ÉCOLE NATIONALE D'AÉROTECHNIQUE
UN CAMPUS DU CÉGEP ÉDOUARD-MONTPETIT

280-3A6-EM
FALL 2016
Pre-Flight department

COURSE OUTLINE

COURSE: **Metal Structural Repair**

PROGRAM: 280.C0 Aircraft Maintenance

DISCIPLINE: 280 Aeronautics

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

Instructor(s)	Office	☎ extension	✉ e-mail or website
Plante Claude	C-182	4216	claude.plante@cegepmontpetit.ca

OFFICE HOURS FOR STUDENTS

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
Morning					
Afternoon					

Department Coordinator(s)	Office	☎ extension	✉ e-mail or website
Dany Charette	B-125	4661	dany.charette@cegepmontpetit.ca
Louis Guimont	B-125	4703	louis.guimont@cegepmontpetit.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.

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 ENA website and in the student agenda under the heading « Privilèges accordés par Transports Canada ».

COMPETENCIES OF THE EXIT PROFILE (STUDENT SKILL PROFILES)

To master aircraft metal structural repairs.

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

TERMINAL OBJECTIVE OF THE COURSE (FINAL COURSE OBJECTIVE)

- Assessing damage.
- Ability to propose a preliminary report of a major repair to the applicable manufacturer standards.
- Ability to prepare and assemble sheet metal.
- To maintain the metal structures and metal 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.	▪ Techniques of shaping sheet metal ▪ Techniques of assembly ▪ Hardware: - Solid rivets; - Blind rivets; - High-stress fasteners; - Specialized fasteners.	▪ Review weekly formative questionnaire ▪ Consult course website (280-376). ▪ Consult recommended readings. ▪ Review personal notes. *Ref : TC App. C P2* *2.0.1, 4.0.5, 7.0.7, 21.0.4* *Chap. 566.13* *a) i* *b) ii* *c) iii*
2- Describe the characteristics of sheet metal tools and demonstrate their operation.	▪ Rules, characteristics and operation of cutting, measuring, marking, folding and finishing tools	
3- Recognize the risks to health and safety.	▪ Safe handling ▪ Standards and guidelines that apply to the materials and technique used.	
4- Interpret technical drawings.	▪ Structural repair manual ▪ Technical drawing	
5- Prepare and perform bending.	▪ Steps to follow : - 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	▪ frames ▪ spars ▪ ribs ▪ stringers ▪ skin ▪ struts ▪ reinforcements (stiffeners) ▪ bulkheads	▪ Review weekly formative questionnaire ▪ Consult course website (280-376). ▪ Consult recommended readings. ▪ Review personal notes. *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* *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- Recognize the stresses applied to the metal structural members.	▪ Tension ▪ Compression ▪ Shearing ▪ Bending ▪ Torsion ▪ Flight control area	
3- Explain the structure of structural repair manuals.	▪ ATA Classification ▪ Manufacturers' Manuals	
4- Identify the causes of damage.	▪ Possible causes : - 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.	▪ 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.	▪ Treatment ▪ Typical repair ▪ Specific repair ▪ Temporary repair ▪ Replacement	
8- Write a work report.	▪ 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	▪ 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. *Réf : TC App. C P2* *1.0.4, 2.0.1, 3.0.5, 7.0.4, 23.0.7* *Chap. 566.17* *a) i, ii* *b) iii*

Competence 025Z : To prepare and assemble sheet metal

Learning Objective	Content	Personal Study Activities
Recycling of course material Minor repairs	▪ 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.	▪ Rules, characteristics and operation of cutting, measuring, tracing, bending and finishing tools.	All activities aimed at improving manual dexterity. *Réf : TC App. C P2* *2.0.1, 4.0.5, 7.0.7, 21.0.4* *Chap. 566.13* *a) i* *b) ii* *c) iii*
2- Choose tools depending on the shaping and assembly technique used in the repair work.	▪ How to use tools and repair equipment. ▪ Planning ▪ Organising	
3- Interpret technical drawings.	▪ Structural Repair Manual ▪ Technical drawing	
4- Size and trim materials.	▪ Calculations of developed pieces of sheet metal ▪ Measurements ▪ Portable cutting tool ▪ Fixed cutting tool	
5- Prepare and perform bending	▪ Steps to follow : - 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.	▪ Steps to follow : - 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	▪ File and polish	
8- Select and use measurement tools to check assembly compliance with technical drawings and aeronatical standards.	▪ Ruler ▪ Micrometer ▪ Vernier. ▪ Protractor	
9- Respect the health and safety standards related to the work performed.	▪ Respect standards and instructions.	
10- Store tools and equipment. Clean the work area.	▪ 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.	▪ 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. *Réf : 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* *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.	▪ Measuring tools ▪ Structural alignment ▪ NDT methods	
3- Follow the path of stresses in the adjacent structures to detect damage	▪ 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	▪ 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.	▪ Structural repair manual ▪ Airworthiness standards ▪ Temps available ▪ Workplace	
8- Perform a repair on an unpressurized aircraft structure (skin, extruded parts, molded parts, machined parts).	▪ 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).	▪ 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.	▪ Ruler ▪ Micrometer ▪ Vernie ▪ Protractor ▪ Compass ▪ Flight control balancing tools ▪ Structural alignment	
11- Write a work report.	▪ Preliminary report ▪ Work report	
12- Respect the health and safety standards related to the work done.	▪ Respecting standards and instructions	
13- Use the standards for hazardous materials.	▪ 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.	▪ Following instructions ▪ Professionalism	
15- Demonstrate professionalism.	▪ 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.	▪ Interest in work ▪ Ponctuality ▪ Attendance ▪ Sense of responsibility ▪ Relationships with others ▪ Judgement	

ACTIVITY PERIODS

Session weeks	# hours	Practical Activities	Competencies		
			025X	025Z	0261
1	8	Assess damage and remove damaged parts	x	x	
2					
3	8*	Bending exercises		x	
4	12	Fabricate stringer, top skin and apply corrosion treatments	x	x	x
5					
6	12*	Installation of stringer, top skin and apply paint		x	x
7					
8					
9					
10	12	Fabricate access door		x	x
11					
12					
13					
14	4*	Final Exam Remove, fabricate and re-install a stringer		x	x
15					

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

ACTIVITY PERIODS

Session weeks	# hours	Practical Activities	Competencies		
			025X	025Z	0261
1 to 2	8	Assess damage and removed damaged parts	x	x	
3	8*	Bending exercices		x	
4 to5	4*	Fabricate frame, top skin and apply corrosion treatments		x	
6 to 9	12	Installation of frame and top skin Fabricate access door	x	x	x
10 to 13					
14 to 15	4*	Final exam		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	10
Research Work	In teams	Preliminary Report Frame		Week 10	10
Exam	Individual	Content of week 1 to 14		Week 15	20

Total : 40 points

SYNTHESIS OF SUMMATIVE EVALUATION METHOD: PRACTICAL WORK

Description of Evaluation Activity	Context	Learning Objective(s)	Evaluation criterias	Due Date (approximate date assignment due or exam given)	Weighting (%)
Removing damaged areas	Work will be conducted individually Work will be conducted individually In teams Individual	Removing rivest	The evaluation criterias will be presented in writing to students week during the first week	Week 2	5
Bending exercise stringer		Fabricate a stringer		Week 3	5
Fabricating to skin		Fabricate the top skin		Week 5	5
Assembling the skin & stringer		Riveting the stringer and skin together		Week 9	5
Access door		Making an access door		Week 13	5
Final exam repairing doubler		Remove, fabricate and reinstall a stringer		Weeks 14 to 15	35

Total : 60 points

REQUIRED MATERIAL

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

MEDIAGRAPHY

Website for this course: _____

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, 3e 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 TECHNICIAL AIRFRAME TEXTBOOK, Jeppesen, EA-ITP-A², Englewood, Colorado, 1992, 794 pages, chapitres 3, 5 et 6.

REQUIREMENTS TO PASS THE COURSE

(1) Passing Mark

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

(2) Tardiness

Students who arrive late after the beginning of the first period of a course are considered absent for this period.

(3) Attendance for Summative Evaluations

Attendance at summative assessment activities is mandatory (PIEA article 5.2.5.1)

(4) Submitting Assignments

Homeworks required by a teacher must be submitted to the date, the place and time set. The penalties associated with delays are established according to departmental rules (PIEA, section 5.2.5.2).

In case of delay penalties are:

- See section «Règles des départements» at the following link: http://guideena.cegepmontpetit.ca/regles-des-departements/

(5) Presentation of Written Work

The student must meet the "Written Work Standard Presentation" adopted by the CEGEP. Non-compliance of these standards may delay the acceptance of the work or affect the rating granted. These standards are available in **Flash Links**, **Bibliothèques** under "**Méthodologie**" of the CEGEP Documentation Centers at: www.cegepmontpetit.ca/normes.

The **departmental penalties** for non-compliance with Written Work Standard Presentation (PIEA, article 5.3.2) are:

- See section « Règles des départements » at the following link: http://guideena.cegepmontpetit.ca/regles-des-departements/

METHODS OF COURSE PARTICIPATION

Safety Regulations for Workshop Personal

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 should be used in a ventilated area (paint shop).
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.

OTHER DEPARTEMENTAL REGULATIONS

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

INSTITUTIONAL POLICIES AND REGULATIONS

All students enrolled in the École Nationale d'aérotechnique of Édouard-Montpetit CEGEP must be aware of and comply with the contents of institutional policies and regulations. In particular, the *Politique institutionnelle de la langue française (PILF), the Politique pour un milieu d'études et de travail exempt de harcèlement et de violence (PPMÉTEHV),), the conditions of admission and academic progress, the procedure dealing with student complaints within educational relations.*

The complete version of these policies and regulations is available on the CEGEP website at the following address: http://www.cegepmontpetit.ca/ena/a-propos-de-l-ecole/reglements-et-politiques. In case of discrepancy between the version appearing elsewhere and the complete version, the complete version will be applied and will be considered the official version for legal purposes.