Milestone Review Flysheet 2024-2025

Institution	North Carolina State University	Milestone	PDR

Vehicle Properties

Total Length (in)	91.75
Diameter (in)	6.17
Aspect Ratio	15:1
Gross Lift Off Weight (lb)	35.78
Ballast Amount (lb) / Material / Location	0.25 / Resin / Nose Cone
Launch Vehicle Burn Out Weight (lb)	31.69
Airframe Material(s)	G12 Fiberglass
Fin Material and Thickness (in)	G10 Fiberglass and 3/16 in.
Coupler Length(s)/Shoulder Length(s) (in)	Nose Cone 6/3, Forward AVAB 16/4.5, Aft AVAB 16/8.5

Motor Properties

Motor Brand/Designation	AeroTech/L1520T
Max/Average Thrust (lb)	396.855/352.455
Total Impulse (lbf-s)	835.16
Mass Before/After Burn (oz)	128.785/63.387
Liftoff Thrust (N)	1545.4
Motor Retention Method	1/8 in. custom 6061-T6 aluminum retainer plate secured to thrust bulkhead with four #8-32 screws.

Stability Analysis

Center of Pressure (in. from nose)	68.46
Center of Gravity (in. from nose)	55.75
Static Stability Margin (on pad)	2.06
Static Stability Margin (at rail exit)	2.08
Thrust-to-Weight Ratio	9.7
Rail Size/Type and Length (in)	1515 / 144
Rail Exit Velocity (ft/s)	28.36

Ascent Analysis

Maximum Velocity (ft/s)	653.75
Maximum Mach Number	0.5741
Maximum Acceleration (ft/s^2)	306.15
Target Apogee (ft)	4800
Predicted Apogee (From Sim.) (ft)	5054

Recovery System Properties - Overall

Total Descent Time (s)	76.4
Total Drift in 20 mph winds (ft)	2241

Recovery System Properties - Energetics

Ejection System Energetics (ex. Black Powder)		#FFF Black Powder
Energetics Mass - Drogue Chute (grams)	Primary	2.75
	Backup	3.25
Energetics Mass - Main Chute (grams)	Primary	2.15
	Backup	2.65
Energetics Mass - Other (grams) - If Applicable	Primary	N/A
	Backup	N/A

Recovery System Properties - Recovery Electronics

Primary Altimeter Make/Model	PerfectFlite StratologgerCF
Secondary Altimeter Make/Model	Altus Metrum EasyMini
Other Altimeters (if applicable)	N/A
Rocket Locator (Make/Model)	Eggfinder Mini
Additional Locators (if applicable)	N/A
Transmitting Frequencies (all - vehicle and payload)	900 MHz
	144-148MHz
Describe Redundancy Plan (batteries, switches, etc.)	Altimter circuits are completely independent of each other. Each altimeter has a set of batteries, micro switches, e-matches, and black powder charges. The secondary altimeter and GPS use the same battery.
Pad Stay Time (Launch Configuration)	6.0 hours

Recovery System Properties - Drogue Parachute

Manufacturer/Model			Fruity Chutes Classic Elliptical	
Size or Diameter (in or ft) / drag coeficient			18 in / 0.8427	
Main Altimeter Deployment Setting			Apogee	
Backup Altimeter Deployment Setting			Apogee + 1 s	
Velocity at Deployment (ft/s)			0	
Terminal Velocity (ft/s)			102.35	
Recovery Harness Material, Size, and Type (examples - 1/2 in. tubular Nylon or 1 in. flat Kevlar strap)			5/8 in. flat Kevlar	
Recovery Harness Length (ft)			27.5	
Harness/Airframe Interfaces		3/8" Steel Eye Bolts, 3/8" Steel Quick Links, and Zinc-plated 5/16" Steel 2" ID U-Bolts		
Kinetic Energy of Each Section (Ft-lbs)	Section 1	Section 2	Section 3	Section 4
	1142.8	1701.15	2314.86	N/A

Recovery System Properties - Main Parachute

Manufacturer/Model			Fruity Chutes Iris Ultra Compact	
Size or Diameter (in or ft) / drag coefficient			96 in / 1.236	
Main Altimeter Deployment Setting			550 ft	
Backup Altimeter Deployment Setting			500 ft	
Velocity at Deployment (ft/s)			102.35	
Terminal Velocity (ft/s)			15.77	
Recovery Harness Material, Size, and Type (examples - 1/2 in. tubular Nylon or 1 in. flat Kevlar strap)			5/8 in. flat Kevlar	
Recovery Harness Length (ft)			23.54	
Harness/Airframe Interfaces		3/8" Steel Eye Bolt, 3/8" Steel Quick Links, and Zinc-plated 5/16" Steel 2" ID U-Bolts		
Kinetic Energy of Each Section (Ft-lbs)	Section 1	Section 2	Section 3	Section 4
	27.137	40.395	54.969	N/A

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Payload

	Overview
Payload 1 (official payload)	STEMCRaFT- This payload will be located in the Nose Cone of the Launch Vehicle. The purpose of this payload will be to proccess data recorded throughout the flight and transmit the data to a NASA reciever. The transmission will be done with the APRS method over the 2 meter band with the exact frequency (144-148) to be specified before launch . The flight computer will utilize the Direwolf software to encode the data to the APRS method and pass the signal to a transiever chip . The ouput signal is then passed to an amplifier and then antenna for transmission.
Payload 2 (non-scored payload)	Air Brakes- The Air Brakes payload will be located at the switchband of the rocket. This payload will give the launch vehicle the ability to vary the drag of the rocket, allowing the Air Brakes controller to guide the trajectory to a target height. It uses a controller in combination with an IMU to gather data which is processed to get an accurate prediction of the flight path. The predicted flight path is used in a Bang Bang control scheme to deploy and retract fins.

Test Plans, Status, and Results

Ejection Charge Tests	Prior to each launch, a ground ejection test is performed to confirm the sizing of the primary ejection charges. Ejection testing consists of configuring the rocket into its final launch day configuration and testing the separation events on the ground. In the event that the launch vehicle fails to separate from the calculated charges, an additional 0.2 grams is added to the ejection charge and the test is repeated. This process continues until both the main and drogue separation charges are verified through this demonstration.
Sub-scale Test Flights	The subscale test flight is scheduled for November 2nd, 2024, with a backup flight scheduled for November 16th, 2024, in the event that the November 2nd deadline is not met. This flight will evaluate the performance of all subsystems of the subscale design, and serve as a feasibility analysis for the developement of the full-scale launch vehicle. Additionally, the flight will test the Air Brakes apogee prediction software and assess the competition payload system responsible for the collection and transmission of data. The launch vehicle will be flown twice in the same day to collect additional data for the Air Brakes system.
Vehicle Demonstration Flights	The Vehicle Demonstration Flight deadline is March 17, 2025. The exact launch date has yet to be finalized, but it is planned to be completed by the end of February. This flight will evaluate the performance of all of the vehicle subsystems of the full-scale launch vehicle and determine if all Team Derived Requirements and NASA Requirements pertaining to the launch vehicle have been met. Successful completion of this flight will satisfy NASA Requirement 2.19.1.
Payload Demonstration Flights	The Payload Demonstration Flight deadline is April 14, 2025. The exact launch data has yet to be finalized, but is planned to be completed by the end of March. This flight will evaluate the performance and safety of the competition payload and determine if all Team Derived Requirements and NASA Requirements pertaining to the competition payload have been met. Successful completion of this flight will satisfy NASA Requirement 2.19.2.

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Transmitter #1			
Location of transmitter:	Avionics Bay		
Purpose of transmitter:	Launch Vehicle Tracking Device		
Brand	Eggtimer Rocketry	RF Output Power (mW)	100
Model	Eggfinder Mini	Specific Frequency used by team (MHz)	915
Handshake or frequency hopping? (explain)	Fixed Frequency, ID 8		
Distance to closest e-match or altimeter (in)	4.15		
Description of shielding plan:	A sheet of aluminum foil will be added between the tracker and other recovery electronics on the AV sled.		

Transmitter #2			
Location of transmitter:	Nose Cone/ Payload Bay		
Purpose of transmitter:	Transmit Payload Data to NASA reciever		
Brand	Silicon Labs	RF Output Power (mW)	5000(100 unamplified)
Model	Si4464 Transceiver	Specific Frequency used by team (MHz)	144-148
Handshake or frequency hopping? (explain)	Fixed Frequency		
Distance to closest e-match or altimeter (in)	24		
Description of shielding plan:	Altimeters will be shielded from RF with a sheet of aluminum foil in the Nose Cone/Payload Bay.		

Transmitter #3			
Location of transmitter:	Nose Cone/Payload Bay		
Purpose of transmitter:	Recieve Remote Overide Transmission		
Brand	Digi International	RF Output Power (mW)	1000
Model	Digi XBee-PRO 900HP (S3B)	Specific Frequency used by team (MHz)	900
Handshake or frequency hopping? (explain)	Fixed Frequency		
Distance to closest e-match or altimeter (in)	24		
Description of shielding plan:	Altimeters will be shielded from RF with a sheet of aluminum foil in the Nose Cone/Payload Bay.		

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