



Higher National Unit specification

General information

Unit title: Aircraft Engineering Practical Skills (SCQF level 6)

Unit code: H94A 33

Superclass: XP

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Version: 01

Unit purpose

This Unit is intended to introduce learners to a variety of practical engineering skills used in the manufacture and maintenance of aircraft components and systems. Specific applications included in this Unit are materials selection, aircraft structures, mechanical, electrical and electronic systems. The integration and interface of electronic systems with mechanical systems will also be introduced.

This Unit will be of interest to learners wishing to increase their knowledge of aircraft manufacture, repair and maintenance techniques with a view of their pursuance of a career in these aircraft engineering sectors.

Outcomes

On successful completion of the Unit the learner will be able to:

- 1 Manufacture and inspect structural and mechanical assemblies typically used in aircraft.
- 2 Assemble and test electrical and electronic circuits typically used in aircraft.
- 3 Carry out a practical aircraft maintenance task.

Credit points and level

2 Higher National Unit credits at SCQF level 6: (16 SCQF credit points at SCQF level 6)

Higher National Unit Specification: General information (cont)

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Recommended entry to the Unit

Access to this Unit is at the discretion of the centre. However, knowledge of aircraft engineering processes or previous practical engineering experience would be beneficial. This may be evidenced by possession of the NC Aircraft Engineering qualification or suitable engineering experience.

Core Skills

Opportunities to develop aspects of Core Skills are highlighted in the Support Notes for this Unit specification.

There is no automatic certification of Core Skills or Core Skill components in this Unit.

Context for delivery

If this Unit is delivered as part of a Group Award, it is recommended that it should be taught and assessed within the subject area of the Group Award to which it contributes.

Equality and inclusion

This Unit specification has been designed to ensure that there are no unnecessary barriers to learning or assessment. The individual needs of learners should be taken into account when planning learning experiences, selecting assessment methods or considering alternative evidence.

Further advice can be found on our website www.sqa.org.uk/assessmentarrangements.

Higher National Unit specification: Statement of standards

Unit title: Aircraft Engineering Practical Skills (SCQF level 6)

Acceptable performance in this Unit will be the satisfactory achievement of the standards set out in this part of the Unit specification. All sections of the statement of standards are mandatory and cannot be altered without reference to SQA.

Outcome 1

Manufacture and inspect structural and mechanical assemblies typically used in aircraft.

Knowledge and/or Skills

- ◆ Interpretation of, and compliance with, aircraft production drawings, planning and aircraft documentation
- ◆ Selection and use of templates, general and specialist tools and precision measuring equipment
- ◆ Manufacture of structural and mechanical assemblies using metal and/or composite materials
- ◆ Selection and use of appropriate fasteners
- ◆ Inspection of completed structural and mechanical assemblies and the identification of faults
- ◆ Comply with health and safety practices in a practical aircraft engineering environment

Outcome 2

Assemble and test electrical and electronic circuits typically used in aircraft.

Knowledge and/or Skills

- ◆ Interpret and comply with appropriate electrical/electronic system schematics, electrical wiring diagrams, electronic schematic diagrams and technical instructions
- ◆ Selection and use of appropriate tools and equipment to manufacture an electrical harness assembly
- ◆ Selection and use of appropriate tools and equipment to manufacture an electronic circuit assembly following appropriate electronic sensitive device handling procedures
- ◆ Selection and use of appropriate equipment and instruments for the testing and fault isolation of electrical and/or electronic circuits and recommend rectification action
- ◆ Comply with health and safety working practices in an electrical/electronic workshop or laboratory environment

Higher National Unit specification: Statement of standards (cont)

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Outcome 3

Carry out a practical aircraft maintenance task.

Knowledge and/or Skills

- ◆ Interpretation of, and compliance with, aircraft documentation, technical instructions, appropriate engineering drawings and/or system schematics and/or electrical wiring diagrams and/or electronic schematic diagrams
- ◆ Selection and use of appropriate general tools and equipment for maintenance and testing
- ◆ Carry out a structural/mechanical and an electrical/electronic maintenance task in accordance with aircraft maintenance documentation
- ◆ Inspection, fault diagnosis and recommended fault rectification
- ◆ Identification and use of information recording techniques
- ◆ Comply with health and safety practices in a practical aircraft engineering environment

Evidence Requirements for this Unit

Outcomes 1 and 2 could be assessed back-to-back with either Outcome 1 or 2 assessed first, or concurrently at the discretion of the centre. Outcome 3 is devised to be delivered and assessed following completion of Outcomes 1 and 2 as the fundamental skills developed in the first two Outcomes are utilised in Outcome 3.

Outcome 1

Learners will need to provide evidence to demonstrate their Knowledge and/or Skills by showing that they can:

- ◆ interpret and comply with production drawings, planning and aircraft documentation.
- ◆ use appropriate templates, tools and precision measuring equipment to manufacture an aircraft structural artefact.
- ◆ manufacture artefacts using metal and/or composite materials.
- ◆ select and use appropriate fasteners for joining components.
- ◆ inspect completed artefacts using visual techniques to identify faults.
- ◆ use safe and healthy working practices in an engineering workshop environment.

Evidence for the Knowledge and/or Skills in this Outcome will be generated under supervised open-book conditions.

Higher National Unit specification: Statement of standards (cont)

Unit title: Aircraft Engineering Practical Skills (SCQF level 6)

Outcome 2

Learners will need to provide evidence to demonstrate their Knowledge and/or Skills by showing that they can:

- ◆ interpret and comply with appropriate electrical/electronic system schematics, electrical wiring diagrams, electronic schematic diagrams and technical instructions.
- ◆ select and use appropriate tools and equipment to manufacture an electrical harness assembly.
- ◆ select and use appropriate tools and equipment to manufacture an electronic circuit assembly following appropriate electronic sensitive device handling procedures.
- ◆ select and use appropriate equipment and instruments for the testing and fault isolation of electrical and/or electronic circuits and recommend rectification action.
- ◆ adhere to safe and healthy working practices in an electrical/electronic workshop or laboratory environment.

Evidence for the Knowledge and/or Skills in this Outcome will be generated under supervised open-book conditions.

Outcome 3

Learners will need to provide evidence to demonstrate their Knowledge and/or Skills by showing that they can:

- ◆ identify, interpret and comply with appropriate aircraft maintenance and inspection documentation to be used in a given task.
- ◆ use general and specialist tools and equipment to be used to complete a given task.
- ◆ inspect, remove, service and install aircraft components using standard techniques
- ◆ diagnose faults and recommend rectification action.
- ◆ use maintenance practices and procedures in accordance with aircraft maintenance and continued airworthiness requirements.
- ◆ use information recording techniques.
- ◆ use safe and healthy working practices in an engineering maintenance environment.

Evidence for the Knowledge and/or Skills in this Outcome will be generated under supervised open-book conditions.



Higher National Unit Support Notes

Unit title: Aircraft Engineering Practical Skills (SCQF level 6)

Unit Support Notes are offered as guidance and are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 80 hours.

Guidance on the content and context for this Unit

This Unit is intended to develop knowledge and understanding of standard aircraft practical engineering procedures, and to develop the learners' practical engineering skills related to aircraft manufacture and maintenance in mechanical and electronic engineering disciplines. In addition, learners will benefit from developing these skills in an environment representative of aircraft engineering practical work.

Outcome 1 develops learners' skills through the manufacturing of a series of metal and/or composite components where two or three components are joined together using aircraft standard fastening techniques in doing so producing a final artefact. Learners should become familiar with the interpretation and use of manufacturing drawings, task planning and documentation as well as standard hand engineering production techniques that are used in aircraft component manufacture and assembly. Learners will also apply inspection and testing skills to assessment and evaluation completed components and artefacts for conformity with relevant documentation.

Outcome 2 develops learners' skills through the assembly and testing of electrical and electronic circuits. Learners should become familiar with the interpretation and use of circuit diagrams, and the application of technical instructions in the assembly of electrical and electronic circuits. In addition they should become familiar with the handling and use of industry standard electrical and electronic components, tools and techniques that are used in wiring harness and circuit assembly. Learners will also apply inspection and testing skills to the assessment and evaluation of components and completed circuits for conformity with relevant documentation for functionality.

Outcome 3 allows learners to apply the skills they have developed in Outcomes 1 and 2, and complete typical aircraft maintenance tasks conducted in a simulated aircraft engineering environment. During such tasks, learners should become familiar with task planning and the use of aircraft documentation such as maintenance manuals and job cards. They should also become familiar with the use of tooling to remove, inspect, service/repair and install mechanical and electronic components and systems on aircraft, as well as the recording of maintenance actions.

Higher National Unit Support Notes (cont)

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Across all three Outcomes, learners must demonstrate their ability to use precision measuring equipment and test instruments, and adhere to safe and healthy work practices in aircraft engineering manufacturing and maintenance environments.

This Unit links to the following Semta National Occupational Standards (NOS):

SEMAE3005	Marking out composite and/or metallic aircraft components
SEMAE3008	Installing aircraft mechanical fasteners into composite and/or metallic components
SEMAE3007	Bending and forming aircraft components
SEMAE3006	Cutting and shaping aircraft components
SEMAE3144	Removing and replacing components of aircraft control systems
SEMAER2_15	Assembling aircraft airframe ancillary components
SEMAER2_17	Assembling aircraft electrical components
SEMAE3002	Using and interpreting engineering drawings and documents
SEMAER2_06	Carrying out aircraft routine servicing
SEMAER2_07	Carrying out maintenance on aircraft mechanical systems by component replacement

Guidance on approaches to delivery of this Unit

The Knowledge and/or Skills throughout the three Outcomes are written in a manner which should allow them to be delivered in the sequence presented as the subsequent concepts and skills increase in complexity.

Outcomes 1 and 2 could be delivered sequentially or concurrently at the discretion of the centre. Outcome 3 could be delivered following completion of Outcomes 1 and 2 as the fundamental skills developed in the first two Outcomes are utilised in Outcome 3.

Whilst the mode of delivery is at the discretion of the centre, Outcomes 1 and 2 could be taught in an engineering workshop/laboratory environment using a combination of demonstrations and supervised practical work. This could be supplemented by a range of media for example videos, simulations and on-line knowledge quizzes. In addition, having access to relevant documentation including Aircraft Maintenance Manuals (AMM), and Illustrated Parts Catalogues (IPC) for a range of aircraft is recommended.

Outcomes 1 and 2 are based on the manufacture of structural/mechanical artefacts and the assembly of electrical/electronic circuits respectively. Centres may consider integrating the development of these skills into the production of an electro-mechanical artefact, perhaps with learners working in small teams.

Outcome 3 could be taught in an engineering workshop/laboratory or in a simulated aircraft maintenance hangar, providing access to a variety of aircraft components and systems. This Outcome may require learners to undertake a number of different maintenance tasks with learners working in small groups to complete task on a rotational basis.

Higher National Unit Support Notes (cont)

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It is recommended that the delivery of the practical elements be allocated sufficient block time within a learning session to make realistic progress toward completing a practical manufacture, assembly or maintenance task. A 2-hour work slot is recommended as the minimum for such practical activities. During such practical sessions, it may be that learners are assigned a task and then expected to manage the task themselves in terms of consulting documentation, task planning, selecting tools and equipment. Supervision of such practical tasks will be necessary at all times to guide the learners' skills development and to maintain safety.

Within each Outcome, learners may have to complete more than one formative development task in order to progressively develop their skill across the breadth of skills required and to the level of complexity set by the Unit standards.

Practical development could be enhanced and developed through the use of field trips. Case studies could be used to demonstrate the importance of health and safety, correct tool control and application of current industry standards related to engineering practice and airworthiness.

Using group work within the Unit will develop learners' ability to work as part of a team such as is representative of a realistic practical aircraft engineering environment.

Guidance on approaches to assessment of this Unit

Evidence can be generated using different types of assessment. The following are suggestions only. There may be other methods that would be more suitable to learners.

Centres are reminded that prior verification of centre-devised assessments would help to ensure that the national standard is being met. Where learners experience a range of assessment methods, this helps them to develop different skills that should be transferable to work or further and higher education.

Whilst the assessment approach and the number of assessed tasks is at the discretion of the centre, it is a requirement of this Unit that all Knowledge and/or Skills are assessed using assessment instruments following the general guidelines offered by the Scottish Qualifications Authority (SQA). Centres are encouraged to use the assessment instruments they consider to be most appropriate, however it is envisaged that learners will undertake a number of interrelated supervised and assessed practical tasks.

Generation of assessment evidence within each Outcome may require learners to complete more than one practical task. Within each Outcome, learners may have to complete more than one summative assessment task in order to demonstrate their knowledge and skills across the breadth of those required set by the Unit standards. Centres are encouraged to optimise the number of summative assessments, perhaps by integrating formative development tasks into the Unit assessment.

Holistic assessment is encouraged although this could be difficult to achieve across the entire Unit. Assessment of Outcomes 1 and 2 could be possible by the learner producing a functioning electro-mechanical model such as that suggested in the guidance for delivery. Given the complexity of this task it is recommended that this is produced by a series of smaller, progressively more difficult tasks allowing the learner to work at their own pace.

Higher National Unit Support Notes (cont)

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Evidence for all three Outcomes could be provided by practical tasks carried out under open-book, supervised conditions. Learners should only have access to appropriate documentation provided by the centre such as drawings, task sheets and aircraft documentation/technical instructions. Evidence of learner achievement should be provided by documentation in the form of a log book and check list signed by both learner and assessor for each task completed. A completed artefact, or photographic record, may provide evidence of assessment toward Outcome 1 and Outcome 2. These records should be made available for external verification. The CAA Cap 741 Aircraft Engineer's logbook provides a suitable format for the log book.

Outcome 1 could involve a task to manufacture a stiffened skin panel and connect it to a structural template. The panel to have two or three components using alloy material which would lend itself to a series of sub-tasks such as:

- 1 Interpret task specification, production drawings and other appropriate documentation/instructions.
- 2 Measure, mark-out, cut and form individual components.
- 3 Produce skin and stringer panel assembly using bent metals and pneumatically bucked rivets.
- 4 Attach panel to a frame using safety locked threaded fasteners.
- 5 Inspect completed components, identify defects and recommend remedial action.
- 6 Complete log book.

For Outcome 2 a task to assemble an electrical and/or electronic circuit having at least 5 different types of components would lend itself to a series of sub-tasks such as:

- 1 Interpret task specification, schematic drawings and technical instructions.
- 2 Select components, tools and test instrumentation.
- 3 Assemble components using a range of joining techniques.
- 4 Crimp and terminate wires.
- 5 Join circuit to input/output transducers.
- 6 Test completed circuit to identify faults.
- 7 Complete log book.

Outcome 3 could require learners to undertake a number of different maintenance tasks with learners working in small groups to complete tasks on a rota basis. Such tasks could be representative of those within the Light Aircraft Maintenance Schedule (CAP 411 and CAP 766) for 50 hour check. Typical maintenance tasks, including the removal, inspection, fault diagnosis/service/repair and replacement, are:

- 1 External structure, including control surfaces
- 2 Instrumentation systems
- 3 Lighting and electrical power systems
- 4 Landing gear assembly
- 5 Propeller
- 6 Engine

Higher National Unit Support Notes (cont)

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Opportunities for e-assessment

E-assessment may be appropriate for some assessments in this Unit. By e-assessment we mean assessment which is supported by Information and Communication Technology (ICT), such as e-testing or the use of e-portfolios or social software. Centres which wish to use e-assessment must ensure that the national standard is applied to all learner evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. The most up-to-date guidance on the use of e-assessment to support SQA's qualifications is available at www.sqa.org.uk/e-assessment.

Opportunities for developing Core and other essential skills

Learners will have opportunities to develop the Core Skill *Working with Others*, and Core Skills components *Communication (Written)*, *Numeracy (Using number)* and *Problem Solving (Planning and Organising)* at SCQF level 5 throughout all Outcomes in this Unit. This could be achieved through accurate written descriptions of tasks completed in log books, correct interpretation of drawings and measurements and successfully completing tasks that require working as a team.

There will also be opportunities to develop the broader skill of employability by working within a simulated aircraft practical engineering environment.

History of changes to Unit

Version	Description of change	Date

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General information for learners

Unit title: Aircraft Engineering Practical Skills (SCQF level 6)

This section will help you decide whether this is the Unit for you by explaining what the Unit is about, what you should know or be able to do before you start, what you will need to do during the Unit together with opportunities for further learning and employment.

This Unit is designed to allow you to develop your practical engineering skills in the manufacture and maintenance of aircraft structures, mechanical systems and electronic systems, as well as giving you the opportunity to work within a representative aircraft engineering environment. You will gain knowledge of industry standard practices and techniques in aircraft engineering as well as in practices used to ensure a safe and healthy working environment.

The Unit may be of particular interest if you wish to pursue a career in aircraft manufacture or aircraft maintenance.

On completion of this Unit you will be able to:

- 1 Manufacture and inspect structural and mechanical assemblies typically used in aircraft.
- 2 Assemble and test electrical and electronic circuits typically used in aircraft.
- 3 Carry out a practical aircraft maintenance task.

You will be assessed on all of the Knowledge and/or Skills contained in the three Outcomes and to complete the Unit successfully you will have to achieve a satisfactory level of performance in the assessment event/s.

You will have opportunities to develop the Core Skill *Working with Others*, and Core Skills components *Communication* (Written), *Numeracy* (Using number) and *Problem Solving* (Planning and Organising) at SCQF level 5 throughout all Outcomes in this Unit although there is no automatic certification of Core Skills or Core Skills components.

This could be achieved through accurate written descriptions of tasks completed in log books, correct interpretation of drawings and measurements and successfully completing tasks that require working as a team.

There will also be opportunities to develop the broader skill of employability by working within a simulated aircraft practical engineering environment.