Milestone Review Flysheet 2022-2023

Institution	North Carolina State University	Milestone	Flight Readiness Review

Vehicle Properties

Total Length (in)	104.5
Diameter (in)	6.17
Aspect Ratio	16.9
Gross Lift Off Weight (lb)	41.15
Ballast Amount (lb) / Material / Location	2.35, rubber coated weight secured in nosecone with nuts
Launch Vehicle Burn Out Weight (lb)	37.15
Airframe Material(s)	G12 Fiberglass
Fin Material and Thickness (in)	Balsa wood core, 2 layers carbon fiber composite, 1/4 in total thick
Coupler Length(s)/Shoulder Length(s) (in)	6in/3in

Motor Properties

Motor Brand/Designation	Aerotech L1520T
Max/Average Thrust (N)	1567.8N/1765.3N
Total Impulse (Ns)	3715.9Ns
Mass Before/After Burn (lb)	8.0/4.0
Liftoff Thrust (N)	1545.4 N
Motor Retention Method	Aerotech Motor Retainer, Centering Rings, Motor Tube

Stability Analysis

Center of Pressure (in. from nose)	75
Center of Gravity (in. from nose)	62
Static Stability Margin (on pad)	2.1
Static Stability Margin (at rail exit)	2.16
Thrust-to-Weight Ratio	8.35
Rail Size/Type and Length (in)	1515, 144
Rail Exit Velocity (ft/s)	60

Ascent Analysis

Maximum Velocity (ft/s)	552
Maximum Mach Number	0.49
Maximum Acceleration (ft/s^2)	289.56
Target Apogee (ft)	4500
Predicted Apogee (From Sim.) (ft)	4500

Recovery System Properties - Overall

Total Descent Time (s)	79.78
Total Drift in 20 mph winds (ft)	2340

Recovery System Properties - Energetics

Ejection System Energetics (ex. Black Powder)		#FFF Black Powder
Energetics Mass - Drogue Chute (grams)	Primary	4
	Backup	4.5
Energetics Mass - Main Chute	Primary	2

Recovery System Properties - Recovery Electronics

Primary Altimeter Make/Model	MissileWorks RRC3
Secondary Altimeter Make/Model	MissileWorks RRC3
Other Altimeters (if applicable)	N/A
Rocket Locator (Make/Model)	EggTimer Quasar
Additional Locators (if applicable)	N/A
Transmitting Frequencies (all - vehicle and payload)	420.250 MHz
Describe Redundancy Plan (batteries, switches, etc.)	Altimeters are fully independent. Each altimeter has its own set of batteres, switches, e-matches and powder charges
Pad Stay Time (Launch Configuration)	2.9 Hr

Recovery System Properties - Drogue Parachute

Manufacturer/Model			Fruity Chutes Compact Elliptical	
Size or Diameter (in or ft)			15 in	
Main Altimeter Deployment Setting			Apogee	
Backup Altimeter Deployment Setting			Apogee + 1 sec	
Velocity at Deployment (ft/s)			0	
Terminal Velocity (ft/s)			88.7	
Recovery Harness Material, Size, and Type (examples - 1/2 in. tubular Nylon or 1 in. flat Kevlar strap)			5/8 in Tubular Kevlar	
Recovery Harness Length (ft)			23	
Harness/Airframe Interfaces		Quick Links connected to bowline knots connected to the U-bolts		
Kinetic Energy of Each Section (Ft-lbs)	Section 1	Section 2	Section 3	Section 4
	2271.1	2255.7	N/A	N/A

Recovery System Properties - Main Parachute

Manufacturer/Model	Fruity Chutes Iris UltraCompact
Size or Diameter (in or ft)	120 in
Main Altimeter Deployment Setting	600
Backup Altimeter Deployment Setting	500
Velocity at Deployment (ft/s)	88.7
Terminal Velocity (ft/s)	14.4
Recovery Harness Material, Size, and Type (examples - 1/2 in. tubular Nylon or 1 in. flat Kevlar strap)	5/8 in Tubular Kevlar
Recovery Harness Length (ft)	17
Harness/Airframe Interfaces	Quick Links connected to bowline knots connected to the U-bolts

(grams)	Backup	2.5
Energetics Mass - Other (grams) - If Applicable	Primary	N/A
	Backup	N/A

Kinetic Energy of Each Section (Ft-lbs)	Section 1	Section 2	Section 3	Section 4
	6.57	13.7	46.16	N/A

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Payload

	Overview
Payload 1 (official payload)	The payload for this year's competition is the Surrounding Optics and Communication System (SOCS). SOCS consists of a RAFCO system and a camera system in the fin can of the launch vehicle mounted under transparent teardrop camera housings. SOCS will receive RAFCO transmitted over APRS. These commands consist of camera controls and editing commands. These commands are to be interpreted and then carried out by SOCS within 30 seconds of receiving, utilizing an on-board camera system that is capable of rotating 360 degrees around an axis normal to the ground. SOCS's RAFCO system consists of two dipole antennas mounted on the launch vehicle. The camera system consists of four cameras mounted to four servos attached directly to the primary payload computer. The computer will interpret and act upon RAFCO commands, instructing the system and image editing software. After the command sequence has been completed, the resulting image will be saved on the computer.

	Overview
Payload 2 (non-scored payload)	N/A

Test Plans, Status, and Results

Ejection Charge Tests	Full Scale Ejection test was completed on February 24th, 2023. The test was initially unsuccessful due to incorrect usage of shear pins and holes left unplugged, but when retested correctly the test was successful. This test ensures that both primary and secondary altimeters are functioning correctly, and the ejection charges have been correctly sized. Using a manual switch to activate the charges, the black powder will be loaded into their correct sections as they will on launch day and the ematches will be connected to a 9V battery. When the circuit is completed, the charges will detonate, and the test will commence. If the ejection charge has been underestimated and the sections fail to separate, then the test will be repeated with a larger charge. If the ejection charge is deemed to be overestimated and the sections separate with too much force, the test will be repeated with a smaller charge. Each subsequent ejection charge will be changed by .2 grams.
Sub-scale Test Flights	The sub-scale test flight occured on November 19th, 2022, and verified all launch vehicle design choices thusfar. This test was designed to to compare component performance in order to evaluate their feasibility on the full-scale vehicle. This test also verified the aerodynamic affects of the tear-drop camera housings, the tail cone, and the ogive fins. While the payload to test the RAFCO system was not fully functional, valuable information about the feasibility of current payload design was gained.
Vehicle Demonstration Flights	Vehicle demonstration flight occurred on February 25th, 2023 This flight is meant to determine if all team derived and NASA requirements have been met by the launch vehicle team and satisfies handbook requirement NASA 2.19.1. The February 25th launch successfully completed this requirement and all recovery systems performed as intended. The vehicle carried all components of the payload to be flown at competition.
[illegible]	Payload demonstration flight occured on February 25th, 2023. This flight is meant to determine if all team derived and NASA requirements have been met by

Payload Demonstration Flights	the payload team and satisfies handbook requirement NASA 2.19.2. The February 25th launch successfully completed this requirement. The payload was safely retained in the vehicle and remained powered on throughout the flight. Unfortunately APRS commands could not be received because the antennas were not connected as intended.

Milestone Review Flysheet 2022-2023

Institution	North Carolina State University	**Milestone**	Critical Design Review

Transmitter #1			
Location of transmitter:	AV Bay		
Purpose of transmitter:	Launch Vehicle Tracking Device		
Brand	Eggtimer Rocketry	RF Output Power (mW)	100 mW
Model	Quasar	Specific Frequency used by team (MHz)	420.25 MHz
Handshake or frequency hopping? (explain)	Fixed Frequency, ID 9		
Distance to closest e-match or altimeter (in)	0.5 in		
Description of shielding plan:	Sheet of aluminum foil between tracker and recovery electronics on AV sled		

Transmitter #2			
Location of transmitter:	N/A		
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 #3			
Location of transmitter:	N/A		
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:	N/A		
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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Institution	North Carolina State University		Milestone	PDR

Transmitter #5			
Location of transmitter:	N/A		
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:	N/A		
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