ECOR4907A (formerly MAAE 4907A) Advanced Aircraft Design Project (2022-23)

3rd Year Information Presentation

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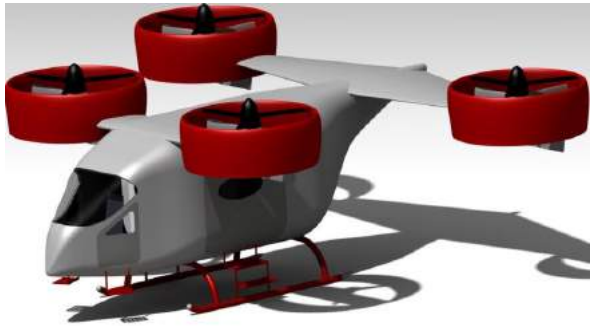
Overview

- Interdisciplinary format
- Learning objectives
- 2022-23 Design challenge



Images from 2020-21 Design Project

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Capstone Learning Objectives

- Engineering design experience
- Application of knowledge and theory from other courses
  - Engineering tools and methods
  - Balance of analytical and hands-on experience
- Complementary skills
  - Project management, communication, leadership and teamwork, technical writing, interdisciplinary teams
- Design, analyze, build, test/fly, re-design

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ECOR4907A Format

- Prior experience with interdisciplinary projects
- One of the first new ECOR4907 projects
- Students and LEs from ELEC/SYSC and MAE
  - Possibly other departments/schools – ID, CogSci
- MAE marking standards and graduate attributes
- MAE meeting schedule

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General Project Information

- 7-8 students per lead engineer
- Assume project to be fully in person
- Single integrated team working on one aircraft design
- Access to 3103CB workspace
  - Shared with Blackbird UAV team and graduate students
  - Equipment and supplies from previous UAV projects
- Access to makerspace in new Engineering Design Centre

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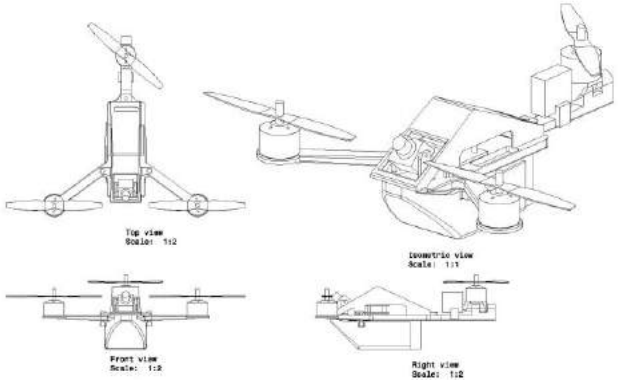
Project Structure

- Modelled on Integrated Product Team from aviation industry
  - Design Integration (JL)
  - Aerodynamics and Propulsion (MY and HM)
  - Avionics and Flight Controls (HM and AS)
  - Structures and Manufacturing (JL)



Project Topic (2-3 years)

- Advanced air mobility (AAM) system based on NRC's Integrated Air Mobility requirements
- Differs from popular "air taxi" concepts with a longer range, icing protection and requirement for fixed wing lift generation
- Other requirements
  - Autonomous and pilotless capabilities
  - Reduced GHG emissions over entire life cycle
  - Design for accessibility
  - NAV Canada UTM/RTM compliant

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Modified NRC-IAM Design Requirements

- Performance
  - Min. 300 km range, divert range of 10 km, 3000 kg MTOW
  - 100-200 kts cruise speed at 1500 m AGL
  - Service ceiling of 3000 m ASL
  - -40°C to 50°C operating temperature range
- Vertical take-off and landing (VTOL) capability
  - Prepared or unprepared landing fields, typical helipads
- Optionally piloted/pilotless operations
- Capable of operating IFR and known icing conditions
  - Limited icing protection system

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Design Missions

- Aeromedical mission
  - 1 pilot, 1 air ambulance stretcher with patient (100 kg), 1 paramedic (100 kg), 100 kg equipment (https://spectrum-aeromed.com/project/20-2200-series/)
- Cargo mission
  - 1 pilot plus 500 kg palleted cargo
  - North American standard forklift pallet

Typical Activities

- Guest lectures and tutorials
- Modelling and simulation – CFX, ANSYS, Abaqus, COMSOL
- Stability and control – DATCOM, Matlab/Simulink
- Wind tunnel testing
- Propulsion system sizing and analysis
- Avionics system design
- Human factors
- Subscale model - design, build, fly

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Questions?

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