Milestone Review Flysheet 2017-2018

Institution	University of Akron

Milestone	FRR

Vehicle Properties	
Total Length (in)	101
Diameter (in)	5.35
Gross Lift Off Weigh (lb.)	38.7
Airframe Material(s)	Fiberglass, Carbon Fiber
Fin Material and Thickness (in)	0.125 Fiberglass
Coupler Length/Shoulder Length(s) (in)	10, 20

Motor Properties	
Motor Brand/Designation	Cesaroni L1050
Max/Average Thrust (lb.)	271.7/235.2
Total Impulse (lbf-s)	837.9
Mass Before/After Burn (lb.)	7.60/3.91
Liftoff Thrust (lb.)	250
Motor Retention Method	Centering rings epoxied to motor mount tube

Stability Analysis	
Center of Pressure (in from nose)	77.39
Center of Gravity (in from nose)	64.15
Static Stability Margin (on pad)	2.57
Static Stability Margin (at rail exit)	2.61
Thrust-to-Weight Ratio	7.2
Rail Size/Type and Length (in)	144
Rail Exit Velocity (ft/s)	65.1

Ascent Analysis	
Maximum Velocity (ft/s)	603
Maximum Mach Number	0.54
Maximum Acceleration (ft/s^2)	204
Predicted Apogee (From Sim.) (ft)	5,278

Recovery System Properties				
Drogue Parachute				
Manufacturer/Model			Elliptical Handmade	
Size/Diameter (in or ft)			17 in.	
Altitude at Deployment (ft)			5278 (Apogee)	
Velocity at Deployment (ft/s)			0	
Terminal Velocity (ft/s)			120	
Recovery Harness Material			Tubular Webbed Nylon	
Recovery Harness Size/Thickness (in)			3/4	
Recovery Harness Length (ft)			10.94	
Harness/Airframe Interfaces		Quick link of shock cord to U-bolt through quick-link.		
Kinetic Energy of Each Section (Ft-lbs)	Section 1	Section 2	Section 3	Section 4
	3909.6	3650.4	n/a	n/a

Recovery System Properties				
Main Parachute				
Manufacturer/Model			Toroidal Handmade	
Size/Diameter (in or ft)			106.5 in.	
Altitude at Deployment (ft)			500	
Velocity at Deployment (ft/s)			120	
Terminal Velocity (ft/s)			16.05	
Recovery Harness Material			Tubular Webbed Nylon	
Recovery Harness Size/Thickness (in)			3/4	
Recovery Harness Length (ft)			24	
Harness/Airframe Interfaces		Quick link of shock cord to U-bolt through quick-link.		
Kinetic Energy of Each Section (Ft-lbs)	Section 1	Section 2	Section 3	Section 4
	69.97	65.36	n/a	n/a

Recovery Electronics	
Altimeter(s)/Timer(s) (Make/Model)	RRC3 Sport Altimeter System by Missile Works
Redundancy Plan and Backup Deployment Settings	Dual RRC3 Sport Altimiters, with individual 2-Pole Rotary Switch and 9 Volt Batteries
Pad Stay Time (Launch Configuration)	(2 hours) Both altimeters and the GPS must be turned on before launch

Recovery Electronics		
Rocket Locators (Make/Model)		Missile Works RTx GPS
Transmitting Frequencies (all - vehicle and payload)		902-928 MHz (alternative option is big red bee at ~400 MHz which will have less interference than a higher frequency but requires a ham radio license)
Ejection System Energetics (ex. Black Powder		Black Powder
Energetics Mass - Drogue Chute (grams)	Primary	5
	Backup	6
Energetics Mass - Main Chute (grams)	Primary	n/a
	Backup	n/a
Energetics Masses - Other (grams) - If Applicable	Primary	n/a
	Backup	n/a

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Payload	
	Overview
Payload 1 (official payload)	Deployable Two-Wheeled self-balancing autonomous rover. To be pushed from Payload Bay using a spring loaded system once rocket nosecone is ejected via black powder charge. Once deployed, the rover will traverse at least 10 feet from its starting position. Will use ultrasonic sensors for obstacle avoidance while traversing terrain. Will deploy solar panels via spring loaded panel once predetermined distance is reached.
	Overview
Payload 2 (non-scored payload)	

Test Plans, Status, and Results	
Ejection Charge Tests	Ejection charge tests will be conducted upon the completion and/or modification of any or all of the following rocket systems: the rocket airframe and the parachute. Additionally, tests will be conducted prior to all full scale test launches, as well as all competion launches. The initial ejection tests will used to help identify the ideal amount of black powder to use to successfully have a recovery separation with full clearance. All other tests will be to ensure that the system works in its entirety before the rocket has been loaded onto its lauch rail. Each test will be led by the members of the recovery subsystem with assistance from the recovery leads, a member from the electronics subsystem, a member from the aerostructure subsytem, and the safety office.
Sub-scale Test Flights	The Sub-scale flight was on January 7th. The launch took place at the team mentor, Jerry Appenzeller's field (Amherst, OH) with seven students. This launch was ideally to be done with a student-wound nosecone and body tube, however timeline constraints required that the team use commercial body tube and nose cone. In addition, the subscale rocket allowed for avionics to confirm distances and signal strength for compatibility with material choices. All variations between the subscale and fullscale material or design choices are recorded and analyzed in the CDR report.
Full-scale Test Flights	The full-scale test flight was held on March 3rd. The force from the launch caused the airbrakes' motor to dislodge from their fin-actuator. During flight, after the vehicle left the launch rail, the rocket cantered with the wind; this caused the rocket's stability to take over and re-adjust it's flight profile. The centripical force from these series of events caused the airbrakes to deploy (the airbrakes are normally locked by their motor, which was disconnected from liftoff). When the airbrakes deployed it decreased the rocket's stability, this caused the batteries for the altimeters to become detached from their fasteners; unfortunately, depriving the altimeters from firing the drogue parachute. The team is preparing for a second test launch to be achieved in the next coming weeks.

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Additional Comments