Milestone Review Flysheet 2019-2020

Institution	The University of Alabama in Huntsville

Milestone	CDR

Vehicle Properties

Total Length (in)	135
Diameter (in)	6
Gross Lift Off Weigh (lb)	54
Airframe Material(s)	Fillament wound fiberglass
Fin Material and Thickness (in)	GT10 Fiberglass, 1/8" thick
Coupler Length(s)/Shoulder Length(s) (in)	14 / 6

Motor Properties

Motor Brand/Designation	AeroTech L2200G
Max/Average Thrust (lb)	697/495
Total Impulse (lbf-s)	1147
Mass Before/After Burn (lb)	12.81/7.26
Liftoff Thrust (lb)	562
Motor Retention Method	Aeropack aft thread-on retainer

Stability Analysis

Center of Pressure (in. from nose)	97.5
Center of Gravity (in. from nose)	82.7
Static Stability Margin (on pad)	2.4
Static Stability Margin (at rail exit)	2.4
Thrust-to-Weight Ratio	8.87
Rail Size/Type and Length (in)	20x20 rail and 144 inches
Rail Exit Velocity (ft/s)	73

Ascent Analysis

Maximum Velocity (ft/s)	588
Maximum Mach Number	0.53
Maximum Acceleration (ft/s^2)	383
Target Apogee (ft)	4500
Predicted Apogee (From Sim.) (ft)	4577

Recovery System Properties - Overall

Total Descent Time (s)	72.8
Total Drift in 20 mph winds (ft)	1435

Recovery System Properties - Energetics

Ejection System Energetics (ex. Black Powder		Black Powder
Energetics Mass - Drogue Chute (grams)	Primary	To Be Determined
	Backup	TBD
Energetics Mass - Main Chute (grams)	Primary	TBD
	Backup	TBD
Energetics Mass - Other (grams) - If Applicable	Primary	TBD
	Backup	TBD

Payload Deployment

Location: Air or Ground (if applicable)	Ground
Altitude of Deployment (if applicable)	N/A

Recovery System Properties - Recovery Electronics

Primary Altimeter Make/Model	Perfect Flite StratoLogger CF
Secondary Altimeter Make/Model	Perfect Flite StratoLogger CF
Other Altimeters (if applicable)	N/A
Rocket Locator (Make/Model)	Xbee Pro-S3B
Additional Locators (if applicable)	N/A
Transmitting Frequencies (all - vehicle and payload)	902-928 Mhz [vehicle], 2.4 Ghz [payload]
Pad Stay Time (Launch Configuration)	Up to 70 hours
Describe Redundancy Plan (batteries, switches, etc.)	Two power sources. Redundant charges for both drogue and main

Recovery System Properties - Drogue Parachute

Manufacturer/Model			Fruity Chutes/CFC-18" Elliptical	
Size or Diameter (in or ft)			18	
Main Altimeter Deployment Setting			4500 ft	
Backup Altimeter Deployment Setting			1 second after main	
Velocity at Deployment (ft/s)			0	
Terminal Velocity (ft/s)			127.33	
Recovery Harness Material, Size, and Type (examples - 1/2 in. tubular Nylon or 1 in. flat Kevlar strap)			1 in Tubular Nylon Webbing	
Recovery Harness Length (ft)			60 ft	
Harness/Airframe Interfaces		3/8" 11/16" Eyebolts on bulkheads, 3/8" Zinc Plated Oval Quick Links to eyebolts		
Kinetic Energy (Ft-lbs)	Section 1	Section 2	Section 3	Section 4
	8199.8	3595		

Recovery System Properties - Main Parachute

Manufacturer/Model			Fruity Chutes/IFC-144" Iris Ultra	
Size or Diameter (in or ft)			144	
Main Altimeter Deployment Setting (ft)			600 ft	
Backup Altimeter Deployment Setting (ft)			550 ft	
Velocity at Deployment (ft/s)			127.33	
Terminal Velocity (ft/s)			13.28	
Recovery Harness Material, Size, and Type (examples - 1/2 in. tubular Nylon or 1 in. flat Kevlar strap)			1 in Tubular Nylon Webbing	
Recovery Harness Length (ft)			30 ft	
Harness/Airframe Interfaces		3/8" 11/16" Eyebolts on bulkheads, 3/8" Zinc Plated Oval Quick Links to eyebolts		
Kinetic Energy (Ft-lbs)	Section 1	Section 2	Section 3	Section 4
	39.1	32.6	24.6	18.8

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Payload	
Payload 1 (official payload)	Overview: The primary payload flown in the vehicle is designed to complete the lunar ice collection mission. The payload is a ground based rover with two tracks for travel and a scoop for collecting the ice. The rover will be driven by an operator using an RC transmitter.
Payload 2 (non-scored payload)	Overview: No additional experiment will be flown along with Payload 1.

Test Plans, Status, and Results	
Ejection Charge Tests	Small amounts of black powder will incrementally be placed in the launch system and fired. The amount of powder will be increased until the parachutes and payload can be reliably ejected very time, without using an excesive amount. Sub-scale tests were conducted before the sub-scale launch day. Full scale tests will be conducted sometime between bulding the full scale rocket and first test launch. No results yet, as no test has been conducted yet for the full scale.
Sub-scale Test Flights	A sub-scale test flight took place on November 9th, 2019. Two (2) identical rockets were flown were each flown once. The purpose for a sub-scale test was to ensure the stability of the rocket was not too little or too great, and that recovery would deploy and behave as predicted. These tests helped plan and prepare for the later full scale rocket building, simulations, and launch testing. Launch day conditions were around 50 degrees Fahrenheit with minimal wind and clear skies; these values were factored into the simulations. Each rocket flew in slightly different configurations. The first rocket was powered by an Aerotech I218 and carried a 3D printed mock payload that was deployed and descended on its own parachute. The second rocket flew with a more powerful Aerotech I284 and carried the mock payload as well as what will be the full-scale payload's tracking device. The subscale design was a 1:2 scale of the full-scale model and designed to match the current full-scale layout at the time as best as possible.The key point to take away from the subscale launch was that on both flights, the actual altitude reached was significantly lower than the simulation prediction. This can be caused by several different factors; however, the two most likely causes are that the experimental thrust was lower than expected, or that the experimental drag could have been higher than expected.
Vehicle Demon-stration Flights	The first vehicle full scale test flight will use a mass simulator in lieu of an actual payload. This will be in order to test the full scale rocket's flight path, stability, recovery, and other factors without risking any catastrophicc failure to the payload. The Vehicle Demonstration Flight will be conducted sometime after the final design of the rocket has been finalized, however a specific date has not been decided yet. The CRW wants to only fly a full scale test after a final design has been chosen to limit changes and variations as best as possible. After a test shows the rocket design is experimentally practical, a Payload Demonstration Flight will be conducted. No results yet as the test has not been conducted.
Payload Demon-stration Flights	After a full scale vehicle test using a mass simulator has been conducted, the vehicle will be tested with a fully functioning payload. This will allow for the vehicle team to not only repeat their previous experiment, but it will allow the payload team to test their deployment from the vehicle and recovery. No results yet as no test has been conducted.

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Transmitter #1			
Location of transmitter:	Vehicle nose cone		
Purpose of transmitter:	Vehicle tracking		
Brand	Xbee	RF Output Power (mW)	250
Model	Pro-S3B	Specific Frequency used by team (MHz)	902-928
Handshake or frequency hopping? (explain)	The radios uses Frequency Hopping Spread Spectrum (FHSS)		
Distance to closest e-match or altimeter (in)	3 in to closest e-match and 60 in to clostest altimeter		
Description of shielding plan:	Seperated by an aluminum bulkhead		

Transmitter #2			
Location of transmitter:	Payload		
Purpose of transmitter:	Radio Control of Rover		
Brand	FlySky	RF Output Power (mW)	100
Model	FS-iA6B	Specific Frequency used by team (MHz)	2400
Handshake or frequency hopping? (explain)	The radios uses Automatic Frequency Hopping Digital System (AFHDS)		
Distance to closest e-match or altimeter (in)	16 in to closest altimeter and 26 in to closets e-match		
Description of shielding plan:	Seperated by an aluminum bulkhead		

Transmitter #3			
Location of transmitter:			
Purpose of transmitter:			
Brand		RF Output Power (mW)	
Model		Specific Frequency used by team (MHz)	
Handshake or frequency hopping? (explain)			
Distance to closest e-match or altimeter (in)			
Description of shielding plan:			

Transmitter #4			
Location of transmitter:			
Purpose of transmitter:			
Brand		RF Output Power (mW)	
Model		Specific Frequency used by team (MHz)	
Handshake or frequency hopping? (explain)			
Distance to closest e-match or altimeter (in)			
Description of shielding plan:			

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Transmitter #5			
Location of transmitter:			
Purpose of transmitter:			
Brand		RF Output Power (mW)	
Model		Specific Frequency used by team (MHz)	
Handshake or frequency hopping? (explain)			
Distance to closest e-match or altimeter (in)			
Description of shielding plan:			

Transmitter #6			
Location of transmitter:			
Purpose of transmitter:			
Brand		RF Output Power (mW)	
Model		Specific Frequency used by team (MHz)	
Handshake or frequency hopping? (explain)			
Distance to closest e-match or altimeter (in)			
Description of shielding plan:			

Additional Comments