

# Milestone Review Flysheet

**Institution** The Pennsylvania State University

**Milestone** Preliminary Design Report

Vehicle Properties	
Total Length (in)	147
Diameter (in)	6.079
Gross Lift Off Weigh (lb)	39.5
Airframe Material	Blue Tube 2.0
Fin Material	Fiberglass (1/8")
Coupler Length	12 inches

Motor Properties	
Motor Designation	4263-L1350-CS-0
Max/Average Thrust (lb)	348.23/ 303.27 lb
Total Impulse (lbf-s)	962 lbf-s
Mass Before/After Burn	7.87/ 4.20 lb
Liftoff Thrust (lb)	101.16
Motor Retention	Slimline Retainer w/ Tailcone

Stability Analysis	
Center of Pressure (in from nose)	110 inches
Center of Gravity (in from nose)	89.7 inches
Static Stability Margin	3.33
Static Stability Margin (off launch rail)	2.25
Thrust-to-Weight Ratio	7.68
Rail Size and Length (in)	1515 rail, 144 in
Rail Exit Velocity	76.6 ft/s

Ascent Analysis		
Maximum Velocity (ft/s)	668 ft/s	
Maximum Mach Number	M 0.6	
Maximum Acceleration (ft/s^2)	255 ft/s^2	
Target Apogee (From Simulations)	5315 ft	
Stable Velocity (ft/s)	337.6 ft/s	
Distance to Stable Velocity (ft)	310 ft	

Recovery System Properties				
Dogue Parachute				
Manufacturer/Model	Fruity Chutes/ Classic Elliptical			
Size	36"			
Altitude at Deployment (ft)	5280			
Velocity at Deployment (ft/s)	0			
Terminal Velocity (ft/s)	65.7			
Recovery Harness Material	Kevlar			
Harness Size/Thickness (in)	0.5			
Recovery Harness Length (ft)	20			
Harness/Airframe Interfaces	Closed 1/2" Steel Eyebolts, 1/4" Steel Quick Links			
Kinetic Energy of Each Section (Ft-lbs)	Section 1	Section 2	Section 3	Section 4
	548.2	604.2	438.5	

Recovery System Properties				
Main Parachute				
Manufacturer/Model	Fruity Chutes/ Iris Ultra			
Size	96"			
Altitude at Deployment (ft)	700			
Velocity at Deployment (ft/s)	65.7			
Terminal Velocity (ft/s)	17.8			
Recovery Harness Material	Kevlar			
Harness Size/Thickness (in)	0.5			
Recovery Harness Length (ft)	30			
Harness/Airframe Interfaces	Closed 1/2" Steel Eyebolts, 1/4" Steel Quick Links			
Kinetic Energy of Each Section (Ft-lbs)	Section 1	Section 2	Section 3	Section 4
	41.5	45.7	33.2	

Recovery Electronics	
Altimeter(s)/Timer(s) (Make/Model)	Stratologger SL100/CF
Redundancy Plan	Two independent altimeters (Stratologger SL100/CF), e-matches, power sources, black

Recovery Electronics	
Rocket Locators (Make/Model)	Garmin Astro 320 GPS Beacon
Transmitting Frequencies	***Required by CDR***
Black Powder Mass Drogue Chute (grams)	7.4

Pad Stay Time (Launch Configuration)	3 hours	Black Powder Mass Main Chute (grams)	7.76
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### Autonomous Ground Support Equipment (MAV Teams Only)

Capture Mechanism	Overview
Container Mechanism	Overview
Launch Rail Mechanism	Overview
	***Include Description of rail locking mechanism***
Igniter Installation Mechanism	Overview

### Payload

Payload 1	Overview
	Due to high accelerations and impacts during rocket flight, fragile objects stored within rocket are particularly vulnerable to break or bend. LTRL's fragile object protection system aims to protect these fragile objects from potential damage caused by vehicle flight by enveloping them in a non-Newtonian fluid suspended in a foam lined chamber via rubber bands.
Payload 2	Overview
	LTRL's second payload, a coaxial helicopter called Kiwi, will be launched from the rocket at apogee. Kiwi will then stabilize itself and autonomously navigate to a predetermined location. It will be equipped with an onboard GPS and emergency parachute.

### Test Plans, Status, and Results

Ejection Charge Tests	LTRL will conduct ground tests for the ejection charges before subscale launch at a local facility. There will also be a ground test on the day of subscale launch and before a full scale launch. The amount of black powder needed for ejections will be estimated using models before initial ground testing but will be refined after the ground tests.
Sub-scale Test Flights	First Subscale test launch is scheduled for early November

Full-scale  
Test Flights

Fullscale test flights have not been scheduled yet

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Additional Comments

