



Collège
Édouard-Montpetit
École nationale d'aérotechnique

280-3A6-EM
FALL 2010
Pre-Flight

COURSE OUTLINE

COURSE: **Metal Structural Repair**

PROGRAM: 280.CO Aircraft Maintenance Technology

DISCIPLINE: 280 Aeronautics

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

Instructor(s)	Office	☎ extension	✉ e-mail or website
Rancourt Serge	C-182	4664	serge.rancourt@college-em.qc.ca

OFFICE HOURS

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
Morning					
Afternoon					

Coordinator(s)	Office	☎ extension	✉ e-mail or website
Ménard Pierre	C-160	4207	pierre.menard@college-em.qc.ca
Leblanc Gérard	C-182	4531	gerard.leblanc@college-em.qc.ca

CONTEXT OF THIS COURSE IN THE PROGRAM

This course is offered during the third session of the program. By the end of the course, students will have developed:

- dexterity with the tools and equipment;
- research skills using technical manuals;
- familiarity with materials and hardware;
- ability to install and remove various types of fasteners and rivets;
- the ability to propose a preliminary report of a major repair according to applicable manufacturer standards;
- the ability to make major repairs to the frame and skin (of an aircraft)

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.

MINISTERIAL OBJECTIVE(S) AND COMPETENCIES

- 025X** To clean, inspect and protect aircraft materials (reinvestment only)
025Z To prepare and assemble sheet metal
0261 To maintain the metal structures and structural components of an aircraft

TEACHING AND LEARNING STRATEGIES

Theory

The theoretical part of the course "Metal Structural Repair" is composed of four themes:

- bending sheet metal;
- hardware;
- constraints and structure of aircraft;
- preliminary report;
- other techniques of metal work

Exercises and discussions in class will be used as a strategy to allow students to develop the necessary skills to perform maintenance on aircraft. Research assignments in technical manuals and the use of multimedia tools will reinforce the learning process.

Practical Work

During the laboratory periods, the instructor will guide students with practical demonstrations of different tools and measuring instruments. Students will acquire manual dexterity and the competence necessary to be aircraft maintenance technicians through a variety of practical exercises that involve evaluating damage, treating corrosion and other observed defects. The different minor repair projects during the session will be assembled by riveting according to aeronautical standards. All activities will comply with the health and safety procedures applicable to the aeronautical industry.

COURSE PLAN – THEORY

Competence 025Z : To prepare and assemble sheet metal

Learning Objective	Content	Personal Study Activities
1- Describe methods of shaping and assembly of sheet metal.	<ul style="list-style-type: none"> ▪ Techniques of shaping sheet metal ▪ Techniques of assembly ▪ Hardware: <ul style="list-style-type: none"> - Solid rivets; - Blind rivets; - High-stress fasteners; - Specialized fasteners. 	<ul style="list-style-type: none"> ▪ Review weekly formative questionnaire ▪ Consult course website (280-376). ▪ Consult recommended readings. ▪ Review personal notes. <p><i>Ref : TC App. C P2 2.0.1, 4.0.5, 7.0.7, 21.0.4 Chap. 566.13</i></p> <p>a) <i>i</i> b) <i>ii</i> c) <i>iii</i></p>
2- Describe the characteristics of sheet metal tools and demonstrate their operation.	<ul style="list-style-type: none"> ▪ Rules, characteristics and operation of cutting, measuring, marking, folding and finishing tools 	
3- Recognize the risks to health and safety.	<ul style="list-style-type: none"> ▪ Safe handling ▪ Standards and guidelines that apply to the materials and technique used. 	
4- Interpret technical drawings.	<ul style="list-style-type: none"> ▪ Structural repair manual ▪ Technical drawing 	
5- Prepare and perform bending.	<ul style="list-style-type: none"> ▪ Steps to follow : <ul style="list-style-type: none"> - Establish the dimensions; - Draw a line of sight; - Bend using a press brake - Measure an angle 	

Competence 0261 : To maintain the metal structures and structural components of an aircraft

Learning Objective	Content	Personal Study Activities
1- Identify the structural members	<ul style="list-style-type: none"> ▪ frames ▪ spars ▪ ribs ▪ stringers ▪ skin ▪ struts ▪ reinforcements (stiffeners) ▪ bulkheads 	<ul style="list-style-type: none"> ▪ Review weekly formative questionnaire ▪ Consult course website (280-376). ▪ Consult recommended readings. ▪ Review personal notes. <p><i>Ref : TC App. C P2 1.0.4, 1.0.5, 7.0.1, 7.0.3, 7.0.7, 8.0.1, 8.0.2, 23.0.7 Chap. 566.13</i></p> <p>a) <i>i, ii, iii</i> b) <i>iv</i> c) <i>ii</i></p> <p><i>Chap. 566.14</i></p> <p>a) <i>iii</i> b) <i>iii</i></p> <p><i>Chap. 566.15</i></p> <p>b) <i>iii</i></p> <p><i>Chap. 566.17</i></p> <p>b) <i>vi</i></p>
2- Recognize the stresses applied to the metal structural members.	<ul style="list-style-type: none"> ▪ Tension ▪ Compression ▪ Shearing ▪ Bending ▪ Torsion ▪ Flight control area 	
3- Explain the structure of structural repair manuals.	<ul style="list-style-type: none"> ▪ ATA Classification ▪ Manufacturers' Manuals 	
4- Identify the causes of damage.	<ul style="list-style-type: none"> ▪ Possible causes : <ul style="list-style-type: none"> - corrosion - collision - fatigue - lightning strike - heat 	

Learning Objective	Content	Personal Study Activities
5- Follow the path of stresses in the adjacent structures to detect damage.	<ul style="list-style-type: none"> ▪ Tension ▪ Compression ▪ Shearing ▪ Bending ▪ Torsion ▪ Bending moment ▪ Shear force 	
6- Identify the tolerances of damaged areas in the structural repair manuals.		
7- Determine the action to take following the inspection.	<ul style="list-style-type: none"> ▪ Treatment ▪ Typical repair ▪ Specific repair ▪ Temporary repair ▪ Replacement 	
8- Write a work report.	<ul style="list-style-type: none"> ▪ Preliminary report ▪ Work report 	

ACTIVITY PERIODS

Week	# hours	Content of the Theory Course	Competencies	
			025Z	0261
1	4	Bending sheet metal	x	
2				
3	4	High-stress fasteners and blind rivets	x	
4				
5	4	Stresses and structures		x
6				
7	4	Calculation methods and rivet repairs		x
8				
9	6	Typical SRM (Structural Repair Manual) repairs		x
10				
11				
12	2	Heat treatment and metal forming technology		x
13	1	Structural alignment		x
	1	Control surface balancing		
14	2	Modification, configuration: fleet/ski/wheels Calculating the centre of gravity		x
15	2	Exam	x	x

COURSE PLAN – PRACTICAL WORK (LABORATORY)

Competence 025X: To clean, inspect and protect aircraft materials (reinvestment only)

Learning Objective	Content	Personal Study Activities
Review of course material Minor repairs	<ul style="list-style-type: none"> ▪ Treat damage that has been authorized ▪ Polish damage ▪ Drill stop holes ▪ Filling compound ▪ Reinforcement and plug ▪ Protection of the materials 	All activities aimed at improving manual dexterity. <i>Réf : TC App. C P2</i> 1.0.4, 2.0.1, 3.0.5, 7.0.4, 23.0.7 <i>Chap. 566.17</i> a) <i>i, ii</i> b) <i>iii</i>

Competence 025Z : To prepare and assemble sheet metal

Learning Objective	Content	Personal Study Activities
Recycling of course material Minor repairs	<ul style="list-style-type: none"> ▪ Consult structural repair manual for general tolerances and the type of minor or major repair. ▪ Use appropriate measuring tools. ▪ Assess damage regarding tolerances, standards and specifications. ▪ Treat for authorized damage. ▪ Eliminate and treat for corrosion 	All activities aimed at improving manual dexterity.

Learning Objective	Content	Personal Study Activities
1- Describe the characteristics of sheet metal tools and demonstrate their operation.	<ul style="list-style-type: none"> ▪ Rules, characteristics and operation of cutting, measuring, tracing, bending and finishing tools. 	All activities aimed at improving manual dexterity. <i>Réf : TC App. C P2</i> 2.0.1, 4.0.5, 7.0.7, 21.0.4 <i>Chap. 566.13</i> a) <i>i</i> b) <i>ii</i> c) <i>iii</i>
2- Choose tools depending on the shaping and assembly technique used in the repair work.	<ul style="list-style-type: none"> ▪ How to use tools and repair equipment. ▪ Planning ▪ Organising 	
3- Interpret technical drawings.	<ul style="list-style-type: none"> ▪ Structural Repair Manual ▪ Technical drawing 	
4- Size and trim materials.	<ul style="list-style-type: none"> ▪ Calculations of developed pieces of sheet metal ▪ Measurements ▪ Portable cutting tool ▪ Fixed cutting tool 	
5- Prepare and perform bending	<ul style="list-style-type: none"> ▪ Steps to follow : <ul style="list-style-type: none"> - Establish the dimensions; - Draw a line of sight; - Bend with a press brake; - Measure an angle 	

Learning Objective	Content	Personal Study Activities
6- Prepare and perform riveting.	<ul style="list-style-type: none"> ▪ Steps to follow : <ul style="list-style-type: none"> - Select the rivet - center - drill - deburr - mill - rivet installation using mobile and fixed tools; - install mechanical rivets - remove the rivets 	
7- Finish the shaped and assembled part	<ul style="list-style-type: none"> ▪ File and polish 	
8- Select and use measurement tools to check assembly compliance with technical drawings and aeronautical standards.	<ul style="list-style-type: none"> ▪ Ruler ▪ Micrometer ▪ Vernier. ▪ Protractor 	
9- Respect the health and safety standards related to the work performed.	<ul style="list-style-type: none"> ▪ Respect standards and instructions. 	
10- Store tools and equipment. Clean the work area.	<ul style="list-style-type: none"> ▪ Follow instructions ▪ Professionalism 	

Competence 0261 : To maintain the metal structures and structural components of an aircraft.

Learning Objective	Content	Personal Study Activities
1- Identify damage on parts.	<ul style="list-style-type: none"> ▪ Wrinkling, cracking, folds, rubbing, scratching, hollows, notches, breaks, swelling, buckling, warping, erosion, delamination, blisters, bumps, cuts, vacuum, wear, corrosion, brittleness 	All activities aimed at improving manual dexterity. <i>Réf : TC App. C P2</i> 1.0.4, 1.0.5, 7.0.1, 7.0.3, 7.0.7, 8.0.1, 8.0.2, 23.0.7 Chap. 566.13 a) i, ii, iii b) iv c) ii Chap. 566.14 a) iii b) iii Chap. 566.15 b) iii Chap. 566.17 b) vi
2- Inspect structures and metal components on the aircraft to identify damage.	<ul style="list-style-type: none"> ▪ Measuring tools ▪ Structural alignment ▪ NDT methods 	
3- Follow the path of stresses in the adjacent structures to detect damage	<ul style="list-style-type: none"> ▪ Tension ▪ Compression ▪ Shearing ▪ Bending ▪ Torsion ▪ Bending moments ▪ Shear force 	
4- Identify the tolerances of the damaged areas in the structural repair manuals.		
5- Compare the inspection results with the specifications for structural repair manuals.		
6- Determine the action to take based on the inspection results	<ul style="list-style-type: none"> ▪ Treatment ▪ Typical repair ▪ Specific repair ▪ Temporary repair ▪ Replacement 	

Learning Objective	Content	Personal Study Activities
7- Organize the work environment based on the work that needs to be done.	<ul style="list-style-type: none"> ▪ Structural repair manual ▪ Airworthiness standards ▪ Temps available ▪ Workplace 	
8- Perform a repair on an unpressurized aircraft structure (skin, extruded parts, molded parts, machined parts).	<ul style="list-style-type: none"> ▪ Following a procedure ▪ Interpreting a drawing ▪ Using marking, cutting, drilling, rivetting, assembly, shaping and finishing tools. ▪ Protection of materials ▪ Sealants ▪ Interior set up 	
9- Perform a repair on a pressurized aircraft structure (skin, extruded parts, molded parts, machined parts).	<ul style="list-style-type: none"> ▪ Following a procedure ▪ Interpreting a drawing ▪ Using marking, cutting, drilling, rivetting, assembly, shaping and finishing tools. ▪ Protection of materials ▪ Sealants ▪ Interior set up 	
10- Select and use measurement tools to verify compliance of an assembly with technical drawings and aeronautical standards.	<ul style="list-style-type: none"> ▪ Ruler ▪ Micrometer ▪ Vernie ▪ Protractor ▪ Compass ▪ Flight control balancing tools ▪ Structural alignment 	
11- Write a work report.	<ul style="list-style-type: none"> ▪ Preliminary report ▪ Work report 	
12- Respect the health and safety standards related to the work done.	<ul style="list-style-type: none"> ▪ Respecting standards and instructions 	
13- Use the standards for hazardous materials.	<ul style="list-style-type: none"> ▪ Using the information system on hazardous materials at work (WHMIS) ▪ Using material safety data sheets and following precautions when handling. 	
14- Put away tools and equipment and clean up the work area.	<ul style="list-style-type: none"> ▪ Following instructions ▪ Professionalism 	
15- Demonstrate professionalism.	<ul style="list-style-type: none"> ▪ Dexterity ▪ Organisation. ▪ Planning ▪ Autonomy ▪ Quality of work ▪ Cleanliness at work ▪ Performance ▪ Health and safety ▪ Communication. ▪ Ability to understand and follow through 	
16- Démontrer des aptitudes personnelles.	<ul style="list-style-type: none"> ▪ Interest in work ▪ Punctuality ▪ Attendance ▪ Sense of responsibility ▪ Relationships with others ▪ Judgement 	

ACTIVITY PERIODS

Session weeks	# hours	Practical Activities	Competencies		
			025X	025Z	0261
1	8	Trim, protect, assemble the two plates and bend frame S6015 into a "U"	x	x	
2					
3	8*	Bending : Simple "U" Inserted "U" Reinforced corner		x	
4					
5	4*	Bending Exam		x	
6	12	Airworthiness : Inspection access door SRM Research Sealant and Anchor nuts	x	x	x
7					
8					
9	12*	Repair frames: S6015 Research SRM CL-415 Calculate the number of rivets		x	x
10					
11					
12	12	Repair pressurized skin Q-400		x	x
13					
14					
15	4*	Exam on small repair		x	x

* **Work or calculations done beforehand must be presented at the beginning of the laboratory period.**

SYNTHESIS OF SUMMATIVE EVALUATION METHODS: THEORY

Description of Evaluation Activity	Context	Learning Objective(s)	Due Date (approximate date assignment due or exam given)	Weighting (%)
Exercise	Individual	Bending	Week 3	4
Exam	Individual	Fasteners, bending, stresses and structure	Week 6	8
Exam	Individual	Preliminary Report Frame CL-415	Week 9	8
Research Work	In teams	Preliminary Report Frame and skin	Week 14	8
Exam	Individual	From Shaping to Calculations of C of G	Week 15	12

Total : 40 points

SYNTHESIS OF SUMMATIVE EVALUATION METHOD: PRACTICAL WORK

Description of Evaluation Activity	Context	Learning Objective(s)	Due Date (approximate date assignment due or exam given)	Weighting (%)
Bending a stiffner	Individual	Bending	Week 5	15
Frame repair	Individual		Week 11	10
Pressurized skin repair	In teams		Week 14	15
Repair	Individual		Week 15	20

Total : 60 points

REQUIREMENTS TO PASS THE COURSE

(1) Passing Mark

The passing mark for this course is 60%.

(2) Attendance for Summative Evaluations

Students must be present for summative evaluations.

(3) Submitting Assignments

- a) Research work: All assignments must be submitted by the date, hour and location designated by the instructor(s). Late assignments will be penalized 10% per day that they are late and will receive a mark of zero (0) after one week.
- b) Lab preparation: An assignment not turned in on the date and at the prescribed time is equivalent to one hour's absence and being expelled from the class.

(4) Presentation of Written Work

Students must follow the standards adopted by the College for written work (« *Normes de présentation matérielle des travaux écrits* »). These can be found in the documentation centre on the College web site (<http://ww2.college-em.qc.ca/biblio/normes.pdf>) under the heading « **Aides à la recherché** ».

RULES OF COURSE PARTICIPATION

Safety Regulations for Workshop Personnel

1. Running is prohibited.
2. Loose clothing and hair must be pulled back, tightened or tucked in when using rotational equipment (e.g. ties, sleeves, long hair).
3. Hand tools and workshop equipment are to be used only after a demonstration.
4. No work may be done in the workshop without the supervision of an instructor.
5. Small metal parts to be drilled (manually or with a drill press) must be held in place with clamps.
6. All dangerous products doivent être employés dans un local convenablement aéré (salle peinture).
7. Sitting on the workbenches or machines is prohibited.
8. Visual and auditory instructions in case of a fire must be followed by everyone.
9. Any accident must be reported to authorized staff; the guard must be notified if first aid is not sufficient.

Safety Regulations for Workshop Equipment

1. Clean the workshop after each course (tables, workbenches, floor, etc.)
2. Clean workshop equipment after each use (drill press, sandblaster, grinder, etc.)
3. No aluminum material or non-ferrous material may be used on the grinders.
4. Respect directives regarding materials when using the bandsaw.
5. Return all workshop equipment to its appropriate place after use.
6. Report any defective or damaged equipment or tools.
7. Correctly maintain the classification of rivets or bolts.

REQUIRED MATERIAL

In the lab, safety glasses, safety boots/shoes and overalls are mandatory.

MEDIAGRAPHY

Website for this course: <http://www.college-em.qc.ca/ena/preenvol/pmenard/>

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.

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

STANDARD AIRCRAFT HANDBOOK, Leavell, Stuart et Stanley BUNGAY, 3^e éd., Fallbrook, Calif., Aero, 1980, 159 pages.

AIRCRAFT SHEET METAL, Nick Bonaci, International Aviation Publisher, EA-SM, Casper (Wyoming), 1987, 134 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, pages 1 à 69.

The following text is recommended for this course (280-376-EM) :

A & P TECHNICAL AIRFRAME TEXTBOOK, Jeppesen, EA-ITP-A², Englewood, Colorado, 1992, 794 pages, chapitres 3, 5 et 6.

INSTITUTIONAL POLICIES AND REGULATIONS

All students enrolled at Collège 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 particulières concernant le maintien de l'admission d'un étudiant, la Politique de 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: www.college-em.qc.ca. 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 specific regulations related to this course:

<http://www.college-em.qc.ca/>
www.college-em.qc.ca/ena/preenvol/reglements