



Higher National Unit specification

General information for centres

Unit title: Aircraft Propulsion Systems: Introduction

Unit code: DR09 34

Unit purpose: This Unit is designed to introduce candidates to the main concepts of Aircraft Propulsion. It will allow the candidate to gain an understanding of the basic propulsive processes regarding both piston and gas turbine cycles. In addition candidates will also achieve a working knowledge of aircraft propulsion fuel systems and their main constituents used within both propulsion areas.

This unit also part covers EASA 66 Modules 15 and 16.

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

- 1 Describe the principles of operation of piston and gas turbine engines.
- 2 Describe a multi-engine aircraft fuel system.
- 3 Describe aircraft fuel types and characteristics.

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 is at the discretion of the centre. The unit has no pre-requisites; however, it would be beneficial if the candidate has a basic understanding of aeronautical engineering. This may be evidenced by possession of the NC Unit Aircraft Power Plant and Fuel Systems and/or engineering experience.

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: The first assessment will cover the first Outcome and be carried out on a sampling basis, where 60% of the question refers to the turbine engine and 40% piston engine. The assessment should be composed of short answers, restricted response and/or multi-choice questions and last approximately 1½ hours.

General information for centres (cont)

Unit title: Aircraft Propulsion Systems: Introduction

For the second outcome the candidate will be required to complete a partial multi-engine fuel system diagram by either adding or labelling correctly six of the ten items listed in the knowledge and/or skills requirements. The candidate must also describe correctly the function and/or purpose of six of the ten items listed in the knowledge and/or skills requirements.

For the third assessment the candidate will be required to research aircraft fuel types and characteristics. A report covering all of the knowledge and/or skills requirements for this outcome must be presented orally along with a written report of their findings. The oral report should be approximately 5–10 minutes and include visuals. The written report should be approximately 600 words using a standard short report format, with references.

In order to achieve this Unit, candidates are required to pass all assessments by presenting sufficient evidence that they have met the minimum Evidence Requirements, giving satisfactory response to the questions.

The assessment instruments used should follow the general guidelines offered by the Scottish Qualification Authority (SQA) assessment model and an integrative approach to assessment is encouraged.

Accurate records should be made of the assessment instruments used showing how evidence is generated for each assessment, 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

Unit title: Aircraft Propulsion Systems: Introduction

Unit code: DR09 34

The sections of the Unit stating the Outcomes, knowledge and/or skills, and evidence requirements are mandatory.

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the knowledge and/or skills 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.

The whole of the content listed in Outcome 1 knowledge and/or skills section must be taught and available for assessment. The emphasis for this outcome should be split 60% turbine engine and 40% piston engine theory and components. Candidates should not know in advance the questions on which they will be assessed and different questions should be set on each assessment occasion.

Outcome 1

Describe the principles of operation of piston and gas turbine engines

Knowledge and/or skills

- ◆ Operating principles for the four stroke engine
- ◆ Piston engine configuration
- ◆ Production of thrust from propellers related to Newton's 2nd Law.
- ◆ Crankcase, crankshaft
- ◆ Piston, compression rings, cylinder
- ◆ Valve train
- ◆ Reduction gearbox
- ◆ Operating cycles for the turbine engine
- ◆ Production of thrust from turbo-jet related to Newton's 2nd Law.
- ◆ Turbine engine types: centrifugal; axial flow; multi-spool; high by-pass; low by-pass
- ◆ Inlet; Compressor; Combustion section; Turbine section; Exhaust.
- ◆ Reduction gearbox

Evidence requirements

Evidence for this Outcome will be generated through sampling of the knowledge and/or skills requirements for this outcome, all of which must be taught and available for assessment. Sampled questions for this assessment will consist of 60% turbine engine and 40% piston engine theory and/or components.

For the first outcome the candidate's response can be judged satisfactory if the evidence generated shows that candidates can explain six of the eight points listed below:

- ◆ operating principles for the 4 stroke engine is explained
- ◆ identify piston engine configuration

Higher National Unit specification: statement of standards (cont)

Unit title: Aircraft Propulsion Systems: Introduction

- ◆ the production of thrust from propellers is correctly related to Newton's 2nd Law
- ◆ functions of the major piston engine components
- ◆ principles of operation of turbine engines
- ◆ the production of thrust from turbo-jet is correctly related to Newton's 2nd Law
- ◆ turbine engine types
- ◆ functions of the major gas turbine engine components

Assessment guidelines

For this assessment the candidates will need to respond to a number of sampled questions. The sampling for this outcome will be derived from the knowledge and/or skills requirements, all of which the must be taught and available for assessment. Sampled questions for this assessment will consist of 60% turbine engine and 40% piston engine theory and components.

This assessment should be composed of short answers, restricted response and/or multi-choice questions and last approximately 1½ hours. Candidates 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, candidates will need to demonstrate that they can achieve the minimum requirements for this Unit.

Outcome 2

Describe a multi-engine aircraft fuel system

Knowledge and/or skills

- ◆ tank
- ◆ filter
- ◆ vent
- ◆ boost pump
- ◆ cross feed valves
- ◆ suction valves
- ◆ non-return valves
- ◆ jettison valve
- ◆ refuel valve
- ◆ inter-engine valve

Evidence requirements

For the second outcome the candidate will be required to complete a partial multi-engine fuel system diagram by either adding or labelling correctly six of the ten items listed in the knowledge and/or skills requirements. The candidate must also describe correctly the functional purpose of six items listed from the knowledge and/or skills requirements. Response can be judged satisfactory if the Fuel system diagram generated shows and describes correctly six of the ten following items:

Higher National Unit specification: statement of standards (cont)

Unit title: Aircraft Propulsion Systems: Introduction

- ◆ tank
- ◆ filter
- ◆ vent
- ◆ boost pump
- ◆ cross feed valves
- ◆ suction valves
- ◆ non-return valves
- ◆ jettison valve
- ◆ refuel valve
- ◆ inter-engine valve

Assessment guidelines

For this assessment the candidate will be required to complete a partially completed multi-engine fuel system by either adding or labelling correctly six of the ten items listed in listed in the knowledge and/or skills requirements. The candidate must also describe correctly the function and/or purpose of the six of the ten items listed in the knowledge and/or skills requirements.

Response can be judged satisfactory if the Fuel system diagram generated shows and describes six of the ten following items:

- ◆ tank
- ◆ filter
- ◆ vent
- ◆ boost pump
- ◆ cross feed valves
- ◆ suction valves
- ◆ non-return valves
- ◆ jettison valve
- ◆ refuel valve
- ◆ inter-engine valve

Outcome 3

Describe aircraft fuel types and characteristics

Knowledge and/or skills

- ◆ piston engine aircraft
- ◆ gas turbine engine aircraft
- ◆ anti-knock rating
- ◆ calorific value
- ◆ volatility
- ◆ corrosive Effects

Higher National Unit specification: statement of standards (cont)

Unit title: Aircraft Propulsion Systems: Introduction

Evidence requirements

The candidate is required to research aircraft fuel types and characteristics; then present an oral and written report of their findings. This report will cover all of the knowledge and/or skills for this Outcome, with the candidate being able to answer questions regarding their report. The oral report should be approximately 5–10 minutes and include visuals. The written report should be approximately three pages (12pt **200words/page**), a standard short report format, including references.

Assessment guidelines

For this assessment the candidate will be required to research aircraft fuel types and characteristics. A report covering all of the knowledge and/or skills for this outcome must be presented orally along with a written report of their findings. The oral report should be approximately 5–10 minutes and include visuals. The written report should be approximately 600 words, a standard short report format, including references.

- ◆ title page
- ◆ introduction
- ◆ discussion
- ◆ conclusion
- ◆ attachments

Assessment guidelines for the Unit

The assessment of this Unit should be carried out by two assessments and a report. All assessments should be carried out under supervised control conditions. Sampled questions used to elicit candidates' evidence should take the form of short answers, restricted response and/or multi-choice questions.

The assessment should be composed of short answers, restricted response questions and last approximately 1½ hours. Candidates should not know in advance the questions on which they will be assessed and different questions should be set on each assessment occasion. Assessments must be carried out under closed book supervised conditions. In order to gain an assessment pass, candidates will need to demonstrate that they can achieve the minimum requirements for this Unit

The assessment instruments used for assessing this Unit should follow the general guidelines offered by the Scottish Qualification Authority (SQA) assessment model. Each centre should make a model answer as a marking guide for each sampled question asked and candidates awarded marks for key points and presentation of answers. Candidates can supplement written answers with sketches and diagrams to clarify points and be allowed to use scientific calculators to carry out any calculation.

For candidates who fail to achieve the pass mark for each assessment, centres may allow candidates to re-sit the assessments at an appropriate time using different sampled questions.

Administrative Information

Unit code:	DR09 34
Unit title:	Aircraft Propulsion Systems: Introduction
Superclass category:	XP
Original date of publication:	August 2005
Version:	03 (July 2008)

History of changes:

Version	Description of change	Date
02	Previous versions were made before the introduction of the History of Changes table.	April 2006
03	Qualitative and quantitative statements added to descriptor Evidence Requirements to clarify standards.	17/7/08

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Higher National Unit specification: support notes

Unit title: Aircraft Propulsion Systems: Introduction

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 has been written in order to allow candidates to develop knowledge, understanding and skills in Aircraft Propulsion:

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

- 1 Describe the principles of operation of piston and gas turbine engines.
- 2 Describe a multi-engine aircraft fuel system
- 3 Describe aircraft fuel types and characteristics.

This Unit is at SCQF level 7 and has been incorporated within the first year of the new HNC/D Aircraft Engineering award (effectively the HNC award) as a mandatory Unit.

Outcome 1: The emphasis for this outcome should be split 60% turbine engine and 40% piston engine theory and components. The candidate should be able to explain the working cycle of both types of engines. The candidate should also be able to identify and explain the purpose of major components from aircraft turbine and piston engines.

Outcome 2: The candidate should be able to complete a partially completed multi-engine fuel system diagram by either adding or labelling correctly six items listed from the knowledge and/or skills requirements. The candidate must also be able to describe correctly the function and/or purpose of six items listed in the Knowledge and/or skill section for this Outcome.

Outcome 3: The candidate should be able to research and present a report (oral and written report) on aviation fuel types and characteristics. This report should include, but not be limited to, the points listed in the knowledge and/or skills section for this Unit. The knowledge and/or skills for this Outcome could be discussed and the candidates given the opportunity to take notes but, care should be taken not to give too much information as part of the objective of this Outcome is to encourage research.

Guidance on the delivery and assessment of this Unit

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

The assessment of this Unit should be carried out by two assessments and a report covering all Outcomes of this Unit. All assessments should be carried out under supervised controlled conditions and last one and a half hours each. Sampled questions used to elicit candidates' evidence should take the form of structured, restricted response questions.

Satisfactory achievement of this unit will be demonstrated by the candidate achieving the minimum evidence requirements.

Higher National Unit specification: support notes (cont)

Unit title: Aircraft Propulsion Systems: Introduction

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 40 hours.

Outcome 1: The emphasis for this outcome should be split 60% turbine engine and 40% piston engine theory and components. The candidate should be able to explain the working cycle of both types of engines. The candidate should also be able to identify and explain the purpose of major components from aircraft turbine and piston engines.

For the assessments the candidate may be asked to explain the working cycles of piston and turbine engine theory, then given a diagram and asked to identify and explain the major components of both types of engines. Depending on the sampling basis they could also be asked to relate thrust to Newton's 2nd Law. The assessment should consist of a 60/40 balance of questions and last approximately 1½ hour.

Outcome 2: A multi-engine fuel system diagram should be given and explained to the candidate. The candidate should be asked to complete a partial multi-engine fuel system diagram by either adding or labelling correctly six of the ten items listed in the knowledge and/or skills requirements. The candidate will then be required to describe correctly the function and/or required purpose of six of the ten items from the multi-engine fuel system diagram.

Outcome 3: For this assessment the candidate will be required to research aircraft fuel types and characteristics. This Outcome could be given to the candidate at the start of the block to allow them time to research the topic and also help in the scheduling of the presentations. A report covering all of the knowledge and/or skills for this Outcome must be presented orally along with a written report of their findings. The oral report should be approximately 5–10 minutes and include visuals followed by a question answer session.

The written report should be approximately 600 words, a standard short report format, including references.

- ◆ title page
- ◆ introduction
- ◆ discussion
- ◆ conclusion
- ◆ attachments

Higher National Unit specification: support notes (cont)

Unit title: Aircraft Propulsion Systems: Introduction

Opportunities for developing Core Skills

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

Open learning

The study material and notes could be used and formatted for Open Learning. However, the assessments procedures must be conducted under supervised closed-book conditions, and as such candidates must not be allowed to use any textbooks, handouts or notes during the assessment.

Candidates with disabilities and/or additional support needs

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. Further advice can be found in the SQA document *Guidance on Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs* (www.sqa.org.uk).

General information for candidates

Unit title: Aircraft Propulsion Systems: Introduction

This Unit is designed to introduce you to the main concepts of Aircraft Propulsion. It will allow you to gain an understanding of the basic propulsive processes regarding both piston and gas turbine cycles. In addition you will also achieve a working knowledge of aircraft propulsion fuel systems and their main constituents used within both propulsion areas.

On completion of this Unit you should be able to:

- 1 Describe the principles of operation of piston and gas turbine engines.
- 2 Describe a multi-engine aircraft fuel system
- 3 Describe aircraft fuel types and characteristics.

There will be two assessments and a report for this Unit. The assessments consist of an appropriate balance of questions from each Outcome. For the report you are required to research aircraft fuel types and characteristics; then present an oral and written report of their findings.

The first assessment will cover the first Outcome and be carried out on a sampling basis, where 60% of the question refers to the turbine engine and 40% piston engine. The assessment should be composed of short answers, restricted response and/or multi-choice questions and last approximately 1½ hours.

For the second Outcome you will be required to complete a partial multi-engine fuel system diagram by either adding or labelling correctly six of the ten items listed in the knowledge and/or skills requirements. You must also describe the function and/or purpose of six of the ten items listed in the knowledge and/or skills requirements.

For the third assessment you will be required to research aircraft fuel types and characteristics. A report covering all of the knowledge and/or skills requirements for this Outcome must be presented orally along with a written report of your findings. The oral report should be approximately 5–10 minutes and include visuals. The written report should be approximately 600 words using a standard short report format, with references.

The Unit may be of particular interest to those who are interested in pursuing a career in aircraft maintenance engineering as it partially covers the knowledge requirements for module 15 and 16 (*Gas Turbine Engine & Piston Engine*) of EASA IR part 66 aircraft licensing requirements for both mechanical and avionics engineers.