Milestone Review Flysheet 2017-2018

Institution	University of Louisville

Milestone	CDR

Vehicle Properties	
Total Length (in)	133
Diameter (in)	6.25
Gross Lift Off Weigh (lb.)	47.22
Airframe Material(s)	Carbon fiber
Fin Material and Thickness (in)	Carbon fiber, 0.125
Coupler Length/Shoulder Length(s) (in)	12/6

Motor Properties	
Motor Brand/Designation	Aerotech L2200
Max/Average Thrust (lb.)	700/434
Total Impulse (lbf-s)	1147.43
Mass Before/After Burn (lb.)	10.46/4.92
Liftoff Thrust (lb.)	697.31
Motor Retention Method	Custom aluminum retainer

Stability Analysis	
Center of Pressure (in from nose)	92.26
Center of Gravity (in from nose)	78.46
Static Stability Margin (on pad)	5.35
Static Stability Margin (at rail exit)	2.21
Thrust-to-Weight Ratio	14.44
Rail Size/Type and Length (in)	1515/144
Rail Exit Velocity (ft/s)	94.5

Ascent Analysis	
Maximum Velocity (ft/s)	702
Maximum Mach Number	0.63
Maximum Acceleration (ft/s^2)	457
Predicted Apogee (From Sim.) (ft)	5,435

Recovery System Properties Drogue Parachute				
Manufacturer/Model			In House	
Size/Diameter (in or ft)			30 in.	
Altitude at Deployment (ft)			apogee / apogee - 64.2 ft.	
Velocity at Deployment (ft/s)			0 ft/s / ~64.2 ft/s	
Terminal Velocity (ft/s)			89.5	
Recovery Harness Material			tubular nylon shock cord	
Recovery Harness Size/Thickness (in)			9/16 in.	
Recovery Harness Length (ft)			112 in. / 264 in. / 64 in.	
Harness/Airframe Interfaces		5/16 in. zinc plated steel quick-links, rated for 1200 lbs. (Nosecone-Payload drogue)(Payload drogue-ARRD)(Booster drogue-Coupler)		
Kinetic Energy of Each Section (Ft-lbs)	Section 1	Section 2	Section 3	Section 4
	43	238.3	17.1	169.9

Recovery System Properties Main Parachute				
Manufacturer/Model			In House	
Size/Diameter (in or ft)			88 in./99 in.	
Altitude at Deployment (ft)			500 ft.	
Velocity at Deployment (ft/s)			89.5	
Terminal Velocity (ft/s)			20.7	
Recovery Harness Material			tubular nylon shock cord	
Recovery Harness Size/Thickness (in)			9/16 in.	
Recovery Harness Length (ft)			264 in. / 216 in.	
Harness/Airframe Interfaces		5/16 in. zinc plated steel quick-links, rated for 1200 lbs. (Payload main-Bulkplate)(Booster main-Bulkplate)		
Kinetic Energy of Each Section (Ft-lbs)	Section 1	Section 2	Section 3	Section 4
	43.8	65	17.47	65

Recovery Electronics	
Altimeter(s)/Timer(s) (Make/Model)	PerfectFlite StratologgerCF
Redundancy Plan and Backup Deployment Settings	Two Redundant stratologgerCf's for each release/separation event. Redundant BP charge for each separation event. Redundant e-match for ARRD activation.
Pad Stay Time (Launch Configuration)	3.8 hours

Recovery Electronics		
Rocket Locators (Make/Model)		Skytraq, Trackimo, Eggfinder, AIM XTRA
Transmitting Frequencies (all vehicle and payload)		Vehicle - Skytraq (902-928MHz), Trackimo (850, 900, 1800, 1900 MHz), Eggfinder (900MHz), AIM XTRA (433 MHz) Payload -
Ejection System Energetics (ex. Black Powder)		Black Powder
Energetics Mass - Drogue Chute (grams)	Primary	1.23/3.27
	Backup	1.23/3.27
Energetics Mass - Main Chute (grams)	Primary	1.02
	Backup	1.02
Energetics Masses - Other (grams) - If Applicable	Primary	.1 (ARRD)
	Backup	second e-match in ARRD

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Payload	
Payload 1 (official payload)	Overview The experimental payload will be a deployable rover with foldable solar cell panels. All systems of the payload will be completely enclosed and secured via a high strength locking mechanism inside the launch vehicle for the duration of the flight and recovery. During landing, the payload's orientation correction system will ensure upright orientation of the rover prior to deployment. After gaining RSO permission, a team memebr will send a deployment signal to the on-board receiver module unlocking the rover. The rover will then autonomously drive at least five feet from the launch vehicle to a final destination. At this point, the rover will deploy a set of foldable solar cell panels. This marks the conclusion of the primary mission of the payload. The secondary mission will be taking images of the rover and surrouding area for data collection. The secondary mission of the payload will have no effect on its ability to successfully complete the primary mission.
Payload 2 (non-scored payload)	Overview The secondary expermental payload will be the variable drag system. The entire system will fit inside of a 12" coupler with three slots that allow the three aluminum drag blades to actuate from the coupler. The drag blades increase the drag coefficient of the vehicle as they actuate, in return slowing the rocket and allowing for a contolled target apogee altitude.

Test Plans, Status, and Results	
Ejection Charge Tests	Subscale ejection tests were completed prior to each of the two flights and were successful. Requirement 2.24 will be complied with prior to each full scale launch as each separating section will be ground tested with the intended amount of black powder for flight. A successful ejection charge test for each section of the full scale vehicle will be required in order to launch the vehicle.
Sub-scale Test Flights	The subscale vehicle was launched twice, once on November 11th and once on December 2nd. On the November 11th launch, the vehicle ascended stably before successfully deplying it's drogue parachute at apogee. However, at 600ft the main parachute failed to deploy, due to tangling ofthe drogue and nose cone, as well as an oversized main bag. For the December 2nd launch, the drogue parachute was manufactured using a more precise method which resulted in less spinning and no tangling. The vehicle ascended stably once again, and deployed drogue at apogee. During drogue phase, the nose cone spun minimally and did not tangle with the nose cone. At 600ft, the main parachute successfully deployed and the subscale vehicle was recovered successfully.
Full-scale Test Flights	The first full-scale test flight is scheduled for February 10th, followed by a launch on 2/17, 2/24, and 3/10. These dates are flexible and may be moved due to weather or unexpected manufacturing delays.

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Additional Comments