Higher National Unit specification

General information

Unit title: Aircraft Engineering Systems (SCQF level 7)

Unit code: H94M 34

Superclass: XP

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Source: Scottish Qualifications Authority

Version: 01

Unit purpose

This Unit is designed to provide learners with the basic knowledge and understanding of the key individual mechanical, avionic, electrical and fluid systems that are used in aircraft today. As an introductory Unit to these key individual systems, it will allow learners to gain an overview and working knowledge of the layout of the principle components used within each system, their function, and how the different systems in an aircraft interrelate with each other.

The Unit is suitable for learners who wish to work in the aircraft engineering sector of the aviation industry.

Outcomes

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

1 Demonstrate knowledge and understanding of the fundamental principles of an aircraft flight control system used to provide safe operation in either flight or ground operations.
2 Explain the principles and operation of an aircraft hydraulic system used to provide hydraulic power and services.
3 Explain the fundamental principles, requirements and operation of an aircraft environmental system.
4 Explain the operation of aircraft fuel systems found in either single or multi-engine aircraft.
5 Demonstrate knowledge and understanding of the fundamental principles and operation of electrical systems found in either commercial, light, or cargo aircraft.
6 Explain the fundamental principles and operation of avionic systems found in either commercial, light, or cargo aircraft.

Higher National Unit Specification: General information (cont)

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Credit points and level

2 Higher National Unit credits at SCQF level 7: (16 SCQF credit points at SCQF level 7)

Recommended entry to the Unit

Access to this Unit is at the discretion of the centre. The Unit has no pre-requisites; however it would be beneficial if the learner has a basic understanding of aeronautical engineering.

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 Systems (SCQF level 7)

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

Demonstrate knowledge and understanding of the fundamental principles of an aircraft flight control system used to provide safe operation in either flight or ground operations.

Knowledge and/or Skills

- Layout and types of aircraft flight controls systems
- Aircraft primary and secondary flight controls systems: aerodynamic principles of operation and function
- Aircraft high-lift and drag inducement devices: aerodynamic principles of operations and function

Outcome 2

Explain the principles and operation of an aircraft hydraulic system used to provide hydraulic power and services.

Knowledge and/or Skills

- Principles and generation of hydraulic power
- Types of hydraulic fluid: properties, identification and hazards
- Components and layout of aircraft hydraulic systems
- Operation of aircraft hydraulic systems

Outcome 3

Explain the fundamental principles, requirements and operation of an aircraft environmental system.

Knowledge and/or Skills

- Aircraft pressurisation systems: principles, requirement and generation
- Aircraft cabin conditioning systems: principles, requirement and generation
- Components and layout of aircraft environmental systems
- Operation of aircraft environmental systems

Outcome 4

Explain the operation of aircraft fuel systems found in either single or multi-engine aircraft.

Knowledge and/or Skills

- Aircraft fuel tanks
- Components and layout of aircraft fuel systems: single and multi-engine aircraft
- Aircraft refuelling systems
- Aircraft fuel system indication

Outcome 5

Demonstrate knowledge and understanding of the fundamental principles and operation of electrical systems found in either commercial, light, or cargo aircraft.

Knowledge and/or Skills

- Function and operation of aircraft generators and components
- Aircraft power conversion and regulation systems
- Aircraft power distribution and switching components

Outcome 6

Explain the fundamental principles and operation of avionic systems found in either commercial, light, or cargo aircraft.

Knowledge and/or Skills

- Avionic instrumentation: principles of operation and function
- Aircraft transducers: function and operation
- Aircraft communication systems: principles and applications

Higher National Unit specification: Statement of standards (cont)

Unit title: Aircraft Engineering Systems (SCQF level 7)

Evidence Requirements for this Unit

Assessment for Outcomes 1 to 5 could be done on an Outcome by Outcome basis or as a combined assessment event, under closed-book supervised conditions.

The assessment for Outcome 6 should be carried out under open-book conditions.

Outcome 1

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

- explain the layout of aircraft flight control systems: mechanical, electromechanical and fly-by-wire (FBW).
- explain how movement of different aircraft primary and secondary flight control surfaces generates aerodynamic force to move an aircraft about its three axes of movement.
- explain how high-lift devices are used to generate lift for take-off and landing.
- explain the purpose of drag inducement devices and how they are used in flight and ground operations.

Outcome 2

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

- explain how pressure and force are generated in a hydraulic system.
- explain the requirements of aircraft hydraulic fluids: properties, types, identification, and hazards.
- explain the operation and functions of typical hydraulic components used in an aircraft system: reservoir, pumps, valves, filters and sensors.
- explain the layout and operation of a typical aircraft hydraulic system.

Outcome 3

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

- explain the requirements of an aircraft environmental system to provide aircraft cabin conditioning and pressurisation.
- explain how cabin conditioning and pressurisation services can be generated: engine bleed, blowers or air pumps.
- explain the operation and functions of typical components used in an aircraft environmental system: heat exchangers, valves, filters and sensors.
- explain the layout and operation of a typical aircraft environmental system.

Higher National Unit specification: Statement of standards (cont)

Unit title: Aircraft Engineering Systems (SCQF level 7)

Outcome 4

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

- explain the types of aircraft fuel tanks: rigid, flexible and integral and how they can be fitted and used.
- explain the operation and functions of typical components used in both single and multi-engine aircraft fuel system: pumps, valves, filters and sensors.
- explain how aircraft tanks are refuelled: over wing and automatic pressure systems.
- explain how fuel quantity is measured and indicated.

Outcome 5

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

- explain how aircraft generators function to provide electrical services.
- explain the operation and functions of typical components in an aircraft electrical generator system.
- explain methods of electrical power conversion within an aircraft.
- explain the operation and functions of components used in electrical power regulation systems.
- explain aircraft power distribution and switching: principles and components.

Outcome 6

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

- explain how avionic instrumentation function to provide flight deck information.
- explain the operation and functions of typical components in an aircraft instrumentation system.
- explain the principles of operation of transducers in providing an electrical signal.
- explain the principles of operation of aircraft communication systems.
- explain the applications of aircraft communication systems.

Higher National Unit Support Notes

Unit title: Aircraft Engineering Systems (SCQF level 7)

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 is an optional Unit within the HNC/HND Aircraft Engineering Group Awards. The Unit is primarily intended to provide learners with the essential underpinning knowledge of the key individual mechanical, avionic, electrical, and fluid systems used in aircraft; in order to prepare them for a career in the aircraft engineering industry or for progression to HND Aircraft Engineering (SCQF level 8).

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

SEMAER2_15	Assembling aircraft airframe ancillary components
SEMAER2_17	Assembling aircraft electrical components
SEMAE3002	Using and interpreting engineering drawings and documents
SEMAE3141	Carrying out fault diagnosis on aircraft airframe mechanical components and systems

Outcome 1

The emphasis of this Outcome is on the principles and operation of aircraft flight controls. Learners should be introduced to the purpose and function of an aircraft primary and secondary flight controls and how the movement of different control surfaces causes the aircraft to move about its three principle axes. The basic layout and operation of mechanical, electromechanical and fly-by-wire (FBW) flight control systems should be covered along with an explanation of the need, purpose and use of high-lift and drag inducement devices used by an aircraft either inflight or during its take-off or landing phases.

Outcome 2

This Outcome covers the principles and operation of an aircraft's hydraulic system. Learners should become familiar with how hydraulic pressure and output forces can be created within a hydraulic system. The function of the major components in a hydraulic system along with the basic layout of a system that could provide a typical hydraulic system operation should also be covered. In addition, the identification of the properties of an ideal hydraulic fluid, the hazards associated of working with hydraulic fluids and how different types of hydraulic fluids can be identified should also be explained.

Higher National Unit Support Notes (cont)

Unit title: Aircraft Engineering Systems (SCQF level 7)

Outcome 3

The emphasis of this Outcome is on principles and operation of an aircraft environmental system. Learners should become familiar with the requirement in flight to provide aircraft cabin conditioning and pressurisation services. The function of the major components in a environmental system should be explained and the basic layout and operation of a typical aircraft environmental system that could provide cabin conditioning and pressurisation services should also be covered.

Outcome 4

This Outcome covers the principles and operation of an aircraft fuel system. Learners should become familiar with the different types of fuel tanks that can be used in an aircraft to carry fuel and how fuel is distributed in both a single or multi-engine aircraft. The function of the major components used in an aircraft fuel system should be covered along with the basic layout and operations of typical fuel systems. In addition, how fuel quality is measured and indicated, and aircraft are refuelled should also be explained.

Outcome 5

The emphasis of this Outcome is on principles and operation of an aircraft electrical system. Learners should be introduced to how electrical power is generated, regulated and converted within an aircraft to provide it with electrical services. The function of the major components required in an aircraft electrical system should be explained and the basic layout and operation of a typical aircraft electrical system and how it is distributed should also be covered.

Outcome 6

The emphasis of this Outcome is on principles and operation of typical avionic systems found in various types of aircraft today. Learners should be introduced to the various aircraft instruments, transducers, and communication systems used in commercial, light, or cargo aircraft. The function of transducers used in avionic systems and how they operate to should be explained along with the function of various instruments and the major components in its circuit. How basic aircraft communication systems operate in an aircraft and their application should also be covered.

Guidance on approaches to delivery of this Unit

This Unit is designed to provide learners with professional knowledge and skills for the specific occupational area of Aircraft Engineering. It is logical to deliver this Unit sequentially by Outcome, with a mixture of assignments and exercises. Having access to relevant publications, diagrams, aircraft and avionic components is recommended to assist in the delivery of this Unit.

Higher National Unit Support Notes (cont)

Unit title: Aircraft Engineering Systems (SCQF level 7)

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.

For Outcomes 1–5, evidence could be generated on an Outcome by Outcome basis or as a combined assessment event. Assessment of the Outcomes could consist of a mixture and balance of multiple-choice and restricted response questions covering all Knowledge and/or Skills items. It is recommended that the total assessment time for Outcomes 1–5 should last approximately 2 hours.

Learners should not know in advance the questions on which they will be assessed and different questions should be set on each assessment occasion. Assessments must be carried out under closed-book supervised conditions.

Evidence for Outcome 6 could be generated by the submission of an essay/report based on avionic systems used in an aircraft, carried out under open-book conditions.

Learners should know in advance the avionic subject chosen by the centre to base the essay/report on from the Knowledge and/or Skills items in Outcome 6 and any relevant aircraft manuals, manufacturers data information and electrical diagrams for the subject chosen should be widely available.

In order to gain an assessment pass, learners will need to demonstrate that they can achieve the minimum requirements for this Unit.

The assessment instruments used for assessing this Unit should follow the general guidelines offered by the Scottish Qualification Authority (SQA) assessment model. Each centre should make a model answer as a marking guide for each question asked and learners awarded marks for key points and presentation of answers. Learners can supplement answers with sketches and diagrams to clarify points and be allowed to use scientific calculators to carry out any calculation.

For learners who fail to achieve the pass mark for each assessment, centres may allow learners to re-sit the assessments at an appropriate time using a significantly different assessment(s).

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 Skills of *Communication* (Written), and *Numeracy* (Using Number), at SCQF level 5 in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

Communication (Written) — this could be achieved through an essay/report, where all essential ideas/information with some supporting detail are appropriately presented in a logical order. These entries would use a structure and/or conventions mainly appropriate to purpose and audience; and use spelling, punctuation and sentence structures.

Numeracy (Using Number) — this could be achieved through the calculations in hydraulic systems, where the learner would need to use given information to calculate pressure, force and area in a system.

History of changes to Unit

Version	Description of change	Date

General information for learners

Unit title: Aircraft Engineering Systems (SCQF level 7)

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 and opportunities for further learning and employment.

This Unit is designed to introduce you to the key individual mechanical, avionic, and electrical systems that are used in aircraft today. It will allow you to gain an understanding, working knowledge and overview of the different systems used in an aircraft. In addition you will also achieve a working knowledge of how the different systems in an aircraft interrelate with each other.

On completion of this Unit you will be able to:

1 Demonstrate knowledge and understanding of the fundamental principles of an aircraft flight control system used to provide safe operation in either flight or ground operations.
2 Explain the principles and operation of an aircraft hydraulic system used to provide hydraulic power and services.
3 Explain the fundamental principles, requirements and operation of an aircraft environmental system.
4 Explain the operation of aircraft fuel systems found in either single or multi-engine aircraft.
5 Demonstrate knowledge and understanding of the fundamental principles and operation of electrical systems found in either commercial, light, or cargo aircraft.
6 Explain the fundamental principles and operation of avionic systems found in either commercial, light, or cargo aircraft.

All Knowledge and/or Skills items will be assessed. The assessment(s) for Outcomes 1 to 5 will be carried out under closed-book supervised conditions. Outcome 6 will be assessed under open-book conditions. To complete this Unit successfully you will have to achieve a satisfactory level of performance in the assessment event(s).

The Unit may be of particular interest to those who are interested in pursuing a career in aircraft engineering. It may also be of interest to others who are interested in either general mechanical, electrical or avionic engineering as it covers a broad range of subjects and how they interrelate with each other.

Although there is no automatic certification of Core Skills or Core Skills components within the Unit, it may, through the undertaking of particular tasks allow you to develop the necessary Core Skills requirements at SCQF level 5 of *Communication (Written)* and *Numeracy (Using Number).*