy	**www.cityandguilds.com**
Unit assessment guidance	**www.cityandguilds.com**, 1789 product documentation pages

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

Assessment of the qualification (extract from Semta QCF Unit Assessment Strategy 1 January 2011)

Carrying out assessments

The NVQ units were specifically developed to cover a wide range of activities. The evidence produced for the units will, therefore, depend on the learner's choice of 'bulleted items' listed in the unit assessment criteria.

Where the assessment criteria gives a choice of bulleted items (for example 'any three from five'), assessors should note that learners do not need to provide evidence of the other items to complete the unit (in this example, two) items, particularly where these additional items may relate to other activities or methods that are not part of the learners normal workplace activity or area of expertise.

Minimum 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 3 different examples of performance must be provided, and must be sufficient to show that the assessment criteria have been achieved to the prescribed standards. It is possible that some of the bulleted items in the assessment criteria may be covered more than once. The assessor and learner need to devise an assessment plan to ensure that performance evidence is sufficient to cover all the specified assessment criteria and which maximises the opportunities to gather evidence. Where applicable, performance evidence may be used for more than one unit.

The most effective way of assessing competence, is through direct observation of the learner. Assessors must make sure that the evidence provided reflects the learner's competence and not just the achievement of a training programme.

Evidence that has been produced from team activities, for example, maintenance or installation activities is only valid when it clearly relates to the learners specific and individual contribution to the activity, and not to the general outcome(s).

Each example of performance evidence will often contain features that apply to more than one unit, and can be used as evidence in any unit where appropriate.

Performance evidence must be a combination of:

- outputs of the learner's work, such as items that have been manufactured, installed, maintained, designed, planned or quality assured, and documents produced as part of a work activity together with:
- evidence of the way the learner carried out the activities such as witness testimonies, assessor observations or authenticated learner reports, records or photographs of the work/activity carried out, etc.

Competent performance is more than just carrying out a series of individual set tasks. Many of the units contain statements that require the learner to provide evidence that proves they are capable of combining the various features and techniques. Where this is the case, separate fragments of evidence would not provide this combination of features and techniques and will not, therefore, be acceptable as demonstrating competent performance.

If there is any doubt as to what constitutes valid, authentic and reliable evidence, the internal and/or external verifier (qualifications consultant) should be consulted.

Assessing knowledge and understanding

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 learner's knowledge and understanding (and the handling of contingency situations) 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. Semta (the Sector Skills Council) expects oral questioning and practical demonstrations to be used, as these are considered the most appropriate for these units. Assessors should ask enough questions to make sure that the learner has an appropriate level of knowledge and understanding, as required by the unit.

Evidence of knowledge and understanding will **not** be required for those bulleted items in the assessment criteria that have not been selected by the learner.

The achievement of the specific knowledge and understanding requirements of the units cannot simply be inferred by the results of tests or assignments from other units, qualifications or training programmes. Where evidence is submitted from these sources, the assessor must, as with any assessment, make sure the evidence is valid, reliable, authentic, directly attributable to the learner, and meets the full knowledge and understanding requirements of the unit. Where oral questioning is used the assessor must retain a record of the questions asked, together with the learner'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 learner. This could be a team leader, supervisor, mentor or line manager who may be regarded as a suitable witness to the learner'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 learner. It will be the responsibility of the assessor to make sure that any witness testimonies accepted as evidence of the learner's competency are reliable, auditable and technically valid.

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.

RPL is allowed and is also sector specific.

5 Units

Availability of units

Below is a list of the learning outcomes for all the units. If you want to download a complete set of units, go to **www.cityandguilds.com**

Structure of units

These units each have the following:

- City & Guilds reference number
- unit accreditation number (UAN)
- title
- level
- credit value
- unit aim
- relationship to NOS, other qualifications and frameworks
- endorsement by a sector or other appropriate body
- information on assessment
- learning outcomes which are comprised of a number of assessment criteria
- notes for guidance.

Unit 001 Complying with statutory regulations and organisational safety requirements

UAN:	**A/601/5013**
Level:	2
Credit value:	5
GLH:	35
Relationship to NOS:	This unit has been derived from national occupational standard: Complying with statutory regulations and organisational safety requirements (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to deal with statutory regulations and organisational safety requirements. It does not deal with specific safety regulations or detailed requirements, it does, however, cover the more general health and safety requirements that apply to working in an industrial environment. The learner will be expected 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. The learner will need to be able to identify the relevant qualified first aiders and know the location of the first aid facilities. The learner will have a knowledge and 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. The learner will also need to be fully conversant with their organisation's procedures for fire alerts and the evacuation of premises. The learner will also 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, the materials and substances that they use, any working practices that do not follow laid-down procedures, and manual

lifting and carrying techniques.

The learner's responsibilities will require them to comply with all relevant statutory and organisational policy and procedures for health and safety in the workplace. The learner must act in a responsible and safe manner at all times, and present themselves in the workplace suitably prepared for the activities to be undertaken. The learner will be expected to report any problems with health and safety issues, to the relevant authority.

The learner's knowledge will provide a good understanding of the relevant statutory regulations and organisational requirements associated with their work, and will provide an informed approach to the procedures used. The learner will need to understand their organisation's health and safety requirements and their application, in adequate depth to provide a sound basis for carrying out their activities in a safe and competent manner.

Learning outcome
The learner will: 1. Be able to comply with statutory regulations and organisational safety requirements
Assessment criteria
The learner can: 1.1 comply with their duties and obligations as defined in the Health and Safety at Work Act 1.2 demonstrate their understanding of their duties and obligations to health and safety by: • applying in principle their duties and responsibilities as an individual under the Health and Safety at Work Act • identifying, within their organisation, appropriate sources of information and guidance on health and safety issues, such as: o eye protection and personal protective equipment (PPE) o COSHH regulations o Risk assessments • identifying the warning signs and labels of the main groups of hazardous or dangerous substances • complying with the appropriate statutory regulations at all times 1.3 present themselves in the workplace suitably prepared for the activities to be undertaken 1.4 follow organisational accident and emergency procedures 1.5 comply with emergency requirements, to include: • identifying the appropriate qualified first aiders and the location of first aid facilities • identifying the procedures to be followed in the event of injury to themselves or others

- following organisational procedures in the event of fire and the evacuation of premises
- identifying the procedures to be followed in the event of dangerous occurrences or hazardous malfunctions of equipment

1.6 recognise and control hazards in the workplace

1.7 Identify the hazards and risks that are associated with the following:

- their working environment
- the equipment that they use
- materials and substances (where appropriate) that they use
- working practices that do not follow laid-down procedures

1.8 use correct manual lifting and carrying techniques

1.9 demonstrate one of the following methods of manual lifting and carrying:

- lifting alone
- with assistance of others
- with mechanical assistance

1.10 apply safe working practices and procedures to include:

- maintaining a tidy workplace, with exits and gangways free from obstruction
- using equipment safely and only for the purpose intended
- observing organisational safety rules, signs and hazard warnings
- taking measures to protect others from any harm resulting from the work that they are carrying out.

Learning outcome
The learner will: 2. Know how to comply with statutory regulations and organisational safety requirements
Assessment criteria
The learner can: 2.1 describe the roles and responsibilities of themselves and others under the Health and Safety at Work Act, and other current legislation 2.2 describe the specific regulations and safe working practices and procedures that apply to their work activities 2.3 describe the warning signs for the nine main groups of hazardous substances defined by Classification, Packaging and Labelling of Dangerous Substances Regulations 2.4 explain how to locate relevant health and safety information for their tasks, and the sources of expert assistance when help is needed 2.5 explain what constitutes a hazard in the workplace 2.6 describe their responsibilities for identifying and dealing with hazards and reducing risks in the workplace 2.7 describe the risks associated with their working environment 2.8 describe the processes and procedures that are used to identify and rate the level of risk

2.9	describe the first aid facilities that exist within their work area and within the organisation in general; the procedures to be followed in the case of accidents involving injury
2.10	explain what constitute dangerous occurrences and hazardous malfunctions, and why these must be reported even if no-one is injured
2.11	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
2.12	describe the organisational policy with regard to fire fighting procedures; the common causes of fire and what they can do to help prevent them
2.13	describe the protective clothing and equipment that is available for their areas of activity
2.14	explain how to safely lift and carry loads, and the manual and mechanical aids available
2.15	explain how to prepare and maintain safe working areas; the standards and procedures to ensure good housekeeping
2.16	describe the importance of safe storage of tools, equipment, materials and products
2.17	describe the extent of their own authority, and to whom they should report in the event of problems that they cannot resolve.

Unit 001 Complying with statutory regulations and organisational safety requirements

Supporting information

Guidance

2.1 (such as The Management of Health and Safety at Work Regulations, Workplace Health and Safety and Welfare Regulations, Personal Protective Equipment at Work Regulations, Manual Handling Operations Regulations, Provision and Use of Work Equipment Regulations, Display Screen at Work Regulations, Reporting of Injuries, Diseases and Dangerous Occurrences Regulations)

2.5 (such as moving parts of machinery, electricity, slippery and uneven surfaces, poorly placed equipment, dust and fumes, handling and transporting, contaminants and irritants, material ejection, fire, working at height, environment, pressure/stored energy systems, volatile, flammable or toxic materials, unshielded processes, working in confined spaces)

2.7 (such as the tools, materials and equipment that they use, spillages of oil, chemicals and other substances, not reporting accidental breakages of tools or equipment and not following laid-down working practices and procedures)

2.8 (such as safety inspections, the use of hazard checklists, carrying out risk assessments, COSHH assessments)

Unit 002 Using and interpreting engineering data and documentation

UAN:	**Y/601/5102**
Level:	2
Credit value:	5
GLH:	25
Relationship to NOS:	This unit has been derived from national occupational standard: Using and interpreting engineering data and documentation (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to make effective use of text, numeric and graphical information, by interpreting and using technical information extracted from documents such as engineering drawings, technical manuals, reference tables, specifications, technical sales/marketing documentation, charts or electronic displays, in accordance with approved procedures. The learner will be required to extract the necessary information from the various documents, in order to establish and carry out the work requirements, and to make valid decisions about the work activities based on the information extracted. The learner's responsibilities will require them to comply with organisational policy and procedures for obtaining and using the documentation applicable to the activity. They will be expected to report any problems with the use and interpretation of the documents that they cannot personally resolve, or are outside their permitted authority, to the relevant people. They will be expected to work to instructions if necessary, with an appropriate level of supervision or as a member of a team, and take personal responsibility for their own actions and for the quality and accuracy of the work that they carry out. The learner's underpinning knowledge will provide a good understanding of the types of documentation used, and will provide an

informed approach to applying instructions and procedures. They will be able to read and interpret the documentation used and will know about the conventions, symbols and abbreviations, in adequate depth to provide a sound basis for carrying out the activities to the required specification.

Learning outcome
The learner will: 1. be able to use and interpret engineering data and documentation
Assessment criteria
The learner can: 1.1 use the approved source to obtain the required data and documentation 1.2 use the data and documentation and carry out all of the following: • check the currency and validity of the data and documentation used • exercise care and control over the documents at all times • correctly extract all necessary data in order to carry out the required tasks • seek out additional information where there are gaps or deficiencies in the information obtained • deal with or report any problems found with the data and documentation • make valid decisions based on the evaluation of the engineering information extracted from the documents • return all documents to the approved location on completion of the work • complete all necessary work related documentation such as production documentation, installation documentation, maintenance documentation, planning documentation 1.3 correctly identify, interpret and extract the required information 1.4 extract information that includes three of the following: • materials or components required • dimensions • tolerances • build quality • installation requirements • customer requirements • time scales • financial information • operating parameters • surface texture requirements • location/orientation of parts • process or treatments required • dismantling/assembly sequence • inspection/testing requirements • number/volumes required

- repair/service methods
- method of manufacture
- weld type and size
- operations required
- connections to be made
- surface finish required
- shape or profiles
- fault finding procedures
- safety/risk factors
- environmental controls
- specific data (such as component data, maintenance data, electrical data, fluid data)
- resources (such as tools, equipment, personnel)
- utility supply details (such as electricity, water, gas, air)
- location of services, including standby and emergency backup systems
- circuit characteristics (such as pressure, flow, current, voltage, speed)
- protective arrangements and equipment (such as containment, environmental controls, warning and evacuation systems and equipment)
- other specific related information

1.5 use the information obtained to ensure that work output meets the specification

1.6 use information extracted from documents to include one from the following:

- drawings (such as component drawings, assembly drawings, modification drawings, repair drawings, welding/fabrication drawings, distribution and installation drawings)
- diagrams (such as schematic, fluid power diagrams, piping, wiring/circuit diagrams)
- manufacturers manuals/drawings
- approved sketches
- technical illustrations
- photographic representations
- visual display screen information
- technical sales/marketing documentation
- contractual documentation
- other specific drawings/documents

1.7 use information extracted from related documentation, to include two from the following:

- instructions (such as job instructions, drawing instructions, manufacturers instructions)
- specifications (such as material, finish, process, contractual, calibration)
- reference materials (such as manuals, tables, charts, guides, notes)
- schedules

- operation sheets
- service/test information
- planning documentation
- quality control documents
- company specific technical instructions
- national, international and organisational standards
- health and safety standards relating to the activity (such as COSHH)
- other specific related documentation

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

1.9 report any inaccuracies or discrepancies in documentation and specifications.

Learning outcome
The learner will: 2. Know how to use and interpret engineering data and documentation
Assessment criteria
The learner can: 2.1 explain what information sources are used for the data and documentation that they use in their work activities 2.2 explain how documents are obtained, and how to check that they are current and valid 2.3 explain the basic principles of confidentiality (including what information should be available and to whom) 2.4 describe the different ways/formats that data and documentation can be presented 2.5 explain how to use other sources of information to support the data 2.6 describe the importance of differentiating fact from opinion when reviewing data and documentation 2.7 describe the importance of analysing all available data and documentation before decisions are made 2.8 describe the different ways of storing and organising data and documentation to ensure easy access 2.9 describe the procedures for reporting discrepancies in the data or documentation, and for reporting lost or damaged documents 2.10 describe the importance of keeping all data and documentation up to date during the work activity, and the implications of this not being done 2.11 explain the care and control procedures for the documents, and how damage or graffiti on documents can lead to scrapped work 2.12 explain the importance of returning documents to the designated location on completion of the work activities 2.13 explain what basic drawing conventions are used and why there needs to be different types of drawings (such as isometric and orthographic, first and third angle, assembly drawings, circuit and wiring diagrams, block and schematic diagrams 2.14 explain what types of documentation are used and how they interrelate 2.15 explain the imperial and metric systems of measurement; tolerancing and fixed reference points

2.16	describe the meaning of the different symbols and abbreviations found on the documents that they use
2.17	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 002 Using and interpreting engineering data and documentation

Supporting information

Guidance

2.4 (such as such as drawings, job instructions product data sheets, manufacturers' manuals, financial spreadsheets, production schedules, inspection and calibration requirements, customer information)

2.5 (such as electronic component pin configuration specifications, reference charts, standards, bend allowances required for material thickness, electrical conditions required for specific welding rods, mixing ratios for bonding and finishing materials, metal specifications and inspection requirements, health and safety documentation)

2.14 (such as production drawings, assembly drawings, circuit and wiring diagrams, block and schematic diagrams)

2.16 (such as surface finish, electronic components, weld symbols, linear and geometric tolerances, pressure and flow characteristics)

Unit 403 Working efficiently and effectively in engineering

UAN:	**K/601/5055**
Level:	3
Credit value:	5
GLH:	25
Relationship to NOS:	This unit has been derived from national occupational standard: working efficiently and effectively in engineering (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to work efficiently and effectively in the workplace, in accordance with approved procedures and practices. Prior to undertaking the engineering activity, the learner 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, the learner 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. In order to be efficient and effective in the workplace, the learner will also be required to demonstrate that they can create and maintain effective working relationships with colleagues and line management. The learner will also be expected to review objectives and targets for their personal development and make recommendations to, and communicate any

opportunities for, improvements that could be made to working practices and procedures.

The learner's responsibilities will require them to comply with organisational policy and procedures for the engineering activities undertaken, and to report any problems with the activities, or the tools and equipment that are used that they cannot personally resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to take personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to working efficiently and effectively in an engineering environment. The learner will understand the need to work efficiently and effectively, and will know about the areas 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.

The learner will understand the safety precautions required when carrying out engineering activities. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. Be able to work efficiently and effectively in engineering
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 prepare the work area to carry out the engineering activity 1.3 prepare to carry out the engineering activity, taking into consideration all of the following, as applicable to the work to be undertaken: • the work area is free from hazards and is suitably prepared for the activities to be undertaken • any required safety procedures are implemented • any necessary personal protection equipment is obtained and is in a usable condition

- tools and equipment required are obtained and checked that they are in a safe and useable condition
- all necessary drawings, specifications and associated documentation is obtained
- job instructions are obtained and understood
- the correct materials or components are obtained
- storage arrangements for work are appropriate
- appropriate authorisation to carry out the work is obtained

1.4 check that there are sufficient supplies of materials and/or consumables and that they meet work requirements

1.5 ensure that completed products or resources are stored in the appropriate location on completion of the activities

1.6 complete work activities, to include all of the following:

- completing all necessary documentation accurately and legibly
- returning tools and equipment
- returning drawings and work instructions
- identifying, where appropriate, any unusable tools, equipment or components
- arranging for disposal of waste materials

1.7 tidy up the work area on completion of the engineering activity

1.8 deal promptly and effectively with problems within their control and report those that cannot be resolved

1.9 deal with problems affecting the engineering process, to include two of the following:

- materials
- tools and equipment
- drawings
- job specification
- quality
- people
- timescales
- safety
- activities or procedures

1.10 contribute to and communicate opportunities for improvement to working practices and procedures

1.11 make recommendations for improving to two of the following:

- working practices
- working methods
- quality
- safety
- tools and equipment
- supplier relationships
- internal communication
- customer service
- training and development
- teamwork
- other

1.12 maintain effective working relationships with colleagues to include two of the following:
- colleagues within own working group
- colleagues outside normal working group
- line management
- external contacts

1.13 review personal training and development as appropriate to the job role

1.14 review personal development objectives and targets to include one of the following:
- dual or multi-skilling
- training on new equipment / technology
- increased responsibility
- understanding of company working practices, procedures, plans and policies
- other specific requirements.

Learning outcome
The learner will: 2. Know how to work efficiently and effectively in engineering
Assessment criteria
The learner can: 2.1 describe the safe working practices and procedures to be followed whilst preparing and tidying up their work area 2.2 describe the correct use of any equipment used to protect the health and safety of themselves and their colleagues 2.3 describe the procedure for ensuring that all documentation relating to the work being carried out is available and current, prior to starting the activity 2.4 describe the action that should be taken if documentation received is incomplete and/or incorrect 2.5 describe the procedure for ensuring that all tools and equipment are available prior to undertaking the activity 2.6 describe the checks to be carried out to ensure that tools and equipment are in full working order, prior to undertaking the activity 2.7 describe the action that should be taken if tools and equipment are not in full working order 2.8 describe the checks to be carried out to ensure that all materials required are correct and complete, prior to undertaking the activity 2.9 describe the action that should be taken if materials do not meet the requirements of the activity 2.10 explain whom to inform when the work activity has been completed 2.11 describe the information and/or documentation required to confirm that the activity has been completed 2.12 explain what materials, equipment and tools can be reused 2.13 explain how any waste materials and/or products are transferred, stored and disposed of 2.14 explain where tools and equipment should be stored and located

2.15	describe the importance of making recommendations for improving working practices
2.16	describe the procedure and format for making suggestions for improvements
2.17	describe the benefits to organisations if improvements can be identified
2.18	describe the importance of maintaining effective working relationships within the workplace
2.19	describe the procedures to deal with and report any problems that can affect working relationships
2.20	describe the difficulties that can occur in working relationships
2.21	describe the regulations that affect how they should be treated at work
2.22	describe the benefits of continuous personal development
2.23	describe the training opportunities that are available in the workplace
2.24	describe the importance of reviewing their training and development
2.25	explain with whom to discuss training and development issues
2.26	describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve.

Unit 403 Working efficiently and effectively in engineering

Supporting information

Guidance

2.21 (such as Equal Opportunities Act, Race and Sex Discrimination, working Time Directive)

Unit 404 Reinstating the work area on completion of activities

UAN:	**K/601/4228**
Level:	3
Credit value:	5
GLH:	25
Relationship to NOS:	This unit has been derived from national occupational standard aeronautical engineering Unit 004: Reinstating the work Area on completion of activities (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to reinstate the work area, in accordance with approved procedures. The learner 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. The learner 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. The learner's 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. The learner 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. The learner's knowledge will provide a good understanding of their work, and provide an informed approach to applying the required procedures. The learner 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.

The learner will understand the safety precautions required when reinstating the work area. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. Be able to reinstate the work area on completion of activities
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following activities during reinstatement of the work area: • work to current schedules • 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 • report any loss or damage to equipment • report any identified hazards within the work area • return all consumables and materials to their correct location • complete any documentation as required 1.3 separate equipment, components, and materials for re-use from waste items and materials 1.4 store reusable materials and equipment in an appropriate location 1.5 correctly label and store four the following resources: • finished products/components • components requiring overhaul/repair • surplus materials/components • tooling, jigs, fixtures or other equipment used • drawings requiring actioning/adjusting • scrap components • measuring and test instruments • finished drawings • finished documentation • documentation requiring actioning/adjusting 1.6 dispose of waste materials in line with organisational and environmental safe procedures

1.7 deal with waste materials, in line with company and environmental regulations, to include two of the following:
- correctly segregating waste materials
- correctly dispose of waste materials
- disposing of joining compounds, sealants and adhesives
- disposing of other chemical products
- removing non-hazardous materials
- disposing of fluid waste (such as oil, hydraulic fluids, fuel)

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

1.9 carry out reinstatement activities on two work areas from:
- workshops/hangers
- airside
- areas at height (such as platforms, staging, lifts)
- internal areas of aircraft (such as wings, tanks, fuselage sections)
- office environment
- computer aided design (CAD) environment
- technical/clean room environment
- other appropriate environment

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

Learning outcome
The learner will: 2. Know how to reinstate the work area on completion of activities
Assessment criteria
The learner can: 2.1 explain the specific safety practices and procedures they need to observe when reinstating the work area 2.2 explain the health and safety requirements of the work area where they are carrying out the activities, and the responsibility these requirements place on them 2.3 describe the hazards associated with reinstating the work area, and explain how to minimise them and reduce any risks 2.4 explain the safe working practices and procedures to be followed when carrying out the various activities 2.5 explain what personal protective clothing and equipment needs to be worn, and where this can be obtained 2.6 explain why work areas need to be restored to a set standard, and what these requirements are 2.7 describe the types of work area that will need to be restored 2.8 Exp[lain the importance of tool and equipment control, and why this is critical within the aerospace industry 2.9 explain the meaning of 'foreign object debris', and why it is vital to ensure that this does not occur or is removed 2.10 describe the stores procedures for tools and equipment, documentation and surplus or waste materials 2.11 explain what materials will need to be stored and disposed of, and why they need to be segregated, correctly identified and labelled

2.12	explain how the various disposal bins can be identified
2.13	explain the procedures for disposing of hazardous materials
2.14	explain what documentation needs to be used on completion of the reinstatement activities
2.15	describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve.

Unit 404 Reinstating the work area on completion of activities

Supporting information

Guidance

2.1 (such as any specific legislation, regulations/codes of practice for the activities, equipment or materials)

2.4 (such as lifting and handling techniques)

2.7 (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)

2.12 (such as colour coded, labelled)

2.13 (such as chemicals, adhesives, oil, hydraulic fluids, fuel

Unit 520 Carrying out fault diagnosis on aircraft avionics components or systems

UAN:	**F/601/4753**
Level:	3
Credit value:	53
GLH:	126
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 120: Carrying out fault diagnosis on aircraft avionics components or systems (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required 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. The learner 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, the learner will be expected to identify the fault and its probable cause, and to determine appropriate action to remedy the problem. The learner's 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. The learner 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. The learner 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.

The learner's 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. The learner will understand the various fault diagnostic methods and techniques used, and their application. The learner 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.

The learner will understand the safety precautions required when carrying out the fault diagnostic activities, especially those for isolating the equipment. The learner 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.

Learning outcome
The learner will: 1. Be able to carry out fault diagnosis on aircraft avionics components or systems
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the fault diagnostic activities: • plan the fault diagnostic activities prior to beginning the work • obtain and use the appropriate documentation (such as job instructions, drawings, technical instructions, and other relevant maintenance documentation) • 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 • obtain clearance to work on the aircraft, and observe all relevant isolation and safety procedures (such as mechanical, electricity, gas, air or fluids) • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current certification/calibration date • where appropriate, apply electrostatic discharge (ESD) protection procedures • provide and maintain a safe working environment for the

diagnostic activities
- carry out the fault diagnostic activities, using approved techniques and procedures
- collect equipment fault diagnostic evidence from live and isolated systems
- disconnect or isolate components or parts of the system, when appropriate, to confirm the diagnosis
- identify the fault and determine the appropriate corrective action
- return all tools and equipment to the correct location on completion of the activities
- leave the aircraft and system in a safe and appropriate condition, free from foreign object debris on completion of the activities

1.3 carry out fault diagnosis on three of the following aircraft avionic systems, to sub-assembly or component level, as appropriate:
- electrical power generation and distribution
- internal and external lighting
- indication and gauging
- pitot static
- communication
- navigational
- armament management
- passive warning and electronic countermeasure
- infra-red and optical systems
- radar
- flight guidance and control

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

1.5 collect information about the fault from four of the following sources:
- the person who reported the fault
- monitoring equipment or gauges
- recording devices
- aircraft self-diagnostics
- approved sensory checks (such as sight, sound, smell, touch)
- aircraft log/documentation
- operation of the equipment
- fault records

1.6 diagnose faults from two of the following breakdown categories:
- intermittent problem
- partial failure or reduced performance
- complete breakdown

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

1.8 use a range of fault diagnostic techniques, to include three of the following:
- half-split technique
- input-to-output

- functional testing
- soak test
- injection and sampling
- unit substitution
- six point technique

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

- aircraft maintenance manual (AMM)
- equipment self-diagnostics
- circuit diagrams/specifications
- algorithms/flow charts
- fault analysis charts (such as fault trees)
- troubleshooting guides

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

- mechanical measuring equipment (such as measuring instruments, dial test indicators, torque instruments)
- electrical/electronic measuring instruments (such as multimeters, wattmeters, oscilloscopes)
- fluid power test equipment (such as test rigs, flow meters, pressure gauges)
- built-in test equipment (BITE)
- 'special-to-type' test equipment

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

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

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

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

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

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

- step-by-step analytical report
- aircraft service/flight log
- aircraft log book
- corrective action report
- company-specific reporting procedure
- computer records.

Learning outcome
The learner will: 2. Know how to carry out fault diagnosis on aircraft avionics components or systems
Assessment criteria
The learner can: 2.1 explain the health and safety requirements of the area in which they

	are carrying out the fault diagnostic activities, and the responsibility these requirements place on them
2.2	explain the specific safety precautions to be taken when carrying out the fault diagnosis of the particular aircraft avionics system
2.3	describe the isolation and lock-off procedure or permit-to-work procedure that applies
2.4	explain the importance of wearing protective clothing and other appropriate safety equipment during the fault diagnostic activities, the type of safety equipment to be used and where to obtain it
2.5	describe the hazards associated with carrying out fault diagnosis on aircraft avionics systems and explain how to minimise them and reduce any risks
2.6	explain where to obtain, and how to interpret drawings, circuit diagrams, specifications, manufacturers' manuals and other documents needed for the fault diagnostic activities
2.7	describe the basic principles of how the avionics system functions, and the working purpose of the various units and components
2.8	describe the various fault finding techniques that can be used, and how they are applied
2.9	explain the importance of applying electrostatic discharge (ESD) procedures when working on sensitive equipment or devices
2.10	explain how to evaluate the various types of information available for fault diagnosis
2.11	explain how to evaluate sensory information from sight, sound, smell, touch
2.12	explain the procedures to be followed to investigate faults, and how to deal with intermittent conditions
2.13	explain how to use the various aids and reports available for fault diagnosis
2.14	describe the types of equipment that can be used to aid fault diagnosis and explain how to check the equipment is calibrated or configured correctly for the intended use and that it is free from damage and defects
2.15	describe the application of specific fault finding methods and techniques that are best suited to the problem
2.16	explain how to analyse and evaluate possible characteristics and causes of specific faults/problems
2.17	explain how to make use of previous reports/records of similar fault conditions
2.18	explain 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
2.19	explain how to prepare a report which complies with the company policy on fault diagnosis
2.20	describe the extent of their own authority and explain to whom they should report if they have problems that they cannot resolve

Unit 520 Carrying out fault diagnosis on aircraft avionics components or systems

Supporting information

Guidance

2.5 (such as electrical contact, using faulty or damaged tools and equipment, using practices and procedures that do not follow laid-down procedures)

2.8 (such as half-split, input-to-output, six point technique, functional testing, unit substitution, injection and sampling techniques, equipment self-diagnostics and soak tests)

2.10 (such as pilot reports, monitoring equipment, aircraft history records, function of the equipment/system)

2.14 (such as mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices)

Unit 521 Undertaking scheduled maintenance of aircraft avionics equipment/systems

UAN:	**J/601/4754**
Level:	3
Credit value:	40
GLH:	98
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 121: Undertaking scheduled maintenance of aircraft avionics equipment/systems (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required 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. The learner 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. The learner's 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. The learner 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. The learner 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.

The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to applying scheduled maintenance procedures to aircraft avionics equipment. The learner will know how the system and equipment functions, and the potential problems or defects that may occur. The learner 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, the learner will be expected to report where the outcome of the maintenance activity identifies the need for further investigation or maintenance work.

The learner will understand the safety precautions required when carrying out the maintenance activities, especially those for isolating the equipment. The learner 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.

Learning outcome
The learner will: 1. Be able to undertake scheduled maintenance of aircraft avionics equipment/systems
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the scheduled maintenance activities: • plan the scheduled maintenance activities to cause minimal disruption to normal working • obtain and use the appropriate documentation (such as job instructions, aircraft manuals, technical instructions, and other relevant maintenance documentation) • 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 • obtain clearance to work on the aircraft, and observe all relevant isolation and safety procedures (such as mechanical,

electricity, gas, air or fluids)
- provide and maintain a safe working environment for the maintenance activities
- obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current certification/calibration date
- carry out the maintenance activities, using approved techniques and procedures
- where appropriate, apply electrostatic discharge (ESD) protection procedures
- re-connect and return the system to service on completion of the maintenance activities
- dispose of waste items in a safe and environmentally acceptable manner
- return all tools and equipment to the correct location on completion of the activities
- leave the aircraft and system in a safe and appropriate condition, free from foreign object debris on completion of the activities

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

1.4 undertake planned maintenance, based on one of the following types of maintenance schedule:
- condition based maintenance
- scheduled maintenance
- total preventative maintenance (TPM)
- depth maintenance

1.5 carry out the scheduled maintenance on three of the following aircraft avionics systems:
- electrical power generation and distribution
- internal and external lighting
- indication and gauging
- pitot static
- communication
- navigational
- armament equipment and systems
- passive warning and electronic countermeasure
- infra-red and optical systems
- radar
- flight guidance and control

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

1.7 carry out twelve of the following planned maintenance activities:
- removing excessive dirt and dust from panels or equipment
- checking the operation of gauges and sensors
- carrying out specified visual inspections
- carrying out testing of equipment against the maintenance schedule
- making visual checks of equipment and cables

- checking the integrity of connections
- replacing damaged or defective connectors
- monitoring the condition of switches and contactors
- replacing 'lifed' consumables (such as filters, desiccant, protection devices)
- replacing 'lifed' components
- carrying out system self-analysis checks
- inspecting and cleaning sensors
- checking and adjusting shock mountings
- tuning and adjusting components
- servicing back-up battery systems
- reviewing equipment/system operation
- equipment/component calibration
- making approved sensory checks (such as sight, sound, smell, touch)
- replacing missing or damaged locking and retaining devices (such as cable ties, clips, proprietary fasteners)
- recording the results of the maintenance activity, and reporting any defects found

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

- off-load checks (such as insulation, continuity, earth bonding, resistance)
- input/output checks (voltage, power)
- frequency checks
- receiver sensitivity
- distant object test
- voltage standing wave ratio (VSWR) checks

1.9 check that the maintained equipment/system meets all of the following:

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

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

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

- Civil Aviation Authority (CAA) / European Aviation Safety Agency (EASA)
- extended twin operations procedures (ETOpS) (where appropriate)
- Ministry of Defence (MoD)

- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures
- aircraft manufacturer's requirements

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

1.13 complete the relevant maintenance records accurately and pass them on to the appropriate person, to include one of the following:

- computer records
- job cards
- aircraft service/flight log
- aircraft log
- permit to work/formal risk assessment

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

Learning outcome
The learner will: 2. Know how to Undertake scheduled maintenance of aircraft avionics equipment/systems
Assessment criteria
The learner can: 2.1 explain the specific safety precautions and procedures to be observed whilst carrying out the scheduled maintenance 2.2 explain the importance of maintenance on, and impact upon ETOpS systems, legislation and local procedures 2.3 explain 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 them 2.4 describe the isolation and lock-off procedure or permit-to-work procedure that applies to the aircraft system being maintained 2.5 explain the importance of wearing protective clothing and other appropriate safety equipment during the maintenance activities, and where it may be obtained 2.6 describe the hazards associated with carrying out maintenance activities on aircraft electrical/avionic equipment and explain how to minimise them and reduce any risks 2.7 explain how to obtain and interpret drawings, charts, specifications, aircraft manuals, history/maintenance reports and other documents needed for the maintenance activities 2.8 describe the various planned maintenance schedules that are generally used and the methods to be followed to comply with company procedures for the maintenance of the aircraft electrical/avionic equipment 2.9 explain the equipment operating and control procedures, and how to apply them in order to carry out the scheduled maintenance activities 2.10 describe the basic principle of operation of the equipment or system being maintained, and explain the purpose of individual

units/components and how they interact

2.11 explain the importance of applying electrostatic discharge (ESD) procedures when working on sensitive equipment or devices

2.12 describe the application and use of a range of electrical components and explain the likely functions that will require checking

2.13 describe the different types of wiring enclosure that are used and explain what to check during the maintenance activities

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

2.15 explain how to recognise defects in aircraft electrical/avionic equipment

2.16 explain what adjustments/corrections/tuning is required to maintain the equipment/system at operational standard through full range parameters

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

2.18 explain how to make sensory checks by sight, sound, smell, touch

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

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

2.21 explain what maintenance documentation and/or reports need to be completed on completion of the maintenance activity

2.22 describe the problems that can occur whilst carrying out the maintenance activities, and explain how they can be avoided

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

2.24 describe the extent of their own authority and explain to whom they should report if they have a problem that they cannot resolve

Unit 521 Undertaking scheduled maintenance of aircraft avionics equipment/systems

Supporting information

Guidance

2.1 (including any specific legislation, regulations or codes of practice relating to the activities, equipment or materials)

2.6 (such as exposure to live conductors, handling fluids, electrical supplies, using damaged or badly maintained tools and equipment, not following laid-down maintenance procedures),

2.8 (such as condition based maintenance, scheduled maintenance, and total preventative maintenance (TPM))

2.12 (such as module blocks, terminal blocks, multi-pin plugs/sockets, tray-mounted sockets, earth bonding points),

2.13 (to include conduit, trunking, traywork systems and bulkhead penetrations),

2.15 (such as under or over performance)

Unit 522 Removing and replacing avionic indication and gauging components in aircraft systems

UAN:	**R/601/4756**
Level:	3
Credit value:	86
GLH:	175
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 122: Removing and replacing avionic indication and gauging components in aircraft systems (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to carry out the removal and replacement of avionic indication and gauging components in aircraft systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft, and includes units and components associated with powerplant and auxiliary power, 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. The learner 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. 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. The learner's 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. The learner 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. The learner 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.

The learner's 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. The learner will understand the removal and replacement methods and procedures, and their application, along with the systems maintenance requirements.

The learner 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, the learner 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.

You will understand the safety precautions required when working on the various aircraft systems and when using the associated tools and equipment. You will be required to demonstrate safe working practices throughout, and will understand the responsibility you owe to yourself and others in the workplace.

Notes: To display competence in this unit, it is necessary to both remove and replace avionic indication and gauging components. You must remove components; however, you may fit a replacement component where the original was previously removed by another person.

Learning outcome
The learner will: 1. Be able to remove and replace avionic indication and gauging components in aircraft systems
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the removal and replacement activity: • obtain clearance to work on the aircraft, and observe all relevant isolation and safety procedures • obtain and use the appropriate documentation (such as job instructions, aircraft manuals, technical instructions, and other relevant maintenance documentation) • 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 • ensure that all relevant safety devices and mechanical/physical locks are in place (where appropriate) • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current certification/calibration date • use approved removal and replacement techniques and procedures at all times • where appropriate, apply electrostatic discharge (ESD) protection procedures • ensure that components and surrounding structures are maintained free from damage and foreign objects • return all tools and equipment to the correct location on completion of the activities • 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 1.3 follow the relevant aircraft manuals and publications to carry out the required work 1.4 establish and, where appropriate, mark component orientation for re-assembly 1.5 carry out the removal and replacement activities, within the limits of their personal authority 1.6 carry out all of the following removal and replacement activities: • disconnecting electrical connections • removal of earth bonding • removing cable securing devices • removing bolt securing devices and mechanical fasteners • applying and removing covering/protection to exposed components, wires, pipework or vents • checking components for serviceability

- replacing all 'lifed' items (seals, filters, gaskets)
- positioning and aligning replaced components
- making mechanical connections
- making electrical connections
- carrying out earth bonding
- installing cable securing devices
- tightening fastenings to the required torque
- making 'off-load' checks before re-connecting power
- labelling (and storing in the correct location) components that require repair or overhaul
- setting, and adjusting replaced components (such as zero, range, travel, clearance)
- applying bolt locking methods (such as split pins, wire locking, lock nuts)

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

1.8 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:

- power plant (such as main engine power, auxiliary power, thrust reverse, propeller, starting, monitoring, fire)
- engine fuel, lubrication, air, cooling and control systems
- fluid power (such as hydraulic power generation, undercarriage, pneumatic or vacuum pressure)
- flying controls (such as flaps, elevators, ailerons/tailerons, spoilers, wing sweep, reaction controls, rudder, rotor)
- wheels, brakes and steering
- transmission systems (such as main and auxiliary gearboxes)
- aircraft fuel systems (such as supply, contents, transfer, venting system, fuel jettison, refuelling and defuelling)
- environmental control systems (such as pressure control, heating and ventilation equipment, air conditioning)
- ice and rain protection systems (such as windshield, engine protection, pitot static protection, ice accretion)
- fuselage (such as access panels, cargo doors, boundary layer and suction doors)

1.9 during the activities identified at 1.8 above, they must cover the removal and replacement of the following major avionic components: remove and replace two of the following:

- transmitters (such as position, flow, pressure, level)
- generators (such as pulse, speed/tacho)
- actuators
- motors
- computers
- gauges/indicators
- capacitance units
- displays
- Other system components: remove and replace two of the following:

- switches (such as micro, proximity)
- relays
- transducers/sensors
- circuit breakers
- input and follow-up potentiometers
- wires/cables
- plugs/sockets

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

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- extended twin operations procedures (ETOpS) (where appropriate)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures
- aircraft manufacturer's requirements

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

1.12 complete the relevant documentation, in accordance with organisational requirements

1.13 complete the relevant paperwork, to include one from the following, and pass it to the appropriate people:

- job cards
- computer records
- aircraft service/flight log
- aircraft log
- permit to work/formal risk assessment

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

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

Learning outcome
The learner will: 2. Know how to remove and replace avionic indication and gauging components in aircraft systems
Assessment criteria
The learner can: 2.1 explain the specific safety practices and procedures that they need to observe when working with aircraft control, indication and gauging systems 2.2 explain the importance of maintenance on, and impact upon ETOpS systems, legislation and local procedures 2.3 describe the hazards associated with removing and replacing aircraft control, indication and gauging system components, and with the tools and equipment used, and explain how to minimise

	them and reduce any risks
2.4	explain what protective equipment they need to use for both personal protection and protection of the aircraft
2.5	explain 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
2.6	explain how to carry out currency/issue checks on the specifications they are working with
2.7	explain the terminology used in aircraft control, indication and gauging systems, and the use of system diagrams and associated symbols
2.8	describe 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
2.9	explain the importance of applying electrostatic discharge (ESD) procedures when working on sensitive equipment or devices
2.10	describe the various mechanical fasteners that are used, and explain their method of removal and replacement
2.11	explain the importance of using the specified fasteners for the installation, and why they must not substitute others
2.12	explain why securing devices need to be locked and labelled, and the different methods that are used to remove and install them
2.13	explain the torque loading requirements of the fasteners, and what to do if these loadings are exceeded or not achieved
2.14	describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections
2.15	describe the techniques used to remove components from aircraft control, indication and gauging systems, without damage to the components or surrounding structure
2.16	explain 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
2.17	describe the techniques used to position, align, adjust and secure the replaced components to the aircraft, without damage to the components or surrounding structure
2.18	describe the quality control procedures to be followed during the removal and replacement operations
2.19	explain the procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities
2.20	explain the methods of lifting, handling and supporting the components/equipment during the removal and replacement activities
2.21	explain the use of seals, sealant, adhesives and anti-electrolysis barriers, and the precautions to be taken
2.22	explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
2.23	explain how to conduct any necessary checks to ensure the system integrity, and the accuracy and quality of the removal and replacement
2.24	describe the tools and equipment used in the removal and replacement activities, and explain their calibration/care and

	control procedures
2.25	explain 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
2.26	describe the problems that can occur with the removal and replacement operations, and explain how these can be overcome
2.27	explain how to recognise defects
2.28	explain what recording documentation needs 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
2.29	describe the procedure for the safe disposal of waste materials and scrap components
2.30	describe the extent of their own responsibility, and explain to whom they should report if they have problems that they cannot resolve

Unit 522 Removing and replacing avionic indication and gauging components in aircraft systems

Supporting information

Guidance

2.1 (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

2.10 (such as threaded fasteners, special securing devices)

2.15 (such as release of pressures/force, draining of fluids, proof marking, the need to protect the circuit integrity by covering and labelling exposed circuits)

2.27 (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)

Unit 523 Removing and replacing components of aircraft electrical power control, distribution and protection systems

UAN:	**H/601/4759**
Level:	3
Credit value:	86
GLH:	175
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 123: Removing and replacing components of aircraft electrical power control, distribution and protection systems (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required 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. The learner 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 batteries, generators, alternators, regulators, inverters, transformers, rectifier units, contactors and change-over relays, under-voltage phase sequence 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. The learner's 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. The learner 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. The learner 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.

The learner's 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 electrical power control and distribution components, in the relevant aircraft systems. The learner will understand the removal and replacement methods and procedures, and their application, along with the system maintenance requirements. The learner 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, the learner 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.

The learner 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. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Notes: To display competence in this unit it is necessary to both remove and replace aircraft electrical power control, distribution and protection components. The learner must remove components; however, they may fit a replacement component where the original was previously removed by another person.

Learning outcome
The learner will: 1. Be able to remove and replace components of aircraft electrical power control, distribution and protection systems
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the removal and replacement activity: • obtain clearance to work on the aircraft, and observe all relevant isolation and safety procedures • obtain and use the appropriate documentation (such as job instructions, aircraft manuals, technical instructions, and other relevant maintenance documentation) • 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 • ensure that all relevant safety devices and mechanical/physical locks are in place (where appropriate) • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current certification/calibration date • use approved removal and replacement techniques and procedures at all times • where appropriate, apply electrostatic discharge (ESD) protection procedures • ensure that components and surrounding structures are maintained free from damage and foreign objects • return all tools and equipment to the correct location on completion of the activities • 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 1.3 follow the relevant aircraft manuals and publications to carry out the required work 1.4 establish and, where appropriate, mark component orientation for re-assembly 1.5 carry out the removal and replacement activities, within the limits of their personal authority 1.6 carry out all of the following removal and replacement activities: • disconnecting electrical connections • removal of earth bonding • removing cable securing devices • removing bolt securing devices and mechanical fasteners • applying and removing covering/protection to exposed components, wires, pipework or vents • checking components for serviceability

- positioning and aligning replaced components
- making mechanical connections
- making electrical connections
- carrying out earth bonding
- installing cable securing devices
- tightening fastenings to the required torque
- labelling (and storing in the correct location) components that require repair or overhaul
- applying bolt locking methods (such as split pins, wire locking, lock nuts)

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

1.8 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:

- AC main power generation equipment
- emergency power back-up equipment
- power distribution equipment
- DC power generation equipment
- secondary/standby power generation equipment

1.9 during the activities identified in 1.8 above, they must cover the removal and replacement of the following major electrical components: remove and replace three of the following:

- generators
- alternators
- regulators
- transformer
- inverters
- rectifier units
- change-over relays
- main contactors
- batteries (such as one-shot or flight control DC batteries)

Other electrical components: remove and replace four of the following:

- switches
- relays
- transducers/sensors
- batteries (other)
- circuit breakers
- under-voltage phase sequence units
- wires/cables
- plugs/sockets

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

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- extended twin operations procedures (ETOpS) (where

appropriate)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures
- aircraft manufacturer's requirements

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

1.12 complete the relevant documentation, in accordance with organisational requirements

1.13 complete the relevant paperwork, to include one from the following, and pass it to the appropriate people:
- job cards
- computer records
- aircraft service/flight log
- aircraft log
- permit to work/formal risk assessment

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

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

Learning outcome
The learner will: 2. Know how to remove and replace components of aircraft electrical power control, distribution and protection systems
Assessment criteria
The learner can: 2.1 explain the specific safety practices and procedures that they need to observe when working with aircraft electrical power control, distribution and protection systems 2.2 explain the importance of maintenance on, and impact upon ETOpS systems, legislation and local procedures 2.3 describe the hazards associated with removing and replacing aircraft electrical power control, distribution and protection system components, and with the tools and equipment used, and explain how to minimise them and reduce any risks 2.4 explain what protective equipment they need to use for both personal protection and protection of the aircraft 2.5 explain 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 2.6 explain how to carry out currency/issue checks on the specifications they are working with 2.7 explain the terminology used in aircraft electrical power control, distribution and protection systems, and the use of system diagrams and associated symbols 2.8 describe 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

2.9 explain the importance of applying electrostatic discharge (ESD) procedures when working on sensitive equipment or devices

2.10 describe the various mechanical fasteners that are used, and explain their method of removal and replacement

2.11 explain the importance of using the specified fasteners for the installation, and why they must not substitute others

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

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

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

2.15 describe the techniques used to remove components from aircraft electrical power control, distribution and protection systems, without damage to the components or surrounding structure

2.16 explain 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

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

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

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

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

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

2.22 explain why electrical bonding is critical, and why it must be both mechanically and electrically secure

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

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

2.25 explain 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

2.26 describe the problems that can occur with the removal and replacement operations, and explain how these can be overcome

2.27 explain how to recognise defects

2.28 explain what recording documentation needs 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

2.29 describe the procedure for the safe disposal of waste materials and scrap components

2.30 describe the extent of their own authority, and explain to whom they should report if they have problems that they cannot resolve

Unit 523 Removing and replacing components of aircraft electrical power control, distribution and protection systems

Supporting information

Guidance

2.1 (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

2.10 (such as threaded fasteners, special securing devices)

2.15 (such as release of pressures/force, draining of fluids, proof marking, the need to protect the circuit integrity by covering and labelling exposed circuits)

2.27 (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)

Unit 524 Removing and replacing components of aircraft pitot static systems

UAN:	**D/601/4761**
Level:	3
Credit value:	86
GLH:	175
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 124: Removing and replacing components of aircraft pitot static systems (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required 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. The learner 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 pitot static components will include items such as gauges, controllers, and amplifiers, indicating devices, position transmitters and selectors. 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. The learner's 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. The learner 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. The learner 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.

The learner's 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. The learner will understand the removal and replacement methods and procedures, and their application, along with the systems maintenance requirements. The learner 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. In addition, the learner 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.

The learner will understand the safety precautions required when working on the various pitot static systems, and when using the associated tools and equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Notes: To display competence in this unit it is necessary to both remove and replace pitot static components. The learner must remove components; however, they may fit a replacement component where the original was previously removed by another person.

Learning outcome
The learner will: 1. Be able to remove and replace components of aircraft pitot static systems
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the removal and replacement activity: • obtain clearance to work on the aircraft, and observe all relevant isolation and safety procedures

- obtain and use the appropriate documentation (such as job instructions, aircraft manuals, technical instructions, and other relevant maintenance documentation)
- 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
- ensure that all relevant safety devices and mechanical/physical locks are in place (where appropriate)
- obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current certification/calibration date
- use approved removal and replacement techniques and procedures at all times
- where appropriate, apply electrostatic discharge (ESD) protection procedures
- ensure that components and surrounding structures are maintained free from damage and foreign objects
- return all tools and equipment to the correct location on completion of the activities
- 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

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

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

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

1.6 carry out all of the following removal and replacement activities:

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

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

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

- rate of climb
- air speed indication
- aircraft height indication
- navigation
- auto-pilot
- oxygen drop out
- flying controls (such as flaps, elevators, ailerons/tailerons, spoilers, wing sweep, reaction controls, rudder, rotor, airbrakes, horizontal stabiliser, artificial feel, gust alleviation, modal suppression)
- engine control systems (such as FADEC, FAFC, EEC)
- environmental control systems (such as pressure control)
- ice and rain protection systems (such as pitot static protection, ice accretion)

1.9 during the activities identified in 1.8 above, they must cover the removal and replacement of the following major pitot static components: remove and replace three of the following:

- airspeed indicators
- altitude indicators
- rate of climb indicators
- cabin altitude alerter
- heaters
- static ports
- transducer units
- digital displays
- analogue/digital converters
- pitot probes/pressure heads
- air data computers/modules
- mach meters

Other system components: remove and replace four of the following:

- wires/cables
- switches
- relays
- plugs/sockets
- circuit breakers
- moisture drains/traps
- rigid pipes
- flexi-pipes

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

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- extended twin operations procedures (ETOpS) (where

appropriate)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures
- aircraft manufacturer's requirements

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

1.12 complete the relevant documentation, in accordance with organisational requirements

1.13 complete the relevant paperwork, to include one from the following, and pass it to the appropriate people:
- job cards
- computer records
- aircraft service/flight log
- aircraft log
- permit to work/formal risk assessment

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

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

Learning outcome
The learner will: 2. Know how to remove and replace components of aircraft pitot static systems
Assessment criteria
The learner can: 2.1 explain the specific safety practices and procedures that they need to observe when working with aircraft pitot static systems 2.2 explain the importance of maintenance on, and impact upon ETOpS systems, legislation and local procedures 2.3 describe the hazards associated with removing and replacing aircraft pitot static system components, and with the tools and equipment used, and explain how to minimise them and reduce any risks 2.4 explain what protective equipment they need to use for both personal protection and protection of the aircraft 2.5 explain 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 2.6 explain how to carry out currency/issue checks on the specifications they are working with 2.7 explain the terminology used in aircraft pitot static systems, and the use of system diagrams and associated symbols 2.8 describe 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 2.9 describe the various mechanical fasteners that are used, and explain

their method of removal and replacement

2.10 explain the importance of using the specified fasteners for the installation, and why they must not substitute others

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

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

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

2.14 explain the importance of applying electrostatic discharge (ESD) procedures when working on sensitive equipment or devices

2.15 describe the techniques used to remove components from aircraft pitot static systems, without damage to the components or surrounding structure

2.16 explain 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

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

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

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

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

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

2.22 explain why electrical bonding is critical, and why it must be both mechanically and electrically secure

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

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

2.25 explain 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

2.26 describe the problems that can occur with the removal and replacement operations, and explain how these can be overcome

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

2.28 explain how to recognise defects

2.29 explain what recording documentation needs 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

2.30 describe the procedure for the safe disposal of waste materials and scrap components

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

Unit 524 Removing and replacing components of aircraft pitot static systems

Supporting information

Guidance

2.1 (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

2.19 (such as threaded fasteners, special securing devices)

2.15 (such as release of pressures/force, draining of fluids, proof marking, the need to protect the circuit integrity by covering and labelling exposed circuits)

2.28 (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)

Unit 525 Removing and replacing components of aircraft armament systems

UAN:	**H/601/4762**
Level:	3
Credit value:	86
GLH:	175
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 125: Removing and replacing components of aircraft armament systems (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to carry out the removal and replacement of components of aircraft armament systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft, and includes equipment and components associated with defensive aids, weapon release equipment, guns, missile, depth charge, pylons and role equipment, as applicable to the aircraft type. The learner 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, umbilicals, 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. The learner's 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. The learner 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. The learner 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.

The learner's 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. The learner will understand the removal and replacement methods and procedures, and their application, along with the systems maintenance requirements. The learner 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, the learner 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.

The learner will understand the safety precautions required when working on the aircraft armament systems and when using the associated tools and equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Notes: To display competence in this unit it is necessary to both remove and replace aircraft armament system components. The learner must remove components; however, they may fit a replacement component where the original was previously removed by another person.

The learner may remove or replace components in conjunction with other trades, where the extent of their involvement is purely the essential aircraft armament aspects of such activities.

Learning outcome
The learner will: 1. Be able to remove and replace components of aircraft armament systems
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the removal and replacement activity: • obtain clearance to work on the aircraft, and observe all relevant isolation and safety procedures • obtain and use the appropriate documentation (such as job instructions, aircraft manuals, technical instructions, and other relevant maintenance documentation) • 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 • ensure that all relevant safety devices and mechanical/physical locks are in place (where appropriate) • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current certification/calibration date • use approved removal and replacement techniques and procedures at all times • where appropriate, apply electrostatic discharge (ESD) protection procedures • ensure that components and surrounding structures are maintained free from damage and foreign objects • return all tools and equipment to the correct location on completion of the activities • 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 1.3 follow the relevant aircraft manuals and publications to carry out the required work 1.4 establish and, where appropriate, mark component orientation for re-assembly 1.5 carry out the removal and replacement activities, within the limits of their personal authority 1.6 carry out all of the following removal and replacement activities: • disconnecting electrical connections • removal of earth bonding • removing cable securing devices • removing bolt securing devices and mechanical fasteners • applying and removing covering/protection to exposed components, wires, pipework or vents • checking components for serviceability

- replacing all 'lifed' items (seals, filters, gaskets)
- positioning and aligning replaced components
- setting, and adjusting replaced components
- making mechanical connections
- making electrical connections
- carrying out earth bonding
- installing cable securing devices
- tightening fastenings to the required torque
- labelling and storing all removed equipment in the correct location
- applying bolt locking methods (such as split pins, wire locking, lock nuts)

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

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

- defensive aids
- weapon release equipment
- guns
- missile
- depth charge
- pylons
- armament role equipment
- torpedoes
- other systems, as applicable

1.9 during the activities identified in 1.8 above, they must cover the removal and replacement of the following major armament components: remove and replace four of the following:

- umbilicals
- motors
- clock units
- guns
- flare magazines
- relay units
- sequence units
- missiles
- control units
- computers
- power supply units
- dispensers

Other armament system components: remove and replace three of the following:

- switches
- relays
- solenoids
- indicators/gauges

- safety devices
- wires/cables
- plugs/sockets

1.10 remove and replace aircraft armament system components in compliance with one of the following:
- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- extended twin operations procedures (ETOpS) (where appropriate)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures
- aircraft manufacturer's requirements

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

1.12 complete the relevant documentation, in accordance with organisational requirements

1.13 complete the relevant paperwork, to include one from the following, and pass it to the appropriate people:
- job cards
- computer records
- aircraft service/flight log
- aircraft log
- permit to work/formal risk assessment

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

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

Learning outcome
The learner will: 2. Know how to remove and replace components of aircraft armament systems
Assessment criteria
The learner can: 2.1 explain the specific safety practices and procedures that they need to observe when working with aircraft armament systems 2.2 explain the importance of maintenance on, and impact upon ETOpS systems, legislation and local procedures 2.3 describe the hazards associated with removing and replacing aircraft armament system components, and with the tools and equipment used, and explain how to minimise them and reduce any risks 2.4 explain what protective equipment they need to use for both personal protection and protection of the aircraft 2.5 explain 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

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

2.7 explain the terminology used in aircraft armament systems, and the use of system diagrams and associated symbols

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

2.9 describe the various mechanical fasteners that are used, and explain their method of removal and replacement

2.10 explain the importance of using the specified fasteners for the installation, and why they must not substitute others

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

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

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

2.14 describe the techniques used to remove components from aircraft armament systems, without damage to the components or surrounding structure

2.15 explain the importance of applying electrostatic discharge (ESD) procedures when working on sensitive equipment or devices

2.16 explain 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

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

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

2.19 explain the procedures for ensuring they have the correct tools, equipment, components and fasteners for the activities

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

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

2.22 explain why electrical bonding is critical, and why it must be both mechanically and electrically secure

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

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

2.25 explain 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

2.26 describe the problems that can occur with the removal and replacement operations, and explain how these can be overcome

2.27 explain how to recognise defects

2.28 explain what recording documentation needs 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
2.29	describe the procedure for the safe disposal of waste materials and scrap components
2.30	describe the extent of their own responsibility, and explain to whom they should report if they have problems that they cannot resolve

Unit 525 Removing and replacing components of aircraft armament systems

Supporting information

Guidance

2.1 (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

2.9 (such as threaded fasteners, special securing devices)

2.14 (such as proof marking, the need to protect the circuit integrity by covering and labelling exposed circuits)

2.27 (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)

Unit 526 Removing and replacing components of aircraft communication systems

UAN:	**K/601/4763**
Level:	3
Credit value:	86
GLH:	175
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 126: Removing and replacing components of aircraft communication systems (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required 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. The learner 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. The learner's 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. The learner 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. The learner 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.

The learner's 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. The learner will understand the removal and replacement methods and procedures, and their application, along with the systems maintenance requirements. The learner 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, the learner 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.

The learner will understand the safety precautions required when working on the aircraft communication systems, and when using the associated tools and equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Notes: To display competence in this unit it is necessary to both remove and replace aircraft communication system components. The learner must remove components; however, they may fit a replacement component where the original was previously removed by another person.

Learning outcome
The learner will: 1. Be able to remove and replace components of aircraft communication systems
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the removal and replacement activity: • obtain clearance to work on the aircraft, and observe all relevant isolation and safety procedures • obtain and use the appropriate documentation (such as job instructions, aircraft manuals, technical instructions, and other relevant maintenance documentation) • 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 • ensure that all relevant safety devices and mechanical/physical locks are in place (where appropriate) • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current certification/calibration date • use approved removal and replacement techniques and procedures at all times • where appropriate, apply electrostatic discharge (ESD) protection procedures • ensure that components and surrounding structures are maintained free from damage and foreign objects • return all tools and equipment to the correct location on completion of the activities • 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 1.3 follow the relevant aircraft manuals and publications to carry out the required work 1.4 establish and, where appropriate, mark component orientation for re-assembly 1.5 carry out the removal and replacement activities, within the limits of their personal authority 1.6 carry out all of the following removal and replacement activities: • disconnecting electrical connections • removal of earth bonding • removing cable securing devices • removing bolt securing devices and mechanical fasteners • applying and removing covering/protection to exposed components, wires, pipework or vents • checking components for serviceability

- replacing all 'lifed' items (seals, filters, gaskets)
- positioning and aligning replaced components
- making mechanical connections
- making electrical connections
- carrying out earth bonding
- installing cable securing devices
- tightening fastenings to the required torque
- labelling (and storing in the correct location) components that require repair or overhaul
- setting, and adjusting/tuning replaced components (such as power output, voltage, frequency pre-sets)
- applying bolt locking methods (such as split pins, wire locking, lock nuts)

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

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

- VHF radio
- intercom (clear)
- intercom (secure speech)
- secure radio links
- HF radio
- UHF radio
- cockpit voice recorder
- aircraft communication address reporting system (ACARS)
- SATCOM
- digital data links
- satellite position systems (GPS)
- flight entertainment systems
- SELCAL
- crash position indicators
- telecommunications

1.9 during the activities identified in 1.8 above, they must cover the removal and replacement of the following major communication components: remove and replace four of the following:

- aerials
- receiver units
- satellite beacons
- transponders
- antenna switching units
- tuning units
- transmitter units
- transformers
- control units
- intercom station boxes

Other communication system components: remove and replace

three of the following:

- batteries
- switches
- relays
- circuit breakers
- unit trays
- headsets
- instruments/gauges/indicators
- wires/cables
- plugs/sockets
- speakers
- microphone units

1.10 remove and replace aircraft communication system components in compliance with one of the following:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- extended twin operations procedures (ETOpS) (where appropriate)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures
- aircraft manufacturer's requirements

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

1.12 complete relevant documentation, in accordance with organisational requirements

1.13 complete the relevant paperwork, to include one from the following, and pass it to the appropriate people:

- job cards
- computer records
- aircraft service/flight log
- aircraft log book
- permit to work/formal risk assessment

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

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

Learning outcome
The learner will: 2. Know how to remove and replace components of aircraft communication systems
Assessment criteria
The learner can: 2.1 explain the specific safety practices and procedures that they need to observe when working with aircraft communication systems

2.2	explain the importance of maintenance on, and impact upon ETOpS systems, legislation and local procedures
2.3	describe the hazards associated with removing and replacing aircraft communication system components, and with the tools and equipment used, and explain how to minimise them and reduce any risks
2.4	explain what protective equipment they need to use for both personal protection and protection of the aircraft
2.5	explain 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
2.6	explain how to carry out currency/issue checks on the specifications they are working with
2.7	explain the terminology used in aircraft communication systems, and the use of system diagrams and associated symbols
2.8	describe the basic principles of operation of the communication system being worked on, and the performance characteristics and function of the components within the system
2.9	describe the various mechanical fasteners that are used, and explain their method of removal and replacement
2.10	explain the importance of using the specified fasteners for the installation, and why they must not substitute others
2.11	explain why securing devices need to be locked and labelled, and the different methods that are used to remove and install them
2.12	explain the torque loading requirements of the fasteners, and what to do if these loadings are exceeded or not achieved
2.13	describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking in of the connections
2.14	describe the techniques used to remove components from aircraft communication systems, without damage to the components or surrounding structure
2.15	explain the importance of applying electrostatic discharge (ESD) procedures when working on sensitive equipment or devices
2.16	explain 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
2.17	describe the techniques used to position, align, adjust and secure the replaced components to the aircraft, without damage to the components or surrounding structure
2.18	describe the quality control procedures to be followed during the removal and replacement operations
2.19	explain the procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities
2.20	explain the methods of lifting, handling and supporting the components/equipment during the removal and replacement activities
2.21	explain the use of seals, sealant and adhesives and anti-electrolysis barriers, and the precautions to be taken
2.22	explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
2.23	explain how to conduct any necessary checks to ensure the system

integrity, accuracy and quality of the removal and replacement

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

2.25 explain 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

2.26 describe the problems that can occur with the removal and replacement operations, and explain how these can be overcome

2.27 explain how to recognise defects

2.28 explain what recording documentation needs 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

2.29 describe the procedure for the safe disposal of waste materials and scrap components

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

Unit 526 Removing and replacing components of aircraft communication systems

Supporting information

Guidance

2.1 (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

2.9 (such as threaded fasteners, special securing devices)

2.14 (such as proof marking, the need to protect the circuit integrity by covering and labelling exposed circuits)

2.27 (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)

Unit 527 Removing and replacing components of aircraft passive warning and optical/surveillance systems

UAN:	**T/601/4765**
Level:	3
Credit value:	86
GLH:	175
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 127: Removing and replacing components of aircraft passive warning and optical/surveillance systems (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required 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. The learner 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 buoys, aerials, dispensers, transmitters, receivers, processors, control units, power supply units, cameras, monitors, fixed or rotating platforms and recording devices. 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. The learner's 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. The learner 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. The learner 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.

The learner's 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. The learner will understand the removal and replacement methods and procedures, and their application, along with the systems maintenance requirements. The learner 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, the learner 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.

The learner 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. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Notes: To display competence in this unit, it is necessary to both remove and replace aircraft passive warning and optical/surveillance system components. The learner must remove components; however, they may fit a replacement component where the original was previously removed by another person.

Learning outcome
The learner will: 1. Be able to remove and replace components of aircraft passive warning and optical/surveillance systems
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the removal and replacement activity: • obtain clearance to work on the aircraft, and observe all relevant isolation and safety procedures • obtain and use the appropriate documentation (such as job instructions, aircraft manuals, technical instructions, and other relevant maintenance documentation) • 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 • ensure that all relevant safety devices and mechanical/physical locks are in place (where appropriate) • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current certification/calibration date • use approved removal and replacement techniques and procedures at all times • where appropriate, apply electrostatic discharge (ESD) protection procedures • ensure that components and surrounding structures are maintained free from damage and foreign objects • return all tools and equipment to the correct location on completion of the activities • 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 1.3 follow the relevant aircraft manuals and publications to carry out the required work 1.4 establish and, where appropriate, mark component orientation for re-assembly 1.5 carry out the removal and replacement activities, within the limits of their personal authority 1.6 carry out all of the following removal and replacement activities: • disconnecting electrical connections • removal of earth bonding • removing cable securing devices • removing bolt securing devices and mechanical fasteners • applying and removing covering/protection to exposed components, wires, pipework or vents • checking components for serviceability

- replacing all 'lifed' items (seals, filters, gaskets)
- positioning and aligning replaced components
- making mechanical connections
- making electrical connections
- carrying out earth bonding
- installing cable securing devices
- tightening fastenings to the required torque
- labelling (and storing in the correct location) components that require repair or overhaul
- setting, and adjusting/tuning replaced components (such as power output, voltage)
- applying bolt locking methods (such as split pins, wire locking, lock nuts)

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

1.8 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:

- acoustics
- air data recording
- collision avoidance
- ground avoidance
- video recording systems
- LASER systems
- cockpit voice recording systems
- sound navigation and ranging (SONAR)
- radar homing and warning receivers (RHWR)
- camera systems (wet film, digital or infra-red)

1.9 during the activities identified in 1.8 above, they must cover the removal and replacement of the following major passive warning and optical/surveillance components: remove and replace three of the following:

- buoys
- aerials
- satellite beacons
- transponders
- transformers
- recording devices (cockpit, video, air data)
- receiver units
- transmitter units
- processors
- cameras
- power supply unit (PSU)
- control units

Other passive warning and optical/surveillance components: remove and replace four of the following:

- batteries

- switches
- relays
- circuit breakers
- instruments/gauges/indicators
- wires/cables
- plugs/sockets
- film or digital modules

1.10 remove and replace aircraft passive warning and optical/surveillance systems components in compliance with one of the following:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- extended twin operations procedures (ETOpS) (where appropriate)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures
- aircraft manufacturer's requirements

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

1.12 complete the relevant documentation, in accordance with organisational requirements

1.13 complete the relevant paperwork, to include one from the following, and pass it to the appropriate people:

- job cards
- computer records
- aircraft service/flight log
- aircraft log book
- permit to work/formal risk assessment

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

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

Learning outcome
The learner will: 2. Know how to remove and replace components of aircraft passive warning and optical/surveillance systems
Assessment criteria
The learner can: 2.1 explain the specific safety practices and procedures that they need to observe when working with aircraft passive warning and optical/surveillance systems 2.2 explain the importance of maintenance on, and impact upon ETOpS systems, legislation and local procedures 2.3 describe the hazards associated with removing and replacing aircraft passive warning and optical/surveillance system

components, and with the tools and equipment used, and explain how to minimise them and reduce any risks

2.4 explain what protective equipment they need to use for both personal protection and protection of the aircraft

2.5 explain 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

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

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

2.8 explain 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

2.9 describe the various mechanical fasteners that are used, and explain their method of removal and replacement

2.10 explain the importance of using the specified fasteners for the installation, and why they must not substitute others

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

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

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

2.14 describe the techniques used to remove components from aircraft passive warning and optical/surveillance systems, without damage to the components or surrounding structure

2.15 explain the importance of applying electrostatic discharge (ESD) procedures when working on sensitive equipment or devices

2.16 explain 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

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

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

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

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

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

2.22 explain why electrical bonding is critical, and why it must be both mechanically and electrically secure

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

2.24 describe the tools and equipment used in the removal and replacement activities, and explain their calibration/care and

	control procedures
2.25	explain 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
2.26	describe the problems that can occur with the removal and replacement operations, and explain how these can be overcome
2.27	explain how to recognise defects
2.28	explain what recording documentation needs 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
2.29	describe the procedure for the safe disposal of waste materials and scrap components
2.30	describe the extent of their own responsibility, and explain to whom they should report if they have problems that they cannot resolve

Unit 527 Removing and replacing components of aircraft passive warning and optical/surveillance systems

Supporting information

Guidance

2.1 (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

2.9 (such as threaded fasteners, special securing devices)

2.14 (such as proof marking, the need to protect the circuit integrity by covering and labelling exposed circuits)

2.27 (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)

Unit 528 Removing and replacing components of aircraft radar systems

UAN:	**F/601/4767**
Level:	3
Credit value:	86
GLH:	175
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 128: Removing and replacing components of aircraft radar systems (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required 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. The learner 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. The learner's 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. The learner 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. The learner 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.

The learner's 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 radar components, in the relevant aircraft systems. The learner will understand the removal and replacement methods and procedures, and their application, along with the system maintenance requirements. The learner 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, the learner 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.

The learner will understand the safety precautions required when working on the aircraft radar systems, and when using the associated tools and equipment. The learner 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.

Notes: To display competence in this unit, it is necessary to both remove and replace aircraft radar system components. The learner must remove components; however, they may fit a replacement component where the original was previously removed by another person.

Learning outcome
The learner will: 1. Be able to remove and replace components of aircraft radar systems
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the removal and replacement activity: • obtain clearance to work on the aircraft, and observe all relevant isolation and safety procedures • obtain and use the appropriate documentation (such as job instructions, aircraft manuals, technical instructions, and other relevant maintenance documentation) • 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 • ensure that all relevant safety devices and mechanical/physical locks are in place (where appropriate) • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current certification/calibration date • use approved removal and replacement techniques and procedures at all times • where appropriate, apply electrostatic discharge (ESD) protection procedures • ensure that components and surrounding structures are maintained free from damage and foreign objects • return all tools and equipment to the correct location on completion of the activities • 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 1.3 follow the relevant aircraft manuals and publications to carry out the required work 1.4 establish and, where appropriate, mark component orientation for re-assembly 1.5 carry out the removal and replacement activities, within the limits of their personal authority 1.6 carry out all of the following removal and replacement activities: • disconnecting electrical connections • removal of earth bonding • removing cable securing devices • removing bolt securing devices and mechanical fasteners • applying and removing covering/protection to exposed components, wires, pipework or vents • checking components for serviceability • replacing all 'lifed' items (seals, filters, gaskets)

- positioning and aligning replaced components
- making mechanical connections
- making electrical connections
- carrying out earth bonding
- installing cable securing devices
- tightening fastenings to the required torque
- pressurising systems (waveguide, coolant)
- labelling (and storing in the correct location) components that require repair or overhaul
- setting, and adjusting/tuning replaced components (such as power output, voltage)
- applying bolt locking methods (such as split pins, wire locking, lock nuts)

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

1.8 remove components from the following aircraft radar systems, and replace components of the following aircraft radar systems:

- Either one of the following:
- surveillance radar
- radar jamming
- OR three of the following:
- towed radar decoys
- radar (radio) altimeter
- Doppler
- enhanced ground proximity warning system (EGPWS)
- supplementary surveillance radar
- obstacle warning systems
- identification friend or foe (IFF)
- tactical air navigation (TACAN)
- weather radar/predictive wind shear
- traffic collision avoidance system (TCAS)

1.9 during the activities identified in 1.8 above, they must cover the removal and replacement of the following major radar components: remove and replace three of the following:

- scanners
- aerials
- transformers
- transmitter units
- computers
- transponders
- radar displays
- receiver units
- processors
- control units
- microwave generators
- intermediate frequency unit (IFU)
- power supply units (PSU)

- winches
- waveguides
- radar packs
- coolant units

Other radar system components: remove and replace four of the following:

- batteries
- switches
- relays
- circuit breakers instruments/gauges
- desiccant units
- wires/cables
- plugs/sockets
- coolant

1.10 remove and replace aircraft radar system components, in compliance with one of the following:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Extended Range Twin-Engine Operations Procedures (ETOPS) (where appropriate)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures
- aircraft manufacturer's requirements

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

1.12 complete the relevant documentation, in accordance with organisational requirements

1.13 complete the relevant paperwork, to include one from the following, and pass it to the appropriate people:

- job cards
- computer records
- aircraft service/flight log
- aircraft log
- permit to work/formal risk assessment

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

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

Learning outcome
The learner will: 2. Know how to remove and replace components of aircraft radar systems
Assessment criteria
The learner can: 2.1 explain the specific safety practices and procedures that they need to observe when working with aircraft radar systems 2.2 explain the importance of maintenance on, and impact upon ETOPS systems, legislation and local procedures 2.3 describe the hazards associated with removing and replacing aircraft radar system components, and with the tools and equipment used, and explain how to minimise them and reduce any risk 2.4 explain what protective equipment they need to use for both personal protection and protection of the aircraft 2.5 explain 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 2.6 explain how to carry out currency/issue checks on the specifications they are working with 2.7 explain the terminology used in aircraft radar systems, and the use of system diagrams and associated symbols 2.8 describe the basic principles of operation of the radar system being worked on, and the performance characteristics and function of the components within the system 2.9 describe the various mechanical fasteners that are used, and explain their method of removal and replacement 2.10 explain the importance of using the specified fasteners for the installation, and why they must not substitute others 2.11 explain why securing devices need to be locked and labelled, and the different methods that are used to remove and install them 2.12 explain the torque loading requirements on the fasteners, and what to do if these loadings are exceeded or not achieved 2.13 describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections 2.14 describe the techniques used to remove components from aircraft radar systems, without damage to the components or surrounding structure 2.15 explain the importance of applying electrostatic discharge (ESD) procedures when working on sensitive equipment or devices 2.16 explain 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 2.17 describe the techniques used to position, align, adjust and secure the replaced components to the aircraft, without damage to the components or surrounding structure 2.18 describe the quality control procedures to be followed during the removal and replacement operations 2.19 explain the procedures for ensuring that they have the correct

tools, equipment, components and fasteners for the activities

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

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

2.22 explain why electrical bonding is critical, and why it must be both mechanically and electrically secure

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

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

2.25 explain 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

2.26 describe the problems that can occur with the removal and replacement operations, and explain how these can be overcome

2.27 explain how to recognise defects

2.28 explain what recording documentation needs 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

2.29 describe the procedure for the safe disposal of waste materials and scrap components

2.30 describe the extent of their own authority, and explain to whom they should report if they have problems that they cannot resolve

Unit 528 Removing and replacing components of aircraft radar systems

Supporting information

Guidance

2.1 (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

2.9 (such as threaded fasteners, special securing devices)

2.14 (such as proof marking, the need to protect the circuit integrity by covering and labelling exposed circuits)

2.27 (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)

Unit 529 Removing and replacing components of aircraft navigational and computing systems

UAN:	**L/601/4769**
Level:	3
Credit value:	86
GLH:	175
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 129: Removing and replacing components of aircraft navigational and computing systems (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required 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 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 navigation (LORAN), homing, inertial navigation system, Decca, and compass as applicable to the aircraft type. The learner 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. The learner's 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. The learner 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. The learner 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.

The learner's 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. The learner will understand the removal and replacement methods and procedures, and their application, along with the systems maintenance requirements. The learner 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, the learner 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.

The learner will understand the safety precautions required when working on the aircraft navigational systems and when using the associated tools and equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Notes: To display competence in this unit it is necessary to both remove and replace aircraft navigational and computing system components. The learner must remove components; however, they may fit a replacement component where the original was previously removed by another person.

Learning outcome
The learner will: 1. Be able to remove and replace components of aircraft navigational and computing systems
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the removal and replacement activity: • obtain clearance to work on the aircraft, and observe all relevant isolation and safety procedures • obtain and use the appropriate documentation (such as job instructions, aircraft manuals, technical instructions, and other relevant maintenance documentation) • 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 • ensure that all relevant safety devices and mechanical/physical locks are in place (where appropriate) • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current certification/calibration date • use approved removal and replacement techniques and procedures at all times • where appropriate, apply electrostatic discharge (ESD) protection procedures • ensure that components and surrounding structures are maintained free from damage and foreign objects • return all tools and equipment to the correct location on completion of the activities • 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 1.3 follow the relevant aircraft manuals and publications to carry out the required work 1.4 establish and, where appropriate, mark component orientation for re-assembly 1.5 carry out the removal and replacement activities, within the limits of their personal authority 1.6 carry out all of the following removal and replacement activities: • disconnecting electrical connections • removal of earth bonding • removing cable securing devices • removing bolt securing devices and mechanical fasteners • applying and removing covering/protection to exposed components, wires, pipework or vents • checking components for serviceability

- replacing all 'lifed' items (seals, filters, gaskets)
- positioning and aligning replaced components
- making mechanical connections
- making electrical connections
- carrying out earth bonding
- installing cable securing devices
- tightening fastenings to the required torque
- labelling (and storing in the correct location) components that require repair or overhaul
- setting, and adjusting/tuning replaced components (such as power output, voltage)
- applying bolt locking methods (such as split pins, wire locking, lock nuts)

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

1.8 remove components from three of the following aircraft navigational systems, and replace components in three of the following aircraft navigational systems:

- distance measuring equipment (DME)
- very high frequency omnidirectional range (VOR)
- instrument landing system (ILS)
- auto direction finder (ADF)
- global positioning system (GPS)
- long range navigation (LORAN)
- inertial navigation system
- microwave landing system (MLS)
- re-transmission systems
- Doppler
- homing
- gyro
- Decca
- Compass
- computing sub-systems

1.9 during the activities identified in 1.8 above, they must cover the removal and replacement of the following major navigational components: remove and replace five of the following:

- aerials
- receiver units
- satellite beacons
- transponders
- analogue/digital converters (A-D/D-A)
- compensation units
- transmitter units
- transformers
- control units
- navigation display units (including head-up)
- computers

- interface units

Other navigational system components: remove and replace three of the following:

- batteries
- switches
- relays
- circuit breakers
- unit trays
- vacuum pump
- instruments/gauges/indicators
- wires/cables
- plugs/sockets
- line replacement units (LRU)
- other system components

1.10 remove and replace aircraft navigational system components in compliance with one of the following:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- extended twin operations procedures (ETOpS) (where appropriate)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures
- aircraft manufacturer's requirements

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

1.12 complete the relevant documentation, in accordance with organisational requirements

1.13 complete the relevant paperwork, to include one from the following, and pass it to the appropriate people:

- job cards
- computer records
- aircraft service/flight log
- aircraft log
- permit to work/formal risk assessment

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

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

Learning outcome
The learner will: 2. Know how to remove and replace components of aircraft navigational and computing systems
Assessment criteria
The learner can: 2.1 explain the specific safety practices and procedures that they need to observe when working with aircraft navigational and computing systems 2.2 explain the importance of maintenance on, and impact upon ETOpS systems, legislation and local procedures 2.3 describe 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 2.4 explain what protective equipment they need to use for both personal protection and protection of the aircraft 2.5 explain 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 2.6 explain how to carry out currency/issue checks on the specifications they are working with 2.7 explain the terminology used in aircraft navigational and computing systems, and the use of system diagrams and associated symbols 2.8 describe 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 2.9 describe the various mechanical fasteners that are used, and explain their method of removal and replacement 2.10 explain the importance of using the specified fasteners for the installation, and why they must not substitute others 2.11 explain why securing devices need to be locked and labelled, and the different methods that are used to remove and install them 2.12 explain the torque loading requirements of the fasteners, and what to do if these loadings are exceeded or not achieved 2.13 describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking in of the connections 2.14 describe the techniques used to remove components from aircraft navigational and computing systems, without damage to the components or surrounding structure 2.15 explain the importance of applying electrostatic discharge (ESD) procedures when working on sensitive equipment/devices 2.16 explain 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 2.17 describe the techniques used to position, align, adjust and secure the replaced components to the aircraft, without damage to the components or surrounding structure 2.18 describe the quality control procedures to be followed during the removal and replacement operations

2.19	explain the procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities
2.20	explain the methods of lifting, handling and supporting the components/equipment during the removal and replacement activities
2.21	explain the use of seals, sealant, adhesives and anti-electrolysis barriers, and the precautions to be taken
2.22	explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
2.23	explain how to conduct any necessary checks to ensure the system integrity, accuracy and quality of the removal and replacement
2.24	describe the tools and equipment used in the removal and replacement activities, and explain their calibration/care and control procedures
2.25	explain 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
2.26	describe the problems that can occur with the removal and replacement operations, and explain how these can be overcome
2.27	explain how to recognise defects
2.28	explain what recording documentation needs 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
2.29	describe the procedure for the safe disposal of waste materials and scrap components
2.30	describe the extent of their own responsibility, and explain to whom they should report if they have problems that they cannot resolve

Unit 529 Removing and replacing components of aircraft navigational and computing systems

Supporting information

Guidance

2.1 (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

2.9 (such as threaded fasteners, special securing devices)

2.14 (such as proof marking, the need to protect the circuit integrity by covering and labelling exposed circuits)

2.27 (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)

Unit 530 Removing and replacing components of aircraft flight guidance and control systems

UAN:	**J/601/4771**
Level:	3
Credit value:	86
GLH:	175
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 130: Removing and replacing components of aircraft flight guidance and control systems (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required 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. The learner 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 computers, controllers, air data units, detectors, gyros (rate and vertical), compass computers, trim units, actuators, stick position cancellers, altitude heading and reference system (AHRS), inertial reference unit (IRUs) primary or secondary, embedded GPS and INS (EGI). 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. The learner's 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. The learner 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. The learner 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.

The learner's 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. The learner will understand the removal and replacement methods and procedures, and their application, along with the systems maintenance requirements. The learner 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, the learner 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.

The learner will understand the safety precautions required when working on the aircraft flight guidance and control systems, and when using the associated tools and equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Notes: To display competence in this unit it is necessary to both remove and replace aircraft flight guidance and control system components. The learner must remove components; however, they may fit a replacement component where the original was previously removed by another person.

Learning outcome
The learner will: 1. Be able to remove and replace components of aircraft flight guidance and control systems
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the removal and replacement activity: • obtain clearance to work on the aircraft, and observe all relevant isolation and safety procedures • obtain and use the appropriate documentation (such as job instructions, aircraft manuals, technical instructions, and other relevant maintenance documentation) • 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 • ensure that all relevant safety devices and mechanical/physical locks are in place (where appropriate) • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current certification/calibration date • use approved removal and replacement techniques and procedures at all times • where appropriate, apply electrostatic discharge (ESD) protection procedures • ensure that components and surrounding structures are maintained free from damage and foreign objects • return all tools and equipment to the correct location on completion of the activities • 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 1.3 follow the relevant aircraft manuals and publications to carry out the required work 1.4 establish and, where appropriate, mark component orientation for re-assembly 1.5 carry out the removal and replacement activities, within the limits of their personal authority 1.6 carry out all of the following removal and replacement activities: • disconnecting electrical connections • removal of earth bonding • removing cable securing devices • removing bolt securing devices and mechanical fasteners • applying and removing covering/protection to exposed components, wires, pipework or vents • checking components for serviceability

- replacing all 'lifed' items (seals, filters, gaskets)
- positioning and aligning replaced components
- making mechanical connections
- making electrical connections
- carrying out earth bonding
- installing cable securing devices
- tightening fastenings to the required torque
- labelling (and storing in the correct location) components that require repair or overhaul
- setting, and adjusting/tuning replaced components (such as power output, voltage)
- applying bolt locking methods (such as split pins, wire locking, lock nuts)

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

1.8 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:

- fly-by-wire
- auto-pilot
- flight director
- turn and slip indication
- gyros
- automatic flying control system (AFCS)
- angle of attack/stall warning
- nose wheel steering
- main gear steering

1.9 during the activities identified in 1.8 above, they must cover the removal and replacement of the following major flight guidance and control components: remove and replace three of the following:

- computers
- controllers
- air data units
- detectors/position sensors
- receiver units
- gyros(rate and vertical)
- compass computers
- trim units
- actuators
- transformers
- stick position cancellers
- attitude heading and reference system (AHRS)
- inertial reference unit (IRUs) primary or secondary
- embedded GPS and INS (EGI)

Other flight guidance and control system components: remove and replace three of the following:

- batteries

- switches
- relays
- aerials
- instruments/gauges/indicators
- wires/cables
- plugs/sockets

1.10 remove and replace aircraft flight guidance and control system components in compliance with one of the following:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- extended twin operations procedures (ETOpS) (where appropriate)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures
- aircraft manufacturer's requirements

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

1.12 complete the relevant documentation, in accordance with organisational requirements

1.13 complete the relevant paperwork, to include one from the following, and pass it to the appropriate people:

- job cards
- computer records
- aircraft service/flight log
- aircraft log
- permit to work/formal risk assessment

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

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

Learning outcome
The learner will: 2. Know how to remove and replace components of aircraft flight guidance and control systems
Assessment criteria
The learner can: 2.1 explain the specific safety practices and procedures that they need to observe when working with aircraft flight guidance and control systems 2.2 explain the importance of maintenance on, and impact upon ETOpS systems, legislation and local procedures 2.3 describe the hazards associated with removing and replacing aircraft flight guidance and control system components, and with the tools and equipment used, and explain how to minimise them and reduce any risks

2.4	explain what protective equipment they need to use for both personal protection and protection of the aircraft
2.5	explain 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
2.6	explain how to carry out currency/issue checks on the specifications they are working with
2.7	explain the terminology used in aircraft flight guidance and control systems, and the use of system diagrams and associated symbols
2.8	describe 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
2.9	describe the various mechanical fasteners that are used, and explain their method of removal and replacement
2.10	explain the importance of using the specified fasteners for the installation, and why they must not substitute others
2.11	explain why securing devices need to be locked and labelled, and the different methods that are used to remove and install them
2.12	explain the torque loading requirements of the fasteners, and what to do if these loadings are exceeded or not achieved
2.13	describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking in of the connections
2.14	describe the techniques used to remove components from aircraft flight guidance and control systems, without damage to the components or surrounding structure
2.15	explain the importance of applying electrostatic discharge (ESD) procedures when working on sensitive equipment or devices
2.16	explain 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
2.17	describe the techniques used to position, align, adjust and secure the replaced components to the aircraft, without damage to the components or surrounding structure
2.18	describe the quality control procedures to be followed during the removal and replacement operations
2.19	explain the procedures for ensuring they have the correct tools, equipment, components and fasteners for the activities
2.20	explain the methods of lifting, handling and supporting the components/equipment during the removal and replacement activities
2.21	explain the use of seals, sealant and adhesives and anti-electrolysis barriers, and the precautions to be taken
2.22	explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
2.23	explain how to conduct any necessary checks to ensure the system integrity, accuracy and quality of the removal and replacement
2.24	describe the tools and equipment used in the removal and replacement activities, and explain their calibration/care and control procedures
2.25	explain 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

2.26 describe the problems that can occur with the removal and replacement operations, and explain how these can be overcome

2.27 explain how to recognise defects

2.28 explain what recording documentation needs 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

2.29 describe the procedure for the safe disposal of waste materials and scrap components

2.30 describe the extent of their own responsibility, and explain to whom they should report if they have problems that they cannot resolve.

Unit 530 Removing and replacing components of aircraft flight guidance and control systems

Supporting information

Guidance

2.1 (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

2.9 (such as threaded fasteners, special securing devices)

2.14 (such as proof marking, the need to protect the circuit integrity by covering and labelling exposed circuits)

2.27 (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)

Unit 531 Removing and replacing components of aircraft internal and external lighting systems

UAN:	**L/601/4772**
Level:	3
Credit value:	84
GLH:	175
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 131: Removing and replacing components of aircraft internal and external lighting systems (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to carry out the removal and replacement of components in aircraft lighting systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft, and includes equipment and components associated with electro-luminescence (EL), emergency lighting, night vision goggles (NVG), utility lighting, spot/search lighting, anti-dazzle lighting, external lighting systems, flood lighting, and cabin lighting, as applicable to the aircraft type. The learner 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. The learner's 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. The learner 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. The learner 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.

The learner's 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. The learner will understand the removal and replacement methods and procedures, and their application, along with the systems maintenance requirements. The learner 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, the learner 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.

The learner will understand the safety precautions required when working on the aircraft lighting systems, and when using the associated tools and equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Notes: To display competence in this unit it is necessary to both remove and replace aircraft lighting system components. The learner must remove components; however, they may fit a replacement component where the original was previously removed by another person.

Learning outcome
The learner will: 1. Be able to remove and replace components of aircraft internal and external lighting systems
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the removal and replacement activity: • obtain clearance to work on the aircraft, and observe all relevant isolation and safety procedures • obtain and use the appropriate documentation (such as job instructions, aircraft manuals, technical instructions, and other relevant maintenance documentation) • 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 • ensure that all relevant safety devices and mechanical/physical locks are in place (where appropriate) • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current certification/calibration date • use approved removal and replacement techniques and procedures at all times • where appropriate, apply electrostatic discharge (ESD) protection procedures • ensure that components and surrounding structures are maintained free from damage and foreign objects • return all tools and equipment to the correct location on completion of the activities • 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 1.3 follow the relevant aircraft manuals and publications to carry out the required work 1.4 establish and, where appropriate, mark component orientation for re-assembly 1.5 carry out the removal and replacement activities, within the limits of their personal authority 1.6 carry out all of the following removal and replacement activities: • disconnecting electrical connections • removal of earth bonding • removing cable securing devices • removing bolt securing devices and mechanical fasteners • applying and removing covering/protection to exposed components, wires, pipework or vents • checking components for serviceability

- positioning and aligning replaced components
- making mechanical connections
- making electrical connections
- carrying out earth bonding
- installing cable securing devices
- weather sealing of lighting unit assemblies
- labelling (and storing in the correct location) components that require repair or overhaul
- applying bolt locking methods (such as split pins, wire locking, lock nuts)

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

1.8 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:

- electro-luminescence (EL)
- emergency lighting
- night vision goggles (NVG)
- spot/search lighting
- anti-dazzle lighting
- external lighting systems
- flood lighting
- cabin lighting
- utility lighting

1.9 during the activities identified in 1.8 above, they must cover the removal and replacement of the following major lighting system components: remove and replace four of the following:

- power supplies
- junction box
- spot/search light (complete unit)
- taxi/landing lamp (complete unit)
- transformer
- inverters
- rheostats
- utility light
- rectifier units
- control units
- strobe light/beacon light
- navigation light

Other lighting system components: remove and replace five of the following:

- switches
- relays
- transducers/sensors
- batteries
- circuit breakers
- terminal blocks

- filaments
- light emitting diodes
- strip lights
- wires/cables
- plugs/sockets

1.10 remove and replace aircraft lighting system components in compliance with one of the following:
- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- extended twin operations procedures (ETOpS) (where appropriate)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures
- aircraft manufacturer's requirements

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

1.12 complete the relevant documentation in accordance with organisational requirements

1.13 complete the relevant paperwork, to include one from the following, and pass it to the appropriate people:
- job cards
- computer records
- aircraft service/flight log
- aircraft log book
- permit to work/formal risk assessment

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

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

Learning outcome
The learner will: 2. Know how to remove and replace components of aircraft internal and external lighting systems
Assessment criteria
The learner can: 2.1 explain the specific safety practices and procedures that they need to observe when working with aircraft internal and external lighting systems 2.2 explain the importance of maintenance on, and impact upon ETOpS systems, legislation and local procedures 2.3 describe the hazards associated with removing and replacing aircraft lighting system components, and with the tools and equipment used, and explain how to minimise them and reduce any risks 2.4 explain what protective equipment they need to use for both

personal protection and protection of the aircraft

2.5 explain 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

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

2.7 explain the terminology used in aircraft lighting systems, and the use of system diagrams and associated symbols

2.8 describe 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

2.9 describe the various mechanical fasteners that are used, and explain their method of removal and replacement

2.10 explain the importance of using the specified fasteners for the installation, and why they must not substitute others

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

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

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

2.14 describe the techniques used to remove components from aircraft lighting systems, without damage to the components or surrounding structure

2.15 explain the importance of applying electrostatic discharge (ESD) procedures when working on sensitive equipment or devices

2.16 explain 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

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

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

2.19 explain the procedures for ensuring they have the correct tools, equipment, components and fasteners for the activities

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

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

2.22 explain why electrical bonding is critical, and why it must be both mechanically and electrically secure

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

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

2.25 explain 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

2.26 describe the problems that can occur with the removal and

	replacement operations, and explain how these can be overcome
2.27	explain how to recognise defects
2.28	explain what recording documentation needs 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
2.29	describe the procedure for the safe disposal of waste materials and scrap components
2.30	describe the extent of their own responsibility, and explain to whom they should report if they have problems that they cannot resolve

Unit 531 Removing and replacing components of aircraft internal and external lighting systems

Supporting information

Guidance

2.1 (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

2.9 (such as threaded fasteners, special securing devices)

2.14 (such as proof marking, the need to protect the circuit integrity by covering and labelling exposed circuits)

2.27 (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)

Unit 532 Modifying aircraft avionic systems

UAN:	**R/601/4773**
Level:	3
Credit value:	77
GLH:	175
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 132: Modifying aircraft electrical/avionic systems (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to modify aircraft electrical/avionic systems, in accordance with approved procedures. In carrying out the modification operations, the learner 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 such as 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. The learner will be expected to remove and replace existing cables, add new cables, change breakout points and change the routeing of cables. The learner will also be expected to change components such as units and trays. The learner will need to show proficiency using various tools for cutting, stripping, crimping and soldering, and for the installation of the avionic systems. The learner's 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. The learner 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.

The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to applying modification procedures to aircraft avionic systems. The learner 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.

The learner will understand the safety precautions required when carrying out the modifications. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Note: This unit 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.

Learning outcome
The learner will: 1. Be able to modify aircraft electrical/avionic systems
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the modification activities: • 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) • 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 • provide and maintain a safe working environment for the modification activities • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within

current calibration date
- obtain clearance to work on the aircraft, and observe the power isolation and safety procedures
- use safe and approved modification techniques and procedures at all times
- where appropriate, apply electrostatic discharge (ESD) protection procedures
- return all tools and equipment to the correct location on completion of the activities
- dispose of waste items in a safe and environmentally acceptable manner
- leave the work area in a safe and appropriate condition, free from foreign object debris on completion of the activities

1.3 obtain and follow the relevant modification specifications and job instructions

1.4 confirm and agree what modifications are to be carried out to meet the specification

1.5 prepare the electrical/avionic system for the required modification

1.6 carry out the system modification, using approved materials, methods and procedures

1.7 carry out modifications to three of the following aircraft electrical/avionic systems:
- indication and gauging
- pitot static
- radar
- navigational
- armament
- communication
- infra-red and optical
- flight guidance and control
- other specific system
- electrical power generation and distribution
- internal and external lighting
- passive warning and electronic countermeasure
- ground proximity/obstacle avoidance

1.8 carry out six of the following types of modification:
- replacing cables of different size or length
- changing or adding components to panels or sub-assemblies
- changing the position or angle of breakout points
- making changes to cable terminations
- making changes to structure (such as framework, casings, panels)
- changing the routes of cables
- adding/removing/replacing pitot static pipes
- adding new looms
- making changes to looms
- changing the position of electrical/avionic units
- fitting new electrical/avionic systems

- removing cables
- adding cables

1.9 carry out at ten of the following processes:

- soldering and de-soldering
- heat shrinking (devices and boots)
- crimping (tags and pins)
- electrical bonding
- updating firmware/software
- stripping cable insulation
- removing and replacing cable end fittings
- changing components
- dismantling and re-assembling
- stage checks of installed components (includes continuity checking)
- changing electrical/avionic trays
- repositioning units
- removal cable protection
- adjusting or tuning/calibrating components
- repositioning pitot static pipes security devices

1.10 complete the modification within the agreed timescale

1.11 check that the modified avionic system meets the specified operating conditions

1.12 modify electrical/avionic systems in compliance with one of the following:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- extended twin operations procedures (ETOpS) (where appropriate)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures
- aircraft manufacturer's requirements

1.13 produce accurate and complete records of all modification work carried out

1.14 complete the relevant paperwork, to include one from the following, and pass it to the appropriate people:

- build records
- log cards
- job cards
- aircraft flight log
- aircraft log book

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

Learning outcome
The learner will: 2. Kknow how to modify aircraft electrical/avionic systems
Assessment criteria
The learner can: 2.1 explain the specific safety precautions and procedures to be observed whilst carrying out the modifications to aircraft electrical/avionic systems 2.2 explain the importance of maintenance on, and impact upon ETOpS systems, legislation and local procedures 2.3 explain 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 2.4 describe the hazards associated with carrying out modifications to aircraft electrical/avionic systems, and explain how to minimise them and reduce any risks 2.5 explain what personal protective equipment and clothing needs to be worn during the modification activities 2.6 describe the various types of drawing and specification that are used during the modification 2.7 explain how to identify the components to be used; component identification systems 2.8 explain what preparations need to be undertaken on the system prior to modification 2.9 explain the importance of applying electrostatic discharge (ESD) procedures when working on sensitive equipment or devices 2.10 describe the methods and techniques to be used for soldering and de-soldering, and the importance of adhering to the procedures 2.11 describe the methods and techniques to be used for crimping and heat shrinking, and the importance of adhering to them 2.12 describe the methods and techniques to be used for the assembly of screened and unscreened plugs and sockets 2.13 explain how to identify the difference between composite and metal plugs and sockets 2.14 explain the different types of cable protection, and reasons for each type 2.15 describe the various mechanical fasteners that will be used, and explain their method of installation 2.16 explain the importance of using the specified fasteners for the modification, and why they must not use substitutes 2.17 describe the quality control procedures to be followed during the modification operations 2.18 explain how to conduct any necessary checks to ensure the accuracy and quality of the modification 2.19 explain how to recognise defects 2.20 explain the importance of ensuring that the completed modification is free from dirt, swarf and foreign object damage 2.21 describe the methods and equipment used to transport, handle and lift components/looms into position, and explain how to check that the equipment is within its current certification dates 2.22 explain 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
2.23	describe the problems that can occur with the modification operations, and explain how these can be overcome
2.24	explain what recording documentation needs 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
2.25	describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 532 Modifying aircraft avionic systems

Supporting information

Guidance

2.1 (including any specific legislation, regulations or codes of practice relating to the activities, equipment or materials)

2.7 (such as codes and component orientation indicators)

2.19 (such as misalignment, ineffective fasteners, foreign object damage or contamination)

Unit 533 Carrying out tests on avionic indication and gauging components of aircraft systems

UAN:	**Y/601/4774**
Level:	3
Credit value:	53
GLH:	119
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 133: carrying out tests on avionic indication and gauging components of aircraft systems (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required 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. The learner 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, BITE tests, fuel gauging checks, content/level checks, comparison and functional checks. The learner's 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. The learner 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. The learner 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.

The learner's 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. The learner 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.

The learner will understand the safety precautions required when carrying out the testing activities and when using the associated tools and equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. Be able to carry out tests on avionic indication and gauging components of aircraft systems
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the testing of the avionic indication and gauging components: • 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) • 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 • provide and maintain a safe working environment for the testing activities • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current calibration date

- obtain clearance to work on the aircraft, and observe all relevant isolation and safety procedures
- ensure that safe working distance procedures are set up (where appropriate)
- where appropriate, apply electrostatic discharge (ESD) protection procedures
- carry out the tests using the specified techniques and procedures
- make any permitted adjustments to components and equipment, to bring the system up to specification
- return all tools and equipment to the correct location on completion of the testing activities
- leave the aircraft and work area in a safe and appropriate condition, free from foreign object debris on completion of the activities

1.3 follow the appropriate procedures for use of tools and equipment to carry out the required tests

1.4 test aircraft indication and gauging systems, using all of the following:

- external power supply (electrical/hydraulic)
- internal power supply source (electrical/hydraulic)
- 'special-to-type' test sets
- measuring equipment

1.5 set up and carry out the tests using the correct procedures and within agreed timescales

1.6 carry out testing on three of the following aircraft indication and gauging systems:

- power plant (such as main engine power, auxiliary power, thrust reverse, propeller, starting, monitoring, fire)
- engine fuel, lubrication, air, cooling, control systems
- fluid power (such as hydraulic power generation, undercarriage, pneumatic or vacuum pressure)
- flying controls (such as flaps/slats, elevators, ailerons/tailerons, horizontal stabiliser, spoilers/speed brakes, wing sweep, reaction controls, rudder, rotor)
- wheels, brakes, steering
- transmission systems (such as main/auxiliary gear boxes)
- aircraft fuel systems (such as supply, contents, transfer, venting system, fuel jettison, refuelling/defuelling)
- environmental control systems (such as pressure control, heating and ventilation, equipment air conditioning)
- ice and rain protection systems (such as windshield, engine protection, pitot static protection, ice accretion)
- fuselage (such as access panels, cargo doors, boundary layer, suction doors)
- ram air turbine (RAT)

1.7 carry out four of the following types of test/check:

- soak test
- functional check
- continuity check

- contents/level check
- voltage check
- BITE test
- comparison check
- 'special-to-type' tests

Including the following:

- a full system test that incorporates at least three of the above tests

1.8 carry out tests in compliance with one of the following:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- extended twin operations procedures (ETOpS) (where appropriate)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- aircraft manufacturer's requirements
- customer standards and requirements
- company standards and procedures
- specific system requirements

1.9 record the results of the tests in the appropriate format

1.10 complete the relevant paperwork, to include one from the following, indicating the results of the tests, and pass it to the appropriate people:

- computer records
- test records
- job cards
- aircraft service/flight log
- aircraft log
- permit to work/formal risk assessment

1.11 review the results and carry out further tests if necessary

Learning outcome
The learner will: 2. Know how to carry out tests on avionic indication and gauging components of aircraft systems
Assessment criteria
The learner can: 2.1 explain the specific safety practices and procedures that they need to observe when testing aircraft indication and gauging systems 2.2 explain the importance of maintenance on, and impact upon ETOpS systems, legislation and local procedures 2.3 explain the health and safety requirements of the work area where they are carrying out the activities, and the responsibility these requirements place on them 2.4 explain the safety procedures that must be carried out before work is started on the aircraft 2.5 explain what protective clothing and equipment needs to be worn,

and where it can be obtained

2.6 describe the hazards associated with testing aircraft indication and gauging systems, and with the tools and equipment used, and explain how to minimise them and reduce any risks

2.7 explain the correct operating procedures of the indication and gauging system being tested

2.8 explain the electrical bonding specifications, and their importance

2.9 explain how to extract and use information from engineering drawings and related specifications

2.10 explain 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

2.11 explain 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

2.12 describe the methods and procedures to be used to carry out the various tests on the aircraft indication or gauging system and its system components

2.13 explain the importance of applying electrostatic discharge (ESD) procedures when working on sensitive equipment or devices

2.14 explain what test equipment is to be used, and its selection and application for the particular tests

2.15 explain the calibration of the test equipment (where applicable), and the currency/issue checks to be carried out

2.16 describe the testing techniques, methods and procedures to be used during the tests

2.17 explain why equipment control is critical, and what to do if a piece of equipment is unaccounted for on completion of the activities

2.18 describe the basic principles of operation of the indication and gauging system under test, and explain the function of the individual components within the system

2.19 explain the importance of carrying out the tests in the specified sequence, checking all readings, movements and levels at each stage

2.20 explain from whom to seek authorisation if they need to alter or change the test procedures

2.21 explain how to record the results of each individual test, and the documentation that must be used

2.22 explain how to analyse the test results, and how to make valid decisions about the acceptability of the system

2.23 explain the procedures to be followed if the equipment or system fails to meet the test specification

2.24 describe the problems that can occur with the testing activities, and explain how they can be overcome

2.25 describe the things that may cause errors or discrepancies with the test results, and explain how to avoid these

2.26 explain any required environmental controls relating to the testing

2.27 explain what documentation needs to be completed at the end of the testing activities

2.28 describe the extent of their own responsibility, and explain to whom they should report if they have problems that they cannot resolv

Unit 533 Carrying out tests on avionic indication and gauging components of aircraft systems

Supporting information

Guidance

2.1 (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

Unit 534 Carrying out tests on aircraft electrical power control, distribution and protection systems

UAN:	**H/601/4776**
Level:	3
Credit value:	53
GLH:	119
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 134: Carrying out tests on aircraft electrical power control, distribution and protection systems (Suite 3) .
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required 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. The learner 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, BITE tests, emergency power failure, comparison and functional checks. The learner's 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. The learner 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. The learner 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.

The learner's 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. The learner 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.

The learner will understand the safety precautions required when carrying out the testing activities and when using the associated tools and equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. Be able to carry out tests on aircraft electrical power control, distribution and protection systems
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the testing of the aircraft electrical power control, distribution and protection systems: • 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) • 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 • provide and maintain a safe working environment for the testing activities • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current calibration date • obtain clearance to work on the aircraft, and observe all relevant isolation and safety procedures

- ensure that safe working distance procedures are set up (where appropriate)
- where appropriate, apply electrostatic discharge (ESD) protection procedures
- carry out the tests using the specified techniques and procedures
- make any permitted adjustments to components and equipment, to bring the system to the specification requirements
- return all tools and equipment to the correct location on completion of the testing activities
- leave the aircraft and work area in a safe and appropriate condition, free from foreign object debris on completion of the activities

1.3 follow the appropriate procedures for use of tools and equipment to carry out the required tests

1.4 test aircraft electrical power control, distribution and protection systems, using all of the following:

- external power source
- internal power source
- 'special-to-type' test sets
- measuring equipment (such as multimeters, insulation testers)

1.5 set up and carry out the tests using the correct procedures and within agreed timescales

1.6 carry out testing on three of the following aircraft electrical power control, distribution and protection systems:

- AC main power generation equipment
- emergency power backup equipment
- power distribution equipment
- DC power generation
- secondary/standby power generation equipment

1.7 carry out four of the following types of test/check:

- soak test
- functional check
- continuity check
- voltage check
- BITE test
- emergency power failure checks
- comparison check
- 'special-to-type' tests

Including the following:

- a full system test that incorporates at least three of the above tests

1.8 carry out tests in compliance with one of the following:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- extended twin operations procedures (ETOpS) (where appropriate)
- Ministry of Defence (MoD)

- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- aircraft manufacturer's requirements
- customer standards and requirements
- company standards and procedures
- specific system requirements

1.9 record the results of the tests in the appropriate format

1.10 complete the relevant paperwork, to include one from the following, indicating the results of the tests, and pass it to the appropriate people:

- computer records
- test records
- job cards
- aircraft service/flight log
- aircraft log
- permit to work/formal risk assessment

1.11 review the results and carry out further tests if necessary

Learning outcome
The learner will: 2. Know how to carry out tests on aircraft electrical power control, distribution and protection systems
Assessment criteria
The learner can: 2.1 explain the specific safety practices and procedures that they need to observe when testing aircraft electrical power control, distribution and protection systems 2.2 explain the importance of maintenance on, and impact upon ETOpS systems, legislation and local procedures 2.3 explain the health and safety requirements of the work area where they are carrying out the activities, and the responsibility these requirements place on them 2.4 explain the safety procedures that must be carried out before work is started on the aircraft 2.5 explain what protective clothing and equipment needs to be worn, and where it can be obtained 2.6 describe the hazards associated with testing aircraft electrical power control, distribution and protection systems, and with the tools and equipment used, and explain how to minimise them and reduce any risks 2.7 explain the correct operating procedures of the electrical power control, distribution and protection systems being tested 2.8 explain the electrical bonding specifications, and their importance 2.9 explain how to extract and use information from engineering drawings and related specifications 2.10 explain 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 2.11 explain 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

2.12 describe 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

2.13 explain the importance of applying electrostatic discharge (ESD) procedures when working on sensitive equipment or devices

2.14 explain what test equipment is to be used, and its selection and application for particular tests

2.15 explain the calibration of the test equipment (where applicable), and the requirement for currency/issue checks

2.16 describe the testing techniques, methods and procedures to be used during the tests

2.17 explain why equipment control is critical, and what to do if a piece of equipment is unaccounted for on completion of the testing activities

2.18 describe the basic principle of operation of the electrical power control, distribution and protection systems under test, and explain the function of the individual components within the system

2.19 explain the importance of carrying out the tests in the specified sequence, checking all readings, movements and levels at each stage

2.20 explain from whom to seek authorisation if they need to alter or change the test procedures

2.21 explain how to record the results of each individual test, and the documentation that must be used

2.22 explain how to analyse the test results, and how to make valid decisions about the acceptability of the system

2.23 explain the procedures to be followed if the equipment or system fails to meet the test specification

2.24 describe the problems that can occur with the testing activities, and explain how they can be overcome

2.25 describe the things that may cause errors or discrepancies with the test results, and explain how to avoid these

2.26 explain any required environmental controls relating to the testing

2.27 explain what documentation needs to be completed at the end of the testing activities

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

Unit 534 Carrying out tests on aircraft electrical power control, distribution and protection systems

Supporting information

Guidance

2.1 (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

Unit 535 Carrying out tests on aircraft pitot static systems

UAN:	**M/601/4781**
Level:	3
Credit value:	53
GLH:	119
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 135: Carrying out tests on aircraft pitot static systems (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required 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. The learner 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 BITE tests, functional checks, sense and leak tests and independent sense and leak tests. The learner's 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. The learner 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. The learner 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.

The learner's 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. The learner 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.

The learner will understand the safety precautions required when carrying out the testing activities, and when using the associated tools and equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. Be able to carry out tests on aircraft pitot static systems
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the testing of the pitot static systems: • 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) • 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 • provide and maintain a safe working environment for the testing activities • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current calibration date • obtain clearance to work on the aircraft, and observe all relevant isolation and safety procedures • ensure that safe working distance procedures are set up (where appropriate) • where appropriate, apply electrostatic discharge (ESD) protection procedures • carry out the tests using the specified techniques and procedures • make any permitted adjustments to components and

equipment, to bring the system to the specification requirements
- return all tools and equipment to the correct location on completion of the testing activities
- leave the aircraft and work area in a safe and appropriate condition, free from foreign object debris on completion of the activities

1.3 follow the appropriate procedures for use of tools and equipment to carry out the required tests

1.4 test aircraft pitot static systems, using four of the following:
- measuring equipment
- external power source (electrical/hydraulic)
- pressure/suction equipment
- 'special-to-type' test sets
- internal power source (electrical/hydraulic)
- internal aircraft computing systems

1.5 set up and carry out the tests using the correct procedures and within agreed timescales

1.6 carry out testing on three of the following aircraft pitot static systems:
- rate of climb
- air speed indication
- aircraft height indication
- navigation
- auto-pilot
- oxygen drop out
- flying controls (such as flaps, elevators, ailerons/tailerons, spoilers, wing sweep, reaction controls, rudder, rotor, airbrakes, horizontal stabilisers, artificial feel, gust alleviation, modal suppression)
- engine control systems (such as FADEC, FAFC, EEC)
- environmental control systems (such as pressure control)
- ice and rain protection systems (such as pitot static protection, ice accretion)

1.7 carry out five of the following types of test/check:
- soak test
- functional check
- independent sense and leak test
- BITE test
- comparison check
- 'special-to-type' tests
- sense and leak tests

Including the following:
- a full system test that incorporates at least three of the above tests

1.8 carry out tests in compliance with one of the following:
- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- extended twin operations procedures (ETOpS) (where

appropriate)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- aircraft manufacturer's requirements
- customer standards and requirements
- company standards and procedures
- specific system requirements

1.9 record the results of the tests in the appropriate format

1.10 complete the relevant paperwork, to include one from the following, indicating the results of the tests, and pass it to the appropriate people:
- computer records
- test records
- job cards
- aircraft service/flight log
- aircraft log book
- permit to work/formal risk assessment

1.11 review the results and carry out further tests if necessary

Learning outcome
The learner will: 2. Know how to carry out tests on aircraft pitot static systems
Assessment criteria
The learner can: 2.1 explain the specific safety practices and procedures that they need to observe when testing aircraft pitot static systems 2.2 explain the importance of maintenance on, and impact upon ETOpS systems, legislation and local procedures 2.3 explain the health and safety requirements of the work area where they are carrying out the activities, and the responsibility these requirements place on them 2.4 explain the safety procedures that must be carried out before work is started on the aircraft 2.5 explain what protective clothing and equipment needs to be worn, and where it can be obtained 2.6 describe the hazards associated with testing aircraft pitot static systems, and with the tools and equipment used, and explain how to minimise them and reduce any risks 2.7 explain the correct operating procedures of the pitot static system being tested 2.8 explain the electrical bonding specifications, and their importance 2.9 explain how to extract and use information from engineering drawings and related specifications 2.10 explain 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 2.11 explain 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

2.12 describe the methods and procedures to be used to carry out the various tests on the aircraft pitot static system and its system components

2.13 explain what test equipment is to be used, and its selection and application for particular tests

2.14 explain the calibration of the test equipment (where applicable), and the requirement for currency/issue checks

2.15 describe the testing techniques, methods and procedures to be used during the tests

2.16 explain the importance of applying electrostatic discharge (ESD) procedures when working on sensitive equipment or devices

2.17 explain why equipment control is critical, and what to do if a piece of equipment is unaccounted for on completion of the testing activities

2.18 describe the basic principle of operation of the pitot static system under test, and explain the function of the individual components within the system

2.19 explain the importance of carrying out the tests in the specified sequence, checking all readings, movements and levels at each stage

2.20 explain from whom to seek authorisation if they need to alter or change the test procedures

2.21 explain how to record the results of each individual test, and the documentation that must be used

2.22 explain how to analyse the test results, and how to make valid decisions about the acceptability of the system

2.23 explain the procedures to be followed if the equipment or system fails to meet the test specification

2.24 describe the problems that can occur with the testing activities, and explain how they can be overcome

2.25 describe the things that may cause errors or discrepancies with the test results, and explain how to avoid these

2.26 explain any required environmental controls relating to the testing

2.27 explain what documentation needs to be completed at the end of the testing activities

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

Unit 535 Carrying out tests on aircraft pitot static systems

Supporting information

Guidance

2.1 (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

Unit 536 Carrying out tests on aircraft communication systems

UAN:	**A/601/4783**
Level:	3
Credit value:	53
GLH:	119
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 136: Carrying out tests on aircraft communication systems (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to test aircraft communication systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft, and 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. The learner 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, BITE tests, continuity checks, soak tests, distortion and sensitivity tests, power output and functional checks. The learner's 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. The learner 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. The learner 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.

The learner's 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. The learner 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.

The learner will understand the safety precautions required when carrying out the testing activities, and when using the associated tools and equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. Be able to carry out tests on aircraft communication systems
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the testing of the aircraft communication systems: • 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) • 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 • provide and maintain a safe working environment for the testing activities • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current calibration date • obtain clearance to work on the aircraft, and observe all relevant isolation and safety procedures • ensure that safe working distance procedures are set up

(where appropriate)

- where appropriate, apply electrostatic discharge (ESD) protection procedures
- carry out the tests using the specified techniques and procedures
- make any permitted adjustments to components and equipment, to bring the system to the specification requirements
- return all tools and equipment to the correct location on completion of the testing activities
- leave the aircraft and work area in a safe and appropriate condition, free from foreign object debris on completion of the activities

1.3 follow the appropriate procedures for use of tools and equipment to carry out the required tests

1.4 test aircraft communication systems, using five of the following:

- multimeter
- time domain refractometer (TDR) equipment
- bonding tester
- headset
- wattmeter
- oscilloscope
- modulation analyser
- RF signal generator
- voltage standing wave ratio (VSWR) equipment
- 'special-to-type' test sets
- external power source (electrical/hydraulic)
- internal power source (electrical/hydraulic)

1.5 set up and carry out the tests using the correct procedures and within agreed timescales

1.6 carry out testing on three of the following aircraft communication systems:

- VHF radio
- intercom (clear)
- secure radio links
- HF radio
- UHF radio
- cockpit voice recorder
- SATCOM
- intercom (secure speech)
- digital data links
- satellite position systems
- flight entertainment systems
- SELCAL
- crash position indicators
- telecommunications
- cabin interphone systems
- aircraft communication address reporting system (ACARS)

1.7 carry out five of the following types of test/check:

- soak test
- functional check
- continuity check
- bonding tests
- BITE test
- distortion checks
- VSWR checks
- power output
- receiver sensitivity
- signal-to-noise checks
- pressure checks
- 'special-to-type' tests

Including the following:

- a full system test that incorporates at least three of the above tests

1.8 carry out tests in compliance with one or more of the following:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- extended twin operations procedures (ETOpS) (where appropriate)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- aircraft manufacturer's requirements
- customer standards and requirements
- company standards and procedures
- specific system requirements

1.9 record the results of the tests in the appropriate format

1.10 complete the relevant paperwork, to include one from the following, indicating the results of the tests, and pass it to the appropriate people:

- computer records
- test records
- job cards
- aircraft service/flight log
- aircraft log
- permit to work/formal risk assessment

1.11 review the results and carry out further tests if necessary

Learning outcome
The learner will: 2. Know how to carry out tests on aircraft communication systems
Assessment criteria
The learner can: 2.1 explain the specific safety practices and procedures that they need to observe when testing aircraft communication systems

2.2	explain the importance of maintenance on, and impact upon ETOpS systems, legislation and local procedures
2.3	explain the health and safety requirements of the work area where they are carrying out the activities, and the responsibility these requirements place on them
2.4	explain the safety procedures that must be carried out before work is started on the aircraft
2.5	explain what protective clothing and equipment needs to be worn, and where it can be obtained
2.6	describe the hazards associated with testing aircraft communication systems, and with the tools and equipment used, and explain how to minimise them and reduce any risks
2.7	explain the correct operating procedures of the communication system being tested
2.8	explain the electrical bonding specifications, and their importance
2.9	explain how to extract and use information from engineering drawings and related specifications
2.10	explain 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
2.11	explain 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
2.12	describe the methods and procedures to be used to carry out the various tests on the aircraft communication system and its system components
2.13	explain the importance of applying electrostatic discharge (ESD) procedures when working on sensitive equipment or devices
2.14	explain what test equipment is to be used, and its selection and application for particular tests
2.15	explain the calibration of the test equipment (where applicable), and the requirement for currency/issue checks
2.16	describe the testing techniques, methods and procedures to be used during the tests
2.17	explain why equipment control is critical, and what to do if a piece of equipment is unaccounted for on completion of the testing activities
2.18	describe the basic principle of operation of the communication system under test, and explain the function of the individual components within the system
2.19	explain the importance of carrying out the tests in the specified sequence, checking all readings, movements and levels at each stage
2.20	explain from whom to seek authorisation if they need to alter or change the test procedures
2.21	explain how to record the results of each individual test, and the documentation that must be used
2.22	explain how to analyse the test results, and how to make valid decisions about the acceptability of the system
2.23	explain the procedures to be followed if the equipment or system fails to meet the test specification
2.24	describe the problems that can occur with the testing activities, and explain how they can be overcome
2.25	describe the things that may cause errors or discrepancies with the test results, and explain how to avoid these

2.26	explain any required environmental controls relating to the testing
2.27	explain what documentation needs to be completed at the end of the testing activities
2.28	describe the extent of their own responsibility, and explain to whom they should report if they have problems that they cannot resolve

Unit 536 Carrying out tests on aircraft communication systems

Supporting information

Guidance

2.1 (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

Unit 537 Carrying out tests on aircraft passive warning and optical/surveillance systems

UAN:	**F/061/4784**
Level:	3
Credit value:	53
GLH:	119
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 137: Carrying out tests on aircraft passive warning and optical/surveillance systems (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required 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. The learner 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 playback, BITE tests, continuity checks, and functional checks. The learner's 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. The learner 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. The learner 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.

The learner's 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. The learner 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.

The learner will understand the safety precautions required when carrying out the testing activities, and when using the associated tools and equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. Be able to carry out tests on aircraft passive warning and optical/surveillance systems
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the testing of the aircraft passive warning and optical/surveillance systems: • 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) • 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 • provide and maintain a safe working environment for the testing activities • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current calibration date • obtain clearance to work on the aircraft, and observe all relevant isolation and safety procedures • ensure that safe working distance procedures are set up

(where appropriate)
- where appropriate, apply electrostatic discharge (ESD) protection procedures
- carry out the tests using the specified techniques and procedures
- make any permitted adjustments to components and equipment, to bring the system to the specification requirements
- return all tools and equipment to the correct location on completion of the testing activities
- leave the aircraft and work area in a safe and appropriate condition, free from foreign object debris on completion of the activities

1.3 follow the appropriate procedures for use of tools and equipment to carry out the required tests

1.4 test aircraft passive warning and optical/surveillance systems, using five of the following:
- oscilloscopes
- multimeter
- bonding tester
- signal generators
- 'special-to-type' test equipment
- inclinometer
- external power source (electrical/hydraulic)
- internal power source (electrical/hydraulic)
- voltage standing wave ratio (VSWR) equipment
- video playback equipment
- photographic developers

1.5 set up and carry out the tests using the correct procedures and within agreed timescales

1.6 carry out testing on three of the following aircraft passive warning and optical/surveillance systems:
- acoustics
- air data recording
- collision avoidance
- ground avoidance
- video recording systems
- LASER systems
- cockpit voice recording systems
- sound navigation and ranging (SONAR)
- radar homing and warning receivers (RHWR)
- camera systems (wet film, digital or infra-red)

1.7 carry out six of the following types of test/check:
- voltage standing wave ratio (VSWR) checks
- alignment checks
- soak test
- functional check
- safety interlock checks

- bonding tests
- voltage checks
- range checks
- BITE test
- signal injection tests
- continuity checks
- 'special-to-type' tests
- receiver sensitivity
- video playback
- photographic development

Including the following:

- a full system test that incorporates at least three of the above tests

1.8 carry out tests in compliance with one of the following:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- extended twin operations procedures (ETOpS) (where appropriate)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- aircraft manufacturer's requirements
- customer standards and requirements
- company standards and procedures
- specific system requirements

1.9 record the results of the tests in the appropriate format

1.10 complete the relevant paperwork, to include one from the following, indicating the results of the tests, and pass it to the appropriate people:

- computer records
- test records
- job cards
- aircraft service/flight log
- aircraft log
- permit to work/formal risk assessment

1.11 review the results and carry out further tests if necessary

Learning outcome
The learner will: 2. Know how to carry out tests on aircraft passive warning and optical/surveillance systems
Assessment criteria
The learner can: 2.1 explain the specific safety practices and procedures that they need to observe when testing aircraft passive warning and optical/surveillance systems 2.2 explain the importance of maintenance on, and impact upon ETOpS

systems, legislation and local procedures

2.3 explain the health and safety requirements of the work area where they are carrying out the activities, and the responsibility these requirements place on them

2.4 explain the safety procedures that must be carried out before work is started on the aircraft

2.5 explain what protective clothing and equipment needs to be worn, and where it can be obtained

2.6 describe the hazards associated with testing aircraft passive warning and optical/surveillance systems, and with the tools and equipment used, and explain how to minimise them and reduce any risks

2.7 explain the correct operating procedures of the passive warning and optical/surveillance system being tested

2.8 explain the electrical bonding specifications, and their importance

2.9 explain how to extract and use information from engineering drawings and related specifications

2.10 explain 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

2.11 explain 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

2.12 describe the methods and procedures to be used to carry out the various tests on the aircraft passive warning and optical/surveillance system components

2.13 explain the importance of applying electrostatic discharge (ESD) procedures when working on sensitive equipment or devices

2.14 explain what test equipment is to be used, and its selection and application for particular tests

2.15 explain the calibration of the test equipment (where applicable), and the requirement for currency/issue checks

2.16 describe the testing techniques, methods and procedures to be used during the tests

2.17 explain why equipment control is critical, and what to do if a piece of equipment is unaccounted for on completion of the testing activities

2.18 describe the basic principle of operation of the passive warning and optical/surveillance system under test, and explain the function of the individual components within the system

2.19 explain the importance of carrying out the tests in the specified sequence, checking all readings, movements and levels at each stage

2.20 explain from whom to seek authorisation if they need to alter or change the test procedures

2.21 explain how to record the results of each individual test, and the documentation that must be used for this

2.22 explain how to analyse the test results, and how to make valid decisions about the acceptability of the system

2.23 explain the procedures to be followed if the equipment or system fails to meet the test specification

2.24 describe the problems that can occur with the testing activities, and explain how they can be overcome

2.25	describe the things that may cause errors or discrepancies with the test results, and explain how to avoid these
2.26	explain any required environmental controls relating to the testing
2.27	explain what documentation needs to be completed at the end of the testing activities
2.28	describe the extent of their own responsibility, and explain to whom they should report if they have problems that they cannot resolve

Unit 537 Carrying out tests on aircraft passive warning and optical/surveillance systems

Supporting information

Guidance

2.1 (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

Unit 538 Carrying out tests on aircraft radar systems

UAN:	**R/601/4787**
Level:	3
Credit value:	53
GLH:	119
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 138: Carrying out tests on aircraft radar systems (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required 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. The learner 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 BITE tests, continuity checks, distortion and range checks, receiver sensitivity, voltage standing wave ratio (VSWR) checks and functional checks. The learner's 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. The learner 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. The learner 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.

The learner's 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. The learner 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. The learner will understand the safety precautions required when carrying out the testing activities, and when using the associated tools and equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. Be able to carry out tests on aircraft radar systems
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the testing of the aircraft radar systems: • 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) • 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 • provide and maintain a safe working environment for the testing activities • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current calibration date • obtain clearance to work on the aircraft, and observe all relevant isolation and safety procedures • ensure that safe working distance procedures are set up (where appropriate) • where appropriate, apply electrostatic discharge (ESD)

protection procedures
- carry out the tests using the specified techniques and procedures
- make any permitted adjustments to components and equipment, to bring the system to the specification requirements
- return all tools and equipment to the correct location on completion of the testing activities
- leave the aircraft and work area in a safe and appropriate condition, free from foreign object debris on completion of the activities

1.3 follow the appropriate procedures for use of tools and equipment to carry out the required tests

1.4 test aircraft radar systems, using four of the following:
- 'special-to-type' test equipment
- multimeter
- bonding tester
- oscilloscope
- modulation analyser
- dummy load
- RF signal generator
- delay lines
- external power source (electrical/hydraulic)
- internal power source (electrical/hydraulic)
- pressure tester (hydraulic, pneumatic, coolant)
- time-domain refractometer (TDR) equipment
- voltage standing wave ratio (VSWR) equipment

1.5 set up and carry out the tests using the correct procedures and within agreed timescales

1.6 carry out testing on three of the following aircraft radar systems:
- surveillance radar
- weather radar/predictive wind shear
- towed radar decoys
- radar (radio) altimeter
- Doppler
- obstacle warning systems
- radar jamming
- identification friend or foe (IFF)
- tactical air navigation (TACAN)
- enhanced ground proximity warning system (EGPWS)
- traffic collision avoidance system (TCAS)
- supplementary surveillance radar

1.7 carry out four of the following types of test/check:
- soak test
- functional check
- continuity check
- bonding tests

- BITE test
- distortion checks
- voltage standing wave ratio (VSWR) checks
- range checks
- LRU replacement test
- receiver sensitivity
- signal to noise checks
- continuity checks
- 'special-to-type' tests

Including the following:

- a full system test that incorporates at least three of the above tests

1.8 carry out tests on aircraft radar systems in compliance with one of the following:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- extended twin operations procedures (ETOpS) (where appropriate)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- aircraft manufacturer's requirements
- customer standards and requirements
- company standards and procedures
- specific system requirements

1.9 record the results of the tests in the appropriate format

1.10 complete the relevant paperwork, to include one from the following, indicating the results of the tests, and pass it to the appropriate people:

- computer records
- test records
- job cards
- aircraft service/flight log
- aircraft log
- permit to work/formal risk assessment

1.11 review the results and carry out further tests if necessary

Learning outcome
The learner will: 2. Know how to carry out tests on aircraft radar systems
Assessment criteria
The learner can: 2.1 explain the specific safety practices and procedures that they need to observe when testing aircraft radar systems 2.2 explain the importance of maintenance on, and impact upon ETOpS systems, legislation and local procedures 2.3 explain the health and safety requirements of the work area where they are carrying out the activities, and the responsibility these

requirements place on them

2.4 explain the safety procedures that must be carried out before work is started on the aircraft

2.5 explain what protective clothing and equipment needs to be worn, and where it can be obtained

2.6 describe the hazards associated with testing aircraft radar systems, and with the tools and equipment used, and explain how to minimise them and reduce any risks

2.7 explain the correct operating procedures of the radar system being tested

2.8 explain the electrical bonding specifications, and their importance

2.9 explain how to extract and use information from engineering drawings and related specifications

2.10 explain 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

2.11 explain 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

2.12 describe the methods and procedures to be used to carry out the various tests on the aircraft radar system and its system components

2.13 explain the importance of applying electrostatic discharge (ESD) procedures when working on sensitive equipment or devices

2.14 explain what test equipment is to be used, and its selection and application for particular tests

2.15 explain the calibration of the test equipment (where applicable), and the requirement for currency/issue checks

2.16 describe the testing techniques, methods and procedures to be used during the tests

2.17 explain why equipment control is critical, and what to do if a piece of equipment is unaccounted for on completion of the testing activities

2.18 describe the basic principle of operation of the radar system under test, and explain the function of the individual components within the system

2.19 explain the importance of carrying out the tests in the specified sequence, checking all readings, movements and levels at each stage

2.20 explain from whom to seek authorisation if they need to alter or change the test procedures

2.21 explain how to record the results of each individual test, and the documentation that must be used

2.22 explain how to analyse the test results, and how to make valid decisions about the acceptability of the system

2.23 explain the procedures to be followed if the equipment or system fails to meet the test specification

2.24 describe the problems that can occur with the testing activities, and explain how they can be overcome

2.25 describe the things that may cause errors or discrepancies with the test results, and explain how to avoid these

2.26 explain any required environmental controls relating to the testing

2.27 explain what documentation needs to be completed at the end of

	the testing activities
2.28	describe the extent of their own responsibility, and explain to whom they should report if they have problems that they cannot resolve

Unit 538 Carrying out tests on aircraft radar systems

Supporting information

Guidance

2.1 (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

Unit 539 Carrying out tests on aircraft navigational and computing systems

UAN:	**D/601/4789**
Level:	3
Credit value:	53
GLH:	119
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 139: Carrying out tests on aircraft navigational and computing systems (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required 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. The learner 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, BITE tests, continuity checks, power output, distortion checks, distant object test, standard serviceability and functional checks. The learner's 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. The learner 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. The learner 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.

The learner's 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. The learner 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.

The learner will understand the safety precautions required when carrying out the testing activities, and when using the associated tools and equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. Be able to carry out tests on aircraft navigational and computing systems
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the testing of the aircraft navigational and computing systems: • obtain and use the appropriate documentation (such as job instructions, aircraft navigation and computing test procedures, quality control documentation, history sheets, flight logbook, aircraft standards and specifications) • 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 • provide and maintain a safe working environment for the testing activities • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current calibration date • obtain clearance to work on the aircraft, and observe all

relevant isolation and safety procedures
- ensure that safe working distance procedures are set up (where appropriate)
- where appropriate, apply electrostatic discharge (ESD) protection procedures
- carry out the tests using the specified techniques and procedures
- make any permitted adjustments to components and equipment, to bring the system to the specification requirements
- return all tools and equipment to the correct location on completion of the testing activities
- leave the aircraft and work area in a safe and appropriate condition, free from foreign object debris on completion of the activities

1.3 follow the appropriate procedures for use of tools and equipment to carry out the required tests

1.4 test aircraft navigational and computing systems, using five of the following:
- multimeter
- bonding tester
- 'special-to-type' test equipment
- radio frequency (RF) signal generators
- headset
- oscilloscope
- reference gyros
- delay lines
- external power source (electrical/hydraulic)
- internal power source (electrical/hydraulic)
- vacuum systems
- time-domain refractometer (TDR) equipment
- voltage standing wave ratio (VSWR) equipment

1.5 set up and carry out the tests using the correct procedures and within agreed timescales

1.6 carry out testing on three of the following aircraft navigational and computing systems:
- DME
- VOR/ILS
- ADF
- GPS
- Doppler
- homing
- re-transmission systems
- inertial navigation system
- LORAN
- compass
- gyro
- Decca

- radio altimeter

1.7 carry out four of the following types of test/check:

- soak test
- functional check
- bonding tests
- standard serviceability checks
- LRV alignment
- applying a dummy load
- voltage standing wave ratio (VSWR) checks
- BITE test
- distortion checks
- power output
- compass swing
- distant object test
- signal injection tests
- signal-to-noise checks
- continuity checks
- 'special-to-type' tests
- TDR checks
- receiver sensitivity

Including the following:

- a full system test that incorporates at least three of the above tests

1.8 carry out tests in compliance with one of the following:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- extended twin operations procedures (ETOpS) (where appropriate)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO OR BSEN standards and procedures
- aircraft manufacturer's requirements
- customer standards and requirements
- company standards and procedures
- specific system requirements

1.9 record the results of the tests in the appropriate format

1.10 complete the relevant paperwork, to include one from the following, indicating the results of the tests, and pass it to the appropriate people:

- computer records
- test records
- job cards
- aircraft service/flight log
- aircraft log
- permit to work/formal risk assessment

1.11 review the results and carry out further tests if necessary

Learning outcome
The learner will: 2. Know how to carry out tests on aircraft navigational and computing systems
Assessment criteria
The learner can: 2.1 explain the specific safety practices and procedures that they need to observe when testing aircraft navigational systems 2.2 explain the importance of maintenance on, and impact upon ETOpS systems, legislation and local procedures 2.3 explain the health and safety requirements of the work area where they are carrying out the activities, and the responsibility these requirements place on them 2.4 explain the safety procedures that must be carried out before work is started on the aircraft 2.5 explain what protective clothing and equipment needs to be worn, and where it can be obtained 2.6 describe the hazards associated with testing aircraft navigational systems, and with the tools and equipment used, and explain how to minimise them and reduce any risks 2.7 explain the correct operating procedures of the navigational system being tested 2.8 explain the electrical bonding specifications, and their importance 2.9 explain how to extract and use information from engineering drawings and related specifications 2.10 explain 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 2.11 explain 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 2.12 describe the methods and procedures to be used to carry out the various tests on the aircraft navigational system and its system components 2.13 explain the importance of applying electrostatic discharge (ESD) procedures when working on sensitive equipment or devices 2.14 explain what test equipment is to be used, and its selection and application for particular tests 2.15 explain the calibration of test equipment (where applicable), and the requirement for currency/issue checks 2.16 describe the techniques, methods and procedures to be used during the tests 2.17 explain why equipment control is critical, and what to do if a piece of equipment is unaccounted for on completion of the testing activities 2.18 describe the basic principle of operation of the navigational system under test, and explain the function of the individual components within the system 2.19 explain the importance of carrying out the tests in the specified sequence, checking all readings, movements and levels at each stage

2.20	explain from whom to seek authorisation if they need to alter or change the test procedures
2.21	explain how to record the results of each individual test, and the documentation that must be used
2.22	explain how to analyse the test results, and how to make valid decisions about the acceptability of the system
2.23	explain the procedures to be followed when the equipment or system fails to meet the test specification
2.24	describe the problems that can occur with the testing activities, and explain how they can be overcome
2.25	describe the things that may cause errors or discrepancies with the test results, and explain how to avoid these
2.26	explain any required environmental controls relating to the testing
2.27	explain what documentation needs to be completed at the end of the testing activities
2.28	describe the extent of their own responsibility, and explain to whom they should report if they have problems that they cannot resolve

Unit 539 Carrying out tests on aircraft navigational and computing systems

Supporting information

Guidance

2.1 (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

Unit 540 Carrying out tests on aircraft flight guidance and control systems

UAN:	**Y/601/4791**
Level:	3
Credit value:	53
GLH:	119
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 140: Carrying out tests on aircraft flight guidance and control systems (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required 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. The learner 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, BITE tests, continuity checks, 'special-to-type' tests and functional checks. The learner's 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. The learner 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. The learner 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.

The learner's 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. The learner 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.

The learner will understand the safety precautions required when carrying out the testing activities, and when using the associated tools and equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. Be able to carry out tests on aircraft flight guidance and control systems
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the testing of the aircraft flight guidance and control systems: • 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) • 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 • provide and maintain a safe working environment for the testing activities • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current calibration date • obtain clearance to work on the aircraft, and observe all relevant isolation and safety procedures • ensure that safe working distance procedures are set up (where appropriate) • where appropriate, apply electrostatic discharge (ESD) protection procedures

- carry out the tests using the specified techniques and procedures
- make any permitted adjustments to components and equipment, to bring the system to the specification requirements
- return all tools and equipment to the correct location on completion of the testing activities
- leave the aircraft and work area in a safe and appropriate condition, free from foreign object debris on completion of the activities

1.3 follow the appropriate procedures for use of tools and equipment to carry out the required tests

1.4 test aircraft flight guidance and control systems, using four of the following:

- simulators
- clinometers
- air data test sets
- tilt tables
- multimeter
- external power source (electrical/hydraulic)
- internal power source (electrical/hydraulic)
- bonding tester
- 'special-to-type' test equipment
- internal aircraft equipment
- oscilloscope
- reference gyros
- headsets
- pantographs

1.5 set up and carry out the tests using the correct procedures and within agreed timescales

1.6 carry out testing on three of the following aircraft flight guidance and control systems:

- fly-by-wire
- auto-pilot
- flight director
- nose wheel steering
- gyros
- automatic flying control system (AFCS)
- angle of attack/stall warning
- turn and slip

1.7 carry out five of the following types of test/check:

- soak test
- functional check
- bonding tests
- BITE test
- signal injection tests
- range/sense of movement
- audio warning

- visual warning
- continuity checks
- 'special-to-type' tests
- rate of movement
- voltage checks

Including the following:

- a full system test that incorporates at least four of the above tests

1.8 carry out tests in compliance with one of the following:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- extended twin operations procedures (ETOpS) (where appropriate)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- aircraft manufacturer's requirements
- customer standards and requirements
- company standards and procedures
- specific system requirements

1.9 record the results of the tests in the appropriate format

1.10 complete the relevant paperwork, to include one from the following, indicating the results of the tests, and pass it to the appropriate people:

- computer records
- test records
- job cards
- aircraft service/flight log
- aircraft log
- permit to work/formal risk assessment

1.11 review the results and carry out further tests if necessary

Learning outcome
The learner will: 2. Know how to carry out tests on aircraft flight guidance and control systems
Assessment criteria
The learner can: 2.1 explain the specific safety practices and procedures that they need to observe when testing aircraft flight guidance and control systems 2.2 explain the importance of maintenance on, and impact upon ETOpS systems, legislation and local procedures 2.3 explain the health and safety requirements of the work area where they are carrying out the activities, and the responsibility these requirements place on them 2.4 explain the safety procedures that must be carried out before work is started on the aircraft 2.5 explain what protective clothing and equipment needs to be worn,

and where it can be obtained

2.6 describe the hazards associated with testing aircraft flight guidance and control systems, and with the tools and equipment used, and explain how to minimise them and reduce any risks

2.7 explain the correct operating procedures of the flight guidance and control system being tested

2.8 explain the electrical bonding specifications, and their importance

2.9 explain how to extract and use information from engineering drawings and related specifications

2.10 explain how to obtain the required test schedules and specifications for the flight guidance and control system and aircraft type being tested, and how to check their currency and validity

2.11 explain 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

2.12 describe 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

2.13 explain the importance of applying electrostatic discharge (ESD) procedures when working on sensitive equipment or devices

2.14 explain what test equipment is to be used, and its selection and application for particular tests

2.15 explain the calibration of the test equipment (where applicable), and the requirement for currency/issue checks

2.16 describe the testing techniques, methods and procedures to be used during the tests

2.17 explain why equipment control is critical, and what to do if a piece of equipment is unaccounted for on completion of the testing activities

2.18 describe the basic principle of operation of the flight guidance and control system under test, and explain the function of the individual components within the system

2.19 explain the importance of carrying out the tests in the specified sequence, checking all readings, movements and levels at each stage

2.20 explain from whom to seek authorisation if they need to alter or change the test procedures

2.21 explain how to record the results of each individual test, and the documentation that must be used

2.22 explain how to analyse the test results, and how to make valid decisions about the acceptability of the system

2.23 explain the procedures to be followed if the equipment or system fails to meet the test specification

2.24 describe the problems that can occur with the testing activities, and explain how they can be overcome

2.25 describe the things that may cause errors or discrepancies with the test results, and explain how to avoid these

2.26 explain any required environmental controls relating to the testing

2.27 explain what documentation needs to be completed at the end of the testing activities

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

Unit 540 Carrying out tests on aircraft flight guidance and control systems

Supporting information

Guidance

2.1 (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

Appendix 1 Relationships to other qualifications

Literacy, language, numeracy and ICT skills development

This qualification 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:

- Regulatory Arrangements for the Qualifications and Credit Framework (2008)
- 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 such on such things as:

- **Walled Garden:** how to register and certificate candidates on line
- **Qualifications and Credit Framework (QCF)**: general guidance about the QCF and how qualifications will change, as well as information on the IT systems needed and FAQs
- **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.

Useful contacts

UK learners **General qualification information**	**T: +44 (0)844 543 0033** **E: learnersupport@cityandguilds.com**
International learners General qualification information	T: +44 (0)844 543 0033 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	T: +44 (0)844 543 0000 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	T: +44 (0)844 543 0000 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	T: +44 (0)844 543 0000 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	T: +44 (0)844 543 0000 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	T: +44 (0)844 543 0000 F: +44 (0)20 7294 2413

If you have a complaint, or any suggestions for improvement about any of the services that we provide, email: feedbackandcomplaints@cityandguilds.com

About City & Guilds

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 operates from three major hubs: London (servicing Europe, the Caribbean and Americas), Johannesburg (servicing Africa), and Singapore (servicing Asia, Australia and New Zealand). The Group also includes the Institute of Leadership & Management (management and leadership qualifications), City & Guilds Land Based Services (land-based qualifications), the Centre for Skills Development (CSD works to improve the policy and practice of vocational education and training worldwide) and Learning Assistant (an online e-portfolio).

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