

Milestone Review Flysheet 2018-2019

Institution The University of Alabama in Huntsville

Milestone FRR

Vehicle Properties	
Total Length (in)	124
Diameter (in)	6
Gross Lift Off Weigh (lb)	50.1
Airframe Material(s)	G12 Fiberglass
Fin Material and Thickness (in)	G10 Fiberglass, 0.125
Coupler Length(s)/Shoulder Length(s) (in)	6

Motor Properties	
Motor Brand/Designation	AeroTech L1420R
Max/Average Thrust (lb)	408/319
Total Impulse (lbf-s)	1043.8
Mass Before/After Burn (lb)	10.1/4.4
Liftoff Thrust (lb)	310
Motor Retention Method	Aft Retention Ring

Stability Analysis	
Center of Pressure (in. from nose)	91.1
Center of Gravity (in. from nose)	77.2
Static Stability Margin (on pad)	2.25
Static Stability Margin (at rail exit)	2.32
Thrust-to-Weight Ratio	6.9
Rail Size/Type and Length (in)	1515, 144
Rail Exit Velocity (ft/s)	57.6

Ascent Analysis	
Maximum Velocity (ft/s)	582
Maximum Mach Number	0.52
Maximum Acceleration (ft/s ²)	249
Target Apogee (ft)	4800
Predicted Apogee (From Sim.) (ft)	4982

Recovery System Properties - Overall	
Total Descent Time (s)	80
Total Drift in 20 mph winds (ft)	2347

Recovery System Properties - Energetics		
Ejection System Energetics (ex. Black Powder)	Black Powder	
Energetics Mass - Drogue Chute (grams)	Primary	3.5
	Backup	3.75
Energetics Mass - Main Chute (grams)	Primary	6
	Backup	7
Energetics Mass - Other (grams) - If Applicable	Primary	TBD
	Backup	TBD

Recovery System Properties - Recovery Electronics	
Primary Altimeter Make/Model	Stratologger CF
Secondary Altimeter Make/Model	Stratologger CF
Other Altimeters (if applicable)	Featherweight Raven3
Rocket Locator (Make/Model)	Xbee Pro S3B
Additional Locators (if applicable)	
Transmitting Frequencies (all - vehicle and payload)	900 MHz
Describe Redundancy Plan (batteries, switches, etc.)	Dual, Independent System
Pad Stay Time (Launch Configuration)	2+ hrs

Recovery System Properties - Drogue Parachute				
Manufacturer/Model		FruityChutes CFC-18		
Size or Diameter (in or ft)		18 in.		
Main Altimeter Deployment Setting		Apogee		
Backup Altimeter Deployment Setting		Apogee + 1s		
Velocity at Deployment (ft/s)		0		
Terminal Velocity (ft/s)		83.1		
Recovery Harness Material, Size, and Type (examples - 1/2 in. tubular Nylon or 1 in. flat Kevlar strap)		1 in. tubular Nylon		
Recovery Harness Length (ft)		50		
Harness/Airframe Interfaces		Upper Airframe Bulkhead/Upper Coupler Bulkhead		
Kinetic Energy of Each Section (Ft-lbs)	Section 1	Section 2	Section 3	Section 4
	1883	2657.7	-	-

Recovery System Properties - Main Parachute				
Manufacturer/Model		FruityChutes IFC-144		
Size or Diameter (in or ft)		144 in.		
Main Altimeter Deployment Setting (ft)		600		
Backup Altimeter Deployment Setting (ft)		550		
Velocity at Deployment (ft/s)		83.1		
Terminal Velocity (ft/s)		11.2		
Recovery Harness Material, Size, and Type (examples - 1/2 in. tubular Nylon or 1 in. flat Kevlar strap)		1 in. tubular Nylon		
Recovery Harness Length (ft)		50		
Harness/Airframe Interfaces		Aft Airframe Bulkhead/Lower Coupler Bulkhead		
Kinetic Energy of Each Section (Ft-lbs)	Section 1	Section 2	Section 3	Section 4
	34.2	10.47	30.87	-

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Payload	
Payload 1 (official payload)	Overview
	The payload selected is the deployable Unmanned Aerial Vehicle. Its dimensions have been constrained by the available space within the internal structure of the rocket. The UAV will fit within a 6 in diameter and a 24 inch longitudinal space within the rocket. The UAV will be encased within a protective sheath that, upon ejection from the rocket body tube, will unfold and passively self-orient itself such that the UAV will deploy upright. Once the sheath unfolds, the UAV will mechanically open its arms and close the circuitry of the vehicle. The UAV pilot will activate the motors, take-off, and fly to the Future Excursion Area where it will release a simulated navigational beacon above the target area.
Payload 2 (non-scored payload)	Overview
	No Secondary Payload

Test Plans, Status, and Results	
Ejection Charge Tests	Black powder charge tests have been conducted for both drogue and main parachute separation. The drogue will use 3.5g to shear two 4-40 nylon shear pins. The main will use 6g to shear eight 4-40 nylon shear pins. Redundant charges will be sized larger to ensure separation. Powder charges for deploying UAV have not yet been properly sized; these will be included in the FRR Addendum.
Sub-scale Test Flights	A subscale flight test was conducted on 17 November, 2018. The system worked as expected and there were no failures in flight. The apogee was lower than initially predicted. The leading cause was overstabilization.
Vehicle Demonstration Flights	The full scale Vehicle Demonstration Flight was conducted on 09 February, 2019. Initial simulations showed the vehicle would be lower than the target apogee; however, the vehicle ascended to 5017 ft. This was due to a lower drag coefficient than expected. This value was estimated to be 0.375. All flight related requirements were met.
Payload Demonstration Flights	The Payload Demonstration Flight has not yet been conducted. The results from this test will be delivered in the FRR Addendum.

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Transmitter #1			
Location of transmitter:	Nose Cone		
Purpose of transmitter:	Rocket Recovery Tracking		
Brand	Xbee	RF Output Power (mW)	100 mW
Model	Pro 900 SB3	Specific Frequency used by team (MHz)	900 MHz
Handshake or frequency hopping? (explain)	Frequency Hopping		
Distance to closest e-match or altimeter (in)	24 in.		
Description of shielding plan:	E-matches are in lowest-gain portion of the antenna.		

Transmitter #2			
Location of transmitter:	Upper Airframe		
Purpose of transmitter:	Payload Deployment		
Brand	Xbee	RF Output Power (mW)	1 mW
Model	Pro 900 S3B	Specific Frequency used by team (MHz)	900 MHz
Handshake or frequency hopping? (explain)	Frequency Hopping		
Distance to closest e-match or altimeter (in)	1 in.		
Description of shielding plan:	Configured to disable all transmission under any circumstances.		

Transmitter #3			
Location of transmitter:	UAV		
Purpose of transmitter:	UAV Telemetry and Control		
Brand	Holybro	RF Output Power (mW)	100 mW
Model	Radio V3	Specific Frequency used by team (MHz)	900 MHz
Handshake or frequency hopping? (explain)	Frequency Hopping		
Distance to closest e-match or altimeter (in)	6 in.		
Description of shielding plan:	Transmitter powered off until deployment from vehicle closes a limit switch.		

Transmitter #4			
Location of transmitter:	UAV		
Purpose of transmitter:	UAV Video Transmission		
Brand	Airy	RF Output Power (mW)	100 mW
Model	Mini 5848	Specific Frequency used by team (MHz)	5845 MHz
Handshake or frequency hopping? (explain)	Fixed Frequency; Channel A2		
Distance to closest e-match or altimeter (in)	6 in.		
Description of shielding plan:	Transmitter powered off until deployment from vehicle closes a limit switch.		

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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