



Carleton
UNIVERSITY



Aerospace Training and Research at Carleton University

November 2016

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Summary



- Overview of Carleton, Department and Aerospace Research Unit
- Capstone Design Projects
- Challenges and Opportunities



- Founded in 1942
- Faculties of Engineering and Design, Public Affairs, Science, Arts and Social Sciences, School of Business
- 29,000+ students, 1,000+ faculty, 700 contract instructors and 1,700 TAs
- Canada's first Bachelor of Aerospace Engineering (1988)



[1945] Establishment of the Faculty of Arts and Science

[1963] Establishment of the Faculty of Engineering

[1988] Canada's First Bachelor of Aerospace Engineering Program

[1989] Department of Mechanical and Aeronautical Engineering Renamed

[1999] Wind Tunnel Renamed *Pratt & Whitney High-Speed Wind Tunnel*

[2007] Inauguration of Aerospace Engineering Stream in Space Systems Design

[2007] Opening of the Centre for Advanced Visualization and Simulation

Carleton's aerodynamics instructor uses a smoke chamber to demonstrate how air passes over the wing of a plane at different speeds and altitudes [1958]



Over 30 award-winning professors conducting aerospace research in Canada

School of
Information
Technology

larges

Mechanical and
Aerospace
Engineering

as in C

Biology

Psychology

disciplin

Systems,
Computer, and
Electrical

between

Computer Science





Low RPM Facility



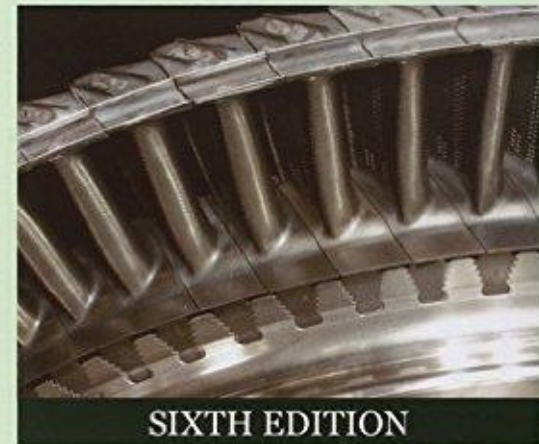
High RPM Facility [Unique in Canada]

ADVANCED PROPULSION SYSTEMS



High Speed Wind Tunnel [Unique in Canada]

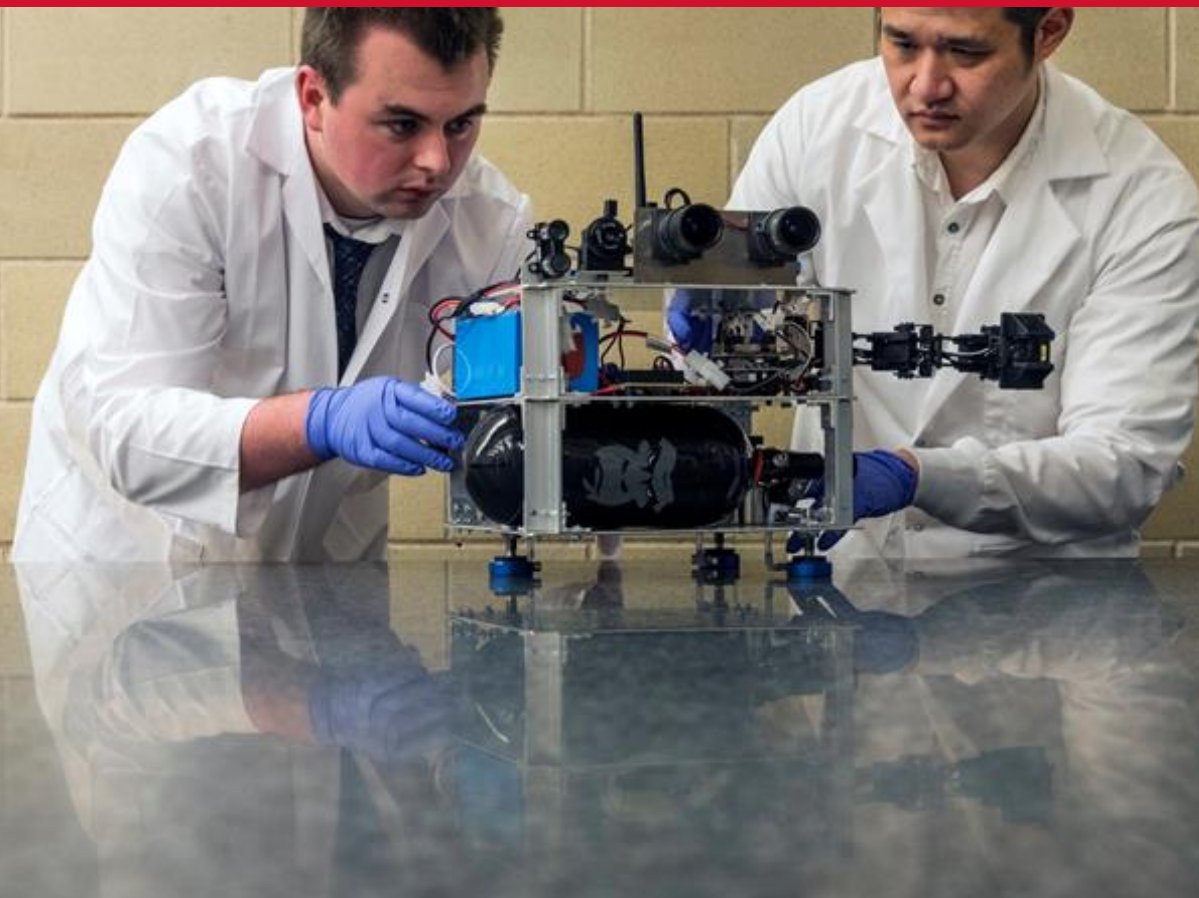
Gas Turbine Theory



SIXTH EDITION

HIH Saravanamuttoo
GFC Rogers • H Cohen
PV Straznicky

SPACE ROBOTICS & SYSTEMS RESEARCH

A robotic system with blue cables and a power supply unit on a table.

Free-Floating Robotic Spacecraft Facility **[Unique in Canada]**



FLIGHT SIMULATION AND HUMAN FACTORS RESEARCH



Carleton University Simulator Project (CUSP)

Mechanical and Aerospace Department Stats



- 40 full-time faculty, 15 Emeritus/Adjunct
- 1,000+ undergraduate students
 - Mechanical, Aerospace, Biomedical and Sustainable Energy Engineering
- 275+ graduate students
 - 175 MASc/MEng, 100 PhD
 - Masters and PhDs in Aerospace, Mechanical, Materials, Biomedical, Sustainable Energy

Undergraduate Aerospace Education at Carleton



- First Aerospace BEng program in Canada (1988)
- Significant program growth
 - From 30 in 1992 to 140 in 2015 - 1st year admissions
- Four streams
 - A** - Aerodynamics, Propulsion and Vehicle Performance
 - B** - Aerospace Structures, Systems and Vehicle Design
 - C** - Aerospace Electronics and Systems (early 1990s)
 - D** - Space Systems Design (mid 2000s)
- Capstone Design Project participation

Capstone Project Background



- Based on Cranfield University Group Design Project
- Originally two projects (1991-92)
 - Aircraft and Spacecraft
- Success of team-style projects led to adoption across Department (early 2000s)
- Evolved into multi-year projects with external collaborators, funding and links to graduate research
- Several projects include students from other departments, faculties and schools

Learning Objectives



- Learning Objective:

“To provide a realistic design learning environment to expose students to the complexities of modern engineering design processes, tools and practices.”

- Each project has its own “corporate” approach dictated by industry-specific design processes
- 20-30 students with 3-5 faculty members per project
- Dedicated project workspaces
- Weekly meetings and technical objectives

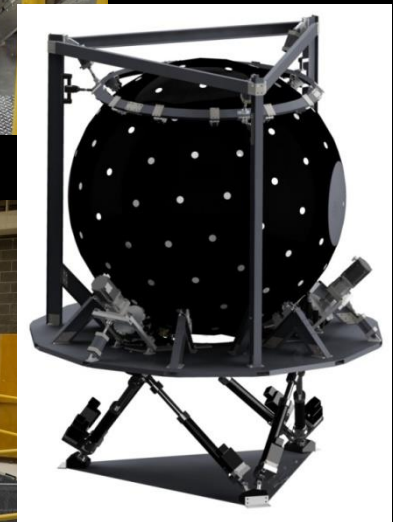
2016-17 MAE Capstone Design Projects



- Fixed Wing Aircraft Design
- Rotary Wing Uninhabited Aircraft System (UAS)
- Spacecraft Design Project
- Intelligent and Assistive Devices (iTAD)
- Formula Student Racecar Team
- Carleton University Simulator Project (CUSP)
- Hybrid Natural Gas Ground Vehicle
- Crash Test Dummy
- High Performance Housing

CUSP 2016 / 2017 Overview

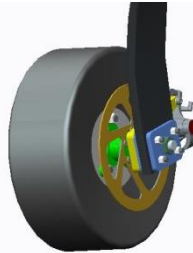
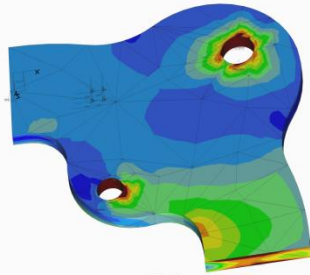
- Finish Commissioning Atlas
 - Complete calibration
 - Benchmark testing, MOOG, and motors
 - Design refinement (where required)
- Integrate developed technology
 - Vehicle modelling
 - Washout control
 - Orientation sensing, VOS, and IOS
- Applications
 - Road vehicle model
 - Rigid inflatable boat
 - Extra 300 aircraft



Fixed Wing Aircraft Design

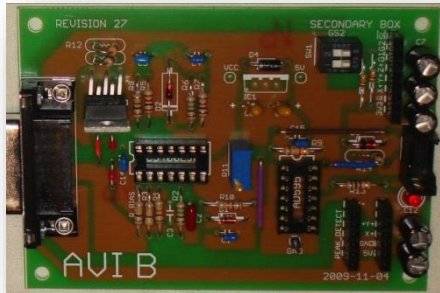


Failure Index (OCB)
Maximum of all plots
Loadset DATE: PLATEANALYSIS Step 2, Time 1.0000E+01

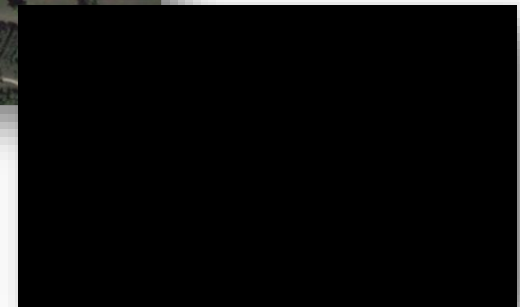


Air vehicle Design and Analysis

Manufacturing and Testing



Avionics design and development



Flight Testing

2017 MAE Design Forum



- Final presentations for all 4th year students
- Saturday April 1st, 2017
- Parallel presentation sessions for each project by students
- Hardware displays and demonstrations
- Contact: jeremy.laliberte@carleton.ca

Training Challenges and Opportunities



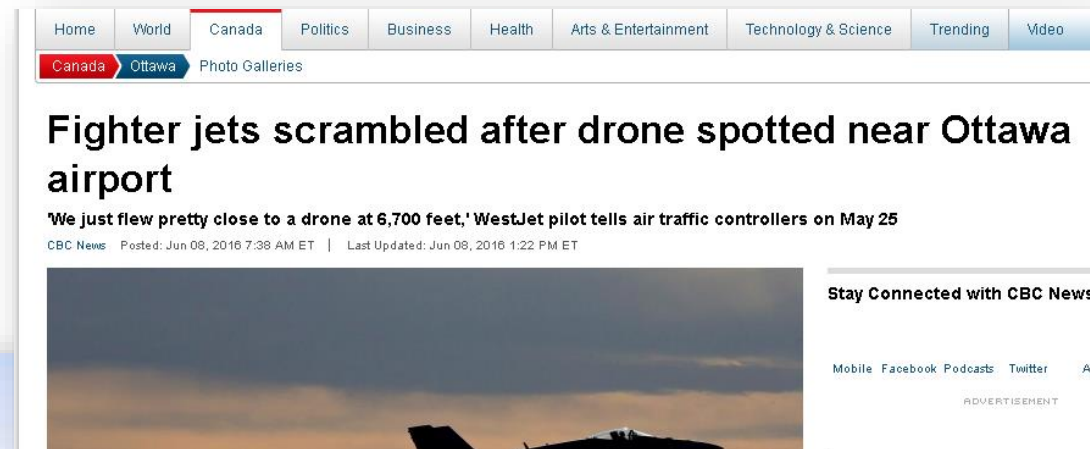
- Competition for talent
- Increasingly complex safety critical software and cyber-security challenges
- Advanced materials and new manufacturing methods
- Increasing levels of automation
- Uninhabited aircraft systems (UAS)

UAS and Aerospace Education



■ Safety above all else – *UAS are aircraft*

- <http://www.tc.gc.ca/eng/civilaviation/drone-safety.html>



The Aviation Herald

www.avherald.com

Next

Previous

List by:

Occurrence

Update

Filter:



The Aviation Herald needs your help

Accident: Porter DH8D at Toronto on Nov 14th 2016, near collision with unmanned aerial vehicle

UAS Proliferation Challenge



Drone flew over Hull jail courtyard Sunday

Nothing recovered, no suspects identified after Sunday morning incident

CBC News Posted: Nov 26, 2013 12:27 PM ET | Last Updated: Nov 26, 2013 8:43 PM ET



<http://www.cbc.ca/news/canada/ottawa/drone-flew-over-hull-jail-courtyard-sunday-1.2440726>

USA TODAY

SPORTS LIFE MONEY TECH TRAVEL OPINION 77° CROSSWORDS ELECTIONS 2016 OLYMPICS VIDEO STOCKS APPS

FAA: Drone registration eclipses that of regular planes



Bart Jansen, USA TODAY 10:26 p.m. EST February 8, 2016



(Photo: David Becker, Getty Images)

WASHINGTON — The number of drones potentially flying in U.S. skies has eclipsed the number of piloted aircraft — from Cessnas to Dreamliners, the Federal Aviation Administration said Monday.

More than 325,000 people registered their drones as of Friday, FAA Administrator Michael Huerta said. That surpasses the 320,000 piloted aircraft registered with the agency. And the numbers could actually be higher, Huerta said, because one registration covers all the drones a person owns. The average operator has 1.5 drones, he said.

<http://www.usatoday.com/story/news/2016/02/08/faa-drone-registration-eclipses-regular-planes/80002730/>

Update - As of May 2016 there were over 460,000 individual UAS registered in the US

(<https://www.faa.gov/news/updates/?newsId=85548>)

The Three “E’s” of UAS



■ Engagement

- Stakeholders, regulators, air operators, policy makers, public, first responders, ANSPs

■ Education

- Public – critical safety messages
- Students – systems engineering, software, sensors, flight controls

■ Enforcement

- Local law enforcement, bylaws, prosecutors

Questions?

