Milestone Review Flysheet

Please see Milestone Review Flysheet Instructions.

Institution	Georgia Institute of Technology	Milestone	CDR

Vehicle Properties

Total Length (in)	80.875
Diameter (in)	4
Gross Lift Off Weight (lb)	16.9
Airframe Material	G10 Fiberglass
Fin Material	G10 Fiberglass
Drag Coefficient	0.5

Motor Properties

Motor Manufacturer(s)	Cesaroni Technologies
Motor Designation(s)	J760
Max/Average Thrust (lb)	211 / 168
Total Impulse (lbf-sec)	1265.7
Mass (before, after burn) (slugs)	0.0738 / 0.0395
Liftoff Thrust (lb)	211

Stability Analysis

Center of Pressure (in from nose)	56.2
Center of Gravity (in from nose)	48.9
Static Stability Margin	1.83
Thrust-to-Weight Ratio	7.6
Rail Size (in)/ Length (in)	1010 / 96
Rail Exit Velocity (ft/s)	72.5

Ascent Analysis

Maximum Velocity (ft/s)		489
Maximum Mach Number		0.44
Maximum Acceleration (ft/s^2)		342
Target Apogee (1st Stage if Multiple Stages)		3000
Stable Velocity (ft/s)		50
Distance to Stable Velocity (in)		47

Recovery System Properties

Drogue Parachute

Manufacturer/Model	Unknown
Size	28 Inches
Altitude at Deployment (ft)	3000
Velocity at Deployment (ft/s)	0
Terminal Velocity (ft/s)	50
Recovery Harness Material	Tubular Nylon
Harness Size/Thickness (in)	0.375
Recovery Harness Length (ft)	20
Harness/Airframe Interfaces	Swivel will attach parachute to a shock cord, which will attach to U-bolts attached to bulkheads in booster and avionics sections. (Sections 1 and 2)

Kinetic Energy of Each Section (ft-	Section 1	Section 2	Section 3	Section 4
	198	242	58	140

Recovery System Properties

Main Parachute

Manufacturer/Model	Unknown
Size	52 inches
Altitude at Deployment (ft)	600
Velocity at Deployment (ft/s)	54.7
Terminal Velocity (ft/s)	18.1
Recovery Harness Material	Tubular Nylon
Harness Size/Thickness (in)	0.375
Recovery Harness Length (ft)	4.33
Harness/Airframe Interfaces	Swivel will attach parachute to a shock cord, which will attach to U-bolts attached to bulkheads in avionics and upper sections. (Sections 2 and 3)

Kinetic Energy of Each Section (ft-lbs)	Section 1	Section 2	Section 3	Section 4
	28	34	8	5

lbs)

Recovery Electronics	
Altimeter(s)/Timer(s) (Make/Model)	Stratologger
Redundancy Plan	The rocket is equipped with two Stratologgers that will connect two sets of ignition wires to a separate set of ejection charges for each parachute, which will ensure detonation and deployment
Pad Stay Time (Launch Configuration)	2+ Hours

Recovery Electronics	
Rocket Locators (Make/Model)	XBee Pro 900 RF
Transmitting Frequencies	ISM 900 MHz
Black Powder Mass Drogue Chute (grams)	0.75
Black Powder Mass Main Chute (grams)	1.5

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Autonomous Ground Support Equipment (AGSE)	
Capture Mechanism	Overview
	An open source 5 degrees of freedom (DOF) robotic arm will be used to reliably and effectively capture the standard Maxi-MAV payload. The team will construct a five degrees-of-freedom arm using laser cut wood parts. Utilizing seven servos, the arm will be able to fully solve for any point in the space.
Container Mechanism	Overview
	The payload is located in the nose cone section of the launch vehicle, which is constructed with G10 fiberglass. An upper section of the nose cone is removable to account for the autonomous insertion of the payload. The removable tip of the nose cone will be held in place by magnetically released spring-loaded notches.
Launch Rail Mechanism	Overview
	The project launch rail to be used will be a standard standard aluminum extrusion bar (X config). The rail will be secured onto a plate with connectors for pivoting threaded fasteners or "nuts", one on each side to acheive stability and structural integrity through symmetry; worms, or threaded cylindrical bars will be inserted into the fasteners. The driving mechanism for the vertical lifting action will be the translation of rotational motion from NEMA 23 stepper driven worms into a linear actuation via the pivoting "nuts."
Igniter Installation Mechanism	Overview
	The igniter installation or insertion mechanism will be driven by a symmetrical threaded steel rack and pinion gear box. One of the pinions will be connected to and driven by a DC motor, the other pionion gear will simply roll along the z-axis of the gear box (vertical translation) providing mechanical stability and allow for smooth actuation. The igniter (along with a cap that fits snugly within the rocket motor chamber) will be attached to the end of the rack and simply be linearly actuated or "pushed" in.
CG Location of Launch Pad (in inches) When Rail is Horizontal (Use Base of Rail as the Reference Point)	9.76" down rod, 5.25" off ground

Moment Analysis	The moment about the pivot point from the rocket and rail is 61.2 lb-ft.

Payload	
Payload 1	Overview
	Payload will be a PVC pipe (dimensions: 3/4 in OD & 4.75 in length) filled with sand (mass: 4.0 oz or 113.4 grams). This will be contained in the nosecone (as described in Container Mechanism).
Payload 2	Overview
	N/A (No science payload is planned for the AGSE, launch vehicle, or Maxi-MAV/Centennial Challenge)

Test Plans, Status, and Results	
Ejection Charge Tests	Testing will comprise of assembled rocket sections with the separation sections held in place by shear pins. Ejection charges will be placed on the outer side of the avionics bulkheads and will be ignited by an e-match. This is to test if the ejection powder masses are enough for separation. Testing has been completed on a subscale body with the results being applicable to the full-scale rocket.
Sub-scale Test Flights	A sub-scale model of the launch vehicle was built and tested in two separate launches. Altimeter data was gathered and compared to simulation results to verify simulation software.
Full-scale Test Flights	A single full-scale test flight is planned for finall calibration of balast mass and ATS drag settings.

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Additional Comments