

COURSE OUTLINE

COURSE: Structural Repairs on Composites, Wood, Fabric and Metal

PROGRAM: 280.C0 Aircraft Maintenance Technology

DISCIPLINE: 280 Aeronautics

WEIGHTING: Theory: 2 Practical Work: 4 Personal Study: 1

Instructor(s)	Office	☎ extension	✉ email or web site
Éric Jetté	C-182	4615	eric.jette@cegepmontpetit.ca

OFFICE HOURS

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
Morning					
Afternoon					

Coordinator(s)	Office	☎ extension	✉ email or web site
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CONTEXT OF THIS COURSE IN THE PROGRAM

This course is offered during the sixth session of the Aircraft Maintenance Program.

By the end of this course, students will have developed:

- Dexterity with tools.
- Research skills in technical manuals
- Knowledge of materials and hardware.
- Ability to repair laminated or sandwich-type composites.
- Ability to carry out repairs using moulds.
- Ability to carry out repairs using wood and fabric.
- Ability to install and remove different types of fasteners.
- Ability to provide a preliminary report of a major repair that complies with the applicable manufacturer's standards.

Students must keep this course outline for the duration of their studies as it will be useful for the comprehensive assessment at the end of the program.

Transport Canada: This course outline meets the requirements of Training Organisation Certification Manual (MCF) of Transport Canada. The Department applies Transport Canada standard which allows a maximum absence of 5% for the course (theory and laboratory). The department compiles absences of all students enrolled in Aircraft Maintenance (280.C0) and Avionics (280.D0) according to Transport Canada requirements. The application of Transport Canada policies regarding absences is available on the college website and in the student agenda under the heading « Privilèges accordés par Transports Canada ».

COMPETENCE OF THE PORTRAIT OF THE GRADUATE

Maintain aircraft structures.

MINISTRY OBJECTIVES OR COMPETENCIES

0261 Maintain the metal structures and structural components of an aircraft.

0262 Maintain aircraft structures and structural components made of composite materials, wood and fabric.

TERMINAL OBJECTIVE OF THE COURSE

At the end of this course, the student will be able to perform the appropriate structural repair.

TEACHING AND LEARNING STRATEGIES

THEORY

The theoretical part of the Structural Repairs on Composites is organized into various themes :

- Composite materials
- Hardware
- Aircraft constraints and structures
- Repair procedures
- Preliminary report
- Techniques for working with wood and fabric

Exercises and class discussions will be used as a strategy to develop the necessary skills for routine aircraft maintenance. Directed research in technical manuals and multimedia elements will complement learning.

PRACTICAL WORK

In the laboratory, the instructor will use hands-on demonstrations to guide students regarding the use of various measuring instruments. The practical assignments will allow students to acquire manual dexterity and the necessary competence for aircraft maintenance technicians. The repair projects carried out during the session are designed to provide students with practical experience using various repair methods on the materials being studied according to aeronautical standards. All of this complies with the health and safety work procedures applicable to the aviation industry.

COURSE PLAN – THEORETICAL PART

0261 Maintain the metal structures and structural components of an aircraft.

Block 1: Review of Metal Structural Repairs

Learning Objective	Content	Personal Study Activities
5. Plan the work	<ul style="list-style-type: none">• Cutting angle• Typical repairs on internal and external sleeves• Rosette welding	<ul style="list-style-type: none">• Consult website for 280-616.• Consult recommended readings• Review personal notes

0262 Maintain aircraft structures and structural components made of composite materials, wood and fabric.

Block 2 : Materials: technical and technological criteria

Learning Objective	Content	Personal Study Activities
<p>6. Ascertain the objectives and needs.</p>	<p>Distinguish wood and fabric materials used on aircraft. Varieties of wood</p> <ul style="list-style-type: none"> • Adhesives • Organic fabric • Synthetic fabric • Coatings • Additives 	<ul style="list-style-type: none"> • Consult website for 280-616. • Consult recommended readings • Review personal notes
	<p>Distinguish composite materials and related materials used on aircraft.</p> <ul style="list-style-type: none"> • Fibres • Resins • Adhesives • Core materials • Mould releasing agent • Film and fabric bagging • Main types of fasteners used 	
	<p>Recognize the aeronautical use of composite materials.</p> <ul style="list-style-type: none"> • Structural use • Non structural use 	
	<p>Recognize manufacturing techniques for composite parts</p> <ul style="list-style-type: none"> • Laminated • NIDA 	
	<p>Recognize the limitations applied to structural members made of composites</p> <p>Tension</p> <ul style="list-style-type: none"> • Compression • Shearing • Bending • Torsion • Flight area 	
<p>Explain repair methods for composite materials.</p> <ul style="list-style-type: none"> • Fibre-resin mixture • Vacuuming • Polymerisation <ul style="list-style-type: none"> - Ambient temperature - Covering • Heat curing 	<ul style="list-style-type: none"> • Consult website for 280-616. • Consult recommended readings • Review personal notes 	

Course Outline 280-6A6-EM: Structural Repairs on Composites, Wood, Fabric and Metal

Learning Objective	Content	Personal Study Activities
	Recognize health and safety risks and hazards. <ul style="list-style-type: none"> • WHMIS • Standards and guidelines applicable to the material and the technique used 	

Block 3 : Work on Composites

Learning Objective	Content	Personal Study Activities
1. Plan the work	<p>Identify the damage.</p> <ul style="list-style-type: none"> • Cracking, wrinkling, friction, scratch, hollow, notch, break, bulge, buckling, veiling, erosion, delamination, blisters, bulges, nick, void, wear, corrosion, brittleness <hr/> <p>Identify the cause of the damage.</p> <ul style="list-style-type: none"> • Possible causes: <ul style="list-style-type: none"> - Contamination - Collision - Fatigue - Lightning strike - Heat <hr/> <p>Follow the path of constraints in the adjacent structures.</p> <ul style="list-style-type: none"> • Tension • Compression • Shearing • Bending • Torsion • Bending moment • Shear <hr/> <p>Locate information relevant to composite, wood and fabric structures in a manual of structural repairs and other publications.</p> <ul style="list-style-type: none"> • Structure and content of the structural repair manual <ul style="list-style-type: none"> - Structure categories - Restricted areas - Aerodynamic zones - Material specifications - Information on damage - Classes of damage - Treatment - Repair - Replacement 	<ul style="list-style-type: none"> • Consult website for 280-616. • Consult recommended readings • Review personal notes

Course Outline 280-6A6-EM: Structural Repairs on Composites, Wood, Fabric and Metal

Learning Objective	Content	Personal Study Activities
	<p>Choose the action to take based on the results of the inspection.</p> <ul style="list-style-type: none"> • Treatment • Typical repair • Specific repair • Temporary repair • Replacement <hr/> <p>Choose the repair according to the standards and operation limitations. Structural repair manual</p> <ul style="list-style-type: none"> • Airworthiness standards and time constraints related to available time and work area. • Workplace <hr/> <p>Submit a preliminary report of structural repairs.</p> <ul style="list-style-type: none"> • Sketch • Justify choice • Procedures 	<ul style="list-style-type: none"> • Consult website for 280-616. • Consult recommended readings • Review personal notes

Course Outline 280-6A6-EM: Structural Repairs on Composites, Wood, Fabric and Metal

Week	Duration	Theoretical Content	Block
1	2	Introduction to Composites	2
2	2	Fibres (glass, carbon, aramid)	2
3	2	Resins (thermoplastic,thermosetting	2
4	2	Pre-impregnated, cores (honeycomb, foams)	2
5	2	Composite Construction methods	2
6	2	Exam 1	2
7	2	Health and safety, bagging	2
8	2	Curing and assembly	2
9	2	Evaluations of a structural repairsas per SRM	1, 3
10	2	SRM major repairs	1, 3
11	2	Presentation of the assignment, CTA visit	3
12	2	Flight domain constraint, tubular structure	1, 2, 3
13	2	Wood and Fabric Materials	2, 3
14	2	New Trends	1, 2, 3
15	2	Exam 2	1, 2 ,3

COURSE PLAN – PRACTICAL PART

FOR ALL ACTIVITIES IN THE LABORATORIES AND IN THE HANGARS, THE FOLLOWING OBJECTIVES APPLY AND WILL BE PART OF THE EVALUATION CRITERIA

0261 Maintain the metal structures and structural components of an aircraft.

Block 1: Metal Work

Learning Objective	Content	Personal Study Activities
4. Perform repair	Perform a repair on a pressurized aircraft structure (coating, extruded parts, formed parts, machined parts). <ul style="list-style-type: none"> • Procedure to repair a pressurized structure • Interpretation of a drawing • Use of tracing, cutting, drilling, riveting, assembling, shaping and finishing tools • Protecting materials • Sealants • Interior layout 	Any activity that improves manual dexterity
	Schedule a tubular repair as per AC 43.13-1A. <ul style="list-style-type: none"> • Cutting angle • Typical repairs of internal and external sleeves • Rosette welds 	

0262 Maintain aircraft structures and structural components made of composite materials, wood and fabric.

Block 2: Knowledge of Materials

Learning Objective	Content	Personal Study Activities
1. Plan the repair	Recognize according to their functions the composite materials and their related products used on aircraft. Fibers <ul style="list-style-type: none"> • Fibres • Resins • Adhesives • Core materials • Mould releasing agents • Film and fabric bagging • Main types of fasteners used 	Study the composite identification guide
	Recognize wood and fabric materials used on aircraft. Varieties of wood <ul style="list-style-type: none"> • Adhesives • Organic fabric • Synthetic fabric • Coatings • Additives 	

Block 3 : Inspection composite

Learning Objective	Content	Personal Study Activities
1, Plan the repair	Identify damage and the causes. <ul style="list-style-type: none"> • Crumpling, cracking, wrinkling, friction, scratch, hollow, notch, break, bulge, buckling, veiling, erosion, delamination, blisters, bulges, nick, void, wear, corrosion, brittleness 	Any activity that improves manual dexterity
	Inspect structures and aircraft components in wood, fabric and composite materials. <ul style="list-style-type: none"> • Measuring tools • Structural alignment • NDT methods 	
	Compare inspection results with the specifications in the structural repair manuals.	

Block 4 : Wood and Fabric Work

Learning Objective	Content	Personal Study Activities
4. Perform the repair	Conduct a trial test with a section of fabric covering <ul style="list-style-type: none"> • Tensile Test • Maule Test 	Any activity that improves manual dexterity
	Perform a repair as per AC 43.13-1A.AC 43.13-1A specifications <ul style="list-style-type: none"> • Cleaning material • Part size • Part cut • Heat shrinkage • Fungicide coating • Stiffening piece • Aluminum pigmented coating • Colour coating • Work report 	
	Perform a repair on a wood composite as per AC 43.13-1A.	

Block 5: Composite Work

5.1 Mould

Learning Objective	Content	Personal Study Activities
4, Perform the repair	Make a mould from an existing model. <ul style="list-style-type: none"> • Choose the material • Develop manufacturing steps • Use mould release product • Teat and install the fibres on the model • Polymerize • Install mould supports • Remove the mould from the model 	Any activity that improves manual dexterity
	Make a part using the mould. <ul style="list-style-type: none"> • Choose the material for the part to be made • Develop the manufacturing steps • Use mould release product • Add finishing coat • Treat and install fibres on the model • Put under vacuum • Polymerize • Unmould the part • Size and finish the part • Check quality of the work • Write work report 	

Course Outline 280-6A6-EM: Structural Repairs on Composites, Wood, Fabric and Metal

Learning Objective	Content	Personal Study Activities
Write various reports	<ul style="list-style-type: none"> • Registration of snags • Preliminary report <p>Work report</p>	
Tidy up and clean up the workplace	Apply the health and safety standards relating to the work performed. <ul style="list-style-type: none"> • Compliance with standards and guidelines 	
	Use hazardous materials standards. <ul style="list-style-type: none"> • Use of the workplace hazardous materials information system (WHMIS) • Use of product safety data sheets and precautions in their handling 	
	Store tools and equipment. <ul style="list-style-type: none"> • Follow-up of instructions 	
	Clean the work area. <ul style="list-style-type: none"> • Follow-up of instructions 	

5.2 Minor Repairs

Learning Objective	Content	Personal Study Activities
4. Perform the repair	Perform treatment to authorized damage <ul style="list-style-type: none"> • Patching compound • Resin injection • Surface finish • Material protection 	Any activity that improves manual dexterity
7. Write various reports	<ul style="list-style-type: none"> • Registration of snags • Preliminary report • Work report 	
5. Tidy up and clean up the workplace	Apply the health and safety standards relating to the work performed. <ul style="list-style-type: none"> • Compliance with standards and guidelines 	
	Use hazardous materials standards. <ul style="list-style-type: none"> • Use of the workplace hazardous materials information system (WHMIS) • Use of product safety data sheets and precautions in their handling 	
	Store tools and equipment. <ul style="list-style-type: none"> • Follow-up of instructions 	
	Clean the work area. <ul style="list-style-type: none"> • Follow-up of instructions 	

5.3 Major Repair

Learning Objective	Content	Personal Study Activities
4. Perform the repair	<p>Perform repairs on a laminated and sandwich-type aircraft component</p> <ul style="list-style-type: none"> • Follow a procedure • Interpret a drawing • Use tracing, cutting, sanding, assembling and finishing tools. • Prepare mould material • Locate and superimpose reinforcements • Respect the order of the superimposition of the bagging products. • Perform polymerization • Add repair finish • Check work quality • Write work report <hr/> <p>Replace a specific fastener to the material.</p> <ul style="list-style-type: none"> • Follow a procedure • Prepare a composite section to install fasteners. • Install fastener • Check work quality 	Any activity that improves manual dexterity
3. Write various reports	<ul style="list-style-type: none"> • Registration of snags • Preliminary report • Work report 	
5. Tidy up and clean up the workplace	<p>Apply the health and safety standards relating to the work performed.</p> <ul style="list-style-type: none"> • Compliance with standards and guidelines <hr/> <p>Use hazardous materials standards.</p> <ul style="list-style-type: none"> • Use of the workplace hazardous materials information system (WHMIS) • Use of product safety data sheets and precautions in their handling <hr/> <p>Store tools and equipment.</p> <ul style="list-style-type: none"> • Follow-up of instructions <hr/> <p>Clean the work area.</p> <ul style="list-style-type: none"> • Follow-up of instructions 	

Course Outline 280-6A6-EM: Structural Repairs on Composites, Wood, Fabric and Metal

Week	Duration	Practical work content	Block
1	4	Presentation & fiberglass laminated plate	2
2	4	Partial penetration, pull test, thermography, humidity test	2, 3
3	4	Repair with mould & NLG door repair & dent	5
4	4	Repair with mould & NLG door repair & dent	5
5	4	Repair with mould & NLG door repair & dent	5
6	4	Repair with mould & NLG door repair & dent	5
7	4	Exam 1	2
8	4	NLG door repair & various projects	1
9	4	Core repair	4,5
10	4	Core repair	4,5
11	4	Mini wing project (wood assembly)	4,5
12	4	Mini wing project (Fabric)	4,5
13	4	Inspection panel installation & various projects	4, 5
14	4	Inspection panel installation & various projects	4, 5
15	4	Exam 2	5

SYNTHESIS OF SUMMATIVE EVALUATION METHODS - THEORY

Description of Evaluation Activity	Context	Learning Objective(s)	Évaluation criterias	Due Date (date assignment is due or exam period)	Weighting (%)
Exam 1	Individual, open questions	Bloc 2	Correct terminology and understanding of technology	6 th	10
Research, repair as per SRM	Individual or in teams of 2	Blocs 1, 2, 3	Inspection of the structure and choice of repair, proper record, correct terminology, Understanding of technology	12 th	15
Exam 2 (final)	Individual, Open questions	Blocs 1, 2, 3	Correct terminology and understanding of technology	15 th	15

Sub-total: 40%

SYNTHESIS OF SUMMATIVE EVALUATION METHODS – PRACTICAL PART

Description of Evaluation Activity	Context	Learning Objective(s)	Évaluation criterias	Due Date (date assignment is due or exam period)	Weighting (%)
Exam 1	Individual	Blocks 2, 3, 4, 5	Correct terminology, accuracy of the mix, precision of the repair	7 th	20
IMA Project	Team	Bloc 2, 3, 5	①		
Exam 2 (final) Repair a sandwich and complete the associated documentation	Individual	Blocks 2, 3, 5	①	15 th	30

Sub-total: 60%
TOTAL: 100%

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① Relevance of observations, accuracy of dimensions, tolerances, compliance with standards in repair steps, rigorous recording, choice of tools and equipment, proper use of tools, precise calculations, careful removal and installation

REQUIRED MATERIAL

In the laboratory, safety glasses, safety shoes or boots and coveralls are mandatory.

MEDIAGRAPHY

ACCEPTABLE METHODS, TECHNIQUES AND PRACTICES; V. 1: AIRCRAFT INSPECTION AND REPAIR, AC 4313-1A, V. 2: AIRCRAFT ALTERATIONS, AC 4313-2A, , Department of Transportation. Federal Aviation Administration. Washington D.C., U.S. Government Printing Office, 1977, 2 volumes.

CARE AND REPAIR OF ADVANCED COMPOSITES, Keith B. Armstrong ,SAE International, 2005, 664 pages.

AIRCRAFT STRUCTURAL TECHNICIAN, Dale Hurst , Avotek Publishing, Harrisonburg, Virginia, 2001, 272 pages.

STANDARD AIRCRAFT HANDBOOK, Leavell, Stuart et Stanley BUNGAY., 3d ed., Fallbrook, Calif., Aero, 1980, 159 pages.

UNDERSTANDING AIRCRAFT STRUCTURE, John Cutler, Granada publishing Ltd, Frogmore (England), 1981, 170 pages.

CELLULES ET SYSTÈMES D'AÉRONEFS, Didier Féminier, Modulo Éditeur, Mont-Royal, 1982, 315 pages. Chapitres 1 à 4, page 1 à 69.

ADVANCED COMPOSITE MATERIAL CHAPTER 7 AMT AIRFRAME HANDBOOK
VOLUME 1 FAA-H8083-31

[HTTP://WWW.FAA.GOV/REGULATIONS_POLICIES/HANDBOOKS_MANUALS/AIRCRAFT/AMT_AIRFRAME_HANDBOOK/MEDIA/AMA_CH07.PDF](http://www.faa.gov/regulations_policies/handbooks_manuals/aircraft/amt_airframe_handbook/media/AMA_CH07.pdf)

REQUIREMENTS TO PASS THE COURSE

(1) Passing Mark

The passing mark for this course is 60% (PIEA, article 5.1m).

(2) Attendance for Summative Evaluations

Attendance is mandatory for summative evaluations (PIEA, article 5.2.5.1).

(3) Submitting Assignments

All assignments must be submitted by the date, time and place designated by the teacher. Any class or homework assignment handed in late will be penalized. The **penalties** associated with delays are set **according to the departmental rules** (PIEA, article 5.2.5.2).

In case of delay the penalties are:

- See the section "Department rules" at the following address:
<http://guideena.cegepmontpetit.ca/regles-des-departements/>

(4) Presentation of Written Work

Students must follow the standards adopted by the Cégep for written work (« *Normes de présentation matérielle des travaux écrits* »). These can be found in the documentation centre on the Cégep web site www.cegepmontpetit.ca/normes, under the heading **Liens éclair, Bibliothèques, « Méthodologie »** (des centres de documentation du Cégep).

The **departmental penalties** concerning non-compliance with the standards for assignment presentation (PIEA, article 5.3.2) are:

<http://guideena.cegepmontpetit.ca/regles-des-departements/>.

CONDITIONS FOR CLASS PARTICIPATION

SAFETY RULES IN THE HANGAR

1. No running
2. Take precautions with loose clothing when using rotary tools. (For example: tie, sleeves, long hair must be tied back).
3. Workshop and hand tools may be used only after demonstration.
4. No work in workshops without the supervision of a teacher.
5. Small pieces of metal to drill (manual or column) must be held in place with a clamp
6. All hazardous products (e.g. M.E.K.) must be used in a room with adequate ventilation (paint room).
7. Do not sit on the equipment tables in the workshop.
8. Everyone must follow instructions according to the visual and aural signals in case of fire.
9. All accidents must be reported to authorized personnel; notify security if first aid measures do not suffice.

SAFETY RULES FOR WORKSHOP EQUIPMENT

1. Clean the workshop after each course (tables, workbenches, floor,...).
2. Clean workshop tools after each use (drill, sander, grinder ...).
3. No aluminum or non-ferrous material on the grinding wheels.
4. Respect material indications on the band saws.
5. Return workshop equipment to the appropriate place after use.
6. Report any defective equipment or tools.
7. Correctly maintain the classification of rivets and bolts.

INSTITUTIONAL POLICIES AND REGULATIONS

All students enrolled at cégep Édouard-Montpetit must become familiar with and comply with the institutional policies and regulations. In particular, these policies address learning evaluations, maintaining admission status, French language policies, maintaining a violence-free and harassment-free environment, and procedures regarding student complaints. The French titles for the policies are: *Politique institutionnelle d'évaluation des apprentissages, les conditions d'admission et cheminement scolaire, la Politique relative à l'usage, à la qualité et à la valorisation de la langue française, la Politique pour un milieu d'études et de travail exempt de harcèlement et de violence, les procédures et règles concernant le traitement des plaintes étudiantes.*

The full text of these policies and regulations is accessible on the College web site at the following address: <http://ena.cegepmontpetit.ca/l-ecole/reglements-et-politiques>. If there is a disparity between shortened versions of the text and the full text, the full text will be applied and will be considered the official version for legal purposes.

OTHER DEPARTMENTAL REGULATIONS

Students are encouraged to consult the website for health and safety regulations : <http://guideena.cegepmontpetit.ca/sante-et-securite/>

Students are encouraged to consult the website for specific regulations related to this course: <http://guideena.cegepmontpetit.ca/regles-des-departements/>

NOTE: This Course Outline is a translation of the *Plan de cours* for 280-616-EM: *Réparation de structures en composite, bois, toile et métal*. If there is a discrepancy, then the original French version will be considered the official version for legal purposes.