

# **Level 3 Diploma in Aviation Maintenance (Military Development Competence) (4608-60) - Avionic Maintenance**

**Version 3.0 (September 2025)**

**Unit Pack**

## Qualification at a glance

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

<b>Title and level</b>	<b>GLH</b>	<b>TQT</b>	<b>City &amp; Guilds qualification number</b>	<b>Ofqual accreditation number</b>
Level 3 Diploma in Aviation Maintenance (Military Development Competence) - Avionic Maintenance	922	922	4608-60	603/2068/0

<b>Version</b>	<b>Amendment</b>	<b>Section</b>
3.0 September 2025	Addition of unit 457	Introduction, Units

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<b>Unit 457</b>	<b>Preparing and applying coatings/finishes to aircraft components by hand.</b>	<b>179</b>

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# 1 Introduction

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

## Structure

Learners must complete 301, 302, 304, 354, 355, 455 plus two from 356-366 and two from 367-374, 457.

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

## Optional

364	Removing and replacing components of aircraft flight guidance and control systems	175
365	Removing and replacing components of aircraft internal and external lighting systems	175
366	Modifying aircraft avionic systems	175
367	Carrying out tests on avionic indication and gauging components of aircraft systems	119
368	Carrying out tests on aircraft electrical power control, distribution and protection systems	119
369	Carrying out tests on aircraft pitot static systems	119
370	Carrying out tests on aircraft communication systems	119
371	Carrying out tests on aircraft passive warning and optical/surveillance systems	119
372	Carrying out tests on aircraft radar systems	119
373	Carrying out tests on aircraft navigational and computing systems	119
374	Carrying out tests on aircraft flight guidance and control systems	119
457	Preparing and applying coatings/finishes to aircraft components by hand	150

## 2 Units

### Structure of the units

These units each have the following:

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

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

Please refer to the main qualification handbook for full information on the qualification and the shared mandatory units.

## Unit 354

# Carrying out fault diagnosis on aircraft avionics components or systems

GLH: 126

### Unit aim:

This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.

This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to carry out fault diagnosis on aircraft avionics systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft and covers a range of avionics systems such as electrical power generation and distribution, internal and external lighting, indication and gauging equipment, pitot static, armament management, communication, passive warning and electronic countermeasure, infra-red and optical systems, radar, navigational, flight guidance and control, to sub-assembly or component level, as applicable.

They will be expected to use a variety of fault diagnosis methods and techniques and to utilise a range of diagnostic aids and equipment. From the fault evidence obtained, they will be expected to identify the fault and its probable cause and to determine appropriate action to remedy the problem. Their responsibilities will require them to comply with organisational policy and procedures for the fault diagnostic activities undertaken and to report any problems with these activities, or with the tools and equipment used, that they cannot personally resolve, or that are outside their permitted authority, to the relevant people.

They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out. They must ensure that all tools, equipment and materials used in the maintenance activities are removed from the aircraft on completion of the activities and that all necessary job/task documentation is completed, accurately and legibly. Their underpinning knowledge will provide a good understanding of their work and will provide an informed approach to applying appropriate fault diagnostic procedures for aircraft avionics systems.

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

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

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## Learning outcome

### Performance Requirements

## Assessment criteria

The learner can:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines.
- P2 demonstrate the required behaviours in line with the job role and organisational objectives.
- P3 review and use all relevant information on the symptoms and problems associated with the product or asset.
- P4 investigate and establish the most likely causes of the fault or faults.
- P5 select, use and apply diagnostic techniques, tools and aids to locate faults.
- P6 complete the fault diagnosis within the agreed time and inform the appropriate people when this cannot be achieved.
- P7 determine the implications of the fault for other work and for safety considerations.
- P8 use the evidence gained to draw valid conclusions about the nature and probable cause of the fault or faults.
- P9 record details on the extent and location of the fault or faults in an appropriate format.

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## Learning outcome

The learner will:

- 1 carry out **all** of the following during the fault diagnostic activities:
  - 1.1 plan the fault diagnostic activities prior to beginning the work
  - 1.2 obtain and use the appropriate documentation (such as job instructions, drawings, technical instructions, and other relevant maintenance documentation)
  - 1.3 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
  - 1.4 obtain clearance to work on the aircraft, and observe all relevant isolation and safety procedures (such as mechanical, electricity, gas, air or fluids)
  - 1.5 obtain the correct tools and equipment for the activity and check that they are in a safe, tested and usable condition and within current certification/calibration date
  - 1.6 where appropriate, apply Electrostatic Discharge (ESD) protection procedures
  - 1.7 provide and maintain a safe working environment for the diagnostic activities
  - 1.8 carry out the fault diagnostic activities, using approved techniques and procedures
  - 1.9 collect equipment fault diagnostic evidence from live and isolated systems
  - 1.10 disconnect or isolate components or parts of the system, when appropriate, to confirm the diagnosis
  - 1.11 identify the fault and determine the appropriate corrective action

- 1.12 return all tools and equipment to the correct location on completion of the activities
  - 1.13 leave the aircraft and system in a safe and appropriate condition, free from foreign object debris on completion of the activities.
- 

### Learning outcome

The learner will:

- 2 carry out fault diagnosis on **four** of the following aircraft avionic systems, to sub-assembly or component level, as appropriate:
    - 2.1 electrical power generation and distribution
    - 2.2 armament management
    - 2.3 internal and external lighting
    - 2.4 passive warning and electronic countermeasure
    - 2.5 indication and gauging
    - 2.6 infra-red and optical systems
    - 2.7 pitot static
    - 2.8 radar
    - 2.9 communication
    - 2.10 flight guidance and control
    - 2.11 aircraft computer system
    - 2.12 navigational
    - 2.13 other specific system.
- 

### Learning outcome

The learner will:

- 3 collect information about the fault from **four** of the following sources:
    - 3.1 the person who reported the fault
    - 3.2 approved sensory checks (such as sight, sound, smell, touch)
    - 3.3 monitoring equipment or gauges
    - 3.4 aircraft log/documentation
    - 3.5 recording devices
    - 3.6 operation of the equipment
    - 3.7 aircraft self-diagnostics
    - 3.8 fault records.
- 

### Learning outcome

The learner will:

- 4 use a range of fault diagnostic techniques, to include three of the following:
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- 4.1 half-split technique
  - 4.2 soak test
  - 4.3 unit substitution
  - 4.4 input-to-output
  - 4.5 injection and sampling
  - 4.6 six point technique
  - 4.7 functional testing
  - 4.8 Built-in Test Equipment (BITE)
  - 4.9 other specific avionic system test.
- 

### Learning outcome

The learner will:

- 5 use a variety of diagnostic aids and equipment, to include **two** of the following:
    - 5.1 Aircraft Maintenance Manual (AMM)
    - 5.2 algorithms/flow charts
    - 5.3 equipment self-diagnostics
    - 5.4 fault analysis charts (such as fault trees)
    - 5.5 circuit diagrams/specifications
    - 5.6 troubleshooting guides
    - 5.7 other specific diagnostic equipment.
- 

### Learning outcome

The learner will:

- 6 use **two** of the following types of test equipment to help in the fault diagnosis:
    - 6.1 mechanical measuring equipment (such as measuring instruments, dial test indicators, torque instruments)
    - 6.2 electrical/electronic measuring instruments (such as multi meters, watt meters, oscilloscopes)
    - 6.3 fluid power test equipment (such as test rigs, flow meters, pressure gauges)
    - 6.4 Built-in Test Equipment (BITE)
    - 6.5 'special-to-type' test equipment.
- 

### Learning outcome

The learner will:

- 7 diagnose faults from **two** of the following breakdown categories:
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- 7.1 intermittent problem
  - 7.2 partial failure or reduced performance
  - 7.3 complete breakdown.
- 

### Learning outcome

The learner will:

- 8 provide a record of the outcome of the fault diagnosis, using **one** of the following:
    - 8.1 step-by-step analytical report
    - 8.2 aircraft service/flight log
    - 8.3 aircraft log book
    - 8.4 corrective action report
    - 8.5 company-specific reporting procedure
    - 8.6 computer records.
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### Learning outcome

Knowledge and understanding

### Assessment criteria

The learner must know and understand:

- K1 the health and safety requirements of the area in which you are carrying out the fault diagnostic activities and the responsibility these requirements place on them.
  - K2 the specific safety precautions to be taken when carrying out the fault diagnosis of the particular aircraft avionics system.
  - K3 the isolation and lock-off procedure or permit-to-work procedure that applies.
  - K4 the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to.
  - K5 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to.
  - K6 the importance of wearing protective clothing and other appropriate safety equipment (PPE) during the fault diagnostic activities, the type of safety equipment to be used and where to obtain it.
  - K7 hazards associated with carrying out fault diagnosis on aircraft avionics systems (such as electrical contact, using faulty or damaged tools and equipment, using practices and procedures that do not follow laid-down procedures) and how to minimise them and reduce any risks.
  - K8 where to obtain and how to interpret drawings, circuit diagrams, specifications, manufacturers' manuals and other documents needed for the fault diagnostic activities.
  - K9 the basic principles of how the avionics system functions and the working purpose of the various units and components.
-

- K10 the various fault finding techniques that can be used and how they are applied (such as half-split, input-to-output, six point technique, functional testing, unit substitution, injection and sampling techniques, equipment self-diagnostics and soak tests).
- K11 the importance of applying Electrostatic Discharge (ESD) procedures when working on sensitive equipment or devices.
- K12 what constitutes a hazardous voltage and how to recognise victims of electric shock.
- K13 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers).
- K14 how to evaluate the various types of information available for fault diagnosis (such as pilot reports, monitoring equipment, aircraft history records, function of the equipment/system).
- K15 how to evaluate sensory information from sight, sound, smell, touch.
- K16 the procedures to be followed to investigate faults and how to deal with intermittent conditions
- K17 how to use the various aids and reports available for fault diagnosis.
- K18 the types of equipment that can be used to aid fault diagnosis (such as mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices) and how to check the equipment is calibrated or configured correctly for the intended use and that it is free from damage and defects.
- K19 the application of specific fault finding methods and techniques that are best suited to the problem.
- K20 how to analyse and evaluate possible characteristics and causes of specific faults/problems.
- K21 how to make use of previous reports/records of similar fault conditions.
- K22 how to evaluate the likely risk of running the aircraft with the displayed fault and the effects the fault could have on the aircraft performance and safety.
- K23 how to prepare a report which complies with the organisation policy on fault diagnosis.
- K24 the extent of your own authority and to whom you should report if you have problems that you cannot resolve.

## **Unit 354**

# **Carrying out fault diagnosis on aircraft avionics components or systems**

### Supporting Information

#### ***Unit guidance***

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

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

## Unit 355

# Undertaking scheduled maintenance of aircraft avionics equipment/systems

GLH: 98

### Unit aim:

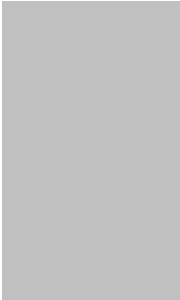
This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.

This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to carry out scheduled maintenance activities on aircraft avionics equipment/systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft and covers a range of avionic equipment and systems such as electrical power generation and distribution, internal and external lighting, indication and gauging equipment, pitot static, armament, communication, passive warning and electronic countermeasure, infra-red and optical systems, radar, navigational and flight guidance and control equipment. They will need to organise and carry out the maintenance activities to minimise down time and ensure that the maintained equipment/system meets airworthiness standards, and performs at operational levels and to the required specification.

Their responsibilities will require them to comply with organisational policy and procedures for the maintenance activities undertaken and to report any problems with the maintenance activities, tools or equipment used that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used in the maintenance activities are removed from the work area on completion of the work and that all necessary job/task documentation is completed, accurately and legibly.

They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

Their underpinning knowledge will provide a good understanding of their work and will provide an informed approach to applying scheduled maintenance procedures to aircraft avionics equipment. They will know how the system and equipment functions and the potential problems or defects that may occur. They will understand the process of developing scheduled maintenance and its application and will know about the maintenance criteria, in adequate depth to provide a sound basis for carrying out the activities safely and effectively and for ensuring that the equipment is maintained to the required specification. In addition, they will be expected to report where the outcome of the maintenance activity identifies the need for further investigation or maintenance work. They will understand the safety precautions required when carrying out the maintenance activities, especially those for isolating the equipment. They will be required to



demonstrate safe working practices throughout and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

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

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## Learning outcome

### Performance Requirements

### Assessment criteria

The learner can:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines.
- P2 demonstrate the required behaviours in line with the job role and organisational objectives.
- P3 follow the relevant maintenance schedules to carry out the required work.
- P4 carry out the maintenance activities within the limits of their personal authority.
- P5 carry out the maintenance activities in the specified sequence and in an agreed timescale.
- P6 report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule.
- P7 complete the relevant maintenance records accurately and pass them on to the appropriate person.
- P8 dispose of waste materials in accordance with safe working practices and approved procedures.

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## Learning outcome

The learner will:

- 1 carry out **all** of the following during the scheduled maintenance activities:
  - 1.1 plan the scheduled maintenance activities to cause minimal disruption to normal working
  - 1.2 obtain and use the appropriate documentation (such as job instructions, aircraft manuals, technical instructions, and other relevant maintenance documentation)
  - 1.3 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
  - 1.4 obtain clearance to work on the aircraft and observe all relevant isolation and safety procedures (such as mechanical, electricity, gas, air or fluids)
  - 1.5 provide and maintain a safe working environment for the maintenance activities
  - 1.6 obtain the correct tools and equipment for the activity and check that they are in a safe, tested and usable condition and within current certification/ calibration date
  - 1.7 carry out the maintenance activities, using approved techniques and procedures
  - 1.8 where appropriate, apply Electrostatic Discharge (ESD) protection procedures
  - 1.9 re-connect and return the system to service on completion of the maintenance activities
  - 1.10 dispose of waste items in a safe and environmentally acceptable manner
  - 1.11 return all tools and equipment to the correct location on completion of the activities
  - 1.12 leave the aircraft and system in a safe and appropriate condition, free from foreign object debris on completion of the activities.

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## Learning outcome

The learner will:

- 2 carry out the scheduled maintenance on **four** of the following aircraft avionics systems:
  - 2.1 electrical power generation and distribution
  - 2.2 armament equipment and systems
  - 2.3 internal and external lighting
  - 2.4 passive warning and electronic countermeasure
  - 2.5 indication and gauging
  - 2.6 infra-red and optical systems
  - 2.7 pitot static
  - 2.8 radar
  - 2.9 communication
  - 2.10 flight guidance and control
  - 2.11 navigational

2.12 other specific system.

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## Learning outcome

The learner will:

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

### Including the following:

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

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## Learning outcome

The learner will:

- 4 carry out **two** of the following checks during the maintenance activities:
  - 4.1 off-load checks (such as insulation, continuity, earth bonding, resistance)
  - 4.2 input/output checks (voltage, power)
  - 4.3 frequency checks
  - 4.4 receiver sensitivity
  - 4.5 BITE
  - 4.6 distant object test
  - 4.7 Voltage Standing Wave Ratio (VSWR) checks

4.8 other specific check.

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### Learning outcome

The learner will:

- 5 ensure that the maintained equipment/system meets **all** of the following:
  - 5.1 all components and units are fit for purpose
  - 5.2 equipment static checks, after maintenance, meet specification
  - 5.3 the equipment operates within acceptable limits for successful continuous operation
  - 5.4 any potential defects are identified and reported for future action
  - 5.5 all relevant documentation is completed, accurately and legibly.

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### Learning outcome

The learner will:

- 6 ensure that the maintained equipment complies with **one** of the following:
  - 6.1 Military Aviation Authority (MAA)
  - 6.2 Civil Aviation Authority (CAA) / European Aviation Safety Agency (EASA)
  - 6.3 BS, ISO or BSEN standards and procedures
  - 6.4 Aerospace Quality Management Standards (AS)
  - 6.5 specific system requirements
  - 6.6 Federal Aviation Authority (FAA)
  - 6.7 organisation standards and procedures
  - 6.8 manufacturer's standards and procedures.

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### Learning outcome

The learner will:

- 7 complete the relevant documentation, to include **one** of the following and pass it to the appropriate people:
  - 7.1 computer records
  - 7.2 job cards
  - 7.3 aircraft service/flight log
  - 7.4 aircraft log
  - 7.5 permit to work/formal risk assessment.

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## Learning outcome

Knowledge and understanding

### Assessment criteria

The apprentice must know and understand:

- K1 the specific safety precautions and procedures to be observed whilst carrying out the scheduled maintenance (including any specific legislation, regulations or codes of practice relating to the activities, equipment or materials).
- K2 the importance of maintenance on and impact upon ETOpS (Extended Twin Operations Procedures) systems, legislation and local procedures.
- K3 the health and safety requirements of the area in which the scheduled maintenance activity is to take place and the responsibility these requirements place on you.
- K4 the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to.
- K5 the isolation and lock-off procedure or permit-to-work procedure that applies to the aircraft system being maintained.
- K6 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to.
- K7 the importance of wearing protective clothing and other appropriate safety equipment (PPE) during the maintenance activities and where it may be obtained.
- K8 hazards associated with carrying out maintenance activities on aircraft electrical/avionic equipment (such as exposure to live conductors, handling fluids, electrical supplies, using damaged or badly maintained tools and equipment, not following laid-down maintenance procedures) and how to minimise them and reduce any risks.
- K9 how to obtain and interpret drawings, charts, specifications, aircraft manuals, history/maintenance reports and other documents needed for the maintenance activities.
- K10 the various planned maintenance schedules that are generally used (such as condition based maintenance, scheduled maintenance, and Total Preventative Maintenance (TPM)) and the methods to be followed to comply with company procedures for the maintenance of the aircraft electrical/avionic equipment.
- K11 the equipment operating and control procedures and how to apply them in order to carry out the scheduled maintenance activities.
- K12 the basic principle of operation of the equipment or system being maintained and the purpose of individual units/components and how they interact.
- K13 the importance of applying Electrostatic Discharge (ESD) procedures when working on sensitive equipment or devices.
- K14 what constitutes a hazardous voltage and how to recognise victims of electric shock
- K15 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers).

- K16 the application and use of a range of electrical components (such as module blocks, terminal blocks, multi-pin plugs/sockets, tray-mounted sockets, earth bonding points) and the likely functions that will require checking.
- K17 the different types of wiring enclosure that are used (to include conduit, trunking, tray work systems and bulkhead penetrations) and what to check during the maintenance activities.
- K18 methods of checking that components are fit for purpose and the need to replace 'lifer' items.
- K19 how to recognise defects in aircraft electrical/avionic equipment (such as under or over performance).
- K20 the adjustments/corrections/tuning required to maintain the equipment/system at operational standard through full range parameters.
- K21 the testing methods and procedures to be used to check that the system conforms to acceptable limits.
- K22 how to make sensory checks by sight, sound, smell, touch.
- K23 company policy on repair/replacement of components during the maintenance activities.
- K24 the importance of ensuring that the equipment is maintained to the prescribed category of cleanliness.
- K25 the generation of maintenance documentation and/or reports on completion of the maintenance activity.
- K26 the problems that can occur whilst carrying out the maintenance activities and how they can be avoided.
- K27 the organisational procedure to be adopted for the safe disposal of waste of all types of materials.
- K28 the extent of your own authority and to whom you should report if you have a problem that you cannot resolve.

## **Unit 355**

# **Undertaking scheduled maintenance of aircraft avionics equipment/systems**

## Supporting Information

### ***Unit guidance***

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

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

## Unit 356

# Removing and replacing avionic indication and gauging components in aircraft systems

**GLH:** 175

**Unit aim:**

This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.

This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to carry out the removal and replacement of avionic indication and gauging components in aircraft systems, in accordance with approved procedures

They will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the components to be removed or replaced. The aircraft components will include items such as gauges, actuators and motors, indicating devices, position transmitters and selectors. Their responsibilities will require them to comply with organisational policy and procedures for the removal and replacement activities undertaken, and to report any problems with these activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out. Their underpinning knowledge will provide a good understanding of their work and will provide an informed approach to applying the appropriate removal and replacement techniques and procedures for the indication and gauging components in the relevant aircraft systems. They will understand the removal and replacement methods and procedures and their application, along with the systems maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the removal and replacement activities and for ensuring that the equipment is replaced to the required standard. In addition, they will have sufficient knowledge of these components to ensure that they are fit for purpose and meet the specifications, thus providing a sound basis for carrying out the replacement to the required specification.

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

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

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

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### Learning outcome

#### Performance Requirements

#### Assessment criteria

The learner can:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines.
- P2 demonstrate the required behaviours in line with the job role and organisational objectives.
- P3 follow the relevant aircraft manuals and publications to carry out the required work.
- P4 establish and where appropriate, mark component orientation for re-assembly.
- P5 carry out the removal and replacement activities, within the limits of their personal authority.
- P6 remove and replace the required components, using approved tools and techniques
- P7 take suitable precautions to prevent damage to components and the surrounding structure.
- P8 complete the relevant documentation, in accordance with organisational requirements.
- P9 label and store (in an appropriate location) components that require repair.
- P10 dispose of waste materials and scrap components, in accordance with approved procedures.

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### Learning outcome

The learner will:

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

- 1.1 obtain clearance to work on the aircraft and observe all relevant isolation and safety procedures.
  - 1.2 obtain and use the appropriate documentation (such as job instructions, aircraft manuals, technical instructions and other relevant maintenance documentation).
  - 1.3 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work.
  - 1.4 ensure that all relevant safety devices and mechanical/physical locks are in place (where appropriate).
  - 1.5 obtain the correct tools and equipment for the activity and check that they are in a safe, tested and usable condition and within current certification/calibration date.
  - 1.6 use approved removal and replacement techniques and procedures at all times.
  - 1.7 where appropriate, apply Electrostatic Discharge (ESD) protection procedures.
  - 1.8 ensure that components and surrounding structures are maintained free from damage and foreign objects.
  - 1.9 return all tools and equipment to the correct location on completion of the activities.
  - 1.10 leave the aircraft and the indication and gauging system in a safe and appropriate condition, free from foreign object debris and in a condition ready for testing.
- 

### Learning outcome

The learner will:

- 2 remove avionic indication and gauging components from **three** of the following aircraft systems and replace avionic indication and gauging components in **three** of the following aircraft systems:
    - 2.1 power plant (such as main engine power, auxiliary power, thrust reverse, propeller, starting, monitoring, fire)
    - 2.2 engine fuel, lubrication, air, cooling and control systems
    - 2.3 fluid power (such as hydraulic power generation, undercarriage, pneumatic or vacuum pressure)
    - 2.4 flying controls (such as flaps, elevators, ailerons/ailerons, spoilers, wing sweep, reaction controls, rudder, rotor)
    - 2.5 wheels, brakes and steering
    - 2.6 transmission systems (such as main and auxiliary gearboxes)
    - 2.7 navigation systems
    - 2.8 aircraft fuel systems (such as supply, contents, transfer, venting system, fuel jettison, refuelling and defuelling)
    - 2.9 environmental control systems (such as pressure control, heating and ventilation equipment, air conditioning)
    - 2.10 ice and rain protection systems (such as windshield, engine protection, pitot static protection, ice accretion)
    - 2.11 fuselage (such as access panels, cargo doors, boundary layer and suction doors)
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2.12 other suitable indication and gauging system.

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### Learning outcome

The learner will:

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

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

3.1a transmitters (such as position, flow, pressure, level)

3.1b generators (such as pulse, speed/taco)

3.1c actuators

3.1d computers

3.1e capacitance units

3.1f motors

3.1g gauges/indicators

3.1h displays.

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

3.2a switches (such as micro, proximity)

3.2b circuit breakers

3.2c wires/cables

3.2d relays

3.2e input and follow-up potentiometers

3.2f plugs/sockets

3.2g transducers/sensors

3.2h software

3.2i other specific system component.

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## Learning outcome

The learner will:

- 4 carry out **twelve** of the following removal and replacement activities:
  - 4.1 disconnecting electrical connections
  - 4.2 positioning and aligning replaced components
  - 4.3 removal of earth bonding
  - 4.4 making mechanical connections
  - 4.5 removing cable securing devices
  - 4.6 making electrical connections
  - 4.7 removing bolt securing devices and mechanical fasteners
  - 4.8 carrying out earth bonding
  - 4.9 software loading
  - 4.10 installing cable securing devices
  - 4.11 applying and removing covering/protection to exposed components, wires, pipe work or vents
  - 4.12 tightening fastenings to the required torque
  - 4.13 making 'off-load' checks before re-connecting power
  - 4.14 checking components for serviceability
  - 4.15 replacing all 'lived' items (seals, filters, gaskets)
  - 4.16 labelling (and storing in the correct location) components that require repair or overhaul
  - 4.17 setting and adjusting replaced components (such as zero, range, travel, clearance)
  - 4.18 applying bolt locking methods (such as split pins, wire locking, lock nuts).

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## Learning outcome

The learner will:

- 5 remove and replace aircraft avionic indication and gauging system components, in accordance with **one** of the following:
  - 5.1 Military Aviation Authority (MAA)
  - 5.2 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
  - 5.3 BS, ISO or BSEN standards and procedures
  - 5.4 Aerospace Quality Management Standards (AS)
  - 5.5 Specific system requirements
  - 5.6 Federal Aviation Authority (FAA)
  - 5.7 organisation standards and requirements
  - 5.8 manufacturers' standards and procedures.

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## Learning outcome

The learner will:

- 6 complete the relevant documentation, to include **one** from the following and pass it to the appropriate people:
    - 6.1 job cards
    - 6.2 computer records
    - 6.3 aircraft service/flight log
    - 6.4 aircraft log
    - 6.5 permit to work/formal risk assessment.
- 

## Learning outcome

Knowledge and understanding

## Assessment criteria

The apprentice must know and understand:

- K1 the specific safety practices and procedures that you need to observe when working with aircraft control, indication and gauging systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials).
  - K2 the importance of maintenance on and impact upon ETOpS (Extended Twin Operations procedures) systems, legislation and local procedures.
  - K3 the hazards associated with removing and replacing aircraft control, indication and gauging system components and with the tools and equipment used and how to minimise them and reduce any risks.
  - K4 the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to.
  - K5 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to.
  - K6 the protective equipment that you need to use for both personal protection (PPE) and protection of the aircraft.
  - K7 how to extract and use information from aircraft manuals, history/maintenance reports, flight logs, charts, circuit and physical layouts, specifications, symbols used in aircraft control, indication and gauging systems, and other documents needed in the maintenance process.
  - K8 how to carry out currency/issue checks on the specifications you are working with.
  - K9 the basic principles of operation of the control, indication and gauging system being worked on, and the performance characteristics and function of the components within the system.
  - K10 the importance of applying Electrostatic Discharge (ESD) procedures when working on sensitive equipment or devices.
  - K11 what constitutes a hazardous voltage and how to recognise victims of electric shock.
-

- K12 the various mechanical fasteners that are used and their method of removal and replacement (such as threaded fasteners, special securing devices).
- K13 the importance of using the specified fasteners for the installation and why you must not substitute others.
- K14 why securing devices need to be locked and labelled, and the different methods that are used to remove and install them.
- K15 the torque loading requirements of the fasteners and what to do if these loadings are exceeded or not achieved.
- K16 the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections.
- K17 the techniques used to remove components from aircraft control, indication and gauging systems, without damage to the components or surrounding structure (such as release of pressures/force, draining of fluids, proof marking, the need to protect the circuit integrity by covering and labelling exposed circuits).
- K18 the need to correctly label and store components that require repair or overhaul and to check that replaced components have the correct part/identification markings.
- K19 the techniques used to position, align, adjust and secure the replaced components to the aircraft, without damage to the components or surrounding structure.
- K20 the quality control procedures to be followed during the removal and replacement operations.
- K21 procedures for ensuring that you have the correct tools, equipment, components and fasteners for the activities.
- K22 methods of lifting, handling and supporting the components/equipment during the removal and replacement activities.
- K23 the use of seals, sealant, adhesives and anti-electrolysis barriers and the precautions to be taken.
- K24 why electrical bonding is critical and why it must be both mechanically and electrically secure.
- K25 how to conduct any necessary checks to ensure the system integrity and the accuracy and quality of the removal and replacement.
- K26 the tools and equipment used in the removal and replacement activities and their calibration/care and control procedures.
- K27 why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities.
- K28 the problems that can occur with the removal and replacement operations and how these can be overcome.
- K29 how to recognise defects (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination).
- K30 the recording documentation to be completed for the activities undertaken and where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation.
- K31 terminology used in aircraft control, indication and gauging systems and the use of system diagrams and associated symbols.

- K32 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers).
- K33 the procedure for the safe disposal of waste materials and scrap components the extent of your own responsibility and to whom you should report if you have problems that you cannot resolve.
- K34 the extent of your own responsibility and to whom you should report if you have problems that you cannot resolve.

## **Unit 356**

# **Removing and replacing avionic indication and gauging components in aircraft systems**

### Supporting Information

#### ***Unit guidance***

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

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

## Unit 357

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

GLH: 175

### Unit aim:

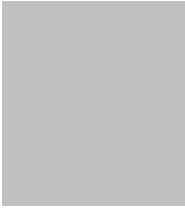
This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief. This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to carry out the removal and replacement of components in aircraft electrical power control, distribution and protection systems, in accordance with approved procedures.

It covers both fixed wing and rotary winged aircraft and includes units and components associated with AC main power generation, DC power generation, secondary/standby power generation, emergency power back-up equipment and power distribution, as applicable to the aircraft type. They will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the components to be removed or replaced.

The removal and replacement activities will include making all necessary checks to ensure that the components are safely and correctly removed and replaced and that the equipment is left in a safe condition and ready for testing. Their responsibilities will require them to comply with organisational policy and procedures for the removal and replacement activities undertaken and to report any problems with these activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities and that all necessary job/task documentation is completed, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

They will understand the safety precautions required when working on the aircraft electrical power control, distribution and protection systems and when using the associated tools and equipment. They will be required to demonstrate safe working practices throughout and will understand the responsibility they owe to themselves and others in the workplace.

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



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

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## Learning outcome

### Performance Requirements

## Assessment criteria

The learner can:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines.
- P2 demonstrate the required behaviours in line with the job role and organisational objectives.
- P3 follow the relevant aircraft manuals and publications to carry out the required work.
- P4 establish and where appropriate, mark component orientation for re-assembly.
- P5 carry out the removal and replacement activities, within the limits of their personal authority.
- P6 remove and replace the required components, using approved tools and techniques.
- P7 take suitable precautions to prevent damage to components and the surrounding structure.
- P8 complete the relevant documentation, in accordance with organisational requirements.
- P9 label and store (in an appropriate location) components that require repair.
- P10 dispose of waste materials and scrap components, in accordance with approved procedures.

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## Learning outcome

The learner will:

- 1 carry out **all** of the following during the removal and replacement activity:
  - 1.1 obtain clearance to work on the aircraft and observe all relevant isolation and safety procedures
  - 1.2 obtain and use the appropriate documentation (such as job instructions, aircraft manuals, technical instructions and other relevant maintenance documentation)
  - 1.3 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
  - 1.4 ensure that all relevant safety devices and mechanical/physical locks are in place (where appropriate)
  - 1.5 obtain the correct tools and equipment for the activity and check that they are in a safe, tested and usable condition and within current certification/calibration date
  - 1.6 use approved removal and replacement techniques and procedures at all times
  - 1.7 where appropriate, apply Electrostatic Discharge (ESD) protection procedures
  - 1.8 ensure that components and surrounding structures are maintained free from damage and foreign objects
  - 1.9 return all tools and equipment to the correct location on completion of the activities
  - 1.10 leave the aircraft and the electrical power system in a safe and appropriate condition, free from foreign object debris and in a condition ready for testing.

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## Learning outcome

The learner will:

- 2 remove aircraft electrical power control, distribution and protection components from **three** of the following aircraft systems and replace aircraft electrical power control, distribution and protection components in **three** of the following aircraft systems:
  - 2.1 AC main power generation equipment
  - 2.2 DC power generation equipment
  - 2.3 emergency power back-up equipment
  - 2.4 secondary/standby power generation equipment
  - 2.5 power distribution equipment
  - 2.6 other specific equipment.

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### Learning outcome

- 3 During the activities identified in learning outcome 2 above, they must cover the removal and replacement of the following:
- 3.1 major electrical components: Remove and replace **three** of the following:
- 3.1a generators
  - 3.1b regulators
  - 3.1c inverters
  - 3.1d change-over relays
  - 3.1e alternators
  - 3.1f transformer
  - 3.1g rectifier units
  - 3.1h main contactors
  - 3.1i batteries (such as one-shot or flight control DC batteries)
  - 3.1j electrical power control units.
- 3.2 other system components: Remove and replace **two** of the following:
- 3.2a switches
  - 3.2b batteries (other types)
  - 3.2c under-voltage phase sequence units
  - 3.2d wires/cables
  - 3.2e relays
  - 3.2f circuit breakers
  - 3.2g plugs/sockets
  - 3.2h transducers/sensors
  - 3.2i other specific components.

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### Learning outcome

The learner will:

- 4 carry out **ten** of the following removal and replacement activities:
- 4.1 disconnecting electrical connections
  - 4.2 checking components for serviceability
  - 4.3 removal of earth bonding
  - 4.4 positioning and aligning replaced components
  - 4.5 removing cable securing devices
  - 4.6 making mechanical connections
  - 4.7 removing bolt securing devices and mechanical fasteners
  - 4.8 making electrical connections
  - 4.9 carrying out earth bonding

- 4.10 applying and removing covering/protection to exposed components, wires, pipe work or vents
  - 4.11 installing cable securing devices
  - 4.12 tightening fastenings to the required torque
  - 4.13 labelling (and storing in the correct location) components that require repair or overhaul
  - 4.14 applying bolt locking methods (such as split pins, wire locking, lock nuts).
- 

### Learning outcome

The learner will:

- 5 remove and replace aircraft electrical power control, distribution and protection system components, in accordance with **one** of the following:
    - 5.1 Military Aviation Authority (MAA)
    - 5.2 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
    - 5.3 BS, ISO or BSEN standards and procedures
    - 5.4 Aerospace Quality Management Standards (AS)
    - 5.5 specific system requirements
    - 5.6 Federal Aviation Authority (FAA)
    - 5.7 organisation standards and procedures
    - 5.8 manufacturers' standards and procedures.
- 

### Learning outcome

The learner will:

- 6 Complete the relevant documentation, to include **one** from the following and pass it to the appropriate people:
    - 6.1 job cards
    - 6.2 computer records
    - 6.3 aircraft service/flight log
    - 6.4 aircraft log
    - 6.5 permit to work/formal risk assessment.
-

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## Learning outcome

Knowledge and understanding

## Assessment criteria

The learner must know and understand:

- K1 the specific safety practices and procedures that they need to observe when working with aircraft electrical power control, distribution and protection systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials).
- K2 the importance of maintenance on and impact upon ETOpS (Extended Twin Operations Procedures) systems, legislation and local procedures.
- K3 the hazards associated with removing and replacing aircraft electrical power control, distribution and protection system components and with the tools and equipment used and how to minimise them and reduce any risks.
- K4 The importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to.
- K5 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to.
- K6 the protective equipment that they need to use for both personal protection (PPE) and protection of the aircraft.
- K7 how to extract and use information from aircraft manuals, history/maintenance reports, flight logs, charts, circuit and physical layouts, specifications, symbols used in aircraft electrical power control, distribution and protection systems and other documents needed in the maintenance process.
- K8 how to carry out currency/issue checks on the specifications they are working with.
- K9 terminology used in aircraft electrical power control, distribution and protection systems and the use of system diagrams and associated symbols.
- K10 the basic principles of operation of the electrical power system being worked on and the performance characteristics and function of the components within the system.
- K11 the importance of applying Electrostatic Discharge (ESD) procedures when working on sensitive equipment or devices.
- K12 what constitutes a hazardous voltage and how to recognise victims of electric shock.
- K13 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers).
- K14 the various mechanical fasteners that are used and their method of removal and replacement (such as threaded fasteners, special securing devices).
- K15 the importance of using the specified fasteners for the installation and why they must not substitute others.
- K16 why securing devices need to be locked and labelled and the different methods that are used to remove and install them.
- K17 the torque loading requirements of the fasteners and what to do if these loadings are exceeded or not achieved.

- K18 the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking in of the connections.
- K19 the techniques used to remove components from aircraft electrical power control, distribution and protection systems, without damage to the components or surrounding structure (such as release of pressures/force, proof marking, the need to protect the circuit integrity by covering and labelling exposed circuits).
- K20 the need to correctly label and store components that require repair or overhaul and to check that replaced components have the correct part/identification markings.
- K21 the techniques used to position, align, adjust and secure the replaced components to the aircraft, without damage to the components or surrounding structure.
- K22 the quality control procedures to be followed during the removal and replacement operations.
- K23 procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities.
- K24 methods of lifting, handling and supporting the components/equipment during the removal and replacement activities.
- K25 the use of seals, sealant and adhesives and anti-electrolysis barriers, and the precautions to be taken.
- K26 why electrical bonding is critical and why it must be both mechanically and electrically secure.
- K27 how to conduct any necessary checks to ensure the system integrity, accuracy and quality of the removal and replacement.
- K28 the tools and equipment used in the removal and replacement activities, and their calibration/care and control procedures.
- K29 why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities.
- K30 the problems that can occur with the removal and replacement operations, and how these can be overcome.
- K31 how to recognise defects (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination).
- K32 the recording documentation to be completed for the activities undertaken and where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation.
- K33 the procedure for the safe disposal of waste materials and scrap components.
- K34 the extent of their own authority and to whom they should report if they have problems that they cannot resolve.

## **Unit 357**

# **Removing and replacing components of aircraft electrical power control, distribution and protection**

## Supporting Information

### ***Unit guidance***

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

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

## Unit 358

# Removing and replacing components of aircraft pitot static systems

**GLH:** 175

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**Unit aim:**

This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief. This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to carry out the removal and replacement of components in aircraft pitot static systems and associated instrumentation, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft and includes units and components associated with height, speed, rate of climb, navigation, auto-pilot, flying control surfaces, ice and rain protection, as applicable to the aircraft type.

They will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the components to be removed or replaced. The removal and replacement activities will include making all necessary checks to ensure that the components are safely and correctly removed and replaced and that the component is left in a safe condition and ready for testing. Their responsibilities will require them to comply with organisational policy and procedures for the removal and replacement activities undertaken and to report any problems with these activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people.

Their underpinning knowledge will provide a good understanding of their work and will provide an informed approach to applying the appropriate removal and replacement techniques and procedures for the pitot static components in the relevant aircraft systems.

They will understand the removal and replacement methods and procedures, and their application, along with the systems maintenance requirements. They will know how the pitot static equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the removal and replacement activities and for ensuring that the equipment is replaced to the required standard.

They will understand the safety precautions required when working on the various pitot static systems and when using the associated tools and equipment. They will be required to demonstrate safe working practices throughout and will understand the responsibility they owe to themselves and others in the workplace. They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall objectives of the organisation, such as strong work ethic, positive attitude,

team player, dependability, responsibility, honesty, integrity, motivation and commitment.

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

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## Learning outcome

Performance Requirements

## Assessment criteria

The learner can:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines.
- P2 demonstrate the required behaviours in line with the job role and organisational objectives.
- P3 follow the relevant aircraft manuals and publications to carry out the required work
- P4 establish and where appropriate, mark component orientation for re-assembly.
- P5 carry out the removal and replacement activities, within the limits of their personal authority.
- P6 remove and replace the required components, using approved tools and techniques.
- P7 take suitable precautions to prevent damage to components and the surrounding structure.
- P8 complete the relevant documentation, in accordance with organisational requirements.
- P9 label and store (in an appropriate location) components that require repair.
- P10 dispose of waste materials and scrap components, in accordance with approved procedures.

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## Learning outcome

The learner will:

- 1 carry out **all** of the following during the removal and replacement activity:
  - 1.1 obtain clearance to work on the aircraft and observe all relevant isolation and safety procedures.
  - 1.2 obtain and use the appropriate documentation (such as job instructions, aircraft manuals, technical instructions and other relevant maintenance documentation).
  - 1.3 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work.
  - 1.4 ensure that all relevant safety devices and mechanical/physical locks are in place (where appropriate).
  - 1.5 obtain the correct tools and equipment for the activity and check that they are in a safe, tested and usable condition and within current certification/calibration date.
  - 1.6 use approved removal and replacement techniques and procedures at all times.
  - 1.7 where appropriate, apply Electrostatic Discharge (ESD) protection procedures.
  - 1.8 ensure that components and surrounding structures are maintained free from damage and foreign objects.
  - 1.9 return all tools and equipment to the correct location on completion of the activities.
  - 1.10 leave the aircraft and the pitot static system in a safe and appropriate condition, free from foreign object debris and in a condition ready for testing.

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## Learning outcome

The learner will:

- 2 remove pitot static components from **three** of the following aircraft systems and replace pitot static components in **three** of the following aircraft systems:
  - 2.1 rate of climb
  - 2.2 aircraft height indication
  - 2.3 auto-pilot
  - 2.4 air speed indication
  - 2.5 navigation
  - 2.6 oxygen drop out
  - 2.7 flying controls (such as flaps, elevators, ailerons/ailerons, spoilers, wing sweep, reaction controls, rudder, rotor, airbrakes, horizontal stabiliser, artificial feel, gust alleviation, modal suppression)
  - 2.8 engine control systems (such as FADEC, FAFC, EEC)
  - 2.9 environmental control systems (such as pressure control)
  - 2.10 ice and rain protection systems (such as pitot static protection, ice accretion).

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### Learning outcome

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

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

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

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

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

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### Learning outcome

The learner will:

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

- 4.1 disconnecting electrical connections
- 4.2 positioning and aligning replaced components
- 4.3 removal of earth bonding
- 4.4 making mechanical connections
- 4.5 removing cable/pipe/tube securing devices
- 4.6 making electrical connections
- 4.7 removing bolt securing devices and mechanical fasteners

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

### Learning outcome

The learner will:

- 5 remove and replace aircraft pitot static system components in compliance with **one** of the following:
    - 5.1 Military Aviation Authority (MAA)
    - 5.2 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
    - 5.3 BS, ISO or BSEN standards and procedures
    - 5.4 Aerospace Quality Management Standards (AS)
    - 5.5 specific system requirements
    - 5.6 Federal Aviation Authority (FAA)
    - 5.7 organisation standards and procedures
    - 5.8 manufacturers' standards and procedures.
- 

### Learning outcome

The learner will:

- 6 complete the relevant documentation, to include **one** from the following and pass it to the appropriate people:
    - 6.1 job cards
    - 6.2 computer records
    - 6.3 aircraft service/flight log
    - 6.4 aircraft log
    - 6.5 permit to work/formal risk assessment
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## Learning outcome

Knowledge and understanding

### Assessment criteria

The learner must know and understand:

- K1 the specific safety practices and procedures that they need to observe when working with aircraft pitot static systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials).
- K2 the importance of maintenance on and impact upon (Extended Twin Operations Procedures) ETOpS systems, legislation and local procedures.
- K3 the hazards associated with removing and replacing aircraft pitot static system components and with the tools and equipment used and how to minimise them and reduce any risks.
- K4 The importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to.
- K5 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to.
- K6 the protective equipment that they need to use for both personal protection (PPE) and protection of the aircraft.
- K7 how to extract and use information from aircraft manuals, history/maintenance reports, flight logs, charts, circuit and physical layouts, specifications, symbols used in aircraft pitot static systems and other documents needed in the maintenance process.
- K8 how to carry out currency/issue checks on the specifications they are working with.
- K9 terminology used in aircraft pitot static systems and the use of system diagrams and associated symbols.
- K10 the basic principles of operation of the pitot static system being worked on and the performance characteristics and function of the components within the system.
- K11 the various mechanical fasteners that are used and their method of removal and replacement (such as threaded fasteners, special securing devices).
- K12 the importance of using the specified fasteners for the installation and why they must not substitute others.
- K13 why securing devices need to be locked and labelled and the different methods that are used to remove and install them.
- K14 the torque loading requirements of the fasteners and what to do if these loadings are exceeded or not achieved.
- K15 the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking in of the connections.
- K16 the importance of applying Electrostatic Discharge (ESD) procedures when working on sensitive equipment or devices.
- K17 what constitutes a hazardous voltage and how to recognise victims of electric shock.
- K18 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers).

- K19 the techniques used to remove components from aircraft pitot static systems, without damage to the components or surrounding structure (such as release of pressures/force, draining of fluids, proof marking, the need to protect the circuit integrity by covering and labelling exposed circuits).
- K20 the need to correctly label and store components that require repair or overhaul and to check that replaced components have the correct part/identification markings.
- K21 the techniques used to position, align, adjust and secure the replaced components to the aircraft without damage to the components or surrounding structure.
- K22 the quality control procedures to be followed during the removal and replacement operations.
- K23 procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities.
- K24 methods of lifting, handling and supporting the components/equipment during the removal and replacement activities.
- K25 the use of seals, sealant and adhesives and anti-electrolysis barriers and the precautions to be taken.
- K26 why electrical bonding is critical and why it must be both mechanically and electrically secure.
- K27 how to conduct any necessary checks to ensure the system integrity, accuracy and quality of the removal and replacement.
- K28 the tools and equipment used in the removal and replacement activities and their calibration/care and control procedures.
- K29 why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities.
- K30 the problems that can occur with the removal and replacement operations and how these can be overcome.
- K31 why it is important not to apply surface finishes/coverings to aircraft static vents.
- K32 how to recognise defects (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination).
- K33 the recording documentation to be completed for the activities undertaken and where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation.
- K34 the procedure for the safe disposal of waste materials and scrap components.
- K35 the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve.

## Unit 358

# Removing and replacing components of aircraft pitot static systems

## Supporting Information

### ***Unit guidance***

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

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

## Unit 359

# Removing and replacing components of aircraft armament systems

**GLH:** 175

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**Unit aim:**

This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.

This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to carry out the removal and replacement of components of aircraft armament systems, in accordance with approved procedures. They will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the components to be removed or replaced. The aircraft components will include items such as control units, computers, power supply units, dispensers, pylons, umbilical's, switches, relays and solenoids. The removal and replacement activities will include making all necessary checks to ensure that the components are safely and correctly removed and replaced and that the equipment is left in a safe condition and ready for testing.

Their responsibilities will require them to comply with organisational policy and procedures for the removal and replacement activities undertaken and to report any problems with these activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people.

Their underpinning knowledge will provide a good understanding of their work and will provide an informed approach to applying the appropriate removal and replacement techniques and procedures for aircraft armament components, in the relevant aircraft systems. They will understand the removal and replacement methods and procedures and their application, along with the systems maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the removal and replacement activities and for ensuring that the equipment is replaced to the required standard.

They will understand the safety precautions required when working on the aircraft armament systems and when using the associated tools and equipment. They will be required to demonstrate safe working practices throughout and will understand the responsibility they owe to themselves and others in the workplace. They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall objectives of the organisation, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

Notes To display competence in this standard it is necessary to both remove and replace aircraft armament system components. They must

remove components; however, they may fit a replacement component where the original was previously removed by another person.

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### Learning outcome

Performance Requirements

### Assessment criteria

The learner can:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines.
  - P2 demonstrate the required behaviours in line with the job role and organisational objectives.
  - P3 follow the relevant aircraft manuals and publications to carry out the required work.
  - P4 establish and where appropriate, mark component orientation for re-assembly.
  - P5 carry out the removal and replacement activities, within the limits of their personal authority.
  - P6 remove and replace the required components, using approved tools and techniques.
  - P7 take suitable precautions to prevent damage to components and the surrounding structure.
  - P8 complete the relevant documentation, in accordance with organisational requirements.
  - P9 label and store (in an appropriate location) components that require repair.
  - P10 dispose of waste materials and scrap components, in accordance with approved procedures.
- 

### Learning outcome

The learner will:

- 1 carry out **all** of the following during the removal and replacement activity:
    - 1.1 obtain clearance to work on the aircraft and observe all relevant isolation and safety procedures
    - 1.2 obtain and use the appropriate documentation (such as job instructions, aircraft manuals, technical instructions and other relevant maintenance documentation)
    - 1.3 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
    - 1.4 ensure that all relevant safety devices and mechanical/physical locks are in place (where appropriate)
    - 1.5 obtain the correct tools and equipment for the activity and check that they are in a safe, tested and usable condition and within current certification/calibration date
    - 1.6 use approved removal and replacement techniques and procedures at all times
    - 1.7 where appropriate, apply Electrostatic Discharge (ESD) protection procedures
-

- 1.8 ensure that components and surrounding structures are maintained free from damage and foreign objects
  - 1.9 return all tools and equipment to the correct location on completion of the activities
  - 1.10 leave the aircraft and the armament system in a safe and appropriate condition, free from foreign object debris and in a condition ready for testing.
- 

### Learning outcome

The learner will:

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

- 2.1 defensive aids
  - 2.2 missile
  - 2.3 armament role equipment
  - 2.4 weapon release equipment
  - 2.5 depth charge
  - 2.6 torpedoes
  - 2.7 guns
  - 2.8 pylons
  - 2.9 other specific system
- 

### Learning outcome

The learner will:

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

- 3.1 Major armament components: Remove and replace **three** of the following:

- 3.1a umbilicals
  - 3.1b guns
  - 3.1c sequence units
  - 3.1d computers
  - 3.1e motors
  - 3.1f flare magazines
  - 3.1g missiles
  - 3.1h power supply units
  - 3.1i clock units
  - 3.1j relay units
  - 3.1k control units
  - 3.1l dispensers.
-

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

### Learning outcome

The learner will:

- 4 carry out **twelve** of the following removal and replacement activities:
    - 4.1 disconnecting electrical connections
    - 4.2 replacing all 'lived' items (seals, filters, gaskets)
    - 4.3 removal of earth bonding
    - 4.4 positioning and aligning replaced components
    - 4.5 removing cable securing devices
    - 4.6 setting and adjusting replaced components
    - 4.7 removing bolt securing devices and mechanical fasteners
    - 4.8 making mechanical connections
    - 4.9 making electrical connections
    - 4.10 applying and removing covering/protection to exposed components, wires, pipework or vents
    - 4.11 carrying out earth bonding
    - 4.12 installing cable securing devices
    - 4.13 checking components for serviceability
    - 4.14 tightening fastenings to the required torque
    - 4.15 labelling and storing all removed equipment in the correct location
    - 4.16 applying bolt locking methods (such as split pins, wire locking, lock nuts).
- 

### Learning outcome

The learner will:

- 5 remove and replace components of aircraft armament systems in accordance with **one** of the following standards:
    - 5.1 Military Aviation Authority (MAA)
    - 5.2 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
-

- 5.3 BS, ISO or BSEN standards and procedures
  - 5.4 Aerospace Quality Management Standards (AS)
  - 5.5 specific system requirements
  - 5.6 Federal Aviation Authority (FAA)
  - 5.7 organisation standards and procedures
  - 5.8 manufacturers' standards and procedures.
- 

### Learning outcome

The learner will:

- 6 complete the relevant documentation, to include **one** from the following and pass it to the appropriate people:
    - 6.1 computer records
    - 6.2 record/history cards
    - 6.3 job cards
    - 6.4 aircraft service/flight log
    - 6.5 other specific recording method.
- 

### Learning outcome

Knowledge and understanding

### Assessment criteria

The learner must know and understand:

- K1 the specific safety practices and procedures that they need to observe when working with aircraft armament systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials).
  - K2 the hazards associated with removing and replacing aircraft armament system components and with the tools and equipment used and how to minimise them and reduce any risks.
  - K3 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to.
  - K4 The importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to.
  - K5 the protective equipment that they need to use for both personal protection (PPE) and protection of the aircraft.
  - K6 what constitutes a hazardous voltage and how to recognise victims of electric shock.
  - K7 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers).
-

- K8 how to extract and use information from aircraft manuals, history/maintenance reports, flight logs, charts, circuit and physical layouts, specifications, symbols used and other documents needed in the maintenance process.
- K9 how to carry out currency/issue checks on the specifications they are working with.
- K10 terminology used in aircraft armament systems and the use of system diagrams and associated symbols.
- K11 the basic principles of operation of the armament system being worked on, and the performance characteristics and function of the components within the system.
- K12 the various mechanical fasteners that are used and their method of removal and replacement (such as threaded fasteners, special securing devices).
- K13 the importance of using the specified fasteners for the installation and why they must not substitute others.
- K14 why securing devices need to be locked and labelled and the different methods that are used to remove and install them.
- K15 the torque loading requirements of the fasteners and what to do if these loadings are exceeded or not achieved.
- K16 the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking in of the connections.
- K17 the techniques used to remove components from aircraft armament systems, without damage to the components or surrounding structure (such as proof marking, the need to protect the circuit integrity by covering and labelling exposed circuits).
- K18 the importance of applying Electrostatic Discharge (ESD) procedures when working on sensitive equipment or devices.
- K19 the need to correctly label and store components that require repair or overhaul and to check that replaced components have the correct part/identification markings.
- K20 the techniques used to position, align, adjust and secure the replaced components to the aircraft, without damage to the components or surrounding structure.
- K21 the quality control procedures to be followed during the removal and replacement operations.
- K22 procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities.
- K23 methods of lifting, handling and supporting the components/equipment during the removal and replacement activities.
- K24 the use of seals, sealant and adhesives and anti-electrolysis barriers, and the precautions to be taken.
- K25 why electrical bonding is critical and why it must be both mechanically and electrically secure.
- K26 how to conduct any necessary checks to ensure the system integrity, accuracy and quality of the removal and replacement.
- K27 the tools and equipment used in the removal and replacement activities, and their calibration/care and control procedures.
- K28 why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities.

- K29 the problems that can occur with the removal and replacement operations and how these can be overcome.
- K30 how to recognise defects (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination).
- K31 the recording documentation to be completed for the activities undertaken and where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation.
- K32 the procedure for the safe disposal of waste materials and scrap components.
- K33 the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve.

## Unit 359

# Removing and replacing components of aircraft armament systems

## Supporting Information

### ***Unit guidance***

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

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

## Unit 360

# Removing and replacing components of aircraft communication systems

**GLH:** 175

**Unit aim:**

This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.

This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to carry out the removal and replacement of components in aircraft communication systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft, and includes equipment and components associated with intercom (clear), intercom (secure), High Frequency (HF) radio, Very High Frequency (VHF) radio, Ultra High Frequency (UHF) radio, cockpit voice recorder, Aircraft Communication Address Reporting System (ACARS), crash position indicators, digital data links, secure radio links, flight entertainment systems, Satellite Communications (SATCOM) and Selective Calling (SELCAL), as applicable to the aircraft type.

They will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the components to be removed or replaced. The aircraft components will include items such as aerials, receiver units, transmitter units, satellite beacons, transponders, antenna switching units, tuning units, control units, intercom station boxes, cables, indicators and switches. The removal and replacement activities will include making all necessary checks to ensure that the components are removed and replaced safely and correctly and that the equipment is left in a safe condition and ready for testing.

Their responsibilities will require them to comply with organisational policy and procedures for the removal and replacement activities undertaken and to report any problems with these activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed, accurately and legibly.

Their underpinning knowledge will provide a good understanding of their work and will provide an informed approach to applying the appropriate removal and replacement techniques and procedures for aircraft communication components, in the relevant aircraft systems. They will understand the removal and replacement methods and procedures and their application, along with the systems maintenance requirements. They will understand the safety precautions required when working on the aircraft communication systems and when using the associated tools and equipment. They will be required to demonstrate safe working practices

throughout and will understand the responsibility they owe to themselves and others in the workplace.

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

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## Learning outcome

Performance Requirements

## Assessment criteria

The learner can:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines.
- P2 demonstrate the required behaviours in line with the job role and organisational objectives.
- P3 follow the relevant aircraft manuals and publications to carry out the required work.
- P4 establish and where appropriate, mark component orientation for re-assembly.
- P5 carry out the removal and replacement activities, within the limits of their personal authority.
- P6 remove and replace the required components, using approved tools and techniques.
- P7 take suitable precautions to prevent damage to components and the surrounding structure.
- P8 complete relevant documentation, in accordance with organisational requirements.
- P9 label and store (in an appropriate location) components that require repair.
- P10 dispose of waste materials and scrap components, in accordance with approved procedures.

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## Learning outcome

The learner will:

- 1 carry out **all** of the following during the removal and replacement activity:
    - 1.1 obtain clearance to work on the aircraft and observe all relevant isolation and safety procedures.
    - 1.2 obtain and use the appropriate documentation (such as job instructions, aircraft manuals, technical instructions and other relevant maintenance documentation).
    - 1.3 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work.
    - 1.4 ensure that all relevant safety devices and mechanical/physical locks are in place (where appropriate).
    - 1.5 obtain the correct tools and equipment for the activity and check that they are in a safe, tested and usable condition and within current certification/calibration date.
    - 1.6 use approved removal and replacement techniques and procedures at all times.
    - 1.7 where appropriate, apply Electrostatic Discharge (ESD) protection procedures.
    - 1.8 ensure that components and surrounding structures are maintained free from damage and foreign objects.
    - 1.9 return all tools and equipment to the correct location on completion of the activities.
    - 1.10 leave the aircraft and the communication system in a safe and appropriate condition, free from foreign object debris and in a condition ready for testing.
- 

## Learning outcome

The learner will:

- 2 remove components from **three** of the following aircraft communication systems, and replace components in **three** of the following aircraft communication systems:
    - 2.1 VHF radio
    - 2.2 cockpit voice recorder
    - 2.3 flight entertainment systems
    - 2.4 intercom (clear)
    - 2.5 SATCOM
    - 2.6 SELCAL
    - 2.7 secure radio links
    - 2.8 intercom (secure speech)
    - 2.9 crash position indicators
    - 2.10 HF radio
    - 2.11 digital data links
    - 2.12 telecommunications
    - 2.13 UHF radio
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- 2.14 satellite position systems
  - 2.15 cabin interphone systems
  - 2.16 Identification Friend or Foe (IFF)
  - 2.17 Aircraft Communication Address Reporting System (ACARS).
- 

### Learning outcome

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

3.1 Major communication components: Remove and replace **three** of the following:

- 3.1a aerials
- 3.1b transponders
- 3.1c transmitter units (inc cockpit voice recorder)
- 3.1d control units
- 3.1e receiver units
- 3.1f antenna switching units
- 3.1g transformers
- 3.1h intercom station boxes
- 3.1i satellite beacons
- 3.1j crypto unit
- 3.1k tuning units.

3.2 Other system components: Remove and replace **two** of the following:

- 3.2a software
- 3.2b batteries
- 3.2c unit trays
- 3.2d plugs/sockets
- 3.2e switches
- 3.2f headsets
- 3.2g speakers
- 3.2h relays
- 3.2i microphone units
- 3.2j circuit breakers
- 3.2k wires/cables.

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## Learning outcome

The learner will:

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

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## Learning outcome

The learner will:

- 5 remove and replace components of aircraft communication systems in accordance with **one** of the following standards:
  - 5.1 Military Aviation Authority (MAA)
  - 5.2 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
  - 5.3 BS, ISO or BSEN standards and procedures
  - 5.4 Aerospace Quality Management Standards (AS)
  - 5.5 specific system requirements
  - 5.6 Federal Aviation Authority (FAA)
  - 5.7 organisation standards and procedures
  - 5.8 manufacturers' standards and procedures.

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## Learning outcome

The learner will:

- 6 complete the relevant documentation, to include **one** from the following and pass it to the appropriate people:
  - 6.1 computer records
  - 6.2 record/history cards
  - 6.3 job cards
  - 6.4 aircraft service/flight log
  - 6.5 other specific recording method.

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## Learning outcome

Knowledge and understanding

### Assessment criteria

The learner must know and understand:

- K1 the specific safety practices and procedures that they need to observe when working with aircraft communication systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials).
- K2 The importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to.
- K3 the importance of maintenance on, and impact upon (Extended Twin Operations Procedures) ETOpS systems, legislation and local procedures.
- K4 the hazards associated with removing and replacing aircraft communication system components and with the tools and equipment used and how to minimise them and reduce any risks.
- K5 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to.
- K6 the protective equipment that they need to use for both personal protection (PPE) and protection of the aircraft.
- K7 what constitutes a hazardous voltage and how to recognise victims of electric shock.
- K8 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers).
- K9 how to extract and use information from aircraft manuals, history/maintenance reports, flight logs, charts, circuit and physical layouts, specifications, symbols used in aircraft communication systems and other documents needed in the maintenance process.
- K10 how to carry out currency/issue checks on the specifications they are working with.
- K11 terminology used in aircraft communication systems and the use of system diagrams and associated symbols.

- K12 the basic principles of operation of the communication system being worked on and the performance characteristics and function of the components within the system.
- K13 the various mechanical fasteners that are used and their method of removal and replacement (such as threaded fasteners, special securing devices).
- K14 the importance of using the specified fasteners for the installation and why they must not substitute others.
- K15 why securing devices need to be locked and labelled and the different methods that are used to remove and install them.
- K16 the torque loading requirements of the fasteners and what to do if these loadings are exceeded or not achieved.
- K17 the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking in of the connections.
- K18 the techniques used to remove components from aircraft communication systems, without damage to the components or surrounding structure (such as proof marking, the need to protect the circuit integrity by covering and labelling exposed circuits).
- K19 the importance of applying Electrostatic Discharge (ESD) procedures when working on sensitive equipment or devices.
- K20 the need to correctly label and store components that require repair or overhaul and to check that replaced components have the correct part/identification markings.
- K21 the techniques used to position, align, adjust and secure the replaced components to the aircraft, without damage to the components or surrounding structure.
- K22 the quality control procedures to be followed during the removal and replacement operations.
- K23 procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities.
- K24 methods of lifting, handling and supporting the components/equipment during the removal and replacement activities.
- K25 the use of seals, sealant and adhesives and anti-electrolysis barriers and the precautions to be taken.
- K26 why electrical bonding is critical and why it must be both mechanically and electrically secure.
- K27 how to conduct any necessary checks to ensure the system integrity, accuracy and quality of the removal and replacement.
- K28 the tools and equipment used in the removal and replacement activities, and their calibration/care and control procedures.
- K29 why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities.
- K30 the problems that can occur with the removal and replacement operations and how these can be overcome.
- K31 how to recognise defects (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination).
- K32 the recording documentation to be completed for the activities undertaken and where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation.

- K33 the procedure for the safe disposal of waste materials and scrap components
- K34 the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve.

## Unit 360

# Removing and replacing components of aircraft communication systems

## Supporting Information

### ***Unit guidance***

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

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

## Unit 361

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

GLH: 175

### Unit aim:


This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.

This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to carry out the removal and replacement of components in aircraft passive warning and optical/surveillance systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft and includes equipment and components associated with acoustics, Sound Navigation and Ranging (SONAR), Radar Homing and Warning Receivers (RHWR), collision and ground avoidance, wet, digital, video and infra-red cameras, recording and LASER systems, as applicable to the aircraft type.

They will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the components to be removed or replaced. The removal and replacement activities will include making all necessary checks to ensure that the components are safely and correctly removed and replaced, and that the equipment is left in a safe condition and ready for testing.

Their responsibilities will require them to comply with organisational policy and procedures for the removal and replacement activities undertaken and to report any problems with these activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities and that all necessary job/task documentation is completed, accurately and legibly.

Their underpinning knowledge will provide a good understanding of their work and will provide an informed approach to applying the appropriate removal and replacement techniques and procedures to aircraft passive warning and optical/surveillance system components, in the relevant aircraft systems. They will understand the removal and replacement methods and procedures and their application, along with the systems maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the removal and replacement activities and for ensuring that the equipment is replaced to the required standard



They will understand the safety precautions required when working on the aircraft passive warning and optical/surveillance systems and when using the associated tools and equipment. They will be required to demonstrate safe working practices throughout and will understand the responsibility they owe to themselves and others in the workplace. They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall objectives of the organisation, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

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## Learning outcome

### Performance Requirements

### Assessment criteria

The learner can:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines.
- P2 demonstrate the required behaviours in line with the job role and organisational objectives.
- P3 follow the relevant aircraft manuals and publications to carry out the required work.
- P4 establish and where appropriate, mark component orientation for re-assembly.
- P5 carry out the removal and replacement activities, within the limits of their personal authority.
- P6 remove and replace the required components, using approved tools and techniques.
- P7 take suitable precautions to prevent damage to components and the surrounding structure.
- P8 complete the relevant documentation, in accordance with organisational requirements.
- P9 label and store (in an appropriate location) components that require repair.
- P10 dispose of waste materials and scrap components in accordance with approved procedures.
- P11 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines.

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## Learning outcome

The learner will:

- 1 carry out **all** of the following during the removal and replacement activity:
  - 1.1 obtain clearance to work on the aircraft and observe all relevant isolation and safety procedures.
  - 1.2 obtain and use the appropriate documentation (such as job instructions, aircraft manuals, technical instructions and other relevant maintenance documentation).
  - 1.3 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work.
  - 1.4 ensure that all relevant safety devices and mechanical/physical locks are in place (where appropriate).
  - 1.5 obtain the correct tools and equipment for the activity and check that they are in a safe, tested and usable condition and within current certification/calibration date.
  - 1.6 use approved removal and replacement techniques and procedures at all times.
  - 1.7 where appropriate, apply Electrostatic Discharge (ESD) protection procedures.
  - 1.8 ensure that components and surrounding structures are maintained free from damage and foreign objects.
  - 1.9 return all tools and equipment to the correct location on completion of the activities.
  - 1.10 leave the aircraft and the passive warning and optical surveillance system in a safe and appropriate condition, free from foreign object debris and in a condition ready for testing.

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## Learning outcome

The learner will:

- 2 remove components from **three** of the following aircraft passive warning and optical/surveillance systems and replace components in **three** of the following aircraft passive warning and optical/surveillance systems:
  - 2.1 acoustics
  - 2.2 collision avoidance
  - 2.3 video recording systems
  - 2.4 air data recording
  - 2.5 ground avoidance
  - 2.6 LASER systems
  - 2.7 cockpit recording systems
  - 2.8 Radar Homing and Warning Receivers (RHWR)
  - 2.9 Sound Navigation and Ranging (SONAR)
  - 2.10 camera systems (wet film, digital or infra-red)
  - 2.11 other specific passive warning or optical/surveillance system.



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### Learning outcome

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

3.1 Major passive warning and optical/surveillance components; Remove and replace **three** of the following:

- 3.1a buoys
- 3.1b transformers
- 3.1c processors
- 3.1d aerials
- 3.1e recording devices (cockpit, video, air data)
- 3.1f cameras
- 3.1g satellite beacons
- 3.1h receiver units
- 3.1i Power Supply Unit (PSU)
- 3.1i transponders
- 3.1k transmitter units
- 3.1l control units.

3.2 Other system components; Remove and replace **two** of the following:

- 3.2a batteries
- 3.2b relays
- 3.2c instruments/gauges/indicators
- 3.2d plugs/sockets
- 3.2e switches
- 3.2f circuit breakers
- 3.2g wires/cables
- 3.2h film or digital modules
- 3.2i software
- 3.2j other specific components.

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## Learning outcome

The learner will:

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

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## Learning outcome

The learner will:

- 5 Remove and replace components of aircraft passive warning and optical/surveillance systems in accordance with **one** of the following standards:
  - 5.1 Military Aviation Authority (MAA)
  - 5.2 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
  - 5.3 BS, ISO or BSEN standards and procedures
  - 5.4 Aerospace Quality Management Standards (AS)
  - 5.5 specific system requirements
  - 5.6 Federal Aviation Authority (FAA)
  - 5.7 organisation standards and procedures
  - 5.8 manufacturers' standards and procedures.

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## Learning outcome

The learner will:

- 6 complete the relevant documentation, to include **one** from the following and pass it to the appropriate people:
  - 6.1 computer records
  - 6.2 record/history cards
  - 6.3 job cards
  - 6.4 aircraft service/flight log
  - 6.5 other specific recording method.

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## Learning outcome

Knowledge and understanding

### Assessment criteria

The learner must know and understand:

- K1 the specific safety practices and procedures that they need to observe when working with aircraft passive warning and optical/surveillance systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials).
- K2 The importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to
- K3 the importance of maintenance on, and impact upon (Extended Twin Operations Procedures) ETOpS systems, legislation and local procedures.
- K4 the hazards associated with removing and replacing aircraft passive warning and optical/surveillance system components and with the tools and equipment used and how to minimise them and reduce any risks.
- K5 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to.
- K6 the protective equipment that they need to use for both personal protection (PPE) and protection of the aircraft.
- K7 what constitutes a hazardous voltage and how to recognise victims of electric shock.
- K8 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers).
- K9 how to extract and use information from aircraft manuals, history/maintenance reports, flight logs, charts, circuit and physical layouts, specifications, symbols used in aircraft passive warning and optical surveillance systems, distribution and protection systems, and other documents needed in the maintenance process.
- K10 how to carry out currency/issue checks on the specifications they are working with.
- K11 terminology used in aircraft passive warning and optical/surveillance systems and the use of system diagrams and associated symbols.

- K12 the basic principles of operation of the passive warning and optical/surveillance system being worked on and the performance characteristics and function of the components within the system.
- K13 the various mechanical fasteners that are used and their method of removal and replacement (such as threaded fasteners, special securing devices).
- K14 the importance of using the specified fasteners for the installation and why they must not substitute others.
- K15 why securing devices need to be locked and labelled and the different methods that are used to remove and install them.
- K16 the torque loading requirements of the fasteners and what to do if these loadings are exceeded or not achieved.
- K17 the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking in of the connections.
- K18 the techniques used to remove components from aircraft passive warning and optical/surveillance systems, without damage to the components or surrounding structure (such as proof marking, the need to protect the circuit integrity by covering and labelling exposed circuits).
- K19 the importance of applying Electrostatic Discharge (ESD) procedures when working on sensitive equipment or devices.
- K20 the need to correctly label and store components that require repair or overhaul and to check that replaced components have the correct part/identification markings.
- K21 the techniques used to position, align, adjust and secure the replaced components to the aircraft, without damage to the components or surrounding structure.
- K22 the quality control procedures to be followed during the removal and replacement operations.
- K23 procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities.
- K24 methods of lifting, handling and supporting the components/equipment during the removal and replacement activities.
- K25 the use of seals, sealant and adhesives and anti-electrolysis barriers and the precautions to be taken.
- K26 why electrical bonding is critical and why it must be both mechanically and electrically secure.
- K27 how to conduct any necessary checks to ensure the system integrity, accuracy and quality of the removal and replacement.
- K28 the tools and equipment used in the removal and replacement activities and their calibration/care and control procedures.
- K29 why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities.
- K30 the problems that can occur with the removal and replacement operations and how these can be overcome.
- K31 how to recognise defects (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination).

- K32 the recording documentation to be completed for the activities undertaken and where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation.
- K33 the procedure for the safe disposal of waste materials and scrap components.
- K34 the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve.

## **Unit 361**

# **Removing and replacing components of aircraft passive warning and optical/surveillance systems**

## Supporting Information

### ***Unit guidance***

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

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

## Unit 362

# Removing and replacing components of aircraft radar systems

**GLH:** 175

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**Unit aim:**

This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.

This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to carry out the removal and replacement of components in aircraft radar systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft and includes units and components associated with surveillance radar (including supplementary surveillance radar), weather radar, and obstacle warning systems (such as Enhanced Ground Proximity Warning Systems - EGPWS), Traffic Collision and Avoidance Systems (TCAS), towed radar decoys, radar (radio) altimeter, tactical air navigation (TACAN), Identification Friend or Foe (IFF), Doppler and radar jamming devices, as applicable to the aircraft type.


They will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the components to be removed or replaced. The aircraft components will include items such as scanners, aerials, transponders, transmitters, receiver units, microwave generators, processors, power supply units, wave guides, intermediate frequency units, indicator units, radar displays, winches, coolant units and control units. The removal and replacement activities will include making all necessary checks to ensure that the components are safely and correctly removed and replaced, and that the equipment is left in a safe condition and ready for testing.

Their responsibilities will require them to comply with organisational policy and procedures for the removal and replacement activities undertaken and to report any problems with these activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people.

Their underpinning knowledge will provide a good understanding of the removal and replacement methods and procedures and their application, along with the system maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the removal and replacement activities and for ensuring that the equipment is replaced to the required standard.

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

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They will be required to demonstrate safe working practices throughout and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

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

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## Learning outcome

### Performance Requirements

### Assessment criteria

The learner can:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines.
- P2 demonstrate the required behaviours in line with the job role and organisational objectives.
- P3 follow the relevant aircraft manuals and publications to carry out the required work.
- P4 establish and where appropriate, mark component orientation for re-assembly.
- P5 carry out the removal and replacement activities, within the limits of their personal authority.
- P6 remove and replace the required components, using approved tools and techniques.
- P7 take suitable precautions to prevent damage to components and the surrounding structure.
- P8 complete the relevant documentation, in accordance with organisational requirements.
- P9 label and store (in an appropriate location) components that require repair.
- P10 dispose of waste materials and scrap components, in accordance with approved procedures.

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## Learning outcome

The learner will:

- 1 carry out **all** of the following during the removal and replacement activity:
  - 1.1 obtain clearance to work on the aircraft and observe all relevant isolation and safety procedures
  - 1.2 obtain and use the appropriate documentation (such as job instructions, aircraft manuals, technical instructions and other relevant maintenance documentation)
  - 1.3 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
  - 1.4 ensure that all relevant safety devices and mechanical/physical locks are in place (where appropriate)
  - 1.5 obtain the correct tools and equipment for the activity and check that they are in a safe, tested and usable condition and within current certification/calibration date
  - 1.6 use approved removal and replacement techniques and procedures at all times
  - 1.7 where appropriate, apply Electrostatic Discharge (ESD) protection procedures
  - 1.8 ensure that components and surrounding structures are maintained free from damage and foreign objects
  - 1.9 return all tools and equipment to the correct location on completion of the activities
  - 1.10 leave the aircraft and the radar system in a safe and appropriate condition, free from foreign object debris and in a condition ready for testing.

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## Learning outcome

The learner will:

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

either

- 2.1 **one** of the following:
  - 2.1a surveillance radar
  - 2.1b radar jamming

or

- 2.2 **three** of the following:
  - 2.2a towed radar decoys
  - 2.2b obstacle warning systems
  - 2.2c Radar (radio) Altimeter (RADALT)
  - 2.2d Identification Friend or Foe (IFF)
  - 2.2e Doppler

- 2.2f Tactical Air Navigation (TACAN)
  - 2.2g Enhanced Ground Proximity Warning System (EGPWS)
  - 2.2h weather radar/predictive wind shear
  - 2.2i supplementary surveillance radar
  - 2.2j Traffic Collision Avoidance System (TCAS)
  - 2.2k other specific radar system.
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### Learning outcome

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

3.1 major radar components: Remove and replace **three** of the following:

- 3.1a scanners
- 3.1b radar displays
- 3.1c Power Supply Units (PSU)
- 3.1d aerials
- 3.1e receiver units
- 3.1f winches
- 3.1g transformers
- 3.1h processors
- 3.1i waveguides
- 3.1j transmitter units
- 3.1k control units
- 3.1l radar packs
- 3.1m computers
- 3.1n microwave generators
- 3.1o coolant units
- 3.1p transponders
- 3.1q Intermediate Frequency Unit (IFU)

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

- 3.2a batteries
  - 3.2b circuit breakers
  - 3.2c wires/cables
  - 3.2d switches
  - 3.2e plugs/sockets
  - 3.2f relays
  - 3.2g desiccant units
  - 3.2h coolant
  - 3.2i software
  - 3.2j other specific component.
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## Learning outcome

The learner will:

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

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## Learning outcome

The learner will:

- 5 remove and replace aircraft radar system components, in compliance with **one** of the following
  - 5.1 Military Aviation Authority (MAA)
  - 5.2 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
  - 5.3 BS, ISO or BSEN standards and procedures
  - 5.4 Aerospace Quality Management Standards (AS)
  - 5.5 specific system requirements
  - 5.6 Federal Aviation Authority (FAA)
  - 5.7 organisation standards and procedures
  - 5.8 manufacturers' standards and procedures.

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## Learning outcome

The learner will:

- 6 complete the relevant documentation, to include **one** from the following and pass it to the appropriate people:
  - 6.1 computer records
  - 6.2 record/history cards
  - 6.3 job cards
  - 6.4 aircraft service/flight log
  - 6.5 other specific recording method.

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## Learning outcome

Knowledge and understanding

### Assessment criteria

The learner must know and understand:

- K1 the specific safety practices and procedures that they need to observe when working with aircraft radar systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials).
- K2 The importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to.
- K3 the importance of maintenance on and impact upon (Extended Range Twin-Engine Operations Procedures) ETOPS systems, legislation and local procedures.
- K4 the hazards associated with removing and replacing aircraft radar system components and with the tools and equipment used and how to minimise them and reduce any risk.
- K5 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to.
- K6 the protective equipment that they need to use for both personal protection (PPE) and protection of the aircraft.
- K7 what constitutes a hazardous voltage and how to recognise victims of electric shock.
- K8 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers).
- K9 how to extract and use information from aircraft manuals, history/maintenance reports, flight logs, charts, circuit and physical layouts, specifications, symbols used in aircraft radar systems and other documents needed in the maintenance process.
- K10 how to carry out currency/issue checks on the specifications they are working with.
- K11 terminology used in aircraft radar systems and the use of system diagrams and associated symbols.
- K12 the basic principles of operation of the radar system being worked on and the performance characteristics and function of the components within the system.

- K13 the various mechanical fasteners that are used and their method of removal and replacement (such as threaded fasteners, special securing devices).
- K14 the importance of using the specified fasteners for the installation and why they must not substitute others.
- K15 why securing devices need to be locked and labelled and the different methods that are used to remove and install them.
- K16 the torque loading requirements on the fasteners and what to do if these loadings are exceeded or not achieved.
- K17 the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections.
- K18 the techniques used to remove components from aircraft radar systems, without damage to the components or surrounding structure (such as proof marking, the need to protect the circuit integrity by covering and labelling exposed circuits).
- K19 the importance of applying Electrostatic Discharge (ESD) procedures when working on sensitive equipment or devices.
- K20 the need to label and store correctly components that require repair or overhaul and to check that replaced components have the correct part/identification markings.
- K21 the techniques used to position, align, adjust and secure the replaced components to the aircraft, without damage to the components or surrounding structure.
- K22 the quality control procedures to be followed during the removal and replacement operations.
- K23 procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities.
- K24 methods of lifting, handling and supporting the components/equipment during the removal and replacement activities.
- K25 the use of seals, sealant and adhesives and anti-electrolysis barriers and the precautions to be taken.
- K26 why electrical bonding is critical and why it must be both mechanically and electrically secure.
- K27 how to conduct any necessary checks to ensure the system integrity, accuracy and quality of the removal and replacement.
- K28 the tools and equipment used in the removal and replacement activities and their calibration/care and control procedures.
- K29 why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities.
- K30 the problems that can occur with the removal and replacement operations and how these can be overcome.
- K31 how to recognise defects (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination).
- K32 the recording documentation to be completed for the activities undertaken and where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation.
- K33 the procedure for the safe disposal of waste materials and scrap components.

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

## Unit 362

# Removing and replacing components of aircraft radar systems

## Supporting Information

### ***Unit guidance***

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

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

## Unit 363

# Removing and replacing components of aircraft navigational and computing systems

GLH:

175

### Unit aim:

This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.

This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to carry out the removal and replacement of components in aircraft navigational and computing systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft and includes equipment and components associated with navigational and computing systems as applicable to the aircraft type.

They will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the components to be removed or replaced. The aircraft components will include items such as aerials, receiver units, unit trays, indicator units and control units. The removal and replacement activities will include making all necessary checks to ensure that the components are safely and correctly removed and replaced and that the equipment is left in a safe condition and ready for testing. Their responsibilities will require them to comply with organisational policy and procedures for the removal and replacement activities undertaken and to report any problems with these activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people.

Their underpinning knowledge will provide a good understanding of their work and will provide an informed approach to applying the appropriate removal and replacement techniques and procedures for aircraft navigational components, in the relevant aircraft systems. They will understand the removal and replacement methods and procedures and their application, along with the systems maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the removal and replacement activities and for ensuring that the equipment is replaced to the required standard. In addition, they will have sufficient knowledge of these components to ensure that they are fit for purpose and meet the specifications, thus providing a sound basis for carrying out the replacement to the required specification. They will understand the safety precautions required when working on the aircraft navigational systems and when using the associated tools and equipment. They will be required to demonstrate

safe working practices throughout and will understand the responsibility they owe to themselves and others in the workplace.

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

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### Learning outcome

Performance Requirements

### Assessment criteria

The learner can:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines.
- P2 demonstrate the required behaviours in line with the job role and organisational objectives.
- P3 follow the relevant aircraft manuals and publications to carry out the required work
- P4 establish and where appropriate, mark component orientation for re-assembly.
- P5 carry out the removal and replacement activities, within the limits of their personal authority.
- P6 remove and replace the required components, using approved tools and techniques
- P7 take suitable precautions to prevent damage to components and the surrounding structure.
- P8 complete the relevant documentation, in accordance with organisational requirements.
- P9 label and store (in an appropriate location) components that require repair.
- P10 dispose of waste materials and scrap components, in accordance with approved procedures.

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### Learning outcome

The learner will:

- 1 carry out **all** of the following during the removal and replacement activity:
  - 1.1 obtain clearance to work on the aircraft and observe all relevant isolation and safety procedures
  - 1.2 obtain and use the appropriate documentation (such as job instructions, aircraft manuals, technical instructions and other relevant maintenance documentation)
  - 1.3 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
  - 1.4 ensure that all relevant safety devices and mechanical/physical locks are in place (where appropriate)

- 1.5 obtain the correct tools and equipment for the activity and check that they are in a safe, tested and usable condition and within current certification/calibration date
  - 1.6 use approved removal and replacement techniques and procedures at all times
  - 1.7 where appropriate, apply Electrostatic Discharge (ESD) protection procedures
  - 1.8 ensure that components and surrounding structures are maintained free from damage and foreign objects
  - 1.9 return all tools and equipment to the correct location on completion of the activities
  - 1.10 leave the aircraft and the navigational and computing system in a safe and appropriate condition, free from foreign object debris and in a condition ready for testing.
- 

### Learning outcome

The learner will:

- 2 remove components from **three** of the following aircraft navigational systems, and replace components in **three** of the following aircraft navigational systems:
  - 2.1 Distance Measuring Equipment (DME)
  - 2.2 re-transmission systems
  - 2.3 Very High Frequency Omnidirectional Range (VOR)
  - 2.4 Doppler
  - 2.5 Instrument Landing System (ILS)
  - 2.6 homing
  - 2.7 Auto Direction Finder (ADF)
  - 2.8 gyro
  - 2.9 Global Positioning System (GPS)
  - 2.10 Long Range Navigation (LORAN)
  - 2.11 compass
  - 2.12 inertial navigation system
  - 2.13 computing sub-systems
  - 2.14 Tactical Air Communication and Navigation System (TACAN)
  - 2.15 Microwave Landing System (MLS).
  - 2.16 other specific navigational system

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## Learning outcome

The learner will:

- 3 During the activities identified in learning outcome 2 above, they must cover the removal and replacement of the following:
  - 3.1 Major navigational components: Remove and replace **three** of the following:
    - 3.1a aerials
    - 3.1b Analogue/Digital Converters (A-D/D-A)
    - 3.1c control units
    - 3.1d receiver units
    - 3.1e compensation units
    - 3.1f navigation display units (including head-up)
    - 3.1g satellite beacons
    - 3.1h transmitter units
    - 3.1i transponders
    - 3.1j transformers
    - 3.1k computers
    - 3.1l interface units
  - 3.2 Other system components: Remove and replace **two** of the following:
    - 3.2a batteries
    - 3.2b unit trays
    - 3.2c plugs/sockets
    - 3.2d switches
    - 3.2e vacuum pump
    - 3.2f software
    - 3.2g relays
    - 3.2h instruments/gauges/indicators
    - 3.2i circuit breakers
    - 3.2j wires/cables
    - 3.2k other specific system components.

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## Learning outcome

The learner will:

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

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## Learning outcome

The learner will:

- 5 remove and replace aircraft navigational system components in compliance with **one** of the following:
  - 5.1 Military Aviation Authority (MAA)
  - 5.2 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
  - 5.3 BS, ISO or BSEN standards and procedures
  - 5.4 Aerospace Quality Management Standards (AS)
  - 5.5 specific system requirements
  - 5.6 Federal Aviation Authority (FAA)
  - 5.7 organisation standards and procedures
  - 5.8 manufacturers' standards and procedures.

---

## Learning outcome

The learner will:

- 6 complete the relevant documentation, to include **one** from the following and pass it to the appropriate people:
  - 6.1 computer records
  - 6.2 record/history cards
  - 6.3 job cards
  - 6.4 aircraft service/flight log
  - 6.5 other specific recording method.

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## Learning outcome

Knowledge and understanding

### Assessment criteria

The learner must know and understand:

- K1 the specific safety practices and procedures that they need to observe when working with aircraft navigational and computing systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials).
- K2 the importance of maintenance on, and impact upon (Extended Twin Operations Procedures) ETOpS systems, legislation and local procedures.
- K3 The importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to.
- K4 the hazards associated with removing and replacing aircraft navigational and computing system components and with the tools and equipment used and how to minimise them and reduce any risks.
- K5 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to.
- K6 the protective equipment that they need to use for both personal protection (PPE) and protection of the aircraft.
- K7 what constitutes a hazardous voltage and how to recognise victims of electric shock.
- K8 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers).
- K9 how to extract and use information from aircraft manuals, history/maintenance reports, flight logs, charts, circuit and physical layouts, specifications, symbols used in aircraft navigational systems, and other documents needed in the maintenance process.
- K10 how to carry out currency/issue checks on the specifications they are working with.
- K11 terminology used in aircraft navigational and computing systems and the use of system diagrams and associated symbols.

- K12 the basic principles of operation of the navigational or computing system being worked on and the performance characteristics and function of the components within the system.
- K13 the various mechanical fasteners that are used and their method of removal and replacement (such as threaded fasteners, special securing devices).
- K14 the importance of using the specified fasteners for the installation and why they must not substitute others.
- K15 why securing devices need to be locked and labelled and the different methods that are used to remove and install them.
- K16 the torque loading requirements of the fasteners and what to do if these loadings are exceeded or not achieved.
- K17 the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking in of the connections.
- K18 the techniques used to remove components from aircraft navigational and computing systems, without damage to the components or surrounding structure (such as proof marking, the need to protect the circuit integrity by covering and labelling exposed circuits).
- K19 the importance of applying Electrostatic Discharge (ESD) procedures when working on sensitive equipment/devices.
- K20 the need to correctly label and store components that require repair or overhaul and to check that replaced components have the correct part/identification markings.
- K21 the techniques used to position, align, adjust and secure the replaced components to the aircraft, without damage to the components or surrounding structure.
- K22 the quality control procedures to be followed during the removal and replacement operations.
- K23 procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities.
- K24 methods of lifting, handling and supporting the components/equipment during the removal and replacement activities.
- K25 the use of seals, sealant, adhesives and anti-electrolysis barriers and the precautions to be taken.
- K26 why electrical bonding is critical and why it must be both mechanically and electrically secure.
- K27 how to conduct any necessary checks to ensure the system integrity, accuracy and quality of the removal and replacement.
- K28 the tools and equipment used in the removal and replacement activities and their calibration/care and control procedures.
- K29 why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities.
- K30 the problems that can occur with the removal and replacement operations and how these can be overcome.
- K31 how to recognise defects (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination).

- K32 the recording documentation to be completed for the activities undertaken and where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation.
- K33 the procedure for the safe disposal of waste materials and scrap components the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve.

## **Unit 363**

# **Removing and replacing components of aircraft navigational and computing systems**

## Supporting Information

### ***Unit guidance***

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

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

## Unit 364

# Removing and replacing components of aircraft flight guidance and control systems

GLH:

175

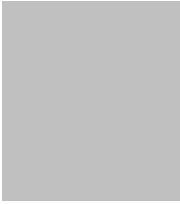
### Unit aim:

This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.

This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to carry out the removal and replacement of components in aircraft flight guidance and control systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft and includes equipment and components associated with fly-by-wire, gyros, autopilot, flight director, angle of attack, turn and slip, and AFCS (Automatic Flying Control System), as applicable to the aircraft type. They will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the components to be removed or replaced. The removal and replacement activities will include making all necessary checks, to ensure that the components are safely and correctly removed and replaced and that the equipment is left in a safe condition and ready for testing. Their responsibilities will require them to comply with organisational policy and procedures for the removal and replacement activities undertaken and to report any problems with these activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people.

Their underpinning knowledge will provide a good understanding of their work and will provide an informed approach to applying the appropriate removal and replacement techniques and procedures for aircraft flight guidance and control components, in the relevant aircraft systems. They will understand the removal and replacement methods and procedures and their application, along with the systems maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the removal and replacement activities and for ensuring that the equipment is replaced to the required standard. In addition, they will have sufficient knowledge of these components to ensure that they are fit for purpose and meet the specifications, thus providing a sound basis for carrying out the replacement to the required specification.

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



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

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### Learning outcome

Performance Requirements

### Assessment criteria

The learner can:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines.
  - P2 demonstrate the required behaviours in line with the job role and organisational objectives.
  - P3 follow the relevant aircraft manuals and publications to carry out the required work.
  - P4 establish and where appropriate, mark component orientation for re-assembly.
  - P5 carry out the removal and replacement activities, within the limits of their personal authority.
  - P6 remove and replace the required components, using approved tools and techniques.
  - P7 take suitable precautions to prevent damage to components and the surrounding structure.
  - P8 complete the relevant documentation, in accordance with organisational requirements.
  - P9 label and store (in an appropriate location) components that require repair.
  - P10 dispose of waste materials and scrap components, in accordance with approved procedures.
- 

### Learning outcome

The learner will:

- 1 carry out **all** of the following during the removal and replacement activity:
    - 1.1 obtain clearance to work on the aircraft and observe all relevant isolation and safety procedures
    - 1.2 obtain and use the appropriate documentation (such as job instructions, aircraft manuals, technical instructions and other relevant maintenance documentation)
    - 1.3 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
    - 1.4 ensure that all relevant safety devices and mechanical/physical locks are in place (where appropriate)
-

- 1.5 obtain the correct tools and equipment for the activity and check that they are in a safe, tested and usable condition and within current certification/calibration date
  - 1.6 use approved removal and replacement techniques and procedures at all times
  - 1.7 where appropriate, apply Electrostatic Discharge (ESD) protection procedures
  - 1.8 ensure that components and surrounding structures are maintained free from damage and foreign objects
  - 1.9 return all tools and equipment to the correct location on completion of the activities
  - 1.10 leave the aircraft and the flight guidance and control system in a safe and appropriate condition, free from foreign object debris and in a condition ready for testing.
- 

### Learning outcome

The learner will:

- 2 remove components from **three** of the following aircraft flight guidance and control systems, and replace components in **three** of the following aircraft flight guidance and control systems:
    - 2.1 fly-by-wire
    - 2.2 Automatic Flying Control System (AFCS)
    - 2.3 auto-pilot
    - 2.4 angle of attack/stall warning
    - 2.5 flight director
    - 2.6 nose wheel steering
    - 2.7 turn and slip indication
    - 2.8 main gear steering
    - 2.9 gyros
    - 2.10 other specific flight guidance and control system.
- 

### Learning outcome

- 3 During the activities identified in learning outcome 2 above, they must cover the removal and replacement of the following:
    - 3.1 major flight guidance and control components: Remove and replace **three** of the following:
      - 3.1a computers
      - 3.1b trim units
      - 3.1c controllers
      - 3.1d actuators
      - 3.1e air data units
      - 3.1f transformers
      - 3.1g detectors/position sensors
      - 3.1h stick position cancellers
-

- 3.1i receiver units
- 3.1j Attitude Heading and Reference System (AHRS)
- 3.1k gyros (rate and vertical)
- 3.1l Inertial Reference Unit (IRUs) primary or secondary
- 3.1m compass computers
- 3.1n embedded GPS and INS (EGI)

- 3.2 other system components: Remove and replace **two** of the following:
    - 3.2a batteries
    - 3.2b aerials
    - 3.2c software
    - 3.2d wires/cables
    - 3.2e switches
    - 3.2f instruments/gauges/indicators
    - 3.2g plugs/sockets
    - 3.2h relays
    - 3.2i other specific system component.
- 

### Learning outcome

The learner will:

5 carry out **ten** of the following removal and replacement activities, where applicable:

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

---

## Learning outcome

The learner will:

- 5 remove and replace aircraft flight guidance and control system components in compliance with **one** of the following:
  - 5.1 Military Aviation Authority (MAA)
  - 5.2 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
  - 5.3 BS, ISO or BSEN standards and procedures
  - 5.4 Aerospace Quality Management Standards (AS)
  - 5.5 specific system requirements
  - 5.6 Federal Aviation Authority (FAA)
  - 5.7 organisation standards and procedures
  - 5.8 manufacturers' standards and procedures.

---

## Learning outcome

The learner will:

- 6 complete the relevant documentation, to include **one** from the following and pass it to the appropriate people:
  - 6.1 computer records
  - 6.2 record/history cards
  - 6.3 job cards
  - 6.4 aircraft service/flight log
  - 6.5 other specific recording method.

---

## Learning outcome

Knowledge and understanding

### Assessment criteria

The learner must know and understand:

- K1 the specific safety practices and procedures that they need to observe when working with aircraft flight guidance and control systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials).
- K2 The importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to.
- K3 the importance of maintenance on and impact upon (Extended Range Twin-Engine Operations Procedures) ETOPS systems, legislation and local procedures.
- K4 the hazards associated with removing and replacing aircraft flight guidance and control system components and with the tools and equipment used and how to minimise them and reduce any risk.
- K5 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to.
- K6 the protective equipment that they need to use for both personal protection (PPE) and protection of the aircraft.
- K7 what constitutes a hazardous voltage and how to recognise victims of electric shock.
- K8 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers).
- K9 how to extract and use information from aircraft manuals, history/maintenance reports, flight logs, charts, circuit and physical layouts, specifications, symbols used in aircraft flight guidance and control systems and other documents needed in the maintenance process.
- K10 how to carry out currency/issue checks on the specifications they are working with
- K11 terminology used in aircraft flight guidance and control systems and the use of system diagrams and associated symbols.

- K12 the basic principles of operation of the flight guidance and control system being worked on and the performance characteristics and function of the components within the system.
- K13 the various mechanical fasteners that are used and their method of removal and replacement (such as threaded fasteners, special securing devices).
- K14 the importance of using the specified fasteners for the installation and why they must not substitute others.
- K15 why securing devices need to be locked and labelled and the different methods that are used to remove and install them.
- K16 the torque loading requirements on the fasteners and what to do if these loadings are exceeded or not achieved.
- K17 the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections.
- K18 the techniques used to remove components from aircraft flight guidance and control systems, without damage to the components or surrounding structure (such as proof marking, the need to protect the circuit integrity by covering and labelling exposed circuits).
- K19 the importance of applying Electrostatic Discharge (ESD) procedures when working on sensitive equipment or devices.
- K20 the need to label and store correctly components that require repair or overhaul and to check that replaced components have the correct part/identification markings.
- K21 the techniques used to position, align, adjust and secure the replaced components to the aircraft, without damage to the components or surrounding structure.
- K22 the quality control procedures to be followed during the removal and replacement operations.
- K23 procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities.
- K24 methods of lifting, handling and supporting the components/equipment during the removal and replacement activities.
- K25 the use of seals, sealant and adhesives and anti-electrolysis barriers and the precautions to be taken.
- K26 why electrical bonding is critical and why it must be both mechanically and electrically secure.
- K27 how to conduct any necessary checks to ensure the system integrity, accuracy and quality of the removal and replacement.
- K28 the tools and equipment used in the removal and replacement activities and their calibration/care and control procedures.
- K29 why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities.
- K30 the problems that can occur with the removal and replacement operations and how these can be overcome.
- K31 how to recognise defects (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination).

- K32 the recording documentation to be completed for the activities undertaken and where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation.
- K33 the procedure for the safe disposal of waste materials and scrap components.
- K34 the extent of their own authority and to whom they should report if they have problems that they cannot resolve.

## **Unit 364**

# **Removing and replacing components of aircraft flight guidance and control systems**

## Supporting Information

### ***Unit guidance***

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

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

## Unit 365

# Removing and replacing components of aircraft internal and external lighting systems

GLH: 175

### Unit aim:

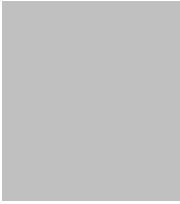
This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.

This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to carry out the removal and replacement of components in aircraft lighting systems, in accordance with approved procedures. They will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the components to be removed or replaced. The aircraft components will include items such as power supplies, batteries, invertors, transformers, rectifier units, terminal blocks and connecting devices, lighting units, switches and circuit breakers. The removal and replacement activities will include making all necessary checks, to ensure that the components are safely and correctly removed and replaced and that the equipment is left in a safe condition and ready for testing.

Their responsibilities will require them to comply with organisational policy and procedures for the removal and replacement activities undertaken and to report any problems with these activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people.

Their underpinning knowledge will provide a good understanding of their work and will provide an informed approach to applying the appropriate removal and replacement techniques and procedures for the aircraft lighting equipment and components, in the relevant aircraft systems. They will understand the removal and replacement methods and procedures and their application, along with the systems maintenance requirements. They will know how the lighting equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the removal and replacement activities and for ensuring that the equipment is replaced to the required standard. In addition, they will have sufficient knowledge of these components to ensure they are fit for purpose and meet the specifications, thus providing a sound basis for carrying out the replacement to the required specification.

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



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

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### Learning outcome

#### Performance Requirements

### Assessment criteria

The learner can:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines.
- P2 demonstrate the required behaviours in line with the job role and organisational objectives.
- P3 follow the relevant aircraft manuals and publications to carry out the required work.
- P4 establish and where appropriate, mark component orientation for re-assembly.
- P5 carry out the removal and replacement activities, within the limits of their personal authority.
- P6 remove and replace the required components, using approved tools and techniques.
- P7 take suitable precautions to prevent damage to components and the surrounding structure.
- P8 complete the relevant documentation in accordance with organisational requirements.
- P9 label and store (in an appropriate location) components that require repair.
- P10 dispose of waste materials and scrap components, in accordance with approved procedures.

---

## Learning outcome

The learner will:

- 1 carry out **all** of the following during the removal and replacement activity:
  - 1.1 obtain clearance to work on the aircraft and observe all relevant isolation and safety procedures
  - 1.2 obtain and use the appropriate documentation (such as job instructions, aircraft manuals, technical instructions and other relevant maintenance documentation)
  - 1.3 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
  - 1.4 ensure that all relevant safety devices and mechanical/physical locks are in place (where appropriate)
  - 1.5 obtain the correct tools and equipment for the activity and check that they are in a safe, tested and usable condition and within current certification/calibration date
  - 1.6 use approved removal and replacement techniques and procedures at all times
  - 1.7 where appropriate, apply Electrostatic Discharge (ESD) protection procedures
  - 1.8 ensure that components and surrounding structures are maintained free from damage and foreign objects
  - 1.9 return all tools and equipment to the correct location on completion of the activities
  - 1.10 leave the aircraft and the lighting system in a safe and appropriate condition, free from foreign object debris and in a condition ready for testing.

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## Learning outcome

The learner will:

- 2 remove aircraft lighting system components from **three** of the following lighting systems, and replace aircraft lighting system components in **three** of the following aircraft systems:
  - 2.1 Electro-Luminescence (EL)
  - 2.2 spot/search lighting
  - 2.3 flood lighting
  - 2.4 emergency lighting
  - 2.5 anti-dazzle lighting
  - 2.6 cabin lighting
  - 2.7 Night Vision Goggles (NVG)
  - 2.8 external lighting systems
  - 2.9 utility lighting
  - 2.10 other specific lighting system.

---

## Learning outcome

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

Remove and replace **three** of the following:

- 3.1 major lighting system components:
  - 3.1a power supplies
  - 3.1b transformer
  - 3.1c rectifier units
  - 3.1d junction box
  - 3.1e inverters
  - 3.1f control units
  - 3.1g spot/search light (complete unit)
  - 3.1h rheostats
  - 3.1i strobe light/beacon light
  - 3.1j taxi/landing lamp (complete unit)
  - 3.1k utility light
  - 3.1l navigation light.

Remove and replace **two** of the following:

- 3.2 other system components:
  - 3.2a switches
  - 3.2b batteries
  - 3.2c filaments
  - 3.2d wires/cables
  - 3.2e relays
  - 3.2f circuit breakers
  - 3.2g light emitting diodes
  - 3.2h plugs/sockets
  - 3.2i transducers/sensors
  - 3.2j terminal blocks
  - 3.2k strip lights
  - 3.2l other specific components.

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### Learning outcome

The learner will:

- 4 carry out **ten** of the following removal and replacement activities:
  - 4.1 disconnecting electrical connections
  - 4.2 checking components for serviceability
  - 4.3 removal of earth bonding
  - 4.4 positioning and aligning replaced components
  - 4.5 removing cable securing devices
  - 4.6 making mechanical connections
  - 4.7 removing bolt securing devices and mechanical fasteners
  - 4.8 making electrical connections
  - 4.9 carrying out earth bonding
  - 4.10 applying and removing covering/protection to exposed components, wires, pipework or vents
  - 4.11 installing cable securing devices
  - 4.12 weather sealing of lighting unit assemblies
  - 4.13 labelling (and storing in the correct location) components that require repair or overhaul
  - 4.14 applying bolt locking methods (such as split pins, wire locking, lock nuts).

---

### Learning outcome

The learner will:

- 5 remove and replace aircraft lighting system components in compliance with **one** of the following:
  - 5.1 Military Aviation Authority (MAA)
  - 5.2 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
  - 5.3 BS, ISO or BSEN standards and procedures
  - 5.4 Aerospace Quality Management Standards (AS)
  - 5.5 specific system requirements
  - 5.6 Federal Aviation Authority (FAA)
  - 5.7 organisation standards and procedures
  - 5.8 manufacturers' standards and procedures.

---

## Learning outcome

The learner will:

- 6 complete the relevant documentation, to include **one** from the following and pass it to the appropriate people:
  - 6.1 computer records
  - 6.2 record/history cards
  - 6.3 job cards
  - 6.4 aircraft service/flight log
  - 6.5 other specific recording method.

---

## Learning outcome

Knowledge and understanding

### Assessment criteria

The learner must know and understand:

- K1 the specific safety practices and procedures that they need to observe when working with aircraft internal and external lighting systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials).
- K2 The importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to.
- K3 the importance of maintenance on, and impact upon (Extended Twin Operations Procedures) ETOpS systems, legislation and local procedures.
- K4 the hazards associated with removing and replacing aircraft lighting system components and with the tools and equipment used, and how to minimise them and reduce any risks.
- K5 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to.
- K6 the protective equipment that they need to use for both personal protection (PPE) and protection of the aircraft.
- K7 what constitutes a hazardous voltage and how to recognise victims of electric shock.
- K8 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers).
- K9 how to extract and use information from aircraft manuals, history/maintenance reports, flight logs, charts, circuit and physical layouts, specifications, symbols used in aircraft lighting systems and other documents needed in the maintenance process.
- K10 how to carry out currency/issue checks on the specifications they are working with.
- K11 terminology used in aircraft lighting systems and the use of system diagrams and associated symbols.

- K12 the basic principles of operation of the aircraft lighting system being worked on and the performance characteristics and function of the components within the system.
- K13 the various mechanical fasteners that are used and their method of removal and replacement (such as threaded fasteners, special securing devices).
- K14 the importance of using the specified fasteners for the installation and why they must not substitute others.
- K15 why securing devices need to be locked and labelled, and the different methods that are used to remove and install them.
- K16 the torque loading requirements of the fasteners, and what to do if these loadings are exceeded or not achieved.
- K17 the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking in of the connections.
- K18 the techniques used to remove components from aircraft lighting systems, without damage to the components or surrounding structure (such as release of pressures/force, proof marking, the need to protect the circuit integrity by covering and labelling exposed circuits).
- K19 the importance of applying Electrostatic Discharge (ESD) procedures when working on sensitive equipment or devices.
- K20 the need to correctly label and store components that require repair or overhaul and to check that replaced components have the correct part/identification markings.
- K21 the techniques used to position, align, adjust and secure the replaced components to the aircraft, without damage to the components or surrounding structure.
- K22 the quality control procedures to be followed during the removal and replacement operations.
- K23 procedures for ensuring they have the correct tools, equipment, components and fasteners for the activities.
- K24 methods of lifting, handling and supporting the components/equipment during the removal and replacement activities.
- K25 the use of seals, sealant and adhesives and anti-electrolysis barriers and the precautions to be taken.
- K26 why electrical bonding is critical and why it must be both mechanically and electrically secure.
- K27 how to conduct any necessary checks to ensure the system integrity, accuracy and quality of the removal and replacement.
- K28 the tools and equipment used in the removal and replacement activities and their calibration/care and control procedures.
- K29 why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities.
- K30 the problems that can occur with the removal and replacement operations and how these can be overcome.
- K31 how to recognise defects (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination).

- K32 the recording documentation to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation.
- K33 the procedure for the safe disposal of waste materials and scrap components.
- K34 the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve.

## **Unit 365**

# **Removing and replacing components of aircraft internal and external lighting systems**

## Supporting Information

### ***Unit guidance***

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

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

## Unit 366

## Modifying aircraft avionic systems

**GLH:** 175

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**Unit aim:**

This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.

This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to modify aircraft electrical/avionic systems, in accordance with approved procedures. In carrying out the modification operations, they will be required to follow laid-down procedures and to use specific modification leaflets, service bulletins and latest issue drawings and standards. It covers both fixed wing and rotary winged aircraft and they will be required to change, modify and update aircraft avionic systems, electrical power generation and distribution, internal and external lighting, indication and gauging, pitot static, communication, navigational, armament, passive warning and electronic countermeasure, infra-red and optical systems, radar, and flight guidance and control, as applicable to the aircraft type. They will be expected to remove and replace existing cables, add new cables, change breakout points and change the routeing of cables. They will also be expected to change components such as units and trays. They will need to show proficiency using various tools for cutting, stripping, crimping and soldering, and for the installation of the avionic systems.

Their responsibilities will require them to comply with organisational policy and procedures for the modifications undertaken, and to report any problems with the modification activities, components or equipment that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They will be expected to work with a minimum of supervision, taking full responsibility for their own actions and for the quality and accuracy of the work that they carry out.

Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying modification procedures to aircraft avionic systems. They will understand the modifications to be carried out, and their application, and will know about the modification methods, tools and equipment to be used, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring that the modification is carried out to the required specification.

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

Note This standard is intended to cover avionic modifications of a significant or complex nature. The level of complexity will include the size and

timescale of the modification, the tolerances required, the variety of equipment, techniques and materials required and the difficulty of access. It must not be used solely for simple modifications, such as changes to, or the addition of, a single wire/cable or termination.

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### Learning outcome

Performance Requirements

### Assessment criteria

The learner can:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines.
  - P2 demonstrate the required behaviours in line with the job role and organisational objectives.
  - P3 obtain and follow the relevant modification specifications and job instructions.
  - P4 confirm and agree what modifications are to be carried out to meet the specification.
  - P5 prepare the avionic system for the required modification.
  - P6 carry out the system modification, using approved materials, methods and procedures
  - P7 complete the modification within the agreed timescale.
  - P8 ensure that the modified avionic system meets the specified operating conditions.
  - P9 produce accurate and complete records of all modification work carried out.
  - P10 deal promptly and effectively with problems within their control, and report those that cannot be solved.
- 

### Learning outcome

The learner will:

- 1 carry out **all** of the following during the modification activities:
    - 1.1 obtain and use the appropriate documentation (such as job instructions, aircraft modification drawings, wiring diagrams, technical instructions, planning and quality control documentation, aircraft standards and specifications)
    - 1.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
    - 1.3 provide and maintain a safe working environment for the modification activities
    - 1.4 obtain the correct tools and equipment for the activity and check that they are in a safe, tested and usable condition and within current calibration date
    - 1.5 obtain clearance to work on the aircraft, and observe the power isolation and safety procedures
    - 1.6 use safe and approved modification techniques and procedures at all times
    - 1.7 where appropriate, apply Electrostatic Discharge (ESD) protection procedures
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- 1.8 return all tools and equipment to the correct location on completion of the activities
  - 1.9 dispose of waste items in a safe and environmentally acceptable manner
  - 1.10 leave the work area in a safe and appropriate condition, free from foreign object debris on completion of the activities.
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### Learning outcome

The learner will:

2 carry out modifications to **three** of the following aircraft avionic systems:

- 2.1 indication and gauging
  - 2.2 navigational
  - 2.3 infra-red and optical
  - 2.4 pitot static
  - 2.5 armament
  - 2.6 flight guidance and control
  - 2.7 radar
  - 2.8 communication
  - 2.9 electrical power generation and distribution
  - 2.10 passive warning and electronic countermeasure
  - 2.11 internal and external lighting
  - 2.12 ground proximity/obstacle avoidance
  - 2.13 other specific system.
- 

### Learning outcome

The learner will:

3 carry out **six** of the following types of modification:

- 3.1 replacing cables of different size or length
  - 3.2 software
  - 3.3 adding new looms
  - 3.4 changing or adding components to panels or sub-assemblies
  - 3.5 making changes to looms
  - 3.6 changing the position or angle of breakout points
  - 3.7 changing the position of electrical/avionic units
  - 3.8 making changes to cable terminations
  - 3.9 making changes to structure (such as framework, casings, panels)
  - 3.10 fitting new electrical/avionic systems
  - 3.11 changing the routes of cables
  - 3.12 removing cables
  - 3.13 adding/removing/replacing pitot static pipes
  - 3.14 adding cables.
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### Learning outcome

The learner will:

- 4 carry out **ten** of the following modification activities:
  - 4.1 soldering and de-soldering
  - 4.2 dismantling and re-assembling
  - 4.3 heat shrinking (devices and boots)
  - 4.4 stage checks of installed components (includes continuity checking)
  - 4.5 crimping (tags and pins)
  - 4.6 electrical bonding
  - 4.7 changing electrical/avionic trays
  - 4.8 updating firmware/software
  - 4.9 repositioning units
  - 4.10 stripping cable insulation
  - 4.11 removal cable protection
  - 4.12 removing and replacing cable end fittings
  - 4.13 adjusting or tuning/calibrating components
  - 4.14 changing components
  - 4.15 repositioning pitot static pipes security devices
  - 4.16 other specific process.

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### Learning outcome

The learner will:

- 5 modify avionic systems in compliance with **one** of the following:
  - 5.1 Military Aviation Authority (MAA)
  - 5.2 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
  - 5.3 BS, ISO or BSEN standards and procedures
  - 5.4 Aerospace Quality Management Standards (AS)
  - 5.5 specific system requirements
  - 5.6 Federal Aviation Authority (FAA)
  - 5.7 organisation standards and procedures
  - 5.8 manufacturers' standards and procedures.

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## Learning outcome

The learner will:

- 6 complete the relevant documentation, to include **one** from the following and pass it to the appropriate people:
  - 6.1 computer records
  - 6.2 record/history cards
  - 6.3 job cards
  - 6.4 aircraft service/flight log
  - 6.5 other specific recording method.

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## Learning outcome

Knowledge and understanding

### Assessment criteria

The learner must know and understand:

- K1 the specific safety precautions and procedures to be observed whilst carrying out the modifications to aircraft electrical/avionic systems (including any specific legislation, regulations or codes of practice relating to the activities, equipment or materials).
- K2 The importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to.
- K3 the importance of maintenance on and impact upon (Extended Twin Operations Procedures) ETOpS systems, legislation and local procedures.
- K4 the health and safety requirements of the work area in which they are carrying out the modification activities and the responsibility these requirements place on them.
- K5 the hazards associated with carrying out modifications to aircraft electrical/avionic systems and how to minimise them and reduce any risks.
- K6 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to.
- K7 the personal protective equipment and clothing (PPE) to be worn during the modification activities.
- K8 what constitutes a hazardous voltage and how to recognise victims of electric shock.
- K9 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers).
- K10 the various types of drawing and specification that are used during the modification.
- K11 how to identify the components to be used; component identification systems (such as codes and component orientation indicators).
- K12 preparations to be undertaken on the system prior to modification.
- K13 the importance of applying Electrostatic Discharge (ESD) procedures when working on sensitive equipment or devices.

- K14 the methods and techniques to be used for soldering and de-soldering, and the importance of adhering to the procedures.
- K15 the methods and techniques to be used for crimping and heat shrinking, and the importance of adhering to them.
- K16 the methods and techniques to be used for the assembly of screened and unscreened plugs and sockets.
- K17 how to identify the difference between composite and metal plugs and sockets.
- K18 the different types of cable protection, and reasons for each type.
- K19 the various mechanical fasteners that will be used and their method of installation.
- K20 the importance of using the specified fasteners for the modification and why they must not use substitutes.
- K21 the quality control procedures to be followed during the modification operations.
- K22 how to conduct any necessary checks to ensure the accuracy and quality of the modification.
- K23 how to recognise defects (such as misalignment, ineffective fasteners, foreign object damage or contamination).
- K24 the importance of ensuring that the completed modification is free from dirt, swarf and foreign object damage.
- K25 the methods and equipment used to transport, handle and lift components/looms into position and how to check that the equipment is within its current certification dates.
- K26 why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities.
- K27 the problems that can occur with the modification operations and how these can be overcome.
- K28 the recording documentation to be completed for the activities undertaken and where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation.
- K29 the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve.

## **Unit 366                      Modifying aircraft avionic systems**

### **Supporting Information**

#### ***Unit guidance***

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

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

## Unit 367

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

GLH

119

### Unit aim:

This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.

This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to test avionic indication and gauging components of aircraft systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft and includes aircraft systems associated with powerplant and auxiliary power units engine fuel and lubrication, flying controls, fluid power, wheels, brakes and steering, transmission systems, aircraft fuel systems, environmental control systems, ice and rain protection, and airframe systems and components, as applicable to the aircraft type. They will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the systems to be tested. The testing activities will include making all necessary checks and adjustments to ensure that components are correctly positioned and secured, and have the required range of movement, and will also include carrying out continuity and voltage checks, insulation checks, Built-In Test Equipment (BITE) tests, fuel gauging checks, content/level checks, comparison and functional checks.

Their responsibilities will require them to comply with organisational policy and procedures for the testing activities undertaken and to report any problems with these activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They will ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities and that all necessary job/task documentation is completed, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

Their underpinning knowledge will provide a good understanding of their work and will provide an informed approach to applying appropriate testing techniques and procedures for aircraft indication and gauging systems. They will understand the indication or gauging system under test and its application, and will know about the tools and equipment used, and the testing requirements, in adequate depth to provide a sound basis for carrying out the activities, and ensuring that the tested system performs to the required specification. They will understand the safety precautions required when carrying out the testing activities and when using the associated tools and equipment. They will be required to demonstrate safe

working practices throughout and will understand the responsibility they owe to themselves and others in the workplace.

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

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## Learning outcome

Performance Requirements

## Assessment criteria

The learner can:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines.
- P2 demonstrate the required behaviours in line with the job role and organisational objectives.
- P3 follow the appropriate procedures for use of tools and equipment to carry out the required tests.
- P4 set up and carry out the tests using the correct procedures and within agreed timescales.
- P5 record the results of the tests in the appropriate format.
- P6 review the results and carry out further tests if necessary.

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## Learning outcome

The learner will:

- 1 carry out **all** of the following during the testing of the avionic indication and gauging components:
  - 1.1 obtain and use the appropriate documentation (such as job instructions, aircraft avionic test procedures, quality control documentation, history sheets, flight logbook, aircraft standards and specifications).
  - 1.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work.
  - 1.3 provide and maintain a safe working environment for the testing activities.
  - 1.4 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration date.
  - 1.5 obtain clearance to work on the aircraft and observe all relevant isolation and safety procedures.
  - 1.6 ensure that safe working distance procedures are set up (where appropriate).
  - 1.7 where appropriate, apply Electrostatic Discharge (ESD) protection procedures.

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

The learner will:

- 2 carry out testing on **three** of the following aircraft indication and gauging systems:
    - 2.1 power plant (such as main engine power, auxiliary power, thrust reverse, propeller, starting, monitoring, fire)
    - 2.2 engine fuel, lubrication, air, cooling, control systems
    - 2.3 fluid power (such as hydraulic power generation, undercarriage, pneumatic or vacuum pressure)
    - 2.4 flying controls (such as flaps/slats, elevators, ailerons/ailerons, horizontal stabiliser, spoilers/speed brakes, wing sweep, reaction controls, rudder, rotor)
    - 2.5 wheels, brakes, steering
    - 2.6 transmission systems (such as main/auxiliary gear boxes)
    - 2.7 navigation systems
    - 2.8 aircraft fuel systems (such as supply, contents, transfer, venting system, fuel jettison, refuelling/de-fuelling)
    - 2.9 environmental control systems (such as pressure control, heating and ventilation, equipment air conditioning)
    - 2.10 ice and rain protection systems (such as windshield, engine protection, pitot static protection, ice accretion)
    - 2.11 fuselage (such as access panels, cargo doors, boundary layer, suction doors)
    - 2.12 other suitable indication and gauging system.
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### Learning outcome

The learner will:

- 3 test aircraft indication and gauging systems, using **three** of the following:
    - 3.1 external power supply source (electrical/hydraulic)
    - 3.2 'special-to-type' test sets
    - 3.3 internal power supply source (electrical/hydraulic)
    - 3.4 measuring equipment (such as multimeters, insulation testers)
    - 3.5 other test equipment (such as internal aircraft equipment)
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### Learning outcome

The learner will:

4 carry out **three** of the following types of test/check:

- 4.1 soak test
- 4.2 contents/level check
- 4.3 comparison check
- 4.4 functional check
- 4.5 voltage check
- 4.6 'special-to-type' tests
- 4.7 continuity check
- 4.8 BITE test.

#### Including the following:

4.9 a full system test that incorporates three of the above tests.

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### Learning outcome

The learner will:

5 carry out tests in compliance with **one** of the following:

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

### Learning outcome

The learner will:

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

- 6.1 computer records
  - 6.2 record/history cards
  - 6.3 job cards
  - 6.4 aircraft service/flight log
  - 6.5 other specific recording method.
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## Learning outcome

Knowledge and understanding

## Assessment criteria

The learner must know and understand:

- K1 the specific safety practices and procedures that they need to observe when testing aircraft indication and gauging systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials).
- K2 The importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to.
- K3 the importance of maintenance on and impact upon (Extended Twin Operations Procedures) ETOpS systems, legislation and local procedures.
- K4 the health and safety requirements of the work area where they are carrying out the activities, and the responsibility these requirements place on them.
- K5 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to.
- K6 the safety procedures that must be carried out before work is started on the aircraft.
- K7 the protective clothing and equipment (PPE) to be worn and where it can be obtained.
- K8 what constitutes a hazardous voltage and how to recognise victims of electric shock.
- K9 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers).
- K10 hazards associated with testing aircraft indication and gauging systems, and with the tools and equipment used, and how to minimise them and reduce any risks.
- K11 the correct operating procedures of the indication and gauging system being tested.
- K12 electrical bonding specifications and their importance.
- K13 how to extract and use information from engineering drawings and related specifications.
- K14 how to obtain the required test schedules and specifications for the system and aircraft type being tested and how to check their currency and validity.
- K15 how to read and interpret the test schedules and specifications, and from whom they can seek assistance if they have problems or issues regarding the test schedules or specifications.
- K16 the methods and procedures to be used to carry out the various tests on the aircraft indication or gauging system and its system components.
- K17 the importance of applying electrostatic discharge (ESD) procedures when working on sensitive equipment or devices.
- K18 the test equipment to be used and its selection and application for particular tests.
- K19 the calibration of test equipment (where applicable), and the requirement for currency/issue checks.
- K20 the techniques, methods and procedures to be used during the tests.

- K21 why equipment control is critical and what to do if a piece of equipment is unaccounted for on completion of the testing activities.
- K22 the basic principles of operation of the indication and gauging system under test and the function of the individual components within the system.
- K23 the importance of carrying out the tests in the specified sequence, checking all readings, movements and levels at each stage.
- K24 from whom to seek authorisation if they need to alter or change the test procedures.
- K25 how to record the results of each individual test and the documentation that must be used.
- K26 how to analyse the test results and how to make valid decisions about the acceptability of the system.
- K27 the procedures to be followed if the equipment or system fails to meet the test specification.
- K28 problems that can occur with the testing activities and how they can be overcome.
- K29 the problems that may cause errors or discrepancies with the test results and how to avoid these.
- K30 any required environmental controls relating to the testing.
- K31 the documentation to be completed at the end of the testing activities.
- K32 the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve.

## **Unit 367**

# **Carrying out tests on avionic indication and gauging components of aircraft systems**

## Supporting Information

### ***Unit guidance***

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

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

## Unit 368

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

GLH:

119

### Unit aim:

This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.

This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to test aircraft electrical power control, distribution and protection systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft, and includes aircraft electrical systems associated with AC main power generation, DC power generation, secondary/standby power generation, emergency power backup equipment and power distribution, as applicable to the aircraft type. They will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the systems to be tested. The testing activities will include making all necessary checks and adjustments to ensure that components are correctly and securely positioned, and have the required range of movement, and will also include carrying out continuity and voltage checks, Built-In Test Equipment (BITE) tests, emergency power failure, comparison and functional checks.

Their responsibilities will require them to comply with organisational policy and procedures for the testing activities undertaken and to report any problems with these activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They will ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

Their underpinning knowledge will provide a good understanding of their work and will provide an informed approach to applying appropriate testing techniques and procedures to aircraft electrical power control, distribution and protection systems. They will understand the electrical system under test and its application, and will know about the tools and equipment used, and the testing requirements, in adequate depth to provide a sound basis for carrying out the activities, and for ensuring that the tested system performs to the required specification. They will understand the safety precautions required when carrying out the testing activities and when using the associated tools and equipment. They will be required to demonstrate

safe working practices throughout and will understand the responsibility they owe to themselves and others in the workplace.

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

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### Learning outcome

Performance Requirements

### Assessment criteria

The learner can:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines.
- P2 demonstrate the required behaviours in line with the job role and organisational objectives.
- P3 follow the appropriate procedures for use of tools and equipment to carry out the required tests.
- P4 set up and carry out the tests using the correct procedures and within agreed timescales.
- P5 record the results of the tests in the appropriate format.
- P6 review the results and carry out further tests if necessary.

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### Learning outcome

The learner will:

- 1 carry out **all** of the following during the testing of the aircraft electrical power control, distribution and protection systems:
  - 1.1 obtain and use the appropriate documentation (such as job instructions, aircraft electrical test procedures, quality control documentation, history sheets, flight logbook, aircraft standards and specifications)
  - 1.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
  - 1.3 provide and maintain a safe working environment for the testing activities
  - 1.4 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration date
  - 1.5 obtain clearance to work on the aircraft, and observe all relevant isolation and safety procedures
  - 1.6 ensure that safe working distance procedures are set up (where appropriate)
  - 1.7 where appropriate, apply Electrostatic Discharge (ESD) protection procedures

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

### Learning outcome

The learner will:

- 2 carry out testing on **three** of the following aircraft electrical power control, distribution and protection systems:
    - 2.1 AC main power generation equipment
    - 2.2 DC power generation
    - 2.3 emergency power backup equipment
    - 2.4 secondary/standby power generation equipment
    - 2.5 power distribution equipment
    - 2.6 other specific equipment.
- 

### Learning outcome

The learner will:

- 3 test aircraft electrical power control, distribution and protection systems, using **three** of the following:
    - 3.1 external power supply source
    - 3.2 'special-to-type' test sets
    - 3.3 internal power supply source
    - 3.4 measuring equipment (such as multimeters, insulation testers)
    - 3.5 other test equipment (such as internal aircraft equipment).
- 

### Learning outcome

The learner will:

- 4 carry out **three** of the following types of test/check:
    - 4.1 soak test
    - 4.2 voltage check
    - 4.3 comparison check
    - 4.4 functional check
-

- 4.5 BITE test
- 4.6 'special-to-type' tests
- 4.7 continuity check
- 4.8 emergency power failure checks.

**Including the following:**

- 4.9 a full system test that incorporates three of the above tests.
- 

**Learning outcome**

The learner will:

- 5 carry out tests in compliance with **one** of the following
    - 5.1 Military Aviation Authority (MAA)
    - 5.2 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
    - 5.3 BS, ISO or BSEN standards and procedures
    - 5.4 Aerospace Quality Management Standards (AS)
    - 5.5 specific system requirements
    - 5.6 Federal Aviation Authority (FAA)
    - 5.7 organisation standards and procedures
    - 5.8 manufacturers' standards and procedures.
- 

**Learning outcome**

The learner will:

- 6 complete the relevant documentation, to include **one** from the following and pass it to the appropriate people:
    - 6.1 computer records
    - 6.2 record/history cards
    - 6.3 job cards
    - 6.4 aircraft service/flight log
    - 6.5 other specific recording method.
- 

**Learning outcome**

Knowledge and understanding

**Assessment criteria**

The learner must know and understand:

- K1 the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to.
-

- K2 the specific safety practices and procedures that they need to observe when testing aircraft electrical power control, distribution and protection systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials).
- K3 the importance of maintenance on and impact upon (Extended Twin Operations Procedures) ETOpS systems, legislation and local procedures.
- K4 the health and safety requirements of the work area where they are carrying out the activities and the responsibility these requirements place on them.
- K5 the safety procedures that must be carried out before work is started on the aircraft.
- K6 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to.
- K7 the protective clothing and equipment (PPE) to be worn and where it can be obtained.
- K8 hazards associated with testing aircraft electrical power control, distribution and protection systems, and with the tools and equipment used, and how to minimise them and reduce any risks.
- K9 what constitutes a hazardous voltage and how to recognise victims of electric shock.
- K10 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers).
- K11 the correct operating procedures of the electrical power control, distribution and protection systems being tested.
- K12 electrical bonding specifications and their importance.
- K13 how to extract and use information from engineering drawings and related specifications.
- K14 how to obtain the required test schedules and specifications for the system and aircraft type being tested and how to check their currency and validity.
- K15 how to read and interpret the test schedules and specifications, and from whom they can seek assistance if they have problems or issues regarding the test schedules or specifications.
- K16 the methods and procedures to be used to carry out the various tests on the aircraft electrical power control, distribution and protection systems and its system components.
- K17 the importance of applying Electrostatic Discharge (ESD) procedures when working on sensitive equipment or devices.
- K18 the test equipment to be used and its selection and application for particular tests.
- K19 the calibration of test equipment (where applicable) and the requirement for currency/issue checks.
- K20 the techniques, methods and procedures to be used during the tests.
- K21 why equipment control is critical and what to do if a piece of equipment is unaccounted for on completion of the testing activities
- K22 the basic principle of operation of the electrical power control, distribution and protection systems under test, and the function of the individual components within the system.

- K23 the importance of carrying out the tests in the specified sequence, checking all readings, movements and levels at each stage.
- K24 from whom to seek authorisation if they need to alter or change the test procedures.
- K25 how to record the results of each individual test and the documentation that must be used.
- K26 how to analyse the test results and how to make valid decisions about the acceptability of the system.
- K27 the procedures to be followed if the equipment or system fails to meet the test specification.
- K28 problems that can occur with the testing activities and how they can be overcome
- K29 the problems that may cause errors or discrepancies with the test results and how to avoid these
- K30 any required environmental controls relating to the testing.
- K31 the documentation to be completed at the end of the testing activities.
- K32 the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve.

## **Unit 368**

# **Carrying out tests on aircraft electrical power control, distribution and protection systems**

## Supporting Information

### ***Unit guidance***

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

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

## Unit 369

# Carrying out tests on aircraft pitot static systems

GLH: 119

### Unit aim:

This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.

This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to test aircraft pitot static systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft, and includes pitot static systems associated with height, speed, rate of climb, navigation, auto-pilot, flying control surfaces, ice and rain protection components, as applicable to the aircraft type. They will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the systems to be tested. The testing activities will include making all necessary checks and adjustments to ensure that components are correctly positioned and aligned and have the required range of movement, and carrying out Built-In Test Equipment (BITE) tests, functional checks, sense and leak tests and independent sense and leak tests.

Their responsibilities will require them to comply with organisational policy and procedures for the testing activities undertaken and to report any problems with these activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They will ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

Their underpinning knowledge will provide a good understanding of their work and will provide an informed approach to applying appropriate testing techniques and procedures for aircraft pitot static systems. They will understand the pitot static system under test and its application, and will know about the tools and equipment used, and the testing requirements, in adequate depth to provide a sound basis for carrying out the activities, and for ensuring that the tested system performs to the required specification. They will understand the safety precautions required when carrying out the testing activities and when using the associated tools and equipment. They will be required to demonstrate safe working practices throughout and will understand the responsibility they owe to themselves and others in the workplace.

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

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## Learning outcome

### Performance Requirements

## Assessment criteria

The learner can:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines.
- P2 demonstrate the required behaviours in line with the job role and organisational objectives.
- P3 follow the appropriate procedures for use of tools and equipment to carry out the required tests
- P4 set up and carry out the tests using the correct procedures and within agreed timescales.
- P5 record the results of the tests in the appropriate format.
- P6 review the results and carry out further tests if necessary.

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## Learning outcome

The learner will:

- 1 carry out **all** of the following during the testing of the pitot static systems:
  - 1.1 obtain and use the appropriate documentation (such as job instructions, aircraft pitot static test procedures, quality control documentation, history sheets, flight logbook, aircraft standards and specifications)
  - 1.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
  - 1.3 provide and maintain a safe working environment for the testing activities
  - 1.4 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration date
  - 1.5 obtain clearance to work on the aircraft and observe all relevant isolation and safety procedures
  - 1.6 ensure that safe working distance procedures are set up (where appropriate)
  - 1.7 where appropriate, apply Electrostatic Discharge (ESD) protection procedures
  - 1.8 carry out the tests using the specified techniques and procedures
  - 1.9 make any permitted adjustments to components and equipment, to bring the system to the specification requirements
  - 1.10 return all tools and equipment to the correct location on completion of the testing activities
  - 1.11 leave the aircraft and work area in a safe and appropriate condition, free from foreign object debris on completion of the activities

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### Learning outcome

The learner will:

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

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### Learning outcome

The learner will:

- 3 test aircraft pitot static systems, using **three** of the following:
  - 3.1 external power supply source
  - 3.2 'special-to-type' test sets
  - 3.3 internal power supply source
  - 3.4 measuring equipment (such as multimeters)
  - 3.5 other test equipment (such as pressure/suction equipment, internal aircraft equipment).

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### Learning outcome

The learner will:

- 4 carry out **three** of the following types of test/check:
  - 4.1 soak test
  - 4.2 BITE test
  - 4.3 'special-to-type' tests
  - 4.4 functional check
  - 4.5 comparison check
  - 4.6 sense and leak tests
  - 4.7 independent sense and leak test.

**Including the following:**

- 4.8 a full system test that incorporates three of the above tests.
- 

**Learning outcome**

The learner will:

- 5 carry out tests in compliance with **one** of the following:
- 5.1 Military Aviation Authority (MAA)
  - 5.2 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
  - 5.3 BS, ISO or BSEN standards and procedures
  - 5.4 Aerospace Quality Management Standards (AS)
  - 5.5 specific system requirements
  - 5.6 Federal Aviation Authority (FAA)
  - 5.7 organisation standards and procedures
  - 5.8 manufacturers' standards and procedures
- Learning outcome
- 

**Learning outcome**

The learner will:

- 6 complete the relevant documentation, to include **one** from the following and pass it to the appropriate people:
- 6.1 job cards
  - 6.2 computer records
  - 6.3 aircraft service/flight log
  - 6.4 aircraft log
  - 6.5 permit to work/formal risk assessment.

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## Learning outcome

Knowledge and understanding

## Assessment criteria

The learner must know and understand:

- K1 The importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to.
- K2 the specific safety practices and procedures that they need to observe when testing aircraft pitot static systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials).
- K3 the importance of maintenance on and impact upon (extended twin operations procedures) ETOpS systems, legislation and local procedures.
- K4 the health and safety requirements of the work area where they are carrying out the activities and the responsibility these requirements place on them.
- K5 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to.
- K6 the safety procedures that must be carried out before work is started on the aircraft.
- K7 the protective clothing and equipment (PPE) to be worn and where it can be obtained.
- K8 hazards associated with testing aircraft pitot static systems and with the tools and equipment used, and how to minimise them and reduce any risks.
- K9 what constitutes a hazardous voltage and how to recognise victims of electric shock.
- K10 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers).
- K11 the correct operating procedures of the pitot static system being tested.
- K12 electrical bonding specifications and their importance.
- K13 how to extract and use information from engineering drawings and related specifications.
- K14 how to obtain the required test schedules and specifications for the system and aircraft type being tested and how to check their currency and validity.
- K15 how to read and interpret the test schedules and specifications and from whom they can seek assistance if they have problems or issues regarding the test schedules or specifications.
- K16 the methods and procedures to be used to carry out the various tests on the aircraft pitot static system and its system components.
- K17 the test equipment to be used and its selection and application for particular tests.
- K18 the calibration of test equipment (where applicable) and the requirement for currency/issue checks.
- K19 the techniques, methods and procedures to be used during the tests.
- K20 the importance of applying Electrostatic Discharge (ESD) procedures when working on sensitive equipment or devices.

- K21 why equipment control is critical and what to do if a piece of equipment is unaccounted for on completion of the testing activities.
- K22 the basic principle of operation of the pitot static system under test and the function of the individual components within the system.
- K23 the importance of carrying out the tests in the specified sequence, checking all readings, movements and levels at each stage.
- K24 from whom to seek authorisation if they need to alter or change the test procedures.
- K25 how to record the results of each individual test and the documentation that must be used.
- K26 how to analyse the test results and how to make valid decisions about the acceptability of the system.
- K27 the procedures to be followed if the equipment or system fails to meet the test specification.
- K28 problems that can occur with the testing activities and how they can be overcome.
- K29 the problems that may cause errors or discrepancies with the test results and how to avoid these.
- K30 any required environmental controls relating to the testing.
- K31 the documentation to be completed at the end of the testing activities.
- K32 the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve.

## Unit 369

# Carrying out tests on aircraft pitot static systems

## Supporting Information

### ***Unit guidance***

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

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

## Unit 370

# Carrying out tests on aircraft communication systems

GLH: 119

### Unit aim:


This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.

This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to test aircraft communication systems, in accordance with approved procedures. It includes communication systems associated with intercom (clear), intercom (secure), high frequency (HF) radio, very high frequency (VHF) radio, ultra high frequency (UHF) radio, cockpit voice recorder, aircraft communication address reporting system (ACARS), cabin interphone systems, crash position indicators, digital data links, secure radio links, flight entertainment systems, Satellite Communications (SATCOM) and Selective Calling (SELCAL), as applicable to the aircraft type. They will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the systems to be tested. The testing activities will include making all necessary checks and adjustments, to ensure that components are correctly positioned and aligned and have the required range of movement, and will also include carrying out voltage checks, Built-In Test Equipment (BITE) tests, continuity checks, soak tests, distortion and sensitivity tests, power output and functional checks.

Their responsibilities will require them to comply with organisational policy and procedures for the testing activities undertaken and to report any problems with these activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

Their underpinning knowledge will provide a good understanding of their work and will provide an informed approach to applying appropriate testing techniques and procedures to aircraft communication systems. They will understand the communication system under test and its application, and will know about the tools and equipment used, and the testing requirements, in adequate depth to provide a sound basis for carrying out the activities, and for ensuring that the tested system performs to the required specification.

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



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

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### Learning outcome

Performance Requirements

### Assessment criteria

The learner can:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines.
  - P2 demonstrate the required behaviours in line with the job role and organisational objectives.
  - P3 follow the appropriate procedures for use of tools and equipment to carry out the required tests.
  - P4 set up and carry out the tests using the correct procedures and within agreed timescales.
  - P5 record the results of the tests in the appropriate format.
  - P6 review the results and carry out further tests if necessary.
- 

### Learning outcome

The learner will:

- 1 carry out **all** of the following during the testing of the aircraft communication systems:
    - 1.1 obtain and use the appropriate documentation (such as job instructions, aircraft communication equipment test procedures, quality control documentation, history sheets, flight logbook, aircraft standards and specifications)
    - 1.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
    - 1.3 provide and maintain a safe working environment for the testing activities
    - 1.4 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration date
    - 1.5 obtain clearance to work on the aircraft and observe all relevant isolation and safety procedures
    - 1.6 ensure that safe working distance procedures are set up (where appropriate)
    - 1.7 where appropriate, apply electrostatic discharge (ESD) protection procedures
    - 1.8 carry out the tests using the specified techniques and procedures
    - 1.9 make any permitted adjustments to components and equipment, to bring the system to the specification requirements
-

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

### Learning outcome

The learner will:

- 2 carry out testing on **three** of the following aircraft communication systems:
    - 2.1 VHF radio
    - 2.2 cockpit voice recorder
    - 2.3 flight entertainment systems
    - 2.4 intercom (clear)
    - 2.5 SATCOM
    - 2.6 SELCAL
    - 2.7 secure radio links
    - 2.8 intercom (secure speech)
    - 2.9 crash position indicators
    - 2.10 HF radio
    - 2.11 digital data links
    - 2.12 telecommunications
    - 2.13 UHF radio
    - 2.14 satellite position systems
    - 2.15 cabin interphone systems
    - 2.16 identification friend or foe (IFF)
    - 2.17 aircraft communication address reporting system (ACARS).
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### Learning outcome

The learner will:

- 3 test aircraft communication systems, using **three** of the following:
    - 3.1 external power supply source
    - 3.2 'special-to-type' test sets
    - 3.3 internal power supply source
    - 3.4 measuring equipment (such as multimeters, SINAD meters)
    - 3.5 other test equipment (such as headset, voltage standing wave ratio (VSWR) equipment, signal generator, databus test equipment, internal aircraft equipment).
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### Learning outcome

The learner will:

- 4 carry out **three** of the following types of test/check:
  - 4.1 soak test
  - 4.2 BITE test
  - 4.3 receiver sensitivity
  - 4.4 functional check
  - 4.5 distortion checks
  - 4.6 signal-to-noise checks
  - 4.7 continuity check
  - 4.8 VSWR checks
  - 4.9 pressure checks
  - 4.10 bonding tests
  - 4.11 power output
  - 4.12 'special-to-type' tests

#### Including the following:

- 4.13 a full system test that incorporates three of the above tests.
- 

### Learning outcome

The learner will:

- 5 carry out tests in compliance with **one** of the following:
    - 5.1 Military Aviation Authority (MAA)
    - 5.2 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
    - 5.3 BS, ISO or BSEN standards and procedures
    - 5.4 Aerospace Quality Management Standards (AS)
    - 5.5 specific system requirements
    - 5.6 Federal Aviation Authority (FAA)
    - 5.7 organisation standards and procedures
    - 5.8 manufacturers' standards and procedures.
- 

### Learning outcome

The learner will:

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

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

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## Learning outcome

Knowledge and understanding

### Assessment criteria

- K1 the specific safety practices and procedures that they need to observe when testing aircraft communication systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials).
- K2 The importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to.
- K3 the importance of maintenance on, and impact upon (extended twin operations procedures) ETOpS systems, legislation and local procedures.
- K4 the health and safety requirements of the work area where they are carrying out the activities and the responsibility these requirements place on them.
- K5 the safety procedures that must be carried out before work is started on the aircraft.
- K6 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to.
- K7 the protective clothing and equipment (PPE) to be worn and where it can be obtained.
- K8 hazards associated with testing aircraft communication systems, and with the tools and equipment used, and how to minimise them and reduce any risks.
- K9 what constitutes a hazardous voltage and how to recognise victims of electric shock.
- K10 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers).
- K11 the correct operating procedures of the communication system being tested.
- K12 electrical bonding specifications and their importance.
- K13 how to extract and use information from engineering drawings and related specifications.
- K14 how to obtain the required test schedules and specifications for the system and aircraft type being tested and how to check their currency and validity.
- K15 how to read and interpret the test schedules and specifications, and from whom they can seek assistance if they have problems or issues regarding the test schedules or specifications.
- K16 the methods and procedures to be used to carry out the various tests on the aircraft communication system and its system components.
- K17 the importance of applying electrostatic discharge (ESD) procedures when working on sensitive equipment or devices.
- K18 the test equipment to be used and its selection and application for particular tests.
- K19 the calibration of test equipment (where applicable) and the requirement for currency/issue checks.
- K20 the techniques, methods and procedures to be used during the tests.
- K21 why equipment control is critical and what to do if a piece of equipment is unaccounted for on completion of the testing activities.

- K22 the basic principle of operation of the communication system under test and the function of the individual components within the system.
- K23 the importance of carrying out the tests in the specified sequence, checking all readings, movements and levels at each stage.
- K24 from whom to seek authorisation if they need to alter or change the test procedures.
- K25 how to record the results of each individual test and the documentation that must be used.
- K26 how to analyse the test results and how to make valid decisions about the acceptability of the system.
- K27 the procedures to be followed if the equipment or system fails to meet the test specification.
- K28 problems that can occur with the testing activities and how they can be overcome.
- K29 the problems that may cause errors or discrepancies with the test results and how to avoid these.
- K30 any required environmental controls relating to the testing.
- K31 the documentation to be completed at the end of the testing activities.
- K32 the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve.

## Unit 370

# Carrying out tests on aircraft communication systems

## Supporting Information

### ***Unit guidance***

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

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

## Unit 371

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

GLH: 119

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### Unit aim:

This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.

This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to test aircraft passive warning and electronic optical/surveillance systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft, and includes passive warning and optical surveillance systems associated with acoustics, sound navigation and ranging (SONAR), radar homing and warning receivers (RHWR), collision and ground avoidance, wet, digital, video and infra-red cameras, recording and LASER systems, as applicable to the aircraft type. They will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the systems to be tested. The testing activities will include making all necessary checks and adjustments to ensure that components are correctly positioned and aligned and have the required range of movement, and will also include carrying out voltage checks, receiver sensitivity, range checks, video/media playback, Built-In Test Equipment (BITE) tests, continuity checks, and functional checks.

Their responsibilities will require them to comply with organisational policy and procedures for the testing activities undertaken, and to report any problems with these activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They will ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

Their underpinning knowledge will provide a good understanding of their work and will provide an informed approach to applying appropriate testing techniques and procedures to aircraft passive warning and optical/surveillance systems. They will understand the passive warning and optical surveillance system under test, and its application, and will know about the tools and equipment used, and the testing requirements, in adequate depth to provide a sound basis for carrying out the activities, and for ensuring that the tested system performs to the required specification. They will understand the safety precautions required when carrying out the testing activities and when using the associated tools and equipment. They will be required to demonstrate safe working practices throughout and will

understand the responsibility they owe to themselves and others in the workplace.

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

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### Learning outcome

Performance Requirements

### Assessment criteria

The learner can:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines.
- P2 demonstrate the required behaviours in line with the job role and organisational objectives.
- P3 follow the appropriate procedures for use of tools and equipment to carry out the required tests.
- P4 set up and carry out the tests using the correct procedures and within agreed timescales.
- P5 record the results of the tests in the appropriate format.
- P6 review the results and carry out further tests if necessary.

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### Learning outcome

The learner will:

- 1 carry out **all** of the following during the testing of the aircraft passive warning and optical/surveillance systems:
  - 1.1 obtain and use the appropriate documentation (such as job instructions, aircraft passive warning and optical surveillance test procedures, quality control documentation, history sheets, flight logbook, aircraft standards and specifications)
  - 1.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
  - 1.3 provide and maintain a safe working environment for the testing activities
  - 1.4 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration date
  - 1.5 obtain clearance to work on the aircraft, and observe all relevant isolation and safety procedures
  - 1.6 ensure that safe working distance procedures are set up (where appropriate)
  - 1.7 where appropriate, apply electrostatic discharge (ESD) protection procedures

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

### Learning outcome

The learner will:

- 2 carry out testing on **three** of the following aircraft passive warning and optical/surveillance systems:
    - 2.1 acoustics
    - 2.2 collision avoidance
    - 2.3 video/media recording systems
    - 2.4 air data recording
    - 2.5 ground avoidance
    - 2.6 LASER systems
    - 2.7 cockpit voice recording systems
    - 2.8 radar homing and warning receivers (RHWR)
    - 2.9 sound navigation and ranging (SONAR)
    - 2.10 camera systems (wet film, digital or infra-red)
    - 2.11 other specific optical and surveillance system.
- 

### Learning outcome

The learner will:

- 3 test aircraft passive warning and optical/surveillance systems, using **three** of the following:
    - 3.1 external power supply source (Electrical/Hydraulic)
    - 3.2 'special-to-type' test sets
    - 3.3 internal power supply source (Electrical/Hydraulic)
    - 3.4 measuring equipment (such as multimeters)
    - 3.5 other test equipment (such as headset, clinometer, databus test equipment, video playback, photographic developers, internal aircraft equipment).
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### Learning outcome

The learner will:

4 carry out **three** of the following types of test/check:

- 4.1 voltage standing wave ratio (VSWR) checks
- 4.2 bonding tests
- 4.3 continuity checks
- 4.4 alignment checks
- 4.5 voltage checks
- 4.6 'special-to-type' tests
- 4.7 soak test
- 4.8 range checks
- 4.9 receiver sensitivity
- 4.10 functional check
- 4.11 BITE test
- 4.12 video/media playback
- 4.13 safety interlock checks
- 4.14 signal injection tests
- 4.15 photographic development

#### Including the following:

4.16 a full system test that incorporates three of the above tests.

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### Learning outcome

The learner will:

5 carry out tests in compliance with **one** of the following:

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

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## Learning outcome

The learner will:

- 6 complete the relevant documentation, to include **one** from the following and pass it to the appropriate people:
  - 6.1 job cards
  - 6.2 computer records
  - 6.3 aircraft service/flight log
  - 6.4 aircraft log
  - 6.5 permit to work/formal risk assessment.

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## Learning outcome

Knowledge and understanding

### Assessment criteria

The learner must know and understand:

- K1 the specific safety practices and procedures that they need to observe when testing aircraft passive warning and optical/surveillance systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials).
- K2 The importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to.
- K3 the importance of maintenance on, and impact upon (extended twin operations procedures) ETOpS systems, legislation and local procedures.
- K4 the health and safety requirements of the work area where they are carrying out the activities and the responsibility these requirements place on them.
- K5 the safety procedures that must be carried out before work is started on the aircraft.
- K6 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to.
- K7 the protective clothing and equipment (PPE) to be worn and where it can be obtained.
- K8 hazards associated with testing aircraft passive warning and optical/surveillance systems, and with the tools and equipment used, and how to minimise them and reduce any risks.
- K9 what constitutes a hazardous voltage and how to recognise victims of electric shock.
- K10 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers).
- K11 the correct operating procedures of the passive warning and optical/surveillance system being tested.
- K12 electrical bonding specifications and their importance.
- K13 how to extract and use information from engineering drawings and related specifications.

- K14 how to obtain the required test schedules and specifications for the system and aircraft type being tested, and how to check their currency and validity.
- K15 how to read and interpret the test schedules and specifications, and from whom they can seek assistance if they have problems or issues regarding the test schedules or specifications.
- K16 the methods and procedures to be used to carry out the various tests on the aircraft passive warning and optical/surveillance system components.
- K17 the importance of applying electrostatic discharge (ESD) procedures when working on sensitive equipment or devices.
- K18 the test equipment to be used, and its selection and application for particular tests.
- K19 the calibration of test equipment (where applicable) and the requirement for currency/issue checks.
- K20 the techniques, methods and procedures to be used during the tests.
- K21 why equipment control is critical and what to do if a piece of equipment is unaccounted for on completion of the testing activities.
- K22 the basic principle of operation of the passive warning and optical/surveillance system under test and the function of the individual components within the system.
- K23 the importance of carrying out the tests in the specified sequence, checking all readings, movements and levels at each stage.
- K24 from whom to seek authorisation if they need to alter or change the test procedures.
- K25 how to record the results of each individual test and the documentation that must be used for this.
- K26 how to analyse the test results and how to make valid decisions about the acceptability of the system.
- K27 the procedures to be followed if the equipment or system fails to meet the test specification.
- K28 problems that can occur with the testing activities and how they can be overcome.
- K29 the problems that may cause errors or discrepancies with the test results and how to avoid these.
- K30 any required environmental controls relating to the testing.
- K31 the documentation to be completed at the end of the testing activities.
- K32 the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve.

## Unit 371

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

## Supporting Information

### ***Unit guidance***

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

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

## Unit 372

# Carrying out tests on aircraft radar systems

**GLH:** 119

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**Unit aim:**

This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.

This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to test aircraft radar systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft, and includes systems associated with surveillance radar, weather radar, obstacle warning systems (such as enhanced ground proximity warning systems - EGPWS), towed radar decoys, radar (radio) altimeter, tactical air navigation (TACAN), identification friend or foe (IFF), Doppler, and radar jamming devices, as applicable to the aircraft type. They will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the systems to be tested. The testing activities will include making all necessary checks and adjustments, to ensure that components are correctly positioned and aligned and have the required range of movement, and will also include carrying out tests such as Built-In Test Equipment (BITE) tests, continuity checks, distortion and range checks, receiver sensitivity, voltage standing wave ratio (VSWR) checks and functional checks.

Their responsibilities will require them to comply with organisational policy and procedures for the testing activities undertaken and to report any problems with these activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They will ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

Their underpinning knowledge will provide a good understanding of their work and will provide an informed approach to applying appropriate testing techniques and procedures to aircraft radar systems. They will understand the radar system under test and its application, and will know about the tools and equipment used, and the testing requirements, in adequate depth to provide a sound basis for carrying out the activities, and for ensuring that the tested system performs to the required specification.

They will understand the safety precautions required when carrying out the testing activities and when using the associated tools and equipment. They will be required to demonstrate safe working practices throughout and will

understand the responsibility they owe to themselves and others in the workplace.

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

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### Learning outcome

Performance Requirements

### Assessment criteria

The learner can:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines.
- P2 demonstrate the required behaviours in line with the job role and organisational objectives.
- P3 follow the appropriate procedures for use of tools and equipment to carry out the required tests.
- P4 set up and carry out the tests using the correct procedures and within agreed timescales.
- P5 record the results of the tests in the appropriate format.
- P6 review the results and carry out further tests if necessary.

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### Learning outcome

The learner will:

- 1 carry out **all** of the following during the testing of the aircraft radar systems:
  - 1.1 obtain and use the appropriate documentation (such as job instructions, aircraft radar test procedures, quality control documentation, history sheets, flight logbook, aircraft standards and specifications)
  - 1.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
  - 1.3 provide and maintain a safe working environment for the testing activities
  - 1.4 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration date
  - 1.5 obtain clearance to work on the aircraft and observe all relevant isolation and safety procedures
  - 1.6 ensure that safe working distance procedures are set up (where appropriate)
  - 1.7 where appropriate, apply electrostatic discharge (ESD) protection procedures
  - 1.8 carry out the tests using the specified techniques and procedures

- 1.9 make any permitted adjustments to components and equipment, to bring the system to the specification requirements
  - 1.10 return all tools and equipment to the correct location on completion of the testing activities
  - 1.11 leave the aircraft and work area in a safe and appropriate condition, free from foreign object debris on completion of the activities.
- 

### Learning outcome

The learner will:

- 2 carry out testing on **three** of the following aircraft radar systems:
    - 2.1 surveillance radar
    - 2.2 radar jamming
    - 2.3 towed radar decoys
    - 2.4 obstacle warning systems
    - 2.5 radar (radio) altimeter (RADALT)
    - 2.6 identification friend or foe (IFF)
    - 2.7 Doppler
    - 2.8 tactical air navigation (TACAN)
    - 2.9 enhanced ground proximity warning system (EGPWS)
    - 2.10 weather radar/predictive wind shear
    - 2.11 supplementary surveillance radar
    - 2.12 traffic collision avoidance system (TCAS)
    - 2.13 other specific radar system.
- 

### Learning outcome

The learner will:

- 3 test aircraft radar systems, using **three** of the following:
    - 3.1 external power supply source (Electrical/Hydraulic)
    - 3.2 'special-to-type' test sets
    - 3.3 internal power supply source (Electrical/Hydraulic)
    - 3.4 measuring equipment (such as multimeters)
    - 3.5 other test equipment (such as dummy load, delay lines, pressure tester (hydraulic, pneumatic, coolant), databus test equipment, internal aircraft equipment).
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### Learning outcome

The learner will:

4 carry out **three** of the following types of test/check:

- 4.1 soak test
- 4.2 distortion checks
- 4.3 receiver sensitivity
- 4.4 functional check
- 4.5 voltage standing wave ratio (VSWR) checks
- 4.6 signal to noise checks
- 4.7 continuity check
- 4.8 range checks
- 4.9 continuity checks
- 4.10 bonding tests
- 4.11 LRU replacement test
- 4.12 'special-to-type' tests
- 4.13 BITE test

#### Including the following:

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

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### Learning outcome

The learner will:

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

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

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## Learning outcome

The learner will:

- 6 complete the relevant documentation, to include **one** from the following and pass it to the appropriate people:
  - 6.1 job cards
  - 6.2 computer records
  - 6.3 aircraft service/flight log
  - 6.4 aircraft log
  - 6.5 permit to work/formal risk assessment.

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## Learning outcome

Knowledge and understanding

### Assessment criteria

The learner must know and understand:

- K1 the specific safety practices and procedures that they need to observe when testing aircraft radar systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials).
- K2 the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to.
- K3 the importance of maintenance on, and impact upon (extended twin operations procedures) ETOpS systems, legislation and local procedures.
- K4 the health and safety requirements of the work area where they are carrying out the activities and the responsibility these requirements place on them.
- K5 the safety procedures that must be carried out before work is started on the aircraft.
- K6 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to.
- K7 the protective clothing and equipment (PPE) to be worn and where it can be obtained.
- K8 hazards associated with testing aircraft radar systems, and with the tools and equipment used, and how to minimise them and reduce any risks.
- K9 what constitutes a hazardous voltage and how to recognise victims of electric shock.
- K10 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers).
- K11 the correct operating procedures of the radar system being tested.
- K12 electrical bonding specifications and their importance.
- K13 how to extract and use information from engineering drawings and related specifications.
- K14 how to obtain the required test schedules and specifications for the system and aircraft type being tested and how to check their currency and validity.

- K15 how to read and interpret the test schedules and specifications, and from whom they can seek assistance if they have problems or issues regarding the test schedules or specifications.
- K16 the methods and procedures to be used to carry out the various tests on the aircraft radar system and its system components.
- K17 the importance of applying electrostatic discharge (ESD) procedures when working on sensitive equipment or devices.
- K18 the test equipment to be used and its selection and application for particular tests.
- K19 the calibration of test equipment (where applicable) and the requirement for currency/issue checks.
- K20 the techniques, methods and procedures to be used during the tests.
- K21 why equipment control is critical and what to do if a piece of equipment is unaccounted for on completion of the testing activities.
- K22 the basic principle of operation of the radar system under test and the function of the individual components within the system.
- K23 the importance of carrying out the tests in the specified sequence, checking all readings, movements and levels at each stage.
- K24 from whom to seek authorisation if they need to alter or change the test procedures.
- K25 how to record the results of each individual test and the documentation that must be used.
- K26 how to analyse the test results and how to make valid decisions about the acceptability of the system.
- K27 the procedures to be followed if the equipment or system fails to meet the test specification.
- K28 problems that can occur with the testing activities and how they can be overcome.
- K29 the problems that may cause errors or discrepancies with the test results and how to avoid these.
- K30 any required environmental controls relating to the testing.
- K31 the documentation to be completed at the end of the testing activities.
- K32 the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve.

## Unit 372

## Carrying out tests on aircraft radar systems

### Supporting Information

#### ***Unit guidance***

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

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

## Unit 373

# Carrying out tests on aircraft navigational and computing systems

GLH: 119

### Unit aim:

This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.

This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to test aircraft navigational and computing systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft and includes navigational systems associated with distance measuring equipment (DME), very high frequency omnidirectional range (VOR), instrument landing system (ILS), auto direction finder (ADF), global positioning system (GPS), Doppler, long range aid navigation (LORAN), homing, radio altimeter, inertial navigation system and compass, as applicable to the aircraft type. They will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the systems to be tested. The testing activities will include making all necessary checks and adjustments, to ensure that components are correctly positioned and aligned and have the required range of movement, and will also include carrying out voltage checks, Built-In Test Equipment (BITE) tests, continuity checks, power output, distortion checks, distant object test, standard serviceability and functional checks.

Their responsibilities will require them to comply with organisational policy and procedures for the testing activities undertaken and to report any problems with these activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They will ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for your own actions and for the quality and accuracy of the work that they carry out.

Their underpinning knowledge will provide a good understanding of their work and will provide an informed approach to applying appropriate testing techniques and procedures to aircraft navigational systems. They will understand the navigational system under test, and its application, and will know about the tools and equipment used, and the testing requirements, in adequate depth to provide a sound basis for carrying out the activities, and for ensuring that the tested system performs to the required specification.

They will understand the safety precautions required when carrying out the testing activities and when using the associated tools and equipment. They

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

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

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## Learning outcome

### Performance Requirements

### Assessment criteria

The learner can:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines.
- P2 demonstrate the required behaviours in line with the job role and organisational objectives.
- P3 follow the appropriate procedures for use of tools and equipment to carry out the required tests.
- P4 set up and carry out the tests using the correct procedures and within agreed timescales.
- P5 record the results of the tests in the appropriate format.

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## Learning outcome

The learner will:

- 1 carry out **all** of the following during the testing of the aircraft navigational and computing systems:
  - 1.1 obtain and use the appropriate documentation (such as job instructions, aircraft radar test procedures, quality control documentation, history sheets, flight logbook, aircraft standards and specifications)
  - 1.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
  - 1.3 provide and maintain a safe working environment for the testing activities
  - 1.4 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration date
  - 1.5 obtain clearance to work on the aircraft and observe all relevant isolation and safety procedures
  - 1.6 ensure that safe working distance procedures are set up (where appropriate)
  - 1.7 where appropriate, apply electrostatic discharge (ESD) protection procedures

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

### Learning outcome

The learner will:

- 2 carry out testing on **three** of the following aircraft navigational and computing systems:
    - 2.1 distance measuring equipment (DME)
    - 2.2 re-transmission systems
    - 2.3 very high frequency omni-directional range (VOR)
    - 2.4 Doppler
    - 2.5 instrument landing system (ILS)
    - 2.6 homing
    - 2.7 auto direction finder (ADF)
    - 2.8 gyro
    - 2.9 global positioning system (GPS)
    - 2.10 long range navigation (LORAN)
    - 2.11 compass
    - 2.12 inertial navigation system
    - 2.13 computing sub-systems
    - 2.14 tactical air communication and navigation system (TACAN)
    - 2.15 microwave landing system (MLS)
    - 2.16 other specific aircraft navigational and computing system.
- 

### Learning outcome

The learner will:

- 3 test aircraft navigational and computing systems, using **three** of the following:
    - 3.1 external power supply source (electrical/hydraulic)
    - 3.2 'special-to-type' test sets
    - 3.3 internal power supply source (electrical/hydraulic)
    - 3.4 measuring equipment (such as multimeters, SINAD Meters)
    - 3.5 other test equipment (such as oscilloscope, signal generator, databus test equipment, internal aircraft equipment).
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### Learning outcome

The learner will:

- 4 carry out **three** of the following types of test/check:
  - 4.1 soak test
  - 4.2 BITE test
  - 4.3 signal-to-noise checks
  - 4.4 functional check
  - 4.5 distortion checks
  - 4.6 continuity checks
  - 4.7 bonding tests
  - 4.8 power output
  - 4.9 'special-to-type' tests
  - 4.10 standard serviceability checks
  - 4.11 compass swing
  - 4.12 TDR checks
  - 4.13 LRU alignment
  - 4.14 distant object test
  - 4.15 databus test
  - 4.16 receiver sensitivity
  - 4.17 applying a dummy load
  - 4.18 signal injection tests
  - 4.19 voltage standing wave ratio (VSWR) checks

### Including the following:

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

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### Learning outcome

The learner will:

- 5 carry out tests on aircraft navigational and computing systems in compliance with the following:
  - 5.1 Military Aviation Authority (MAA)
  - 5.2 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
  - 5.3 BS, ISO or BSEN standards and procedures
  - 5.4 Aerospace Quality Management Standards (AS)
  - 5.5 specific system requirements
  - 5.6 Federal Aviation Authority (FAA)
  - 5.7 organisation standards and procedures

## 5.8 manufacturers' standards and procedures.

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### Learning outcome

The learner will:

- 6 complete the relevant documentation, to include **one** from the following and pass it to the appropriate people:
    - 6.1 job cards
    - 6.2 computer records
    - 6.3 aircraft service/flight log
    - 6.4 aircraft log
    - 6.5 permit to work/formal risk assessment.
- 

### Learning outcome

Knowledge and understanding

### Assessment criteria

The learner must know and understand:

- K1 the specific safety practices and procedures that they need to observe when testing aircraft navigational and computing systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
  - K2 The importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to.
  - K3 the importance of maintenance on, and impact upon (extended twin operations procedures) ETOpS systems, legislation and local procedures.
  - K4 the health and safety requirements of the work area where they are carrying out the activities and the responsibility these requirements place on them.
  - K5 the safety procedures that must be carried out before work is started on the aircraft.
  - K6 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to.
  - K7 the protective clothing and equipment (PPE) to be worn and where it can be obtained.
  - K8 hazards associated with testing aircraft navigational and computing systems, and with the tools and equipment used, and how to minimise them and reduce any risks.
  - K9 what constitutes a hazardous voltage and how to recognise victims of electric shock
  - K10 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers).
  - K11 the correct operating procedures of the navigational and computing system being tested.
  - K12 electrical bonding specifications and their importance.
-

- K13 how to extract and use information from engineering drawings and related specifications.
- K14 how to obtain the required test schedules and specifications for the system and aircraft type being tested and how to check their currency and validity.
- K15 how to read and interpret the test schedules and specifications, and from whom they can seek assistance if they have problems or issues regarding the test schedules or specifications.
- K16 the methods and procedures to be used to carry out the various tests on the aircraft radar navigational and computing system and its system components.
- K17 the importance of applying electrostatic discharge (ESD) procedures when working on sensitive equipment or devices.
- K18 the test equipment to be used and its selection and application for particular tests.
- K19 the calibration of test equipment (where applicable) and the requirement for currency/issue checks.
- K20 the techniques, methods and procedures to be used during the tests.
- K21 why equipment control is critical and what to do if a piece of equipment is unaccounted for on completion of the testing activities.
- K22 the basic principle of operation of the radar system under test and the function of the individual components within the system.
- K23 the importance of carrying out the tests in the specified sequence, checking all readings, movements and levels at each stage.
- K24 from whom to seek authorisation if they need to alter or change the test procedures.
- K25 how to record the results of each individual test and the documentation that must be used.
- K26 how to analyse the test results and how to make valid decisions about the acceptability of the system.
- K27 the procedures to be followed if the equipment or system fails to meet the test specification.
- K28 problems that can occur with the testing activities and how they can be overcome.
- K29 the problems that may cause errors or discrepancies with the test results and how to avoid these.
- K30 any required environmental controls relating to the testing.
- K31 the documentation to be completed at the end of the testing activities.
- K32 the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve.

## **Unit 373**

# **Carrying out tests on aircraft navigational and computing systems**

## Supporting Information

### ***Unit guidance***

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

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

## Unit 374

# Carrying out tests on aircraft flight guidance and control systems

GLH: 119

### Unit aim:

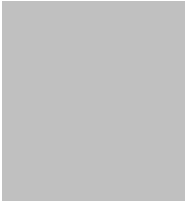
This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.

This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to test aircraft flight guidance and control systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft, and includes flight guidance and control systems associated with fly-by-wire, gyros, autopilot, flight director, and AFCS (Automatic Flying Control System), angle of attack and nose wheel steering, as applicable to the aircraft type. They will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the systems to be tested. The testing activities will include making all necessary checks and adjustments, to ensure that components are correctly positioned and aligned and have the required range of movement, and will also include carrying out voltage checks, Built-In Test Equipment (BITE) tests, continuity checks, 'special-to-type' tests and functional checks.

Their responsibilities will require them to comply with organisational policy and procedures for the testing activities undertaken and to report any problems with these activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They will ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities and that all necessary job/task documentation is completed, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

Their underpinning knowledge will provide a good understanding of their work and will provide an informed approach to applying appropriate testing techniques and procedures to aircraft flight guidance and control systems. They will understand the flight guidance and control system under test, and its application, and will know about the tools and equipment used, and the testing requirements, in adequate depth to provide a sound basis for carrying out the activities, and for ensuring that the tested system performs to the required specification.

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



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

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### Learning outcome

Performance Requirements

### Assessment criteria

The learner can:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines.
  - P2 demonstrate the required behaviours in line with the job role and organisational objectives.
  - P3 follow the appropriate procedures for use of tools and equipment to carry out the required tests.
  - P4 set up and carry out the tests using the correct procedures and within agreed timescales.
  - P5 record the results of the tests in the appropriate format.
- 

### Learning outcome

The learner will:

- 1 carry out **all** of the following during the testing of the aircraft flight guidance and control systems:
    - 1.1 obtain and use the appropriate documentation (such as job instructions, aircraft flight guidance and control test procedures, quality control documentation, history sheets, flight logbook, aircraft standards and specifications).
    - 1.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work.
    - 1.3 provide and maintain a safe working environment for the testing activities.
    - 1.4 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration date.
    - 1.5 obtain clearance to work on the aircraft and observe all relevant isolation and safety procedures.
    - 1.6 ensure that safe working distance procedures are set up (where appropriate).
    - 1.7 where appropriate, apply electrostatic discharge (ESD) protection procedures.
    - 1.8 carry out the tests using the specified techniques and procedures.
-

- 1.9 make any permitted adjustments to components and equipment, to bring the system to the specification requirements.
  - 1.10 return all tools and equipment to the correct location on completion of the testing activities.
  - 1.11 leave the aircraft and work area in a safe and appropriate condition, free from foreign object debris on completion of the activities.
- 

### Learning outcome

The learner will:

- 2 carry out testing on **three** of the following aircraft flight guidance and control systems:
    - 2.1 fly-by-wire
    - 2.2 automatic flying control system (AFCS)
    - 2.3 auto-pilot
    - 2.4 angle of attack/stall warning
    - 2.5 flight director
    - 2.6 nose wheel steering
    - 2.7 turn and slip indication
    - 2.8 main gear steering
    - 2.9 gyros
    - 2.10 other specific aircraft flight guidance and control system.
- 

### Learning outcome

The learner will:

- 3 test aircraft flight guidance and control systems, using **three** of the following:
    - 3.1 external power supply source (electrical/hydraulic)
    - 3.2 'special-to-type' test sets
    - 3.3 internal power supply source (electrical/hydraulic)
    - 3.4 measuring equipment (such as multimeters)
    - 3.5 other test equipment (such as headset, clinometer, databus test equipment, pantographs, tilt tables, internal aircraft equipment).
-

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### Learning outcome

The learner will:

4 carry out **three** of the following types of test/check:

- 4.1 soak test
- 4.2 BITE test
- 4.3 audio warning
- 4.4 'special-to-type' tests
- 4.5 functional check
- 4.6 signal injection tests
- 4.7 visual warning
- 4.8 rate of movement
- 4.9 bonding tests
- 4.10 range/sense of movement
- 4.11 continuity checks
- 4.12 voltage checks

#### Including the following:

4.13 a full system test that incorporates three of the above tests

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### Learning outcome

The learner will:

5 Carry out tests on aircraft flight guidance and control systems in compliance with **one** of the following:

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

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## Learning outcome

The learner will:

- 6 complete the relevant documentation, to include **one** from the following and pass it to the appropriate people:
    - 6.1 job cards
    - 6.2 computer records
    - 6.3 aircraft service/flight log
    - 6.4 aircraft log
    - 6.5 permit to work/formal risk assessment.
- 

## Learning outcome

Knowledge and understanding

## Assessment criteria

The learner must know and understand:

- K1 the specific safety practices and procedures that they need to observe when testing aircraft flight guidance and control systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials).
  - K2 The importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the organisation if these are not adhered to.
  - K3 the importance of maintenance on, and impact upon (extended twin operations procedures) ETOpS systems, legislation and local procedures.
  - K4 the health and safety requirements of the work area where they are carrying out the activities and the responsibility these requirements place on them.
  - K5 the safety procedures that must be carried out before work is started on the aircraft.
  - K6 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to.
  - K7 the protective clothing and equipment (PPE) to be worn and where it can be obtained.
  - K8 hazards associated with testing aircraft flight guidance and control systems, and with the tools and equipment used, and how to minimise them and reduce any risks.
  - K9 what constitutes a hazardous voltage and how to recognise victims of electric shock.
  - K10 how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers).
  - K11 the correct operating procedures of the flight guidance and control system being tested.
  - K12 electrical bonding specifications and their importance.
  - K13 how to extract and use information from engineering drawings and related specifications.
-

- K14 how to obtain the required test schedules and specifications for the system and aircraft type being tested and how to check their currency and validity.
- K15 how to read and interpret the test schedules and specifications, and from whom they can seek assistance if they have problems or issues regarding the test schedules or specifications.
- K16 the methods and procedures to be used to carry out the various tests on the aircraft flight guidance and control system and its system components.
- K17 the importance of applying electrostatic discharge (ESD) procedures when working on sensitive equipment or devices.
- K18 the test equipment to be used and its selection and application for particular tests.
- K19 the calibration of test equipment (where applicable) and the requirement for currency/issue checks.
- K20 the techniques, methods and procedures to be used during the tests.
- K21 why equipment control is critical and what to do if a piece of equipment is unaccounted for on completion of the testing activities.
- K22 the basic principle of operation of the flight guidance and control system under test and the function of the individual components within the system.
- K23 the importance of carrying out the tests in the specified sequence, checking all readings, movements and levels at each stage.
- K24 from whom to seek authorisation if they need to alter or change the test procedures.
- K25 how to record the results of each individual test and the documentation that must be used.
- K26 how to analyse the test results and how to make valid decisions about the acceptability of the system.
- K27 the procedures to be followed if the equipment or system fails to meet the test specification.
- K28 problems that can occur with the testing activities and how they can be overcome.
- K29 the problems that may cause errors or discrepancies with the test results and how to avoid these.
- K30 any required environmental controls relating to the testing.
- K31 the documentation to be completed at the end of the testing activities.
- K32 the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve.

## **Unit 374**

# **Carrying out tests on aircraft flight guidance and control systems**

### Supporting Information

#### ***Unit guidance***

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

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

## Unit 457 Preparing and applying coatings/finishes to aircraft components by hand.

GLH:

150

**Unit aim:**

This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the sector.

This EUC identifies the training and development required in order that the apprentice can demonstrate competency in removing coatings and surface finishes, carrying out surface preparation and preparing and applying aircraft component coating/finishing materials for application, in accordance with approved procedures and practices.

They will be required to use appropriate job instructions, specifications, tools and equipment to carry out the preparations of the coating/finishing materials. They will be required to check that all coatings have been prepared in accordance with manufacturers' recommendations for the application conditions. They will be required to apply the various coatings/finishes to the components/parts of the aircraft by hand.

They will be expected to use the specified or appropriate processes and techniques to remove existing material, prepare surfaces and apply the coatings. This will include degreasing, priming, colouring or protecting/masking the various parts, as applicable to the task.

Their responsibilities will require them to comply with organisational policy and procedures for the preparation of the coating materials, the coating/finishing activities undertaken, and for the disposal of surplus product, arisings, and contaminated solvents. They will be required to report any problems with the activities, equipment or materials that they cannot personally resolve – or are outside their permitted authority – to the relevant people. They will need to ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and they must complete all necessary job/task documentation accurately and legibly.

They will be expected to work either with a minimum level of supervision or as a member of a team, and to take personal responsibility for their own actions and for the quality and accuracy of the work that they carry out. Where team working is involved, they must demonstrate a significant personal contribution during the team activities to satisfy the requirements of this standard, and they must demonstrate competence in all the areas required by the standard.

Their underpinning knowledge will provide a good understanding of their work and will provide an informed approach to the preparation and application of aircraft coating/finishing materials. They will understand the properties of the aircraft coatings and the applications for which they are

intended. They will know about expiry dates, induction times, viscosity and temperature conditioning requirements in sufficient depth to provide a sound basis for carrying out the activities, and for ensuring that the coatings are prepared and applied to the required standards.

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

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

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## Learning outcome

Performance Requirements

### Assessment criteria

The learner can:

- P1 work safely at all times, complying with health and safety and environmental legislation, regulations and other relevant guidelines
- P2 obtain the required materials and check them for quantity, quality, and 'in date'
- P3 determine how the materials need to be prepared
- P4 carry out the preparations using suitable equipment
- P5 ensure the material surfaces to be coated/finished are suitably prepared including old material removal, cleanliness and any masking for the finishing operations to be carried out
- P6 check that the finishing equipment and coating solutions are set up and maintained at satisfactory operating conditions and levels
- P7 carry out the coating/finishing process in accordance with operating procedures and the component specification
- P8 ensure that the coated/finished workpiece achieves the required characteristics and meets the finishing specification
- P9 deal promptly and effectively with problems within your control and report those that cannot be solved
- P10 dispose of waste and excess materials in line with agreed organisational policy and procedures
- P11 complete relevant paperwork and submit to appropriate people

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## Learning outcome

The learner will:

- 1 Carry out **all** of the following during the coating/finishing activities:
  - 1.1 ensure that the correct documentation for the coating operations (such as coating manufacturer's specifications, job instructions, aircraft standards) is followed
  - 1.2 adhere to procedures or systems in place for risk assessment, COSHH, Chemical Hazard Information and Packaging for Supply (CHIPS) data, personal protective equipment and other relevant safety regulations
  - 1.3 obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition
  - 1.4 apply appropriate and safe preparation, ensuring underlying layers/structure remain free from damage where applicable
  - 1.5 apply a suitable level of protection and masking to the surrounding area of the repair
  - 1.6 apply appropriate coating/finishing techniques and procedures at all times
  - 1.7 dispose of waste items and materials in a safe and environmentally acceptable manner, in line with company procedures
  - 1.8 clean and return all tools and equipment to the correct location on completion of the activities
  - 1.9 leave the work area in a safe condition and free from any spillages, excess materials and foreign object debris

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## Learning outcome

The learner will:

- 2 Obtain an estimate of the volume of coating/finishing material to be prepared for the complete coating of bare substrate or for the overcoating of previously coated substrate, to include **two** of the following:
  - 2.1 aircraft detail components
  - 2.2 major assemblies
  - 2.3 sub-assemblies
  - 2.4 complete aircraft
  - 2.5 other specific components

---

## Learning outcome

The learner will:

- 3 Prepare aircraft coatings for application, by carrying out **all** the following activities:
  - 3.1 obtain the correct type and quantities of materials

- 3.2 ensure that the correct mixing ratios are adhered to (where applicable)
  - 3.3 mix correct quantities of primer (where applicable)
  - 3.4 mix correct quantities of colour (where applicable)
  - 3.5 check the prepared coating material is of the correct viscosity
  - 3.6 ensure the prepared material has been in the container for the induction period (where applicable)
  - 3.7 ensure the prepared material is at the recommended temperature and humidity for application
- 

### Learning outcome

The learner will:

- 4 Prepare and apply **two** of the following types for application:
    - 4.1 one-part finishes
    - 4.2 two-part finishes
    - 4.3 solvent based
    - 4.4 adhesive based
    - 4.5 water based
- 

### Learning outcome

The learner will:

- 5 Prepare and apply **three** of the following types of aircraft coatings/finishes for application:
    - 5.1 surface sealers
    - 5.2 top-coats
    - 5.3 UV coatings
    - 5.4 temporary protective coatings
    - 5.5 primers
    - 5.6 flexible coatings
    - 5.7 heatproof coatings
    - 5.8 specialty coatings
- 

### Learning outcome

The learner will:

- 6 Apply coatings/finishes to **two** of the following:
    - 6.1 aircraft detail components
    - 6.2 major assemblies
-

- 6.3 sub-assemblies
  - 6.4 complete aircraft
  - 6.5 other specific components
- 

### **Learning outcome**

The learner will:

- 7 Apply coatings/finishes to parent materials, to include **two** of the following:
    - 7.1 bare metal (ferrous)
    - 7.2 bare metal (non-ferrous)
    - 7.3 composite
    - 7.4 previously painted surfaces
- 

### **Learning outcome**

The learner will:

- 8 Apply coating/finishing materials using **two** of the following:
    - 8.1 brushes
    - 8.2 rollers
    - 8.3 pads
    - 8.4 dipping
    - 8.5 other specific method
- 

### **Learning outcome**

The learner will:

- 9 Apply coatings/finishes, using appropriate techniques to achieve **three** of the following:
    - 9.1 correct thickness
    - 9.2 colour match
    - 9.3 uniform and complete coverage of the surface to be coated
    - 9.4 gloss levels
    - 9.5 smooth surface free from runs or drips
    - 9.6 repair Integration/Integration of the repair
-

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## Learning outcome

The learner will:

- 10 Reinststate the work area on completion of the preparation activities, to include carrying out **all** of the following:
  - 10.1 dispose of excess or unused coatings/finishes, in accordance with approved policy and procedures
  - 10.2 clean containers to be reused, and dispose of arisings and used solvents, in accordance with approved policy and procedures
  - 10.3 dispose of non-reusable containers, equipment, materials in accordance with approved policy and procedures
  - 10.4 clean and return all tools and excess materials
  - 10.5 contribute to the completion of all required records (including consumption of paint and solvents)

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## Learning outcome

The learner will:

- 11 Prepare and apply coatings/finishes which comply with **one** of the following standards:
  - 11.1 Civil Aviation Authority (CAA)
  - 11.2 customer standards and requirements
  - 11.3 Ministry of Defence (MoD)
  - 11.4 organisation standards and procedures
  - 11.5 Federal Aviation Authority (FAA)
  - 11.6 coating finishes manufacturer's recommendations

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## Learning outcome

The learner will:

- 12 Complete the relevant paperwork, to include **one** from the following, and pass it to the appropriate people:
  - 12.1 build/production records
  - 12.2 quality control documentation
  - 12.3 aircraft log
  - 12.4 other specific records

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## Learning outcome

Knowledge and understanding

### Assessment criteria

The learner must know and understand:

- K1 the safe working practices and procedures to be observed when working with aircraft component coating/finishing materials and equipment (including items such as general workshop and site safety, protecting other workers from the effects of the work, cordoning and atmospheric controls)
- K2 the importance of applying the appropriate occupational behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to, how to present themselves in the workplace suitably dressed for the activities to be undertaken (such as being neat, clean and dressed in clothes appropriate to the area of activity)
- K3 the hazards associated with carrying out coating/finishing activities on aircraft components, and with the materials and equipment used (including hazards such as the storage, preparation and disposal of aircraft component coating products and solvents, inhalation of fumes, fire and explosion, contact with solvents and other chemicals), and how these hazards can be minimised
- K4 the information found in manufacturers' data sheets, COSHH and in Chemical Hazard Information and Packaging for Supply (CHIPS) data sheets
- K5 the personal protective equipment (PPE) and respiratory protective equipment (RPE) to be worn during the coating/finishing activity, and its care and correct use
- K6 the importance of emergency procedures and safe systems of work (including permits to work, required air quantities (RAQs) and local exhaust ventilation (LEV)) to maintain safe conditions, the provision of adequate and safe lighting and avoidance of sources of ignition
- K7 the environmental impact of the operations being carried out, and with the materials that will be used, and the minimisation of this impact
- K8 the characteristics and applications of various aircraft component coating/finishing products (including items such as sealers, primers, topcoats, and specialised protective coatings)
- K9 the manual material removal techniques including the use of sandpaper and scrapers, to ensure the underlying structure is not damaged
- K10 the need to ensure that the substrates have been prepared correctly for the coatings/finishes to be applied
- K11 product expiry, stock control and the use of batch numbers
- K12 the storage requirements (including environmental controls and containment arrangements) for aircraft component coating/finishing products and solvents (including items such as thinners, cleaners)
- K13 the procedures for transportation, storage and safe use of the coating/finishing materials and solvents

- K14 how to obtain an estimate of the product volume to be prepared for a defined usage (including estimation of areas to be covered, practical paint consumption and loss factors)
- K15 the use of appropriate containers for defined products and usages
- K16 the preparation requirements (including expiry dates, induction times and temperature conditioning requirements)
- K17 the requirements and the process of ensuring adequate protection, including masking the surrounding areas of the repair.
- K18 the importance of mixing ratios (such as use of whole packs) for 'multi-part' products
- K19 the importance of maintaining appropriate environmental conditions for the application and curing of the aircraft coating products
- K20 the time intervals that are required between coats, and why these must be adhered to
- K21 the application equipment to be used and its selection to suit the materials and the coating/finish required (such as brushes, rollers, suitable containers)
- K22 the uses of appropriate containers, hand tools and electro-mechanical/pneumatic equipment
- K23 the equipment care and control procedures (including fume extraction systems and RPE)
- K24 the importance of repair blending/integration techniques
- K25 cleaning and maintenance procedures for aircraft component coating/finishing equipment
- K26 how to recognise defects including the need to reject wrongly mixed coatings and items such as bubbles, foreign object damage, contamination, and surface defects
- K27 problems that can occur with the coating/finishing operations, and how these can be overcome
- K28 the disposal procedures for redundant materials and non-returnable containers
- K29 the procedures to contain and to clear away spillages, and the appropriate disposal of the arisings
- K30 the procedure for the safe disposal and correct separation of waste materials
- K31 the quality control requirements and techniques to be followed
- K32 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
- K33 the importance of the maintenance records and the recording documentation to be completed for the coating/finishing activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
- K34 the extent of their own authority and to whom they should report if they have a problem that they cannot resolve

## **Unit 457**

# **Preparing and applying coatings/finishes to aircraft components by hand.**

## Supporting Information

### ***Unit guidance***

#### Assessment Requirements

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Aerospace and Aviation Sector. Although all of the content and assessment requirements must be met in full, employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

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

## Useful contacts

Please visit the [contact us](#) section of the City & Guilds website.

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