

Milestone Review Flysheet

Institution University of Evansville

Milestone CDR

Vehicle Properties

Total Length (in)	112
Diameter (in)	5.5
Gross Lift Off Weigh (lb)	34.6
Airframe Material	Carbon Fiber
Fin Material	Fiberglass
Coupler Length (in)	12

Motor Properties

Motor Designation	AeroTech L850W
Max/Average Thrust (lb)	266.4/195.1
Total Impulse (lbf-s)	830.7
Mass Before/After Burn	8.1/3.54
Liftoff Thrust (lb)	163.1
Motor Retention	Aero Pack 75mm Retainer - P

Stability Analysis

Center of Pressure (in from nose)	86.1
Center of Gravity (in from nose)	70.9
Static Stability Margin (After Burn-out)	3.66
Static Stability Margin (off launch rail)	2.13
Thrust-to-Weight Ratio	5.59:1
Rail Size and Length (in)	1515 and 12'
Rail Exit Velocity	67 ft/s

Ascent Analysis

Maximum Velocity (ft/s)	622
Maximum Mach Number	0.56
Maximum Acceleration (ft/s^2)	219
Target Apogee (From Simulations)	5,283 feet
Stable Velocity (ft/s)	67
Distance to Stable Velocity (ft)	11.8

Recovery System Properties

Drogue Parachute

Manufacturer/Model	Fruity Chutes CFC-24			
Size (in)	24			
Altitude at Deployment (ft)	Apogee			
Velocity at Deployment (ft/s)	0			
Terminal Velocity (ft/s)	72.4			
Recovery Harness Material	Tubular Nylon			
Harness Size/Thickness (in)	1			
Recovery Harness Length (ft)	35			
Harness/Airframe Interfaces	5/16" Steel U-bolts through 1/4" aluminum bulkheads, secured with lock washers and nuts			
Kinetic Energy of Each Section (Ft-lbs)	Bow Body Tube	Aft Body Tube	-	-
	749	1360		

Recovery System Properties

Main Parachute

Manufacturer/Model	Fruity Chutes IFC-96			
Size (in)	96			
Altitude at Deployment (ft)	750			
Velocity at Deployment (ft/s)	72.4			
Terminal Velocity (ft/s)	15.3			
Recovery Harness Material	Tubular Nylon			
Harness Size/Thickness (in)	1			
Recovery Harness Length (ft)	35			
Harness/Airframe Interfaces	5/16" Steel U-bolts through 1/4" aluminum bulkheads, secured with lock washers and nuts			
Kinetic Energy of Each Section (Ft-lbs)	Bow Body Tube	Recovery Bay	Aft Body Tube	-
	32.1	15.1	43.2	

Recovery Electronics

Altimeter(s)/Timer(s) (Make/Model)	2 x PerfectFlite Stratologger CF
Redundancy Plan	Two identical, separate systems that each include a battery, switch, altimeter, main and drogue igniters with main and drogue black powder charges.
Pad Stay Time (Launch Configuration)	3 Hours 13 Minutes

Recovery Electronics

Rocket Locators (Make/Model)	Altus TeleMega Vs. 2.0
Transmitting Frequencies	434.55 MHz
Black Powder Mass Drogue Chute (grams)	2.00 g
Black Powder Mass Main Chute (grams)	3.20 g

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Autonomous Ground Support Equipment (MAV Teams Only)

Capture Mechanism	Overview
	N/A
Container Mechanism	Overview
	N/A
Launch Rail Mechanism	Overview
	N/A
Igniter Installation Mechanism	Overview
	N/A

Payload

Payload 1	Overview
	The fragile material payload consists of a concentric cylinder design with the inner cylinder housing said material. The two cylinders are connected via a parallel and series spring system. The inner cylinder is connected to the outer cylinder via wire rope isolators used to dampen small vibrations while the outer cylinder is connected to the bulkhead via larger conventional springs to absorb large impact, takeoff and parachute forces. The entire concentric cylinder assembly oscillates within the main body tube of the rocket and will be lubricated with graphite for smooth translation.
Payload 2	Overview
	N/A

Test Plans, Status, and Results

Ejection Charge Tests	Ejection charge testing was conducted prior to sub-scale launch, and will be conducted again prior to full scale model launch in order to ensure that the calculated masses of black powder can successfully shear the pins and separate the rocket sections. Black powder charge mass will be optimized for the main parachute and drogue parachute compartments to ensure extreme confidence in creating an ejection event without over pressurizing the compartments or creating excessive velocity. A specific apparatus was created for this testing operation that focused on securing the rocket at various angles. It will be designed to protect the ejected section from damage after it is free.
Sub-scale Test Flights	Two sub-scale test flights were conducted to ascertain the integrity of the launch vehicle's design and the predictability of its performance. During the first flight, the main parachute failed to deploy as the result of undersized black powder charges. The resulting ground impact caused minor damage to the airframe; a fin popped out of its body tube and the main altimeter mount was rendered unusable. A second test flight was possible after repairing the fin and removing the main altimeter. Additionally, all black powder charges were doubled in mass. The second flight was a complete success, with both parachutes deploying successfully. The flight data recovered from both recovery altimeters was consistent with simulated predictions.
Full-scale Test Flights	Full scale tests will be performed on the rocket after optimization. These tests will be used to verify that all the materials used to make the rocket are fully functional and safe for launch. Additionally, full-scale tests will be conducted in order to verify data obtained from computer simulations, such as maximum height and parachute deployment at proper times. Furthermore, this test will also be used to ensure the rocket does not ascend beyond the allowable limit and all rules and regulations set forth by the FAA and NASA are met. The team intends to do two Full-Scale test flights.

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Additional Comments