

Milestone Review Flysheet

Institution University of Evansville

Milestone FRR

Vehicle Properties	
Total Length (in)	114 (With Retention System)
Diameter (in)	5.5
Gross Lift Off Weigh (lb)	36.5
Airframe Material	Carbon Fiber
Fin Material	G10 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 (lb)	8.1/3.54
Liftoff Thrust (lb)	163.1
Motor Retention	Aero Pack 75mm Retainer - P

Stability Analysis	
Center of Pressure (in from nose)	84.3
Center of Gravity (in from nose)	67.1
Static Stability Margin (After Burn-out)	4.0818
Static Stability Margin (off launch rail)	2.143
Thrust-to-Weight Ratio	5.34:1
Rail Size and Length (in)	1515 and 12'
Rail Exit Velocity	66.9

Ascent Analysis	
Maximum Velocity (ft/s)	590
Maximum Mach Number	0.53
Maximum Acceleration (ft/s^2)	208
Target Apogee (From Simulations)	5326 ft
Stable Velocity (ft/s)	67
Distance to Stable Velocity (ft)	11.8

Recovery System Properties				
Dogue 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)		76.5		
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 Enerfy of Each Section (Ft-lbs)	Bow Body Tube	Aft Body Tube	-	-
	1141	1249		

Recovery System Properties				
Main Parachute				
Manufacturer/Model		Fruity Chutes IFC-96		
Size (in)		96		
Altitude at Deployment (ft)		750		
Velocity at Deployment (ft/s)		76.5		
Terminal Velocity (ft/s)		14.5		
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 Enerfy of Each Section (Ft-lbs)	Bow Body Tube	Recovery Bay	Aft Body Tube	-
	41.0	10.88	33.9	

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)	3.00 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	<p>Ejection tests were conducted prior to full-scale test launches using the as-flown configuration. A successful test was defined as complete ignition of the black powder charge and separation of the body tube from the coupling tube. Satisfactory performance of a recovery event was defined by two consecutive successful tests. A damping apparatus was constructed to stop the body tube movement after being separated.</p> <p>Only one unsuccessful test, which highlighted a wiring problem, was conducted. After correcting this issue, all tests were completed successfully, verifying the integrity of the recovery system.</p>
Sub-scale Test Flights	<p>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.</p>
Full-scale Test Flights	<p>Three full scale test flights were performed. The first flight was flown with two pounds of ballast and performed perfectly, however the rocket did not go high enough. Ballast was removed for the second flight to try to reach the mile mark. This resulted in the rocket being understable and left the launch rail at 14 degrees. For the third flight, a pound and a half of ballast was added to get the rocket stable again. Using less ballast than the first flight resulted in the apogee being within 11 feet off the mile mark. For flight three the recovery quicklinks used in flights one and two were replaced with the smaller size used in the subscale flight. The fragile material payload survived all three flights.</p>

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Additional Comments