



## National Unit Specification: general information

**UNIT** Aircraft Systems (SCQF level 6)

**CODE** F5GR 12

### SUMMARY

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

This Unit is designed to provide candidates with an introduction to Aircraft Systems. Candidates will develop a knowledge and understanding of the function and operation of aircraft mechanical, fluid, electrical and avionic systems. Candidates will also learn to recognise aircraft systems and understand their function.

The Unit is suitable for candidates who:

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

### OUTCOMES

- 1 Identify aircraft mechanical systems and describe their function and operation.
- 2 Identify aircraft fluid systems and describe their function and operation.
- 3 Identify aircraft electrical systems and describe their function and operation.
- 4 Identify aircraft avionic systems and describe their function and operation.

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#### Administrative Information

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## **National Unit Specification: general information (cont)**

**UNIT**          Aircraft Systems (SCQF level 6)

### **RECOMMENDED ENTRY**

Entry is at the discretion of the centre. Candidates do not require any prior knowledge or experience of the subject but it would be beneficial if the candidate had achieved one or more of the following, or equivalent:

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

### **CREDIT VALUE**

1 credit at Higher (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 Skill:

Communication          (SCQF level 6)

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

## **National Unit Specification: statement of standards**

### **UNIT Aircraft Systems (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**

Identify aircraft mechanical systems and describe their function and operation.

##### **Performance Criteria**

- (a) Correctly identify aircraft mechanical systems.
- (b) Describe accurately the function and operation of mechanical flight control systems.
- (c) Describe accurately the function and operation of mechanical engine control systems.
- (d) Describe accurately the function and operation of mechanical door operating systems.

#### **OUTCOME 2**

Identify aircraft fluid systems and describe their function and operation.

##### **Performance Criteria**

- (a) Correctly identify aircraft fluid systems.
- (b) Describe accurately the function and operation of aircraft hydraulic systems.
- (c) Describe accurately the function and operation of aircraft pneumatic systems.
- (d) Describe accurately the function and operation of aircraft fuel systems.
- (e) Describe accurately the function and operation of aircraft environmental control systems.
- (f) Describe accurately the function and operation of aircraft oxygen systems.

#### **OUTCOME 3**

Identify aircraft electrical systems and describe their function and operation.

##### **Performance Criteria**

- (a) Correctly identify aircraft electrical systems.
- (b) Describe accurately the function and operation of aircraft DC generation systems.
- (c) Describe accurately the function and operation of aircraft AC generation systems.
- (d) Describe accurately the function and operation of aircraft emergency electrical systems.
- (e) Describe accurately the function and operation of aircraft lighting systems.

## **National Unit Specification: statement of standards (cont)**

### **UNIT Aircraft Systems (SCQF level 6)**

#### **OUTCOME 4**

Identify aircraft avionic systems and describe their function and operation.

#### **Performance Criteria**

- (a) Correctly identify aircraft avionic systems.
- (b) Describe accurately the function of basic aircraft communications systems.
- (c) Describe accurately the function and operation of basic aircraft navigation systems.
- (d) Describe accurately the function and operation of aircraft autopilot systems.
- (e) Describe accurately the function and operation of fly by wire flight control systems.

#### **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 is required which demonstrates that the candidate has achieved all Outcomes to the standard specified in the Outcome and Performance Criteria.

Outcomes may be assessed on an individual basis, or in combination with others.

Alternatively, all four Outcomes may be assessed by a single, holistic assessment conducted at a single assessment event lasting no more than 3 hours.

Assessment 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.

#### **With regard to Outcome 1**

- ◆ The candidate must identify three different aircraft mechanical systems
- ◆ The candidate must describe the function and operation of the three previously identified mechanical systems

#### **With regard to Outcome 2**

- ◆ The candidate must identify five different aircraft fluid systems
- ◆ The candidate must describe the function and operation of the five previously identified aircraft fluid systems

#### **With regard to Outcome 3**

- ◆ The candidate must identify four aircraft electrical systems
- ◆ The candidate must describe the function and operation of the four previously identified aircraft electrical systems

## **National Unit Specification: statement of standards (cont)**

### **UNIT      Aircraft Systems (SCQF level 6)**

#### **With regard to Outcome 4**

- ◆ The candidate must identify four aircraft avionic systems
- ◆ The candidate must describe the function and operation of the four previously identified aircraft avionic systems

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 Aircraft Systems (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.

The Unit is designed to provide candidates with an introduction to Aircraft Systems. Candidates will develop a knowledge and understanding of the function and operation of aircraft mechanical, fluid, electrical and avionic systems. Candidates will also learn to recognise aircraft systems and comprehend their function.

The list below provides 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 Identify aircraft mechanical systems and describe their function and operation.

- ◆ The candidate must identify three aircraft mechanical systems and state their function and operation:
  - Flight Control Systems:
    - Function — to enable the flight crew to control the roll, yaw and pitch of the aircraft
    - Operation — mechanical cables and rods connect the movement of the control column, rudder pedals and trim mechanism to move the respective surface
  - Engine Control Systems:
    - Function — to enable the flight deck power setting to be relayed to the engine
    - Operation — mechanical cables and rods enable the movement of the power levers on the flight deck to adjust fuel flow to enable the engine to achieve the selected power level
  - Door Systems:
    - Function — to enable safe opening and locking of the doors during all operations including emergency
    - Operation — handles on both the inside and outside of the aircraft control mechanical linkages which allow the doors to be opened, closed and locked and prevent inadvertent operation during aircraft movement

## National Unit Specification: support notes (cont)

### UNIT Aircraft Systems (SCQF level 6)

#### 2 Identify aircraft fluid systems and describe their function and operation.

- ◆ The candidate must identify five different aircraft fluid systems and state their function and operation:
  - Hydraulic Systems:
    - Function — to enable control of airframe components which require greater power for their operation eg landing gear, flaps, spoilers, brakes etc
    - Operation — pressurised hydraulic fluid is carried throughout the aircraft in suitable pipework to enable movement of pistons and hence control of aircraft components
  - Pneumatic Systems:
    - Function — to enable control of airframe components which require lesser power for their operation eg door seal inflation, de-icing boots, environmental control system valves operation etc
    - Operation — pressurised air drawn from the engine is carried throughout the aircraft in suitable pipework to enable control of door seal inflation, de-icing boot inflation, environmental control system valve operation etc
  - Environmental Control System:
    - Function — to enable crew and passengers to fly in comfort at altitudes without additional oxygen equipment
    - Operation — compressed air is drawn from the engine and, after being cooled and regulated, it is introduced to the cabin to maintain suitable cabin air pressure
  - Oxygen Systems:
    - Function — to enable commercial aircraft crew and passengers to survive in the event of an environmental control system failure and to supply combat military crew with oxygen throughout the flight to enable operation at altitudes of up to around 35,000ft
    - Operation — commercial aircraft are fitted with bottles containing gaseous oxygen (military-liquid oxygen) which supply oxygen through pipework to individual masks for crew and passenger emergency use (Combat military- normal use)
  - Fuel Systems:
    - Function — to supply the correct quantity of clean fuel at the correct pressure to the engines during all operations. In addition the fuel system also comprises re-fuel, de-fuel and jettison functions
    - Operation — the fuel is stored in tanks -normally integral wing- and pressurised via pumps, passed through various filters and valves which control flow direction. The clean regulated fuel is then passed to the engine for combustion

## National Unit Specification: support notes (cont)

### UNIT Aircraft Systems (SCQF level 6)

#### 3 Identify aircraft electrical systems and describe their function and operation.

- ◆ The candidate must identify five different aircraft electrical systems and state their function and operation:
  - Aircraft Lighting Systems:
    - Function — aircraft lighting systems perform many functions. These include: navigation lighting, taxi lighting, instrument lighting, anti-collision lighting, emergency lighting etc
    - Operation — AC or DC power is supplied to independent lighting circuits within the aircraft. This enables illumination of selected areas of the aircraft
  - DC Systems:
    - Function — to provide direct current for electrical services within the aircraft
    - Operation — DC generators are normally driven from the aircraft engines. The generator is regulated to supply 28V at all times. The conversion to DC is carried out using a commutator and rectifier.
  - AC Systems:
    - Function — to provide alternating current for electrical services within the aircraft
    - Operation — AC generators are normally driven from the aircraft engines. The generator supplies a voltage of 115V which is normally fixed frequency; most aircraft AC generators supply three phase electricity
  - Emergency Electrical Systems:
    - Function — to allow safe operation of the aircraft if main electrical generation fails
    - Operation — emergency electrical systems include batteries, ram air turbines, back up converters and permanent magnet generators. The operation can be selected from any of these

#### 4 Identify aircraft electrical systems and describe their function and operation.

- ◆ The candidate must identify three different aircraft avionic systems and state their function and operation:
  - Communications Systems:
    - Function — to enable communication between the aircraft, air traffic control and other aircraft
    - Operation — voice inputs are converted to electromagnetic waves and transmitted through the air from antennas. These signals are received by antennas and converted back to audible communication
  - Navigation Systems:
    - Function — to enable aircraft to conduct journeys taking the safest and most economical route
    - Operation — various navigation systems are employed; the operation can be chosen from ADF, VOR, DME, ATC or TCAS



## **National Unit Specification: support notes (cont)**

### **UNIT      Aircraft Systems (SCQF level 6)**

- Auto-pilot systems:
  - Function — to relieve the pilot of the physical and mental fatigue of flying the aircraft, especially during long flights
  - Operation — the auto pilot system using computers will automatically control the aircraft flying control surfaces to manoeuvre the aircraft and stabilise it with respect to required flight conditions
  
- Electrical Flight Control Systems:
  - Function — to enable the flight crew to control the roll, yaw and pitch of the aircraft
  - Operation — fly by wire is a flying control system which receives inputs derived from electrical signals. The flying control actuators are an electro-hydraulic design, converting an electrical signal into the movement of a hydraulic ram which moves the control surface

### **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 this Unit. The Unit may be delivered by a combination of lectures, tutorial work (which may involve some group work), investigations, computer simulations, external visits and practical work. While the majority of the Unit may be delivered in a classroom it is recommended that candidates undertake some investigative work (eg using the Internet, computer simulation software etc.) and practical experimental work (eg experiments involving the use of a wind tunnel etc.) to confirm and reinforce the theory taught in the Unit.

It is recommended that aircraft models, wall charts and DVDs/videos are used extensively to assist learning

### **OPPORTUNITIES FOR CORE SKILL DEVELOPMENT**

Candidates should undertake investigative background reading, and be encouraged to analyse and evaluate a range of current technical data. Undertaking on-line investigative research would ensure currency of knowledge; access to software simulation and/or on-line tutorials during formative work will enhance understanding and further develop IT skills.

Guidance should be given on requirements for written evidence, which should be accurate and clearly expressed; examples of technical reports could be provided to indicate acceptable standards. Group discussion during practical experimental work and external visits will confirm and reinforce the theory taught in the Unit and allow opportunities to develop oral communication skills in a work related context.

## **National Unit Specification: support notes (cont)**

### **UNIT          Aircraft Systems (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 systems.

The assessment for Outcomes 1, 2, 3 and 4 may comprise suitable illustrations, short answer and restricted response questions, or objective questions (eg multi-choice questions), or a mixture of both. The assessment may be delivered online.

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.

##### **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](http://www.sqa.org.uk/assessmentarrangements)**