Desna: Pathfinder VI Experimental Payload
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Abstract
The objective of this project is to design, fabricate and test a fixed wing unmanned aerial vehicle (UAV) that is to be carried in, and deployed from the Pathfinder VI rocket. The UAV, known as Desna, is tasked with being able to carry a Tamarisk 640 75mm thermal imaging camera, and transmit live video footage to a ground station from 8,500 feet AGL. Desna must also fit inside Pathfinder VI's 7.5" diameter, 35" long cargo bay. To accomplish this, Desna’s wing configuration, determined through description matrices and light prototype testing, will consist of a 35” wing that rotates about its center with 11” folding winglets to increase lift and stability. Desna will be constructed from blue high-density foam to allow for cheap, rapid prototyping as well as being light as possible while still being able to survive the G loadings during assent. Desna will fly in high-density foam to allow for cheap, rapid prototyping as well as being light as possible.

Mission Objectives
- Desna must fit within the allocated payload bay space of a cylinder 7” in diameter and 35” in length.
- Desna must carry a DRS Tamarisk 640, 75mm thermal imaging camera.
- Desna must cruise at an altitude of 8,500 feet AGL.
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Flight Performance Calculations
All calculations were done using a custom flight stability MATLAB program.

Aircraft Design
Desna was designed with a centrally rotating wing mechanism, allowing it to fold and fit into a cylinder 7” in diameter and 35” long. The mechanism folds the 11” winglets under the 35” main wing section, and then routes the wing about a bolt in Desna’s payload access hatch.

System Configuration
Desna’s electrical systems are split into two sections, the propulsion and flight control system, and the video transition system. Each system is powered by a three cell lithium polymer battery. The wiring setup for both systems is displayed below.

Conclusion
Desna is currently in the final stages of development. Desna has passed both it’s Preliminary Design Review and Critical Design Review, and the Desna team has begun manufacturing both a prototype for flight testing and the final iteration. The prototype of Desna will be flown aboard the maiden flight of Pathfinder VI on Saturday, April 18th at the Spaceport Rocketry Association. The final iteration of Desna will be flight tested upon completion, and will fly aboard Pathfinder VI in the Intercollegiate Rocket Engineering Competition (IREC) in Green River Utah this June. In the future, Desna can be used by the Coast Guard for search and rescue missions, or by the military for rapid reconnaissance in the field.

References