



Higher National Unit specification

General information

Unit title: Aircraft Avionics and Electrical Systems (SCQF level 8)

Unit code: H94T 35

Superclass: XP

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Unit purpose

This Unit is designed to allow learners to acquire the knowledge, understanding and analysis skills of modern aircraft avionics and electrical installations. The Unit encompasses the fundamental characteristics and operation of aircraft instruments, automatic flight control, radio communications, navigation systems and aircraft electrical power. Learners will gain in-depth knowledge and understanding surrounding the purpose, functionality and operation of these systems and their integration within an aircraft platform.

This Unit is aimed at learners wishing to pursue a career in aircraft maintenance engineering and avionics system design and manufacture.

Outcomes

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

- 1 Analyse and evaluate the functionality, operation and integration of aircraft communications and monitoring and recording systems.
- 2 Analyse and evaluate the functionality and operation of a typical aircraft navigation system, including its integration within an aircraft avionics suite.
- 3 Analyse and evaluate modern aircraft automatic flight and flight management systems, including their functionality, operation and integration with other aircraft systems.
- 4 Analyse and evaluate the functionality, operation and integration of aircraft electrical power and ice and rain protection systems.

Credit points and level

2 Higher National Unit credits at SCQF level 8: (16 SCQF credit points at SCQF level 8)

Higher National Unit Specification: General information (cont)

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Recommended entry to the Unit

Entry is at the discretion of the centre. However, learners would benefit from having knowledge and understanding of the theoretical principles that underpin modern aircraft avionics systems. This could be achieved through successful completion of the SCQF level 7 Unit H94V 34 *Aircraft Avionics Principles*.

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

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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.

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the Knowledge and/or Skills section must be taught and available for assessment. Learners should not know in advance the items on which they will be assessed and different items should be sampled on each assessment occasion.

Outcome 1

Analyse and evaluate the functionality, operation and integration of aircraft communications and monitoring and recording systems.

Knowledge and/or Skills

- ◆ V/UHF radio communication systems
- ◆ HF radio communication systems
- ◆ Cockpit Voice Recorder (CVR) systems
- ◆ Flight Data Recorder (FDR) systems
- ◆ Quick Access Recorder (QAR) systems
- ◆ Electronic instruments for engine and airframe systems

Outcome 2

Analyse and evaluate the functionality and operation of a typical aircraft navigation system, including its integration within an aircraft avionics suite.

Knowledge and/or Skills

- ◆ Inertial Navigation Systems (INS)
- ◆ Global Navigation Satellite Systems (GNSS)
- ◆ VOR navigation systems
- ◆ DME navigation systems
- ◆ ILS navigation systems
- ◆ Secondary Surveillance Radar (SSR) systems
- ◆ Air Data Systems

Higher National Unit specification: Statement of standards (cont)

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Outcome 3

Analyse and evaluate modern aircraft automatic flight and flight management systems, including their functionality, operation and integration with other aircraft systems.

Knowledge and/or Skills

- ◆ Aircraft autopilot systems
- ◆ Aircraft flight director systems
- ◆ Fly-by wire systems
- ◆ Flight Management Systems (FMS)

Outcome 4

Analyse and evaluate the functionality, operation and integration of aircraft electrical power and ice and rain protection systems.

Knowledge and/or Skills

- ◆ DC power generation and distribution systems
- ◆ AC power generation and distribution systems
- ◆ Emergency power generation systems
- ◆ Ice and rain protection systems

Evidence Requirements for this Unit

The assessment for this Unit could be done on an Outcome by Outcome basis or as part of a combined assessment event. Learners are required to provide written or oral recorded evidence, generated under closed-book conditions.

Evidence for the Knowledge and/or Skills in this Unit will be generated through sampling. Any sampling process must be 'unseen' by the learner before the assessment. That is, learners are expected to fully prepare the range of Knowledge and Skills and not be able to predict a chosen sample.

Outcome 1

Learners will need to provide written and/or oral recorded evidence to demonstrate they can examine three of the six Knowledge and/or Skills items by showing that they can analyse and evaluate the functionality, operation and integration of:

- ◆ aircraft HF or V/UHF radio communications systems
- ◆ a typical aircraft cockpit voice recorder system
- ◆ aircraft flight data recording systems
- ◆ a typical aircraft quick access recorder system
- ◆ a typical airframe and engine monitoring system

Higher National Unit specification: Statement of standards (cont)

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Outcome 2

Learners will need to provide written and/or oral recorded evidence to demonstrate they can examine four of the seven Knowledge and/or Skills items by showing that they can analyse and evaluate the functionality, operation and integration of:

- ◆ an aircraft inertial navigation system
- ◆ an aircraft global navigation satellite system
- ◆ an aircraft VOR system
- ◆ an aircraft DME system
- ◆ an aircraft ILS system
- ◆ an aircraft Secondary Surveillance Radar identification system
- ◆ an aircraft air data system

Outcome 3

Learners will need to provide written and/or oral recorded evidence to demonstrate they can examine two of the four Knowledge and/or Skills items by showing that they can analyse and evaluate the functionality, operation and integration of:

- ◆ an aircraft autopilot system
- ◆ an aircraft flight director system
- ◆ a typical aircraft fly-by-wire system
- ◆ a typical aircraft flight management system

Outcome 4

Learners will need to provide written and/or oral recorded evidence to demonstrate they can examine two of the four Knowledge and/or Skills items by showing that they can analyse and evaluate the functionality, operation and integration of:

- ◆ a typical aircraft DC power generation system and its distribution throughout the aircraft
- ◆ a typical aircraft AC power generation system and its distribution throughout the aircraft
- ◆ a typical aircraft emergency power generation system and its distribution throughout the aircraft
- ◆ a typical aircraft ice and rain protection system



Higher National Unit Support Notes

Unit title: Aircraft Avionics and Electrical Systems (SCQF level 8)

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 that is part of the HND Aircraft Engineering Group Award. The Unit is intended to provide the learner with the skills to analyse and evaluate modern aircraft avionics and electrical equipment installations.

This Unit provides learners with in-depth knowledge of functionality, operation and integration of modern aircraft avionics and electrical systems that will enable them to study advanced avionics principles and associated aircraft systems. This Unit also links to the National Occupational Standard (NOS) SEMAE3120 Carry out fault diagnosis on aircraft components and systems.

The Unit is broken down into four Outcomes that examine the key aircraft installations of radio communications, automatic flight control, navigation, monitoring and recording, electrical power generation and distribution and ice and rain protection. Additional information and context is provided as follows:

Outcome 1

Learners will be given in-depth knowledge of the operation and functionality of aircraft air-to-ground and air-to-air radio communications systems. This will encompass VHF, UHF and HF radio installations and their integration within the aircraft avionics suite. This Outcome also examines key aircraft systems that provide functionality for monitoring and recording of aircraft data and flight parameters. A typical cockpit voice recorder installation is studied to understand how the system captures and records all flight deck audio data and how it integrates with other aircraft systems. The operation and functionality of aircraft quick access recorder systems will be studied to analyse how they provide rapid access to raw aircraft data. Learners will receive in-depth knowledge of the need and mandatory requirement for an aircraft flight data recording system and examine the functionality and operation of a typical aircraft installation. A typical airframe and engine monitoring system, such as the Engine Indicating and Crew Alerting System (EICAS) or the Electronic Centralised Aircraft Monitoring (ECAM) System will be studied.

Higher National Unit Support Notes (cont)

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Outcome 2

This Outcome provides learners with the in-depth knowledge that will allow them to analyse and evaluate the functionality and operation of aircraft autonomous and radio navigation systems. The functionality and operation of a typical inertial navigation system will be studied including its outputs, limitations and integration with other aircraft systems. A typical Global Navigation Satellite System will also be studied including its key inputs, outputs, functionality and integration with other aircraft systems. Key radio navigation aids will also be examined to understand how VOR, DME and ILS systems provide key navigation data to ensure safe and successful flight. Secondary Surveillance Radar identifications will be explored, specifically addressing aircraft systems that provide Mode A, C and S functionality. Finally, learners will gain a good understanding of typical aircraft air data systems encompassing pitot and static pressure sensor requirements, air data computers and integration with other aircraft systems.

Outcome 3

In this Outcome, aircraft automatic flight control systems will be examined. This encompasses the functionality and operation of typical aircraft autopilot installations including system inputs, system outputs, modes of operation and automatic stabilisation. Flight director systems will be studied, specifically addressing their integration with autopilot systems, modes of operation and system displays. Learners will also study a typical aircraft fly-by-wire flight control system including manual operation and its integration with autopilot and flight director systems. Finally, learners will gain an in-depth knowledge of a typical aircraft flight management systems and how it uses information from key navigation systems alongside other parameters to achieve safe and efficient flight.

Outcome 4

This Outcome focuses on aircraft electrical installations including on-aircraft AC, DC and emergency power generation and distribution and the safety-critical ice and rain protection system. Learners will gain in-depth knowledge on the functionality and operation of aircraft AC and DC electrical power generation systems and how their outputs are distributed throughout the aircraft. This could include aircraft electrical busbars, internal distribution, electrical system control and monitoring functionality, interface with external power generation devices and aircraft wiring requirements. A typical aircraft emergency power generation system will also be studied allowing learners to analyse and evaluate the requirements and functionality of a typical system including its key components, limitations and power distribution. Learners will gain understanding on the need for a safety-critical ice and rain protection systems including ice detection functionality, airframe surface anti-icing, air data probe heating and rain dispersal.

Higher National Unit Support Notes (cont)

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Guidance on approaches to delivery of this Unit

This Unit is designed to provide learners with the ability to analyse and evaluate the functionality, operation and integration of modern aircraft avionics and electrical systems. The knowledge gained in this Unit will allow learners to study higher level avionics concepts and advanced aircraft systems.

It is recommended that this Unit is delivered following delivery of the SCQF level 7 Unit *Aircraft Avionics Principles*. There is no requirement to deliver the Outcome of this Unit in any particular order, but as an example centres may choose to deliver in the order presented in this Unit specification. Throughout delivery of this Unit, learners should build an in-depth knowledge of the functionality and operation of each system and how they integrate with other aircraft systems. Centres may consider the option of aligning the knowledge requirements of this Unit to a typical aircraft type to provide contextualisation to the knowledge requirements.

The theoretical nature of this Unit lends itself to classroom delivery, but opportunities can be taken for practical activity to support the learning and teaching. Centres may choose to undertake practical activities on aircraft flight simulators or ground training aids as well as ICT based learning to support the theoretical concepts delivered in a classroom 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.

Assessment for this Unit could be done on an Outcome by Outcome basis or by using combined assessment events. As an example, two combined assessments could take place, the first covering Outcomes 1 and 2 and the second Outcomes 3 and 4, each lasting one hour and carried out under closed-book supervised conditions. This may be influenced by the order that centres choose to deliver the Unit Outcomes. In this example, each assessment could comprise of two distinctive parts such as, the first containing a selection of multiple choice response questions and the second containing restricted response questions.

Irrespective of which assessment strategy is adopted, assessments should contain a sample of the Knowledge and/or Skills requirements for each Outcome as detailed in the Statement of Standards. That is, two Knowledge and/or Skills items for each Outcome should be sampled for the relevant assessment.

In order to achieve this Unit, learners are required to pass all assessments by presenting sufficient evidence that they have met the minimum Evidence Requirements, giving satisfactory response to the sampled questions.

Higher National Unit Support Notes (cont)

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Accurate records should be made of the assessment instruments used showing how evidence is generated for each assessment and providing marking schemes and/or check lists. Records of learners evidence should be kept and made available for verification as required.

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 component Written Communication at SCQF level 5 in this Unit throughout all Outcomes. This could be achieved through accurate written answers to formative and summative assessment questions.

History of changes to Unit

Version	Description of change	Date

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General information for learners

Unit title: Aircraft Avionics and Electrical Systems

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 allow you to acquire the knowledge and understanding of modern aircraft electrical and avionics systems and the ability to analyse and evaluate such systems including their functionality, operation and integration within a modern aircraft platform. The Unit comprises of the following core areas: radio communications, aircraft monitoring and recording, navigation aids, automatic flight control and flight management systems, electrical power generation and distribution and ice and rain protection systems. This Unit is aimed at those wishing to pursue a career in aircraft maintenance engineering in line and base maintenance environments. This Unit also provides you with the Knowledge and Skills to progress to other degree programmes that contain further avionics study. The knowledge elements provided by this Unit address typical aircraft avionics and electrical installations.

The Unit is broken down into four Outcomes, summarised as follows:

- Outcome 1: The operation, functionality and integration of aircraft radio communications and monitoring and recording systems.
- Outcome 2: The operation, functionality and integration of aircraft navigation systems.
- Outcome 3: The operation, functionality and integration of aircraft automatic flight control, fly-by-wire and flight management systems.
- Outcome 4: The operation, functionality and integration of aircraft electrical power generation and distribution and aircraft ice and rain protection systems.

You will be assessed on aspects of all four Outcomes of this Unit and assessment(s) will be carried out under closed-book, supervised conditions. 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 Skills component of Written Communication at SCQF level 5 in this Unit throughout all Outcomes.