Milestone Review Flysheet 2017-2018

Institution	Wichita State University

Milestone	CDR

Vehicle Properties

Total Length (in)	92
Diameter (in)	5.5
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)	62.0
Center of Gravity (in from nose)	75.2
Static Stability Margin (on pad)	2.28
Static Stability Margin (at rail exit)	2.38
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)	36 in
Altitude at Deployment (ft)	5,260
Velocity at Deployment (ft/s)	32.1
Terminal Velocity (ft/s)	122.1
Recovery Harness Material	Kevlar
Recovery Harness Size/Thickness (in)	1900 lb / 0.25
Recovery Harness Length (ft)	30
Harness/Airframe Interfaces	500# Ball Bearing Swivel, 3/8" Quick Link 3/8" Eye Bolt, 3/8" Quick Link

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)	61.8
Terminal Velocity (ft/s)	14.9
Recovery Harness Material	Kevlar
Recovery Harness Size/Thickness (in)	1900 lb / 0.25
Recovery Harness Length (ft)	30
Harness/Airframe Interfaces	500# Ball Bearing Swivel, 3/8" Quick Link 3/8" Eye Bolt, 3/8" Quick Link

Kinetic Energy of Each Section (Ft-lbs)	Section 1	Section 2	Section 3	Section 4
	20	42	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	Fault-tolerant ejection (can still deploy on just one of the two nominal charges). Identical backup flight altimeter connected to both charges for Apogee +1.5 seconds. Identical chute releases connected "in-series" for 600 ft and 500 ft
Pad Stay Time (Launch Configuration)	7 hrs

Recovery Electronics

Rocket Locators (Make/Model)	Xbee RF TX + GPS Module (Spy Tec / STI GL300 for redundancy)	
Transmitting Frequencies (all vehicle and payload)	***Required by CDR***	
Ejection System Energetics (ex. Black Powder)		Black Powder
Energetics Mass - Drogue Chute (grams)	Primary	1.9
	Backup	1.9
Energetics Mass - Main Chute (grams)	Primary	N/A
	Backup	N/A
Energetics Masses - Other (grams) - If Applicable	Primary	N/A
	Backup	N/A

Milestone Review Flysheet 2017-2018

Institution	Wichita State University	Milestone	CDR

Payload

	Overview
Payload 1 (official payload)	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)	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 Depoyment, 1xChute Release (Successful) **Full-Scale Ejection Testing** (Jan. 25 - Feb. 7) 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
Sub-scale Test Flights	The team will conduct a minimum of **two (2)** sub-scale flight tests (One has been completed). The current sub-scale vehicle will be a **1:3.4** scale of the full-scale vehicle and use a vented **F15-0** motor in order to facilitate testing by members who do not have a NAR/TRA certification. The sub-scale tests will test the two flight StratologgerCF altimeters (on separate flights) for deployment, apogee reporting and data acquisition, the full-scale vehicle drogue (as a main), and the two flight chute releases (on separate flights) as well as validate ejection and shear pin sizing calculation methods, apogee prediction models, and coefficient of drag estimates. First test results: 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. Second subscale test is planned for January 13th.
Full-scale Test Flights	The team will conduct a minimum of **two (2)** full-scale flight tests (Feb. 2 - Mar. 4). The test flights will be used to validate all mission ascent and descent performance predictions including apogee predictions and drift distance for the specific launch day wind conditions. The full-scale tests will utilize the final recovery system configuration to validate performance as designed. The final full-scale test flight will be used as the *demonstration flight* after which the vehicle properties will be frozen until competition launch day. At least one flight will carry the actual rover payload for payload launch, recovery and deployment testing.

Milestone Review Flysheet 2017-2018

Institution	Wichita State University

Milestone	CDR

Additional Comments