

Milestone Review Flysheet 2019-2020

Institution University of Illinois at Urbana-Champaign

Milestone PDR

Vehicle Properties

Total Length (in)	95 in
Diameter (in)	4 in (body) / 6 in (fairing)
Gross Lift Off Weight (lb)	25.6 lbm
Airframe Material(s)	Blue Tube (body tube), Fiberglass (nose cone), PLA (streamlining interstage)
Fin Material and Thickness (in)	1/8 in
Coupler Length(s)/Shoulder Length(s) (in)	10 in (coupler), 3 in (nose cone)

Motor Properties

Motor Brand/Designation	Apogee Rockets K780R-P
Max/Average Thrust (lb)	175.4
Total Impulse (lbf-s)	533
Mass Before/After Burn (lb)	6.468/3.673
Liftoff Thrust (lb)	175.4
Motor Retention Method	2.95 in Aero Pack motor retainer

Stability Analysis

Center of Pressure (in. from nose)	70.1 in
Center of Gravity (in. from nose)	55.3 in
Static Stability Margin (on pad)	2.46 cal
Static Stability Margin (at rail exit)	2.19 cal
Thrust-to-Weight Ratio	8.5
Rail Size/Type and Length (in)	96 in, 1010 rail
Rail Exit Velocity (ft/s)	58.9

Ascent Analysis

Maximum Velocity (ft/s)	588
Maximum Mach Number	0.55
Maximum Acceleration (ft/s^2)	418
Target Apogee (ft)	4450
Predicted Apogee (From Sim.) (ft)	4450

Recovery System Properties - Overall

Total Descent Time (s)	70.8
Total Drift in 20 mph winds (ft)	1619

Recovery System Properties - Energetics

Ejection System Energetics (ex. Black Powder)		
Energetics Mass - Drogue Chute (grams)	Primary	.83 grams
	Backup	
Energetics Mass - Main Chute (grams)	Primary	.73 grams
	Backup	
Energetics Mass - Other (grams) - If Applicable	Primary	.15 grams
	Backup	

Payload Deployment

Location: Air or Ground (if applicable)	Air
Altitude of Deployment (if applicable)	400 ft

Recovery System Properties - Recovery Electronics

Primary Altimeter Make/Model	Perfectflite
Secondary Altimeter Make/Model	Atlas Metrum
Other Altimeters (if applicable)	
Rocket Locator (Make/Model)	Atlas Metrum
Additional Locators (if applicable)	
Transmitting Frequencies (all - vehicle and payload)	Xbee Pro S3B 900 - 928 MHz
Pad Stay Time (Launch Configuration)	2 Hours
Describe Redundancy Plan (batteries, switches, etc.)	Redundant altimeters with separately connected batteries for each unit

Recovery System Properties - Drogue Parachute

Manufacturer/Model		Fruity Chutes Elliptical 18"		
Size or Diameter (in or ft)		18 in		
Main Altimeter Deployment Setting		Apogee		
Backup Altimeter Deployment Setting		Apogee		
Velocity at Deployment (ft/s)		86.7		
Terminal Velocity (ft/s)		119		
Recovery Harness Material, Size, and Type (examples - 1/2 in. tubular Nylon or 1 in. flat Kevlar strap)		0.5 in tubular Kevlar shock cord		
Recovery Harness Length (ft)		20 ft		
Harness/Airframe Interfaces		U-bolt		
Kinetic Energy (Ft-lbs)	Section 1	Section 2	Section 3	Section 4
	3874	837	2534	679

Recovery System Properties - Main Parachute

Manufacturer/Model		Iris Ultra 72"		
Size or Diameter (in or ft)		6 ft		
Main Altimeter Deployment Setting (ft)		800 ft		
Backup Altimeter Deployment Setting (ft)		800 ft		
Velocity at Deployment (ft/s)				
Terminal Velocity (ft/s)		24.4		
Recovery Harness Material, Size, and Type (examples - 1/2 in. tubular Nylon or 1 in. flat Kevlar strap)		0.5 in tubular Kevlar shock cord		
Recovery Harness Length (ft)		20 ft		
Harness/Airframe Interfaces		U-bolt		
Kinetic Energy (Ft-lbs)	Section 1	Section 2	Section 3	Section 4
	72.9	15.8	47.7	12.8

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Payload	
Payload 1 (official payload)	Overview
	<p>The official payload will be an unmanned aerial vehicle (UAV), deployed aially at 400 ft through vertical lowering through the fairing after recovery of the nose cone. The nominal operational period is 12 minutes, wit the UAV descending and navigating to the nearest recovery area by means of GPS and computer vision. Then, the UAV will lower onto the recovery area, retrieving ice samples by way of an actuatable arm. Having retrieved the sample, the UAV will distance itself from the recovery area.</p> <p>The payload will be operated autonomously, with manual control being possible by way of a remote control link operated by a human operator. Telemetry is also provided for, so that ground control may ascertain vehicle health and proper operations throughout the mission.</p>
Payload 2 (non-scored payload)	Overview

Test Plans, Status, and Results	
Ejection Charge Tests	The required black powder charges will be determined through the ejection charge tests. Here, the shear bolt will be tested under volumetric constraints.
Sub-scale Test Flights	Half-size vehicle model, launched in December. Predicted apogee is 1600 ft, similar stability margin and mass distribution, with half of the maximum velocity of the full-scale vehicle.
Vehicle Demonstration Flights	Demonstation of full system capabilities, including but not limited to staging, parachute deployment and payload deployment testing. After payload deployment is achieved, the payload will be tested for flight time and reliability when controlled both autonomously and remotely. A mockup of the actual flight environment will be constructed so as to validate the reliability and efficacy of the computer vision and guidance algorithms. Finally, sample retrieval will be demonstrated.
Payload Demonstration Flights	In addition to the abovementioned vehicle demonstration flight, the payload will undergo additional testing to validate its flight time, maneuverability, failure tolerance and mission performance.

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Transmitter #1			
Location of transmitter:	Avionics Coupler		
Purpose of transmitter:	Recovery Transmitter		
Brand	Atlus Metrum	RF Output Power (mW)	40
Model	TeleMetrum	Specific Frequency used by team (MHz)	433

Handshake or frequency hopping? (explain)	Fixed frequency
Distance to closest e-match or altimeter (in)	0
Description of shielding plan:	Avionics will be shielded by copper mesh lining

Transmitter #2			
Location of transmitter:	Nose Cone		
Purpose of transmitter:	Recovery Transmitter		
Brand	Atlas Metrum	RF Output Power (mW)	40
Model	TeleMetrum	Specific Frequency used by team (MHz)	433
Handshake or frequency hopping? (explain)	Fixed frequency		
Distance to closest e-match or altimeter (in)	0		
Description of shielding plan:	Avionics will be shielded by copper mesh lining		

Transmitter #3			
Location of transmitter:	Nose Cone		
Purpose of transmitter:	UAV Deployment System		
Brand	Digi	RF Output Power (mW)	250
Model	Xbee Pro XSC S3B	Specific Frequency used by team (MHz)	900
Handshake or frequency hopping? (explain)	Multiple channels are available		
Distance to closest e-match or altimeter (in)	1		
Description of shielding plan:	Avionics will be shielded by copper mesh lining		

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