

Undergraduate 4th Year Project - UAV

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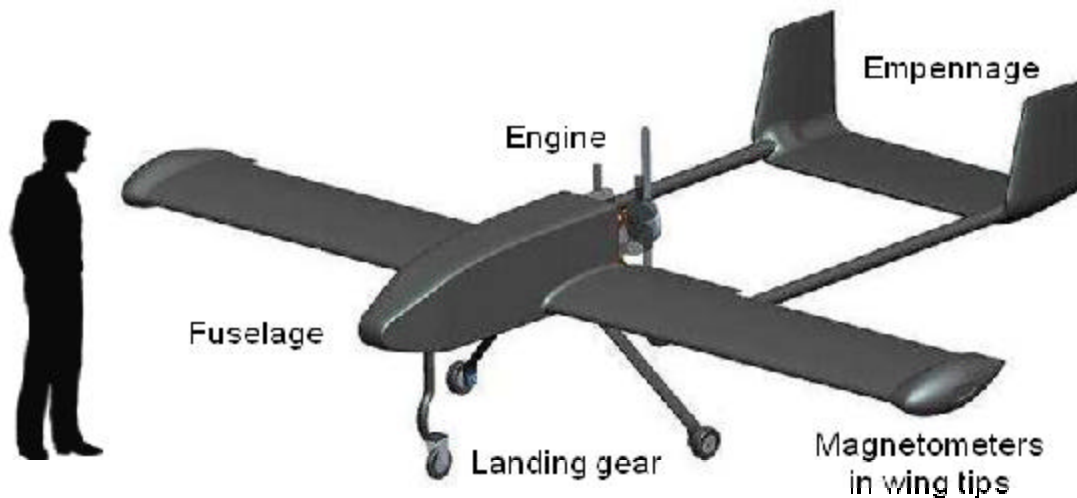
Course AERO 4907 / MECH 4907

2009/2010 academic year design project offered by the Department of Mechanical and Aerospace Engineering for final year students.

Project 1: (UAV) Unmanned Air Vehicle System - GeoSurv II and OpenUAS
Project Manager: Professor J. Laliberté

The 2009/2010 UAV design project will consist of two different uninhabited aerial vehicle (UAV) designs at different stages of development - GeoSurv II entering its fifth year and the OpenUAS small UAV commencing this year.

GeoSurv II development will continue into its fifth year. Our customer, Sander Geophysics Ltd. (SGL) is providing strong support of the project and has defined a very ambitious mission. The air vehicle will carry sensitive magnetometers in the wing tips and will fly close to the ground, following the terrain. Autonomous operation will eventually be demonstrated. The air vehicle must be simple, robust, easy to assemble, maintain, and have low-cost. The system will be operated by no more than two persons. These requirements dictate a well-integrated air vehicle and a state-of-the-art avionics system.



Teams of students working over the 2004-2009 period finalized the outer shape of the air vehicle, analyzed its predicted aerodynamic performance, carried out wind tunnel tests and purchased an engine for the vehicle. Manufacturing of the all-composite airframe was completed over the 2007-2009 timeframe.

The 2008/2009 team has completed the detailed design, the majority of the manufacturing, testing and certification documentation for the prototype full-scale flight test version of the GeoSurv II air vehicle. The prototype flight control system has been designed including specialized flight test instrumentation (air data boom and data acquisition system). Wind tunnel testing on a full 3D model of the air vehicle was completed at the National Research Council Institute for Aerospace Research. The Airworthiness and Certification Group has applied for and obtained a Special Flight Operations Certificate for the prototype's first flight planned to take place in the spring or summer of 2009. Data collected from prototype flight testing will be used to improve the design of the final GeoSurv II system during the 2009/2010 project year.

This past work has set the stage for a very exciting 2009/2010 project year. The team will review all the previous work, and then will complete the design of the final version of the GeoSurv II. Some of the tasks include:

- Structural optimization and weight reduction with improved manufacturing techniques and structural design;
- Optimization of the fuselage outer mould line to reduce drag and improve overall aerodynamic efficiency validated through analysis, wind tunnel testing and flight testing;
- Fabrication of new structural components (e.g. empennage and fuselage) incorporating weight and drag reductions;
- Flight testing using the GeoSurv II prototype and Avionics Test Bed aircraft to validate performance models and test the avionics system;
- Further enhancements to the onboard flight control system including integration of a laser altimeter system, completion of MP2028 autopilot integration and an expanded vehicle health monitoring system;
- Further stability and control analyses and engine performance testing;
- Completion of the detailed design of the final GeoSurv II UAV system based on the results of flight testing and structural and aerodynamic design improvements;
- Continue discussions with Transport Canada on the certification issues.



It is expected that the first flight of the GeoSurv II prototype will take place in the spring or summer of 2009 so that a flyable prototype will be available to the 2009/2010 team for further testing. In addition to the undergraduate development work, research will continue on four areas critical to the mission, namely autonomous operations, obstacle detection and avoidance, low magnetic signature actuating system, and low-cost composite structures.

The 2009/2010 UAV Project Team will also begin work on the successor to GeoSurv II, OpenUAS. A small team of students in the UAV Advanced Design Group will undertake the conceptual design of this new multi-mission high performance small UAS platform. This work will include reviewing civil UAS market studies, defining notional missions, developing a concept of operations and carrying out the preliminary sizing, performance analysis and layout of the OpenUAS system. OpenUAS will be based on modular hardware and software specifications designed using the spiral development approach so that a functional initial version of the vehicle can be fielded early in the life of the project and then incrementally improved upon over several years. The Advanced Design Group will be fully integrated in to the main UAV Project Team and will make use of past aerodynamic, structural and avionics analyses and test data whenever possible.

The project is multidisciplinary and the team will ideally consist of students of aerospace (all streams), mechanical, systems and computer, electrical and software engineering.

If you have any questions, please contact the Project Manager, or you may contact the departmental office at (613) 520-5684.