Higher National Unit specification

General information

Unit title: Aircraft Structures and Materials (SCQF level 7)

Unit code: H94F 34

Superclass: XP

Publication date: May 2015

Source: Scottish Qualifications Authority

Version: 01

Unit purpose

This Unit is designed to allow learners to acquire an in-depth knowledge and understanding of the types of materials and structures used in modern aircraft construction.

This Unit is primarily intended for learners who wish to pursue a career in aircraft maintenance engineering but is equally as pertinent to those who wish to follow an aircraft structural engineering role.

Outcomes

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

1 Explain the characteristics and properties of materials used in aircraft construction.
2 Explain the general concepts and classification of aircraft structures designed to meet airworthiness requirements.
3 Explain the construction methods of major components of an aircraft structure.

Credit points and level

1 Higher National Unit credits at SCQF level 7: (8 SCQF credit points at SCQF level 7)

Recommended entry to the Unit

Access to this Unit is at the discretion of the centre. The Unit has no pre-requisites; however, it would be beneficial if the learner has a basic knowledge of aircraft and/or engineering theory.

Higher National Unit specification: General information (cont)

Unit title: Aircraft Structures and Materials (SCQF level 7)

Core Skills

There are opportunities to develop the Core Skill of *Communication* (Written Communication) at SCQF level 5 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.

The Assessment Support Pack (ASP) for this Unit provides assessment and marking guidelines that exemplify the national standard for achievement. It is a valid, reliable and practicable assessment. Centres wishing to develop their own assessments should refer to the ASP to ensure a comparable standard. A list of existing ASPs is available to download from SQA's website **(http://www.sqa.org.uk/sqa/46233.2769.html)**.

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

Unit title: Aircraft Structures and Materials (SCQF level 7)

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

Explain the characteristics and properties of materials used in aircraft construction.

Knowledge and/or Skills

- Ferrous and non-ferrous materials their characteristics, properties and identification
- Testing and heat treatments processes of aircraft materials
- Composite and non-metallic materials used in aircraft construction
- Common types of defect/deterioration found in aircraft structures
- Common detection and repair methods of defects/deterioration
- Sealant and bonding agents for aircraft materials

Outcome 2

Explain the general concepts and classification of aircraft structures designed to meet airworthiness requirements.

Knowledge and/or Skills

- Airworthiness requirements for structural strength, fail safe, safe life and damage tolerance concepts
- Structure classification of primary, secondary and tertiary structure, significance of primary structural elements along with zones and station identification
- Types of forces acting on an aircraft structure
- System installation along with drainage and ventilation provision
- Lightning strike protection and aircraft bonding

Higher National Unit specification: Statement of standards (cont)

Unit title: Aircraft Structures and Materials (SCQF level 7)

Outcome 3

Explain the construction methods of major components of an aircraft structure.

Knowledge and/or Skills

- Stressed skin fuselage, floors and reinforcement items
- Formers, stringers, longerons, bulkheads and frames
- Doublers, struts, ties and beams
- Skinning and anti-corrosive protection
- Attachments of wings, empennage and engines

Evidence Requirements for this Unit

Outcome 1

Learners will need to provide written and/or oral recorded evidence to demonstrate their Knowledge and/or Skills by showing that they can explain the:

- characteristics, properties and identification of different types of ferrous and non-ferrous materials
- different types of heat treatments and testing of ferrous and non-ferrous materials
- characteristics, properties and identification of composite and non-metallic materials used in aircraft construction.
- common types of defect/deterioration found in aircraft structures
- common defect/deterioration detection and repair methods
- sealant and bonding agents used in aircraft materials

The evidence for this Outcome should be generated by a closed-book supervised assessment.

Outcome 2

Learners will need to provide written and/or oral recorded evidence to demonstrate their Knowledge and/or Skills by showing that they can explain:

- airworthiness requirements for structural strength, including fail safe, safe life and damage tolerance
- how structures are classified as either primary, secondary or tertiary and the significance of primary structural elements, how structures are split into zones and different structural stations identified
- the forces that act on an aircraft structure during flight and ground operations
- aircraft systems installation along with drainage and ventilation provision
- how aircraft are protected from lightning strike and how aircraft are electrically bonded

The evidence for this Outcome should be generated by a closed-book supervised assessment.

Higher National Unit specification: Statement of standards (cont)

Unit title: Aircraft Structures and Materials (SCQF level 7)

Outcome 3

Learners will need to provide written and/or oral recorded evidence to demonstrate their Knowledge and/or Skills by showing that they can explain:

- the construction of stressed skin fuselage, floors and reinforcement items
- constructional methods used to manufacture formers, stringers, longerons, bulkheads and frames
- constructional methods of doublers, struts, ties and beams
- methods of skinning and applying anti-corrosive protection
- methods of attachments of wings, empennage and engines

The evidence for this Outcome should be generated by a closed-book supervised assessment.

Higher National Unit Support Notes

Unit title: Aircraft Structures and Materials (SCQF level 7)

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 40 hours.

Guidance on the content and context for this Unit

This is a mandatory Unit in the HNC/HND Aircraft Engineering Group Awards. This Unit is designed to allow learners to acquire an in-depth knowledge and understanding of the types of materials and structures used in modern aircraft construction.

This Unit links to the following Semta National Occupational Standards (NOS):

SEMAE3013	Repairing air frames and structures
SEMAE2_27	Carrying out bonding operations on aircraft composite components

Content/context corresponding to Outcomes

Outcome 1

The characteristics, properties and identification of ferrous, non-ferrous, composite and non-metallic materials used in aircraft construction. The testing of ferrous and non-ferrous material to determine hardness, tensile strength, fatigue strength and impact resistance along with their respective heat treatment and application. The types of sealant and bonding agents used in aircraft materials and the types of defect/deterioration commonly found in aircraft structures and methods of detection and repair of the defects/deterioration in metallic, non-metallic and composite structures.

Outcome 2

General concepts of aircraft structures and airworthiness requirements for structural strength, fail safe, safe life and damage tolerance. The classification of an aircraft structure as primary, secondary or tertiary. The significance of primary structural elements and how structures are split into zones and different structural stations identified. Aircraft systems installation through and around structures along with drainage and ventilation provision, how aircraft are protected from lightning strike and how they are electrically bonded. The types of forces that act on an aircraft structure during flight and during ground operations.

Higher National Unit Support Notes (cont)

Unit title: Aircraft Structures and Materials (SCQF level 7)

Outcome 3

The construction methods of stressed skin fuselage, floors and reinforcement items. The methods of manufacturing formers, stringers, longerons, bulkheads, frames, doublers, struts, ties and beams for use in aircraft structures. The methods of skinning and applying anti-corrosive protection to component parts of a structure and methods of attaching wings, empennage and engines.

Guidance on approaches to delivery of this Unit

It is logical to deliver this Unit sequentially by Outcome as basic material properties and characteristics introduced in Outcome 1 should improve the understanding as to why materials are selected for particular elements of an aircraft structure and these topics are developed throughout Outcomes 2 and 3.

Whilst the mode of delivery is at the discretion of the centre it is anticipated that traditional lectures will be supplemented by a range of media for example videos, simulations and actual aircraft components/materials. In addition having access to relevant publications including Aircraft Maintenance Manuals (AMM), Illustrated Parts Catalogues (IPC) and Structural Repair Manuals for a range of aircraft is recommended.

The Knowledge and/or Skills are written is a manner which should allow them to be effectively delivered in the sequence presented.

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.

Holistic assessment is encouraged and learners could be assessed by a single one and half hour closed-book assessment covering all three Outcomes after completion of the teaching of the Unit. The assessment could be comprised of a number of multiple-choice and extended response questions enabling Unit Evidence Requirements to be met and breadth and depth of learner knowledge to be demonstrated. This assessment approach should reduce the frequency of assessment/re-assessment events and ensure more time is afforded for teaching and learning whilst meeting the Evidence Requirements of the Unit.

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

Higher National Unit Support Notes (cont)

Unit title: Aircraft Structures and Materials (SCQF level 7)

Learners should not know in advance the questions on which they will be assessed and different questions should be set on each assessment occasion. This assessment must be carried out under closed-book supervised conditions. In order to gain an assessment pass, learners will need to demonstrate that they can achieve the minimum requirements for this Unit.

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 Skill component of *Communication* (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

General information for learners

Unit title: Aircraft Structures and Materials (SCQF level 7)

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 enable you to acquire a knowledge and understanding of the types of materials and basic structures used in modern aircraft construction.

In particular the Unit will look at how basic aircraft structures and materials apply to an aircraft engineering maintenance environment. The Unit is primarily intended for learners who are interested in aircraft engineering and is a mandatory Unit in the HNC/HND Aircraft Engineering Group Awards, although it may be of interest to learners of other disciplines.

The Unit has three main areas, each area covered by a separate Outcome. The three main areas the Unit covers are:

1 Explain the characteristics and properties of materials using in aircraft construction.
2 Explain the general concepts and classification of aircraft structures designed to meet airworthiness requirements.
3 Explain the construction methods of major components of an aircraft structure.

You will be assessed under closed-book conditions on all of the Knowledge and/or Skills contained in the three Outcomes and to complete the Unit successfully you will have to achieve a satisfactory level of performance in the assessment event/s.

In the closed-book assessment you will not be permitted to bring textbooks, handouts or other material into the assessment event.

You will have opportunities to develop the Core Skill component of *Communication* (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.