Unit 69: Aircraft Workshop Principles and Practice

Unit code: K/600/7196

QCF Level 3: BTEC Nationals

Credit value: 15

Guided learning hours: 90

Aim and purpose

This unit will give learners the knowledge, understanding and skills needed to safely carry out a range of practical tasks in an aircraft workshop.

Unit introduction

An understanding of aircraft workshop principles and practice is a fundamental requirement for those wishing to practice as aircraft engineering technicians or engineers, irrespective of their chosen specialisation.

This unit will give learners an understanding of the safe working practices associated with aircraft workshop activities and the care, control and safe use of aircraft workshop tools and equipment. Learners will develop the skills needed to safely carry out tasks associated with aircraft sheet metal work, aircraft fasteners, fluid plumbing, transmission systems and electrical systems. They will also gain the skills necessary to read and interpret engineering diagrams and drawings.

This unit covers part of the knowledge required for those taking the European Aviation Safety Agency (EASA) Part 66 examinations.

Learning outcomes

On completion of this unit a learner should:

1 Understand the safe working practices associated with the care, control and use of aircraft workshop tools and equipment

2 Be able to read and interpret aircraft engineering drawings and diagrams

3 Be able to carry out airframe metalwork exercises

4 Be able to remove, inspect and fit aircraft fasteners, fluid plumbing, transmission systems and aircraft control cable hardware

5 Be able to carry out workshop fitting activities on aircraft electrical cables, terminations and fittings

6 Know about soldering, brazing and welding.

Unit content

1 Understand the safe working practices associated with the care, control and use of aircraft workshop tools and equipment

Safe working practices: procedures and actions to be followed eg personal protection (such as use of protective clothing, face masks and barrier creams) electricity (shock), prevention of electric shock, electrostatic hazards, high-pressure and low-pressure gases, oxygen and cryogenic substances, oils and chemicals in a workshop environment, fire, soldering irons; layout and nature of workshop fire-fighting equipment and first-aid provision

Care and use of tools and equipment: tool control methods eg shadow boards, portable servicing kits, toolboxes, tool tags, booking out/in systems; awareness and observation of safety procedures; precautions and pre-use checks for the care and use of workshop tools and equipment eg

- marking out and work holding tools (engineer's rule, key seat rule, callipers, scribe, centre punch, dividers, fitters square, combination set, surface plate, surface gauge V- blocks, clamps, vices)
- cutting and metal removal tools (guillotines, hacksaws, files, pillar drills, electric and pneumatic drills and riveters, drill bits, taps and dies, reamers, grinding machines, countersinks)
- assembly/dismantling tools (hammers, pliers, hand and hydraulic crimping tools, screwdrivers, spanners, strap wrenches, torque wrenches, sockets, circlip pliers, soldering irons, hand riveting tools)
- precision measuring tools (calibration and control, bevel protractors, micrometers, Vernier callipers, Vernier height and depth gauges)
- soldering and welding equipment (gas bottles, regulators, welding torches, soldering irons, fluxes, solders)
- electrical test/measurement equipment (oscilloscopes, power supplies, wave generators, analogue and digital meters, continuity testers, insulation testers, bonding testers)

2 Be able to read and interpret aircraft engineering drawings and diagrams

Drawing types and conventions: types eg schematic diagrams, block diagrams, circuit diagrams, assembly and single-part diagrams, sketches, charts, tables; conventional methods of projection eg isometric, oblique, orthographic first or third angle, additional and auxiliary views; symbol conventions eg hydraulic, pneumatic British Standards (BS) 2917, International Standards Organisation (ISO) 1219, electrical BS 3939, BS 7845, BS EN 60617, ISO 286, standard symbols and abbreviations (BS 8888); dimensioning and tolerances eg BS 8888

Read and interpret aircraft engineering drawings: key information from aircraft engineering drawings and circuit diagrams drawn to current national and international engineering standards eg BS 8888, BS 2917, ISO 1219, BS 3939, Air Transport Association (ATA) 100, Aerospace Industries Association (AIA), American National (AN), aircraft Air Publications (APs); retrieve key information from hard-copy or computer-based aircraft engineering publication drawings and diagrams

Aircraft engineering standards and presentation: relevant civil or military standards eg ATA 100, APs, BS, ISO, AN, Military Specifications (MS), AIA; limits, fits and clearances eg BS EN 20286, common systems, classes of fit, drill sizes, schedule of fits and clearances for aircraft and engines; presentation methods eg printed manuals, microfilm, microfiche, posters, wall charts, tables, computerised methods; drawing amendment and control actions

3 Be able to carry out airframe metalwork exercises

Airframe metalwork: carry out sheet metalwork exercises observing all related safety precautions, laid down procedures and standards eg

- identifying and classifying aircraft sheet metal
- carrying out pre-use checks and checks for correct operation and serviceability
- using riveting and sheet metalwork tools (such as hand drills, pillar drills, chobert/avdel riveting tools, pneumatic riveters, pop pliers, lazy tongs, pneumatic drills and hammers, reaction blocks, bend bars, guillotine, bending machine)
- calculating bend allowance
- determining correct rivet type, tolerance, allowance and spacing
- measuring and marking out sheet metal
- bending and forming sheet metal
- removing metal, drilling holes, dimpling metal, countersinking holes
- producing solid and blind riveted joints
- inspecting metalwork to ensure compliance with standards
- replace substandard rivets

4 Be able to remove, inspect and fit aircraft fasteners, fluid plumbing, transmission and aircraft control cable hardware

Aircraft hardware: remove, check for serviceability, fit/replace, observing related safety precautions and procedures eg

- fasteners (screws, nuts, bolts, studs, rivets, spring and tab washers, lock nuts, lock wire, friction devices, wing nuts, quick release fasteners, toggle fasteners, bayonet fasteners)
- fluid plumbing hardware (flexible hoses, rigid pipes, unions, fittings, screw and bayonet connectors); carrying out other maintenance (bending and belling/flaring aircraft pipes, inspecting and testing aircraft pipes and hoses, installing and clamping pipe runs, inspecting/renewing pipe insulation)
- transmission systems hardware (springs, belts, chains, pulleys, sprockets, gears, bearings, screw-jacks, lever devices, push-pull rods, systems limits measurement – bow, twist and wear, shafts, bearings, moving parts)
- control cables hardware (control cable runs, Bowden cable runs, Teleflex cable runs, swaged, screwed and pinned end fittings, turnbuckles, turn barrels, cable tensioners)

5 Be able to carry out workshop fitting activities on aircraft electrical cables, terminations and fittings

Workshop fitting activities: carrying out fitting activities and observing all related safety precautions and procedures eg

- preparing crimping tools (such as aircraft marine products (AMP), Burndy, series, hydraulic)
- preparing cable ends
- splicing an inline connection
- crimping cable terminations
- checking integrity of crimped fittings
- removing and connecting electrical terminations, plugs and sockets
- using insertion/removal tool on terminal blocks
- sheathing, assembling and looming cable runs
- carrying out continuity, bonding and insulation checks
- checking soldered joints for serviceability
- testing grounding and earth points
- inspecting electrical cables such as (insulation, shielding, cable clamps, terminations) inspect fixture and fittings for serviceability

6 Know about soldering, brazing and welding

Soldering: safety precautions associated with soldering, soldering equipment and de-soldering (including the use of solder, flux, heat sinks and soldering irons); soldered joint techniques and procedures (such as pre-tinning wire/soldering iron, insulation stripping, applying solder, wrap requirements, hook terminals, cup terminals, pierced terminals, cleaning/wiping finished joint); inspection for joint solder level, wetting and visibility

Brazing: safety precautions associated with brazing and brazing equipment; brazing methods and their use and advantages/disadvantages (such as manual flame brazing, automated flame brazing, furnace brazing, solid and liquid phase diffusion bonding); inspection for joint imperfections, distortion and in-service performance

Welding: safety precautions associated with welding and welding equipment; welding methods, their use and advantages/disadvantages (such as oxygen/fuel gas welding, tungsten arc gas-shielded (TAGS) and metal arc gas shielded (MAGS), resistance welding); inspection of welded joints for shape profile, uniformity of surface, degree of undercut, freedom from surface defects, penetration bead, smoothness and consistency of weld joint, elimination of stress concentrators

Assessment and grading criteria

In order to pass this unit, the evidence that the learner presents for assessment needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria for a pass grade describe the level of achievement required to pass this unit.

Assessment and grading criteria		
To achieve a pass grade the evidence must show that the learner is able to:	**To achieve a merit grade the evidence must show that, in addition to the pass criteria, the learner is able to:**	**To achieve a distinction grade the evidence must show that, in addition to the pass and merit criteria, the learner is able to:**
P1 describe the different procedures to be followed in the event of a workshop fire, an electric shock to human operator and a chemical spillage	**M1** explain what is meant by clearance fit, running fit and interference fit and give an aircraft example of the use of each	**D1** carry out an aircraft metalwork exercise that requires the calculation of bend allowance, the determination of rivet tolerance and pitch and requires a bent metal section and insert to be correctly riveted into place, observing all relevant safety precautions and pre-use checks
P2 explain the precautions that must be observed for the control, care and use of tools needed for cutting and removing metal, for precision measurement and for assembly/dismantling	**M2** determine from valid sources the correct sheet metal and rivet specification and procedure to be followed, to effect a satisfactory repair on a given piece of airframe riveted structure or structural component	**D2** remove, inspect, refit/replace and adjust a control cable run, observing all related safety precautions and laid down procedures and explain the essential checks and test required after fit/replacement.
P3 use drawing types and conventions to read and interpret key information from an engineering drawing and a circuit diagram that conform to relevant standards and presentation	**M3** carry out an aircraft metalwork exercise that requires precision measuring, marking out, metal removal, countersunk holes and the production of solid and blind rivet joints, observing all relevant safety precautions and pre-use checks	
P4 retrieve appropriate information from a hardcopy or computer-based aircraft engineering publication [IE4]	**M4** carry out a continuity, bonding and insulation check on an electrical cable loom, observing all relevant safety precautions and procedures.	
P5 describe the safety precautions that must be observed when a metal work task requires the use of pneumatic drills, riveters and hammers		

Assessment and grading criteria			
To achieve a pass grade the evidence must show that the learner is able to:		**To achieve a merit grade the evidence must show that, in addition to the pass criteria, the learner is able to:**	**To achieve a distinction grade the evidence must show that, in addition to the pass and merit criteria, the learner is able to:**
P6	carry out a metal work exercise that involves the use of hand and/or pneumatic tools to measure, mark out, remove metal, drill holes and produce a riveted joint in sheet metal, observing all safety precautions and pre-use checks [SM3, SM4]		
P7	describe the safety precautions and procedures to be followed in order to remove, inspect, fit/replace an aircraft toggle fastener and flexible fluid plumbing hose		
P8	remove, inspect, fit/replace four different types of fastener or fluid plumbing hardware, observing all related safety precautions and procedures [SM3, SM4]		
P9	remove and inspect a transmission system component for serviceability and wear and refit or replace as appropriate, observing all related safety precautions and procedures [SM3, SM4]		
P10	inspect a control cable system for serviceability and report on the serviceability state of the system, observing all related safety precautions and procedures [SM3, SM4]		
P11	describe the procedures and safety considerations that need to be observed and the checks that need to be made, to ensure a correctly crimped electrical cable end fitting is produced		
P12	carry out two different workshop fitting exercises on aircraft electrical cables runs and/or terminations/fittings		

Assessment and grading criteria		
To achieve a pass grade the evidence must show that the learner is able to:	**To achieve a merit grade the evidence must show that, in addition to the pass criteria, the learner is able to:**	**To achieve a distinction grade the evidence must show that, in addition to the pass and merit criteria, the learner is able to:**
P13 describe the essential safety precautions that must be observed when using a soldering iron, a flame brazing torch and an oxygen/ acetylene torch to carry out, soldering, brazing and welding operations		
P14 describe the procedures and techniques that should be followed to correctly solder hook terminals and cup terminals		
P15 describe the important points to observe when inspecting a soldered, brazed and welded joint for serviceability.		

PLTS: This summary references where applicable, in the square brackets, the elements of the personal, learning and thinking skills applicable in the pass criteria. It identifies opportunities for learners to demonstrate effective application of the referenced elements of the skills.

Key	IE – independent enquirers	RL – reflective learners	SM – self-managers
	CT – creative thinkers	TW – team workers	EP – effective participators

Essential guidance for tutors

Delivery

This unit should be delivered after, or in tandem with its co-requisite *Unit 70: Aircraft Materials and Hardware*, preferably in the first year of the programme. The unit has been designed to give learners knowledge and skills in a number of areas of workshop practice and therefore the content should primarily be delivered in an aircraft engineering workshop environment. Ideally, the majority of the learning outcomes should be achieved through investigation and participation in a number of practical activities.

The delivery approach used will be determined not only by the availability of physical resources but by the learners' proposed area of specialisation and possibly local aerospace employers' requirements, for those with learners attending the programme. Whichever approach is taken the learners' experience should be sufficiently varied to provide them with sound underpinning knowledge and the ability to carry out the range of practical aircraft workshop activities needed to meet the learning outcomes.

The learning outcomes can generally be delivered in any order that reflects the requirements of each centre. However learning outcomes 1 and 2 provide the underpinning knowledge on aircraft workshop safety and interpreting drawings, circuit diagrams and technical information and therefore should be delivered first.

The approach used for delivery of the practical-based learning outcomes will depend on the available physical and human resources at the centre. The practical activities used to provide evidence of achievement at pass level should not require a large amount of preparation/completion time or a restrictively large amount of resources. Therefore, for learners to achieve a pass grade for the unit, centres will only need to make available a limited amount of practical equipment. However, throughout delivery, the physical resources needed to achieve the higher grades should be made available either on or off site, so that there are no restrictions placed on learners wishing to achieve the best possible grade.

Some of the practical activities may be delivered in tandem or as part of a related NVQ unit. This combined method of delivery has the obvious advantage of bringing together elements of learning that may lead to improvements in efficiency and a reduction in delivery costs for the centre.

Outline learning plan

The outline learning plan has been included in this unit as guidance and can be used in conjunction with the programme of suggested assignments.

The outline learning plan demonstrates one way in planning the delivery and assessment of this unit.

Topic and suggested assignments/activities and/assessment
Whole-class teaching: • introduction to unit content, overview of activities and assessment method • issue personal safety equipment, walk round aircraft workshop, identify first-aid and fire-points, explain safety rules and procedures including emergency evacuation procedures • identify hazards and explain the necessary precautions and preventions for electric shock, electrostatic hazards, handling of high and low-pressure gases, oxygen, cryogenic substances, oils and chemicals, electrical and pneumatic equipment hazards and the hazards associated with soldering, brazing and welding equipment • explain tool control methods. *Individual learner activity*: • learners to identify and note potential hazards in aircraft workshop and familiarise themselves with hand-tool and specialist tool control methods.

Topic and suggested assignments/activities and/assessment
Workshop teaching: • explanation and demonstration of safety precautions and use of tools eg marking out and work holding tools, cutting and metal removal tools, assembly/dismantling tools, precision measuring tools, hand and pneumatic riveting tools, soldering, brazing and welding equipment, electrical test and measuring equipment.
Whole-class teaching: • explain drawing types and conventions. *Individual activity*: • learners to read and interpret a range of drawings that use conventional projection methods and symbols. *Whole-class teaching:* • explain and demonstrate how to read and obtain key information from aircraft engineering drawings and publications • explain how aircraft drawings, diagrams and publications are amended and controlled. *Individual learner activity*: • read, interpret and retrieve appropriate information from a number of aircraft publications that use different presentation methods.
Prepare for and carry out **Assignment 1: Aircraft Workshop Safety and Engineering Drawings** (P1, P2, P3, P4, M1).
Whole-class teaching: • explain hardware theory associated with metal work • explain all safety precautions, procedures and standards for airframe metal work exercises, including the care and use of metal working equipment and tools. *Practical workshop activities*: • carry out (under supervision) a range of practical exercises eg marking out, metal removal (by hand and/or guillotine), drilling and countersinking holes, bending metal, selecting and broaching rivets (by hand and/or using pneumatic riveting equipment), inspecting work, replacing substandard rivets, calculating bend allowance, preparing sheet metal inserts and butt-straps, using riveting broaching methods, validating materials needed for repair, using valid sources of reference for information on sheet metal repairs to aircraft structure.
Prepare for and carry out **Assignment 2: Airframe Metalwork** (P5, P6, M2, M3, D1).
Whole-class teaching: • explain hardware theory associated with aircraft fasteners, fluid plumbing, transmission, aircraft control cables and fittings, electrical cables, terminations and fittings • explain, the use of appropriate tools and equipment and all related safety precautions, procedures and standards for the removal, inspection, fit/replacement and tests for serviceability of aircraft hardware. *Practical workshop activities*: • carry out (under supervision) a range of practice exercises eg removal, inspection, fit/replacement of a range of aircraft fasteners, fluid plumbing, transmission systems and aircraft control cables hardware, also carryout fitting exercises on aircraft cables, terminations and fittings, as appropriate and as directed.
Prepare for and carry out **Assignment 3: Aircraft Hardware** (P7, P8, P9, P10, P11, P12, M4, D2).

Topic and suggested assignments/activities and/assessment
Whole-class teaching: • explain and demonstrate the safety precautions associated with soldering, brazing and welding equipment • explain and demonstrate the use and preparation of soldering irons, soldered jointing techniques and inspection • describe the associated safety precautions, procedures, and relative advantages/disadvantages for a range of brazing and welding methods • explain the defects that should be looked for when inspecting brazed and welded joints. *Individual activity:* • multiple-choice quiz on soldering, brazing and welding.
Prepare for and carry out **Assignment 4: Soldering Brazing and Welding** (P13, P14, P15).
Feedback on assessment and unit evaluation.

Assessment

Due to the nature of this unit, assessment evidence needs to be collected not only from well-planned theoretical assignments but also, more importantly, from tutor observation or expert witness testimony and reports from practical exercises.

Evidence for achievement of learning outcomes 1 and 2 may be gathered from well planned written assignments. In addition, further evidence of continuing compliance with safety precautions may be obtained from tutor observation/expert witness testimony when learners are carrying out related practical exercises.

To achieve a pass grade, learners need to understand the safe working practices associated with the care, control and use of aircraft workshop tools and equipment. In particular they should describe and comply with the procedures for fire, electric shock and chemical spillage (P1), as well as explain the precautions that must be observed for the control, care and use of tools and equipment (P2). As learners undertake their practical work they must be aware of the safety issues concerned with all aspects of these tasks, including those when using pneumatic riveting tools (P5), aircraft fasteners and flexible fluid plumbing hoses (P7), crimping electrical cable fittings (P11) and when using soldering, brazing and welding equipment (P13). Learners must be able to read and interpret engineering drawings of various types (P3) and read and retrieve information from aircraft publications (P4).

Learners must be able to mark out, remove metal, drill holes and produce a riveted joint (P6) in sheet metal and remove, inspect, fit/replace three different types of fastener or fluid plumbing hardware (P8). They must be able to remove, inspect, fit/replace a single transmission system component (P9) and inspect for serviceability and report on a control cable system (P10). In order to satisfy P9 and P10, the transmission and manual control cable systems to be worked on can be simple mock-ups or rigs and do not necessarily have to be installed on an aircraft. Learners must be able to carry out two different fitting exercises on aircraft electrical cable runs, and/or terminations/fittings (P12). They must be able to detail the essential safety precautions to be observed when using soldering, brazing and welding equipment (P13), describe the procedures to be followed in order to correctly solder, hook and cup terminals (P14) and detail the important points to be observed when inspecting a soldered, brazed and welded joint for serviceability (P15).

For M1 learners must be able to explain the meaning of clearance, running and interference fits and provide an aircraft example of the use of each. Evidence for M1 can gathered from a written task as part of the assignment covering P1, P2, P3 and P4.

For a given piece of airframe riveted structure, learners must be able to determine from valid sources the correct sheet metal and rivets specification and procedure to be followed to effect a satisfactory repair (M2).

Evidence to satisfy M2 could be gathered from tutor observation and/or from a short written report produced by the learner, containing the required valid information.

Learners must be able to carryout out a metal work exercise that requires them to take precision measurements, mark out and remove metal, countersink holes and produce solid and blind rivets (M3). Evidence for M3 would be best obtained by extending the practical exercise needed for P6, to include countersunk holes and the broaching of countersunk, blind and solid rivets. Learners must also carryout a continuity, bonding and insulation check on a given electrical cable loom (M4). Evidence for the achievement of M4 and indeed for all the assessed practical work required for a merit grade, could come from expert witness testimony or tutor observation and/or pre-prepared marking guides, as suggested previously.

In order to achieve a distinction grade, learners must be able calculate bend allowance, determine rivet tolerance and pitch to meet particular given requirements and produce a correctly bent section and fabricate a metal insert, that must both be riveted into place (D1). Again, evidence of achievement may be obtained by extending the practical exercise needed to achieve P6 and M3, or by designing a separate exercise. They must also be able remove, inspect, refit/replace and adjust a control cable run and detail and explain the need for the checks and tests required after fit/replacement (D2). In order to achieve D2, it is not necessary for the control cable run to be installed within an aircraft – training rigs or mock-ups of control cable, Bowden cable or Teleflex control rod systems, would be viable alternatives.

Programme of suggested assignments

The table below shows a programme of suggested assignments that cover the pass, merit and distinction criteria in the assessment and grading grid. This is for guidance and it is recommended that centres either write their own assignments or adapt any Edexcel assignments to meet local needs and resources.

Criteria covered	Assignment title	Scenario	Assessment method
P1, P2, P3, P4, M1	Aircraft Workshop Safety and Engineering Drawings	Two part assignment, where the first part consists of formal written assessment covering (P1, P2) and the second part set in a workshop environment, involves a reading and retrieval exercise from given drawings, diagrams and air publications (P3, P4).	Written responses to set written tasks under controlled conditions and written information provided as a result of a reading and retrieval exercise, also carried out under controlled conditions.
P5, P6, P7, M2, M3, D1	Airframe Metal Work	A two part assignment covering related theory and practice, consisting of a formal written assessment covering (P5, M2) and a staged practical exercise (covering P6, M3, D1), in a workshop environment.	Written response to set theoretical tasks under controlled conditions and tutor observation or expert witness testimony from practical tasks.

Criteria covered	Assignment title	Scenario	Assessment method
P7, P8, P9, P10, P11, P12, M4, D2	Aircraft Hardware	A two part assignment covering related theory and practice, consisting of a formal written assessment (covering P7, P11) and a staged practical exercise/s (P8, P9, P10, P12, D2), in a workshop environment.	Written response to set theoretical tasks under controlled conditions and tutor observation or expert witness testimony from practical tasks.
P13, P14, P15	Soldering, Brazing and Welding	A formal theoretical multiple choice test or written assignment.	Answers to multiple-choice test questions or written response to set tasks, carried out under controlled conditions.

Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

This unit forms part of the BTEC Engineering sector suite. This unit has particular links with:

Level 1	Level 2	Level 3
		Aircraft Materials and Hardware
		Inspection and Repair of Airframe Components and Structures
		Airframe Structural Concepts and Construction Methods
		Aircraft Maintenance Practices

This unit has been mapped against the EASA Part-66 examinations and, together with *Unit 70: Aircraft Materials and Hardware*, *Unit 71: Inspection and Repair of Airframe Components and Structures*, *Unit 72: Aircraft Maintenance Practice* and *Unit 79: Airframe Structural Concepts and Construction Methods*, covers the knowledge requirements for Modules 6 Aircraft Materials and Hardware and Module 7 Aircraft Maintenance Practices.

This unit also contributes knowledge towards SEMTA Level 3 National Occupational Standards in Aeronautical Engineering, particularly:

- Unit 8: Installing Aircraft Mechanical Fasteners into Composite and/or Metallic Components
- Unit 12: Installing Aircraft Mechanical Controls
- Unit 13: Repairing Airframes and Structures
- Unit 62: Installing Aircraft Cable Forms/Looms.

Essential resources

Learners will require access to an aircraft engineering workshop suitably equipped with the following:

- a comprehensive range of hand tools, suitable for metal work and the removal/fit or replacement of aircraft fasteners, fluid plumbing, transmission and aircraft control cable systems hardware
- specialist riveting tools and equipment (hand and/or pneumatic or both)
- a range of tools, specialist tools and test instruments and equipment suitable for a range of electrical fitting exercises
- a comprehensive range of aircraft hardware, including aircraft structure parts, fasteners, transmission system hardware, fluid plumbing pipes, couplings and fittings, control cables and manual control system components and fittings, electrical cables, connectors, terminations, fixtures and fittings
- suitable transmission and manual control cable system mock-ups/training rigs or a training aircraft
- access to soldering, brazing and welding tools and equipment.

Employer engagement and vocational contexts

Liaison with employers would prove of benefit to centres, especially if they are able to offer help with the provision of physical resources that may not be available at the centre but are required in order to meet the unit outcomes.

Much of the work for this unit can be set in the context of learners' work placements or be based on case studies of local employers. Further information on employer engagement is available from the organisations listed below:

- Work Experience/Workplace learning frameworks – Centre for Education and Industry (CEI – University of Warwick) – www.warwick.ac.uk/wie/cei/
- Learning and Skills Network – www.vocationallearning.org.uk
- Network for Science, Technology, Engineering and Maths Network Ambassadors Scheme – www.stemnet.org.uk
- National Education and Business Partnership Network – www.nebpn.org
- Local, regional Business links – www.businesslink.gov.uk
- Work-based learning guidance – www.aimhighersw.ac.uk/wbl.htm

Indicative reading for learners

Textbooks

Black B – *Workshop Processes, Practices and Materials* (Newnes, 2004) ISBN 0750660732

Simmons C and Maguire D – *Manual of Engineering Drawing: Technical Product Specification and Documentation to British and International Standards* (Butterworth-Heinemann, 2009) ISBN 0750689854

Other

Air Publications – 101 series of manuals and aircraft engineering publications (Military)

ATA – 100 Series, specialist publications from the Joint Aviation Authority sanctioned by the European Aviation Safety Agency (Civil)

Delivery of personal, learning and thinking skills

The table below identifies the opportunities for personal, learning and thinking skills (PLTS) that have been included within the pass assessment criteria of this unit.

Skill	When learners are ...
Independent enquirers	retrieving, analysing and evaluating information from an aircraft engineering publication, judging its relevance and value
Self-managers	organising time and resources and prioritising actions when carrying out aircraft workshop activities anticipating, taking and managing risks when carrying out aircraft workshop activities.

Although PLTS are identified within this unit as an inherent part of the assessment criteria, there are further opportunities to develop a range of PLTS through various approaches to teaching and learning.

Skill	When learners are ...
Creative thinkers	trying out alternatives or new solutions to problems in the aircraft workshop and following ideas through
Team workers	working in teams and collaborating with others when carrying out a range of aircraft workshop activities.

Functional Skills – Level 2

Skill	When learners are ...
English	
Reading – compare, select, read and understand texts and use them to gather information, ideas, arguments and opinions	researching and investigating aircraft workshop activities
Writing – write documents, including extended writing pieces, communicating information, ideas and opinions, effectively and persuasively	describing safety precautions and procedures to be followed when carrying out a range of aircraft workshop activities.