

Milestone Review Flysheets

Institution The University of Alabama

Milestone Critical Design Review

Vehicle Properties	
Total Length (in)	89
Diameter (in)	5.5
Gross Lift Off Weigh (lb)	32.2
Airframe Material	Fiberglass
Fin Material	Fiberglass
Drag Coefficient	0.467

Motor Properties	
Motor Manufacturer	Cesaroni Technology Inc.
Motor Designation	L3200
Max/Average Thrust (lb)	834.9 / 721.4
Total Impulse (lbf-s)	749.1
Motor Mass Before/After Burn(kg)	3.26 / 1.61
Liftoff Thrust (lb)	630

Stability Analysis	
Center of Pressure (in from nose)	64.8
Center of Gravity (in from nose)	53.7
Static Stability Margin	2.00 calibers
Static Stability Margin (off launch rail)	1.66 calibers
Thrust-to-Weight Ratio	22.4
Rail Size and Length (in)	144
Rail Exit Velocity (ft/s)	130.5

Ascent Analysis	
Maximum Velocity (ft/s)	723
Maximum Mach Number	0.65
Maximum Acceleration (ft/s ²)	824
Target Apogee (From Simulations)	5290
Stable Velocity (ft/s)	77.22
Distance to Stable Velocity (ft)	4.82

Recovery System Properties				
Drogue Parachute				
Manufacturer/Model	Giant Leap Rocketry/TAC-1			
Size (in)	54			
Altitude at Deployment (ft)	5290			
Velocity at Deployment (ft/s)	3.21			
Terminal Velocity (ft/s)	35.66			
Recovery Harness Material	Kevlar			
Harness Size/Thickness (in)	0.5			
Recovery Harness Length (ft)	4.17			
Harness/Airframe Interfaces	Parachute harness will be secured to an eye bolt on the electronics bay bulk plate			
Kinetic Energy of Each Section (Ft-lbs)	Nose Cone	Forward	Aft	Total
	25.9	166.5	197.3	389.6

Recovery System Properties				
Main Parachute				
Manufacturer/Model	Giant Leap Rocketry/TAC-1			
Size (in)	110			
Altitude at Deployment (ft)	900			
Velocity at Deployment (ft/s)	32.75			
Terminal Velocity (ft/s)	14.52			
Recovery Harness Material	Kevlar			
Harness Size/Thickness (in)	0.625			
Recovery Harness Length (ft)	5.58			
Harness/Airframe Interfaces	Parachute harness will be secured to eye bolts on the electronics bay bulk plate and aft section bulk plate			
Kinetic Energy of Each Section (Ft-lbs)	Nose Cone	Forward	Aft	Total
	4.29	27.6	32.7	64.5

Recovery Electronics	
Altimeter(s)/Timer(s) (Make/Model)	Perfectflite Stratologger
Redundancy Plan	Team will use two altimeters to ensure ignition of black powder charges
Pad Stay Time (Launch Configuration)	1 hour and 30 minutes

Recovery Electronics	
Rocket Locators (Make/Model)	Adafruit Ultimate GPS Breakout
Transmitting Frequencies	900 Hz
Black Powder Mass Drogue Chute (grams)	5
Black Powder Mass Main Chute (grams)	5

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Payload	
Payload 1	Overview
	Payload 1 will be a landing hazards detection system. This system will use a camera to take images of the ground during descent and analyze these images to detect landing hazards.
Payload 2	Overview
	Payload 2 will be a guided descent system. This system will use the data from the landing hazards detection system and the Raspberry Pi to control servo motors, which will in turn control the payload's parafoil.

Test Plans, Status, and Results	
Ejection Charge Tests	The team plans to use ground testing of the black powder charges to ensure the charge will produce the correct pressure to eject the parachutes. The test will be a static ignition of full scale charges at the Phoenix Missile Works launch area.
Sub-scale Test Flights	The team has built a sub-scale model at .727 scale. The sub-scale motor was chosen to match the full scale flight Mach number as closely as possible. The subscale launch will occur on January 16th.
Full-scale Test Flights	The team will test all sub-systems and components of the full scale rocket, and at least one full scale mission will be flown. Full scale flights will provide the team with data on altitude, stability, and performance of the recovery system of the rocket.

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Additional Comments

Stability Velocity, Distance to stable velocity, and Static stability margin (off launch rail) were all calculated at a wind speed of 20 mph.

