

Project Definition Document

*Aerospace Senior Projects (ASEN 4018 & 4028)
Fall 2003 and Spring 2004*

1.0 Information

1.1 Project Title

SCOUR: Slow flying Coaxial Unmanned Rotorcraft

Hovering UAV – H-UAV

1.2 Project Customers

none

2.0 Background and Context

Small hovering UAVs will be used in the future for reconnaissance missions where it is undesirable for a human to go. The military and search and rescue teams have the desire to inspect dangerous areas without risk to human life. These hovering aircrafts, will provide image data of a given location or series of locations in a small proximity.

By hovering well above the ground, the aircraft will allow soldiers to see over obstacles through the use of onboard cameras. The use for search and rescue comes through the aircraft's size and ability to maneuver through damaged buildings. A building can be searched for survivors without undue risk to the rescuers. The coaxial rotor design allows the aircraft to remain small in size, and with the addition of a shroud around the blades, the craft will be able to glance off walls with no damage. To enable the aircraft to be operated without expertise, an onboard augmented dampening system will provide stability. This stabilization control system along with user input will allow for the objectives to be accomplished.

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3.0 Objectives

3.1 Overall Objective

The overall objective of the proposed project is to conceive, design, fabricate, integrate and verify a small, lightweight hovering UAV for reconnaissance.

3.2 Functional Objectives

Objectives	Discussion
1. There is a vehicle weight and size goal of 2 lbs, 20" dia, and a limit of 10lbs, 40" dia.	The vehicle may be stowed in a back pack and carried, so small size and light weight is necessary.
2. SCOUR must carry a usable payload of at least 1oz, with a goal of 16oz.	The payload will be hardware that is needed for the reconnaissance.
3. SCOUR must be able to stay aloft for at least 5 min with a goal of 30 min.	Time aloft is important to the range and usefulness of the aircraft.
4. SCOUR must be able to operate indoors.	The stacked rotor system will enable for Indoor (commercial and residential structures) reconnaissance due to reduction in size. Shrouded fan protects rotors from impacting obstacles
5. SCOUR must have 3 axis user control.	Partial onboard control allows for simplified flight controls for the user. Rate gyros and accelerometers will supply onboard stability control.
6. The aircraft must be able to maintain a steady hover with lateral mobility. Directional movement of 5 mph is the project goal.	By launching near the desired target, the flight velocity of the aircraft is less important than stable maneuverability.
7. SCOUR will not require image stability hardware or software.	The extra weight and complexity of image stability is not a required goal of the project.
8. The vehicle will be stabilized via on-board hardware and software	Helicopters, especially coaxial designs can be very unstable and require the use of stabilization systems

4.0 Anticipated Engineering Expertise

Technical Expertise	How Applied
Precision Mechanical	Produce conceptual and detailed 3D drawings of each

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Design	component in the Hovering UAV (H-UAV).
Structures and Materials	Design the airframe of the Hovering UAV, understanding the strengths, weaknesses, of all components and materials in use. Develop a stacked rotor system utilizing collective pitch to allow the UAV to hover in flight.
Aerodynamics	Understand aerodynamics of H-UAV, to develop control system. Comprehension of the aerodynamics of a stacked rotor to allow for stable flight.
Thermal	Producing a motor system that will not overheat itself or the electric components in the device.
Data Acquisition Software	Transmission from remote controls to the aircraft. User Flight Control - facilitate aircraft to stabilize, which enables H-UAV to hover steadily.
Software Design - Control	On-Board Flight Controls give aircraft augmented damping for added stability.
Mechanical Fabrication	Machine Airframe, and incorporate motor and rotor into airframe.
Electronic Fabrication	Integrate electronic components to fit and function in certain allowed space of the hovering UAV.
Mechanical and Dynamic Test	Verification of the project

5.0 Resources

5.1 Facilities

In addition to the standard facilities made available to the entirety of the ASEN 4018/4028 class, the SCOUR team will make use of the shielded rotor-testing box in the interests of testing safety.

5.2 Additional Advisors

Aerodynamics – Professor Argrow

Structures – Professor Peterson

Remotely-piloted vehicles – Jim Maslanik

5.3 Funds

The SCOUR project will be funded by a total sum of \$4000, with these funds coming directly from the ASEN department.