

Guidance to Instructors on Subject Delivery

AIRFRAMES

Programme of learning:

- This is a suggested programme for the delivery of this subject.
- The main headings are the Learning Outcomes (LO1, LO2, etc), with sub headings related to topics within those Learning Outcomes (see Glossary of Terms).

Activities:

- Some practical activities are suggested throughout the programme as a way of reinforcing the learning and adding interest.
- It may be not be practical to undertake all of these activities at the suggested part of the programme.
- Instructors may have to adapt this programme to prevailing circumstances.

Method of delivery:

- Learning resources can be found on Ultilearn and may be adapted by the instructor, if required.
- Lesson delivery should be as practical as possible and should contain the maximum amount of cadet participation and interaction.

Check of understanding:

- Each lesson should contain a check of understanding (see Glossary of Terms).
- At the start of each lesson, the previous check of understanding should be reviewed in order to consolidate previous learning before moving on to new learning.

Formative assessment:

- There should be a formative assessment at the conclusion of each Learning Outcome (see Glossary of Terms).

Summative assessment:

- This is the Online Assessment, through Ultilearn, of the Assessment Criteria for this subject (see Glossary of Terms).
- Assessment Criteria (see Glossary of Terms) are found on the final page of this document.

AIRFRAMES
Introduction: <ul style="list-style-type: none">• Introduction to the subject and assessment method
LO1: Know main components of airframe structures
Introduction: <ul style="list-style-type: none">• Introduce the main components of airframe structures
Main components: <ul style="list-style-type: none">• Discuss on what constitutes a 'main' component• Use of models to show various parts of the aircraft
Fuselage: <ul style="list-style-type: none">• Explain what the fuselage is, including:<ul style="list-style-type: none">○ Shape○ Configurations○ Stretching and sections○ Forces on the fuselage○ Pressure vessel
Wing and tailplane: <ul style="list-style-type: none">• Explain what the functions are of the wing and tailplane• Explain wing loading and forces• Discuss design considerations, including:<ul style="list-style-type: none">○ Sweep back wings○ Swing wings○ Delta wings• Explain aspect ratio• Explain flying wings• Explain wing spar design• Explain the tailplane• Explain the fin• Explain foreplane design
Undercarriage: <ul style="list-style-type: none">• Introduce the undercarriage• Explain types of undercarriage layout, including:<ul style="list-style-type: none">○ Tail sitter

<ul style="list-style-type: none">○ Tricycle○ Large aircraft configurations● Explain coping with the landing forces● Explain stowing undercarriage and related systems
Structural elements: <ul style="list-style-type: none">● Introduce structural loads and forces encountered by an airframe● Explain the types of structural elements used in an airframe, using everyday items as examples to show different types of structural elements● Use paper to show how design can influence and take advantage of the strength of materials
Activity 1: <ul style="list-style-type: none">● Visit to air museum to look at full size aircraft to identify parts of the aircraft, and to look at various aircraft construction (for example, restoration department)
Activity 2: <ul style="list-style-type: none">● Use a small balsa wood glider to show construction methods (for example; spars and ribs, frames and stringers)
Review: <ul style="list-style-type: none">● Review the main components of airframe structures
Formative assessment: <ul style="list-style-type: none">● Formative assessment of the main components of airframe structures

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LO2: Know techniques and tools used in airframe manufacture

Manufacturing technology:

- Introduction to manufacturing technology
- Introduce manufacturing tools used for material removal, including a discussion on everyday tools and processes of material removal, for example:
 - Saw
 - Chisel
 - Plane
 - File
 - Sander
- Explain the techniques used in material forming, including a discussion about material forming methods, for example:
 - Folding
 - Bending
 - Casting
- Use examples found in the home to reinforce learning
- Explain the techniques used in additive processes, including examples of rapid prototyping (Note: Most colleges will have small machines for stereo lithography or similar processes)
- Explain the use of computers in design and manufacturing, reinforced with a visit to local college to see examples of NC machines and CAD software
- Explain the use of plastics and composites in airframe structures, including examples of more accessible plastics designs, for example:
 - Modern car panels
 - Bumpers
 - Sports cars such as F1 using carbon fibre
 - Use of composites in sports equipment (for example; golf, tennis, fishing)

Activity 1:

- Visit to local college or manufacturers of plastic components in the local area

Activity 2:

- Cadets should search on the internet for composite material uses and present their findings to the group

Formative assessment of manufacturing technology:

- Formative assessment of manufacturing technology

Aircraft fuselages:

- Introduction to the design concepts as used in aircraft fuselages
- Discuss what could be contained in an aircraft fuselage, fuselage shape and configuration (for example; stretching of civil airliners and the differences in military aircraft)
- Explain the forces acting on a fuselage
- Explain the types and methods of fuselage construction, including a discussion of different the types of construction through the history of aircraft (for example; welded truss, semimonocoque)
- Explain the types of doors and windows utilised

Activity 3:

- Cadets should use of scale models to show different fuselage types, including civil verses military

Activity 4:

- Cadets should consolidate their understanding by visiting an air museum

Formative assessment of aircraft fuselages:

- Formative assessment of design concepts used in aircraft fuselages

Wing and tailplane:

- Introduce the design concepts for wing and tailplane design
- Discuss what could be contained in aircraft wing and design considerations, including:
 - Sweep back wings
 - Swept wings
 - Delta wings
- Explain the design of wing spars, including the difference between civil and military (for example, wing loading considerations)
- Explain the definition of aspect ratio and how it relates to wing design
- Explain the types and methods of tailplane, fin and foreplane construction, including a discussion of the different types of construction through the history of aircraft (for example; fabric covered, stressed skin)
- Introduce an appreciation of the underlying features such as spars, ribs, leading and trailing edges, as well as undercarriage attachment

Activity 5:

- Cadets should use scale models and a balsa aircraft kit to reinforce where the structural components are used

Formative assessment of wing and tailplane:

- Formative assessment of design concepts for wing and tailplane design

Undercarriages:

- Introduce the layout and types of undercarriages as used in airframes
- Explain the need for different layouts depending on the size and weight of the aircraft
- Introduce an understanding of the forces imposed on the undercarriage
- Explain how the undercarriage can be stowed and looking at the associated systems
- Explain the design implications of nose wheel steering, for example, jockey wheel units
- Explain shock absorption, for example, oleo leg types
- Explain braking systems

Activity 6:

- Cadets should use scale models to show different undercarriage layouts, for example; 'tail dragger' and tricycle

Activity 7:

- Cadets should visit an aircraft museum to see different types of aircraft and the varied types and layouts of undercarriages

Formative assessment of undercarriages:

- Formative assessment of undercarriages used in airframes

Review:

- Review the techniques and tools used in airframe manufacture

Formative assessment:

- Formative assessment of the techniques and tools used in airframe manufacture

AIRFRAMES
LO3: Know principles of hydraulics and pneumatics
Introduction: <ul style="list-style-type: none">• Introduce the principles of hydraulics and pneumatics
Hydraulics and pneumatics: <ul style="list-style-type: none">• Discuss the main components of an aircraft hydraulic and pneumatic system• Introduce Pascal's law and the practical uses for Pascal's law• Discuss the more familiar uses of multiplication of forces (for example; car jack, car brakes)• Explain the use of hydraulic and pneumatic systems in an airframe
Activity 8: <ul style="list-style-type: none">• Cadets should take part in practical sessions showing hydraulics and / or pneumatics, for example a demonstration of a hydraulic car jack
Activity 9: <ul style="list-style-type: none">• Cadets should visit a local fire station to see things like the 'Jaws of Life'
Activity 10: <ul style="list-style-type: none">• Cadets should build a demonstration system using different-sized syringes
Review: <ul style="list-style-type: none">• Review the principles of hydraulics and pneumatics
Formative assessment: <ul style="list-style-type: none">• Formative assessment of the principles of hydraulics and pneumatics

AIRFRAMES

Subject review:

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| <ul style="list-style-type: none">• Review of the subject and activities |
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Preparation for summative assessment:
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| <ul style="list-style-type: none">• Prepare for Online Assessment on Utilearn |
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AIRFRAMES	
Assessment Criteria for Each Learning Outcome	
Subject	Airframes
Classification	Senior Cadet / Master Air Cadet
BTEC Aviation Studies	Unit 13: Principles of Airframes for Air Cadets
Learning Outcome	Assessment Criterion
The learner will:	The learner can:
LO1: Know main components of airframe structures	P1: Identify main components of an airframe structure
LO2: Know techniques and tools used in airframe manufacture	P2: Outline engineering concepts relating to airframe structural design
	P3: Identify methods of airframe construction
	P4: Describe components of a fuselage
	P5: Describe components of a tailplane structure
	P6: Describe components of a wing structure
	P7: Describe materials used in an airframe structure
	P8: Describe tools and techniques used in airframe manufacture
LO3: Know principles of hydraulics and pneumatics	P9: Describe principles of hydraulics and pneumatics
	P10: Identify features of hydraulics and pneumatic systems

ACO Aviation Training Syllabus

Glossary of Terms

Term	Meaning
Learning outcomes	What a cadet is expected to know, understand or be able to do.
Assessment criteria	The standard a cadet is expected to meet to demonstrate that a learning outcome, or set of learning outcomes, has been achieved.
Guidance to instructors on subject delivery	A programme that gives the instructor guidance on the content and suggested order of delivery for a particular subject. It will include the learning outcomes, what should be covered to achieve those outcomes and any relevant practical activities.
Formative assessment	Regular and informal assessment that provides feedback throughout the learning process that supports the cadet's progress. This can take the form of checks of understanding through question and answer sessions or demonstration of an activity.
Summative assessment	Assessment of learning by an HQ Air Cadets paper-based examination or online assessment. A cadet will have to correctly answer a question that directly relates to an assessment criterion.
Examination	Paper-based exclusive choice question paper for the old syllabus subjects for Leading, Senior and Master Air Cadet.
Online assessment	Online assessment process, accessed through Utlilearn, for Leading Cadet from Sep 10 and Senior and Master Air Cadet from Sep 11.
Lesson check of understanding	Throughout and at the end of each lesson there should be a check of understanding. At the start of the next lesson, the previous check of understanding should be reviewed in order to consolidate previous learning before moving on to new learning.
Check of understanding for First Class Cadet	This is a competence-based assessment process for First Class Cadet which should test understanding through practical demonstration, activity observation, oral questioning and inspection.