QUALIFICATION HANDBOOK

Level 3 NVQ Diploma in Aeronautical Engineering (Aircraft Manufacture Electrical) (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 Diploma in Aeronautical Engineering (Aircraft Manufacture Electrical)	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, 404
1.2 September 2018	Changed from 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 qualification:

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 (Aircraft Manufacture Electrical)**, learners must achieve **20** credits from the mandatory units and a minimum of **200** credits from the optional units available.

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
Optional			
M/601/4585	462	Installing aircraft cableforms/looms	77
A/601/4587	463	Installing aircraft instrument panels and meters	86
A/601/4590	464	Installing aircraft visual display units and computer systems	86
H/601/4597	465	Installing aircraft engine control units	77
L/601/4609	466	Installing aircraft power supplies	77
L/601/4612	467	Installing aircraft communication systems	86

Unit accreditation number	City & Guilds unit	Unit title	Credit value
T/601/4622	468	Installing aircraft flight guidance and control systems	86
R/601/4630	469	Installing aircraft navigational systems	86
Y/601/4659	470	Installing aircraft radar systems	86
R/601/4661	471	Installing aircraft countermeasure systems	86
Y/601/4662	472	Installing aircraft electro-optical and infrared systems	86
H/601/4664	473	Installing aircraft instrumentation systems	86
K/601/4665	474	Modifying aircraft electrical systems	77
H/601/4681	475	Modifying aircraft avionics systems	77
K/601/4682	476	Testing aircraft cableforms/looms	55
M/601/4683	477	Testing aircraft visual display units and computer systems	55
T/601/4684	478	Testing aircraft engine control units	55
A/601/4685	479	Testing aircraft communication systems	55
J/601/4687	480	Testing aircraft flight guidance and control systems	55
R/601/4689	481	Testing aircraft navigational systems	55
L/601/4691	482	Testing aircraft radar systems	55
R/601/4692	483	Testing aircraft countermeasure systems	55
D/601/4694	484	Testing aircraft electro-optical and infrared systems	55
H/601/4695	485	Testing aircraft instrumentation systems	55
K/601/4696	486	Producing aircraft wiring layouts and routings	35
T/601/4698	487	Producing aircraft electrical sub-assemblies, cableforms and looms	86
H/601/4700	488	Modifying aircraft cableforms and looms	77

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 462 Installing aircraft cableforms/looms

UAN:	**M/601/4585**
Level:	3
Credit value:	77
GLH:	161
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical engineering Unit 062: Installing aircraft cableforms/looms (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 install aircraft cableforms/looms and associated equipment, in accordance with approved procedures. The learner will be required to use appropriate installation drawings, specifications and documentation to install the various types of cableforms/looms and associated equipment. The learner will be expected to position, align and secure the cableforms/looms and equipment in the correct locations, using the specified/appropriate techniques and fastening devices. The cableforms/looms will include aircraft system cable assemblies, heavy duty cable assemblies, aircraft lighting cables, co-axial cables, fibre-optic cables, secure speech cables, headset leads, AFCS cable assemblies, databus looms and amalgamated looms. The equipment to be installed will include circuit breaker panels, distribution panels, relay panels, transformers, aerials and data recorders. The learner's responsibilities will require them to comply with organisational policy and procedures for the installation 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 be expected to work with minimal supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they produce. The learner's knowledge will provide a good

understanding of their work, and will provide an informed approach to applying installation techniques and procedures. The learner will understand the aircraft cableforms/looms being installed, and their application, and will know about the installation tools, techniques and methods, in adequate depth to provide a sound basis for carrying out the activities to the required specification.

The learner will understand the safety precautions required when carrying out the installations. 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 install aircraft cableforms/looms
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 installation activities: • obtain and use the appropriate documentation (such as job instructions, installation drawings, 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 installation 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 • follow safe practice/approved installation techniques and procedures at all times • return all tools and equipment to the correct location on completion of the installation activities • dispose of waste materials in accordance with approved procedures • leave the work area in a safe and appropriate condition, free from foreign object debris on completion of the activities 1.3 follow all relevant drawings and specifications for the installation being carried out 1.4 use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition 1.5 install, position and secure the equipment and components in

accordance with the specification

1.6 install four types of aircraft cableform/loom from the following:

- co-axial cable assemblies
- heavy duty cable assemblies
- aircraft system cable assemblies
- secure speech cable assemblies
- fibre-optic cables/assemblies
- aircraft lighting cable assemblies
- headset leads (mic-tel leads)
- AFCS cable assemblies
- databus looms
- amalgamated system looms

1.7 install cableform/loom components, to include four from the following:

- relay panels
- distribution panels
- cable protection
- data recorders
- avionic trays
- control panels
- circuit breaker/switch panels
- terminal blocks
- cockpit/flightdeck equipment
- line replacement units external to cockpit/flightdeck
- fuel content/quantity probes
- formation/internal lighting
- transformers
- module blocks
- aerials
- batteries

1.8 apply five of the following installation methods and techniques:

- soldering
- securing and locking
- loom protection
- earth bonding
- crimping
- wire locking
- taking electrostatic discharge (ESD) precautions
- correct loom/fibre-optic handling
- correct amalgamated loom handling

1.9 make four of the following types of mechanical securing connections:

- straps
- p-clips
- locking devices
- screws

- nuts and bolts
- torque load bolts
- ties (cord)
- panel fasteners

1.10 make five of the following types of electrical connection:

- module blocks
- terminal blocks
- fibre-optic connections
- fast-on connections
- earth bonding points
- soldered connections
- crimped connections
- co-axial cable terminations
- free plugs and sockets
- tray-mount sockets

1.11 check that all necessary connections to the equipment are complete

1.12 carry out installations in compliance with one of the following standards:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures

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

1.14 check that the installation is complete and that all components are free from damage

1.15 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.

Learning outcome
The learner will: 2. Know how to install aircraft cableforms/looms
Assessment criteria
The learner can: 2.1 explain the specific safety practices and procedures that they need to observe when working with cableforms and looms 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 installing cableforms and

looms, 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 interpret the drawings, standards, quality control procedures and specifications used for the installation

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

2.7 describe the cableforms/looms to be installed, and explain their function within the particular system

2.8 describe the various mechanical fasteners that will be used, and explain their method of installation

2.9 describe the various electrical connection methods that are used, and explain their methods of termination

2.10 explain the importance of using the specified fasteners and electrical connectors for the particular 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

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 quality control procedures to be followed during the installation operations

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

2.15 describe the techniques used to position, align, adjust and secure the components to the aircraft without damage

2.16 describe the methods of lifting, handling and supporting the components/equipment during the installation activities

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

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

2.19 describe the procedure for the safe disposal of waste materials

2.20 explain how to conduct any necessary checks to ensure the system integrity, functionality, accuracy and quality of the installation

2.21 explain the importance of ensuring that the completed installation is free from dirt, swarf and foreign object damage, and of ensuring that any exposed components or pipe ends are correctly covered/protected

2.22 describe the tools and equipment used in the installation activities, and explain their calibration/care and control procedures

2.23 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

2.24 describe the problems that can occur with the installation operations, and explain how these can be overcome

2.25 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

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

Unit 462 Installing aircraft cableforms/looms

Supporting information

Guidance

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

2.5 (including BS, ISO or BSEN schematics, symbols and terminology)

2.8 (such as threaded fasteners, special securing and locking devices)

2.9 (such as free plugs and sockets, crimped connections, soldered connections, co-axial connectors, fibre-optic connectors)

Unit 463 Installing aircraft instrument panels and meters

UAN:	**A/601/4587**
Level:	3
Credit value:	86
GLH:	210
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical engineering Unit 063: Installing aircraft instrument panels and meters (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 install aircraft instrument panels and meters, in accordance with approved procedures. The learner will be required to use appropriate installation drawings and specifications to install the various items of equipment. The learner will be expected to position, align and secure equipment in their correct locations, using the specified/appropriate techniques and fastening devices. The equipment will include central warning panel, clock, radio altimeter, barometric altimeter, air speed indicator, attitude indicator, horizontal situation indicator, engine oil temperature gauge, engine oil pressure gauge, engine torque meters, fuel gauges and magnetic indicators. The learner's responsibilities will require them to comply with organisational policy and procedures for the installation activities undertaken, and to report any problems with the installation 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's knowledge will provide a good understanding of their work, and will provide an informed approach to applying installation techniques and procedures. The learner will understand the aircraft instrument panels and meters being installed, and their application,

and will know about the installation tools and techniques, in adequate depth to provide a sound basis for carrying out the activities to the required specification.

The learner will understand the safety precautions required when carrying out the installation operations. 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 install aircraft instrument panels and meters
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 installation activities: • obtain and use the appropriate documentation (such as job instructions, installation drawings, 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 installation 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 • follow safe practice/approved installation techniques and procedures at all times • return all tools and equipment to the correct location on completion of the installation activities • dispose of waste materials in accordance with approved procedures • leave the work area in a safe and appropriate condition, free from foreign object debris on completion of the activities 1.3 follow all relevant drawings and specifications for the installation being carried out 1.4 use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition 1.5 install, position and secure the equipment and components in accordance with the specification 1.6 install nine of the following types of aircraft instrument: • central warning panel • clock

- radio altimeter
- barometric altimeter
- air speed indicator
- attitude indicator
- horizontal situation indicator
- engine oil temperature gauge
- engine oil pressure gauge
- engine torque meters
- fuel gauges
- magnetic indicators

1.7 use all of the following installation methods and techniques:

- levelling and aligning
- earth bonding
- taking ESD precautions
- securing and locking

1.8 make three of the following types of mechanical securing connection:

- nuts and bolts
- locking devices
- screws
- torque load bolts
- quick-release fasteners
- pipe connections

1.9 make three of the following types of electrical connection:

- module blocks
- terminal blocks
- tray-mounted sockets
- free plugs
- earth bonding points

1.10 check that all necessary connections to the equipment are complete

1.11 carry out installations in compliance with one of the following standards:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures

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

1.13 check that the installation is complete and that all components are free from damage

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.

Learning outcome
The learner will: 2. Know how to install aircraft
Assessment criteria
The learner can: 2.1 explain the specific safety practices and procedures that they need to observe when working with instrument panels and meters 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 installing aircraft instrument panels and equipment, 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 interpret the drawings, standards, quality control procedures and specifications used for the installation 2.6 explain how to carry out currency/issue checks on the specifications they are working with 2.7 describe the components to be installed, and explain their function within the particular instrument panels 2.8 describe the various mechanical fasteners that will be used, and explain their method of installation 2.9 explain the importance of using the specified fasteners for the particular installation, and why they must not substitute others 2.10 explain why securing devices need to be locked and labelled, and the different methods that are used 2.11 explain the torque loading requirements of the fasteners, and what to do if these loadings are exceeded or not achieved 2.12 describe the quality control procedures to be followed during the installation operations 2.13 explain the procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities 2.14 describe the techniques used to position, align, adjust and secure the components to the aircraft without damage 2.15 describe the methods of lifting, handling and supporting the components/equipment during the installation activities 2.16 explain the use of seals, sealant, adhesives and anti-electrolysis barriers, and the precautions to be taken 2.17 explain why electrical bonding is critical, and why it must be both mechanically and electrically secure 2.18 describe the procedure for the safe disposal of waste materials 2.19 explain how to conduct any necessary checks to ensure the system integrity, functionality, accuracy and quality of the installation 2.20 explain how to recognise installation defects 2.21 explain the importance of ensuring that the completed installation is free from dirt, swarf and foreign object damage, and of ensuring that any exposed components or pipe ends are correctly

	covered/protected
2.22	describe the tools and equipment used in the installation activities, and explain their calibration/care and control procedures
2.23	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
2.24	describe the problems that can occur with the installation operations, and explain how these can be overcome
2.25	explain what recording documentation to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
2.26	describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 463 Installing aircraft instrument panels and meters

Supporting information

Guidance

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

2.5 (including BS, ISO or BSEN schematics, symbols and terminology)

2.8 (such as open and blind rivets, threaded fasteners, special securing devices)

2.20 (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage or contamination)

Unit 464 Installing aircraft visual display units and computer systems

UAN:	**A/601/4590**
Level:	3
Credit value:	86
GLH:	210
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical engineering Unit 064: Installing aircraft visual display units and computer 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 install aircraft visual display units and computer systems, in accordance with approved procedures. The learner will be required to use appropriate installation drawings, specifications and documentation to install the various types of equipment. The learner will be expected to position, align and secure the equipment in the correct locations, using the specified/appropriate techniques and fastening devices. The equipment will include aircraft management computers, sensor interface units, AMC control panels, symbol generators, display units, and display mode select panels. The learner's responsibilities will require them to comply with organisational policy and procedures for the installation 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 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 installation techniques and procedures. The learner will understand the aircraft visual display units and computer systems being installed, and their application, and will know about the installation

tools and techniques and methods, in adequate depth to provide a sound basis for carrying out the activities to the required specification.

The learner will understand the safety precautions required when carrying out the installation operations. 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 install aircraft visual display units and computer 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 installation activities: • obtain and use the appropriate documentation (such as job instructions, installation drawings, 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 installation 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 • follow safe practice/approved installation techniques and procedures at all times • return all tools and equipment to the correct location on completion of the installation activities • dispose of waste materials in accordance with approved procedures • leave the work area in a safe and appropriate condition, free from foreign object debris on completion of the activities 1.3 follow all relevant drawings and specifications for the installation being carried out 1.4 use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition 1.5 position and secure the equipment and components in accordance with the specification 1.6 install aircraft visual display equipment and systems which include both of the following: • aircraft management system (AMS) • electronic instrumentation systems (EIS)

1.7 install all of the following aircraft system components:
- AMS computer
- AMS sensor interface units
- AMC control panel
- EIS display mode select panels
- EIS display units
- EIS symbol generators

1.8 use all of the following installation methods and techniques:
- levelling and aligning
- earth bonding
- taking ESD precautions
- securing and locking

1.9 make three of the following types of mechanical securing connection:
- nuts and bolts
- locking devices
- screws
- torque load bolts
- quick-release fasteners

1.10 make three of the following types of electrical connection:
- module blocks
- terminal blocks
- tray-mounted sockets
- free plugs
- earth bonding points

1.11 check that all necessary connections to the equipment are complete

1.12 carry out installations in compliance with one of the following standards:
- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures

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

1.14 check that the installation is complete and that all components are free from damage

1.15 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.

Learning outcome
The learner will: 2. Know how to install aircraft visual display units and computer systems
Assessment criteria
The learner can: 2.1 explain the specific safety practices and procedures that they need to observe when working with visual displays and computer systems 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 installing visual display and computer systems, 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 interpret the drawings, standards, quality control procedures and specifications used for the installation 2.6 explain how to carry out currency/issue checks on the specifications they are working with 2.7 describe the components to be installed, and explain their function within the particular visual display or computer system 2.8 describe the various mechanical fasteners that will be used, and explain their method of installation 2.9 explain the importance of using the specified fasteners for the particular installation, and why they must not substitute others 2.10 explain why securing devices need to be locked and labelled, and the different methods that are used 2.11 explain the torque loading requirements of the fasteners, and what to do if these loadings are exceeded or not achieved 2.12 describe the quality control procedures to be followed during the installation operations 2.13 explain the procedures for ensuring they have the correct tools, equipment, components and fasteners for the activities 2.14 describe the techniques used to position, align, adjust and secure the components to the aircraft without damage 2.15 describe the methods of lifting, handling and supporting the components/equipment during the installation activities 2.16 explain the use of seals/sealant, adhesives and anti-electrolysis barriers, and the precautions to be taken 2.17 explain why unit electrical bonding is critical, and why it must be both mechanically and electrically secure 2.18 describe the procedure for the safe disposal of waste materials 2.19 explain how to conduct any necessary checks to ensure the system integrity, functionality, accuracy and quality of the installation 2.20 explain how to recognise installation defects 2.21 explain the importance of ensuring that the completed installation is free from dirt, swarf and foreign objects 2.22 describe the tools and equipment used in the installation activities, and explain their calibration/care and control procedures 2.23 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
2.24	describe the problems that can occur with the installation operations, and explain how these can be overcome
2.25	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
2.26	describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 464 Installing aircraft visual display units and computer systems

Supporting information

Guidance

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

2.5 (including BS, ISO or BSEN schematics, symbols and terminology)

2.8 (such as open and blind rivets, threaded fasteners, special securing devices)

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

Unit 465 Installing aircraft engine control units

UAN:	**H/601/4597**
Level:	3
Credit value:	77
GLH:	161
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical engineering Unit 065: Installing aircraft engine control units (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 install aircraft engine control units, in accordance with approved procedures. The learner will be required to use appropriate installation drawings and specifications to install the various items of equipment. The learner will be expected to position, align and secure equipment in their correct locations, using the specified/appropriate techniques and fastening devices. The equipment will include flying control pick-offs, engine electronic control units, cockpit control levers and switches. The learner's responsibilities will require them to comply with organisational policy and procedures for the installation activities undertaken, and to report any problems with the installation 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's knowledge will provide a good understanding of their work, and will provide an informed approach to applying installation techniques and procedures. The learner will understand the aircraft engine control units being installed, and their application, and will know about the installation tools, techniques and methods, in adequate depth to provide a sound basis for carrying out the activities to the

required specification.

The learner will understand the safety precautions required when carrying out the installation operations. 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 install aircraft engine control units
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 installation activities: • obtain and use the appropriate documentation (such as job instructions, installation drawings, 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 installation 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 • follow safe practice/approved installation techniques and procedures at all times • return all tools and equipment to the correct location on completion of the installation activities • dispose of waste materials in accordance with approved procedures • leave the work area in a safe and appropriate condition, free from foreign object debris on completion of the activities 1.3 follow all relevant drawings and specifications for the installation being carried out 1.4 use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition 1.5 install, position and secure the equipment and components in accordance with the specification 1.6 install two of the following types of equipment: • aircraft cockpit control levers and switches • aircraft engine electronic control units • flying control pick-offs (helicopter only) 1.7 use all of the following installation methods and techniques: • levelling and aligning

- earth bonding
- taking electrostatic discharge (ESD) precautions

1.8 make three of the following types of mechanical securing connection:
- nuts and bolts
- locking devices
- screws
- torque load bolts
- quick-release fasteners

1.9 make five of the following types of electrical connection:
- module blocks
- terminal blocks
- tray-mounted connectors
- free plugs and sockets
- earth bonding points
- composite connectors

1.10 check that all necessary connections to the equipment are complete

1.11 carry out installations in compliance with one of the following standards:
- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures

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

1.13 check that the installation is complete and that all components are free from damage

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.

Learning outcome
The learner will: 2. Know how to install aircraft engine control units
Assessment criteria
The learner can: 2.1 explain the specific safety practices and procedures that they need to observe when working with engine control units 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 installing aircraft engine control units, 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 interpret the drawings, standards, quality control procedures and specifications used for the installation
2.6	explain how to carry out currency/issue checks on the specifications they are working with
2.7	describe the components to be installed, and explain their function within the particular engine control units
2.8	describe the various mechanical fasteners that will be used, and explain their method of installation
2.9	explain the importance of using the specified fasteners for the particular installation, and why they must not substitute others
2.10	explain why securing devices need to be locked and labelled, and the different methods that are used
2.11	explain the torque loading requirements of the fasteners, and what to do if these loadings are exceeded or not achieved
2.12	describe the quality control procedures to be followed during the installation operations
2.13	explain the procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities
2.14	describe the techniques used to position, align, adjust and secure the components to the aircraft without damage
2.15	describe the methods of lifting, handling and supporting the components/equipment during the installation activities
2.16	explain the use of seals, sealant, adhesives and anti-electrolysis barriers, and the precautions to be taken
2.17	explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
2.18	describe the procedure for the safe disposal of waste materials
2.19	explain how to conduct any necessary checks to ensure the system integrity, functionality, accuracy and quality of the installation
2.20	explain how to recognise installation defects
2.21	explain the importance of ensuring that the completed installation is free from dirt, swarf and foreign object damage, and of ensuring that any exposed components or pipe ends are correctly covered/protected
2.22	describe the tools and equipment used in the installation activities, and explain their calibration/care and control procedures
2.23	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
2.24	describe the problems that can occur with the installation operations, and explain how these can be overcome
2.25	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
2.26	describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 465 Installing aircraft engine control units

Supporting information

Guidance

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

2.5 (including BS, ISO or BSEN schematics, symbols and terminology)

2.8 (such as open and blind rivets, threaded fasteners, special securing devices)

2.20 (such as bad connections, misalignment, ineffective fasteners, foreign object damage or contamination)

Unit 466 Installing aircraft power supplies

UAN:	**L/601/4609**
Level:	3
Credit value:	77
GLH:	161
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical engineering Unit 066: Installing aircraft power supplies (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 install aircraft power supplies, in accordance with approved procedures. The learner will be required to use appropriate installation drawings, specifications and documentation to install the various items of equipment. The learner will be expected to position, align and secure equipment in its correct locations, using the specified/appropriate techniques and fastening devices. The equipment will include batteries, generators, alternators, regulators, invertors, transformers, rectifier units and main contactors. The learner's responsibilities will require them to comply with organisational policy and procedures for the installation activities undertaken, and to report any problems with the installation 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's knowledge will provide a good understanding of their work, and will provide an informed approach to applying installation techniques and procedures. The learner will understand the aircraft power supplies being installed, and their application, and will know about the installation tools, techniques and methods, in adequate depth to provide a sound basis for carrying out the activities to the

required specification.

The learner will understand the safety precautions required when carrying out the installation operations. 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 install aircraft power supplies
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 installation activities: • obtain and use the appropriate documentation (such as job instructions, installation drawings, 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 installation 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 • follow safe practice/approved installation techniques and procedures at all times • return all tools and equipment to the correct location on completion of the installation activities • dispose of waste materials in accordance with approved procedures • leave the work area in a safe and appropriate condition, free from foreign object debris on completion of the activities 1.3 follow all relevant drawings and specifications for the installation being carried out 1.4 use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition 1.5 install, position and secure the equipment and components in accordance with the specification 1.6 install aircraft equipment systems which include four of the following: • batteries • generators • alternators • inverters

- transformers
- rectifier units
- regulators
- main contactors
- change-over relays

1.7 use all of the following installation methods and techniques:
- levelling and aligning
- earth bonding
- taking ESD precautions
- securing and locking

1.8 make three of the following types of mechanical securing connections:
- nuts and bolts
- locking devices
- screws
- torque load bolts
- quick-release fasteners

1.9 make three of the following types of electrical connection:
- module blocks
- terminal blocks
- tray-mounted sockets
- free plugs
- earth bonding points

1.10 check that all necessary connections to the equipment are complete

1.11 carry out installations in compliance with one of the following standards:
- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures

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

1.13 check that the installation is complete and that all components are free from damage

1.14 complete the relevant paperwork, to include one from the following, and pass it to the appropriate people:
- build records
- job cards
- log cards
- aircraft flight log.

Learning outcome
The learner will: 2. Know how to install aircraft Power Supplies
Assessment criteria
The learner can: 2.1 explain the specific safety practices and procedures that they need to observe when working with aircraft power supplies 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 installing aircraft power supplies, and with the tools and equipment used, and explain how to minimise them and reduce any risks 2.4 explain what protective equipment that they need to use for both personal protection and protection of the aircraft 2.5 explain how to interpret the drawings, standards, quality control procedures and specifications used for the installation 2.6 explain how to carry out currency/issue checks on the specifications they are working with 2.7 describe the components to be installed, and explain their function within the particular power supplies 2.8 describe the various mechanical fasteners that will be used, and explain their method of installation 2.9 explain the importance of using the specified fasteners for the particular installation, and why they must not substitute others 2.10 explain why securing devices need to be locked and labelled, and the different methods that are used 2.11 explain the torque loading requirements of the fasteners, and what to do if these loadings are exceeded or not achieved 2.12 describe the quality control procedures to be followed during the installation operations 2.13 explain the procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities 2.14 describe the techniques used to position, align, adjust and secure the components to the aircraft without damage 2.15 describe the methods of lifting, handling and supporting the components/equipment during the installation activities 2.16 explain the use of seals/sealant, adhesives and anti-electrolysis barriers, and the precautions to be taken 2.17 explain why unit electrical bonding is critical, and why it must be both mechanically and electrically secure 2.18 describe the procedure for the safe disposal of waste materials 2.19 explain how to conduct any necessary checks to ensure the system integrity, functionality, accuracy and quality of the installation 2.20 explain how to recognise installation defects 2.21 explain the importance of ensuring that the completed installation is free from dirt, swarf and foreign objects 2.22 describe the tools and equipment used in the installation activities, and explain their calibration/care and control procedures 2.23 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
2.24	describe the problems that can occur with the installation operations, and explain how these can be overcome
2.25	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
2.26	describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve.

Unit 466 Installing aircraft power supplies

Supporting information

Guidance

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

2.5 (including BS, ISO or BSEN schematics, symbols and terminology)

2.8 (such as open and blind rivets, threaded fasteners, special securing and locking devices)

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

Unit 467 Installing aircraft communication systems

UAN:	**L/601/4612**
Level:	3
Credit value:	86
GLH:	210
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical engineering Unit 067: Installing 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 install aircraft communication systems, in accordance with approved procedures. The learner will be required to use appropriate installation drawings and specifications to install the various items of equipment. The learner will be expected to position, align and secure equipment in its correct locations, using specified/appropriate techniques and fastening devices. The communication equipment will include intercom (clear), intercom (secure), high frequency (HF) radio, very high frequency (VHF) radio, ultra high frequency (UHF) radio, cockpit voice recorder, crash position indicators, digital data links, secure radio links, flight entertainment systems, satellite communications (SATCOM), and selective calling (SELCAL). The learner's responsibilities will require them to comply with organisational policy and procedures for the installation activities undertaken, and to report any problems with the 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 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 installation techniques and procedures. The learner will understand the aircraft communication systems

being installed, and their application, and will know about the installation, techniques, tools and methods, in adequate depth to provide a sound basis for carrying out the activities to the required specification.

The learner will understand the safety precautions required when carrying out the installation operations. 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 install 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 installation activities: • obtain and use the appropriate documentation (such as job instructions, installation drawings, 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 installation 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 • follow safe practice/approved installation techniques and procedures at all times • return all tools and equipment to the correct location on completion of the installation activities • dispose of waste materials in accordance with approved procedures • leave the work area in a safe and appropriate condition, free from foreign object debris on completion of the activities 1.3 follow all relevant drawings and specifications for the installation being carried out 1.4 use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition 1.5 install, position and secure the equipment and components in accordance with the specification 1.6 install aircraft communication systems which include both of the following: • VHF radio

- intercom (clear)

Plus four more items from the following:

- secure radio links
- HF radio
- UHF radio
- cockpit voice recorder
- SATCOM
- digital data links
- crash position indicators
- flight entertainment systems
- intercom (secure speech)
- SELCAL
- GPS systems
- aircraft communication address reporting system (ACARS)
- interphone (such as internal communications)
- audio integrating (such as microphones, headphones, cockpit loudspeakers)
- integrated automatic tuning (such as digital data links)
- audio and video monitoring (such as voice recorders, passenger conversation/movement, external cameras)

1.7 install ten of the following aircraft communication system components:

- aerials
- receiver units
- satellite beacons
- switches
- tuning units
- unit trays
- transmitter units
- relays
- transponders
- control units
- microphone units
- circuit breakers
- intercom station boxes
- transformers
- speakers
- instruments/gauges/indicators

1.8 use all of the following installation methods and techniques:

- levelling and aligning
- earth bonding
- taking ESD precautions
- securing and locking

1.9 make three of the following types of mechanical securing connection:

- nuts and bolts
- locking devices

- screws
- torque load bolts
- quick-release fasteners

1.10 make five of the following types of electrical connection:

- co-axial
- tri-axial
- overall screened
- module blocks
- terminal blocks
- free plugs and sockets
- tray-mounted sockets
- earth bonding points

1.11 check that all necessary connections to the equipment are complete

1.12 carry out installations in compliance with one of the following standards:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures

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

1.14 check that the installation is complete and that all components are free from damage

1.15 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 .

Learning outcome
The learner will: 2. Know how to install 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 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 installing aircraft communication systems, 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 interpret the drawings, standards, quality control procedures and specifications used for the installation
2.6	explain how to carry out currency/issue checks on the specifications they are working with
2.7	describe the components to be installed, and their function within the particular communications system
2.8	describe the various mechanical fasteners that will be used, and explain their method of installation
2.9	explain the importance of using the specified fasteners for the particular installation, and why they must not substitute others
2.10	explain why securing devices need to be locked and labelled, and the different methods that are used
2.11	explain the torque loading requirements of the fasteners, and what to do if these loadings are exceeded or not achieved
2.12	describe the quality control procedures to be followed during the installation operations
2.13	explain the procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities
2.14	describe the techniques used to position, align, adjust and secure the components to the aircraft without damage
2.15	describe the methods of lifting, handling and supporting the components/equipment during the installation activities
2.16	explain the use of seals, sealant, adhesives and anti-electrolysis barriers and the precautions to be taken
2.17	explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
2.18	describe the procedure for the safe disposal of waste materials
2.19	explain how to conduct any necessary checks to ensure the system integrity, functionality, accuracy and quality of the installation
2.20	explain how to recognise installation defects
2.21	explain the importance of ensuring that the completed installation is free from dirt, swarf and foreign object damage, and of ensuring that any exposed components or pipe ends are correctly covered/protected
2.22	describe the tools and equipment used in the installation activities, and explain their calibration/care and control procedures
2.23	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
2.24	describe the problems that can occur with the installation operations, and explain how these can be overcome
2.25	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
2.26	describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 467 Installing aircraft communication systems

Supporting information

Guidance

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

2.5 (including BS, ISO or BSEN schematics, symbols and terminology)

2.8 (such as open and blind rivets, threaded fasteners, special securing devices)

2.20 (such as poor seals, misalignment, ineffective fasteners, foreign object damage or contamination)

Unit 468 Installing aircraft flight guidance and control systems

UAN:	**T/601/4622**
Level:	3
Credit value:	86
GLH:	210
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical engineering Unit 068: Installing 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 install aircraft flight guidance and control systems, in accordance with approved procedures. The learner will be required to use appropriate installation drawings and specifications to install the various types of equipment. The learner will be expected to position, align and secure the equipment in the correct locations, using the specified/appropriate techniques and fastening devices. The equipment will include fly by wire, gyros, autopilot, flight director, and AFCS (Automatic Flying Control System). The learner's responsibilities will require them to comply with organisational policy and procedures for the installation activities undertaken, and to report any problems with the 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 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 installation techniques and procedures. The learner will understand the aircraft flight guidance and control systems being installed, and their application, and will know about the installation techniques, tools, equipment and

	methods, in adequate depth to provide a sound basis for carrying out the activities to the required specification. The learner will understand the safety precautions required when carrying out the installation operations. 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 install 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 installation activities: • obtain and use the appropriate documentation (such as job instructions, installation drawings, 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 installation 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 • follow safe practice/approved installation techniques and procedures at all times • return all tools and equipment to the correct location on completion of the installation activities • dispose of waste materials in accordance with approved procedures • leave the work area in a safe and appropriate condition, free from foreign object debris on completion of the activities 1.3 follow all relevant drawings and specifications for the installation being carried out 1.4 use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition 1.5 install, position and secure the equipment and components in accordance with the specification 1.6 install two of the following aircraft flight guidance and control systems: • fly by wire • autopilot

- flight director
- gyros
- AFCS

1.7 install five of the following aircraft navigational system components:

- computers
- controllers
- air data units
- detectors
- gyros(rate and vertical)
- compass computers
- trim units
- actuators
- stick position cancellers
- Attitude Heading & Reference System (AHRS)
- Inertial Reference Unit (IRUs)
- embedded GPS and INS (EGI)

1.8 use all the following installation methods and techniques:

- levelling and aligning
- earth bonding
- taking electrostatic discharge (ESD) precautions

1.9 make three of the following types of mechanical securing connection:

- nuts and bolts
- locking devices
- screws
- torque load bolts
- quick-release fasteners

1.10 make all of the following types of electrical connection:

- free plugs and sockets
- module blocks
- terminal blocks
- tray-mounted sockets
- earth bonding points

1.11 check that all necessary connections to the equipment are complete

1.12 carry out installations in compliance with one of the following standards:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures

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

1.14 check that the installation is complete and that all components are free from damage

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

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

Learning outcome

The learner will:

2. Know how to install 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 flight guidance and control systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

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 installing flight guidance and control systems, 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 interpret the drawings, standards, quality control procedures and specifications used for the installation

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

2.7 describe the components to be installed, and explain their function within the particular flight guidance and control systems

2.8 describe the various mechanical fasteners that will be used, and explain their method of installation

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

2.10 explain why securing devices need to be locked and labelled, and the different methods that are used

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

2.12 explain the quality control procedures to be followed during the installation operations

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

2.14 describe the techniques used to position, align, adjust and secure the components to the aircraft without damage

2.15 describe the methods of lifting, handling and supporting the components/equipment during the installation activities

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

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

2.18	describe the procedure for the safe disposal of waste materials
2.19	explain how to conduct any necessary checks to ensure the system integrity, functionality, accuracy and quality of the installation
2.20	explain how to recognise installation defects
2.21	explain the importance of ensuring that the completed installation is free from dirt, swarf and foreign object damage, and of ensuring that any exposed components or pipe ends are correctly covered/protected
2.22	describe the tools and equipment used in the installation activities, and explain their calibration/care and control procedures
2.23	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
2.24	describe the problems that can occur with the installation operations, and explain how these can be overcome
2.25	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
2.26	describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 468 Installing 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)

2.5 (including BS, ISO or BSEN schematics, symbols and terminology)

2.8 (such as open and blind rivets, threaded fasteners, special securing devices)

2.20 (such as poor seals, misalignment, ineffective fasteners, foreign object damage or contamination)

Unit 469 Installing aircraft navigational systems

UAN:	**R/601/4630**
Level:	3
Credit value:	86
GLH:	210
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical engineering Unit 069: Installing aircraft navigational 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 install aircraft navigational systems, in accordance with approved procedures. The learner will be required to use appropriate installation drawings, specifications and documentation to install the various items of equipment. The learner will be expected to position, align and secure equipment in its correct locations, using specified/appropriate techniques and fastening devices. The aircraft equipment will include items such as central air data computers, pitot/static systems, 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, compasses and other devices as applicable to the aircraft type. The learner's responsibilities will require them to comply with organisational policy and procedures for the installation activities undertaken, and to report any problems with the 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 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 installation techniques and procedures. The learner will understand the aircraft navigational systems being installed, and their application, and will know about the installation techniques, tools and methods, in adequate depth to provide a sound basis for carrying out the activities to the required specification.

The learner will understand the safety precautions required when carrying out the installation operations. 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 install aircraft navigational 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 installation activities: • obtain and use the appropriate documentation (such as job instructions, installation drawings, 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 installation 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 • follow safe practice/approved installation techniques and procedures at all times • return all tools and equipment to the correct location on completion of the installation activities • dispose of waste materials in accordance with approved procedures • leave the work area in a safe and appropriate condition, free from foreign object debris on completion of the activities 1.3 follow all relevant drawings and specifications for the installation being carried out 1.4 use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition 1.5 install, position and secure the equipment and components in

accordance with the specification

1.6 install four of the following aircraft navigational systems:

- distance measuring equipment (DME)
- very high frequency omni directional 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)
- enhanced ground proximity warning system (EGPWS)
- traffic collision avoidance system (TCAS)
- re-transmission systems
- Doppler
- homing
- gyro
- Decca
- compass
- weather radar
- flight management computing (such as course computers, flight management, performance data computers)
- flight environment data (such as central air data computers, pitot/static, rate-of-climb, air speed, high speed warning, altitude, altitude reporting, altimeter correction, air disturbance detection, air temperature)
- attitude and direction (such as magnetic compasses, vertical and directional references, magnetic heading systems, attitude director systems, symbol generators, turn and bank, rate of turn)

1.7 install eight of the following aircraft navigational system components:

- airspeed indicator
- altimeter
- satellite beacons
- transponders
- compensation units
- receiver units
- transformers
- air data computer
- VOR unit
- HIS unit
- transmitter units
- control units
- aerials
- analogue/digital converters (A-D/D-A)
- navigation display units (including head-up)
- computers

- compass
- gyro
- interface units

1.8 use all of the following installation methods and techniques:
- levelling and aligning
- earth bonding
- taking ESD precautions
- securing and locking

1.9 make three of the following types of mechanical securing connection:
- nuts and bolts
- locking devices
- screws
- torque load bolts
- quick-release fasteners

1.10 make five of the following types of electrical connection:
- co-axial
- tri-axial
- overall screened
- module blocks
- terminal blocks
- free plugs and sockets
- tray-mounted sockets
- earth bonding points

1.11 check that all necessary connections to the equipment are complete

1.12 carry out installations in compliance with one of the following standards:
- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures

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

1.14 check that the installation is complete and that all components are free from damage

1.15 complete the relevant paperwork, to include one from the following, and pass it to the appropriate people:
- build records
- log cards
- aircraft flight log
- job cards.

Learning outcome
The learner will: 2. Know how to install aircraft navigational 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 systems 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 installing aircraft navigational systems, 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 interpret the drawings, standards, quality control procedures and specifications used for the installation 2.6 explain how to carry out currency/issue checks on the specifications they are working with 2.7 describe the components to be installed, and explain their function within the particular navigational systems 2.8 describe the various mechanical fasteners that will be used, and explain their method of installation 2.9 explain the importance of using the specified fasteners for the particular installation, and why they must not substitute others 2.10 explain why securing devices need to be locked and labelled, and the different methods that are used 2.11 explain the torque loading requirements of the fasteners, and what to do if these loadings are exceeded or not achieved 2.12 describe the quality control procedures to be followed during the installation operations 2.13 explain the procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities 2.14 describe the techniques used to position, align, adjust and secure the components to the aircraft without damage 2.15 describe the methods of lifting, handling and supporting the components/equipment during the installation activities 2.16 explain the use of seals, sealant, adhesives and anti-electrolysis barriers, and the precautions to be taken 2.17 explain why electrical bonding is critical, and why it must be both mechanically and electrically secure 2.18 describe the procedure for the safe disposal of waste materials 2.19 explain how to conduct any necessary checks to ensure the system integrity, functionality, accuracy and quality of the installation 2.20 explain how to recognise installation defects 2.21 explain the importance of ensuring that the completed installation is free from dirt, swarf and foreign object damage, and of ensuring that any exposed components or pipe ends are correctly covered/protected 2.22 describe the tools and equipment used in the installation activities, and explain their calibration/care and control procedures 2.23 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
2.24	describe the problems that can occur with the installation operations, and explain how these can be overcome
2.25	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
2.26	describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 469 Installing aircraft navigational systems

Supporting information

Guidance

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

2.5 (including BS, ISO or BSEN schematics, symbols and terminology)

2.8 (such as open and blind rivets, threaded fasteners, special securing devices)

2.20 (such as poor seals, misalignment, ineffective fasteners, foreign object damage or contamination)

Unit 470 Installing aircraft radar systems

UAN:	**Y/601/4659**
Level:	3
Credit value:	86
GLH:	210
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical engineering Unit 070: Installing 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 install aircraft radar systems, in accordance with approved procedures. The learner will be required to use appropriate installation drawings, specifications and documentation to install the various types of equipment. The learner will be expected to position, align and secure the equipment in the correct locations, using the specified/appropriate techniques and fastening devices. The equipment will include surveillance radar, weather radar, obstacle warning systems, and radar jamming devices. The learner's responsibilities will require them to comply with organisational policy and procedures for the installation activities undertaken, and to report any problems with the 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 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 installation techniques and procedures. The learner will understand the aircraft radar systems being installed, and their application, and will know about the installation techniques, tools and methods, in adequate depth to provide a sound basis for carrying out the activities to

	the required specification. The learner will understand the safety precautions required when carrying out the installation operations. 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 install 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 installation activities: • obtain and use the appropriate documentation (such as job instructions, installation drawings, 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 installation 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 • follow safe practice/approved installation techniques and procedures at all times • return all tools and equipment to the correct location on completion of the installation activities • dispose of waste materials in accordance with approved procedures • leave the work area in a safe and appropriate condition, free from foreign object debris on completion of the activities 1.3 follow all relevant drawings and specifications for the installation being carried out 1.4 use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition 1.5 install, position and secure the equipment and components in accordance with the specification 1.6 install one of the following aircraft radar systems: • surveillance radar • weather radar • obstacle warning systems • radar jamming 1.7 install radar components, to include five of the following:

- scanners
- aerials
- transmitters
- receivers
- processors
- microwave generators
- power supply units (PSU)
- intermediate frequency unit (IFU)
- waveguides

1.8 use all of the following installation methods and techniques:

- levelling and aligning
- earth bonding
- taking ESD precautions
- securing and locking

1.9 make three of the following types of mechanical securing connection:

- nuts and bolts
- wire locking
- screws
- torque loaded bolts
- quick-release fasteners

1.10 make five of the following types of electrical connection:

- co-axial
- tri-axial
- overall screened
- module blocks
- terminal blocks
- free plugs
- tray-mounted sockets
- earth bonding points

1.11 check that all necessary connections to the equipment are complete

1.12 carry out installations in compliance with one of the following standards:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures

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

1.14 check that the installation is complete and that all components are free from damage

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

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

Learning outcome
The learner will: 2. Know how to install 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 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 installing aircraft radar systems, 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 interpret the drawings, standards, quality control procedures and specifications used for the installation 2.6 explain how to carry out currency/issue checks on the specifications they are working with. 2.7 describe the components to be installed, and explain their function within the particular radar systems 2.8 describe the various mechanical fasteners that will be used, and explain their method of installation 2.9 explain the importance of using the specified fasteners for the particular installation, and why they must not substitute others 2.10 explain why securing devices need to be locked and labelled, and the different methods that are used 2.11 explain the torque loading requirements of the fasteners, and what to do if these loadings are exceeded or not achieved 2.12 describe the quality control procedures to be followed during the installation operations 2.13 explain the procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities 2.14 describe the techniques used to position, align, adjust and secure the components to the aircraft without damage 2.15 describe the methods of lifting, handling and supporting the components/equipment during the installation activities 2.16 explain the use of seals, sealant, adhesives and anti-electrolysis barriers, and the precautions to be taken 2.17 explain why electrical bonding is critical, and why it must be both mechanically and electrically secure 2.18 describe the procedure for the safe disposal of waste materials 2.19 explain how to conduct any necessary checks to ensure the system integrity, functionality, accuracy and quality of the installation 2.20 explain how to recognise installation defects 2.21 explain the importance of ensuring that the completed installation

	is free from dirt, swarf and foreign object damage, and of ensuring that any exposed components or pipe ends are correctly covered/protected
2.22	describe the tools and equipment used in the installation activities, and explain their calibration/care and control procedures
2.23	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
2.24	describe the problems that can occur with the installation operations, and explain how these can be overcome
2.25	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
2.26	describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 470 Installing aircraft radar systems

Supporting information

Guidance

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

2.5 (including BS, ISO or BSEN schematics, symbols and terminology)

2.8 (such as open and blind rivets, threaded fasteners, special securing devices)

2.20 (such as poor seals, misalignment, ineffective fasteners, foreign object damage or contamination)

Unit 471 Installing aircraft countermeasure systems

UAN:	**R/601/4661**
Level:	3
Credit value:	77
GLH:	154
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical engineering Unit 071: Installing aircraft countermeasure 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 install aircraft countermeasure systems, in accordance with approved procedures. The learner will be required to use appropriate installation drawings, specifications and documentation to install the various types of equipment. The learner will be expected to position, align and secure the equipment in the correct locations, using the specified/appropriate techniques and fastening devices. The countermeasure equipment will include Identification, Friend or Foe (IFF), electronic surveillance methods (ESM), sonics, sound navigation and ranging (SONAR), radar height warning receivers (RHWR), dispensing equipment, and towed radar decoys. The learner's responsibilities will require them to comply with organisational policy and procedures for the installations undertaken, and to report any problems with the installation 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 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 installation techniques and procedures. The learner will understand the aircraft countermeasure

systems being installed, and their application, and will know about the installation techniques, tools and methods used, in adequate depth to provide a sound basis for carrying out the activities to the required specification.

The learner will understand the safety precautions required when carrying out the installation operations. 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 install aircraft countermeasure 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 installation activities: • obtain and use the appropriate documentation (such as job instructions, installation drawings, 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 installation 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 • follow safe practice/approved installation techniques and procedures at all times • return all tools and equipment to the correct location on completion of the installation activities • dispose of waste materials in accordance with approved procedures • leave the work area in a safe and appropriate condition, free from foreign object debris on completion of the activities 1.3 follow all relevant drawings and specifications for the installation being carried out 1.4 use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition 1.5 install, position and secure the equipment and components in accordance with the specification 1.6 install two of the following aircraft countermeasure systems: • IFF • ESM

- sonics
- SONAR
- RHWR
- dispensing equipment
- towed radar decoys

1.7 install aircraft counter measure system components, to include five of the following:

- buoys
- aerials
- dispensers
- transmitters
- receivers
- processors
- microwave generators
- power supply unit (PSU)
- winches

1.8 use all the following installation methods and techniques:

- levelling and aligning
- earth bonding
- taking ESD precautions
- securing and locking

1.9 make three of the following types of mechanical securing connection:

- nuts and bolts
- locking devices
- screws
- torque load bolts
- quick-release fasteners

1.10 make five of the following types of electrical connection:

- co-axial
- tri-axial
- module blocks
- earth bonding points
- terminal blocks
- free plugs
- tray-mounted sockets

1.11 check that all necessary connections to the equipment are complete

1.12 carry out installations in compliance with one of the following standards:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures

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

1.14 check that the installation is complete and that all components are free from damage

1.15 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

Learning outcome

The learner will:

2. Know how to install aircraft countermeasure systems

Assessment criteria

The learner can:

2.1 explain the specific safety practices and procedures that they need to observe when working with aircraft countermeasure systems

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 installing aircraft countermeasure systems, 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 interpret the drawings, standards, quality control procedures and specifications used for the installation

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

2.7 describe the components to be installed, and explain their function within the particular countermeasure systems

2.8 describe the various mechanical fasteners that will be used, and explain their method of installation

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

2.10 explain why securing devices need to be locked and labelled, and the different methods that are used

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

2.12 describe the quality control procedures to be followed during the installation operations

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

2.14 describe the techniques used to position, align, adjust and secure the components to the aircraft without damage

2.15 describe the methods of lifting, handling and supporting the components/equipment during the installation activities

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

2.17 explain why electrical bonding is critical, and why it must be both

	mechanically and electrically secure
2.18	describe the procedure for the safe disposal of waste materials
2.19	explain how to conduct any necessary checks to ensure the system integrity, functionality, accuracy and quality of the installation
2.20	explain how to recognise installation defects
2.21	explain the importance of ensuring that the completed installation is free from dirt, swarf and foreign object damage, and of ensuring that any exposed components or pipe ends are correctly covered/protected
2.22	describe the tools and equipment used in the installation activities, and explain their calibration/care and control procedures
2.23	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
2.24	describe the problems that can occur with the installation operations, and explain how these can be overcome
2.25	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
2.26	describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 471 Installing aircraft countermeasure systems

Supporting information

Guidance

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

2.5 (including BS, ISO or BSEN schematics, symbols and terminology)

2.8 (such as open and blind rivets, threaded fasteners, special securing devices)

2.20 (such as poor seals, misalignment, ineffective fasteners, foreign object damage or contamination)

Unit 472 Installing aircraft electro-optical and infrared systems

UAN:	**Y/601/4662**
Level:	3
Credit value:	86
GLH:	210
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical engineering Unit 072: Installing aircraft electro-optical and infrared 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 install aircraft electro-optical and infrared systems, in accordance with approved procedures. The learner will be required to use appropriate installation drawings, specifications and documentation to install the various types of equipment. The learner will be expected to position, align and secure the equipment in the correct locations, using the specified/appropriate techniques and fastening devices. The equipment will include still cameras, television/video cameras, infrared cameras and laser devices. The learner's responsibilities will require them to comply with organisational policy and procedures for the installation activities undertaken, and to report any problems with the 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 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 installation techniques and procedures. The learner will understand the aircraft electro-optical and infrared systems being installed, and their application, and will know about the installation techniques, tools, equipment and

methods used, in adequate depth to provide a sound basis for carrying out the activities to the required specification.

The learner will understand the safety precautions required when carrying out the installation operations. 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 install aircraft electro-optical and infrared 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 installation activities: • obtain and use the appropriate documentation (such as job instructions, installation drawings, 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 installation 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 • follow safe practice/approved installation techniques and procedures at all times • return all tools and equipment to the correct location on completion of the installation activities • dispose of waste materials in accordance with approved procedures • leave the work area in a safe and appropriate condition, free from foreign object debris on completion of the activities 1.3 follow all relevant drawings and specifications for the installation being carried out 1.4 use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition 1.5 install, position and secure the equipment and components in accordance with the specification 1.6 install all of the following electro-optical and infrared systems: • still cameras • video cameras • infrared cameras

- laser devices

1.7 install all of the following electro-optical and infrared system components:
- cameras
- power supply units (PSU)
- rotating platforms
- processor units
- monitors
- remote control devices
- fixed platforms

1.8 use all of the following installation methods and techniques:
- levelling and aligning
- earth bonding
- taking ESD precautions
- securing and locking

1.9 make three of the following types of mechanical securing connection:
- nuts and bolts
- locking devices
- screws
- torque load bolts
- quick-release fasteners

1.10 make five of the following types of electrical connection:
- co-axial
- tri-axial
- module blocks
- free plugs
- terminal blocks
- earth bonding points
- tray-mounted sockets

1.11 check that all necessary connections to the equipment are complete

1.12 carry out installations in compliance with one of the following standards:
- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures

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

1.14 check that the installation is complete and that all components are free from damage

1.15 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.

Learning outcome
The learner will: 2. Know how to install aircraft electro-optical and infrared systems
Assessment criteria
The learner can: 2.1 explain the specific safety practices and procedures that they need to observe when working with electro-optical and infrared systems 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 installing aircraft electro-optical and infrared systems, 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 interpret the drawings, standards, quality control procedures and specifications used for the installation 2.6 explain how to carry out currency/issue checks on the specifications they are working with 2.7 describe the components to be installed, and explain their function within the particular electro-optical and infrared systems 2.8 describe the various mechanical fasteners that will be used, and explain their method of installation 2.9 explain the importance of using the specified fasteners for the particular installation, and why they must not substitute others 2.10 explain why securing devices need to be locked and labelled, and the different methods that are used 2.11 explain the torque loading requirements of the fasteners, and what to do if these loadings are exceeded or not achieved 2.12 describe the quality control procedures to be followed during the installation operations 2.13 explain the procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities 2.14 describe the techniques used to position, align, adjust and secure the components to the aircraft without damage 2.15 describe the methods of lifting, handling and supporting the components/equipment during the installation activities 2.16 explain the use of seals, sealant, adhesives and anti-electrolysis barriers, and the precautions to be taken 2.17 explain why electrical bonding is critical, and why it must be both mechanically and electrically secure 2.18 describe the procedure for the safe disposal of waste materials 2.19 explain how to conduct any necessary checks to ensure the system integrity, functionality, accuracy and quality of the installation 2.20 explain how to recognise installation defects 2.21 explain the importance of ensuring that the completed installation is free from dirt, swarf and foreign object damage, and of ensuring that any exposed components or pipe ends are correctly

	covered/protected
2.22	describe the tools and equipment used in the installation activities, and explain their calibration/care and control procedures
2.23	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
2.24	describe the problems that can occur with the installation operations, and explain how these can be overcome
2.25	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
2.26	describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 472 Installing aircraft electro-optical and infrared systems

Supporting information

Guidance

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

2.5 (including BS, ISO or BSEN schematics, symbols and terminology)

2.8 (such as open and blind rivets, threaded fasteners, special securing devices)

2.20 (such as poor seals, misalignment, ineffective fasteners, foreign object damage or contamination)

Unit 473 Installing aircraft instrumentation systems

UAN:	**H/601/4664**
Level:	3
Credit value:	86
GLH:	210
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical engineering Unit 073: Installing aircraft Instrumentation 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 install aircraft instrumentation systems, in accordance with approved procedures. The learner will be required to use appropriate installation drawings and specifications to install the various types of equipment. The learner will be expected to position, align and secure the equipment in the correct locations, using the specified/appropriate techniques and fastening devices. The equipment will include various data acquisition systems, monitoring for analogue or digital parameters (temperature, stress, vibration, performance signals), Aeronautical Radio Incorporated (ARINC) 429 and mil-standard 1553 data buses. Other installations could include photographic systems (stills, video and digital), accident recorders, and specialist measurement systems for specific environmental trials. The learner's responsibilities will require them to comply with organisational policy and procedures for the installation activities undertaken, and to report any problems with the 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 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 installation techniques and procedures. The learner will understand the aircraft instrumentation systems being installed, and their application, and will know about the installation techniques, tools, equipment and methods used, in adequate depth to provide a sound basis for carrying out the activities to the required specification. The learner will understand the safety precautions required when carrying out the installation operations. 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 install aircraft instrumentation 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 installation activities: • obtain and use the appropriate documentation (such as job instructions, installation drawings, 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 installation 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 • follow safe practice/approved installation techniques and procedures at all times • return all tools and equipment to the correct location on completion of the installation activities • dispose of waste materials in accordance with approved procedures • leave the work area in a safe and appropriate condition, free from foreign object debris on completion of the activities 1.3 follow all relevant drawings and specifications for the installation being carried out 1.4 use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition 1.5 install, position and secure the equipment and components in

accordance with the specification

1.6 install aircraft instrumentation systems which include five of the following:
- strain gauge components
- accelerometer mounting blocks and associated pre-amplifiers
- temperature sensors (surface, air or immersed probes)
- control position potentiometers and indicators
- instrumentation LRUs
- pilot-static transducers
- rate gyros
- video cameras
- controllers
- accelerometers

1.7 use all the following installation methods and techniques:
- levelling and aligning
- earth bonding
- taking ESSD precautions
- securing and locking

1.8 make three of the following types of mechanical securing connection:
- nuts and bolts
- locking devices
- screwed
- torque loaded
- quick-release fasteners

1.9 make three of the following types of electrical connection:
- free plugs and sockets
- co-axial
- solder joints
- module blocks
- tray-mounted sockets
- earth bonding points
- in-line crimps

1.10 check that all necessary connections to the equipment are complete

1.11 carry out installations in compliance with one of the following standards:
- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures

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

1.13 check that the installation is complete and that all components are free from damage

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

Learning outcome
The learner will: 2. Know how to install aircraft instrumentation systems
Assessment criteria
The learner can:
2.1 explain the specific safety practices and procedures that they need to observe when working with aircraft instrumentation systems
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 installing aircraft instrumentation systems, 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 interpret the drawings, standards, quality control procedures and specifications used for the installation
2.6 explain how to carry out currency/issue checks on the specifications they are working with
2.7 describe the components to be installed and explain their function within the particular instrumentation systems
2.8 describe the various mechanical fasteners that will be used, and explain their method of installation
2.9 explain the importance of using the specified fasteners for the particular installation, and why they must not substitute others
2.10 explain why securing devices need to be locked and labelled, and the different methods that are used
2.11 explain the torque loading requirements on the fasteners, and what to do if these loadings are exceeded or not achieved
2.12 describe the quality control procedures to be followed during the installation operations
2.13 explain the procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities
2.14 describe the techniques used to position, align, adjust and secure the components to the aircraft without damage
2.15 describe the methods of lifting, handling and supporting the components/equipment during the installation activities
2.16 explain the use of seals, sealant, adhesives and anti-electrolysis barriers, and the precautions to be taken
2.17 explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
2.18 describe the procedure for the safe disposal of waste materials
2.19 explain how to conduct any necessary checks to ensure the system integrity, functionality, accuracy and quality of the installation

2.20	explain how to recognise installation defects (such as poor seals, misalignment, ineffective fasteners and foreign object damage or contamination)
2.21	explain the importance of ensuring that the completed installation is free from dirt, swarf and foreign object damage, and of ensuring that any exposed components or pipe ends are correctly covered/protected
2.22	describe the tools and equipment used in the installation activities, and explain their calibration/care and control procedures
2.23	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
2.24	describe the problems that can occur with the installation operations, and explain how these can be overcome
2.25	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
2.26	describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 473 Installing aircraft instrumentation systems

Supporting information

Guidance

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

2.5 (including BS, ISO or BSEN schematics, symbols and terminology)

2.8 (such as open and blind rivets, threaded fasteners, special securing devices)

Unit 474 Modifying aircraft electrical systems

UAN:	**K/601/4665**
Level:	3
Credit value:	77
GLH:	161
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical engineering Unit 074: Modifying aircraft electrical 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 systems, in accordance with approved procedures. The learner will be required to change, modify and update aircraft electrical systems in accordance with modification leaflets, latest issue drawings and standards. 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, units and trays. The learner will need to show proficiency in using various tools for cutting, stripping, crimping and soldering, and in the installation of the electrical 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. 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.

Learning outcome
The learner will: 1. Be able to modify aircraft electrical 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, modification drawings, 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 installation 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 • follow safe practice/approved installation techniques and procedures at all times • return all tools and equipment to the correct location on completion of the installation activities • dispose of waste materials in accordance with approved procedures • 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 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 systems:

- A/C lighting systems
- A/C power supply systems
- AFCS
- engine control systems
- A/C instrumentation systems

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 position or angle of breakout points
- making changes to component on end of cable
- changing routes of cables
- adding new looms
- making changes to looms
- changing position of electrical units
- fitting new electrical systems
- removing cables
- adding cables

1.9 carry out at six of the following processes:

- soldering and de-soldering
- heat shrinking (devices and boots)
- crimping (tags and pins)
- stripping
- removing cable end fittings
- changing components
- changing electrical trays
- repositioning units
- removal cable protection

1.10 complete the modification within the agreed timescale

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

1.12 modify aircraft electrical systems in compliance with one of the following standards:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures

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

1.15	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 modify aircraft electrical systems
Assessment criteria
The learner can:
2.1 explain the specific safety precautions and procedures to be observed whilst carrying out the modifications to electrical systems
2.2 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
2.3 describe the hazards associated with carrying out modifications to aircraft electrical systems, and explain how to minimise them and reduce any risks
2.4 explain what personal protective equipment and clothing needs to be worn during the modification activities
2.5 describe the various types of drawing and specifications that are used during the modification
2.6 explain how to identify the components to be used; component identification systems
2.7 explain what preparations need to be undertaken on the system prior to modification
2.8 describe the methods and techniques to be used for soldering and de-soldering, and explain the importance of adhering to the procedures
2.9 describe the methods and techniques to be used for crimping and heat shrinking, and explain the importance of adhering to them
2.10 describe the methods and techniques to be used for the assembly of screened and unscreened plugs and sockets
2.11 explain how to identify the difference between composite and metal plugs and sockets
2.12 explain the different types of cable protection, and reasons for each type
2.13 describe the various mechanical fasteners that will be used, and explain their method of installation
2.14 explain the importance of using the specified fasteners for the modification, and why they must not use substitutes
2.15 describe the quality control procedures to be followed during the modification operations
2.16 explain how to conduct any necessary checks to ensure the accuracy and quality of the modification
2.17 explain how to recognise defects
2.18 explain the importance of ensuring that the completed modification is free from dirt, swarf and foreign object damage
2.19 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
2.20 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

2.21	describe the problems that can occur with the modification operations, and explain how these can be overcome
2.22	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
2.23	describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 474 Modifying aircraft electrical 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 codes and component orientation indicators)

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

Unit 475 Modifying aircraft avionics systems

UAN:	**H/601/4681**
Level:	3
Credit value:	77
GLH:	161
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical engineering Unit 075: Modifying aircraft avionics 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 avionics systems, in accordance with approved procedures. The learner will be required to change, modify and update aircraft avionics systems in accordance with modification leaflets, latest issue drawings and standards. The learner will be expected to remove and replace cables, add new cables, change breakout points and change the routeing of cables. The learner will also be expected to change components, units and trays. The learner will need to show proficiency in using various tools for cutting, stripping, crimping and soldering, and in the installation of the avionics 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. The learner will understand the modification, and its application, and will know about the modification requirements and

methods, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring that the completed modification is 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.

Learning outcome
The learner will: 1. Be able to modify aircraft avionics 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, modification drawings, 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 installation 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 • follow safe practice/approved installation techniques and procedures at all times • return all tools and equipment to the correct location on completion of the installation activities • dispose of waste materials in accordance with approved procedures • 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 avionics system for the required modification 1.6 carry out the system modification using approved materials, methods and procedures 1.7 carry out modifications to two different types of avionics system from the following:

- visual display units
- communications systems
- flight guidance and control systems
- navigational systems
- radar systems
- countermeasure systems
- electro-optical/infrared
- instrumentation systems

1.8 carry out six of the following types of modification:

- removing cables
- adding cables
- changing routes of cables
- making changes to looms
- adding looms to cableform
- replacing cables of different size or length
- making changes to panels or sub-assemblies
- changing position or angle of breakout points
- making changes to component on end of cable
- changing or adding avionics units/systems
- changing position of avionics units

1.9 carry out at six of the following processes during the modifications

- soldering and de-soldering
- heat shrinking (devices and boots)
- crimping (tags and pins)
- stripping
- removing cable end fittings
- changing components
- changing electrical trays
- repositioning units
- removing cable protection

1.10 complete the modification within the agreed timescale

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

1.12 carry out modifications in compliance with one of the following standards

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures

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

1.15 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 modify aircraft avionics systems
Assessment criteria
The learner can: 2.1 explain the specific safety precautions and procedures to be observed whilst carrying out the modifications to avionics systems 2.2 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 2.3 describe the hazards associated with modifying aircraft avionic systems and with the tools and equipment used, and explain how to minimise them and reduce any risks 2.4 explain what personal protective equipment and clothing needs to be worn during the modification activities 2.5 describe the various types of drawing and specifications that are used during the modification 2.6 explain how to identify the components to be used; component identification systems 2.7 explain what preparations need to be undertaken on the system, prior to modification 2.8 describe the methods and techniques to be used for soldering and de-soldering, and explain the importance of adhering to the procedures 2.9 describe the methods and techniques to be used for crimping and heat shrinking, and explain the importance of adhering to them 2.10 describe the methods and techniques to be used for the assembly of screened and unscreened plugs and sockets 2.11 explain how to identify the difference between composite and metal plugs and sockets 2.12 explain the different types of cable protection, and reasons for each type 2.13 describe the various mechanical fasteners that will be used, and explain their method of installation 2.14 explain the importance of using the specified fasteners for the modification, and why they must not use substitutes 2.15 describe the quality control procedures to be followed during the modification operations 2.16 explain how to conduct any necessary checks to ensure the accuracy and quality of the modification 2.17 explain how to recognise defects 2.18 explain the importance of ensuring that the completed modification is free from dirt, swarf and foreign object damage 2.19 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

2.20	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
2.21	describe the problems that can occur with the modification operations, and explain how these can be overcome
2.22	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
2.23	describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 475 Modifying aircraft avionics 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 codes and component orientation indicators)

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

Unit 476 Testing aircraft cableforms/looms

UAN:	**K/601/4682**
Level:	3
Credit value:	55
GLH:	126
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical engineering Unit 076: Testing aircraft cableforms/looms (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 cableforms/looms, in accordance with approved procedures. The learner will be required to use appropriate drawings, specifications and test documentation to test the various types of equipment. The learner will be expected to carry out the appropriate testing procedures on cableforms/looms and associated components, including aircraft system cable assemblies, heavy duty cable assemblies, aircraft lighting cables, co-axial cables, fibre-optic cables, secure speech cables, headset leads, AFCS cable assemblies, databus looms and amalgamated looms, circuit breaker/switch panels, distribution panels, relay panels, control panels, transformers, aerials and data recorders. The learner's responsibilities will require them to comply with organisational policy and procedures for the tests undertaken, and to report any problems with the testing 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 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 test techniques and procedures. The learner will

understand the aircraft cableforms/looms being tested, and their application, and will know about the test equipment and methods, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring that the work output is to the required specification.

The learner will understand the safety precautions required when carrying out the testing operations. 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 test aircraft cableforms/looms
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 activities: • obtain and use the appropriate documentation (such as job instructions, aircraft cable form/loom 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 1.3. 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 safety procedures (where appropriate) • ensure that isolation procedures are followed and that safe working distance procedures are set up (where appropriate) • carry out the tests using the specified techniques and procedures • 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 1.4. follow the appropriate procedures for use of tools and equipment to carry out the required tests 1.5. use four of the following types of test equipment: • multimeters • continuity testers

- battery discharge tester
- time domain reflectometer (TDR) equipment
- voltage standing wave ratio (VSWR) equipment
- optical light source and power meter kit
- ditmaco machines
- databus tester
- other specific

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

1.7. test four of the following aircraft cableforms/looms:

- co-axial cable assemblies
- heavy duty cable assemblies
- aircraft system cable assemblies
- secure speech cable assemblies
- fibre-optic cables/assemblies
- aircraft lighting cable assemblies
- headset leads (mic-tel leads)
- AFCS cable assemblies
- databus looms
- amalgamated system looms

1.8. test the cableform/loom components, to include four from the following:

- relay panels
- distribution panels
- cable protection
- data recorders
- avionic trays
- fuel content/quantity probes
- circuit breaker/switch panels
- terminal blocks
- cockpit/flightdeck equipment
- line replacement units external to cockpit/flightdeck
- formation/internal lighting
- control panels
- transformers
- module blocks
- aerials
- batteries

1.9. carry out three of the following types of test:

- voltage checks
- continuity checks
- VSWR checks
- TDR checks

1.10. deal with two of the following levels of complexity during the testing activities:

- equipment with no faults

- equipment with faults
- equipment with intermittent faults

1.11. during tests use two of the following fault finding techniques:

- six point
- half-split
- input-to-output
- function testing
- equipment self-diagnostics
- emergent problem sequence
- injection and sampling
- unit substitution

1.12. carry out tests in compliance with one of the following standards:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures

1.13. record the results of the tests in the appropriate format

1.14. review the results and carry out further tests if necessary

1.15. review fault symptoms and history of problems, using four of the following:

- data sheets
- calibration records
- log cards/history sheet
- aircraft documentation
- fault records
- maintenance records

Learning outcome
The learner will: 2. Know how to test aircraft cableforms/looms
Assessment criteria
The learner can: 2.1 explain the specific safety practices and procedures that they need to observe when testing aircraft cableforms/looms 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 explain what safety procedures must be carried out before work is started on the aircraft 2.4 describe the hazards associated with testing cableforms and looms, and with the tools and equipment used, and explain how to minimise them and reduce any risks 2.5 explain what protective clothing and equipment needs to be worn, and where it can be obtained 2.6 explain the correct operating procedures for the system being

	tested
2.7	explain the electrical bonding specifications, and their importance
2.8	explain how to obtain the required test specifications for the systems they are working on, how to interpret them and how to check their currency/issue
2.9	explain who can provide guidance to clarify the specifications, and who can provide assistance in applying test methods and techniques
2.10	explain what test equipment is to be used, and its selection for the particular tests
2.11	describe the testing techniques, methods and procedures to be used during the tests
2.12	explain the calibration of the test equipment (where applicable), and the currency/issue checks that need to be carried out
2.13	describe the fault finding techniques to be used if the system fails the tests
2.14	explain how to analyse the test results
2.15	explain how to display/record the test results, and the documentation to be used for this
2.16	explain the authorisation procedures for changes to test procedures
2.17	describe the problems or errors that may affect test results
2.18	explain any environmental controls required relating to the testing
2.19	explain what documentation needs to be used on completion of all the tests
2.20	describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 476 Testing aircraft cableforms/looms

Supporting information

Guidance

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

Unit 477 Testing aircraft visual display units and computer systems

UAN:	**M/601/4683**
Level:	3
Credit value:	55
GLH:	126
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical engineering Unit 077: Testing aircraft visual display units and computer 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 visual display units and computer systems, in accordance with approved procedures. The learner will be required to use appropriate test specifications and documentation to test the various types of equipment. The learner will be expected to carry out the appropriate test procedures on the various units fitted. The equipment will include aircraft management computers (AMC), sensor interface units, AMC control panels, symbol generators, display units and display mode select panels. The learner's responsibilities will require them to comply with organisational policy and procedures for the tests undertaken, and to report any problems with the testing 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 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 testing techniques and procedures to visual display units and computer systems. The learner will understand the equipment and systems being tested, and their application, and will know about the test equipment, techniques and methods, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring that the tested system functions to the required

specification.

The learner will understand the safety precautions required when carrying out the testing operations. 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 test aircraft visual display units and computer 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 activities: • obtain and use the appropriate documentation (such as job instructions, aircraft avionic system 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) • carry out the tests using the specified techniques and procedures • 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 use three types of test equipment from the following: • bonding tester • multimeter • bus test set • oscilloscope • Arinc429/1553 test set • 'special-to-type' test equipment 1.5 set up and carry out the tests using the correct procedures and

within agreed timescales

1.6 test aircraft visual display equipment and computer systems which include both of the following:
- aircraft management system (AMS)
- electronic instrumentation systems (EIS)

1.7 test all of the following aircraft system components:
- AMS computer
- AMC control panel
- AMS sensor interface units
- EIS symbol generators
- EIS display units
- EIS display mode select panels

1.8 carry out three of the following types of test:
- bonding tests
- voltage checks
- data checks
- serviceability checks
- continuity checks

1.9 deal with two of the following levels of complexity during the testing activities:
- equipment with no faults
- equipment with faults
- equipment with intermittent faults

1.10 use two of the following fault finding techniques during the testing activities:
- six point
- half-split
- input-to-output
- function testing
- equipment self-diagnostics
- emergent problem sequence
- injection and sampling
- unit substitution

1.11 carry out tests in compliance with one of the following standards:
- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- BS, ISO or BSEN standards and procedures
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- customer standards and requirements
- company standards and procedures

1.12 record the results of the tests in the appropriate format

1.13 review the results and carry out further tests if necessary

1.14 review fault symptoms and history of problems using four of the following:
- data sheets
- calibration records

- log cards/history sheet
- aircraft documentation
- fault records
- maintenance records .

Learning outcome
The learner will: 2. Know how to test aircraft visual display units and computer systems
Assessment criteria
The learner can: 2.1 explain the specific safety practices and procedures that they need to observe when testing visual display units and computer systems 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 explain the safety procedures that must be carried out before work is started on the aircraft 2.4 describe the hazards associated with testing visual displays and computer systems, and with the tools and equipment used, and explain how to minimise them and reduce any risks 2.5 explain what protective clothing and equipment needs to be worn, and where it can be obtained 2.6 explain the correct operating procedures of the system being tested 2.7 explain the electrical bonding specifications, and their importance 2.8 explain how to obtain the required test specifications for the systems they are working on, how to interpret them and how to check their currency/issue 2.9 explain who can provide guidance to clarify the specifications, and who can provide assistance in applying test methods and techniques 2.10 explain what test equipment is to be used, and its selection for the particular tests 2.11 explain why equipment control is critical, and what to do if a piece of equipment is unaccounted for on completion of the activities 2.12 describe the testing techniques, methods and procedures to be used during the tests 2.13 explain the calibration of the test equipment (where applicable), and the currency/issue checks that need to be carried out 2.14 describe the fault finding techniques to be used if the system fails the tests 2.15 explain how to analyse the test results 2.16 explain how to display/record the test results, and the documentation used 2.17 explain the authorisation procedures for changes to test procedures 2.18 describe the problems and errors that may affect the test results 2.19 explain any environmental controls required relating to the testing 2.20 explain what documentation needs to be used on completion of all the tests 2.21 describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve.

Unit 477 Testing aircraft visual display units and computer systems

Supporting information

Guidance

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

Unit 478 Testing aircraft engine control units

UAN:	**T/601/4684**
Level:	3
Credit value:	55
GLH:	126
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical engineering Unit 078: Testing aircraft engine control units (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 engine control units, in accordance with approved procedures. The learner will be required to use appropriate drawings, specifications and test documentation to test the various items of equipment. The learner will be expected to carry out the appropriate testing procedures. The equipment to be tested will include flying control pick-offs, engine electronic control units, cockpit control levers and switches. The learner's responsibilities will require them to comply with organisational policy and procedures for the tests undertaken, and to report any problems with the testing 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 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 testing techniques and procedures to aircraft engine control units. The learner will understand the control units being tested, and their application, and will know about the test equipment and methods, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring that the tested system functions to the required

specification.

The learner will understand the safety precautions required when carrying out the testing operations. 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 test aircraft engine control units
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 activities: • obtain and use the appropriate documentation (such as job instructions, aircraft engine control system 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) • carry out the tests using the specified techniques and procedures • 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 engine control units, using tools or test equipment which include all of the following: • ground supply (electrical/ hydraulic) • 'special-to-type' test equipment • test lamps • continuity tester • voltmeter 1.5 set up and carry out the tests using the correct procedures and

within agreed timescales

1.6 test two of the following types of equipment:
- aircraft cockpit control levers and switches
- aircraft engine electronic control units
- flying control pick-offs (helicopter only)

1.7 carry out all of the following types of test:
- alignment checks
- voltage checks
- continuity checks
- cockpit indications
- standard serviceability checks
- microswitch operations

1.8 deal with two of the following levels of complexity during the testing activities:
- equipment with no faults
- equipment with faults
- equipment with intermittent faults

1.9 use two of the following fault finding techniques during the testing activities:
- six point
- half-split
- input-to-output
- function testing
- equipment self-diagnostics
- emergent problem sequence
- injection and sampling
- unit substitution

1.10 carry out tests in compliance with one of the following standards:
- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- BS, ISO or BSEN standards and procedures
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- customer standards and requirements
- company standards and procedures

1.11 record the results of the tests in the appropriate format

1.12 review the results and carry out further tests if necessary

1.13 review fault symptoms and history of problems using four of the following:
- data sheets
- calibration records
- log cards/history sheet
- aircraft documentation
- fault records
- maintenance records .

Learning outcome
The learner will: 2. Know how to test aircraft engine control units
Assessment criteria
The learner can: 2.1 explain the specific safety practices and procedures that they need to observe when testing aircraft engine control units 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 explain the safety procedures that must be carried out before work is started on the aircraft 2.4 describe the hazards associated with testing aircraft engine control units, and with the tools and equipment used, and explain how to minimise them and reduce any risks 2.5 explain what protective clothing and equipment needs to be worn and where it can be obtained 2.6 explain the correct operating procedures of the system being tested 2.7 explain the electrical bonding specifications, and their importance 2.8 explain how to obtain the required test specifications for the systems they are working on, how to interpret them and how to check their currency/issue 2.9 explain who can provide guidance to clarify the specifications, and who can provide assistance in applying test methods and techniques 2.10 explain what test equipment is to be used, and its selection for the particular tests 2.11 describe the testing techniques, methods and procedures to be used during the tests 2.12 explain the calibration of the test equipment (where applicable), and the currency/issue checks that need to be carried out 2.13 describe the fault finding techniques to be used if the system fails the tests 2.14 explain how to analyse the test results 2.15 explain how to display/record the test results, and the documentation used 2.16 explain the authorisation procedures for changes to test procedures 2.17 describe the problems or errors that may affect the test results 2.18 explain any environmental controls required relating to the testing 2.19 explain what documentation needs to be used on completion of all the tests 2.20 describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 478 Testing aircraft engine control units

Supporting information

Guidance

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

Unit 479 Testing aircraft communication systems

UAN:	**A/601/4685**
Level:	3
Credit value:	55
GLH:	126
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical engineering Unit 079: Testing 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. The learner will be required to use appropriate drawings, specifications, and test documentation to test the various items of equipment. The learner will be expected to carry out the appropriate testing procedures. The communication equipment will include intercom (clear), intercom (secure), high frequency (HF) radio, very high frequency (VHF) radio, ultra high frequency (UHF) radio, cockpit voice recorder, crash position indicators, digital data links, secure radio links, flight entertainment systems, satellite Communications (SATCOM) and selective calling (SELCAL). The learner's responsibilities will require them to comply with organisational policy and procedures for the tests undertaken, and to report any problems with the testing 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 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 testing techniques and procedures. The learner will

understand the aircraft communication systems being tested, and their application, and will know about the testing techniques, test equipment and methods, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring that the tested system functions to the required specification.

The learner will understand the safety precautions required when carrying out the testing operations. 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 test 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 activities: • obtain and use the appropriate documentation (such as job instructions, aircraft communication system 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) • carry out the tests using the specified techniques and procedures • 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 equipment, using tools or test equipment which include seven of the following:

- ‘special-to-type’ test equipment
- multimeter
- TDR equipment
- bonding tester
- modulation analyser
- torque spanners
- RF signal generator
- VWSR equipment
- headset
- wattmeter
- oscilloscope
- wire locking pliers

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

1.6 test aircraft communication systems which include both of the following:

- VHF radio
- intercom (clear)
- Plus four more items from the following:
- secure radio links
- HF radio
- UHF radio
- cockpit voice recorder
- SATCOM
- digital data links
- crash position indicators
- flight entertainment systems
- intercom (secure speech)
- SELCAL
- GPS systems
- aircraft communication address reporting system (ACARS)
- interphone (such as internal communications)
- audio integrating (such as microphones, headphones, cockpit loudspeakers)
- integrated automatic tuning (such as digital data links)
- audio and video monitoring (such as voice recorders, passenger conversation/movement, external cameras)

1.7 carry out all of the following types of test:

- bonding tests
- serviceability checks
- distortion checks
- VWSR checks
- signal-to-noise checks
- continuity checks
- power output
- receiver sensitivity

1.8 deal with two of the following levels of complexity during the

testing activities:

- equipment with no faults
- equipment with faults
- equipment with intermittent faults

1.9 use two of the following fault finding techniques during the testing activities:

- six point
- half-split
- input-to-output
- function testing
- equipment self-diagnostics
- emergent problem sequence
- injection and sampling
- unit substitution

1.10 carry out tests in compliance with one of the following standards:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- BS, ISO or BSEN standards and procedures
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- customer standards and requirements
- company standards and procedures

1.11 record the results of the tests in the appropriate format

1.12 review the results and carry out further tests if necessary

1.13 review fault symptoms and history of problems using four of the following:

- data sheets
- calibration records
- log cards/history sheet
- aircraft documentation
- fault records
- maintenance records

Learning outcome
The learner will: 2. Know how to test aircraft communication systems
Assessment criteria
The learner can: 2.1 explain the specific safety practices and procedures that they need to observe when testing communication systems 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 explain the safety procedures that must be carried out before work is started on the aircraft 2.4 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

2.5	explain what protective clothing and equipment needs to be worn, and where it can be obtained
2.6	explain the correct operating procedures of the system being tested
2.7	explain the electrical bonding specifications, and their importance
2.8	explain how to obtain the required test specifications for the systems they are working on, how to interpret them and how to check their currency/issue
2.9	explain who can provide guidance to clarify the specifications, and who can provide assistance in applying test methods and techniques
2.10	explain what test equipment is to be used, and its selection for the particular tests
2.11	explain why equipment control is critical, and what to do if a piece of equipment is unaccounted for on completion of the activities
2.12	describe the testing techniques, methods and procedures to be used during the tests
2.13	explain the calibration of the test equipment (where applicable), and the currency/issue checks that need to be carried out
2.14	describe the fault finding techniques to be used if the system fails the tests
2.15	explain how to analyse the test results
2.16	explain how to display/record the test results, and the documentation used
2.17	explain the authorisation procedures for changes to test procedures
2.18	describe the problems or errors that may affect the test results
2.19	explain any environmental controls required relating to the testing
2.20	explain what documentation needs to be used on completion of all the tests
2.21	describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 479 Testing aircraft communication systems

Supporting information

Guidance

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

Unit 480 Testing aircraft flight guidance and control systems

UAN:	**J/601/4687**
Level:	3
Credit value:	55
GLH:	126
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical engineering Unit 080: Testing 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. The learner will be required to use appropriate drawings, specifications and test documentation to test the various types of equipment. The learner will be expected to carry out the appropriate testing procedures. The equipment will include fly by wire, gyros, autopilot, flight director, and AFCS (Automatic Flying control System). The learner's responsibilities will require them to comply with organisational policy and procedures for the tests undertaken, and to report any problems with the testing 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 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 testing techniques and procedures. The learner will understand the aircraft flight guidance and control systems being tested, and their application, and will know about the test equipment and methods, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring that

	the tested system functions to the required specification. The learner will understand the safety precautions required when carrying out the testing operations. 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 test 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 activities: • obtain and use the appropriate documentation (such as job instructions, aircraft flight guidance and control system 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) • carry out the tests using the specified techniques and procedures • 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 use all of the following tools or test equipment: • multimeters • special to type test equipment • simulators • clinometers • air data test sets

- tilt tables

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

1.6 test all of the following flight guidance and control equipment:

- fly by wire
- autopilot
- automatic flying control system (AFCS)
- gyros
- flight director

1.7 test flight guidance system components, using tools or test equipment, to include five of the following:

- computers
- controllers
- air data units
- detectors
- gyros (rate and vertical)
- compass computers
- trim units
- actuators
- stick position cancellers
- Attitude Heading & Reference System (AHRS)
- Inertial Reference Unit (IRUs)
- embedded GPS & INS (EGI)

1.8 carry out all of the following types of test:

- alignment checks
- bit checks
- standard serviceability checks
- voltage checks

1.9 deal with two the following complexities during the testing activities:

- equipment with no faults
- equipment with faults
- equipment with intermittent faults.

1.10 use three of the following fault finding techniques during the testing activities:

- six point
- half-split
- input-to-output
- function testing
- equipment self-diagnostics
- emergent problem sequence
- injection and sampling
- unit substitution

1.11 carry out tests in compliance with one of the following standards:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)

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

1.12 record the results of the tests in the appropriate format

1.13 review the results and carry out further tests if necessary

1.14 review fault symptoms and history of problems using four of the following:

- data sheets
- calibration records
- log cards/history sheet
- aircraft documentation
- fault records
- maintenance records

Learning outcome
The learner will: 2. Know how to test 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 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 explain the safety procedures that must be carried out before work is started on the aircraft 2.4 describe the hazards associated with testing flight guidance and control systems, and with the tools and equipment used, and explain how to minimise them and reduce any risks 2.5 explain what protective clothing and equipment needs to be worn, and where it can be obtained 2.6 explain the correct operating procedures of the system being tested 2.7 explain the electrical bonding specifications, and their importance 2.8 explain how to obtain the required test specifications for the systems they are working on, how to interpret them and how to check their currency/issue 2.9 explain who can provide guidance to clarify the specifications, and who and provide assistance in applying test methods and techniques 2.10 explain what test equipment is to be used, and its selection for the particular tests 2.11 describe the testing techniques, methods and procedures to be used during the tests 2.12 explain the calibration of the test equipment (where applicable), and the currency/issue checks that need to be carried out 2.13 describe the fault finding techniques to be used if the system fails the tests

2.14	explain how to analyse the test results
2.15	explain how to display/record the test results, and the documentation used
2.16	explain the authorisation procedures for changes to test procedures
2.17	describe the problems or errors that may affect test results
2.18	explain any environmental controls required relating to the testing
2.19	explain what documentation needs to be used on completion of all the tests
2.20	describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 480 Testing 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)

Unit 481 Testing aircraft navigational systems

UAN:	**R/601/4689**
Level:	3
Credit value:	55
GLH:	126
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical engineering Unit 081: Testing aircraft navigational 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 systems, in accordance with approved procedures. The learner will be required to use appropriate drawings, specifications and test documentation to test the various items of equipment. The learner will be expected to carry out the appropriate testing procedures. The navigational equipment will include 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), tactical air navigation (TACAN), homing, radio altimeter, inertial navigation system, Decca, and compass. The learner's responsibilities will require them to comply with organisational policy and procedures for the tests undertaken, and to report any problems with the testing 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 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 testing techniques and procedures. The learner will

understand the aircraft navigational systems being tested, and their application, and will know about the test equipment and methods, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring that the tested system functions to the required specification.

The learner will understand the safety precautions required when carrying out the testing operations. 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 test aircraft navigational 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 activities during testing: • obtain and use the appropriate documentation (such as job instructions, aircraft navigational system 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) • carry out the tests using the specified techniques and procedures • 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 equipment using tools or test equipment, to include seven of the following: • 'special-to-type' test equipment

- radio frequency (RF) signal generators
- time domain reflectometer (TDR) equipment
- voltage standing wave ratio (VSWR) equipment
- reference gyros
- torque spanners
- bonding tester
- multimeter
- headset
- delay lines
- wire locking pliers

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

1.6 test aircraft navigational systems which include four of the following:

- distance measuring equipment (DME)
- very high frequency omni directional 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)
- enhanced ground proximity warning system (EGPWS)
- traffic collision avoidance system (TCAS)
- re-transmission systems
- Doppler
- homing
- gyro
- Decca
- compass
- weather radar
- flight management computing (such as course computers, flight management, performance data computers)
- flight environment data (such as central air data computers, pitot/static, rate-of-climb, air speed, high speed warning, altitude, altitude reporting, altimeter correction, air disturbance detection, air temperature)
- attitude and direction (such as magnetic compasses, vertical and directional references, magnetic heading systems, attitude director systems, symbol generators, turn and bank, rate of turn)

1.7 carry out all of the following types of test:

- bonding tests
- standard serviceability checks
- LRV alignment
- VSWR checks
- compass swing

- continuity checks
- TDR checks
- receiver sensitivity

1.8 deal with two of the following levels of complexity:
- equipment with no faults
- equipment with faults
- equipment with intermittent faults

1.9 use two of the following fault finding techniques during the testing activities:
- six point
- half-split
- input-to-output
- function testing
- equipment self-diagnostics
- emergent problem sequence
- injection and sampling
- unit substitution

1.10 carry out tests in compliance with one of the following standards:
- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- BS, ISO or BSEN procedures
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- customer standards and requirements
- company standards and procedures

1.11 record the results of the tests in the appropriate format

1.12 review the results and carry out further tests if necessary

1.13 review fault symptoms and history of problems using four of the following:
- data sheets
- calibration records
- log cards/history sheet
- aircraft documentation
- fault records
- maintenance records.

Learning outcome
The learner will: 2. Know how to test aircraft navigational 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 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 explain the safety procedures that must be carried out before work

	is started on the aircraft
2.4	describe the hazards associated with testing aircraft navigation systems, and with the tools and equipment used, and explain how to minimise them and reduce any risks
2.5	explain what protective clothing and equipment to be worn, and where it can be obtained
2.6	explain the correct operating procedures of the system being tested
2.7	explain the electrical bonding specifications, and their importance
2.8	explain how to obtain the required test specifications for the systems they are working on, how to interpret them and how to check their currency/issue
2.9	explain who can provide guidance to clarify the specifications, and who can provide assistance in applying test methods and techniques
2.10	explain what test equipment is to be used, and its selection for the particular tests
2.11	explain why equipment control is critical, and what to do if a piece of equipment is unaccounted for on completion of the activities
2.12	describe the testing techniques, methods and procedures to be used during the tests
2.13	explain the calibration of the test equipment (where applicable), and the currency/issue checks that need to be carried out
2.14	describe the fault finding techniques to be used if the system fails the tests
2.15	explain how to analyse the test results
2.16	explain how to display/record the test results and the documentation used
2.17	explain the authorisation procedures for changes to test procedures
2.18	describe the problems or errors that may affect the test results
2.19	explain any environmental controls required relating to the testing
2.20	explain what documentation needs to be used on completion of all the tests
2.21	describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 481 Testing aircraft navigational systems

Supporting information

Guidance

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

Unit 482 Testing aircraft radar systems

UAN:	**L/601/4691**
Level:	3
Credit value:	55
GLH:	126
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical engineering Unit 082: Testing 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. The learner will be required to use appropriate installation drawings, specifications and test documentation to test the various types of equipment. The learner will be expected to carry out the appropriate testing procedures. The equipment will include surveillance radar, weather radar, obstacle warning systems and radar jamming devices. The learner's responsibilities will require them to comply with organisational policy and procedures for the tests undertaken, and to report any problems with the testing 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 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 testing techniques and procedures. The learner will understand the aircraft radar systems being tested, and their application, and will know about the test equipment and methods, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring that the tested system functions to the required specification. The learner will understand the safety precautions required when carrying out the testing operations. 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 test 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 activities: • obtain and use the appropriate documentation (such as job instructions, aircraft radar system 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) • carry out the tests using the specified techniques and procedures • 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 equipment, using tools or test equipment to include all of the following: • voltage standing wave ratio (VSWR) equipment • 'special-to-type' test equipment • multimeter • signal generators • oscilloscope 1.5 set up and carry out the tests using the correct procedures and within agreed timescales 1.6 test one of the following aircraft radar systems: • surveillance radar • weather radar

- obstacle warning systems
- radar jammers

1.7 test aircraft radar components, to include five from the following:

- scanners
- aerials
- processors
- transmitters
- receivers
- wave guides
- microwave generators
- power supply units (PSU)
- intermediate frequency unit (IFU)
- carry out all the following types of test:
- VSWR checks
- alignment checks
- voltage checks
- range checks
- standard serviceability checks

1.8 deal with two of the following levels of complexity during the testing activities:

- equipment with no faults
- equipment with faults
- equipment with intermittent faults

1.9 use two of the following fault finding techniques during the testing activities:

- six point
- half-split
- input-to-output
- function testing
- equipment self-diagnostics
- emergent problem sequence
- injection and sampling
- unit substitution

1.10 carry out tests in compliance with one of the following standards:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN procedures
- customer standards and requirements
- company standards and procedures

1.11 record the results of the tests in the appropriate format

1.12 review the results and carry out further tests if necessary

1.13 review fault symptoms and history of problems using four of the following:

- data sheets
- calibration records

- log cards/history sheet
- aircraft documentation
- fault records
- maintenance records

Learning outcome
The learner will: 2. Know how to test aircraft radar systems
Assessment criteria
The learner can: 2.1 explain the specific safety practices and procedures that they need to observe when testing radar systems 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 explain the safety procedures that must be carried out before work is started on the aircraft 2.4 describe the hazards associated with testing radar systems, and with the tools and equipment used, and explain how to minimise them and reduce any risk 2.5 explain what protective clothing and equipment needs to be worn, and where it can be obtained 2.6 explain the correct operating procedures of the system being tested 2.7 explain the electrical bonding specifications, and their importance 2.8 explain how to obtain the required test specifications for the systems they are working on, how to interpret them and how to check their currency/issue 2.9 explain who can provide guidance to clarify the specifications, and who can provide assistance in applying test methods and techniques 2.10 explain what test equipment is to be used, and its selection for the particular tests 2.11 explain why equipment control is critical, and what to do if a piece of equipment is unaccounted for on completion of the activities 2.12 describe the testing techniques, methods and procedures to be used during the tests 2.13 explain the calibration of the test equipment (where applicable), and the currency/issue checks that need to be carried out 2.14 describe the fault finding techniques to be used if the system fails the tests 2.15 explain how to analyse the test results 2.16 explain how to display/record the test results, and the documentation used 2.17 explain the authorisation procedures for changes to test procedures 2.18 describe the potential problems, errors that may affect the test results 2.19 explain any environmental controls required relating to the testing 2.20 explain what documentation needs to be used on completion of all the tests 2.21 describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 482 Testing aircraft radar systems

Supporting information

Guidance

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

2.2 (eg, ensuring safe distances around the aircraft when testing radar systems)

Unit 483 Testing aircraft countermeasure systems

UAN:	**R/601/4692**
Level:	3
Credit value:	86
GLH:	168
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical engineering Unit 083: Testing aircraft countermeasure 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 countermeasure systems, in accordance with approved procedures. The learner will be required to use appropriate drawings, specifications and documentation to test the various types of equipment. The learner will be expected to carry out the appropriate testing procedures. The equipment will include Identification, Friend or Foe (IFF), electronic surveillance methods (ESM), sonics, sound navigation and ranging (Sonar), radar height warning receiver (RHWR), dispensing equipment, and towed radar decoys. The learner's responsibilities will require them to comply with organisational policy and procedures for the tests undertaken, and to report any problems with the testing 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 testing techniques and procedures. The learner will understand the aircraft countermeasure systems being tested, and their application, and will know about the test equipment and

methods, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring that the tested system functions to the required specification.

The learner will understand the safety precautions required when carrying out the testing operations. 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 test aircraft countermeasure 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 activities: • obtain and use the appropriate documentation (such as job instructions, aircraft countermeasure system 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) • carry out the tests using the specified techniques and procedures • 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 counter measures systems equipment using all of the following tools and test equipment: • VSWR machines • oscilloscopes • multimeters

- signal generators
- 'special-to-type' test equipment

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

1.6 test two of the following aircraft countermeasure systems:

- IFF
- ESM
- sonics
- Sonar
- RHWR
- dispensing equipment
- towed radar decoys

1.7 test aircraft countermeasure systems components, to include five of the following:

- buoys
- aerials
- dispensers
- transmitters
- receivers
- processors
- microwave generators
- power supply units (PSU)
- winches

1.8 carry out all of the following types of test:

- VSWR checks
- alignment checks
- winch speed checks
- voltage checks
- range checks
- standard serviceability checks
- code checks

1.9 deal with two of the following complexities during the testing activities:

- equipment with no faults
- equipment with faults
- equipment with intermittent faults

1.10 use two of the following fault finding techniques during the testing activities:

- six point
- half-split
- input-to-output
- function testing
- equipment self-diagnostics
- emergent problem sequence
- injection and sampling
- unit substitution

1.11 carry out tests in compliance with one of the following standards:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- BS, ISO or BSEN standards and procedures
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- customer standards and requirements
- company standards and procedures

1.12 record the results of the tests in the appropriate format

1.13 review the results and carry out further tests if necessary

1.14 review fault symptoms and history of problems using four of the following:

- data sheets
- calibration records
- log cards/history sheet
- aircraft documentation
- fault records
- maintenance records

Learning outcome
The learner will: 2. Know how to test aircraft countermeasure systems
Assessment criteria
The learner can: 2.1 explain the specific safety practices and procedures that they need to observe when testing countermeasure systems 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 explain the safety procedures that must be carried out before work is started on the aircraft 2.4 describe the hazards associated with testing aircraft counter measure systems, and with the tools and equipment used, and explain how to minimise them and reduce any risks 2.5 explain what protective clothing and equipment needs to be worn, and where it can be obtained 2.6 explain the correct operating procedures of the system being tested 2.7 explain the electrical bonding specifications, and their importance 2.8 explain how to obtain the required test specifications for the systems they are working on, how to interpret them and how to check their currency/issue 2.9 explain who can provide guidance to clarify the specifications, and who can provide assistance in applying test methods and techniques 2.10 explain what test equipment is to be used, and its selection for the particular tests 2.11 explain the calibration of the test equipment (where applicable), and the currency/issue checks that need to be carried out 2.12 explain why equipment control is critical, and what to do if a piece of equipment is unaccounted for on completion of the activities

2.13	describe the testing techniques, methods and procedures to be used during the tests
2.14	describe the fault finding techniques to be used if the system fails the tests
2.15	explain how to analyse the test results
2.16	explain how to display/record the test results and the documentation used
2.17	explain the authorisation procedures for changes to test procedures
2.18	describe the problems or errors that may affect the test results
2.19	explain any environmental controls required relating to the testing
2.20	explain what documentation needs to be used on completion of all the tests
2.21	describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 483 Testing aircraft countermeasure systems

Supporting information

Guidance

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

2.2 (eg, ensuring safe distances around the aircraft when testing radar systems)

Unit 484 Testing aircraft electro-optical and infrared systems

UAN:	**D/601/4694**
Level:	3
Credit value:	55
GLH:	126
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical engineering Unit 084: Testing aircraft electro-optical and infrared 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 electro-optical and infrared systems, in accordance with approved procedures. The learner will be required to use appropriate installation drawings, specifications and test documentation to test the various types of equipment. The learner will be expected to carry out the appropriate testing procedures. The equipment to be tested will include still cameras, television/video cameras, infrared cameras, and laser devices. The learner's responsibilities will require them to comply with organisational policy and procedures for the tests undertaken, and to report any problems with the testing 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 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 testing techniques and procedures. The learner will understand the aircraft electro-optical and infrared systems being tested, and their application, and will know about the test equipment and methods, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring that the tested system functions to the required

specification.

The learner will understand the safety precautions required when carrying out the testing operations. 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 test aircraft electro-optical and infrared 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 activities: • obtain and use the appropriate documentation (such as job instructions, aircraft electro-optical and infrared system 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) • carry out the tests using the specified techniques and procedures • 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 electro-optical and infrared equipment, using tools/test equipment which include all of the following: • multimeter • transfer gyros • inclinometer • 'special-to-type' test equipment 1.5 set up and carry out the tests using the correct procedures and within agreed timescales

1.6 test all of the following electro-optical and infrared systems:
- still cameras
- television/video cameras
- infrared cameras
- laser devices

1.7 test all of the following electro-optical and infrared system components:
- cameras
- rotating platforms
- fixed platforms
- monitors
- remote control devices

1.8 carry out all of the following types of test:
- voltage standing wave ratio (VSWR)
- alignment checks
- voltage checks
- range checks
- standard serviceability checks

1.9 deal with two of the following levels of complexity during the testing activities:
- equipment with no faults
- equipment with faults
- equipment with intermittent faults

1.10 use two of the following fault finding techniques during the testing activities:
- six point
- half-split
- input-to-output
- function testing
- equipment self-diagnostics
- emergent problem sequence
- injection and sampling
- unit substitution

1.11 carry out tests in compliance with one of the following standards:
- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures

1.12 record the results of the tests in the appropriate format

1.13 review the results and carry out further tests if necessary

1.14 review fault symptoms and history of problems using four of the following:
- data sheets
- calibration records

- log cards/history sheet
- aircraft documentation
- fault records
- maintenance records

Learning outcome
The learner will: 2. Know how to test aircraft electro-optical and infrared systems
Assessment criteria
The learner can: 2.1 explain the specific safety practices and procedures that they need to observe when testing electro-optical and infrared systems 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 explain the safety procedures that must be carried out before work is started on the aircraft 2.4 describe the hazards associated with testing aircraft electro-optical and infrared systems, and with the tools and equipment used, and explain how to minimise them and reduce any risks 2.5 explain what protective clothing and equipment needs to be worn, and where it can be obtained 2.6 explain the correct operating procedures of the system being tested 2.7 explain the electrical bonding specifications, and their importance 2.8 explain how to obtain the required test specifications for the systems they are working on, how to interpret them and how to check their currency/issue 2.9 explain who can provide guidance to clarify the specifications, and who can provide assistance in applying test methods and techniques 2.10 explain what test equipment is to be used, and its selection for the particular tests 2.11 explain the calibration of the test equipment (where applicable), and the currency/issue checks that need to be carried out 2.12 explain why equipment control is critical, and what to do if a piece of equipment is unaccounted for on completion of the activities 2.13 describe the testing techniques, methods and procedures to be used during the tests 2.14 describe the fault finding techniques to be used if the system fails the tests 2.15 explain how to analyse test results 2.16 explain how to display/record the test results, and the documentation used 2.17 explain the authorisation procedures for changes to test procedures 2.18 describe the problems or errors that may affect the test results 2.19 explain any environmental controls required relating to the testing 2.20 explain what documentation needs to be used on completion of all the tests 2.21 describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve.

Unit 484 Testing aircraft electro-optical and infrared systems

Supporting information

Guidance

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

2.2 (eg, ensuring safe distances around the aircraft when testing radar systems)

Unit 485 Testing aircraft instrumentation systems

UAN:	**H/601/4695**
Level:	3
Credit value:	55
GLH:	126
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical engineering Unit 085: Testing aircraft instrumentation 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 instrumentation systems, in accordance with approved procedures. The learner will be required to use appropriate drawings, specifications and test documentation to test the various types of equipment. The learner will be expected to use the specified/appropriate techniques to carry out the appropriate testing procedures. The equipment will include various data acquisition systems, monitoring of analogue or digital parameters (temperature, stress, vibration, and performance signals), Aeronautical Radio Incorporated (ARINC) 429 and mil-standard 1553 data buses. Other instrumentation systems to be tested could include photographic equipment (stills, video and digital), accident recorders, and specialist measurement systems for specific environmental trials. The learner's responsibilities will require them to comply with organisational policy and procedures for the tests undertaken, and to report any problems with the testing 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 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 testing techniques and procedures. The learner will understand the aircraft instrumentation systems being tested, and their application, and will know about the test equipment and methods, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring that the tested system functions to the required specification.

The learner will understand the safety precautions required when carrying out the testing operations. 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 test aircraft instrumentation 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 activities: • obtain and use the appropriate documentation (such as job instructions, aircraft instrumentation system 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) • carry out the tests using the specified techniques and procedures • 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 instrumentation equipment, using tools or test

equipment which include five of the following:

- multimeter
- oscilloscope
- pressure tester
- thermocouple
- rate gyro tables
- simulators
- strain gauge test set
- voltage simulators
- inclinometer
- pitot-static test set
- tilt table
- vibration table

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

1.6 test three of the following aircraft instrumentation systems:

- strain gauge components
- accelerometer and associated pre-amplifiers
- temperature sensors (surface, air or immersed probes)
- control position potentiometers and indicators
- instrumentation (LRUs)
- pilot-static transducers
- rate gyros
- video cameras
- controllers

1.7 carry out seven of the following types of test:

- voltage checks
- temperature calibration
- accelerometer calibration
- strain gauge checks
- camera alignment
- pre-flight checks
- control position calibrations
- pressure calibrations

1.8 deal with two of the following levels of complexity during the testing activities:

- equipment with no faults
- equipment with faults
- equipment with intermittent faults

1.9 use two of the following fault finding techniques:

- six point
- half-split
- input-to-output
- function testing
- equipment self-diagnostics
- emergent problem sequence

- injection and sampling
- unit substitution

1.10 carry out tests in compliance with one of the following standards:
- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures

1.11 record the results of the tests in the appropriate format

1.12 review the results and carry out further tests if necessary

1.13 review fault symptoms and history of problems using four of the following:
- data sheets
- calibration records
- log cards/history sheet
- aircraft documentation
- fault records
- maintenance records .

Learning outcome
The learner will: 2. Know how to test aircraft instrumentation systems
Assessment criteria
The learner can: 2.1 explain the specific safety practices and procedures that they need to observe when testing instrumentation systems 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 explain the safety procedures that must be carried out before work is started on the aircraft 2.4 describe the hazards associated with testing aircraft instrumentation systems, and with the tools and equipment used, and explain how to minimise them and reduce any risks 2.5 explain what protective clothing and equipment needs to be worn, and where it can be obtained 2.6 explain the correct operating procedures of the system being tested 2.7 explain the electrical bonding specifications, and their importance 2.8 explain how to obtain the required test specifications for the systems they are working on, how to interpret them and how to check their currency/issue 2.9 explain who can provide guidance to clarify the specifications, and who can provide assistance in applying test methods and techniques 2.10 explain what test equipment is to be used, and its selection for the particular tests 2.11 explain the calibration of the test equipment (where applicable),

and the currency/issue checks that need to be carried out

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

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

2.14 describe the fault finding techniques to be used if the system fails the tests

2.15 explain how to analyse test results

2.16 explain how to display/record the test results and the documentation used

2.17 explain the authorisation procedures for changes to test procedures

2.18 describe the problems or errors that may affect test results

2.19 explain any environmental controls required relating to the testing

2.20 explain what documentation needs to be used on completion of all the tests

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

Unit 485 Testing aircraft instrumentation systems

Supporting information

Guidance

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

Unit 486 Producing aircraft wiring layouts and routings

UAN:	**K/601/4696**
Level:	3
Credit value:	35
GLH:	77
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical engineering Unit 086: Producing aircraft wiring layouts and routings (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 produce aircraft wiring layouts and routeings, in accordance with approved procedures. The learner will be required to use appropriate drawings, standards and specifications to produce the wiring layouts and routeings. The learner will be expected to draft loom formats, transfer data, process data, create loom boards, and determine the lengths and shapes of looms. The learner's responsibilities will require them to comply with organisational policy and procedures for the wiring layout activities undertaken, and to report any problems with the activities, materials, 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's knowledge will provide a good understanding of their work, and will provide an informed approach to applying aircraft wiring layout procedures. The learner will understand the production requirements for the wiring layouts and routeings, and will know about the various wire types and gauges, and the tools, terminations and techniques, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring that the wiring layouts and routeings are to the required specification. The learner will understand the safety precautions

required when carrying out the wiring layout and routeing 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 produce aircraft wiring layouts and routings
Assessment criteria
The learner can: 1.1 use the approved sources to obtain the required drawings and specifications 1.2 carry out all of the following during the production of the wiring layouts and routeings: • obtain and use the appropriate documentation (such as job instructions, aircraft routeing drawings, loom drawings, standards, wiring diagrams, 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 wiring activities • obtain the correct equipment for the activity, and check that it is in a safe and usable condition and within current calibration date • use appropriate techniques and procedures to produce the required layouts • return all drawings and equipment to the correct location on completion of the activities • leave the work area in a safe and appropriate condition, free from foreign object debris on completion of the activities 1.3 correctly interpret the drawings and specifications 1.4 identify, extract and interpret the required information 1.5 carry out all of the following activities: • draft loom formats from loom drawings • plot the format on an XY plotter • use data from the design, and plot and process into manufacture systems • transfer data from design to manufacture 1.6 use the information obtained to ensure that work output meets the specification 1.7 produce two of the following: • new path for design menu • loom layout • format for a loom board 1.8 determine both the following technical requirements to create either a process sketch or a loom board:

- wiring lengths
- shape of loom

1.9 produce wiring layouts in compliance with one of the following standards:
- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures

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

1.11 report any inaccuracies or discrepancies in drawings and specifications

Learning outcome
The learner will: 2. Know how to produce aircraft wiring layouts and routings
Assessment criteria
The learner can: 2.1 explain the specific safety precautions to be taken when producing aircraft wiring layout and routeings 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 producing aircraft wiring layouts and routings and with the equipment used, and explain how to minimise them and reduce any risks 2.4 explain how to interpret the aircraft routeing drawings, loom drawings, standards, wiring diagrams, quality control procedures and specifications used 2.5 explain how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing 2.6 explain how to carry out currency/issue checks of the drawings and specifications they are working with 2.7 describe the cableform/loom layout to be produced, and its function within the particular system 2.8 explain how to access and retrieve information from CAD systems 2.9 explain how to access and retrieve information from company document management systems 2.10 describe the manufacturing requirements of aircraft wiring cableforms and looms 2.11 explain how information should be presented 2.12 describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 486 Producing aircraft wiring layouts and routings

Supporting information

Guidance

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

2.4 (including BS, ISO or BSEN schematics, symbols and terminology)

2.11 (to include process sketches and computer reports)

Unit 487 Producing aircraft electrical sub-assemblies, cableforms and looms

UAN:	**T/601/4698**
Level:	3
Credit value:	86
GLH:	210
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical engineering Unit 087: Producing aircraft electrical sub-assemblies, cableforms and looms (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 produce aircraft electrical sub-assemblies, cableforms and looms, in accordance with approved procedures. The learner will be required to use appropriate drawings, methods of manufacture, standards and specifications to produce the various sub-assemblies, cableforms, looms and panels. The learner will be expected to cut, strip, solder, crimp and form loom assemblies, and to position and secure equipment in the correct location on panels, using the specified/appropriate techniques and fastening devices. The cableforms/looms to be assembled will include aircraft system cable assemblies, heavy duty cable assemblies, aircraft lighting cables, co-axial cables, fibre-optic cable assemblies, secure speech cables, headset leads, AFCS cable assemblies, databus looms and amalgamated looms. The equipment to be assembled will include circuit breaker/switch panels, control/relay panels, flightdeck/cockpit panels and avionic trays. The learner's responsibilities will require them to comply with organisational policy and procedures for the production activities undertaken, and to report any problems with the production, 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 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 production procedures. The learner will understand the procedures and techniques for producing the aircraft sub-assemblies, cableforms and looms, and will know about the tools and techniques, in adequate depth to provide a sound basis for carrying out the activities to the required specification.

The learner will understand the safety precautions required when carrying out the assembly operations. 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 produce aircraft electrical sub-assemblies, cableforms and looms
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 manufacturing activities: • obtain and use the appropriate documentation (such as job instructions, aircraft drawings, standards, wiring diagrams, 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 assembly and wiring 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 • ensure that correct part numbers are used, including (where appropriate) left or right handed parts • use appropriate techniques and procedures to produce the required sub-assemblies, cableforms and looms • return all tools and equipment to the correct location on completion of the activities • leave the work area in a safe and appropriate condition, free from foreign object debris on completion of the activities 1.3 follow the relevant instructions, assembly drawings and any other

specifications

1.4 check that the specified components are available and that they are in a usable condition

1.5 use fifteen of the following components:

- ring tongue terminals
- discrete components
- heat shrink devices
- connectors (multi-contact)
- connectors (co-axial)
- contacts (crimped)
- identification markers
- printed circuit boards
- contacts (soldered)
- lacing cord
- terminal blocks
- contactors
- filters
- tray-mount connectors
- polished fibre-optic contacts
- fibre-optic connectors
- gore cables
- module blocks
- panels (bare)
- circuit breakers
- bonding leads
- clipping points
- databus cables
- cable ties
- p-clips
- relays
- lamps
- busbars
- wire cables
- switches

1.6 use the appropriate methods and techniques to assemble the components in their correct positions

1.7 assemble two of the following types of aircraft electrical sub-assembly:

- circuit breaker/switch panels
- flightdeck/cockpit panels
- control/relay panels
- avionic trays

1.8 assemble four of the following types of aircraft cableform and loom:

- co-axial cable assemblies
- heavy duty cable assemblies
- aircraft system cable assemblies

- secure speech cable assemblies
- fibre-optic cables/assemblies
- aircraft lighting cable assemblies
- headset leads (mic-tel leads)
- AFCS cable assemblies
- databus looms
- amalgamated system looms

1.9 apply twelve of the following sub-assembly methods and techniques:

- solder sleeve fitting
- cable protection
- terminal block breakouts
- crimping
- soldering
- data bus stripping
- loom forming
- cable stripping
- high density connectors
- braiding
- heat shrinking
- panel wiring
- screened plug and socket assembly
- polishing fibre-optic connections
- unscreened plug and socket assembly
- preparing fibre-optic cables

1.10 secure the components using the specified connectors and securing devices

1.11 check the completed assembly to ensure that all operations have been completed and the finished assembly meets the required specification

1.12 produce assemblies in compliance with one of the following standards:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures

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

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

- build records
- job cards

Learning outcome
The learner will: 2. Know how to produce aircraft electrical sub-assemblies, cableforms and looms
Assessment criteria
The learner can: 2.1 explain the specific safety precautions to be taken whilst carrying out the assembly activities 2.2 explain the health and safety requirements of the work area in which they are carrying out the assembly activities, and the responsibility these requirements place on them 2.3 explain what personal protective equipment and clothing needs to be worn during the assembly activities 2.4 describe the hazards associated with producing aircraft electrical assemblies, and with the tools and equipment used, and explain how to minimise them and reduce any risks 2.5 describe the various types of drawing and specification that are used during the assembly activities, and explain how to interpret the various symbols and abbreviations 2.6 explain how to identify cables/components to be used, and associated identification systems 2.7 explain what preparations need to be undertaken on cable/components prior to assembly 2.8 describe the assembly methods and techniques used 2.9 describe the methods and techniques used for the termination of fibre-optic and databus cables, and the types of connector that are used 2.10 explain how to assemble screened and unscreened plugs and sockets, and the difference between composite and metal plugs and sockets 2.11 explain the different types of cable protection, and reasons for each type 2.12 explain how to deal with cables/components that are incorrectly assembled, damaged or that have other faults 2.13 describe the quality control procedures to be followed during the manufacturing operations 2.14 explain how to conduct any necessary checks to ensure the accuracy and quality of the assemblies produced 2.15 explain how to take electrostatic discharge (ESD) precautions, and why are they needed 2.16 describe the procedure for handling long lengths of cable 2.17 explain the precautions needed when handling completed looms 2.18 explain the precautions required for handling discrete components 2.19 explain the importance of checking that the tools and equipment to be used are correctly calibrated, and are in a safe and serviceable condition 2.20 explain the importance of ensuring that all tools are used correctly and within their permitted operating range 2.21 describe the sort of problems that can occur with the assembly operations, and explain the importance of informing appropriate people of non-conformances 2.22 describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 487 Producing aircraft electrical sub-assemblies, cableforms and looms

Supporting information

Guidance

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

2.6 (such as cable/component markers)

2.7 (such as loom forming, soldering preparation, preparing fibre-optic cables, polishing fibre-optic connections, data bus stripping)

2.8 (such as soldering, crimping, heat shrinking and cable forming)

Unit 488 Modifying aircraft cableforms and looms

UAN:	**H/601/4700**
Level:	3
Credit value:	77
GLH:	161
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical engineering Unit 088: Modifying aircraft cableforms and looms (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 cableforms/looms and associated panels, in accordance with approved procedures. The learner will be required to change, modify and update cableforms and looms, in accordance with modification leaflets, latest issue drawings and standards. The learner will be expected to remove and replace cables, add cables, change breakout points, and change the routeing of cables. The learner will also be expected to change components on small panels and sub-assemblies, such as circuit breaker/switch panels, flightdeck/cockpit panels, control/relay panels and avionic trays. The learner will need to show proficiency in using various tools for cutting, stripping, crimping and soldering. The learner's responsibilities will require them to comply with organisational policy and procedures for the modification activities undertaken, and to report any problems with the 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 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 modification

procedures. The learner will understand the modification and the reason for it, and will know about the modification procedures, tools, equipment and methods, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring that the modification is completed to the required specification.

The learner will understand the safety precautions required when carrying out the modification operations. 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 modify aircraft cableforms and looms
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/loom drawings, wiring diagrams, planning and quality control documentation, aircraft standards and specifications) • adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and 1.3 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 • use approved modification techniques and procedures to produce the required cableform and loom modifications • return all tools and equipment to the correct location on completion of the activities • leave the work area in a safe and appropriate condition, free from foreign object debris on completion of the activities 1.4 obtain and follow the relevant modification specifications and job instructions 1.5 confirm and agree what modifications are to be carried out to meet the specification 1.6 prepare the cableforms and looms for the required modification 1.7 carry out the modification, using approved materials, methods and procedures 1.8 carry out modifications to cableforms/looms for three of the following electrical systems:

- co-axial cable assemblies
- heavy duty cable assemblies
- aircraft system cable assemblies
- secure speech cables assemblies
- fibre-optic cables/assemblies
- aircraft lighting cable assemblies
- headset leads (mic-tel leads)
- AFCS cable assemblies
- databus looms
- amalgamated system looms
- circuit breaker/switch panels
- flightdeck/cockpit panels
- control/relay panels
- avionic trays

1.9 carry out six of the following modifications:

- replacing cables of different type or length
- changing or adding components to panels or sub-assemblies
- changing position or angle of breakout points
- changes to component/connector on end of cable
- changing routeing of cables
- making changes to looms
- adding looms
- removing cables
- adding cables

1.10 carry out six of the following processes:

- soldering and de-soldering
- heat shrinking (devices and boots)
- crimping (tags and pins)
- polishing fibre-optic connections
- preparing fibre-optic cables
- wire stripping
- removing cable-end fittings
- changing components
- data bus stripping
- rewiring panels
- changing electrical trays
- repositioning units
- removing cable protection

1.11 complete the modification within the agreed timescale

1.12 check that the modified cableforms and looms meet the specified operating conditions

1.13 carry out modifications in compliance with one of the following standards:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)

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

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

1.15 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

1.16 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 modify aircraft cableforms and looms
Assessment criteria
The learner can: 2.1 explain the specific safety precautions and procedures to be observed whilst carrying out the modifications to cableforms and looms 2.2 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 2.3 describe the hazards associated with modifying aircraft cableforms and looms and with the tools and equipment used, and explain how to minimise them and reduce any risks 2.4 explain what personal protective equipment and clothing needs to be worn during the modification activities 2.5 describe the various types of drawing and specification that are used during the modification 2.6 explain how to identify the components to be used; component identification systems 2.7 explain what preparations need to be undertaken on the cableform/loom system, prior to modification 2.8 explain how to add and remove cables from the cableform/loom without causing damage to the remaining cables or loom 2.9 describe the methods and techniques to be used for soldering and de-soldering, and explain the importance of adhering to them 2.10 describe the methods and techniques to be used for crimping and heat shrinking, and explain the importance of adhering to them 2.11 describe the methods and techniques to be used for the assembly of screened and unscreened plugs and sockets 2.12 describe the methods and techniques used for the assembly of fibre-optic and databus cables 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 methods 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 488 Modifying aircraft cableforms and looms

Supporting information

Guidance

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

2.6 (such as codes and component orientation indicators)

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

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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