

Milestone Review Flysheet 2017-2018

Institution Wichita State University

Milestone FRR

Vehicle Properties	
Total Length (in)	92.4
Diameter (in)	5.52
Gross Lift Off Weigh (lb.)	22
Airframe Material(s)	Blue Tube Body, Fiberglass Nose
Fin Material and Thickness (in)	Aluminum, 0.2
Coupler Length/Shoulder Length(s) (in)	11.0 / 5.5

Motor Properties	
Motor Brand/Designation	AeroTech K560W
Max/Average Thrust (lb.)	169.4 / 125.9
Total Impulse (lbf-s)	543.4
Mass Before/After Burn (lb.)	6.05 / 2.91
Liftoff Thrust (lb.)	128
Motor Retention Method	Bulkhead Bolted Motor Foreclosure

Stability Analysis	
Center of Pressure (in from nose)	75.2
Center of Gravity (in from nose)	63.0
Static Stability Margin (on pad)	2.21
Static Stability Margin (at rail exit)	2.28
Thrust-to-Weight Ratio	5.7
Rail Size/Type and Length (in)	1.5/1515, 144
Rail Exit Velocity (ft/s)	56.4

Ascent Analysis	
Maximum Velocity (ft/s)	621
Maximum Mach Number	0.56
Maximum Acceleration (ft/s ²)	231.2
Predicted Apogee (From Sim.) (ft)	5,338

Recovery System Properties				
Drogue Parachute				
Manufacturer/Model	Dino Chutes / X-Form			
Size/Diameter (in or ft)	18 in			
Altitude at Deployment (ft)	5,260			
Velocity at Deployment (ft/s)	16.1			
Terminal Velocity (ft/s)	122.1			
Recovery Harness Material	Kevlar			
Recovery Harness Size/Thickness (in)	5500 lb / 0.25			
Recovery Harness Length (ft)	33			
Harness/Airframe Interfaces	500# Ball Bearing Swivel, 1/4" steel shackles, 1/2" steel eye Bolt			
Kinetic Energy of Each Section (Ft-lbs)	Section 1	Section 2	Section 3	Section 4
	1250	2623	N/A	N/A

Recovery System Properties				
Main Parachute				
Manufacturer/Model	Fruity Chutes / Iris Ultra			
Size/Diameter (in or ft)	60 in			
Altitude at Deployment (ft)	600			
Velocity at Deployment (ft/s)	122.1			
Terminal Velocity (ft/s)	20			
Recovery Harness Material	Kevlar			
Recovery Harness Size/Thickness (in)	5500 lb / 0.25			
Recovery Harness Length (ft)	33			
Harness/Airframe Interfaces	Built-in Ball Bearing Swivel, 1/4" steel shackles, 1/2" steel eye Bolt			
Kinetic Energy of Each Section (Ft-lbs)	Section 1	Section 2	Section 3	Section 4
	50	67.6	N/A	N/A

Recovery Electronics	
Altimeter(s)/Timer(s) (Make/Model)	PerfectFlite / StratologgerCF x2 Jolly Logic / Chute Release x2
Redundancy Plan and Backup Deployment Settings	Redundant ejection (can still deploy on just one of the two nominal charges). Identical backup flight altimeter connected to separate charges for Apogee +0 and +0.5 seconds. Identical chute releases connected "in-series" for 600 ft
Pad Stay Time (Launch)	

Recovery Electronics		
Rocket Locators (Make/Model)	EggTimer Rocketry / EggFinder GPS	
Transmitting Frequencies (all - vehicle and payload)	Payload: 2.4 GHz / GPS: 900 MHz	
Ejection System Energetics (ex. Black Powder)	Black Powder	
Energetics Mass - Drogue Chute (grams)	Primary	2.3
	Backup	2.5
Energetics Mass - Main Chute (grams)	Primary	chute release
	Backup	chute release
Energetics Masses - Other	Primary	N/A

Assembly Time (person Configuration)	5 hrs	Emergency Masses (grams) - If Applicable	Backup	N/A
--------------------------------------	-------	--	--------	-----

Milestone Review Flysheet 2017-2018

Institution	Wichita State University
--------------------	--------------------------

Milestone	FRR
------------------	-----

Payload

Payload	
Payload 1 (official payload)	Overview
	The team has elected to conduct the Autonomous Rover payload experiment. The rover will deploy after the vehicle has landed from the fore section of the rocket using a spur gear and rack system, the vehicle will autonomously use a folding top door which also carries solar panels on the inside to reorient itself and utilize its gear wheels to move across the rough terrain until its final destination and deploy the folding top door fully to reveal the solar panels on both the vehicle and the top door.
Payload 2 (non-scored payload)	Overview
	N/A

Test Plans, Status, and Results

Ejection Charge Tests	The team will conduct the following ground based ejection charge tests Ignition & Equivalency Testing (Complete) Tests: Ejection charge, E-matches (Successful) Sub-Scale Ejection & Release Testing (Complete) Tests: Actual sub-scale vehicle, ejection charge, 1xStratologgerCF AND Drogue Chute Deployment, 1xChute Release (Successful) Full-Scale Ejection Testing (Complete) Tests: Actual full-scale vehicle, Pyrodex charges, 2xStratologgerCF, Arming Mechanism & Circuitry, Ejection Redundancy, Drogue & Main Ejection, Shearing and Separation AND Main Chute Deployment, 2xChute Release, Release Redundancy (Successful - determined 2.3 grams for ejection charge)
Sub-scale Test Flights	(Complete) Vehicle launch performed nominally, with a stable controlled ascent. Vehicle deployed ejection charge at apogee, which caused the detachment of the nose cone through failure of the plastic mounting hook. Chute release deployed nominally at 200 ft AGL, yet chute did not fully inflate due to tangling of shroud lines. Data was acquired successfully.
Full-scale Test Flights	(Complete) The test flight was conducted using the vehicle in the final configuration and weight, including a complete prototype of the rover payload with accurate mass. This exact vehicle will be flown on launch day in Huntsville, Alabama after being flight-proven in this test flight. The test validated vehicle stability, drag coefficient estimations, recovery concept and redundant deployment mechanisms, drogue and main parachute deployment speeds, descent time and drift distance for resulting apogee and wind conditions, airframe integrity and load bearing components, payload enclosure integrity and Rover locking mechanism and validate launch procedures and checklists. From acceleration and velocity analysis as presented in FRR, the team determined that the motor underperformed specifications and resulted in approximately 15% loss in burnout velocity as well as a 15% loss in apogee. The main parachute deployed early and the team was able to replicate the failure on ground and implemented a mitigation, after which the issue was not replicable.

Milestone Review Flysheet 2017-2018

Institution

Wichita State University

Milestone

FRR

Additional Comments

