Milestone Review Flysheet 2018-2019

Institution	Oregon State University
Milestone	PDR

Vehicle Properties

Total Length (in)	100
Diameter (in)	6.25
Gross Lift Off Weigh (lb)	54.9
Airframe Material(s)	Carbon Fiber, Fiberglass
Fin Material and Thickness (in)	Carbon Fiber
Coupler Length(s)/Shoulder Length(s) (in)	12.5 / 6.25

Motor Properties

Motor Brand/Designation	Cesaroni L2375-WT
Max/Average Thrust (lb)	586.3 / 533.7
Total Impulse (lbf-s)	1102.67
Mass Before/After Burn (lb)	9.71 / 4.06
Liftoff Thrust (lb)	553.5
Motor Retention Method	Threaded Retainer

Stability Analysis

Center of Pressure (in. from nose)	72.051
Center of Gravity (in. from nose)	58.548
Static Stability Margin (on pad)	2.1
Static Stability Margin (at rail exit)	2.1
Thrust-to-Weight Ratio	9.77
Rail Size/Type and Length (in)	1515 / 144
Rail Exit Velocity (ft/s)	84.6

Ascent Analysis

Maximum Velocity (ft/s)	596
Maximum Mach Number	0.54
Maximum Acceleration (ft/s^2)	322
Target Apogee (ft)	4500
Predicted Apogee (From Sim.) (ft)	4797

Recovery System Properties - Overall

Total Descent Time (s)	71 (fore), 72 (aft)
Total Drift in 20 mph winds (ft)	2092 (fore), 2113 (aft)

Recovery System Properties - Energetics

Ejection System Energetics (ex. Black Powder)		Black Powder
Energetics Mass - Drogue Chute (grams)	Primary	2.12
	Backup	3
Energetics Mass - Main Chute (grams)	Primary	0.33
	Backup	0.33
Energetics Mass - Other (grams) - If Applicable	Primary	5.5
	Backup	8.25

Recovery System Properties - Recovery Electronics

Primary Altimeter Make/Model	PerfectFlite, StratoLoggerCF
Secondary Altimeter Make/Model	Missleworks, RRC3
Other Altimeters (if applicable)	Jolly Logic, AltimeterThree
Rocket Locator (Make/Model)	X-Bee Pro 900HP
Additional Locators (if applicable)	Sparkfun Venus GPS
Transmitting Frequencies (all - vehicle and payload)	CC1200: 433 MHz Xbee PRO 900HP: 900 MHz
Describe Redundancy Plan (batteries, switches, etc.)	Two altimeters for each section, separate batteries for each altimeter, separate charges for each altimeter, two chute releases per main chute
Pad Stay Time (Launch Configuration)	Altimeters: 8+ hours Tracking Unit: 3 hours

Recovery System Properties - Drogue Parachute

Manufacturer/Model	Top Flight Recovery / XTEAR-18
Size or Diameter (in or ft)	18 in. (fore) / 18 in. (aft)
Main Altimeter Deployment Setting	Apogee
Backup Altimeter Deployment Setting	Apogee +1 s
Velocity at Deployment (ft/s)	1.7
Terminal Velocity (ft/s)	146 (fore) /127 (aft)
Recovery Harness Material, Size, and Type (examples - 1/2 in. tubular Nylon or 1 in. flat Kevlar strap)	1 in. Nylon Web
Recovery Harness Length (ft)	30 (fore) / 30 (aft)
Harness/Airframe Interfaces	3/8 in. forged steel eyebolts connected to altimeter bulkheads

	Section 1	Section 2	Section 3	Section 4
Kinetic Energy of Each Section (Ft-lbs)	5137 (fore)	3444 (aft)	419.3 (nosecone)	N/A

Recovery System Properties - Main Parachute

Manufacturer/Model	Fruity Chutes Toroidal
Size or Diameter (in or ft)	10 ft (fore) / 8 ft (aft)
Main Altimeter Deployment Setting (ft)	525
Backup Altimeter Deployment Setting (ft)	500
Velocity at Deployment (ft/s)	146 (fore) / 127 (aft)
Terminal Velocity (ft/s)	12.02 (fore) / 12.95 (aft)
Recovery Harness Material, Size, and Type (examples - 1/2 in. tubular Nylon or 1 in. flat Kevlar strap)	1 in. Nylon Web
Recovery Harness Length (ft)	15
Harness/Airframe Interfaces	3/8 in. forged steel eyebolts connected to altimeter bulkheads

	Section 1	Section 2	Section 3	Section 4
Kinetic Energy of Each Section (Ft-lbs)	60.20 (fore)	52.40 (aft)	4.913 (nosecone)	N/A

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Payload

Payload 1 (official payload)	Overview
	The rover will be contained within the fore section of the airframe. Upon landing, the rover will be ejected from the airframe using black powder charges. The rover will have two coaxial, independently driven wheels with a chassis suspended between them. A spring-loaded stabilizer arm will act as a third point of contact with the ground. An Arduino Teensy 3.6 development board will autonomously control the motors to move the rover, receiving input from a sensor array including active sonar, passive sonar, and a nine-degree-of-freedom IMU. An auger will be mounted in the center of the chassis. When the rover is deployed the auger will periodically gather soil samples and store them in an internal containment unit. After collection, the rover will autonomously drive to a Scientific Base Station where it will perform an additional scientific experiment.
Payload 2 (non-scored payload)	Overview
	None

Test Plans, Status, and Results

Ejection Charge Tests	Sub-Scale Test Plan: After final launch vehicle assembly with bulkheads and recovery system, a remote ignition system will be used to ensure proper seperation and parachute ejection with selected amount of black powder. Full-Scale Test Plan: After final launch vehicle assembly with bulkheads and recovery system, a remote ignition system will be used to ensure proper seperation and parachute ejection with selected amount of black powder.
Sub-scale Test Flights	Test Plan: Sub-scale launch vehicle will be constructed with the same stability margin as the full scale launch vehicle. The same ejection controllers will be used in sub-scale flights as the full scale launch vehicle. Status: Planned test flight November 17th, 2018 & December 15th, 2018. Results: N/A
Vehicle Demon-stration Flights	Test Plan: The full scale launch vehicle will be manufactured from final design choices. Altitude and decent calculations will be calculated and verfied with simulations. The full scale launch vehicle will be flown multiple times in January and February 2019 before NASA Student Launch competition launch day April 6th, 2019. Status: Preliminary design of launch vehicle is complete. Results: N/A
Payload Demon-stration Flights	Test Plan: The competition payload is planned to fly in all full scale flights. The payload demonstration flights will be the same flights as the vehicle demonstration flights. Status: Preliminary design of launch vehicle is complete. Results: N/A

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Transmitter #1

Location of transmitter:	Nosecone		
Purpose of transmitter:	Tracking/Telemetry		
Brand	Digi	RF Output Power (mW)	250
Model	Xbee PRO 900HP	Specific Frequency used by team (MHz)	900
Handshake or frequency hopping? (explain)	Frequency hopping, 400KHz wide channels		
Distance to closest e-match or altimeter (in)	6		
Description of shielding plan:	Conductive spray paint RF shielding around recovery electronics to ensure no interference with recovery electronics and to ensure that ejection takes place at the correct altitude.		

Transmitter #2

Location of transmitter:	Nosecone		
Purpose of transmitter:	Long Range Tracking/Telemetry		
Brand	Texas Instruments	RF Output Power (mW)	40
Model	CC1200	Specific Frequency used by team (MHz)	433
Handshake or frequency hopping? (explain)	Frequency hopping		
Distance to closest e-match or altimeter (in)	6		
Description of shielding plan:	Conductive spray paint RF shielding around recovery electronics to ensure no interference with recovery electronics and to ensure that ejection takes place at the correct altitude.		

Transmitter #3

Location of transmitter:	Aft section of airframe directly above the motor		
Purpose of transmitter:	Tracking/Telemetry		
Brand	Digi	RF Output Power (mW)	250
Model	Xbee PRO 900HP	Specific Frequency used by team (MHz)	900
Handshake or frequency hopping? (explain)	Frequency hopping, 400KHz wide channels		
Distance to closest e-match or altimeter (in)	4		
Description of shielding plan:	Conductive spray paint RF shielding around recovery electronics to ensure no interference with recovery electronics and to ensure that ejection takes place at the correct altitude.		

Transmitter #4

Location of transmitter:	Aft section of airframe directly above the motor		
Purpose of transmitter:	Long Range Tracking/Telemetry		
Brand	Texas Instruments	RF Output Power (mW)	40
Model	CC1200	Specific Frequency used by team (MHz)	433
Handshake or frequency hopping? (explain)	Frequency hopping		
Distance to closest e-match or altimeter (in)	4		
Description of shielding plan:	Conductive spray paint RF shielding around recovery electronics to ensure no interference with recovery electronics and to ensure that ejection takes place at the correct altitude.		

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Transmitter #5

Location of transmitter:	Fore section above payload bay		
Purpose of transmitter:	Payload Ejection		
Brand	Digi	RF Output Power (mW)	250
Model	Xbee PRO 900HP	Specific Frequency used by team (MHz)	900
Handshake or frequency hopping? (explain)	Frequency hopping, 400KHz wide channels		
Distance to closest e-match or altimeter (in)	6		
Description of shielding plan:	Conductive spray paint RF shielding around recovery electronics to ensure no interference with recovery electronics and to ensure that ejection takes place at the correct altitude.		

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

None