Milestone Review Flysheet

Please see Milestone Review Flysheet Instructions.

Institution	University of Louisville

Milestone	FRR

Vehicle Properties	
Total Length (in)	143
Diameter (in)	6.17
Gross Lift Off Weight (lb)	42.9
Airframe Material	Fiberglass
Fin Material	Fiberglass
Drag	Drag coefficient: 0.45

Motor Properties	
Motor Manufacturer(s)	Cesaroni
Motor Designation(s)	L935-IM
Max/Average Thrust (lb)	356.5/209.9
Total Impulse (lbf-sec)	707.4
Mass (before, after burn)	5.6, 1.8
Liftoff Thrust (lb)	148.4

Stability Analysis	
Center of Pressure (in from nose)	99.79
Center of Gravity (in from nose)	88.37
Static Stability Margin	1.85
Thrust-to-Weight Ratio	4.89
Rail Size (in)/ Length (in)	120
Rail Exit Velocity (ft/s)	61.7

Ascent Analysis		
Maximum Velocity (ft/s)	415	
Maximum Mach Number	0.37	
Maximum Acceleration (ft/s^2)	218	
Target Apogee (1st Stage if Multiple Stages)	2918	
Stable Velocity (ft/s)	50	
Distance to Stable Velocity (ft)	7.9	

Recovery System Properties				
Upper Airframe Parachute				
Manufacturer/Model	Vortex Ring - custom made			
Size	29.2 ft^2			
Altitude at Deployment (ft)	3000			
Velocity at Deployment (ft/s)	0			
Terminal Velocity (ft/s)	16.2			
Recovery Harness Material	9/16" tubular nylon			
Harness Size/Thickness (in)	9/16"			
Recovery Harness Length (ft)	42			
Harness/Airframe Interfaces	1/4 inch U-bolt and quick link connected to a swivel and qiucklink.			
Kinetic Energy of Each Section (ft-lbs)	Section 1 (Upper Airframe)	Section 2	Section 3	Section 4
	60			

Recovery System Properties				
Lower Airframe Parachute				
Manufacturer/Model	Cruciform - custom made			
Size	132.2 ft^2			
Altitude at Deployment (ft)	1500			
Velocity at Deployment (ft/s)	14.67			
Terminal Velocity (ft/s)	13.64			
Recovery Harness Material	9/16" tubular nylon			
Harness Size/Thickness (in)	9/16"			
Recovery Harness Length (ft)	18			
Harness/Airframe Interfaces	1/4 inch U-bolt and quick link			
Kinetic Energy of Each Section (ft-lbs)	Section 1 (Lower Airframe)	Section 2 (Cache Capsule)	Section 3	Section 4
	60	10		

Recovery Electronics	
Altimeter(s)/Timer(s) (Make/Model)	PerfectFlite StratoLogger (x6)
Redundancy Plan	Each avionics bay will utlize a StatoLogger for a primary altimeter and will have a StratoLogger as a back up altimeter.

Recovery Electronics	
Rocket Locators (Make/Model)	Garmin Astro DC 40 (x2) EggFinder (x1)
Transmitting Frequencies	Garmin Astro DC 40 - 151880 MHz EggFinder - 900 MHz
Black Powder Mass Upper Airframe Chute (grams)	4

Pad Stay Time (Launch Configuration)	1 hour

Black Powder Lower Airframe Chute (grams)	4

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Autonomous Ground Support Equipment (AGSE)

Capture Mechanism	Overview A threadless screw will move down the height of the ground station where two gripper arms will grab the payload. From there, they will raise to system height, the rod rotates 90 degrees and then inserts the paylaod into the vehicle.
Container Mechanism	Overview The cache will be inserted into two clips, located inside the capsule. The clips mechanically retain the capsule. The doors to the capsule are actuated via servo, further retaining the door.
Launch Rail Mechanism	Overview The rail will not be locked in place, instead, a screw mechanism will guide the tower to the proper position. A motor will monitor and provide necessary torque to keep the platform at the 5 degree of vertical postion as stated from the statement of work. The motor will monitor and provide required torque to maintain position.
Igniter Installation Mechanism	Overview The igniter will be augmented with dowel rods and aluminum tape for shielding. Four wheels will extrude the igniter wire until it is in the proper placement in the vehicle. A magnetic field sensor will detect a magnetic flag on the wire to ensure proper placement.
CG Location of Launch Pad (in inches) When Rail is Horizontal (Use Base of Rail as the Reference Point)	
Moment Analysis	Vehicle horizontal: 22 inches (relative to ground) Vehicle in launch position: 26 inches (relative to ground)

Payload

Payload 1	Overview Custom weather sensing (wind speed, wind direction, and temperature) will be placed on the ground station to get a gradient of conditions that would effect flight. This data will be transmitted via bluetooth communications to the vehicle during flight to be recovered with the cache system.
Payload 2	Overview

Test Plans, Status, and Results

Ejection Charge Tests	All ejection charges will be tested on the ground prior to flight to ensure that black powder charges are all properly sized.
Sub-scale Test	A subscale vortex ring was constructed and tested. This was used to verrify the design and the coefficient of drag that can be achived for the parachute.

Flights	
Full-scale Test Flights	The full scale rocket was flight tested. This verrified the stability of the rocket, that the seal on the door was adequate to withstand aerodynamic forcess on the airframe, fin retention system. There was no interference experienced between the GPS and the sensitive electronics. The deployment of a custom made vortex ring parachute and unique deplyment bag was flight tested sucessfully. A secondary full scale flight test is currently scheduled for March 28th with a backup on March 29th.

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Additional Comments

Unconventional payload deployment with use of cache capsule at 1,000 feet by use of fairing ejection system.