Aerospace Stream Selection: Streams A, B, C

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Canadian Aerospace
Important Facts and Figures

• Key early milestones
  • First powered flight in the Commonwealth – Baddeck, 23 Feb 1909, AES *Silver Dart*
  • Canada was third nation to have its own satellite built and launched – 1962, *Alouette*

• Aerospace is a national industry with regional clusters
  • 2/3rd of economic activity in Quebec (45%) and Ontario (25%)
  • Montreal region has third largest concentration of aircraft manufacturing activity in World [1st: Seattle (Boeing). 2nd: Toulouse (Airbus)]
Canadian Aerospace
Important Facts and Figures

- **Canada is a Global leader in:**
  - Civil helicopters
  - Small gas turbines
  - Simulators
  - Regional aircraft, business jets
  - Avionics
  - Landing gear systems,
  - Small and microsatellites
  - Maintenance

- **Economic impact (Ref AIAC Aerospace Economic Impact, 2010)**
  - ~85k employees, $23B in revenue (~80% from exports)
  - Employment normalized to population – 2nd versus all other nations (France is 1st)
  - Revenue normalized to GDP - 2nd versus all other nations (U.S. is 1st)
Aerospace at Carleton

- First BEng program in Canada (1988) and largest by enrolment
  (160 in 2016 vs. 30 in 1992)

- Four streams
  A - Aerodynamics, Propulsion and Vehicle Performance
  B - Aerospace Structures, Systems and Vehicle Design
  C - Aerospace Electronics and Systems
  D - Space Systems Design

- Originally only Stream A and B
  - Stream C added in the early 1990’s
  - Stream D added in 2007-08
Engineering Education

1st year:
common core: math, science, basic engineering, complementary studies

2nd year:
math, engineering science (solids, fluids, thermo, materials)

3rd year:
engineering specialization

4th year:
4th year project engineering electives

also:
• co-op
• economics
• professional practice
• communication skills
• minor (math, business, etc.)
Aerospace Streams
Overview of Bachelor Programs

Stream C is offered in cooperation with Electrical Engineering
Core Aerospace Courses

- Most or all AERO students take
  - AERO 3002 Design and Practice (A, B, C, D)
  - AERO 4003 Systems Design (A, B, C)
  - AERO 4907 (Capstone Design Project)
  - AERO 3700 Aerospace Materials (A, B, D-elect.)

- There are many stream-specific courses
  - Can be taken as electives (space permitting)
Jobs in Aerospace Engineering

Overview of Bachelor Programs

- Satellite & Space
- Robotic Design
- Aircraft Design
- Rotorcraft Design
- Simulators
- Aerospace Systems
- Gas Turbine Engines
- Maintenance, Repair, & Overhaul
Stream A
Aerodynamics, Propulsion & Vehicle Performance

- Sample stream-specific courses
  - Aerodynamics and heat transfer
  - Aerospace vehicle performance
  - Aircraft stability and control
- Typical electives
  - Computational Fluid Dynamics (CFD)
  - Rotorcraft Aerodynamics and Performance
  - Aerelasticity
  - Aeroacustics

- Example Careers
  - Aerodynamicist
  - Computational Fluid Dynamics engineer
  - Aircraft Conceptual Design
  - Aeroelastic analysis engineer
  - Aeroacoustics engineer
  - Flight test engineer
  - Stability and handling prediction
  - Performance prediction engineer
  - Jet engine aerodynamic designer
  - Launch vehicle aerodynamicist
  - Other:
    - wind energy
    - ground vehicle aerodynamics
    - building aerodynamics, etc.
Aerospace Engineering: Stream A

http://www.carleton.ca/engineering-design/current-students/undergrad-academic-support/prerequisites/
How to read the Engineering “Tree”

Beware of Pre-requisites!

Engineering Electives

Two Complementary Studies Electives

Final Year Project

Basic Science Elective
Key Industry and Research Opportunities
Stream B
Aerospace Structures, Systems and Vehicle Design

- Sample stream-specific courses
  - Aerospace Materials
  - Lightweight structures
  - Composite materials
  - Aeroelasticity
  - Strength and fracture

- Typical electives
  - Finite Element Methods
  - Rotorcraft Aerodynamics and Performance
  - Rocket design

- Example careers
  - Airframe structural engineer
  - Computational Structural Dynamicist
  - Conceptual design
  - Aeroelastics engineer
  - Aircraft mechanical systems
  - Landing gear
  - Engine structural design
  - Manufacturing engineer
  - Spacecraft structural design
  - Other:
    - Wind turbine structural design
    - Transportation structures
Key Industry and Research Opportunities
Stream C
Aerospace Electronics and Systems

- **Sample stream-specific courses**
  - Communication theory
  - Electromagnetic waves
  - Digital electronics
  - Power engineering

  Typical Electives:
  - Any from Electronics or MAE

- **Example careers**
  - Avionics engineer
  - Systems engineering
  - Fly-by-wire flight controls
  - Unmanned aerial systems
  - Airborne remote sensing
  - Engine controls
  - Spacecraft communications
  - Terrestrial telecommunications
  - Power generation
Engineering Education

http://www.carleton.ca/engineering-design/current-students/undergrad-academic-support/prerequisites/
Key Industry and Research Opportunities
Questions?
What is Our Makeup?

Department of Mechanical & Aerospace Engineering

- Single, integrated department (not two separate parts)
- Approximately 1300 undergraduate students
  - 2014 first year admissions (total 418)
- Entering minimum averages: 83% Aerospace, 76% Mechanical
- 36 full-time Professors + 19 Adjunct Professors + 5 Emeritus Professors
Engineering Co-op Program
Department of Mechanical & Aerospace Engineering

- Co-op option available for all programs
- 30% of students in co-op
- 4, 8, 12, and 16 month placement options
- Placement options after 2nd year
- 12 or 16 month placement after 3rd year most popular

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Currently 9 Capstone Design Projects

Learning & Teaching Philosophy

Simulator Project

Spacecraft Project

Fixed-Wing UAV

Rotorcraft UAV
Currently 8 Capstone Design Projects

Learning & Teaching Philosophy

- Formula SAE Hybrid Race Car
- Crash Test Dummy
- High Performance Housing
- Zero-Emissions Gas Turbine Generator