Milestone Review Flysheet 2017-2018

Institution	Piedmont Virginia Community College

Milestone	CDR

Vehicle Properties	
Total Length (in)	105
Diameter (in)	6.17
Gross Lift Off Weigh (lb.)	43.6
Airframe Material(s)	G12 Fiberglass & ABS Plastic
Fin Material and Thickness (in)	G10 Fiberglass, 1/4 in.
Coupler Length/Shoulder Length(s) (in)	6

Motor Properties	
Motor Brand/Designation	Aerotech L1420R
Max/Average Thrust (lb.)	319.2
Total Impulse (lbf-s)	1034.8
Mass Before/After Burn (lb.)	10.06 / 4.41
Liftoff Thrust (lb.)	349
Motor Retention Method	AeroPack Screw-On Retainer

Stability Analysis	
Center of Pressure (in from nose)	73
Center of Gravity (in from nose)	52
Static Stability Margin (on pad)	3.5
Static Stability Margin (at rail exit)	3.6
Thrust-to-Weight Ratio	7.5:1
Rail Size/Type and Length (in)	1515, 144 in.
Rail Exit Velocity (ft/s)	63

Ascent Analysis	
Maximum Velocity (ft/s)	717.76
Maximum Mach Number	0.65
Maximum Acceleration (ft/s^2)	273
Predicted Apogee (From Sim.) (ft)	5252

Recovery System Properties				
Drogue Parachute				
Manufacturer/Model		Main with Chute Release		
Size/Diameter (in or ft)		24 in. effective diameter		
Altitude at Deployment (ft)		Apogee / 5252 ft		
Velocity at Deployment (ft/s)		0		
Terminal Velocity (ft/s)		119.3		
Recovery Harness Material		Tubular Kevlar		
Recovery Harness Size/Thickness (in)		1/2 in.		
Recovery Harness Length (ft)		26		
Harness/Airframe Interfaces		Harness -> swivel -> 2 quick links -> 2 U-boolts. Same at both ends.		
Kinetic Energy of Each Section (Ft-lbs)	Section 1	Section 2	Section 3	Section 4
	~0	~0	N/A	N/A

Recovery System Properties				
Main Parachute				
Manufacturer/Model		Rocketman Parachutes / Standard Recovery System		
Size/Diameter (in or ft)		14 ft		
Altitude at Deployment (ft)		800		
Velocity at Deployment (ft/s)		119.3		
Terminal Velocity (ft/s)		15.3		
Recovery Harness Material		Tubular Kevlar		
Recovery Harness Size/Thickness (in)		1/2 in.		
Recovery Harness Length (ft)		26		
Harness/Airframe Interfaces		Harness -> swivel -> 2 quick links -> 2 U-bolts. Same at both ends.		
Kinetic Energy of Each Section (Ft-lbs)	Section 1	Section 2	Section 3	Section 4
	44.9	70.2	N/A	N/A

Recovery Electronics	
Altimeter(s)/Timer(s) (Make/Model)	Primary: Altus Metrum / EasyMega Secondary: Missile Works / RRC3
Redundancy Plan and Backup Deployment Settings	Two altimeters with separate switches and batteries. Second charge at apogee + 2 s, third at apogee + 4 s, fourth at apogee + 6
Pad Stay Time (Launch Configuration)	Primary: 2+ hours; Secondary: 23 hours

Recovery Electronics		
Rocket Locators (Make/Model)	Adafruit Ultimate GPS Module v3	
Transmitting Frequencies (all - vehicle and payload)	Main data + GPS: 902 - 928 MHz Video: 5.8 GHz	
Ejection System Energetics (ex. Black Powder)		Black Powder
Energetics Mass - Drogue Chute (grams)	Primary	3.8
	Backup	4.7
Energetics Mass - Main Chute (grams)	Primary	4.7
	Backup	4.7
Energetics Masses - Other (grams) - If Applicable	Primary	1
	Backup	N/A

Milestone Review Flysheet 2017-2018

Institution	Piedmont Virginia Community College

Milestone	CDR

Payload	
Payload 1 (official payload)	Overview
	Six wheeled rover. Rover is mounted in nosecone, which is ejected after landing. The nosecone splits into two pieces after separation, allowing the rover to fall out. The rover then rotates three of its wheels 90°; this configuration, with half of the wheels out of sync, is used throughout the rover's mission. The rover then moves away from the landing point, using an infrared distance sensor to detect and avoid obstacles. It uses its GPS position to determine when it has moved far enough away. The rover transmits data throughout its mission, and can optionally transmit video on a different frequency.
Payload 2 (non-scored payload)	Overview
	N/A

Test Plans, Status, and Results	
Ejection Charge Tests	A full scale ejection charge test will most likely be performed on the weekend of Jan. 27-28. This test will involve attempting to separate the rocket when it is prepped as for flight. Both ejection charge sizes (3.8 and 4.7 grams) will be tested.

Sub-scale Test Flights	A subscale version of the rocket was flown at the Battle Park TRA launch site near Culpeper, VA on Dec. 16th. The flight to apogee was successful, proving out the stability of the airframe, and providing data to refine full scale altitude predictions and coefficient-of-drag calculations. Despite a sucessful ejection charge test earlier, the subscale did not separate at apogee and came back on a ballistic trajectory. One of the altimeters survived, and it shows that all four ejection charges fired at the correct times / altitudes. The cause of the failure is believed to be the force of launch pushing the parachute and blast protector against the upper end of the avionics bay, where they became stuck on exposed threaded rods; this created a seal that prevented the gasses from the ejection charge from reaching the separation point. To prevent this from happening again, the avionics and ejection charges were moved to the other end of the parachute tube and now face downwards. This means that the acceleration of launch and the ejection charges are pushing the parachute in the same direction. Also, acorn nuts will be used to cap off the ends of the threaded rods.
Full-scale Test Flights	The full-scale rocket will be flown at Battle Park on Feb. 3rd. The first flight will just test the stability of the airframe and the reliability of the recovery system. Subsequent flights will test the altitude control system (cold gas thrusters) and the depoyment and operation of the payload.

Milestone Review Flysheet 2017-2018

Institution	Piedmont Virginia Community College

Milestone	CDR

Additional Comments