Desna: Pathfinder VI Experimental Payload
Max Siege, Robert Moore, Lingxiao Wang, Charles Watson, Jacob Adamski, and James Le
Embry-Riddle Future Space Explorers and Developers Society

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 Tamarkin 640 75mm thermal imaging camera, and transmit live video footage to a ground station from 8500 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 ascent. Desna will fly in 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 ascent. Desna will fly in

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 Tamarkin 640, 75mm thermal imaging camera.
- Desna is to be able to be launched inside of the Pathfinder VI rocket to an altitude of 10,000 feet above ground level (AGL).
- Desna must cruise at an altitude of 8500 feet AGL.
- Desna must carry a DRS Tamarisk 640, 75mm thermal imaging camera.

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.

Flight Performance Calculations
All calculations were done using a custom flight stability MATLAB program.

Concept of Operations
- Apogee Deployment at 10,000 feet AGL
- Wing mechanism folds immediately after deployment
- Controlled Descent to 8,500 feet AGL
- Cruise and Observe at 8,500 feet AGL
- Deploy Chute at 500 feet AGL
- Deploy Camera at 500 feet AGL
- Launch

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 of 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 1829 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.

Acknowledgments
The Embry-Riddle Future Space Explorers and Developers Society would like to thank DRS Technologies for the donation of their Tamarisk 640 camera. We would also like to thank the Department of Undergraduate Research, the Student Finance Board, and Dr. Perrell for their support.

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