

Higher National Unit Specification

General information for centres

Unit title: Avionics

Unit code: DR05 34

Unit purpose: This Unit is designed to allow candidates to acquire the knowledge and understanding of principles, functions, operation and maintenance of gyro-magnetic compass systems, aviation radio communication systems, weather radar and radio altimeters. It covers the knowledge about aircraft instrument required for EASA Part 66 B1 license(part of module 11 in EASA Part 66 requirements) or EASA Part 66 B2 license(part of module 13 in EASA Part 66 requirements).

On completion of the Unit the candidate should be able to:

- 1 Explain the principles, functions, and operation of magnetic heading and gyro-magnetic compass systems.
- 2 Explain the principles, functions, operation and maintenance of aviation radio communication systems and ATC transponder systems.
- 3 Explain the principles, functions, operation and maintenance of weather radars and radio altimeters.

Credit points and level: 1 HN Credit at SCQF level 7 (8 SCQF credit points at SCQF level 7).

**SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.*

Recommended prior knowledge and skills: Access to this Unit will be at the discretion of the centre. The Unit has no mandatory prerequisites, however it is recommended that candidates have complete Higher National Units DR0A 33 Mathematics and Physics for Aviation, and DR06 34 Electrical Fundamental for Aviation.

Core skills: There may be opportunities to gather evidence towards Core Skills in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

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.

Assessment: Candidates are assessed on an outcome by outcome basis or by a single assessment combining all three Outcomes. The assessment papers could be composed of an appropriate balance of short answer, restricted response and structured questions. Assessment should be carried out on a sample basis and under supervised, closed-book, controlled conditions.

General information for centres (cont)

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In order to achieve this unit, candidates are required to present sufficient evidence that they have met all the requirements for each outcome within the evidence requirements specified. Details of these requirements are given for each Outcome. The assessment instruments used should follow the general guidance offered by the Scottish Qualifications Authority (SQA) assessment model and an integrative approach to assessment is encouraged. (See references at the end of support notes).

Accurate records should be made of the assessment instruments used showing how evidence is generated for each Outcome and giving marking schemes and/or checklists, etc. Records of candidates' achievements should be kept. These records will be available for external verification.

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 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 skill section must be taught and available for assessment. Candidates 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

Explain the principles, functions, and operation of magnetic heading and gyro-magnetic compass systems

Knowledge and/or skills

- ◆ earth's magnetic field
- ◆ direct reading compass and errors in indication
- ◆ aircraft magnetic effects
- ◆ remote reading compass and gyro-magnetic compass

Evidence requirements:

Evidence for the knowledge and/or skills in this Outcome will be provided by an examination taken as a single assessment lasting 40 minutes or by a single two hour assessment combining all three Outcomes, and carried out under supervised, closed-book, controlled conditions.

Where the knowledge is sampled, the sample should comprise at least three bullet points listed under knowledge and/or skills. In order to ensure that candidates will not be able to foresee the sample, the whole of the content listed must be taught and available for assessment. Moreover, a different sample is required each time the outcome is assessed, to which candidates must give a satisfactory response. The evidence may be presented in responses to specific questions.

A candidate's response can be judged to be satisfactory where the evidence provided is sufficient to meet the requirements for each item by showing that the candidate has correct understanding or skills in:

- ◆ earth's magnetic field — magnetic variation; magnetic dip
- ◆ direct reading compass and errors in indication — principle of operation; construction; installation of compass; compass reading errors
- ◆ aircraft magnetic effects — ferrous and non-ferrous materials in aircraft; hard iron and soft iron
- ◆ remote reading compass and gyro-magnetic compass — principle of operation; construction; magnetic flux detector

Higher National Unit specification: statement of standards (cont)

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Assessment guidelines

This Outcome can be assessed by an examination taken as a single assessment lasting 40 minutes or by a single two hour assessment combining all three Outcomes, and carried out under supervised, closed-book, controlled conditions.

Questions used to elicit candidate evidence may take the form of an appropriate balance of short answer, restricted response and structured questions.

Outcome 2

Explain the principles, functions, operation and maintenance of aviation radio communication systems and ATC transponder systems.

Knowledge and/or skills

- ◆ radiation of electromagnetic waves
- ◆ modulation
- ◆ airborne radio frequency utilisation
- ◆ radio communication systems
- ◆ audio integrating systems
- ◆ basic principles of secondary radar
- ◆ ATC communication

Evidence requirements

Evidence for the knowledge and/or skills in this Outcome will be provided by an examination taken as a single assessment lasting 40 minutes or by a single two hour assessment combining all three Outcomes, and carried out under supervised, closed-book, controlled conditions.

Where the knowledge is sampled, the sample should comprise at least four bullet points listed under knowledge and/or skills. In order to ensure that candidates will not be able to foresee the sample, the whole of the content listed must be taught and available for assessment. Moreover, a different sample is required each time the Outcome is assessed, to which candidates must give a satisfactory response. The evidence may be presented in responses to specific questions.

A candidate's response can be judged to be satisfactory where the evidence provided is sufficient to meet the requirements for each item by showing that the candidate has correct understanding or skills in:

- ◆ radiation of electromagnetic waves — velocity and wavelength; electromagnetic spectrum; wave propagation; antennas
- ◆ modulation — amplitude modulation; frequency modulation; pulse modulation
- ◆ airborne radio frequency utilisation
- ◆ radio communication systems — very high frequency (vhf) communication; high frequency (hf) communication; SELCAL
- ◆ audio integrating systems

Higher National Unit specification: statement of standards (cont)

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- ◆ basic principles of secondary radar: Primary Surveillance Radar (PSR) and secondary Surveillance Radar (SSR); interrogation and reply
- ◆ ATC communication — coding; false target; side lobe suppression; installation

Assessment guidelines

This Outcome can be assessed by an examination taken as a single assessment lasting 40 minutes or by a single two hour assessment combining all three Outcomes, and carried out under supervised, closed-book, controlled conditions.

Questions used to elicit candidate evidence may take the form of an appropriate balance of short answer, restricted response and structured questions.

Outcome 3

Explain the principles, functions, operation and maintenance of weather radars and radio altimeters

Knowledge and/or skills

- ◆ basic principles of a radar
- ◆ characteristics of a weather radar
- ◆ weather radar displays
- ◆ basic principles for a radio altimeter
- ◆ operation of a radio altimeter
- ◆ aircraft installation delay of a radio altimeter

Evidence requirements

Evidence for the knowledge and/or skills in this Outcome will be provided by an examination taken as a single assessment lasting 40 minutes or by a single two hour assessment combining all three Outcomes, and carried out under supervised, closed-book, controlled conditions.

Where the knowledge is sampled, the sample should comprise at least four bullet points listed under knowledge and/or skills. In order to ensure that candidates will not be able to foresee the sample, the whole of the content listed must be taught and available for assessment. Moreover, a different sample is required each time the outcome is assessed, to which candidates must give a satisfactory response. The evidence may be presented in responses to specific questions.

A candidate's response can be judged to be satisfactory where the evidence provided is sufficient to meet the requirements for each item by showing that the candidate has correct understanding or skills in:

- ◆ basic principles of a radar — radio detection; measuring range; measuring direction
- ◆ characteristics of a weather radar — frequency and raindrop effects; pulse width; pulse repetition frequency; power output; beam width; tilt and stabilisation; contour; sensitivity time control
- ◆ weather radar displays

Higher National Unit specification: statement of standards (cont)

Unit title: Avionics

- ◆ basic principles for a radio altimeter — radio ranging; modulation of the carrier; factors affecting performance
- ◆ operation of a radio altimeter — monitoring and self-test
- ◆ aircraft installation delay of a radio altimeter

Assessment guidelines

This Outcome can be assessed by an examination taken as a single assessment lasting 40 minutes or by a single two hour assessment combining all three Outcomes, and carried out under supervised, closed-book, controlled conditions.

Questions used to elicit candidate evidence may take the form of an appropriate balance of short answer, restricted response and structured questions.

Administrative Information

Unit code:	DR05 34
Unit title:	Avionics
Superclass category:	XP
Date of publication:	August 2005
Version:	01
Source:	SQA

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Higher National Unit specification: support notes

Unit title: Avionics

This part of the Unit specification is offered as guidance. The support notes are not mandatory.

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

Guidance on the content and context for this Unit

This Unit is designed to allow candidates to acquire the knowledge and understanding of principles, functions, operation and maintenance of aviation radio communication systems, radar and radio altimeters, inertial navigation systems and GPS systems.

Corresponding to outcomes:

- 1 Explain the principles, functions, and operation of magnetic heading and gyro-magnetic compass systems
 - ◆ Earth's Magnetic Field
 - magnetic variation
 - earth's magnetic field variation
 - terrestrial magnetism
 - magnetic dip
 - ◆ Aircraft Magnetic Effects
 - ferrous and non-ferrous materials in aircraft
 - hard iron and soft iron
 - ◆ Direct reading compass and errors in indication
 - ferromagnetism
 - line of force
 - laws of magnetism
 - construction of magnetic compass
 - installation of compass
 - compass reading errors
 - ◆ Remote reading compass and magnetic flux detector
 - construction of a magnetic flux detector
 - basic operational principles
 - ◆ Gyro-magnetic compass: a monitored gyroscope system
 - operational principles and construction
- 2 Explain the principles, functions, operation and maintenance of aviation radio communication systems and ATC transponder systems
 - ◆ Radiation of electromagnetic waves
 - velocity and wavelength
 - electromagnetic spectrum and propagation
 - radiation of electro-magnetic waves, dipole and unipole antennas

Higher National Unit specification: support notes (cont)

Unit title: Avionics

- ◆ Modulation
 - amplitude modulation
 - combining signals of different frequency
 - spectrum of amplitude modulation and sidebands
 - frequency modulation
 - spectrum of frequency modulation

Airborne radio frequency utilisation

- ◆ Radio Communication Systems
 - very high frequency (vhf) communication
 - operational principles and block diagram
 - System interface and controls
 - Aircraft installation and maintenance
 - high frequency (hf) communication
 - operational principles
 - SSB and DSB
 - block diagram description of system operation
 - system interface and controls
 - aircraft installation and maintenance
 - SELCAL
 - operational principles and block diagram
 - system interface and controls
 - aircraft installation and maintenance
- ◆ Audio integrating systems
 - operational principles and block diagram
 - system interface and controls
 - aircraft installation and maintenance
- ◆ Basic principles of secondary radar
 - operational principles and block diagram
 - primary Surveillance Radar (PSR) and Secondary Surveillance Radar (SSR)
 - interrogation and reply
 - system interface and controls
 - aircraft installation and maintenance
- ◆ ATC communication
 - operational principles and block diagram
 - coding and altitude encoding
 - false target
 - side lobe suppression
 - control and operation
 - installation

Higher National Unit specification: support notes (cont)

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- 3 Explain the principles, functions, operation and maintenance of weather radars and radio altimeters
 - ◆ Basic principles of a radar
 - radio detection
 - measuring range
 - pulsed signals
 - measuring direction
 - pencil beam
 - fan beam
 - operational principles and block diagram
 - ◆ Characteristics of a weather radar
 - frequency and raindrop effects
 - pulse width
 - pulse repetition frequency
 - power output
 - beam width
 - tilt and stabilisation
 - contour
 - sensitivity time control
 - ◆ Weather radar displays
 - basic principles for a radio altimeter
 - radio ranging
 - modulation of the carrier
 - factors affecting performance
 - ◆ Operation of a radio altimeter
 - ◆ Monitoring and self test
 - ◆ Aircraft installation delay of a radio altimeter

Guidance on the delivery and assessment of this Unit

Unit title: Avionics

Opportunities for developing Core Skills

There are no opportunities to develop Core Skills in this Unit.

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

It is possible to assess candidates either on an outcome by outcome basis or by a single two hour holistic assessment combining all three Outcomes. The assessment papers could be composed of an appropriate balance of short answer, restricted response and structured questions. Assessment should be carried out under closed-book, supervised, controlled conditions.

Open learning

If this Unit is delivered by open or distance learning methods, additional planning and resources may be required for candidate support, assessment and quality assurance.

A combination of new and traditional authentication tools may have to be devised for assessment and re-assessment purposes.

For further information and advice, please see *Assessment and Quality Assurance for Open and Distance Learning* (SQA, February 2001 - publication code A1030).

Candidates with additional support needs

This Unit specification is intended to ensure that there are no artificial barriers to learning or assessment. The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments or considering alternative Outcomes for Units. For information on these, please refer to the SQA document *Guidance on Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs*, which is available on the SQA website **www.sqa.org.uk**.

General information for candidates

Unit title: Avionics

In this Unit you will acquire the knowledge and understanding of principles, functions, operation and maintenance of gyro-magnetic compass systems, aviation radio communication systems, radar and radio altimeters. It covers the knowledge about aircraft instrument required for EASA Part 66 B1 license (part of module 11 in EASA Part 66 requirements) or EASA Part 66 B2 license (part of module 13 in EASA Part 66 requirements). There are three Outcomes:

This Unit is designed to allow you to understand and explain the:

- ◆ explain the principles, functions, and operation of magnetic heading and gyro-magnetic compass systems
- ◆ explain the principles, functions, operation and maintenance of aviation radio communication systems and ATC transponder systems
- ◆ explain the principles, functions, operation and maintenance of radars and radio altimeters

This Unit will be beneficial if you are interested in aircraft engineering or are doing an aircraft engineering course.

You will be assessed either on an outcome by outcome basis or by a single two hour assessment combining all three Outcomes. The assessment papers could be composed of an appropriate balance of short answer, restricted response and structured questions. Assessment should be carried out under closed-book, supervised, controlled conditions.