National Unit Specification: general information

UNIT Aircraft Design: An Introduction (SCQF level 6)

CODE F5GN 12

SUMMARY

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

The Unit is designed to provide candidates with an introduction to aircraft design. During the delivery of the Unit candidates will be provided with the opportunity to develop knowledge and understanding of aircraft structural, repair, systems and electrical design. Candidates will also have opportunities to learn about the main elements of aircraft design — from initial concept to detailed component design for new products and in-service design.

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 aircraft design
- are considering a career in the aviation industry and wish to gain a basic knowledge and understanding of aircraft design

OUTCOMES

1 Investigate the main features of aircraft structural design.
2 Investigate the main features of aircraft repair design.
3 Investigate the main features of aircraft systems design.
4 Investigate the main features of aircraft electrical design.

Administrative Information

Superclass: XP

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Version: 01

National Unit Specification: general information (cont)

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 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)

Communication (SCQF level 6)

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

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.

OUTCOME 1

Investigate the main features of aircraft structural design.

Performance Criteria

(a) State correctly examples of structural design load cases.
(b) State correctly main aircraft structural items.
(c) State correctly examples of aircraft operating conditions.
(d) State correctly factors affecting materials selection.
(e) Select and justify accurately a solution for a given structural design problem.

OUTCOME 2

Investigate the main features of aircraft repair design.

Performance Criteria

(a) State correctly types of damage inspection.
(b) State correctly types of damage commonly found on aircraft.
(c) State correctly common repair types.
(d) Identify and justify accurately a suitable inspection procedure and aircraft repair type to commonly found damage.

OUTCOME 3

Investigate the main features of aircraft systems design.

Performance Criteria

(a) State correctly appropriate examples of airworthiness requirements related to systems design.
(b) State correctly appropriate examples of fluid system design considerations.
(c) State correctly appropriate examples of mechanical system design considerations.
(d) Identify and justify accurately a suitable aircraft systems' solution for given airworthiness requirements and system design constraints.

National Unit Specification: statement of standards (cont)

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OUTCOME 4

Investigate the main features of aircraft electrical design.

Performance Criteria

(a) State correctly appropriate examples of customer requirements related to aircraft electrical design.
(b) State correctly examples of airworthiness requirements related to aircraft electrical design.
(c) State correctly appropriate examples of electrical design considerations.
(d) Identify and justify accurately a suitable electrical design solution for given customer requirements, airworthiness requirements and electrical design constraints.

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 should 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 should not exceed 3 hours.

With regard to Outcome 1

- Candidates must state a minimum of four examples of structural design load cases
- Candidates must state a minimum of four examples of main aircraft structural items
- Candidates must state three examples of aircraft operating conditions
- Candidates must state a minimum of three factors affecting materials selection

With regard to Outcome 2

- Candidates must state a minimum of three types of damage inspection
- Candidates must state a minimum of four types of damage commonly found on aircraft
- Candidates must state a minimum of four common repair types

With regard to Outcome 3

- Candidates must state a minimum of three examples of airworthiness requirements related to systems design
- Candidates must state a minimum of three examples of fluid system design considerations
- Candidates must state a minimum of three examples of mechanical system design considerations

National Unit Specification: statement of standards (cont)

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With regard to Outcome 4

- Candidates must state a minimum of three examples of customer requirements related to aircraft electrical design
- Candidates must state a minimum of three airworthiness requirements related to aircraft electrical design
- Candidates must state a minimum of three examples of electrical design considerations

National Unit Specification: support notes

UNIT Aircraft Design: 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.

The Unit is designed to provide candidates with an introduction to aircraft design. On successful completion of the Unit candidates will have a basic knowledge and understanding of aircraft structural, repair, systems and electrical design. Candidates will also have a basic knowledge and understanding of the main elements of aircraft design from initial concept through to detailed component design for new products and in-service design.

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

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 Investigate the main features of aircraft structural design.

- Structural load cases may be selected from the following: flight loads, landing loads, gust loads, engine loads, pressurisation loads, crash loads and jacking loads
- Main structural items may include the following: spar, rib, frame (former), intercostal, stringer, stiffener, skin, seat rail, keel and diaphragm
- Operating conditions may be selected from the following: high temperature, ambient or cabin environment, high vibration area, erosion zone and aerodynamic surface
- Factors affecting material selection may be selected from the following: operating temperature, load, fatigue, corrosion resistance, reactance to other materials, weight manufacturability and cost
- Consideration of design problems relating to structural design, selection of suitable structural items and materials with justification of selections

2 Investigate the main features of aircraft repair design.

- Types of damage inspection may include: visual, fluorescent dye penetrant, magnetic particle, radiographic, wear check (size limitations) tap test and ultrasonic
- Types of damage may include: dent, scratch, gouge, buckle, corrosion, crack, wear, incorrect fit, incorrect fastener/hole, de-lamination and disbond
- Types of common repair may include: external patch repair, insert repair, bush repair, weld repair, oversize fastener repair, resin injection repair, core replacement and composite lay-up repair
- Images of aircraft damage and selection of suitable inspection procedure and repair type

National Unit Specification: support notes (cont)

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3 Investigate the main features of aircraft systems design.

- Examples of airworthiness requirements may include: cable diameters, cable tension, clearances, ventilation, pressurisation, fire detection/extinguishant and fuel tank installation
- Examples of fluid system design considerations may include: redundancy, fluid type, operating conditions, flow rate, fluid conditioning, disc burst analysis and cost
- Examples of mechanical systems design considerations may include: redundancy, cable tension, disc burst analysis, operating conditions, connection locking, travels, foul conditions, jam conditions and cost
- Consideration of systems design problems and selection of suitable mechanical system solutions with justification of selections

4 Investigate the main features of aircraft electrical design.

- Examples of customer requirements related to electrical design may include: galley configuration, battery type, lighting configuration, additional heaters, cabin cooling and cost
- Examples of airworthiness requirements related to electrical design may include: emergency power duration, emergency lighting, basic flight instrumentation, redundancy, cable segregation and disc burst analysis
- Examples of electrical design considerations may include: electrical load, operating conditions, cable routing and clipping and cost
- Consideration of electrical design problems and production of suitable solutions with justification in terms of airworthiness requirements and electrical design considerations

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 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 aspects of aircraft design as they relate to real aircraft.

The use of aircraft models, DVDs, CDs, videos and posters to illustrate aspects of aircraft design may greatly assist candidate learning.

OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

Aspects of the Core Skill of *Problem Solving*, that is, critical thinking, planning, organising, reviewing and evaluating, will be naturally developed in this Unit, which requires the application of theory to a practical task. Candidates have to identify and justify suitable design solutions to take into account airworthiness requirements, operating conditions and customer needs. Design constraints and health and safety requirements are identified and taken into account. Discussion during formative work will reinforce the ability to evaluate and review design solutions and will also develop oral communication skills in a work related context.

National Unit Specification: support notes (cont)

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Candidates should be encouraged to undertake investigative reading, analysing and evaluating relevant technical data. 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.

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 basic aircraft design.

Where 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 may consist of short answer and restricted response questions, or objective questions or a combination of both. The assessment may be suitable for online 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**