

## COURSE OUTLINE

**COURSE:** Introduction to Aeronautics

**PROGRAMS:** 280.C0 Aircraft Maintenance

**DISCIPLINE:** 280 Aeronautics

**WEIGHTING:** Theory: 3                      Laboratory: 2                      Personal Study: 2

Your teacher	Office	☎ Extension	✉ Email or Website
Stéphane Caron	B-122	4687	<a href="mailto:stephane.caron@ena.ca">stephane.caron@ena.ca</a>

### OFFICE HOURS FOR STUDENTS

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
Morning					
Afternoon					

Coordinators	Office	☎ Extension	✉ Email or Website
Stéphanie Arpin	C-160	4664	<a href="mailto:stephanie.arpin@ena.ca">stephanie.arpin@ena.ca</a>
Éric Goudreault	C-160	4207	<a href="mailto:eric.goudreault@ena.ca">eric.goudreault@ena.ca</a>

## CONTEXT OF THIS COURSE IN THE PROGRAM

This course is designed for all beginning students at ENA regardless of the program they have chosen.

The fundamental knowledge acquired in this course will serve students in a number of other courses, in particular courses that involve working on aircraft and the systems that make up the aircraft. Consequently, students are strongly advised to pass this course during their first year. **In addition, students must keep this course outline and notes for the duration of their studies as it will be useful for the comprehensive assessment at the end of the program.**

The overall objective of the course is to introduce students to the construction of aircraft and the physical principles that affect flight.

**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) according to Transport Canada requirements. The application of Transport Canada policies regarding absences is available on the [Ma réussite à l'ÉNA](#) website under the heading « Privilèges accordés par Transports Canada ».

## COMPETENCIES OF THE EXIT PROFILE (STUDENT SKILL PROFILES)

To master the aeronautic maintenance work technics.

## MINISTERIAL OBJECTIVE(S) OR COMPETENCIES

This course outline was written using element of each of the following competencies:

- **011X** Establish relationships between the operation characteristics of an aircraft and the principles of construction.
- **0273 and 026G** Check flight management and navigation systems for reckoning and analyzing work function.
- **025N** To analyse the function of work.
- **0260 and 0268** To apply the principles of aerodynamics to flight and aircraft maintenance.

## TERMINAL OBJECTIVE OF THE COURSE

Knowing the technical terminology, the role of the aircraft different components and the basic principles of aerodynamics.

## TEACHING AND LEARNING STRATEGIES

**Theory:**

This part of the course is made up of four modules that cover basic concepts of aeronautics and aerodynamics of helicopters and planes. Lecture courses will be supported with examples, exercises, illustrations and equipment. Students are expected to take notes to reinforce their learning.

**Laboratory:**

The practical part of the course is divided into three modules, two of which cover aircraft. During the two modules, students will learn through exercises in the hangars. Students will experiment with wind tunnels for the module on aerodynamics in order to progressively learn the basic concepts.

Caution: exercises or preparatory activities (classroom (theory) and laboratory (practical)) requested by the teacher (s) must be completed before arriving in the classroom or lab. The teacher (s) reserves the right to deny access to the class, workshop or hangars if the exercises were not fully completed in advance and the absence will be recorded in the student's file (e). It is the responsibility of the student (s) to complete the exercises as these will be used to answer several exam questions.

If absent, the student (s) is responsible to check with their classmates what has been done and the work that has been given, and to keep up to date (see table learning objectives: synthesis of summative evaluation methods).

**Learning objectives**

1. Recognize French and English terminology related to aircraft
2. Identify the main aircraft systems
3. Make connections between the principals of aerodynamics and the flight of an aircraft
4. Distinguish between the different structures and components of an aircraft and their roles.
5. Distinguish the main components and on-board instruments and their roles.

**COURSE PLAN – THEORY**

week	Learning objectives number	Theory content	Functional mode	Technological resources and tools (URL link)
1	1	<ul style="list-style-type: none"> <li>▪ Classification of aircraft according to Canadian Aviation Regulations (CAR)</li> <li>▪ Buoyancy, projectiles and aerodynamic forces.</li> <li>▪ Areas of aeronautical activities (aviation, construction, maintenance and related activities).</li> <li>▪ Engineers, technicians, assemblers, inspectors, drivers.</li> <li>▪ Leading Manufacturer.</li> <li>▪ In Canada, USA and Europe.</li> <li>▪ Canadian law and CARs.</li> <li>▪ Historical overview of the evolution of aircraft.</li> <li>▪ Major manufactures and their country of origin.</li> </ul>	Presentation, internet recherche, video and quiz	Microsoft Teams PowerPoint Léa documents
2	1, 3	<ul style="list-style-type: none"> <li>▪ Composition, structure and standardization of the atmosphere.</li> <li>▪ Distinction between the different physical properties of air.</li> <li>▪ MKSA (Metre, Kilogram, Second, Ampere) International Units System and FSS (Foot, Slug, Second) System.</li> <li>▪ Definition and units: acceleration, density, force, weight, pressure, temperature, density and speed (of sound, subsonic, transonic and supersonic).</li> <li>▪ Conversions (calculus)</li> </ul>	Presentation, internet recherche, video and quiz	Microsoft Teams PowerPoint Léa documents
3	1, 3	<ul style="list-style-type: none"> <li>▪ Speed: relative, indicated, true and ground</li> <li>▪ Pitot static system.</li> <li>▪ Calculation of true air speed.</li> </ul>	Presentation, internet recherche, video and quiz	Microsoft Teams PowerPoint Léa documents
4	1, 3	<ul style="list-style-type: none"> <li>▪ Conservation laws of flow and Fluid Power set by Venturi and Bernoulli</li> <li>▪ Relative wind, relative speed and airspeed.</li> <li>▪ Role and description of wind tunnels.</li> <li>▪ Distinction between laminar and turbulent air flow.</li> <li>▪ Control of the boundary layer.</li> </ul>	Presentation, internet recherche, video and quiz	Microsoft Teams PowerPoint Léa documents
5	1, 3	Evaluation	At school	
6	1, 3	<p>AERODYNAMIC</p> <ul style="list-style-type: none"> <li>▪ Origin of air resistance.</li> <li>▪ List the six factors affecting air resistance on an object.</li> <li>▪ Calculation of drag.</li> <li>▪ Calculating the speed limit.</li> <li>▪ Effect of altitude and temperature on drag</li> <li>▪ General aircraft Drag (shape, friction, Profile, parasite, induced.</li> <li>▪ Solutions to induced drag.</li> </ul>	Presentation, internet recherche, video and quiz	Microsoft Teams PowerPoint Léa documents
7	1, 3	<ul style="list-style-type: none"> <li>▪ Static Lift (Archimedes' principle) and dynamic lift.</li> <li>▪ Calculating the dynamic lift.</li> <li>▪ Effect of altitude and temperature of on lift.</li> <li>▪ Nomenclature of an airfoil.</li> <li>▪ Distinction between an angle of attack and wing angle.</li> <li>▪ Distinction between a bi-convex profile, symmetrical and asymmetrical biconvex profile.</li> <li>▪ Illustration of air flow and the distribution of pressure on each airfoil.</li> <li>▪ Bernoulli's principle, deflection of air masses and impact of air molecules over a wing.</li> <li>▪ Stall of a wing</li> <li>▪ Characteristics of ideal profile.</li> <li>▪ Classification of profiles</li> <li>▪ Calculating the finesse of a profile.</li> </ul>	Presentation, internet recherche, video and quiz	Microsoft Teams PowerPoint Léa documents
8	1, 3	<ul style="list-style-type: none"> <li>▪ Equilibrium of the forces:                             <ul style="list-style-type: none"> <li>- Lift / weight.</li> <li>- Pull / drag.</li> </ul> </li> <li>▪ Nose up and down moments, and the role of the horizontal stabilizer.</li> <li>▪ Axes, movements, commands, control and pitch of a plane.</li> </ul>	Presentation, internet recherche, video and quiz	Microsoft Teams PowerPoint Léa documents 8.6)
9	1, 2	PLANE	Presentation,	Microsoft Teams PowerPoint

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		<ul style="list-style-type: none"> <li>▪ Airfoils: roles; types; classification; profiles used; loads supported construction elements.</li> <li>▪ Tail assembly: roles, types, relative surfaces, profiles used.</li> </ul>	internet recherche, video and quiz	Léa documents
10	1, 2, 3	Evaluation	At school	
11	1, 2, 3	<ul style="list-style-type: none"> <li>▪ Fuselage: roles, shapes, loads supported, construction elements, stability and control around the axes.</li> </ul>	Presentation, internet recherche, video and quiz	Microsoft Teams PowerPoint Léa documents
12	1, 2, 3	<ul style="list-style-type: none"> <li>▪ Means used to achieve stability and maneuverability around the axes of the aircraft.</li> </ul>	Presentation, internet recherche, video and quiz	Microsoft Teams PowerPoint Léa documents
13	1, 2, 3	<ul style="list-style-type: none"> <li>▪ Flight controls: primary and secondary control surfaces.</li> <li>▪ Landing gear: roles, types and configurations.</li> <li>▪ Ground services: hydraulic, pneumatic and electric.</li> <li>▪ Propellers: types and configurations.</li> <li>▪ Environment: air conditioning, pressurisation and oxygen.</li> <li>▪ Fuel: supply system.</li> </ul>	Presentation, internet recherche, video and quiz	Microsoft Teams PowerPoint Léa documents
14	1, 2, 3	<p>Helicopter</p> <ul style="list-style-type: none"> <li>▪ Historical overview.</li> <li>▪ Roles, missions and major manufacturer.</li> <li>▪ Roles of airframe components and flight controls.</li> <li>▪ Flight controls: control of lift in intensity and direction.</li> <li>▪ Types of main rotor head : rotor blade movements (pitch, flapping, drag).</li> <li>▪ Distinction between stationary and translation.</li> <li>▪ Autorotation.</li> <li>▪ Driving torque and torque of the main rotor.</li> <li>▪ Tail rotor, contrarotating rotors and air jets.</li> </ul>	Presentation, internet recherche, video and quiz	Microsoft Teams PowerPoint Léa documents
15	1, 2, 3	Evaluation	At school	

**COURSE PLAN – LABORATORY**

Week	Learning objectives number	Laboratory content	Functional mode	Technological resources and tools (URL link)
1		<ul style="list-style-type: none"> <li>▪ Presentations</li> <li>▪ Course, Courseoutline, Student book, Safety equipments...</li> </ul>	Presentation Hangars visit	PowerPoint
2	1, 2, 4	<ul style="list-style-type: none"> <li>▪ Responsible behavior:</li> <li>▪ Professional ethics (compliance with safety and labor).</li> <li>▪ Importance of teamwork.</li> <li>▪ Identification of emergency equipment</li> <li>▪ Approach and leaving procedures: propeller aircraft and helicopters.</li> <li>▪ Identifying limits (distances) required in its aspiration, blast, heat and noise generated by the engines of jet aircraft.</li> <li>▪ Aircraft identification.</li> <li>▪ Aircraft characteristics.</li> <li>▪ Nomenclature: role and function.</li> </ul>	Presentation Hangars visit	Book 5591 chap. 1
3			Hangar exercises	Book 5591 chap. 2 p. 1 to 20
4				Book 5591 chap. 2 p. 21
5				Book 5591 chap. 2 p. 22 to 25

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6				Book 5591 chap. 2 p, 26 to 37
7	1, 2, 4	<ul style="list-style-type: none"> <li>▪ Evaluation</li> </ul>		
8	3	<ul style="list-style-type: none"> <li>▪ Use dome and a vacuum pump.</li> <li>▪ Physical properties of fluids.</li> <li>▪ Ideal Gas Law.</li> <li>▪ Principle of Archimedes.</li> </ul>	Demo	Book 5591 chap. 3 p. 23 to 24
9		<ul style="list-style-type: none"> <li>▪ Nomenclature related to the use of wind tunnels.</li> <li>▪ The role of different components of a wind tunnel.</li> <li>▪ Operation wind tunnels.</li> <li>▪ Air Flow, made visible by smoke, using a plate, a sphere, a wing profile, etc.</li> <li>▪ Production of two different types of air flow</li> <li>▪ Transition point shift.</li> <li>▪ Variation of the scale of the turbulent zones in the shape and orientation of an object.</li> <li>▪ Drag induced.</li> </ul>	Notes taking Student book exercises Hangar exercises	Book 5591 chap. 3 p.3 to 9
10		<ul style="list-style-type: none"> <li>▪ Application of Bernoulli's principle.</li> <li>▪ Relation: Bernoulli - Venturi - Pitot with the aid of a Venturi tube, a Pitot-static tube, oil pressure gauges and an anemometer.</li> <li>▪ Graph curves, pressure, static, dynamic and total.</li> <li>▪ Calculations of static, dynamic and totale pressure as well as true and actual speeds.</li> </ul>		Book 5591 chap. 3 p. 10 to 22
11	5	<ul style="list-style-type: none"> <li>▪ Names and function of the flight instruments, operation and navigation.</li> </ul>		Book 5591 chap. 4 p. 3 to 14
12				<ul style="list-style-type: none"> <li>▪ chap. 4 p. 15 to 26</li> </ul>
13	5	<ul style="list-style-type: none"> <li>▪ Identification and characteristics of helicopters.</li> <li>▪ Name of manufacturers and countries of origin.</li> <li>▪ Nomenclature and function</li> </ul>		<ul style="list-style-type: none"> <li>▪ Book 5591</li> <li>▪ chap. 5 p.3 to 5</li> </ul>
14				<ul style="list-style-type: none"> <li>▪ chap. 5 p.6 to 12</li> </ul>
15	3, 5	<ul style="list-style-type: none"> <li>▪ Evaluation</li> </ul>		

**SYNTHESIS OF SUMMATIVE EVALUATION METHODS**

**Theory**

Description of Evaluation Activity	Context	Learning Objective(s)	Evaluation criterias	Due Date	Weighting (%)
Written exam, mainly multiple choice answers.	Individual, in-class exam without course notes; a calculator is necessary.	1, 3	Terminology Calculations - Only the answer account. - Accuracy to 3 decimal places. - Mandatory Units.	Week 5	20%
Written exam, mainly multiple choice answers.	Individual, in-class exam without course notes; a calculator is necessary.	1, 2, 3	Terminology Calculations - Only the answer account. - Accuracy to 3 decimal places. - Mandatory Units.	Week 10	20%
Written exam, mainly multiple choice answers.	Individual, in-class exam without course notes.	1, 2, 3	Terminology	Week 15	20%

**Laboratory**

Description of Evaluation Activity	Context	Learning Objective(s)	Evaluation criterias	Due Date	Weighting (%)
Written exam, mainly short answer.	Individual, in-class exam in two parts. Course notes not allowed for part on subject area, notes are allowed for exercises.	1, 2, 4	Terminology	Week 7	20%
Written exam, mainly short answer.	Individual, in-class exam in two parts. Course notes not allowed for part on subject area, notes are allowed for exercises.	3, 5	Terminology	Week 15	20%

## REQUIRED MATERIAL

- Course Notes for the Laboratory (practical) part of the course (the instructor(s) will provide the number at the first course).
- The only model of calculator allowed during exams is the **SHARP EL531**.
- Dress code: See section «Santé et sécurité» at the following link :  
<https://mareussite.cegepmontpetit.ca/ena/mes-outils/sante-et-securite/>

## MEDIAGRAPHY

### Theory:

- Chappuy J.P., Grégori J.P. Instruments de bord, Tome 1 : Mesure de vitesse, incidence, température, dispositifs de sécurité, compas de navigation, contrôle moteurs; Tome 3 : Instruments gyroscopiques, altimètre, variomètre, compas magnétique. Institut aéronautique Jean Mermoz, Paris, 1978. 629.135 C 4671 1978.
- Féminier, Didier. Cellules et systèmes d'aéronef. Outremont, Modulo, c1982, 315 p. D 629.13431 F 329c.
- Fleury, Jacques. Technologie cellule. Institut aéronautique Jean Mermoz, c1981, 410 p. D 629.13431 F618t.
- Gauvin, Daniel. Aérodynamique mécanique du vol, Institut aéronautique Jean Mermoz, Paris, 1979, 281 p. A.629.1323C375a
- Kermode, A.C. Mécanique du vol. traduction, Didier Féminier, Outremont, Modulo, c1982, 515 p. D 629.132 K 39m.
- McKinley, Bent. Aircraft basic science. USA, Gregg Division, Mc Graw-Hill Book Company, c1970, 374 p. D 629.13 M 158b.
- Raletz, Roger, Théorie élémentaire de l'hélicoptère, Suresne, Aérospatiale Hélicoptère, 1983. 629.13335 R163T
- Thierry du Puy de Goynes, Yves Plays, Patrick Lepourry, Jacques Besse. Initiation à l'aéronautique. Cépaduès-Éditions, Toulouse, ©Cepad2000, 176 p.
- Rice handbook of Airfoil Sections for Light Aircraft.
- Histoire de l'évolution des aéronefs (diaporama) 629-1300971-H673-EX-2

### Laboratory:

- Jane's Encyclopedia of Aviation, R629.13005 T244J.
- Jane's Pocket Book of Light Aircraft, 629.133340422 T244J.
- Maintenance d'aéronefs, EA-AC 43.13-1A et 2A, D629.1346E83ac.
- Schafer, Joseph. Basic Helicopter Maintenance, Basin, Wyo., Aviation Maintenance, c1980, 343 pages. 629.1346 S 296 b
- How Airplane Fly (vidéo) 629.1323 H 847-EX.2 VHS (18 min.)
- Les substances dangereuses, 363.19S234 (25 min.)
- Sécurité au sol et sur les aéroports (vidéo) A-629.1368 - S446-EX-2 VHS (25 min.)



## REQUIREMENTS TO PASS THE COURSE

### 1. Passing Mark

The passing mark for this course is 60% by adding the marks for the theory and practical work for the course.

### 2. Attendance for Summative Evaluations

Students must be present for summative evaluations and must comply with the instructions given by the instructor to carry out the evaluation activity and written in the course outline. Unexcused tardiness for a summative evaluation could result in being excluded from the activity. Any absence from a summative evaluation that is not due to serious reasons (illness, death in the family, etc.) could result in a mark of zero (0) for the activity.

Students are responsible for meeting with the instructor before an evaluation activity is held or immediately upon returning to ENA to explain the reason for an absence. Proper documentation, such as a medical certificate, a death certificate, legal papers, etc., must be shown if the reason for absence is serious and recognized as such by the instructor(s), arrangements will be made between the instructor(s) and the student to make up the activity.

### 3. Submitting Assignments

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.

### 4. Presentation of Written Work

The instructor(s) will provide students with information and guidelines regarding the presentation of written work. When the presentation of an assignment is unacceptable, the work will be penalized as a late assignment until an acceptable version is submitted. In this case, the penalties for late work will be applied.

Students must follow the standards adopted by the Cégep for written work (« *Normes de présentation matérielle des travaux écrits* »). These can be found at : <http://rmsh.cegepmontpetit.ca/normes-de-presentation-materielle-des-travaux-ecrits-du-cegep/>.

## METHODS OF COURSE PARTICIPATION

### In class, workshop or hangars:

- it is forbidden to bring food, drink, cell phone, pager, MP3, iPod, camera or anything similar.

### In workshop or hangars:

- ENA's coverall or the polo and pants kit, as well as glasses and safety shoes are MANDATORY. Those who do not will be denied access to the workshop or hangar and the absence will be recorded in their file. He (she) cannot use aircraft and equipment with the permission of the teacher (s) and following the instructions.
- It is forbidden to climb on a stool, a table or bench.
- It should never be more than 3 students (es) per team unless otherwise specified by the teacher (s), never more than one team per stations or aircraft.
- He (she) has to clean up the workbench and store equipment after use, in short, he (she) must be sure to leave the room clean and tidy.

**In hangars:**

**IT IS PROHIBITED TO:**

- Bring suitcases, briefcases or briefcase as backpack;
- To move in the hangars without the permission of the teacher (s);
- Move to other hangar without the permission of the teacher (s);
- Use the stairs corkscrew and mobile platforms;
- To place a binder or other object on the wings or other external part of the aircraft;
- Display an open flame (eg lighters, matches.)
- To touch the propellers;
- Opening doors and aircraft cowlings;
- To touch the levers, buttons, switches and controls of aircraft. Respect written on labels maintenance information;
- Be outraged;
- Disturbing those (students (s) of another course) working on an aircraft.
- Only the teacher (s) can unlock and lock the doors of the aircraft. Never attempt to open or close the doors. Handle them with care.
- If an aircraft is on jacks, do not stir unnecessary. Also, be careful.
- When unjacking an aircraft, do not jump.
- It is the responsibility of the student (s) to complete the exercises on time.
- Once prescribed by the teacher (s) of time, it must always return to class.
- Compliance with safety and work is not optional, it is REQUIRED.

**For the theoretical part offered by videoconference (if applicable):**

By participating in a course given remotely through a videoconferencing platform, the student understands and accepts that their image and voice can be captured as part of the course delivery. This recording will only be visible live, by the teacher and the other students of the group.

For educational reasons, some recordings could be recorded. The teacher should clearly inform the students, before each recording begins, that their image and voice will be recorded. If a student objects to their image and / or voice being recorded, they can participate in the course by turning off their camera and microphone and communicate in writing in the manner specified by the teacher. Otherwise, the student who uses his camera or microphone will be deemed to have given his consent to the recording of his voice and image. Videoconference course recordings may be made available only to students of all course groups for the duration of the session. It is forbidden to broadcast these recordings in public or to make any use of them other than for educational purposes.

No recording of a course given by videoconference can be made by a student without first obtaining the teacher's agreement. Students whose information (voice and images) is collected may exercise recourse for the rights of access and rectification provided for by the Act respecting access to documents held by public bodies and the protection of personal information from the Secretary General. of Cégep.

**OTHER DEPARTEMENTAL REGULATIONS**

Students are encouraged to consult the website for the specific regulations for this course:

<http://guideena-en.cegepmontpetit.ca/department-rules/>

<https://mareussite.cegepmontpetit.ca/ena/mon-parcours/mon-programme/regles-departementales>

## **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.

## **THE ADAPTED SERVICE CENTER FOR STUDENTS WITH DISABILITIES**

**Students with a professional diagnosis (motor limitations, neurological, organic, sensory, learning disabilities, mental health disabilities, autism spectrum disorder or others) or with a temporary medical condition can apply for appropriate measures.**

To access this service, send your diagnosis either by MIO to "Service, CSA-ENA" or by email to <https://mareussite.cegepmontpetit.ca/ena/mes-ressources/soutien-aux-apprentissages/centre-de-services-adaptes/>.

If you already have an adapted measures plan with the CSA, you are invited to contact your teacher at the start of the session in order to discuss with him the accommodation measures determined by the CSA.

## **APPENDIX**

None.