

# Milestone Review Flysheet

**Institution** Northwestern University

**Milestone** FRR

Vehicle Properties	
Total Length (in)	110
Diameter (in)	5.5
Gross Lift Off Weigh (lb)	49.8
Airframe Material	G12 Fiberglass
Fin Material	G12 Fiberglass
Coupler Length	6"

Motor Properties	
Motor Designation	L1420
Max/Average Thrust (lb)	407.8/319.2
Total Impulse (lbf-s)	1035
Mass Before/After Burn	10.1/4.4
Liftoff Thrust (lb)	346
Motor Retention	Retainer ring

Stability Analysis	
Center of Pressure (in from nose)	83.086
Center of Gravity (in from nose)	66.78
Static Stability Margin	2.96
Static Stability Margin (off launch rail)	1.85
Thrust-to-Weight Ratio	6.41:1
Rail Size and Length (in)	1.5/96
Rail Exit Velocity	56.1 ft/s

Ascent Analysis	
Maximum Velocity (ft/s)	584
Maximum Mach Number	0.52
Maximum Acceleration (ft/s^2)	216
Target Apogee (From Simulations)	5003
Stable Velocity (ft/s)	40
Distance to Stable Velocity (ft)	< 8

Recovery System Properties				
Dogue Parachute				
Manufacturer/Model	Fruity Chutes: Elliptical			
Size	30"			
Altitude at Deployment (ft)	5003			
Velocity at Deployment (ft/s)	0			
Terminal Velocity (ft/s)	97.4			
Recovery Harness Material	Nylon			
Harness Size/Thickness (in)	1"			
Recovery Harness Length (ft)	30			
Harness/Airframe Interfaces	Threaded welded eye bolts and 880 lb quick links			
Kinetic Energy	Section 1	Section 2	Section 3	Section 4

Recovery System Properties				
Main Parachute				
Manufacturer/Model	Fruity Chutes: Iris Ultra Parachute			
Size	168"			
Altitude at Deployment (ft)	700			
Velocity at Deployment (ft/s)	60			
Terminal Velocity (ft/s)	10.36			
Recovery Harness Material	Nylon			
Harness Size/Thickness (in)	1"			
Recovery Harness Length (ft)	45			
Harness/Airframe Interfaces	Threaded welded eye bolts and 880 lb quick links			
Kinetic Energy	Section 1	Section 2	Section 3	Section 4

of Each Section (Ft-lbs)	6498			
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of Each Section (Ft-lbs)	73.5			
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Recovery Electronics	
Altimeter(s)/Timer(s) (Make/Model)	2 Missileworks RRC3
Redundancy Plan	One Missileworks altimeter is the main with one acting as a backup. They both set off charges independently of each other
Pad Stay Time (Launch Configuration)	batteries, once avionics are powered on the pad stay time is 1

Recovery Electronics	
Rocket Locators (Make/Model)	Communications Specialist Rocket Hunters beacon
Transmitting Frequencies	223.450, 223.210, 222.180, 223.330
Black Powder Mass Drogue Chute (grams)	4
Black Powder Mass Main Chute (grams)	6

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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
Payload 2	Overview

**Test Plans, Status, and Results**

Ejection Charge Tests	Ground test before both subscale flight and fullscale flight	
Sub-scale Test Flights	Weather conditions: 12mph wind speeds and 10 <sup>0</sup> F; very stable flight; could not recover avionics bay as it was stuck in a tree 40 feet or higher off the ground	
Full-scale Test Flights	Launch 1: 5 mph wind speeds and 40F; stable flight; unsuccessful dual deployment as the main parachute got stuck inside the body tube mph wind speeds and 65F; stable flight; Successful recovery of the launch vehicle	Launch 2: 7

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**Additional Comments**

