



# ENTG13003 *Advanced Materials in Aviation*

## Term 2 - 2023

Profile information current as at 27/04/2024 05:23 pm

All details in this unit profile for ENTG13003 have been officially approved by CQUUniversity and represent a learning partnership between the University and you (our student). The information will not be changed unless absolutely necessary and any change will be clearly indicated by an approved correction included in the profile.

## General Information

### Overview

Materials used in the aviation industry have become ever diverse, more sophisticated, and very important as aerospace technologies developed rapidly. The selection of materials in the aircraft industry has a significant impact on all stages of aircraft life from the initial design phase, to manufacturing, flight operations, and maintenance, and when decommissioning. In this unit, you will learn about the principles and fundamentals of materials science and engineering. You will apply this knowledge to various types of advanced materials in aviation.

### Details

Career Level: *Undergraduate*

Unit Level: *Level 3*

Credit Points: 6

Student Contribution Band: 8

Fraction of Full-Time Student Load: 0.125

### Pre-requisites or Co-requisites

Aircraft Maintenance Practices

Important note: Students enrolled in a subsequent unit who failed their pre-requisite unit, should drop the subsequent unit before the census date or within 10 working days of Fail grade notification. Students who do not drop the unit in this timeframe cannot later drop the unit without academic and financial liability. See details in the [Assessment Policy and Procedure \(Higher Education Coursework\)](#).

### Offerings For Term 2 - 2023

- Online
- Rockhampton

### Attendance Requirements

All on-campus students are expected to attend scheduled classes - in some units, these classes are identified as a mandatory (pass/fail) component and attendance is compulsory. International students, on a student visa, must maintain a full time study load and meet both attendance and academic progress requirements in each study period (satisfactory attendance for International students is defined as maintaining at least an 80% attendance record).

### Website

[This unit has a website, within the Moodle system, which is available two weeks before the start of term. It is important that you visit your Moodle site throughout the term. Please visit Moodle for more information.](#)

## Class and Assessment Overview

### Recommended Student Time Commitment

Each 6-credit Undergraduate unit at CQUniversity requires an overall time commitment of an average of 12.5 hours of study per week, making a total of 150 hours for the unit.

### Class Timetable

#### [Regional Campuses](#)

Bundaberg, Cairns, Emerald, Gladstone, Mackay, Rockhampton, Townsville

#### [Metropolitan Campuses](#)

Adelaide, Brisbane, Melbourne, Perth, Sydney

### Assessment Overview

#### 1. **Online Quiz(zes)**

Weighting: 20%

#### 2. **Written Assessment**

Weighting: 15%

#### 3. **Group Work**

Weighting: 30%

#### 4. **Online Test**

Weighting: 35%

### Assessment Grading

This is a graded unit: your overall grade will be calculated from the marks or grades for each assessment task, based on the relative weightings shown in the table above. You must obtain an overall mark for the unit of at least 50%, or an overall grade of 'pass' in order to pass the unit. If any 'pass/fail' tasks are shown in the table above they must also be completed successfully ('pass' grade). You must also meet any minimum mark requirements specified for a particular assessment task, as detailed in the 'assessment task' section (note that in some instances, the minimum mark for a task may be greater than 50%). Consult the [University's Grades and Results Policy](#) for more details of interim results and final grades.

## CQUniversity Policies

**All University policies are available on the [CQUniversity Policy site](#).**

You may wish to view these policies:

- Grades and Results Policy
- Assessment Policy and Procedure (Higher Education Coursework)
- Review of Grade Procedure
- Student Academic Integrity Policy and Procedure
- Monitoring Academic Progress (MAP) Policy and Procedure – Domestic Students
- Monitoring Academic Progress (MAP) Policy and Procedure – International Students
- Student Refund and Credit Balance Policy and Procedure
- Student Feedback – Compliments and Complaints Policy and Procedure
- Information and Communications Technology Acceptable Use Policy and Procedure

This list is not an exhaustive list of all University policies. The full list of University policies are available on the [CQUniversity Policy site](#).

## Unit Learning Outcomes

**On successful completion of this unit, you will be able to:**

1. Develop equations for the governing theories of material failures in aviation
2. Evaluate applications of advanced materials in electrical and mechanical components of aviation systems
3. Investigate material selection for aviation systems by applying international standards and industry regulations
4. Discuss advanced techniques for structural monitoring, non-destructive testing, and sustainable aircraft materials.

## Alignment of Learning Outcomes, Assessment and Graduate Attributes



### Alignment of Assessment Tasks to Learning Outcomes

Assessment Tasks	Learning Outcomes			
	1	2	3	4
1 - Online Quiz(zes) - 20%	•			•
2 - Written Assessment - 15%		•		•
3 - Group Work - 30%		•	•	
4 - Online Test - 35%	•		•	

### Alignment of Graduate Attributes to Learning Outcomes

Graduate Attributes	Learning Outcomes			
	1	2	3	4
1 - Communication			•	
2 - Problem Solving	•		•	•
3 - Critical Thinking	•	•	•	•
4 - Information Literacy		•	•	•
5 - Team Work			•	
6 - Information Technology Competence				
7 - Cross Cultural Competence				
8 - Ethical practice				
9 - Social Innovation				
10 - Aboriginal and Torres Strait Islander Cultures				

## Textbooks and Resources

### Textbooks

ENTG13003

#### Supplementary

##### Civil Avionics System

(2013)

Authors: Ian Moir, Allan Seabridge, Malcolm Jukes

Binding: eBook

ENTG13003

#### Supplementary

##### Introduction to Aerospace Materials

(2012)

Authors: Adrian Mouritz

Binding: eBook

### IT Resources

**You will need access to the following IT resources:**

- CQUniversity Student Email
- Internet
- Unit Website (Moodle)

## Referencing Style

All submissions for this unit must use the referencing style: [Harvard \(author-date\)](#)

For further information, see the Assessment Tasks.

## Teaching Contacts

**Jay Sul** Unit Coordinator

[j.sul@cqu.edu.au](mailto:j.sul@cqu.edu.au)

## Schedule

### Week 1 - 10 Jul 2023

Module/Topic	Chapter	Events and Submissions/Topic
Introduction to materials engineering and materials in aviation		
- Material engineering and science		
- Atomic bonds and crystalline structures		
- Main types and history of aerospace materials		

### Week 2 - 17 Jul 2023

Module/Topic	Chapter	Events and Submissions/Topic
Introduction to statics, dynamics, and mechanics of materials0		
- Equilibrium		
- Force (Newton's law of motion)		
- Torsion		
- Tension		

**Week 3 - 24 Jul 2023**

Module/Topic	Chapter	Events and Submissions/Topic
Mechanical properties of aerospace materials and testing standards - Strength, stiffness, and hardness - Tension & Compression test, Flexural test, Hardness test - Impact test, Fatigue test, Creep Test - Environmental durability test		

**Week 4 - 31 Jul 2023**

Module/Topic	Chapter	Events and Submissions/Topic
Introduction to electrical, thermal, optical, and magnetic properties of aerospace materials - Electrical and thermal conductivity - Heat capacity, thermal expansion, thermal stress - Electromagnetic radiation - Piezoelectricity		

**Week 5 - 07 Aug 2023**

Module/Topic	Chapter	Events and Submissions/Topic
Principles of materials selection and materials selection in aerospace - Materials selection in design - Ashby's materials selection process - Economic and manufacturing considerations in materials selection - Durability and environmental considerations in materials selection		

**Vacation Week - 14 Aug 2023**

Module/Topic	Chapter	Events and Submissions/Topic

**Week 6 - 21 Aug 2023**

Module/Topic	Chapter	Events and Submissions/Topic
Polymer, ceramic, reinforcements, and composites - Polymers for aerospace applications - Thermosetting and thermoplastics - Elastomers and structural adhesive - Carbon fibre-reinforced composite & Glass fibre reinforced composites - Metal matrix composites & Ceramic matrix composites		<b>Literature review on advanced materials in aviation</b> Due: Week 6 Monday (21 Aug 2023) 11:59 pm AEST

**Week 7 - 28 Aug 2023**

Module/Topic	Chapter	Events and Submissions/Topic
Aerospace materials for mechanical parts -1 (Conventional materials) - Electrical, thermal, mechanical, and magnetic properties of metals and wood - Steel, aluminium, and titanium alloys (how alloying affects properties of metals)		

**Week 8 - 04 Sep 2023**

Module/Topic	Chapter	Events and Submissions/Topic

Aerospace materials for mechanical part -2 (Composites)

- Electrical, thermal, mechanical, and magnetic properties of composites
- Various constituents that form composites
- Types of composites and their characteristics
- Bonding between metals and composites

**Week 9 - 11 Sep 2023**

Module/Topic	Chapter	Events and Submissions/Topic
Aerospace materials for electrical parts - 1		
- Insulators		
- Magnetic materials		
- Solid and hollow cables		
- Heat dissipation material		

**Week 10 - 18 Sep 2023**

Module/Topic	Chapter	Events and Submissions/Topic
Aerospace materials for electrical parts -2		
- EMI / RF radiation shielding		
- Braided copper cloth		
- Materials in solid-state relays		
- Optical fibres and transistors		
		<b>Materials selection process for aviation materials</b> Due: Week 10 Monday (18 Sept 2023) 11:59 pm AEST

**Week 11 - 25 Sep 2023**

Module/Topic	Chapter	Events and Submissions/Topic
Parallel session week		
Semiconductors, materials in batteries, semiconductor devices for Avionics students		
- Intrinsic & extrinsic semiconductors		
- P-type and n-type		
Tribology for mechanical students		
- Fundamentals of tribology		
- Roughness, friction, and wear		
- Lubrication		

**Week 12 - 02 Oct 2023**

Module/Topic	Chapter	Events and Submissions/Topic
Structural health monitoring, and sustainable and future aerospace materials		
- Sensory system		
- Infrared (ID) thermography		
- Ultrasonic wave		
- Acoustic emission		
- Environmental impacts & composite recycling		
- Nano-composites		
- Shape memory materials and super-alloys		

**Review/Exam Week - 09 Oct 2023**

Module/Topic	Chapter	Events and Submissions/Topic

**Exam Week - 16 Oct 2023**

Module/Topic	Chapter	Events and Submissions/Topic
		<b>Final online test</b> Due: Exam Week Monday (16 Oct 2023) 11:45 pm AEST

## Assessment Tasks

### 1 Tri-Weely Online Quizzes

**Assessment Type**

Online Quiz(zes)

**Task Description**

This assessment consists of four tri-weekly online quizzes which can be accessed via the unit's Moodle site. A set of multiple-choice, short-answer, drag-and-drop, and calculation questions is assigned every three weeks (viz. Weeks 3, 6, 9 and 12). Each online quiz will cover the contents in the previous two weeks and the corresponding week (e.g. Online Quiz 1 covers the contents in Weeks 1 to 3).

**Number of Quizzes**

4

**Frequency of Quizzes**

Other

**Assessment Due Date**

Four tri-weekly online quizzes are held in Weeks 3, 6, 9 and 12.

**Return Date to Students**

Sudents will receive their marks immediately after the due date of each quiz.

**Weighting**

20%

**Minimum mark or grade**

50%

**Assessment Criteria**

- The total marks of each of the four online quizzes will be scaled to out of 5 marks for the unit total.
- Numerical answers must be entered to 3 significant figures.

**Referencing Style**

- [Harvard \(author-date\)](#)

**Submission**

Online

**Learning Outcomes Assessed**

- Develop equations for the governing theories of material failures in aviation
- Discuss advanced techniques for structural monitoring, non-destructive testing, and sustainable aircraft materials.

### 2 Literature review on advanced materials in aviation

**Assessment Type**

Written Assessment

**Task Description**

A literature review on aviation materials is a critical component of research in the field of aerospace engineering. It involves gathering, analysing, and synthesising existing knowledge and scholarly work related to the properties, applications, and advancements in materials used in aviation. The aim is to provide a comprehensive overview of the subject, identify gaps in knowledge, and highlight areas for further research and development. Students will choose a topic / area of their interest to summarise and analyse the literature to demonstrate knowledge and understanding of a topic.

**Assessment Due Date**

Week 6 Monday (21 Aug 2023) 11:59 pm AEST

Students to submit their report to the link provided in the unit's Moodle site.



## Return Date to Students

Week 8 Monday (4 Sept 2023)

Students can check their mark and feedback through the link used for submission.

## Weighting

15%

## Assessment Criteria

Students work will be assessed by the following criteria.

Language (15%) - Very few or no spelling or grammar errors with a professional standard of language and writing.

Structure (20%) - The document commences by briefly introducing the sections which follow. The document concludes with a summary of the primary outcomes from each section of the review. Each topic should include multipled citations to reputable sources that are distinct, if practical.

Presentation (20%) - All but the cover page contains headers, footers, and page numbers. Text font and formatting are consistent throughout. Tables and figures have consistent formatting. All tables are recreated from consistent formatting and to remove superfluous information.

Referencing style (10%) - The in-text citations and reference list are formatted correctly but for a few very minor exceptions. A citation supports all technical points. Where required, multiple sources are grouped correctly for the in-text citations.

Information sources (10%) - A broad range of information types is included (academic journals, conference papers, textbooks, or reports). Papers based on similar projects are included to demonstrate the breath of knowledge.

Comprehension (20%) - The methods applied in the articles reviewed are correctly summarised and are relevant to the project.

Knowledge synthesis (15%) - Connections are made between separate information sources to explain some topics. Most topics include citations from separate information sources to demonstrate knowledge synthesis. Conflicts or varied opinions between separate articles are explained for some topics in the review.

## Referencing Style

- [Harvard \(author-date\)](#)

## Submission

Online

## Learning Outcomes Assessed

- Evaluate applications of advanced materials in electrical and mechanical components of aviation systems
- Discuss advanced techniques for structural monitoring, non-destructive testing, and sustainable aircraft materials.

## 3 Materials selection process for aviation materials

### Assessment Type

Group Work

### Task Description

Your task is to complete the materials selection process template by analysing a product / application of your interest and suggesting an alternative material(s) to improve its design for any purpose (e.g. process and/or manufacturing cost, performance, better use and environmental friendliness, improved safety, improved operation conditions, etc.).

Your approach to this task should include (but not be limited to):

- Choose a component within an aircraft of your interest. This can be ANYTHING that is composed of materials
- Investigate the chosen component to identify materials used and select a material (up to two) that has more room to improve
- Analyse the material(s) to identify its design requirements as per the following criteria: Function- What does the component do?, Constraints- What non-negotiable conditions must be met? What are negotiable?, Objective- What is to be maximised or minimised?, and Free variables- What parameters of the problem is the designer free to change?
- Look for possible alternatives and eliminate those that cannot meet the criteria set earlier
- Rank the short-listed materials after screening
- Further investigation into the top-ranked material to support
- Report your findings and the rationale behind your objectives and detail the procedures

**Assessment Due Date**

Week 10 Monday (18 Sept 2023) 11:59 pm AEST

Students will complete and submit the materials selection process template to the link provided in the unit's Moodle site.

**Return Date to Students**

Review/Exam Week Monday (9 Oct 2023)

Students can check their mark and feedback through the link used for submission.

**Weighting**

30%

**Assessment Criteria**

- Report language (15%)
- Justification (15%)
- Methodology (20%)
- Results and discussion (25%)
- Conclusions and recommendations (15%)
- References (10%)

**Referencing Style**

- [Harvard \(author-date\)](#)

**Submission**

Online

**Submission Instructions**

Students will complete and submit it to the link provided in the unit's Moodle site.

**Learning Outcomes Assessed**

- Evaluate applications of advanced materials in electrical and mechanical components of aviation systems
- Investigate material selection for aviation systems by applying international standards and industry regulations

## 4 Final online test

**Assessment Type**

Online Test

**Task Description**

This final online test as a summative assessment will test your achievement of the learning outcomes. It will consist of various types of questions, including calculation questions, drag-and-drop questions, multiple-choice questions, short & long description questions, etc. This final online test will cover all contents from Week 1 to Week 12, including the assignment items. You could sit for this online test wherever you want while it is a synchronous timed online test for three hours which means every student starts at the same time. Only one attempt is allowed and it will be a three-hour online test. You are required to upload your workings for calculation questions to the unit's Moodle page after you finish the test.

**Assessment Due Date**

Exam Week Monday (16 Oct 2023) 11:45 pm AEST

Students will be notified of the exact date and time for this assessment towards the end of the term.

**Return Date to Students**

Students will be able to access their results on the grade certification day.

**Weighting**

35%

**Minimum mark or grade**

50%

**Assessment Criteria**

Students will be assessed for the correctness of their answers to the questions given in the final test. Drag-and-drop and multiple-choice questions will be marked automatically while short and long description questions will be marked manually. Your understanding and own interpretation of the topics

will be sought. You will need to present your answer for the calculation questions with correct units and relevant significant figures. You are required to upload your workings for the calculation questions after the test to prove your genuine attempt and to receive partial marks where applicable.

### Referencing Style

- [Harvard \(author-date\)](#)

### Submission

Online

### Learning Outcomes Assessed

- Develop equations for the governing theories of material failures in aviation
- Investigate material selection for aviation systems by applying international standards and industry regulations

## Academic Integrity Statement

As a CQUniversity student you are expected to act honestly in all aspects of your academic work.

Any assessable work undertaken or submitted for review or assessment must be your own work. Assessable work is any type of work you do to meet the assessment requirements in the unit, including draft work submitted for review and feedback and final work to be assessed.

When you use the ideas, words or data of others in your assessment, you must thoroughly and clearly acknowledge the source of this information by using the correct referencing style for your unit. Using others' work without proper acknowledgement may be considered a form of intellectual dishonesty.

Participating honestly, respectfully, responsibly, and fairly in your university study ensures the CQUniversity qualification you earn will be valued as a true indication of your individual academic achievement and will continue to receive the respect and recognition it deserves.

As a student, you are responsible for reading and following CQUniversity's policies, including the [Student Academic Integrity Policy and Procedure](#). This policy sets out CQUniversity's expectations of you to act with integrity, examples of academic integrity breaches to avoid, the processes used to address alleged breaches of academic integrity, and potential penalties.

### What is a breach of academic integrity?

A breach of academic integrity includes but is not limited to plagiarism, self-plagiarism, collusion, cheating, contract cheating, and academic misconduct. The Student Academic Integrity Policy and Procedure defines what these terms mean and gives examples.

### Why is academic integrity important?

A breach of academic integrity may result in one or more penalties, including suspension or even expulsion from the University. It can also have negative implications for student visas and future enrolment at CQUniversity or elsewhere. Students who engage in contract cheating also risk being blackmailed by contract cheating services.

### Where can I get assistance?

For academic advice and guidance, the [Academic Learning Centre \(ALC\)](#) can support you in becoming confident in completing assessments with integrity and of high standard.

### What can you do to act with integrity?



**Be Honest**

If your assessment task is done by someone else, it would be dishonest of you to claim it as your own



**Seek Help**

If you are not sure about how to cite or reference in essays, reports etc, then seek help from your lecturer, the library or the Academic Learning Centre (ALC)



**Produce Original Work**

Originality comes from your ability to read widely, think critically, and apply your gained knowledge to address a question or problem