Milestone Review Flysheet 2017-2018

Institution	Cornell University

Milestone	CDR

Vehicle Properties	
Total Length (in)	103
Diameter (in)	5.15
Gross Lift Off Weigh (lb.)	37.3
Airframe Material(s)	G12 Fiberglass
Fin Material and Thickness (in)	3/32" G10 Fiberglass
Coupler Length/Shoulder Length(s) (in)	3", 4", 11", 10"

Motor Properties	
Motor Brand/Designation	AeroTech L1520T
Max/Average Thrust (lb.)	381.5/339.7
Total Impulse (lbf-s)	847.3
Mass Before/After Burn (lb.)	7.98/4.07
Liftoff Thrust (lb.)	356
Motor Retention Method	Screw-On

Stability Analysis	
Center of Pressure (in from nose)	78.3
Center of Gravity (in from nose)	59.34
Static Stability Margin (on pad)	3.68
Static Stability Margin (at rail exit)	3.5
Thrust-to-Weight Ratio	9.1
Rail Size/Type and Length (in)	1515/144
Rail Exit Velocity (ft/s)	81.5

Ascent Analysis	
Maximum Velocity (ft/s)	659
Maximum Mach Number	0.59
Maximum Acceleration (ft/s^2)	306
Predicted Apogee (From Sim.) (ft)	5478

Recovery System Properties Drogue Parachute (forward Section/Booster Section)				
Manufacturer/Model			Fruity Chutes	
Size/Diameter (in or ft)			15"/18"	
Altitude at Deployment (ft)			5280	
Velocity at Deployment (ft/s)			0	
Terminal Velocity (ft/s)			82.19/76.74	
Recovery Harness Material			Kevlar	
Recovery Harness Size/Thickness (in)			1/2"	
Recovery Harness Length (ft)			25'	
Harness/Airframe Interfaces		1" forged steel eyebolts		
Kinetic Energy of Each Section (Ft-lbs)	Forward	Booster	Section 3	Section 4
	1553.77	1700.56	N/A	N/A

Recovery System Properties Main Parachute (forward Section/Booster Section)				
Manufacturer/Model			Spherachutes	
Size/Diameter (in or ft)			72"/96"	
Altitude at Deployment (ft)			500/500	
Velocity at Deployment (ft/s)			82.19/76.74	
Terminal Velocity (ft/s)			16.76/14.14	
Recovery Harness Material			Kevlar	
Recovery Harness Size/Thickness (in)			1/2"	
Recovery Harness Length (ft)			25'	
Harness/Airframe Interfaces		1" forged steel eyebolts		
Kinetic Energy of Each Section (Ft-lbs)	Forward	Booster	Section 3	Section 4
	64.63	57.76	N/A	N/A

Recovery Electronics	
Altimeter(s)/Timer(s) (Make/Model)	Missile Works RRC3
Redundancy Plan and Backup Deployment Settings	Missile Works RRC3
Pad Stay Time (Launch Configuration)	1 hour minimum

Recovery Electronics		
Rocket Locators (Make/Model)	BigRedBee 100mW BeeLine/CRT 100mW	
Transmitting Frequencies (all - vehicle and payload)	420 MHz, 424MHz, 433 MHz, 470 MHz	
Ejection System Energetics (ex. Black Powder		
Energetics Mass - Nose Cone Ejection (grams)	Primary	2.175
	Backup	3.263
Energetics Mass - Forward/Booster Separation (grams)	Primary	0.15
	Backup	0.225
Energetics Masses - AV/Booster Separation (grams)	Primary	3.525
	Backup	5.288

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Payload	
	Overview
Payload 1 (official payload)	The official payload is the Deployable Rover System (DRS). During flight, a two-wheeled, autonomous rover is stored securely inside the launch vehicle. After landing, a remote signal is received by the DRS, triggering a lead screw mechanism that deploys the rover from within the airframe. The rover then navigates to at least 5 ft away from the airframe, using time-of-flight distance sensors to detect and avoid obstacles. Upon reaching its final location, solar panels on the top of the chassis are unfolded using a servo motor.
	Overview
Payload 2 (non-scored payload)	

Test Plans, Status, and Results	
Ejection Charge Tests	CRT will test black powder charge amounts, wiring electrnics, section ejections, and parachute deployment by conducting ground testing. CRT will place the determined black powder charge amounts within the launch vehicle, and manually ignite ejection charges. In order for ground testing to be successful, all section must separate fully, parachutes must be pulled out of the launch vehicle, and the separable wiring must separate without any damage to the launch vehicle.
Sub-scale Test Flights	CRT launched its sub-scale vehicle on 10/28. The sub-scale results showed that the planned recovery system of the launch vehicle could successfully recover both sections of the launch vehicle. The separable wiring succeeded in deploying the forward section separation charges.
Full-scale Test Flights	CRT will conduct a full-scale test flight using the fully constructed launch vehicle in order to verify that the separable wiring works properly and to adjust the ballast mass and drag coefficients in order to more accurately reach the target apogee of 5280 ft.

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Additional Comments

The main and drogue parachutes for the forward section of the launch vehicle are ejected from the launch vehicle when the nose cone separates. The drogue parachute deploys immediately after that and the main parachute is held shut by two Jolly Logic Chute Releases until the launch vehicle has descended to 500 ft. Next, forward and booster sections separate. After this, the AV bay separates from the booster section, pulling the main and drogue parachutes for the booster section from the launch vehicle. Again, the drogue parachute is deployed immediately and the main parachute is held shut by two Jolly Logic Chute Releases until the launch vehicle has descended to 500 ft. The projected apogee is higher than 1 mile because CRT has found that the OpenRocket Simulations overestimate the apogee the launch vehicle will reach.