



8546

AIRCRAFT MATERIALS AND  
FABRICATION (11B)

30S/30E/30M

An Aviation and Aerospace Technologies Course



# 8546: AIRCRAFT MATERIALS AND FABRICATION (11B) 30S/30E/30M

## Course Description

Aircraft Materials and Fabrication is intended for students continuing in the specialization phase of aviation and aerospace technologies. Curriculum content provides an introduction to the materials and fabrication processes of aircraft structures. Topics include airframe sheet metal processes and composite fabrication.

Cross-curricular learning outcomes, or essential skills from subject areas including, but not limited to, information and communication technologies, science, English language arts, and mathematics, are to be integrated into the authentic learning activities of the course.

The curriculum is not sequential. For instructional purposes, the sequence of learning outcomes can vary based on the learning activities within the course.

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**Goal 1:** Describe and apply appropriate **health and safety** practices for aerospace technologies.

**GLO 1.1:** Describe and apply appropriate **health and safety** practices for aerospace technologies.

- SLO 11B.1.1.1 Demonstrate an awareness of the principles of Workplace Hazardous Materials Information Systems (WHMIS) as they apply to aerospace technologies.
- SLO 11B.1.1.2 Describe the purpose of Material Safety Data Sheets (MSDS).
- SLO 11B.1.1.3 Identify immediate and potential hazards and assess their impact on self, others, and the environment.
- SLO 11B.1.1.4 Establish and follow personal and environmental health and safety procedures and practices.
- SLO 11B.1.1.5 Identify and follow maintenance safety practices/precautions for sheet metal and/or composite materials/structures.
- SLO 11B.1.1.6 Identify and follow appropriate emergency response procedures.
- SLO 11B.1.1.7 Identify organizational norms and establish a culture of safety.
- SLO 11B.1.1.8 Describe handling of materials in composite form.
- SLO 11B.1.1.9 Explain the health and safety requirements for core detailing and pre- and post-cure.

SLO 11B.1.1.10 Explain health and safety precautions for trimming cured composite material.

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**Goal 2:** Demonstrate comprehension of the **principles of flight**, as they apply to aviation and aerospace technologies.

**GLO 2.1:** Demonstrate an understanding of **aerodynamics, control, and stability** in **fixed-** and **rotary-wing** aircraft.

SLO 11B.2.1.1 Demonstrate an understanding of aerodynamics related to aircraft materials and fabrication.

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**Goal 3:** Demonstrate an understanding of the **major components of an aircraft** and their **functions**.

**GLO 3.1:** Demonstrate an understanding of the **major components of an aircraft** and their **functions**.

No applicable SLOs.

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**Goal 4:** Demonstrate comprehension of **aircraft systems**.

**GLO 4.1:** Describe **aircraft systems** and their purposes.

No applicable SLOs.

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**Goal 5:** Demonstrate the safe and appropriate **operation of equipment and tools**.

**GLO 5.1:** Describe the safe and appropriate **management of equipment and tools**.

SLO 11B.5.1.1 Demonstrate the safe and appropriate cleaning, storage, and management of equipment and tools used in aircraft materials and fabrication.

SLO 11B.5.1.2 Demonstrate the use of pounding, turning, cutting, holding, and measuring hand tools in the aviation and aerospace industry.

SLO 11B.5.1.3 Demonstrate the safe operating procedures for the pounding, turning, and cutting equipment used in the aviation and aerospace industry.

SLO 11B.5.1.4 Select, operate, and maintain the appropriate pounding, turning, cutting, holding, and measuring hand tools, power tools, and equipment used in the aviation and aerospace industry.

- SLO 11B.5.1.5 Explain and demonstrate the application of common metal fastening processes for a specific aerospace project.
- SLO 11B.5.1.6 Explain the criteria for a clean room.
- SLO 11B.5.1.7 Explain manufacturers' methods and requirements of layup and applying pressures for consolidating materials, including, but not limited to,
- manual layup using PLT, CLT
  - vacuum bagging process for temporary compaction
  - manual layup using optical locating template (PLT)
- SLO 11B.5.1.8 Explain the use of curing and heating equipment.
- SLO 11B.5.1.9 Describe workplace ventilation and vacuums required during machining.
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**GLO 5.2:** Demonstrate the **operation** of **tools and equipment** to fabricate **metallic** parts and projects.

- SLO 11B.5.2.1 Determine and apply the appropriate metal fastening processes required to safely create a metal product.
- SLO 11B.5.2.2 Determine and apply the appropriate metal forming processes required to safely create a metal product.
- SLO 11B.5.2.3 Demonstrate the ability to install and remove at least two each of two or more types of rivets.
- SLO 11B.5.2.4 Demonstrate the ability to fabricate a sheet metal structure according to a technical document.
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**GLO 5.3:** Demonstrate the **operation** of **tools and equipment** to fabricate **non-metallic** parts and projects.

- SLO 11B.5.3.1 Perform the kit cutting of composite materials for a sandwich panel constructed project.
- SLO 11B.5.3.2 Perform a manual layup using PLT and CLT processes for composite plies and honeycomb core materials for a sandwich panel constructed project.
- SLO 11B.5.3.3 Set up and complete the curing process for a composite project.
- SLO 11B.5.3.4 Perform a trim process using manual trimming procedures for post-cured composite materials.
- SLO 11B.5.3.5 Perform the core detailing of honeycomb core materials for a sandwich panel constructed project.

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**Goal 6:** Demonstrate comprehension of the properties and applications of various **materials and consumables** used in the aviation and aerospace industry.

**GLO 6.1:** Explain the **properties** of various **materials and consumables** used in the aviation and aerospace industry.

- SLO 11B.6.1.1 Identify and classify common metallic and non-metallic materials.
  - SLO 11B.6.1.2 Demonstrate comprehension of material properties as they apply to the aviation and aerospace industry.
  - SLO 11B.6.1.3 Define composite materials and core material as they pertain to composite fabrication.
  - SLO 11B.6.1.4 Describe the importance of warp fibre direction.
  - SLO 11B.6.1.5 Explain matrixes in composites, including, but not limited to, epoxies.
  - SLO 11B.6.1.6 Explain the requirements for composite classification.
  - SLO 11B.6.1.7 Describe common reinforcement materials used for laminates, and compare their qualities.
  - SLO 11B.6.1.8 Explain how composite material is manufactured.
  - SLO 11B.6.1.9 Explain the purpose for curing composite material.
  - SLO 11B.6.1.10 Explain the advantages and disadvantages of composite materials.
  - SLO 11B.6.1.11 Describe the properties of the materials commonly used in sandwich panel composite structures.
  - SLO 11B.6.1.12 Compare and contrast I-beams with composite sandwich panels.
  - SLO 11B.6.1.13 Identify and explain honeycomb core materials and core configuration.
  - SLO 11B.6.1.14 Identify and describe the code system used by aluminum rivet manufacturers to identify AN/MS standard parts.
  - SLO 11B.6.1.15 Identify and describe sheet metal fasteners.
  - SLO 11B.6.1.16 Explain the requirements for CORE classification.
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**GLO 6.2:** Describe **applications** of the various aerospace **materials and consumables**.

- SLO 11B.6.2.1 Describe which materials are used in the various aircraft structures and components.
- SLO 11B.6.2.2 Describe handling procedures and storage of sheet metal.

- SLO 11B.6.2.3 Identify and explain the general concepts and construction of airframe metallic and non-metallic structures.
- SLO 11B.6.2.4a State methods of processing pre-cured composite materials, including the use of hand and power tools for
- cutting
  - drilling
  - sanding
- SLO 11B.6.2.4b State methods of processing pre-cured core materials, including the use of hand and power tools for
- cutting
  - drilling
  - sanding
- SLO 11B.6.2.5 List the steps for curing a composite layup.
- SLO 11B.6.2.6 State methods of machining post-cured reinforcement materials, including the use of hand and power tools for
- cutting
  - drilling
  - sanding
- SLO 11B.6.2.7 Describe the fabrication of non-metallic composite structures, including, but not limited to, solid laminates and honeycomb sandwiches.
- SLO 11B.6.2.8 Identify and explain how to use the tools and equipment used in kit cutting of composite materials.
- SLO 11B.6.2.9 List the steps involved in trimming composite panel.
- SLO 11B.6.2.10 Determine a rivet layout pattern.
- SLO 11B.6.2.11 List and explain the sandwich panel fabrication process for composite structures.
- SLO 11B.6.2.12 Explain the purpose for a core in sandwich panel construction.
- SLO 11B.6.2.13 Define the use of the contact and non-contact materials used in temporary compaction.
- SLO 11B.6.2.14 Explain the purpose or function of the skin, doubler, filler, core, and edgeband in a composite sandwich panel.

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**Goal 7: Fabricate parts and components** for use in the aviation and aerospace industry.

**GLO 7.1:** Fabricate **metallic** parts.

- SLO 11B.7.1.1 Use common measurement/layout tools used in metalworking.

SLO 11B.71.2	Apply the process for marking and drilling holes in sheet metal.
SLO 11B.71.3	Apply appropriate layout techniques to the creation of a metalwork project.
SLO 11B.71.4	Apply rivet-sizing formulas.
SLO 11B.71.5	Perform rivet pitch and edge distance calculations.
SLO 11B.71.6	Describe the inspection of formed rivets.
SLO 11B.71.7	Demonstrate the ability to lay out sheet metal to given dimensions, including at least one bend.
SLO 11B.71.8	Describe the calculation of bend allowance and setback for forming sheet metal.
SLO 11B.71.9	Describe quality control processes.

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**GLO 7.2:** Fabricate **non-metallic** parts.

SLO 11B.72.1	Use common measurement/layout tools used in composite fabrication.
SLO 11B.72.2	Apply appropriate layout techniques to the creation of a composite fabrication project.
SLO 11B.72.3	Apply the process for marking and drilling holes in composite fabrication.
SLO 11B.72.4	Inspect a composite panel using the tap test and the visual method.
SLO 11B.72.5	Describe methods of inspection (including the visual method, tap testing, and NDI) and their applications.
SLO 11B.72.6	Describe quality control processes.

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**GLO 7.3:** Fabricate **electrical/electronic** components.

No applicable SLOs.

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**Goal 8:** Describe and demonstrate the transferable **cross-curricular skills** as they pertain to **aviation and aerospace technologies**.

**GLO 8.1:** **Read, interpret, and communicate** information relevant to aviation and aerospace technologies.

SLO 11B.8.1.1	Describe the purpose of and identify the information in the aircraft maintenance, overhaul, structural repair, service, and component manuals.
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- SLO 11B.8.1.2 Demonstrate how to access information in an aircraft illustrated parts catalogue to determine correct part numbers when replacing components within an installed system.
  - SLO 11B.8.1.3 Demonstrate the use of a typical aircraft maintenance or overhaul manual to locate information on components repair or overhaul procedures.
  - SLO 11B.8.1.4 Identify technical information using the Air Transport Association Specification 100 (ATA Spec 100) numbering system.
  - SLO 11B.8.1.5 Use technical language and terms appropriately in context.
  - SLO 11B.8.1.6 Recognize and use the different types of drawings used in aircraft maintenance.
  - SLO 11B.8.1.7 Interpret technical drawings to perform tasks related to aircraft components.
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**GLO 8.2:** Acquire and organize information using **information and communication technology.**

- SLO 11B.8.2.1 Acquire, analyze, and apply specialized information and skills from various disciplines in a variety of realistic circumstances.
  - SLO 11B.8.2.2 Use a computer-assisted design and drafting (CADD) system to produce a simple technical drawing.
  - SLO 11B.8.2.3 Support and enhance basic information requirements by using a wide variety of resources (e.g., print, online, community).
  - SLO 11B.8.2.4 Apply an appropriate combination of digital, graphic, oral, and written techniques to effectively communicate a technical idea.
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**GLO 8.3:** Apply **mathematical** knowledge and skills related to aviation and aerospace technologies.

- SLO 11B.8.3.1 Apply common measurement standards used in the aviation and aerospace industry.
  - SLO 11B.8.3.2 Demonstrate the use of addition, subtraction, multiplication, and division (for more than 1-digit divisors or 2-digit multipliers) of whole numbers, decimals, and fractions to solve problems.
  - SLO 11B.8.3.3 Use fractions, decimals, ratios, and percentages.
  - SLO 11B.8.3.4 Convert from imperial to metric measurements.
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**GLO 8.4:** Apply **scientific** knowledge and skills related to aviation and aerospace technologies.

No applicable SLOs.

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**Goal 9:** Describe **career opportunities** in aviation and aerospace technologies and associated fields.

**GLO 9.1:** Describe **education** and **career opportunities** and **professional organizations** in aviation and aerospace technologies and associated fields.

SLO 11B.9.1.1 Demonstrate an awareness of careers in the area of aircraft manufacturing.

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**Goal 10:** Demonstrate an awareness of **sustainability** as it pertains to aviation and aerospace technologies.

**GLO 10.1:** Describe the impact of the aviation and aerospace industry on **human health and well-being**.

SLO 11B.10.1.1 Describe basic concepts of human factors (Dirty Dozen) as applied to aviation maintenance.

SLO 11B.10.1.2 Explain how ergonomics and a good manufacturing work environment can affect people's daily lives (e.g., long-term health benefits, creating job efficiencies).

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**GLO 10.2:** Describe the aviation and aerospace industry's sustainability practices and impact on the **environment**.

SLO 11B.10.2.1 Demonstrate a basic knowledge of efficient material usage to reduce waste and its impact on the environment.

SLO 11B.10.2.2 Discuss the impact of chemical hazards on the environment.

SLO 11B.10.2.3 Describe the benefits of using environmentally friendly products and more efficiently designed aircraft.

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**GLO 10.3:** Describe **sustainable business practices** within the aviation and aerospace industry.

SLO 11B.10.3.1 Describe the LEAN model for manufacturing.

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**Goal 11:** Demonstrate an awareness of the **ethical and legal standards** as they pertain to aviation and aerospace technologies.

**GLO 11.1:** Practise the **ethical and legal standards** as they pertain to aviation and aerospace technologies.

No applicable SLOs.

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**Goal 12:** Demonstrate **employability skills** related to aviation and aerospace technologies.

**GLO 12.1:** Demonstrate **employability skills** related to aviation and aerospace technologies.

SLO 11B.12.1.1 Demonstrate the criteria that comprise the Global Industry Standard of essential skills for employees.

SLO 11B.12.1.2 Demonstrate the skills listed on the Conference Board of Canada's *Employability Skills 2000+* for employees.

SLO 11B.12.1.3 Describe the skills required for a specific career path in the aviation and aerospace industry.

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**Goal 13:** Describe the **evolution** of aviation and aerospace technologies, including **technological progression** and **emerging trends**.

**GLO 13.1:** Describe the **evolution** of aviation and aerospace technologies, including **technological progression** and **emerging trends**.

SLO 11B.13.1.1 Describe the evolution of aerospace manufacturing, including its technological progression and emerging trends.

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