Milestone Review Flysheet

Institution	North Carolina State University

Milestone	Preliminary Design Review

Vehicle Properties	
Total Length (in)	113
Diameter (in)	6.2
Gross Lift Off Weigh (lb)	46.2
Airframe Material	Fiberglass
Fin Material	Aircraft-Grade Birch Plywood
Coupler Length	8 in

Motor Properties	
Motor Designation	L1120W
Max/Average Thrust (lb)	349.57 / 220.91
Total Impulse (lbf-s)	1106.51
Mass Before/After Burn	10.27 lbs / 4.19 lbs
Liftoff Thrust (lb)	1375
Motor Retention	Retainer, engine mount, centering ring

Stability Analysis	
Center of Pressure (in from nose)	84.8
Center of Gravity (in from nose)	71.7
Static Stability Margin	2.12
Static Stability Margin (off launch rail)	2.1
Thrust-to-Weight Ratio	7.6
Rail Size and Length (in)	1.5 x 1.5 x 144
Rail Exit Velocity	59.2 fps

Ascent Analysis	
Maximum Veloxity (ft/s)	604
Maximum Mach Number	0.54
Maximum Acceleration (ft/s^2)	217
Target Apogee (From Simulations)	5455 ft
Stable Velocity (ft/s)	59.2
Distance to Stable Velocity (ft)	9.83

Recovery System Properties				
Dogue Parachute				
Manufacturer/Model		Fruity Chutes / Iris Ultra		
Size		2 ft (dia)		
Altitude at Deployment (ft)			5280	
Velocity at Deployment (ft/s)			0	
Terminal Velocity (ft/s)			90	
Recovery Harness Material			Kevlar	
Harness Size/Thickness (in)			0.5	
Recovery Harness Length (ft)			25	
Harness/Airframe Interfaces		U-bolt with quick link		
Kinetic Energy of Each Section (Ft-lbs)	Section 1	Section 2	Section 3	Section 4
	2457	2476		

Recovery System Properties				
Main Parachute				
Manufacturer/Model		Fruity Chutes / Iris Ultra		
Size		15 ft (dia)		
Altitude at Deployment (ft)			700	
Velocity at Deployment (ft/s)			90	
Terminal Velocity (ft/s)			8.5	
Recovery Harness Material			Kevlar	
Harness Size/Thickness (in)			0.5	
Recovery Harness Length (ft)			16	
Harness/Airframe Interfaces		Black powder charge and u-bolt with quick link		
Kinetic Enerfy of Each Section (Ft-lbs)	Section 1	Section 2	Section 3	Section 4
	4	18	22	

Recovery Electonics	
Altimeter(s)/Timer(s) (Make/Model)	Stratologger SL100, Entacore AIM 3.0
Redundancy Plan	Redundant charge fired 1 second after apogee
Pad Stay Time (Launch Configuration)	1 hour

Recovery Electonics	
Rocket Locators (Make/Model)	BigRedBee 900 MHz GPS
Transmitting Frequencies	***Required by CDR***
Black Powder Mass Drogue Chute (grams)	2.0
Black Powder Mass Main Chute (grams)	2.5

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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
	Include Description of rail locking mechanism
Igniter Installation Mechanism	Overview
	N/A

Payload	
Payload 1	Overview
	After payload deployment, the Upright Landing System (ULS) will automatically deploy from its stowed position. Two completely redundant target differentiation systems (TDS) on the payload, one run with a Raspberry Pi and the other with a BeagleBone Black, will control all autonomous tasking for the (collective) on-board target differentiation system. Each computer will control a camera used to take images of the targets and will process the images to identify and differentiate between the targets. The two systems managed by the microcontrollers are completely redundant and as such will perform all task simultaneously. The payload recovery system will manage the descent velocity of the payload and the ULS will absorb the shock from ground contact and ensure a stable and upright landing of the payload.
Payload 2	Overview
	N/A

Test Plans, Status, and Results	
Ejection Charge Tests	In order to ensure that the altimeters used for ejection charges onboard the rocket execute correctly, altimeters will be placed in a vacuum chamber and will be hooked up to an LED. If the LED illuminates at the correct pressure, then it will be deemed worthy for flight. The same test will be run on the altimeters that will be used for the air brake system. Black powder ejection charge testing will take place to confirm calculations performed in §3.2 of the PDR. These calculations rely on a constant to find the ideal pressure for a certain separation force. Testing will start with the calculated amount of black powder loaded into a mock-up of each section that is weighted and connected appropriately. Further tests will be performed until the sections separate by the appropriate amount.
Sub-scale Test Flights	The subscale test flight is scheduled for December 17-18, 2016. During this test, the primary mission system designs will be validated and any failures will be accounted for in future documentation. The subscale payload will not incorporate redundant target recognition subsystems. The launch vehicle will test in-flight payload deployment and validate recovery systems for launch vehicle and payload. Altimeter accuracy will also be validated during these tests.
Full-scale Test Flights	The full-scale test flight will take place in February, 2017 (specific date is unknown at this time). This test will validate all launch vehicle and payload systems and provide complete confidence in mission success prior to FRR. Paylaod will implement fully redundant target recognition subsystems and full-scale recovery devices. Payload deployment (that was validated during subscale) will be tested for complete success. Launch vehicle recovery system timing and sizing will be confirmed. Target apogee and altimeter accuracy will be tested and necessary weight adjustments will be made in the weeks preceeding FRR.

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Additional Comments