

Milestone Review Flysheet

Institution NC State University

Milestone Flight-Readiness Review

Vehicle Properties	
Total Length (in)	125
Diameter (in)	6.2
Gross Lift Off Weigh (lb)	52.6
Airframe Material	G12 Fiberglass
Fin Material	Aircraft-Grade Birch Plywood
Coupler Length	12 in

Motor Properties	
Motor Designation	L2200G
Max/Average Thrust (lb)	697 / 504
Total Impulse (lbf-s)	1147
Mass Before/After Burn	10.5 / 4.9
Liftoff Thrust (lb)	562
Motor Retention	Retainer, 2 x centering ring

Stability Analysis	
Center of Pressure (in from nose)	91.8
Center of Gravity (in from nose)	77.9
Static Stability Margin	2.25
Static Stability Margin (off launch rail)	2.25
MaxThrust-to-Weight Ratio	13.3
Rail Size and Length (in)	1.5 x 1.5 x 144
Rail Exit Velocity	65.3 ft/s

Ascent Analysis	
Maximum Velocity (ft/s)	639
Maximum Mach Number	0.57
Maximum Acceleration (ft/s/s)	409
Target Apogee (From Simulations)	5302
Stable Velocity (ft/s)	52
Distance to Stable Velocity (ft)	4.4

Recovery System Properties				
Drogue Parachute				
Manufacturer/Model		Fruity Chutes / Classic Elliptical		
Size		24 in		
Altitude at Deployment (ft)		Apogee		
Velocity at Deployment (ft/s)		0		
Terminal Velocity (ft/s)		83.9		
Recovery Harness Material		Kevlar		
Harness Size/Thickness (in)		3/4in		
Recovery Harness Length (ft)		25 ft		
Harness/Airframe Interfaces		Tubluar Kevlar Shock Cord / U-bolt with quick link		
Kinetic Energy of Each Section (Ft-lbs)	Section 1	Section 2	Section 3	Section 4
	4607			

Recovery System Properties				
Main Parachute				
Manufacturer/Model		Fruity Chutes / Iris Ultra Toroidal		
Size		168 in		
Altitude at Deployment (ft)		1100		
Velocity at Deployment (ft/s)		81		
Terminal Velocity (ft/s)		9.87		
Recovery Harness Material		Kevlar		
Harness Size/Thickness (in)		1		
Recovery Harness Length (ft)		25 ft		
Harness/Airframe Interfaces		Tubluar Kevlar Shock Cord / U-bolt with quick link		
Kinetic Energy of Each Section (Ft-lbs)	Section 1	Section 2	Section 3	Section 4
	67.8	10.9		

Recovery Electronics	
Altimeter(s)/Timer(s) (Make/Model)	2 x StratologgerCF
Redundancy Plan	Redundant charge fired 1 second after apogee
Pad Stay Time (Launch Configuration)	1 hour

Recovery Electronics	
Rocket Locators (Make/Model)	Big Red Bee 900 MHz GPS
Transmitting Frequencies	900 MHz
Black Powder Mass Drogue Chute (grams)	4.00
Black Powder Mass Main Chute (grams)	3.00

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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 Payload Deployment System will detach the payload from the launch vehicle using a pyrotechnically activated tether-and-release device after the payload bay and fin can have separated. After payload deployment, the Target Differentiation System (TDS), controlled by a Raspberry Pi 3 Model B microcontroller, will control all autonomous tasking for the onboard TDS. The TDS will use a Raspberry Pi Camera Module v2 to capture images of the landing zone. The microcontroller will process the images onboard, locate the targets in the landing zone, and differentiate between them. Once landed, the servo-controlled Upright Landing System (ULS) will deploy and upright the payload from its landing orientation if it is not already upright. Telemetry data from the onboard orientation sensor will confirm the upright landing.
Payload 2	Overview
	N/A

Test Plans, Status, and Results

Ejection Charge Tests	Black powder ejection charge testing took place to confirm calculations. These calculations rely on a constant, which converts cubic inches of pressurized volume to grams of black powder, to find the ideal pressure for a certain separation force. Since calculations assumed empty tubes smaller charges were tested first. Testing for the main recovery system was conducted using the completed nosecone and avionics bay sections. Testing for the drogue chute was conducted using a constructed deployment test rig.
Sub-scale Test Flights	Second Sub-scale launch was conducted on January 21st, 2017 due to minor issues with the first subscale launch that was conducted on December 17th, 2016. Second subscale confirmed design was capable of ejecting payload and safely delivering the launch vehicle and payload to the ground. Full-scale was built on confidence in design provided by the second subscale launch.
Full-scale Test Flights	The full-scale test flight took place on February 25 or 26, 2017. The test validated all launch vehicle and payload systems and provide confidence in mission success of target altitude. However, fin can detached from parachute and fell ballistic and the payload failed to engage target differentiation system and upright landing system, but recovery system safely delivered payload to the ground. Fin Section was mostly recovered and repairs and redesigns are being made leading up to the next test launch currently scheduled for March 18th. A back up launch is also available for March 25th in

case of weather issues.

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Additional Comments