



Grades 9 to 12 Aviation and Aerospace Technologies

Manitoba Technical-Vocational
Curriculum Framework
of Outcomes



GRADES 9 TO 12
AVIATION AND AEROSPACE
TECHNOLOGIES

Manitoba Technical-Vocational Curriculum
Framework of Outcomes

Manitoba Education and Advanced Learning Cataloguing in Publication Data

Grades 9 to 12 aviation and aerospace technologies [electronic resource] :
Manitoba technical-vocational curriculum framework
of outcomes

Includes bibliographical references.

ISBN: 978-0-7711-5870-4

1. Aircraft industry—Vocational guidance.
 2. Airplanes—Maintenance and repair—Study and teaching (Secondary)—Manitoba.
 3. Aerospace engineering—Study and teaching (Secondary)—Manitoba.
 4. Aircraft industry—Study and teaching (Secondary)—Manitoba.
 5. Technical education—Manitoba—Curricula.
 6. Vocational education—Manitoba—Curricula.
- I. Manitoba. Manitoba Education and Advanced Learning.
629.10712

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Manitoba Education and Advanced Learning
School Programs Division
Winnipeg, Manitoba, Canada

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This resource is available on the Manitoba Education and Advanced Learning website at
<www.edu.gov.mb.ca/k12/cur/teched/sy_tech_program.html>.

Available in alternate formats upon request.

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ACKNOWLEDGEMENTS

Manitoba Education and Advanced Learning gratefully acknowledges the contributions of the following individuals in the development of *Grades 9 to 12 Aviation and Aerospace Technologies: Manitoba Technical-Vocational Curriculum Framework of Outcomes*.

Members of the Development Team	Brian Deane	Red River College
	Terry Holowaty	Technical Vocational High School Winnipeg School Division
	Brian Weiser	Technical Vocational High School Winnipeg School Division
Manitoba Education and Advanced Learning School Programs Division Staff	Carole Bilyk Project Manager	Development Unit Instruction, Curriculum and Assessment Branch
	Louise Boissonneault Coordinator	Document Production Services Unit Educational Resources Branch
	John Finch Coordinator	Learning Support and Technology Unit Instruction, Curriculum and Assessment Branch
	Kristin Grapentine Desktop Publisher	Document Production Services Unit Educational Resources Branch
	Gilles Landry Project Leader	Development Unit Instruction, Curriculum and Assessment Branch
	Daniel Lemieux Consultant	Learning Support and Technology Unit Instruction, Curriculum and Assessment Branch
	Peter Narth Coordinator (until September 2013)	Technical Vocational Education Unit Instruction, Curriculum and Assessment Branch

Ken Nimchuk
Consultant

Marjorie Poor
Publications Editor

Learning Support and Technology Unit
Instruction, Curriculum and Assessment Branch

Document Production Services Unit
Educational Resources Branch

TECHNICAL-VOCATIONAL EDUCATION OVERVIEW

In 2013, Manitoba Education released the document [Technical-Vocational Education Overview](#) to provide the philosophical and pedagogical underpinnings for curriculum development and the teaching of courses in the Senior Years Technology Education Program.

This overview presents educators with the vision and goals of technical-vocational education (TVE) in Manitoba. Topics include the following:

- curriculum revitalization and renewal
- curriculum framework and implementation
- articulation of programming
- assessment and reporting
- safety
- employability/essential skills and career development
- sustainable development

The TVE curriculum includes Grades 9 to 12 courses in a variety of areas, including aviation and aerospace technologies.

AVIATION AND AEROSPACE TECHNOLOGIES OVERVIEW

Grades 9 to 12 Aviation and Aerospace Technologies: Manitoba Technical-Vocational Curriculum Framework of Outcomes identifies the goals, general learning outcomes (GLOs), and specific learning outcomes (SLOs) for nine aviation and aerospace technologies courses. This framework is intended for use in all Manitoba schools teaching aviation and aerospace technologies courses as part of the Senior Years Technology Education Program.

The high school aviation and aerospace technologies courses provide students with an introduction to the knowledge and skills associated with the manufacturing and maintenance of aircraft. Students who study aviation and aerospace technologies apply problem-based learning that integrates science, technology, engineering, and mathematics.

These courses include both aviation and aerospace. In industry, it is generally accepted that with respect to aircraft maintenance, *aviation* refers to the maintenance of operational aircraft carried out by aircraft maintenance engineers (AMEs) whether it is repairing aircraft defects or carrying out minor and major aircraft inspections. *Aerospace* generally refers to the overhaul and manufacture of aircraft components, including the manufacture of complete aircraft. For instance, a jet engine is overhauled by an aerospace service provider, and installed on the aircraft by an AME (aviation).

Aviation and aerospace technologies requires students to apply their ingenuity with tools, materials, processes,

and resources to create solutions and opportunities for themselves and others. The following topics will be addressed:

- aircraft components and functions
- aircraft engine fundamentals (both piston and gas turbine)
- aviation math and physics
- reading blueprints and technical drawings
- composite fabrication and repair
- mentorship
- non-destructive testing
- principles of flight (both fixed- and rotary-wing)
- sheet metal fabrication and repair
- Test of Workplace Essential Skills (TOWES) preparation
- WHMIS certification
- work experience

To be successful, students completing the aviation and aerospace technologies courses must be able to do the following:

- display the ability to safely utilize the wide variety of tools and equipment with a high level of accuracy and proficiency
- solve mathematical problems quickly and accurately when measuring and laying out materials
- select materials, plan sequences, and choose methods of work
- cut and shape materials and join them with fasteners and adhesives

- check completed work to ensure it is to industry standards
- work with national regulating agencies
- demonstrate employability skills

Implementation of Aviation and Aerospace Technologies Courses

To receive a Senior Years Technical Education diploma from Manitoba Education and Advanced Learning, a student must complete eight departmentally developed courses from an approved technical-vocational cluster, together with 16 compulsory credits and six optional credits. The grade level in which the courses are offered is a local school-based decision, but it is highly recommended that the sequencing of credits follow the schedule set out at the end of this introduction.

In most courses, the emphasis is on applied activities. For instructional purposes, the sequence of learning outcomes can vary based on the learning activities within the course. Teachers are advised to select the learning activities best suited to teach the learning outcomes, based on a variety of factors, including access to resources, or regional needs.

The curriculum is not sequential. In other words, learning outcomes might be taught in an order different from how they appear in this document.

In light of rapid changes in technology, teachers are encouraged to update their learning activities in order to meet the needs of students.

References to Aircraft Maintenance Engineer (AME)

Some of the specific learning outcomes in some of the Grade 12 courses include an alphanumeric reference, such as (*AME 19.G17.1*), at the end. This refers to a specific subject (for example, 19 is Weight and Balance) and competency of the Aircraft Maintenance Engineer curriculum, which is taught at Red River College—Stevenson Aviation and Aerospace Southport Campus.

Information on this curriculum can be found at www.gov.mb.ca/tce/apprent/apprentice/curriculum.

This high school curriculum includes some, but not all, of the competencies found in the AME curriculum. Students completing this program will be prepared to enter a number of educational programs in aviation and aerospace, including a certified AME program.

Career and Employment Opportunities

Students who have completed the aviation and aerospace technologies courses can seek entry-level employment in an aviation and aerospace manufacturing or maintenance facility in a variety of positions.

Students can also continue on into post-secondary education or apprenticeship in a variety of related areas. The opportunities range from technician to licensed personnel.

Potential careers include the following:

- aircraft gas turbine engine repair and overhaul technician
- aircraft maintenance engineer
- computer numerical control (CNC) machinists
- composite fabricator/plastics technician
- mechanical engineer technologist
- non-destructive inspection technician

Potential Manitoba employers (at the time of the writing of this document) include the following:

- Boeing Canada Operation Ltd.
- Advanced Composites Structures Inc.
- Aero Recip Canada Ltd.
- Cadorath Aerospace
- Calm Air
- Canadian Propeller Ltd.
- Corner Aerospace
- EMTEQ
- Fast Air Executive Aviation Services
- Flightcraft Maintenance Services
- Keewatin Air Limited
- Magellan Aerospace Corporation
- Manitoba Government Air Services
- Perimeter Aviation
- StandardAero

In addition, some related fields that students can enter upon completion of the program include the following:

- transportation manufacturing
- engineering
- engineering technology
- non-destructive testing
- electronics
- medical technology
- agricultural technology
- energy and power technology
- information and communication technology
- manufacturing technology
- construction technology

Curriculum Goals and General Learning Outcomes

Curriculum goals outline the major curriculum components in addition to the general or across-the-curriculum learning goals for the subject area. The learning outcomes for each aviation and aerospace technologies course were developed based on the following goals and general learning outcomes:

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.

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.

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**.

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

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

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**.

GLO 5.2: Demonstrate the **operation** of **tools and equipment** to fabricate **metallic** parts and projects.

GLO 5.3: Demonstrate the **operation** of **tools and equipment** to fabricate **non-metallic** parts and projects.

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.

GLO 6.2: Describe **applications** of the various aerospace **materials and consumables**.

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

GLO 7.1: Fabricate **metallic** parts.

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

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

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.

GLO 8.2: Acquire and organize information using **information and communication technology**.

GLO 8.3: Apply **mathematical** knowledge and skills related to aviation and aerospace technologies.

GLO 8.4: Apply **scientific** knowledge and skills related to aviation and aerospace technologies.

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.

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**.

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

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

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.

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

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

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**.

8547 Reciprocating Engines 30S/30E/30M

Reciprocating Engines is intended for students completing the specialization phase of aviation and aerospace technologies. Curriculum content provides an introduction to the operation and maintenance of reciprocating engines. Topics include the following:

- history of reciprocating engines
- engine systems
- components and accessories
- lock wiring

8548 Aircraft Structure and Repair 40S/40E/40M

Aircraft Structure and Repair is intended for students entering the transition phase of aviation and aerospace technologies. Curriculum content provides an introduction to the construction and repair of metallic and non-metallic structures. Topics include the following:

- fabrication of an airfoil
- repair of non-metallic structures
- non-destructive testing

8549 Aircraft Electrical Systems 40S/40E/40M

Aircraft Electrical Systems is intended for students in the transition phase of aviation and aerospace technologies. Curriculum content provides an introduction to aircraft electrical components and functions. Topics include the following:

- AC/DC circuits
- AC/DC components
- troubleshooting

8561 Aircraft Systems and Propulsion 40S/40E/40M

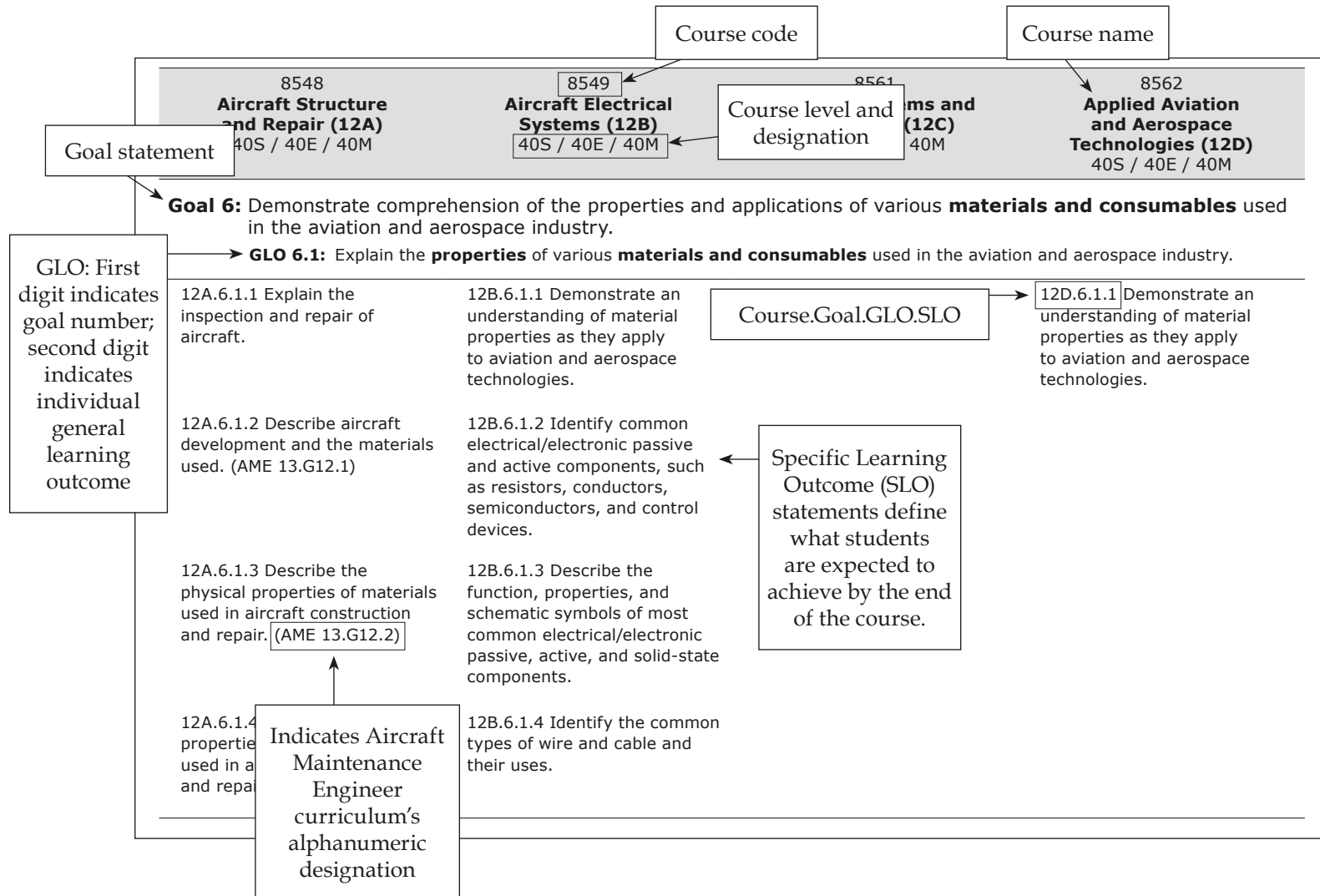
Aircraft Systems and Propulsion is intended for students in the transition phase of aviation and aerospace technologies. Curriculum content provides an introduction to turbine engines, propellers, hydraulic, pneumatic, pitot-static, and fuel systems. Topics include the inspection and maintenance of the above systems and gas turbine theory.

8562 Applied Aviation and Aerospace Technologies 40S/40E/40M

Applied Aviation and Aerospace Technologies is intended for students transitioning from aviation and aerospace technologies. Curriculum content provides students the opportunity to synthesize their previously learned skills and knowledge to facilitate entry into the workforce. Topics include the following:

- TOWES certification
- WHMIS certification
- ethical and legal requirements
- human factors

Guide to Reading Aviation and Aerospace Technologies Goals and Learning Outcomes



Curriculum Implementation Dates

During **voluntary implementation**, teachers in Manitoba have the *option* of teaching the entire new draft curriculum as soon as Manitoba Education and Advanced Learning releases it on the [Technology Education](#) website. Teachers also have the option of teaching courses from the previous curriculum. Teachers who implement courses before system-wide implementation need to ensure that students who are already taking courses from the previous curriculum achieve all SLOs with a minimum of redundancy.

Voluntary implementation for all aviation and aerospace technologies courses began in the fall of 2013 and will continue until their respective system-wide implementation dates.

Date	System-Wide Implementation
Fall 2014	Grade 9 (optional)
Fall 2015	Grade 10
Fall 2016	Grade 11
Fall 2017	Grade 12

Under **system-wide implementation**, all teachers in Manitoba teach the new curriculum and use the new course codes. Teachers will no longer be able to use the previous course codes. Course codes are found in the [Subject Table Handbook: Technology Education](#).



GRADES 9 TO 11
AVIATION AND AEROSPACE
TECHNOLOGIES

General and Specific Learning
Outcomes by Goal

GRADES 9 TO 11 AVIATION AND AEROSPACE TECHNOLOGIES

GENERAL AND SPECIFIC LEARNING OUTCOMES BY GOAL

8543 Exploration of Aviation and Aerospace Technologies (9) 15S / 15E / 15M 10S / 10E / 10M	8544 Introduction to Aviation and Aerospace Technologies (10) 20S / 20E / 20M	8545 Aircraft Components and Functions (11A) 30S / 30E / 30M	8546 Aircraft Materials and Fabrication (11B) 30S / 30E / 30M	8547 Reciprocating Engines (11C) 30S / 30E / 30M
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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.

9.1.1.1 Demonstrate an awareness of the principles of Workplace Hazardous Materials Information Systems (WHMIS) as they apply to aerospace technologies.	10.1.1.1 Demonstrate an awareness of the principles of Workplace Hazardous Materials Information Systems (WHMIS) as they apply to aerospace technologies.	—	11B.1.1.1 Demonstrate an awareness of the principles of Workplace Hazardous Materials Information Systems (WHMIS) as they apply to aerospace technologies.	11C.1.1.1 Demonstrate an awareness of the principles of Workplace Hazardous Materials Information Systems (WHMIS) as they apply to aerospace technologies.
9.1.1.2 Describe the purpose of Material Safety Data Sheets (MSDS).	10.1.1.2 Describe the purpose of Material Safety Data Sheets (MSDS).		11B.1.1.2 Describe the purpose of Material Safety Data Sheets (MSDS).	11C.1.1.2 Describe the purpose of Material Safety Data Sheets (MSDS).
9.1.1.3 Describe workplace health and safety procedures (e.g., S.A.F.E., Right to Refuse).	10.1.1.3 Describe workplace health and safety procedures (e.g., S.A.F.E., Right to Refuse).		11B.1.1.3 Identify immediate and potential hazards and assess their impact on self, others, and the environment.	11C.1.1.3 Identify immediate and potential hazards and assess their impact on self, others, and the environment.

8543 Exploration of Aviation and Aerospace Technologies (9) 15S / 15E / 15M 10S / 10E / 10M	8544 Introduction to Aviation and Aerospace Technologies (10) 20S / 20E / 20M	8545 Aircraft Components and Functions (11A) 30S / 30E / 30M	8546 Aircraft Materials and Fabrication (11B) 30S / 30E / 30M	8547 Reciprocating Engines (11C) 30S / 30E / 30M
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Goal 1: Describe and apply appropriate **health and safety** practices for aerospace technologies. *(continued)*

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

<p>9.1.1.4 Demonstrate the ability to follow safety information on supplier labels.</p>	<p>10.1.1.4 Demonstrate the ability to follow safety information on supplier labels.</p>	<p>11B.1.1.4 Establish and follow personal and environmental health and safety procedures and practices.</p>	<p>11C.1.1.4 Establish and follow personal and environmental health and safety procedures and practices.</p>
<p>9.1.1.5 Follow personal and environmental health and safety procedures.</p>	<p>10.1.1.5 Follow personal and environmental health and safety procedures.</p>	<p>11B.1.1.5 Identify and follow maintenance safety practices/precautions for sheet metal and/or composite materials/structures.</p>	<p>11C.1.1.5 Identify and follow maintenance safety practices/precautions for sheet metal and/or composite materials/structures.</p>
<p>9.1.1.6 Identify immediate hazards and their impact on self, others, and the environment.</p>	<p>10.1.1.6 Identify immediate hazards and their impact on self, others, and the environment.</p>	<p>11B.1.1.6 Identify and follow appropriate emergency response procedures.</p>	

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

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

<p>9.1.1.7 Identify and follow appropriate emergency response procedures.</p>	<p>10.1.1.7 Identify and follow appropriate emergency response procedures.</p>	<p>11B.1.1.7 Identify organizational norms and establish a culture of safety.</p> <p>11B.1.1.8 Describe handling of materials in composite form.</p> <p>11B.1.1.9 Explain the health and safety requirements for core detailing and pre- and post-cure.</p> <p>11B.1.1.10 Explain health and safety precautions for trimming cured composite material.</p>
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8543 Exploration of Aviation and Aerospace Technologies (9) 15S / 15E / 15M 10S / 10E / 10M	8544 Introduction to Aviation and Aerospace Technologies (10) 20S / 20E / 20M	8545 Aircraft Components and Functions (11A) 30S / 30E / 30M	8546 Aircraft Materials and Fabrication (11B) 30S / 30E / 30M	8547 Reciprocating Engines (11C) 30S / 30E / 30M
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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.

<p>9.2.1.1 Demonstrate an understanding of the terms relating to aerodynamics and airfoils.</p>	<p>10.2.1.1 Demonstrate an understanding of the terms relating to aerodynamics and airfoils.</p>	<p>11A.2.1.1 Compare and contrast the various rotor designs associated with rotary-wing aircraft.</p>	<p>11B.2.1.1 Demonstrate an understanding of aerodynamics related to aircraft materials and fabrication.</p>	<p>11C.2.1.1 Explain factors affecting performance.</p>
<p>9.2.1.2 Demonstrate an understanding of the four forces acting on an aircraft in straight and level flight.</p>	<p>10.2.1.2 Demonstrate an understanding of the four forces acting on an aircraft in straight and level flight.</p>	<p>11A.2.1.2 Explain the forces that act on the rotor.</p>		<p>11C.2.1.2 Demonstrate an understanding of aerodynamics related to power plants and propellers.</p>
	<p>10.2.1.3 Demonstrate an understanding of Newton’s third law and Bernoulli’s principle as they apply to the generation of lift by airfoils.</p>	<p>11A.2.1.3 Compare and contrast the aerodynamic terminology related to fixed- and rotary-wing aircraft.</p>		

8543 Exploration of Aviation and Aerospace Technologies (9) 15S / 15E / 15M 10S / 10E / 10M	8544 Introduction to Aviation and Aerospace Technologies (10) 20S / 20E / 20M	8545 Aircraft Components and Functions (11A) 30S / 30E / 30M	8546 Aircraft Materials and Fabrication (11B) 30S / 30E / 30M	8547 Reciprocating Engines (11C) 30S / 30E / 30M
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Goal 2: Demonstrate comprehension of the **principles of flight**, as they apply to aviation and aerospace technologies. *(continued)*

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

10.2.1.4 Explain how an aircraft is controlled around its three axes, and the primary flight control surfaces that accomplish this control. This should include built-in aircraft stability.

11A.2.1.4 Define the terms associated with rotary-wing aircraft flight (e.g., *autorotation, ground resonance, stability*).

10.2.1.5 Explain secondary flight control surfaces, such as tabs, flaps, spoilers, and leading edge devices.

11A.2.1.5 Describe and explain the functions of rotary-wing controls.

8543 Exploration of Aviation and Aerospace Technologies (9) 15S / 15E / 15M 10S / 10E / 10M	8544 Introduction to Aviation and Aerospace Technologies (10) 20S / 20E / 20M	8545 Aircraft Components and Functions (11A) 30S / 30E / 30M	8546 Aircraft Materials and Fabrication (11B) 30S / 30E / 30M	8547 Reciprocating Engines (11C) 30S / 30E / 30M
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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**.

—	10.3.1.1 Identify the five major components of a fixed-wing aircraft.	11A.3.1.1 Describe the five major components of a fixed-wing aircraft.	—	11C.3.1.1 Describe the types of engines developed for aviation use.
	10.3.1.2 Describe the functions of the major components of a fixed-wing aircraft.	11A.3.1.2 Describe how control surfaces of fixed-wing aircraft function aerodynamically, including stall strips, wing fences, vortex generators, flaps, slats, spoilers, ailerons, stabilators, elevators, rudders, and trim tabs.		11C.3.1.2 Explain the differences and advantages of different types of engines.
		11A.3.1.3 Describe the functions of the components that comprise the airframe structural members of fixed-wing aircraft.		11C.3.1.3 Describe engine development and application.

8543 Exploration of Aviation and Aerospace Technologies (9) 15S / 15E / 15M 10S / 10E / 10M	8544 Introduction to Aviation and Aerospace Technologies (10) 20S / 20E / 20M	8545 Aircraft Components and Functions (11A) 30S / 30E / 30M	8546 Aircraft Materials and Fabrication (11B) 30S / 30E / 30M	8547 Reciprocating Engines (11C) 30S / 30E / 30M
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Goal 3: Demonstrate an understanding of the **major components of an aircraft** and their **functions**. *(continued)*

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

11A.3.1.4 Identify the major components of a rotary-wing aircraft's airframe.

11A.3.1.5 Explain the functions of the major components of rotary-wing aircraft.

11A.3.1.6 Compare and contrast the operation of aerodynamic factors in the flight of airplanes and/or helicopters.

11C.3.1.4 Describe the limitations of piston engines.

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

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

<p>9.4.1.1 Identify the types of systems that are present in fixed-wing aircraft.</p>	<p>10.4.1.1 Describe the types of systems that are present in fixed-wing aircraft.</p>	<p>11A.4.1.1 Describe flight control systems and activation methods for the following:</p> <ul style="list-style-type: none"> ■ cable control systems ■ pushrod control systems ■ hydraulic-assisted systems ■ artificial feel systems 	<p>—</p>	<p>11C.4.1.1 Identify and describe internal engine components.</p> <p>11C.4.1.2 Identify and describe external engine components.</p> <p>11C.4.1.3 Identify and describe engine accessories.</p> <p>11C.4.1.4 Explain the function of engine components.</p>
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Goal 4: Demonstrate comprehension of **aircraft systems**. *(continued)*

GLO 4.1: Describe **aircraft systems** and their purposes. *(continued)*

11C.4.1.5 Explain engine operation terminology for both two-stroke and four-stroke engines.

11C.4.1.6 Explain terms used in aircraft engine identification and classification, and identify them by symbols.

11C.4.1.7 Classify engines by cylinder arrangement or displacement.

11C.4.1.8 Explain the purpose of engine data plates.

11C.4.1.9 Explain piston displacement.

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Goal 4: Demonstrate comprehension of **aircraft systems**. *(continued)*

GLO 4.1: Describe **aircraft systems** and their purposes. *(continued)*

11C.4.1.10 Explain power calculations.

11C.4.1.11 Explain engine efficiency.

11C.4.1.12 Explain the Otto cycle.

11C.4.1.13 Explain power curves.

11C.4.1.14 Draw a graph to represent the indicator diagram for the Otto cycle.

11C.4.1.15 Compute horsepower using the PLANK formula.

11C.4.1.16 Calculate piston displacement.

11C.4.1.17 Calculate compression ratio.

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Goal 4: Demonstrate comprehension of **aircraft systems**. *(continued)*

GLO 4.1: Describe **aircraft systems** and their purposes. *(continued)*

11C.4.1.18 Explain engine timing.

11C.4.1.19 Describe engine cooling.

11C.4.1.20 Determine the firing order of various reciprocating engines.

11C.4.1.21 Identify combustion and valve timing components.

11C.4.1.22 Identify engine cylinder positions.

11C.4.1.23 Describe disassembly, cleaning, and inspection procedures.

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Goal 4: Demonstrate comprehension of **aircraft systems**. *(continued)*

GLO 4.1: Describe **aircraft systems** and their purposes. *(continued)*

11C.4.1.24 Describe dimensional inspection procedures.

11C.4.1.25 Describe repair and replacement procedures for repairable and replaceable items, respectively.

11C.4.1.26 Determine parts' serviceability with reference to manufacturers' technical publications.

11C.4.1.27 Describe assembly and testing procedures.

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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**.

9.5.1.1 Identify the safe and appropriate cleaning, storage, and management of equipment and tools.	10.5.1.1 Demonstrate the safe and appropriate cleaning, storage, and management of equipment and tools.	—	11B.5.1.1 Demonstrate the safe and appropriate cleaning, storage, and management of equipment and tools used in aircraft materials and fabrication.	11C.5.1.1 Demonstrate the safe and appropriate cleaning, storage, and management of equipment and tools used in reciprocating engines.
9.5.1.2 Identify the pounding, turning, cutting, holding, and measuring hand tools used in the aviation and aerospace industry.	10.5.1.2 Demonstrate the use of pounding, turning, cutting, holding, and measuring hand tools in the aviation and aerospace industry.		11B.5.1.2 Demonstrate the use of pounding, turning, cutting, holding, and measuring hand tools in the aviation and aerospace industry.	11C.5.1.2 Demonstrate the use of pounding, turning, cutting, holding, and measuring hand tools in the aviation and aerospace industry.
9.5.1.3 Explain the safe operating procedures for the pounding, turning, and cutting equipment used in the aviation and aerospace industry.	10.5.1.3 Demonstrate the safe operating procedures for the pounding, turning, and cutting equipment used in the aviation and aerospace industry.		11B.5.1.3 Demonstrate the safe operating procedures for the pounding, turning, and cutting equipment used in the aviation and aerospace industry.	11C.5.1.3 Demonstrate the safe operating procedures for the pounding, turning, and cutting equipment used in the aviation and aerospace industry.

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

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

<p>9.5.1.4 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.</p>	<p>10.5.1.4 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.</p>	<p>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.</p> <p>11B.5.1.5 Explain and demonstrate the application of common metal fastening processes for a specific aerospace project.</p> <p>11B.5.1.6 Explain the criteria for a clean room.</p>	<p>11C.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.</p> <p>11C.5.1.5 Select and utilize tools and equipment for the overhaul and repair of aircraft reciprocating power plants.</p> <p>11C.5.1.6 Select and utilize measuring tools.</p>
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Goal 5: Demonstrate the safe and appropriate **operation** of **equipment and tools**. *(continued)*

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

	<p>11B.5.1.7 Explain manufacturers' methods and requirements of layup and applying pressures for consolidating materials, including, but not limited to,</p> <ul style="list-style-type: none"> ■ manual layup using PLT, CLT ■ vacuum bagging process for temporary compaction ■ manual layup using optical locating template (PLT) <p>11B.5.1.8 Explain the use of curing and heating equipment.</p>	<p>11C.5.1.7 Demonstrate the application of torque and the units used to measure torque in reciprocating engine fasteners.</p> <p>11C.5.1.8 Use fastener repair methods in reciprocating engine applications.</p>
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Goal 5: Demonstrate the safe and appropriate **operation of equipment and tools.** *(continued)*

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

11B.5.1.9 Describe workplace ventilation and vacuums required during machining.

11C.5.1.9 Demonstrate the use of fastener locking methods in reciprocating engine applications.

GLO 5.2: Demonstrate the **operation of tools and equipment** to fabricate **metallic** parts and projects.

9.5.2.1 Demonstrate several common metal fastening processes, such as using threaded fasteners and riveting.

10.5.2.1 Demonstrate several common metal fastening processes, such as using threaded fasteners and riveting.

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11B.5.2.1 Determine and apply the appropriate metal fastening processes required to safely create a metal product.

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9.5.2.2 Demonstrate several common metal forming processes.

10.5.2.2 Demonstrate several common metal forming processes.

11B.5.2.2 Determine and apply the appropriate metal forming processes required to safely create a metal product.

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

GLO 5.2: Demonstrate the **operation** of **tools and equipment** to fabricate **metallic** parts and projects. *(continued)*

9.5.2.3 Apply several mechanical forming processes to a metal product.	10.5.2.3 Apply several mechanical forming processes to a metal product.	11B.5.2.3 Demonstrate the ability to install and remove at least two each of two or more types of rivets.	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.

9.5.3.1 Perform the kit cutting of composite materials for a solid laminate constructed project.	10.5.3.1 Perform the kit cutting of composite materials for a solid laminate constructed project.	—	11B.5.3.1 Perform the kit cutting of composite materials for a sandwich panel constructed project.	—
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Goal 5: Demonstrate the safe and appropriate **operation of equipment and tools.** *(continued)*

GLO 5.3: Demonstrate the **operation of tools and equipment** to fabricate **non-metallic** parts and projects. *(continued)*

<p>9.5.3.2 Perform a manual layup for composite plies for a solid laminate constructed project.</p> <p>9.5.3.3 Perform a trim process using manual trimming procedures for post-cured composite materials.</p>	<p>10.5.3.2 Perform a manual layup using PLT and CLT processes for composite plies for a solid laminate constructed project.</p> <p>10.5.3.3 Set up and complete the curing process for a composite project.</p> <p>10.5.3.4 Perform a trim process using manual trimming procedures for post-cured composite materials.</p>	<p>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.</p> <p>11B.5.3.3 Set up and complete the curing process for a composite project.</p> <p>11B.5.3.4 Perform a trim process using manual trimming procedures for post-cured composite materials.</p> <p>11B.5.3.5 Perform the core detailing of honeycomb core materials for a sandwich panel constructed project.</p>
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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.

<p>9.6.1.1 Identify common materials and their classification.</p> <p>9.6.1.2 Demonstrate an understanding of material properties as they apply to the aviation and aerospace industry.</p>	<p>10.6.1.1 Identify and classify common metallic and non-metallic materials.</p> <p>10.6.1.2 Demonstrate an understanding of material properties as they apply to the aviation and aerospace industry.</p> <p>10.6.1.3 Define composite materials as they pertain to composite fabrication.</p> <p>10.6.1.4 Describe the importance of warp fibre direction.</p> <p>10.6.1.5 Explain matrixes in composites, including, but not limited to, epoxies.</p>	<p>11A.6.1.1 Identify and classify common metallic and non-metallic materials.</p>	<p>11B.6.1.1 Identify and classify common metallic and non-metallic materials.</p> <p>11B.6.1.2 Demonstrate comprehension of material properties as they apply to the aviation and aerospace industry.</p> <p>11B.6.1.3 Define composite materials and core material as they pertain to composite fabrication.</p> <p>11B.6.1.4 Describe the importance of warp fibre direction.</p> <p>11B.6.1.5 Explain matrixes in composites, including, but not limited to, epoxies.</p>	<p>11C.6.1.1 Identify and classify common metallic and non-metallic materials.</p> <p>11C.6.1.2 Demonstrate comprehension of material properties as they apply to the aviation and aerospace industry.</p>
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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. *(continued)*

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

10.6.1.6 Explain the requirements for composite classification.

11B.6.1.6 Explain the requirements for composite classification.

10.6.1.7 Describe common reinforcement materials used for laminates, and compare their qualities.

11B.6.1.7 Describe common reinforcement materials used for laminates, and compare their qualities.

10.6.1.8 Explain the advantages and disadvantages of composite materials.

11B.6.1.8 Explain how composite material is manufactured.

10.6.1.9 Explain the purpose for curing composite material.

11B.6.1.9 Explain the purpose for curing composite material.

11B.6.1.10 Explain the advantages and disadvantages of composite materials.

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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. *(continued)*

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

11B.6.1.11 Describe the properties of the materials commonly used in sandwich panel composite structures.

11B.6.1.12 Compare and contrast I-beams with composite sandwich panels.

11B.6.1.13 Identify and explain honeycomb core materials and core configuration.

11B.6.1.14 Identify and describe the code system used by aluminum rivet manufacturers to identify AN/MS standard parts.

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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. *(continued)*

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

11B.6.1.15 Identify and describe sheet metal fasteners.

11B.6.1.16 Explain the requirements for CORE classification.

GLO 6.2: Describe **applications** of the various aerospace **materials and consumables**.

9.6.2.1 Identify which materials are used in the various aircraft structures and components.

10.6.2.1 Describe which materials are used in the various aircraft structures and components.

11A.6.2.1 Describe which materials are used in the various aircraft structures and components.

11B.6.2.1 Describe which materials are used in the various aircraft structures and components.

11C.6.2.1 Identify common metal fasteners used on aircraft engines.

9.6.2.2 List the applications of composite materials in aircraft fabrication.

10.6.2.2 List the applications of composite materials in aircraft fabrication.

11A.6.2.2 List the applications of composite materials in aircraft fabrication.

11B.6.2.2 Describe handling procedures and storage of sheet metal.

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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. *(continued)*

GLO 6.2: Describe **applications** of the various aerospace **materials and consumables**. *(continued)*

<p>9.6.2.3 Describe types of composite construction.</p> <p>9.6.2.4 State methods of processing pre-cured composite materials, including the use of hand and power tools for</p> <ul style="list-style-type: none"> ■ cutting ■ drilling ■ sanding 	<p>10.6.2.3 Describe types of composite construction.</p> <p>10.6.2.4 State methods of processing pre-cured composite materials, including the use of hand and power tools for</p> <ul style="list-style-type: none"> ■ cutting ■ drilling ■ sanding 	<p>11A.6.2.3 Describe types of composite construction.</p>	<p>11B.6.2.3 Identify and explain the general concepts and construction of airframe metallic and non-metallic structures.</p> <p>11B.6.2.4a State methods of processing pre-cured composite materials, including the use of hand and power tools for</p> <ul style="list-style-type: none"> ■ cutting ■ drilling ■ sanding <p>11B.6.2.4b State methods of processing pre-cured core materials, including the use of hand and power tools for</p> <ul style="list-style-type: none"> ■ cutting ■ drilling ■ sanding
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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. *(continued)*

GLO 6.2: Describe **applications** of the various aerospace **materials and consumables**. *(continued)*

10.6.2.5 List the steps for curing a composite layup.

10.6.2.6 State methods of machining post-cured reinforcement materials, including the use of hand and power tools for

- cutting
- drilling
- sanding

10.6.2.7 Describe the fabrication of non-metallic composite structures, including, but not limited to, solid laminates.

11B.6.2.5 List the steps for curing a composite layup.

11B.6.2.6 State methods of machining post-cured reinforcement materials, including the use of hand and power tools for

- cutting
- drilling
- sanding

11B.6.2.7 Describe the fabrication of non-metallic composite structures, including, but not limited to, solid laminates and honeycomb sandwiches.

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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. *(continued)*

GLO 6.2: Describe **applications** of the various aerospace **materials and consumables**. *(continued)*

<p>10.6.2.8 Identify and explain how to use the tools and equipment used in kit cutting of composite materials.</p> <p>10.6.2.9 List the steps involved in trimming composite panel.</p> <p>10.6.2.10 Determine a rivet layout pattern.</p> <p>10.6.2.11 Describe solid rivets.</p>	<p>11B.6.2.8 Identify and explain how to use the tools and equipment used in kit cutting of composite materials.</p> <p>11B.6.2.9 List the steps involved in trimming composite panel.</p> <p>11B.6.2.10 Determine a rivet layout pattern.</p> <p>11B.6.2.11 List and explain the sandwich panel fabrication process for composite structures.</p> <p>11B.6.2.12 Explain the purpose for a core in sandwich panel construction.</p>
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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. *(continued)*

GLO 6.2: Describe **applications** of the various aerospace **materials and consumables**. *(continued)*

11B.6.2.13 Define the use of the contact and non-contact materials used in temporary compaction.

11B.6.2.14 Explain the purpose or function of the skin, doubler, filler, core, and edgeband in a composite sandwich panel.

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

GLO 7.1: Fabricate **metallic** parts.

9.7.1.1 Identify several common measurement/layout tools used in metalworking.	10.7.1.1 Use common measurement/layout tools used in metalworking.	—	11B.7.1.1 Use common measurement/layout tools used in metalworking.	—
9.7.1.2 Describe the process for marking and drilling holes in sheet metal.	10.7.1.2 Describe the process for marking and drilling holes in sheet metal.	—	11B.7.1.2 Apply the process for marking and drilling holes in sheet metal.	—

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

GLO 7.1: Fabricate **metallic** parts. *(continued)*

<p>10.7.1.3 Describe the use of layout tools and instruments.</p> <p>10.7.1.4 Apply rivet-sizing formulas.</p> <p>10.7.1.5 Perform rivet pitch and edge distance calculations.</p> <p>10.7.1.6 Describe the inspection of formed rivets.</p>	<p>11B.7.1.3 Apply appropriate layout techniques to the creation of a metalwork project.</p> <p>11B.7.1.4 Apply rivet-sizing formulas.</p> <p>11B.7.1.5 Perform rivet pitch and edge distance calculations.</p> <p>11B.7.1.6 Describe the inspection of formed rivets.</p> <p>11B.7.1.7 Demonstrate the ability to lay out sheet metal to given dimensions, including at least one bend.</p>
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Goal 7: Fabricate parts and components for use in the aviation and aerospace industry. *(continued)*

GLO 7.1: Fabricate **metallic** parts. *(continued)*

11B.7.1.8 Describe the calculation of bend allowance and setback for forming sheet metal.

11B.7.1.9 Describe quality control processes.

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

9.7.2.1 Identify several common measurement/layout tools used in composite fabrication.	10.7.2.1 Use common measurement/layout tools used in composite fabrication.	—	11B.7.2.1 Use common measurement/layout tools used in composite fabrication.	—
9.7.2.2 Use several common layout tools used in composite fabrication.	10.7.2.2 Describe layout procedures for different fabrication applications.		11B.7.2.2 Apply appropriate layout techniques to the creation of a composite fabrication project.	

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

GLO 7.2: Fabricate **non-metallic** parts. *(continued)*

<p>9.7.2.3 Describe the process for marking and drilling holes in composite material.</p> <p>9.7.2.4 Inspect a composite panel using the tap test and the visual method.</p>	<p>10.7.2.3 Describe the use of layout tools and instruments.</p> <p>10.7.2.4 Inspect a composite panel using the tap test and the visual method.</p>	<p>11B.7.2.3 Apply the process for marking and drilling holes in composite fabrication.</p> <p>11B.7.2.4 Inspect a composite panel using the tap test and the visual method.</p> <p>11B.7.2.5 Describe methods of inspection (including the visual method, tap testing, and NDI) and their applications.</p> <p>11B.7.2.6 Describe quality control processes.</p>
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Goal 7: Fabricate parts and components for use in the aviation and aerospace industry. *(continued)*

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

No applicable specific learning outcomes.

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.

9.8.1.1 Interpret a graphic presentation of a technical idea.	10.8.1.1 Demonstrate the proper use of tools, materials, and equipment used to create technical drawings.	11A.8.1.1 Describe the purpose of and identify the information in the aircraft maintenance, overhaul, structural repair, service, and component manuals.	11B.8.1.1 Describe the purpose of and identify the information in the aircraft maintenance, overhaul, structural repair, service, and component manuals.	11C.8.1.1 Describe the purpose of and identify the information in the aircraft maintenance, overhaul, structural repair, service, and component manuals.
9.8.1.2 Identify and demonstrate the proper use of tools, materials, and equipment used to create technical drawings.	10.8.1.2 Identify and use traditional "board" tools used in drafting, such as T-squares, drafting machines, set-squares, scales, and rules.	11A.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.	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.	11C.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.

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

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

10.8.1.3 Identify the main conventions related to simple technical drawings.	11A.8.1.3 Demonstrate the use of a typical aircraft maintenance or overhaul manual to locate information on components repair or overhaul procedures.	11B.8.1.3 Demonstrate the use of a typical aircraft maintenance or overhaul manual to locate information on components repair or overhaul procedures.	11C.8.1.3 Demonstrate the use of a typical aircraft maintenance or overhaul manual to locate information on components repair or overhaul procedures.
10.8.1.4 Demonstrate an understanding of drawing practices, including methods of illustration and sketching.	11A.8.1.4 Identify technical information using the Air Transport Association Specification 100 (ATA Spec 100) numbering system.	11B.8.1.4 Identify technical information using the Air Transport Association Specification 100 (ATA Spec 100) numbering system.	11C.8.1.4 Identify technical information using the Air Transport Association Specification 100 (ATA Spec 100) numbering system.
10.8.1.5 Use technical language and terms appropriately in context.	11A.8.1.5 Use technical language and terms appropriately in context.	11B.8.1.5 Use technical language and terms appropriately in context.	11C.8.1.5 Use technical language and terms appropriately in context.
		11B.8.1.6 Recognize and use the different types of drawings used in aircraft maintenance.	11C.8.1.6 Identify the main conventions related to simple technical drawings.

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

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

11B.8.1.7 Interpret technical drawings to perform tasks related to aircraft components.

11C.8.1.7 Describe documentation and certification.

GLO 8.2: Acquire and organize information using **information and communication technology.**

9.8.2.1 Acquire and organize information using appropriate technology and information systems.

10.8.2.1 Access and use a range of relevant information, material, and human resources.

11A.8.2.1 Acquire, analyze, and apply specialized information and skills from various disciplines in a variety of realistic circumstances.

11B.8.2.1 Acquire, analyze, and apply specialized information and skills from various disciplines in a variety of realistic circumstances.

11C.8.2.1 Use a computer-assisted design and drafting (CADD) system to produce a simple technical drawing.

9.8.2.2 Demonstrate the appropriate use of information as directed.

10.8.2.2 Use a computer-assisted design and drafting (CADD) system to produce a simple technical drawing.

11A.8.2.2 Support and enhance basic information requirements by using a wide variety of resources (e.g., print, online, community).

11B.8.2.2 Use a computer-assisted design and drafting (CADD) system to produce a simple technical drawing.

11C.8.2.2 Support and enhance basic information requirements by using a wide variety of resources (e.g., print, online, community).

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

GLO 8.2: Acquire and organize information using **information and communication technology**. *(continued)*

11A.8.2.3 Apply an appropriate combination of digital, graphic, oral, and written techniques to effectively communicate a technical idea.

11B.8.2.3 Support and enhance basic information requirements by using a wide variety of resources (e.g., print, online, community).

11B.8.2.4 Apply an appropriate combination of digital, graphic, oral, and written techniques to effectively communicate a technical idea.

GLO 8.3: Apply **mathematical** knowledge and skills related to aviation and aerospace technologies.

9.8.3.1 Recognize and apply common measurement standards used in metalworking.

10.8.3.1 Recognize and apply common measurement standards used in the aviation and aerospace industry.

11A.8.3.1 Use fractions, decimals, ratios, and percentages.

11B.8.3.1 Apply common measurement standards used in the aviation and aerospace industry.

11C.8.3.1 Apply common measurement standards used in the aviation and aerospace industry.

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

GLO 8.3: Apply **mathematical** knowledge and skills related to aviation and aerospace technologies. *(continued)*

<p>10.8.3.2 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.</p> <p>10.8.3.3 Use fractions, decimals, ratios, and percentages.</p> <p>10.8.3.4 Convert from imperial to metric measurements.</p>	<p>11A.8.3.2 Convert from imperial to metric measurements.</p>	<p>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.</p> <p>11B.8.3.3 Use fractions, decimals, ratios, and percentages.</p> <p>11B.8.3.4 Convert from imperial to metric measurements.</p>	<p>11C.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.</p> <p>11C.8.3.3 Use fractions, decimals, ratios, and percentages.</p> <p>11C.8.3.4 Convert from imperial to metric measurements.</p>
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Goal 8: Describe and demonstrate the transferable **cross-curricular skills** as they pertain to **aviation and aerospace technologies.** *(continued)*

GLO 8.4: Apply **scientific** knowledge and skills related to aviation and aerospace technologies.

9.8.4.1 Explain Bernoulli’s principle as it applies to a venturi.	10.8.4.1 Describe the characteristics of matter, including, but not limited to, atomic structure, states of matter, weight, mass, and density.	11A.8.4.1 Describe the characteristics of matter, including, but not limited to, atomic structure, states of matter, weight, mass, and density.	—	11C.8.4.1 Compare and contrast potential and kinetic energy and how they apply to reciprocating engines.
9.8.4.2 Describe Newton’s laws of motion.	10.8.4.2 Describe Newton’s laws of motion.	11A.8.4.2 Describe Newton’s laws of motion in relation to aircraft components and functions.		11C.8.4.2 Define work, power, and force as they apply to reciprocating engines.
	10.8.4.3 Identify any parts or systems of an aircraft and/or engine where Bernoulli’s principle and/or Newtonian law is applied.	11A.8.4.3 Identify any parts or systems of an aircraft and/or engine where Bernoulli’s principle and/or Newtonian law is applied.		

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

GLO 8.4: Apply **scientific** knowledge and skills related to aviation and aerospace technologies. *(continued)*

10.8.4.4 Compare and contrast potential and kinetic energy and how they apply to aircraft and/or aircraft systems.	11A.8.4.4 Explain the relationship between fluid density and specific gravity.
10.8.4.5 Define <i>work</i> , <i>power</i> , and <i>force</i> .	11A.8.4.5 Explain the characteristics of specific gravity of fluids and how it may be applied to aircraft maintenance.
10.8.4.6 Define the function of common simple machines and explain how mechanical advantage is applied to them.	11A.8.4.6 Compare and contrast potential and kinetic energy and how they apply to aircraft and/or aircraft systems.
10.8.4.7 Design a simple machine (on paper) that uses one or more methods of mechanical advantage.	11A.8.4.7 Design a simple machine (on paper) that uses one or more methods of mechanical advantage.

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

GLO 8.4: Apply **scientific** knowledge and skills related to aviation and aerospace technologies. *(continued)*

11A.8.4.8 List and explain the five forces or stresses affecting aircraft structures.

11A.8.4.9 Determine which of the five forces/stresses are acting on an aircraft or aircraft parts at specific points under given conditions.

11A.8.4.10 Explain the relationship among force, area, and pressure.

11A.8.4.11 Calculate force, area, or pressure in a specific application.

11A.8.4.12 Compare and contrast speed, velocity, and acceleration.

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

GLO 8.4: Apply **scientific** knowledge and skills related to aviation and aerospace technologies. *(continued)*

11A.8.4.13 Define *vector*, *centripetal force*, and *centrifugal force*.

11A.8.4.14 Define the term *heat*.

11A.8.4.15 Explain how heat is manifested in matter and how heat transfer is accomplished through conduction and/or convection and/or radiation.

11A.8.4.16 Identify one or more methods of heat transfer in aircraft systems, and where and how heat damage may occur when performing aircraft maintenance.

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

GLO 8.4: Apply **scientific** knowledge and skills related to aviation and aerospace technologies. *(continued)*

11A.8.4.17 Perform temperature conversion calculations for centigrade, Fahrenheit, and Kelvin or absolute scales.

11A.8.4.18 Demonstrate an understanding of linear (thermal) expansion as related to aircraft materials.

11A.8.4.19 Define *pressure*.

11A.8.4.20 Compare and contrast absolute and relative (gauge and differential) pressures.

11A.8.4.21 Define Pascal’s law.

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

GLO 8.4: Apply **scientific** knowledge and skills related to aviation and aerospace technologies. *(continued)*

11A.8.4.22 Apply Pascal's law as it relates to the underlying principle of the hydraulic jack and hydraulic press and the force amplification in the braking system of an aircraft.

11A.8.4.23 Explain the general effects of pressure and temperature on gases and liquids and how the qualities of compressibility and/or incompressibility of gases and liquids are generally applied to aircraft systems.

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

GLO 8.4: Apply **scientific** knowledge and skills related to aviation and aerospace technologies. *(continued)*

11A.8.4.24 Explain Boyle’s, Charles’s, and Avogadro’s gas laws, and apply them to observations of gas behaviour.

11A.8.4.25 Explain Bernoulli’s principle as it applies to a venturi.

11A.8.4.26 Define the conditions of standard day/STP (standard temperature and pressure).

11A.8.4.27 Apply the concepts of the gas laws to gas phase reactions; perform calculations using gas properties, masses, and volumes.

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

GLO 8.4: Apply **scientific** knowledge and skills related to aviation and aerospace technologies. *(continued)*

11A.8.4.28 Perform calculations using the ideal gas equation.

11A.8.4.29 Identify parts or systems of an aircraft where Boyle's, Charles's, and/or Pascal's laws apply.

11A.8.4.30 List and explain the properties of sound, including frequency, wavelength, amplitude, and decibel.

11A.8.4.31 Define sound resonance, and explain how it can be a hazard to aircraft and how sound may be used to aid in inspecting aircraft.

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

GLO 8.4: Apply **scientific** knowledge and skills related to aviation and aerospace technologies. *(continued)*

11A.8.4.32 Explain the concept of the speed of sound and how it relates to aircraft.

11A.8.4.33 Describe the composition of the atmosphere.

11A.8.4.34 Explain temperature.

11A.8.4.35 Describe humidity.

11A.8.4.36 Explain the factors that determine density altitude.

11A.8.4.37 Describe density altitude and the effects of temperature and/or pressure and/or humidity on aircraft and/or engine performance.

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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.

<p>9.9.1.1 Demonstrate an awareness of careers in aviation and aerospace technologies and associated fields.</p> <p>9.9.1.2 Describe career opportunities in aviation and aerospace technologies.</p>	<p>10.9.1.1 Demonstrate an awareness of careers in aviation and aerospace technologies and associated fields.</p> <p>10.9.1.2 Demonstrate an awareness of apprenticeship.</p> <p>10.9.1.3 Research the academic knowledge and skills required for employment and post-secondary education.</p>	<p>11A.9.1.1 Demonstrate an awareness of careers in the area of aircraft maintenance engineering.</p> <p>11A.9.1.2 Demonstrate an awareness of post-secondary opportunities in aviation and aerospace technologies and associated fields.</p>	<p>11B.9.1.1 Demonstrate an awareness of careers in the area of aircraft manufacturing.</p>	<p>11C.9.1.1 Demonstrate an awareness of careers in the area of gas turbine R & O (repair and overhaul).</p>
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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**.

—	<p>10.10.1.1 Describe basic concepts of human factors (Dirty Dozen) as applied to aviation maintenance.</p> <p>10.10.1.2 Identify organizational norms and establish a culture of safety in the workplace.</p> <p>10.10.1.3 Identify the impacts of aviation to human health and well-being.</p>	—	<p>11B.10.1.1 Describe basic concepts of human factors (Dirty Dozen) as applied to aviation maintenance.</p> <p>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).</p>	<p>11C.10.1.1 Describe basic concepts of human factors (Dirty Dozen) as applied to aviation maintenance.</p> <p>11C.10.1.2 Identify organizational norms and establish a culture of safety in the workplace.</p>
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Goal 10: Demonstrate an awareness of **sustainability** as it pertains to aviation and aerospace technologies.
(continued)

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

<p>9.10.2.1 Explain how and why lightweight and recyclable materials are used in aircraft production.</p>	<p>10.10.2.1 Explain how and why lightweight and recyclable materials are used in aircraft production.</p>	<p>11A.10.2.1 Explain how and why lightweight and recyclable materials are used in aircraft production.</p>	<p>11B.10.2.1 Demonstrate a basic knowledge of efficient material usage to reduce waste and its impact on the environment.</p>	<p>11C.10.2.1 Identify a variety of alternative fuels and explain how the use of these fuels and energy sources can reduce the environmental impact of the aviation and aerospace industry.</p>
	<p>10.10.2.2 Discuss how the aviation and aerospace industry affects the environment.</p>	<p>11A.10.2.2 Discuss the impact of chemical hazards on the environment.</p>	<p>11B.10.2.2 Discuss the impact of chemical hazards on the environment.</p>	<p>11C.10.2.2 Discuss the impact of chemical hazards on the environment.</p>
	<p>10.10.2.3 Describe the benefits of using environmentally friendly products and more efficiently designed aircraft.</p>	<p>11A.10.2.3 Describe the benefits of using environmentally friendly products and more efficiently designed aircraft.</p>	<p>11B.10.2.3 Describe the benefits of using environmentally friendly products and more efficiently designed aircraft.</p>	<p>11C.10.2.3 Describe the benefits of using environmentally friendly products and more efficiently designed aircraft.</p>
	<p>10.10.2.4 Describe and apply efficient materials usage and disposal practices.</p>			

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

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

—	10.10.3.1 Define sustainable business practices.	11A.10.3.1 Contrast sustainable and unsustainable business practices.	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.

9.11.1.1 Discuss the meaning of ethical and legal standards.	10.11.1.1 Discuss ethical and legal standards in the aviation and aerospace industry workplace.	11A.11.1.1 Identify the ethical and legal expectations of aviation and aerospace technicians.	—	—
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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.

—	10.12.1.1 Demonstrate the criteria that comprise the Global Industry Standard of essential skills for employees.	11A.12.1.1 Demonstrate the criteria that comprise the Global Industry Standard of essential skills for employees.	11B.12.1.1 Demonstrate the criteria that comprise the Global Industry Standard of essential skills for employees.	11C.12.1.1 Demonstrate the criteria that comprise the Global Industry Standard of essential skills for employees.
	10.12.1.2 Demonstrate the skills listed on the Conference Board of Canada's <i>Employability Skills 2000+</i> for employees.	11A.12.1.2 Demonstrate the skills listed on the Conference Board of Canada's <i>Employability Skills 2000+</i> for employees.	11B.12.1.2 Demonstrate the skills listed on the Conference Board of Canada's <i>Employability Skills 2000+</i> for employees.	11C.12.1.2 Demonstrate the skills listed on the Conference Board of Canada's <i>Employability Skills 2000+</i> for employees.
		11A.12.1.3 Describe the skills required for a specific career path in the aviation and aerospace industry.	11B.12.1.3 Describe the skills required for a specific career path in the aviation and aerospace industry.	11C.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**.

—	10.13.1.1 Describe the evolution of aviation and aerospace technologies, including technological progression and emerging trends.	11A.13.1.1 Describe the evolution of aircraft design, including its technological progression and emerging trends.	11B.13.1.1 Describe the evolution of aerospace manufacturing, including its technological progression and emerging trends.	11C.13.1.1 Describe the evolution of engine design, including its technological progression and emerging trends. 11C.13.1.2 Describe the early development of heat engines. 11C.13.1.3 Describe factors affecting development of engines.
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GRADE 12 AVIATION AND
AEROSPACE TECHNOLOGIES

General and Specific Learning
Outcomes by Goal

GRADE 12 AVIATION AND AEROSPACE TECHNOLOGIES

GENERAL AND SPECIFIC LEARNING OUTCOMES BY GOAL

8548 Aircraft Structure and Repair (12A) 40S / 40E / 40M	8549 Aircraft Electrical Systems (12B) 40S / 40E / 40M	8561 Aircraft Systems and Propulsion (12C) 40S / 40E / 40M	8562 Applied Aviation and Aerospace Technologies (12D) 40S / 40E / 40M
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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.

12A.1.1.1 Describe and apply appropriate health and safety practices for aircraft structure and repair.	12B.1.1.1 Describe and apply appropriate health and safety practices for aircraft electrical systems.	12C.1.1.1 Describe and apply appropriate health and safety practices for aircraft systems and propulsion.	12D.1.1.1 Describe and apply appropriate health and safety practices for aviation and aerospace technologies.
12A.1.1.2 Explain safety practices/precautions for metallic and non-metallic structures.	12B.1.1.2 Practise safety precautions related to electrical circuits.		12D.1.1.2 Complete WHMIS certification.
12A.1.1.3 Describe safe handling of composite materials in pre-cured form.	12B.1.1.3 Practise safety precautions related to solid-state components.		
12A.1.1.4 Explain the health and safety requirements for core detailing, both pre- and post-cure.	12B.1.1.4 Practise safety precautions to be used when soldering.		
12A.1.1.5 Explain the health and safety requirements for liquid penetrant and magnetic-particle non-destructive inspection.	12B.1.1.5 Identify battery shop safety features and precautions when servicing various types of batteries.		

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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.

12A.2.1.1 Demonstrate an understanding of aerodynamics, control, and stability as they apply to aircraft structure and repair.

12B.2.1.1 Demonstrate an understanding of control and stability as they apply to aircraft electrical systems.

12C.2.1.1 Demonstrate an understanding of control and stability as they apply to aircraft systems and propulsion.

12D.2.1.1 Demonstrate an understanding of aerodynamics, control, and stability as they apply to aviation and aerospace technologies.

12A.2.1.2 Define terminology used in weight and balance procedures and reports. (AME 19.G17.1)

12A.2.1.3 Explain reasons for weight and balance of aircraft. (AME 19.G17.3)

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**.

12A.3.1.1 Demonstrate an understanding of the major components of wings, and their flight controls and functions.

12B.3.1.1 Demonstrate an understanding of the major components found in aircraft electrical systems.

12C.3.1.1 Demonstrate an understanding of the major components found in the following: hydraulic systems, pneumatic systems, pitot-static systems, fuel systems, aircraft engines, and propellers.

12D.3.1.1 Demonstrate an understanding of the major components of an aircraft and their functions.

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

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

—	<p>12B.4.1.1 Describe the functions of the major components of an aircraft’s electrical system.</p> <p>12B.4.1.2 Define terms related to basic DC electricity, including <i>passive</i>, <i>active</i>, <i>semiconductor components</i>, and <i>control devices</i>.</p> <p>12B.4.1.3 Identify basic DC electrical and schematic symbols and components.</p> <p>12B.4.1.4 Explain the theory of chemical batteries.</p> <p>12B.4.1.5 Identify types and construction of aircraft batteries.</p>	<p>12C.4.1.1 Describe the functions of the major components of an aircraft’s hydraulic system.</p> <p>12C.4.1.2 Describe the functions of the major components of an aircraft’s pneumatic system.</p> <p>12C.4.1.3 Describe the functions of the major components of an aircraft’s pitot-static system.</p> <p>12C.4.1.4 Describe the functions of the major components of an aircraft’s fuel system.</p> <p>12C.4.1.5 Describe different types of gas turbine engines, including their advantages and disadvantages. (AME 23.P7.2)</p>	<p>12D.4.1.1 Demonstrate an understanding of aircraft systems and their purposes.</p>
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Goal 4: Demonstrate comprehension of **aircraft systems**. *(continued)*

GLO 4.1: Describe **aircraft systems** and their purposes. *(continued)*

	12B.4.1.6 Explain the process of servicing aircraft batteries.	12C.4.1.6 Explain the physics related to gas turbine theory. (AME 23.P7.3)
	12B.4.1.7 Identify the types of ignition systems.	12C.4.1.7 Describe gas turbine/jet engine propulsion principles. (AME 23.P7.4)
	12B.4.1.8 Describe the principles of spark discharge and coil ignition systems.	12C.4.1.8 Describe the design, construction, and function of engine inlets. (AME 23.P7.5)
	12B.4.1.9 Describe the types of magneto ignition systems.	12C.4.1.9 Describe the design and construction of compressors. (AME 23.P7.6)
	12B.4.1.10 Describe the principles of gas turbine ignition systems.	12C.4.1.10 Explain the design, construction, and operation of combustion chambers. (AME 23.P7.7)
	12B.4.1.11 Describe the principles of operation of ignition systems.	12C.4.1.11 Describe the design, construction, and function of turbines. (AME 23.P7.8)

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Goal 4: Demonstrate comprehension of **aircraft systems**. *(continued)*

GLO 4.1: Describe **aircraft systems** and their purposes. *(continued)*

	<p>12B.4.1.12 Describe the operation of a DC generator, a DC alternator, a turbine engine starter-generator, a converter, and a transformer rectifier.</p>	<p>12C.4.1.12 Describe the design and construction of gas turbine engine exhaust systems. (AME 23.P7.9)</p>	
	<p>12B.4.1.13 Identify common problems encountered in a DC generation system and their typical fixes.</p>	<p>12C.4.1.13 Describe the turbine engine internal air systems. (AME 23.P7.10)</p>	
	<p>12B.4.1.14 Identify common inspection and maintenance practices for an AC generation system.</p>	<p>12C.4.1.14 Describe the applications of propellers. (AME 12.P11.1)</p>	
	<p>12B.4.1.15 Describe the operation of a basic power distribution system.</p>	<p>12C.4.1.15 Identify parts of fixed and variable pitch propellers. (AME 12.P11.2)</p>	
	<p>12B.4.1.16 Describe the operation of an AC generation system.</p>	<p>12C.4.1.16 Explain the variables that affect propeller operation. (AME 12.P11.3)</p>	
	<p>12B.4.1.17 Describe the operation of a split-bus power and parallel bus distribution system.</p>	<p>12C.4.1.17 Describe the general classifications and types of propellers. (AME 12.P11.4)</p>	

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Goal 4: Demonstrate comprehension of **aircraft systems**. *(continued)*

GLO 4.1: Describe **aircraft systems** and their purposes. *(continued)*

12B.4.1.18 Identify faults in a basic bus distribution system.

12C.4.1.18 Describe the construction, assembly, and advantages of both wood and metal fixed pitch propellers and ground-adjustable propellers. (AME 12.P11.5)

12B.4.1.19 Identify the types of light bulbs used on aircraft.

12C.4.1.19 Describe propeller governors. (AME 12.P11.6)

12B.4.1.20 Describe the configuration, purpose, and operation of each typical aircraft interior, exterior, and emergency lighting system circuit.

12B.4.1.21 Define and describe basic aircraft instruments.

12B.4.1.22 Describe the various operating principles of aircraft instruments.

12B.4.1.23 Describe aircraft internal communications systems.

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Goal 4: Demonstrate comprehension of **aircraft systems**. *(continued)*

GLO 4.1: Describe **aircraft systems** and their purposes. *(continued)*

12B.4.1.24 Identify common radio communications failures, and describe typical repairs for each failure.

12B.4.1.25 Identify the letters of the phonetic alphabet.

12B.4.1.26 Describe the procedures and regulations for transmitting a radio communications check.

12B.4.1.27 Explain the function of antennas.

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**.

12A.5.1.1 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 for metallic and non-metallic structure and repair.

12B.5.1.1 Demonstrate the safe and appropriate cleaning, storage, and management of equipment and tools used in aircraft electrical systems.

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12D.5.1.1 Demonstrate the safe and appropriate cleaning, storage, and management of equipment and tools used in aviation and aerospace technologies.

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

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

12B.5.1.2 Demonstrate precautions required to prevent static damage.

GLO 5.2: Demonstrate the **operation of tools and equipment** to fabricate **metallic** parts and projects.

12A.5.2.1 Describe sheet metal tools. (AME 21.G6.5)

12B.5.2.1 Demonstrate proper use of tools, and test equipment utilized in electricity/electronics.

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12D.5.2.1 Demonstrate the operation of tools and equipment to fabricate metallic parts and projects.

12A.5.2.2 Identify and handle aircraft sheet metal, and describe related documentation. (AME 21.A11.3)

12B.5.2.2 Describe the construction and operation of a multimeter.

12B.5.2.3 Use a multimeter to perform series, parallel, and complex circuit analysis.

12B.5.2.4 Select appropriate test equipment to measure specified functions of an electrical/electronic circuit.

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

GLO 5.2: Demonstrate the **operation** of **tools and equipment** to fabricate **metallic** parts and projects. *(continued)*

12B.5.2.5 Apply appropriate test equipment techniques to the analysis, repair, and calibration of electrical/ electronic circuits and devices.

12B.5.2.6 Use correct procedures to solder electrical/ electronic circuitry, including unique and heat sensitive circuits.

GLO 5.3: Demonstrate the **operation** of **tools and equipment** to fabricate **non-metallic** parts and projects.

12A.5.3.1 Demonstrate the operation of tools and equipment to fabricate non-metallic parts and projects.

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12D.5.3.1 Demonstrate the operation of tools and equipment to fabricate non-metallic parts and projects.

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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.

12A.6.1.1 Explain the inspection and repair of aircraft.	12B.6.1.1 Demonstrate an understanding of material properties as they apply to aviation and aerospace technologies.	—	12D.6.1.1 Demonstrate an understanding of material properties as they apply to aviation and aerospace technologies.
12A.6.1.2 Describe aircraft development and the materials used. (AME 13.G12.1)	12B.6.1.2 Identify common electrical/electronic passive and active components, such as resistors, conductors, semiconductors, and control devices.		
12A.6.1.3 Describe the physical properties of materials used in aircraft construction and repair. (AME 13.G12.2)	12B.6.1.3 Describe the function, properties, and schematic symbols of most common electrical/electronic passive, active, and solid-state components.		
12A.6.1.4 Describe the physical properties of ferrous metals used in aircraft construction and repair. (AME 13.G12.3)	12B.6.1.4 Identify the common types of wire and cable and their uses.		

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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. (*continued*)

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

12A.6.1.5 Describe the physical properties of non-ferrous metals used in aircraft construction and repair. (AME 13.G12.4)

12A.6.1.6 Describe the types, uses, and maintenance of plastics and glass in aviation products. (AME 13.G12.6)

12A.6.1.7 Explain the formation of corrosion, and identify types of corrosion. (AME 13.G14.1)

12A.6.1.8 Determine the type of corrosion and corrosion-prone areas. (AME 13.G14.2)

12A.6.1.9 Identify correct removal methods, and remove and control corrosion. (AME 13.G14.3)

12B.6.1.5 Identify each element of a wire identification number.

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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. (*continued*)

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

12A.6.1.10 Demonstrate methods used to prevent corrosion and to protect aircraft structures from damage caused by corrosive elements. (AME 13.G14.4)

12A.6.1.11 Describe the use of wood in aircraft manufacturing and repair. (AME 14.G12.7)

12A.6.1.12 Describe inspection and repair procedures for wood structured aircraft. (AME 14.A12.1)

12A.6.1.13 Describe fabric coverings used on aircraft. (AME 14.G12.8)

12A.6.1.14 Describe fabric covering inspection and repair. (AME 14.A12.2)

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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. *(continued)*

GLO 6.2: Describe **applications** of the various aerospace **materials and consumables**.

12A.6.2.1 Describe which materials are used in various aircraft structures and components.	—	—	12D.6.2.1 Describe applications of the various materials and consumables used in the aviation and aerospace industry.
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Goal 7: Fabricate parts and components for use in the aviation and aerospace industry.

GLO 7.1: Fabricate **metallic** parts.

12A.7.1.1 Lay out, cut, and drill sheet metal. (AME 21.A11.4)	12B.7.1.1 Build and install a simple aircraft wiring system.	—	—
12A.7.1.2 Install rivets, inspect the condition and installation of rivets, and remove poor or damaged rivets. (AME 21.A11.5)			
12A.7.1.3 Form and bend sheet metal. (AME 21.A11.6)			
12A.7.1.4 Perform sheet metal repairs. (AME 21.A11.7)			

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

GLO 7.1: Fabricate **metallic** parts. *(continued)*

12A.7.1.5 Explain inspection procedures.

12A.7.1.6 Conduct visual inspections.

12A.7.1.7 Explain and demonstrate a liquid penetrant inspection.

12A.7.1.8 Explain and demonstrate a magnetic-particle inspection.

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

12A.7.2.1 Identify the steps involved in selecting materials for composites. — — —

12A.7.2.2 Identify the items needed for production/fabrication.

12A.7.2.3 Fabricate/repair non-metallic parts.

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

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

—	12B.7.3.1 Construct DC circuits from schematic diagrams.	—	—
	12B.7.3.2 Combine electrical/electronic circuits and systems to create electrical/electronic devices and applications that perform specific functions.		
	12B.7.3.3 Determine resistor values using colour codes.		
	12B.7.3.4 Discuss the interrelationship of resistance and capacitive reactance.		
	12B.7.3.5 Calculate all values in an RC circuit.		
	12B.7.3.6 Troubleshoot a DC circuit using schematic diagrams and a multimeter.		
	12B.7.3.7 Identify methods of wire tinning.		
	12B.7.3.8 Demonstrate how and when to tin a wire.		

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

GLO 7.3: Fabricate **electrical/electronic** components. *(continued)*

12B.7.3.9 Identify methods of wire splicing.

12B.7.3.10 Demonstrate how and when to splice a wire.

12B.7.3.11 Describe the application of different terminal types and connections.

12B.7.3.12 Solder terminal types and connections.

12B.7.3.13 Identify the general characteristics of PC boards.

12B.7.3.14 Identify the options and procedures available for repairing broken circuit board copper lands.

12B.7.3.15 Describe the purpose of wire bundle lacing, spot tying, grommets, Adel clamps, and wrapping.

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

GLO 7.3: Fabricate **electrical/electronic** components. *(continued)*

12B.7.3.16 Identify the types and purpose of aircraft wiring splices, terminal lugs, and connectors.

12B.7.3.17 Identify parts of a wire harness assembly.

12B.7.3.18 Demonstrate an understanding of how a wire harness assembly is constructed using screw-on and twist-and-lock connectors.

12B.7.3.19 Analyze a simple aircraft wiring system.

12B.7.3.20 Identify and repair faults in a wire and connector assembly.

12B.7.3.21 Modify the simple aircraft wiring system according to the Federal Aviation Administration's *AC 43.13-1B—Acceptable Methods, Techniques, and Practices—Aircraft Inspection and Repair*.

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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.

12A.8.1.1 Read, interpret, and communicate information relevant to aviation and aerospace technologies.	12B.8.1.1 Read, interpret, and communicate information relevant to aviation and aerospace technologies.	12C.8.1.1 Read, interpret, and communicate information relevant to aviation and aerospace technologies.	12D.8.1.1 Communicate effectively with supervisors and aviation personnel.
	12B.8.1.2 Interpret a schematic diagram.		
	12B.8.1.3 Produce schematic and/or block diagrams of electrical/electronic circuits and systems.		
	12B.8.1.4 Use a computer-assisted design and drafting (CADD) system to produce a simple schematic diagram.		

GLO 8.2: Acquire and organize information using information and communication technology.

—	—	—	12D.8.2.1 Demonstrate familiarity with online job application processes.
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Goal 8: Describe and demonstrate the transferable **cross-curricular skills** as they pertain to **aviation and aerospace technologies.** *(continued)*

GLO 8.3: Apply **mathematical** knowledge and skills related to aviation and aerospace technologies.

12A.8.3.1 Demonstrate the addition, subtraction, multiplication, and division (for more than 1-digit divisors or 2-digit multipliers) of whole numbers, decimals, and fractions to solve problems.	12B.8.3.1 Demonstrate the addition, subtraction, multiplication, and division (for more than 1-digit divisors or 2-digit multipliers) of whole numbers, decimals, and fractions to solve problems.	12C.8.3.1 Demonstrate the addition, subtraction, multiplication, and division (for more than 1-digit divisors or 2-digit multipliers) of whole numbers, decimals, and fractions to solve problems.	—
12A.8.3.2 Demonstrate the use of fractions, decimals, ratios, and percentages.	12B.8.3.2 Demonstrate the use of fractions, decimals, ratios, and percentages.	12C.8.3.2 Demonstrate the use of fractions, decimals, ratios, and percentages.	
12A.8.3.3 Convert from imperial to metric measurements.	12B.8.3.3 Convert from imperial to metric measurements.	12C.8.3.3 Convert from imperial to metric measurements.	
	12B.8.3.4 Recognize and apply common measurement standards used in the aviation and aerospace industry.		
	12B.8.3.5 Analyze series, parallel, and series-parallel circuit diagrams, and calculate problems using Ohm’s and Kirchhoff’s laws.		
	12B.8.3.6 Apply mathematical calculations and formulas to analyze electrical/electronic circuitry.		

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

GLO 8.4: Apply **scientific** knowledge and skills related to aviation and aerospace technologies.

<p>—</p>	<p>12B.8.4.1 Demonstrate an understanding of basic DC electrical theory, including concepts such as the atomic model, electrons, current, electromotive force, potential difference, volt, resistance, and inductance.</p> <p>12B.8.4.2 List and discuss the three basic elements of a simple circuit.</p> <p>12B.8.4.3 List the basic units of electrical measurement.</p> <p>12B.8.4.4 Describe the six sources of electrical energy.</p> <p>12B.8.4.5 Discuss the physical characteristics that affect conductor resistance.</p> <p>12B.8.4.6 Define magnetism and describe lines of force.</p>	<p>—</p>	<p>—</p>
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Goal 8: Describe and demonstrate the transferable **cross-curricular skills** as they pertain to **aviation and aerospace technologies**. *(continued)*

GLO 8.4: Apply **scientific** knowledge and skills related to aviation and aerospace technologies. *(continued)*

12B.8.4.7 Identify types of magnets.

12B.8.4.8 Discuss properties of electromagnets.

12B.8.4.9 Discuss the principle of Kirchhoff's voltage and current law.

12B.8.4.10 Discuss the characteristics of series, parallel, and series-parallel circuits.

12B.8.4.11 Demonstrate an understanding of basic electrical laws and formulas, such as Ohm's law, Watt's law, and the law of magnetism.

12B.8.4.12 Compare and contrast electron flow theory and conventional flow theory.

12B.8.4.13 Demonstrate an understanding of basic AC electrical theory, including concepts such as sine wave, AC generation, hertz, induction, and capacitive reactance.

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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.

12A.9.1.1 Demonstrate an awareness of careers in aircraft structure and repair.	12B.9.1.1 Demonstrate an awareness of careers in avionics.	12C.9.1.1 Demonstrate an awareness of various aircraft maintenance engineer licence categories.	12D.9.1.1 Create a resumé for the purpose of obtaining employment in aviation and aerospace technologies and associated fields.
12A.9.1.2 Demonstrate an awareness of industry groups associated with the aviation and aerospace industry and associated fields.	12B.9.1.2 Demonstrate an awareness of professional organizations associated with the aviation and aerospace industry and associated fields.		12D.9.1.2 Create an employment portfolio for the purpose of obtaining employment in aviation and aerospace technologies and associated fields.
			12D.9.1.3 Research career opportunities in aviation and aerospace technologies and associated fields.

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**.

—	12B.10.1.1 Discuss the impacts of aviation on human health and well-being.	12C.10.1.1 Describe basic concepts of human factors (Dirty Dozen) as applied to aviation and aerospace technologies.	12D.10.1.1 Discuss basic concepts of human factors (Dirty Dozen) as applied to aviation and aerospace technologies.
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Goal 10: Demonstrate an awareness of **sustainability** as it pertains to aviation and aerospace technologies.
(continued)

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

12A.10.2.1 Discuss how the use of lighter materials in aircraft results in a reduced impact on the environment.	12B.10.2.1 Discuss why it is important for the aviation and aerospace industry to reduce its impact on the environment.	12C.10.2.1 Discuss how the use of more fuel-efficient engines in aircraft results in a reduced impact on the environment.	12D.10.2.1 Demonstrate responsible sustainability practices.
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GLO 10.3: Describe **sustainable business practices** within the aviation and aerospace industry.

—	—	12C.10.3.1 Discuss the effects of unsustainable business practices on the viability of an aviation and aerospace facility, and the resulting impact on the community and stakeholders.	12D.10.3.1 Describe how the manufacturing industry responds to changes in the global economy (e.g., fluctuating currencies, trade agreements, fluctuating demand in other countries) and how this response affects the local community and/or the province as a whole (e.g., in terms of economic opportunities or risks for the local and/or provincial population).
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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.

12A.11.1.1 Discuss the effects of operating in non-compliance with the <i>Canadian Aviation Regulations</i> on the viability of an aviation and aerospace facility, and the resulting impact on the community and stakeholders.	—	—	12D.11.1.1 Adhere to ethical and legal standards within an aviation and aerospace environment.
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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.

12A.12.1.1 Define TOWES (Test of Workplace Essential Skills), and state how it relates to employment in the aviation and aerospace industry.	12B.12.1.1 Define TOWES (Test of Workplace Essential Skills), and state how it relates to employment in the aviation and aerospace industry.	12C.12.1.1 Define TOWES (Test of Workplace Essential Skills), and state how it relates to employment in the aviation and aerospace industry.	12D.12.1.1 Define TOWES (Test of Workplace Essential Skills), and state how it relates to employment in the aviation and aerospace industry.
12A.12.1.2 Apply the three domains of TOWES (text reading, document use, and numeracy) in learning activities.	12B.12.1.2 Apply the three domains of TOWES (text reading, document use, and numeracy) in learning activities.	12C.12.1.2 Apply the three domains of TOWES (text reading, document use, and numeracy) in learning activities.	12D.12.1.2 Apply the three domains of TOWES (text reading, document use, and numeracy) in learning activities.

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

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

12A.12.1.3 List and define the criteria that comprise the Global Industry Standard of essential skills for employees.	12B.12.1.3 List and define the criteria that comprise the Global Industry Standard of essential skills for employees.	12C.12.1.3 List and define the criteria that comprise the Global Industry Standard of essential skills for employees.	12D.12.1.3 Demonstrate the Global Industry Standard of essential skills for employees.
12A.12.1.4 List and define the criteria that comprise the Conference Board of Canada’s <i>Employability Skills 2000+</i> for employees.	12B.12.1.4 List and define the criteria that comprise the Conference Board of Canada’s <i>Employability Skills 2000+</i> for employees.	12C.12.1.4 List and define the criteria that comprise the Conference Board of Canada’s <i>Employability Skills 2000+</i> for employees.	12D.12.1.4 Demonstrate the skills outlined in the Conference Board of Canada’s <i>Employability Skills 2000+</i> for employees.
			12D.12.1.5 Identify critical skills needed for employability in today's workplace.
			12D.12.1.6 Outline skills required for a specific career path in the aviation and aerospace industry.
			12D.12.1.7 Identify employers’ expectations to foster appropriate working conditions and dynamics 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**.

12A.13.1.1 Describe the evolution of aircraft structures and repair, including technological progression and emerging trends.	12B.13.1.1 Describe the evolution of avionics, including technological progression and emerging trends. 12B.13.1.2 Identify several current innovations in electricity/electronics, such as computer numerical control, robotics and automation, digital communication, fibre optic networks, nanotechnology, and circuit simulation software.	12C.13.1.1 Describe the evolution of aircraft systems and propulsion, including technological progression and emerging trends.	—
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Printed in Canada
Imprimé au Canada