National Unit Specification: general information

UNIT Avionics: An Introduction (SCQF level 6)

CODE F5GS 12

SUMMARY

This Unit may form part of a National Qualification Group Award but may also be offered on a free-standing basis.

This introductory Unit is designed to provide candidates with basic knowledge and understanding of aircraft instrumentation and avionics (aviation electronic systems). During Unit delivery candidates will learn to recognise the main instrument displays on a flight deck as well as describe the main functions and basic operating principles of key aircraft instruments and avionics systems, including air-data measurement instruments, radio communication systems and the radio navigation system – VOR/DME (Very High Frequency Omni-Directional Range/Distance Measuring Equipment).

This Unit is suitable for candidates who:

- are undertaking the study of this subject for the first time
- wish to gain a basic knowledge and understanding of avionics
- are considering a career in the aviation industry and wish to gain a basic knowledge and understanding of avionics

OUTCOMES

1 Describe the basic layout of flight decks and interpret key instrument displays.
2 Describe the basic principles of using Pitot tubes and static vents or slots to measure the altitude and airspeed.
3 Outline the use, basic configuration and operating principles of radio communication systems in aviation.
4 Describe the basic operating principles of radio navigation and the use of VOR/DME systems.

Administrative Information

Superclass: XP

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National Unit Specification: general information (cont)

UNIT Avionics: An Introduction (SCQF level 6)

RECOMMENDED ENTRY

While entry is at the discretion of the centre, it would be beneficial if candidates had attained one of the following, or equivalent:

- Standard Grade Physics (Credit level)
- Intermediate 2 Physics
- *Aeronautical Engineering: Fundamentals (SCQF level 6)*

CREDIT VALUE

1 credit at SCQF Level 6 (6 SCQF credit points at SCQF level 6*).

**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.*

CORE SKILLS

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

This Unit provides opportunities for candidates to develop aspects of the following Core Skills:

Problem Solving (SCQF level 6)

Numeracy (SCQF level 6)

These opportunities are highlighted in the Support Notes of this Unit Specification.

National Unit Specification: statement of standards

UNIT Avionics: An Introduction (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

Describe the basic layout of flight decks and interpret key instrument displays.

Performance Criteria

(a) Describe correctly one current main flight deck layout.
(b) Identify and read out correctly displays on an altimeter, airspeed indicator and vertical speed indicator.
(c) Identify and interpret correctly engine measurement displays.
(d) Interpret correctly the displays of an artificial horizon and aircraft attitude on a typical attitude-director indicator.
(e) Interpret correctly the displays of flight direction and selected course information on a typical horizontal situation indicator.

OUTCOME 2

Describe the principles of using Pitot tubes and static vents or slots to measure altitude and airspeed.

Performance Criteria

(a) Describe correctly the pressure-altitude relation and the principle of measuring altitude by means of ambient air pressure measurement.
(b) Describe correctly the meaning of undisturbed flow, static pressure and the use of static slots or vents for sensing static pressure.
(c) Describe correctly the meaning of stagnation point, total pressure, dynamic pressure and the use of Pitot tubes for sensing the total pressure.
(d) Describe correctly the principle of measuring airspeed by means of differential pressure measurement between static pressure and total pressure.

OUTCOME 3

Outline the use, basic configuration and operating principles of radio communication systems in aviation.

Performance Criteria

(a) Identify correctly typical frequency bands used in aircraft communication.
(b) Compare correctly the use of High Frequency (HF) radio communication and Very High Frequency (VHF) radio communication in aviation.
(c) Identify correctly the main parts of a radio system and explain correctly the key functions of each part.
(d) Describe correctly voice signal communication through radio waves.

National Unit Specification: statement of standards (cont)

UNIT Avionics: An Introduction (SCQF level 6)

OUTCOME 4

Describe the basic operating principles of radio navigation and the use of VOR/DME systems.

Performance Criteria

(a) Describe correctly the basic operational principles of a VOR system in terms of the generation of bearing signals.
(b) Describe correctly the basic operational principles of a DME system in terms of airborne interrogator, ground station transponder and slant range measurement.
(c) Describe correctly the basic operational principles of navigation by using VOR/DME systems in terms of bearing-bearing and bearing-distance.

EVIDENCE REQUIREMENTS FOR THIS UNIT

Evidence is required to demonstrate that candidates have achieved all Outcomes and Performance Criteria.

Written and/or recorded oral evidence must be produced to demonstrate that candidates have achieved all the Outcomes and Performance Criteria.

Outcomes may be assessed on an individual basis, as a combination of Outcomes or as a single, holistic assessment covering all four Outcomes. Assessment(s) must be conducted under supervised, closed-book conditions in which candidates may use reference materials provided by the centre but are not allowed to bring their own notes, handouts, textbooks or other materials into the assessment. The total time set aside for assessment must not exceed 3 hours.

With regard to Outcome 1

- One flight deck layout must be described. If reassessment is required a different flight deck must be chosen for assessment purposes.

- Candidates must interpret a set of readings under normal engine operating conditions.

With regard to Outcome 3

- Candidates must identify one HF and one VHF band.

- Candidates must identify, as a minimum, the following main parts of a radio system: transmitter, receiver, amplifier, antenna.

The Assessment Support Pack for this Unit provides sample assessment material. Centres wishing to develop their own assessments should refer to the Assessment Support Pack to ensure a comparable standard.

National Unit Specification: support notes

UNIT Avionics: An Introduction (SCQF level 6)

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 40 hours.

GUIDANCE ON THE CONTENT AND CONTEXT FOR THIS UNIT

This Unit forms part of the National Qualification Group Award in Aeronautical Engineering at SCQF level 6, but may also be offered on a free-standing basis.

It is strongly recommended that the Unit *Aeronautical Engineering: Fundamentals* at SCQF level 6 be delivered to candidates before this Unit.

This Unit is designed to provide candidates with a basic knowledge and understanding of aircraft instrumentation and avionics (aviation electronic systems). On successful completion of the Unit candidates will be able to recognise the main flight instrument displays on a flight deck. They will also be able to describe the main functions and basic operating principles of key aircraft instruments and avionics systems including air-data measurement instruments, radio communication systems and the radio navigation system — VOR/DME (Very High Frequency Omni-Directional Range/Distance Measuring Equipment).

The list below shows a suggested range of topics which may be delivered to candidates to support and underpin the requirements set out in the Outcomes, Performance Criteria and Evidence Requirements.

1 Describe the basic layout of flight decks and recognise key instrument displays.

- Different flight deck layouts:
  - — ‘basic six’ layout
  - — ‘basic T’ layout
  - — ‘PFD-ND’ layout

- The variation of layouts in different aircraft, such as light general aviation aircraft, transport/passenger aircraft built in 1970s, 1980s and early 1990s and modern transport/passenger aircraft

- Key displays in flight decks:
  - — Altimeters
  - — airspeed indicators
  - — vertical speed indicators
  - — attitude-director indicator
  - — horizontal situation indicator
  - — key engine measurement displays

- Key information displayed by those displays

2 Describe the basic principles of using Pitot tubes and static vents or slots to measure the altitude and airspeed.

- Pressure-altitude relation
- Ambient air pressure measurement
- Undisturbed flow
- Static pressure and static slots or vents for measuring the static pressure
- Altitude measurement and datum
- Airflow and stagnation point
- Total pressure and dynamic pressure
- Pitot tube and total pressure measurement
- Airspeed
- Differential pressure measurement
- Airspeed measurement by means of the measurement of differential pressure between total pressure and static pressure

3 Outline the use, basic configuration and operating principles of radio communication in aviation.

- Electromagnetic wave
- Wave frequency, speed and wavelength.
- Radio frequency bands
- Key propagation features of HF and VHF radio waves
- Comparison of the use of HF and VHF radio communication in aviation
- Main functional parts of a radio system:
  - antenna,
  - antenna tuning Unit
  - transceiver (transmitter / receiver) and amplifier
  - control panel
  - microphone

- Basic operational process of voice signal communication through radio waves:
  - signal pick-up
  - amplification
  - modulation
  - transmission
  - receiving
  - demodulation and amplification
  - speak-out

4 Describe the basic operating principles of radio navigation and the use of VOR/DME systems.

- Basic operating principles of VOR systems:
  - generation of bearing signals
- Basic operating principles of DME systems:
  - airborne interrogator
  - ground station transponder
  - slant range measurement
- Basic operational concept of navigation by using VOR/DME systems:
  - bearing-bearing
  - bearing-distance

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

It is recommended that the Unit is delivered in the same sequence the Outcomes are presented in the National Unit Specification: statement of standards section of the Unit. The Unit may be delivered by a combination of lectures, tutorial work, group work, computer simulation and aircraft hangar visits. While the majority of the Unit can be delivered in a classroom it is recommended that candidates make hangar visits so that they can view actual aircraft instrumentation and systems.

The use of flight simulator software, DVDs, CDs, videos and posters to illustrate aircraft flight decks and systems would greatly assist candidate learning.

OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

Aspects of the Core Skill of *Problem Solving*, that is, critical thinking, planning and organising, will be naturally developed in this Unit. Candidates have to identify and describe a significant range of factors influencing aircraft instrumentation and avionics. They must demonstrate understanding of basic operating principles as they investigate the workings of instrumentation, navigation and communication systems.

Candidates have to work with a number of numerical concepts, problem solving in practical contexts where the relevance and significance of information needs to be understood and clarified with accuracy. *Numeracy* skills should be naturally enhanced as technical information is interpreted and applied. Discussion, with assessor support, of technical issues will develop skills in evaluating problem solving approaches.

National Unit Specification: support notes (cont)

UNIT Avionics: An Introduction (SCQF level 6)

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

Opportunities for the use of 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 communications technology (ICT), such as e-testing or the use of e-portfolios or e-checklists. Centres which wish to use e-assessment must ensure that the national standard is applied to all candidate evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. Further advice is available in *SQA Guidelines on Online Assessment for Further Education (AA1641, March 2003), SQA Guidelines on e-assessment for Schools (BD2625, June 2005).*

Centres are encouraged to use formative assessment extensively as it plays a particularly important role in allowing candidates to develop a sound knowledge and understanding of aircraft instrumentation and avionics.

Where summative assessment is carried out on an individual Outcome basis the assessment papers may consist of short answer and restricted-response questions, or objective questions (eg multi-choice questions), or a mixture of both. Individual assessment events may last no longer than 45 minutes. It is recommended that each assessment event is carried out after the completion of the delivery of the corresponding Outcome. Assessment papers may be suitable for on-line delivery.

Where Outcomes are assessed using a single, holistic assessment the assessment paper may consist of short answer and restricted response questions, or objective questions or a combination of both. The assessment paper may be suitable for on-line delivery.

DISABLED CANDIDATES AND/OR THOSE WITH ADDITIONAL SUPPORT NEEDS

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering whether any reasonable adjustments may be required. Further advice can be found on our website **www.sqa.org.uk/assessmentarrangements**