Milestone Review Flysheet 2018-2019

Institution	Purdue University

Milestone	PDR

Vehicle Properties

Total Length (in)	122
Diameter (in)	5.15
Gross Lift Off Weight (lb)	39.5
Airframe Material(s)	Filament-wound fiberglass
Fin Material and Thickness (in)	3/16" G10 fiberglass
Coupler Length(s)/Shoulder Length(s) (in)	12"

Motor Properties

Motor Brand/Designation	Aerotech L1520T
Max/Average Thrust (lb)	381.42 / 323.67
Total Impulse (lbf-s)	841.55
Mass Before/After Burn (lb)	8.04 / 3.96
Liftoff Thrust (lb)	355.2
Motor Retention Method	Aeropack Motor Retainer

Stability Analysis

Center of Pressure (in. from nose)	89.782
Center of Gravity (in. from nose)	71.345
Static Stability Margin (on pad)	3.58
Static Stability Margin (at rail exit)	2.71
Thrust-to-Weight Ratio	8.99
Rail Size/Type and Length (in)	1.5, 144
Rail Exit Velocity (ft/s)	79.4

Ascent Analysis

Maximum Velocity (ft/s)	620
Maximum Mach Number	0.56
Maximum Acceleration (ft/s^2)	287
Target Apogee (ft)	4950
Predicted Apogee (From Sim.) (ft)	5023

Recovery System Properties - Overall

Total Descent Time (s)	92.19
Total Drift in 20 mph winds (ft)	1594.17

Recovery System Properties - Energetics

Ejection System Energetics (ex. Black Powder)		Black powder (4FG)
Energetics Mass - Drogue Chute (grams)	Primary	3.2
	Backup	3.5
Energetics Mass - Main Chute (grams)	Primary	3.2
	Backup	3.5
Energetics Mass - Other (grams) - If Applicable	Primary	n/a
	Backup	n/a

Recovery System Properties - Recovery Electronics

Primary Altimeter Make/Model	Altus Metrum Telemetrum
Secondary Altimeter Make/Model	Missileworks RRC3+ Sport
Other Altimeters (if applicable)	N/A
Rocket Locator (Make/Model)	Altus Metrum Telemetrum
Additional Locators (if applicable)	N/A
Transmitting Frequencies (all - vehicle and payload)	Likely to be 70cm ham band
Describe Redundancy Plan (batteries, switches, etc.)	Fully redundant and independent systems with individual batteries, switches, wires, and ejection charges.
Pad Stay Time (Launch Configuration)	3 hours

Recovery System Properties - Drogue Parachute

Manufacturer/Model	Skyangle Cert 3 Drogue
Size or Diameter (in)	24
Main Altimeter Deployment Setting	Apogee
Backup Altimeter Deployment Setting	Apogee + 1 second
Velocity at Deployment (ft/s)	8.11
Terminal Velocity (ft/s)	6.57
Recovery Harness Material, Size, and Type (examples - 1/2 in. tubular Nylon or 1 in. flat Kevlar strap)	5/8" tubular nylon
Recovery Harness Length (ft)	2
Harness/Airframe Interfaces	1/4" SS quick link through looped tether ends and 1/4" SS U-bolts through bulkheads

Kinetic Energy of Each Section (Ft-lbs)	Fore Section	Mid Section	Aft Section	Section 4
	1560.61	1082.64	2405.7	N/A

Recovery System Properties - Main Parachute

Manufacturer/Model	Skyangle Cert 3 XL
Size or Diameter (in)	100
Main Altimeter Deployment Setting (ft)	700
Backup Altimeter Deployment Setting (ft)	650
Velocity at Deployment (ft/s)	91.38
Terminal Velocity (ft/s)	3.2
Recovery Harness Material, Size, and Type (examples - 1/2 in. tubular Nylon or 1 in. flat Kevlar strap)	5/8" tubular nylon
Recovery Harness Length (ft)	8.33
Harness/Airframe Interfaces	1/4" SS quick link through looped tether ends and 1/4" SS U-bolts through bulkheads

Kinetic Energy of Each Section (Ft-lbs)	Fore Section	Mid Section	Aft Section	Section 4
	34.65	24.04	53.41	N/A

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Payload

Payload 1 (official payload)	**Overview** The launch vehicle created by the team will carry an autonomous rover and soil sampling system. The rover will be deployed from the payload bay upon landing and must drive at least 10 feet away from any part of the rocket. The rover will consist of two large wheels on either side of a chassis. The chassis will hold the control unit, power system, motion unit, as well as the object detection method needed for navigation. The soil collection apparatus will be deployable from the rear of the chassis. Once the payload bay has landed completely, a signal will be sent to deploy the rover. When the payload bay receives the signal, a black powder charge will ignite, launching a fairing capsule out of the payload bay. The fairing will open via spring loaded hinges, and the rover will deploy.
Payload 2 (non-scored payload)	**Overview** N/A

Test Plans, Status, and Results

Ejection Charge Tests	Several tests will be conducted. The first test will have each half of the launch vehicle constructed fully on either side (minus motor) around the avionics bay. Each half will be attached to the avionics bay and a manual electrical signal will be sent the the e-matches, igniting the black powder in the chagre well thus allowing us to measure accuracy of how much black powder we use. This test will be conducted several times on either side to ensure safe deployment of both the drogue and main parachutes. A secondary test will be conducted on the altimeters to verify that they are sending electrical charges to the e-match. This testing will be conducted by wiring both avionics systems to their own light (rather than e-match) . We will then turn on the altimeters as we would for final flight and place the two systems in a vacuum. In the vaccum we will then decrease the pressure to simulate an increase in altitude. Our lights should light up at both apogee and at the set altitude above ground level.
Sub-scale Test Flights	The sub-scale vehicle is almost fully constructed - fins are cut and need to be attached and the motor mount must be secured, but the rest of the vehicle is fully constructed. The team is aiming to conduct its first sub-scale test flight on November 11, 2018. If this launch date cannot be used, other available dates are 12/04/2018, 12/08/2018, and 12/09/2018.
Vehicle Demon-stration Flights	The team would like to have the full-scale vehicle fully constructed and ready to launch by January, but construction has not yet begun on this vehicle.
Payload Demon-stration Flights	The team would like to have an operational payload on the full-scale test flight that is planned to happen in January. The payload being tested will have the rover contained in a separate vessle inside the payload bay. Upon safe landing of the full-scale, the vessle will eject from the bay and deploy the rover. The rover will be tested for accuracy in meeting the criteria as defined by NASA and the team.

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Transmitter #1

Location of transmitter:	Transmitter #1 is located on the rover, contained within the payload's active retention system while in flight.		
Purpose of transmitter:	Transmitter #1 receives the signal sent from the RDO to eject the rover from the rocket.		
Brand	Xbee	RF Output Power (mW)	60
Model	Pro Series 1 (802.15.4)	Specific Frequency used by team (MHz)	2400
Handshake or frequency hopping? (explain)	Transmitters #1 and #2 are assigned 64-bit addresses in the manufacturing process. Each transmitter will be programmed to only send and receive data from the other transmitter. In this way, a basic handshake will be made between each transmitter.		
Distance to closest e-match or altimeter (in)	29.9		
Description of shielding plan:	Shielded boxing, short connections		

Transmitter #2

Location of transmitter:	Transmitter #2 is located with the team at the RDO.		
Purpose of transmitter:	Transmitter #2 is responsible for sending the signal to the payload from the RDO to trigger payload ejection.		
Brand	Xbee	RF Output Power (mW)	60
Model	Pro Series 1 (802.15.4)	Specific Frequency used by team (MHz)	2400
Handshake or frequency hopping? (explain)	Transmitters #1 and #2 are assigned 64-bit addresses in the manufacturing process. Each transmitter will be programmed to only send and receive data from the other transmitter. In this way, a basic handshake will be made between each transmitter.		
Distance to closest e-match or altimeter (in)	29.9		
Description of shielding plan:	Shielded boxing, short connections		

Transmitter #3

Location of transmitter:	Transmitter #3 is located in the Telemetrum in the Avionics Bay		
Purpose of transmitter:	Transmitter #3 is responsible for recording the altitude of the rocket and to trigger the ejection of the parachutes.		
Brand	TI	RF Output Power (mW)	40
Model	CC1120	Specific Frequency used by team (MHz)	435
Handshake or frequency hopping? (explain)	The transmitter will utilize a basic handshake between the altimeter and laptop on ground to track the flight of the rocket and deploy the parachutes when necessary.		
Distance to closest e-match or altimeter (in)	1.25		
Description of shielding plan:	Shielded boxing, short connections		

Transmitter #4

Location of transmitter:	Transmitter #4 is located in the RRC3 Sport in the Avionics Bay		
Purpose of transmitter:	Transmitter #4 is responsible for recording the altitude of the rocket and to trigger the ejection of the parachutes. This is used as a redundancy to the Telemetrum.		
Brand	TI	RF Output Power (mW)	40
Model	MSP430	Specific Frequency used by team (MHz)	16
Handshake or frequency hopping? (explain)	The transmitter will utilize a basic handshake between the altimeter and laptop on ground to track the flight of the rocket and deploy the parachutes when necessary.		
Distance to closest e-match or altimeter (in)	1.25		
Description of shielding plan:	Shielded boxing, short connections		

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Transmitter #5			
Location of transmitter:	N/A		
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:			

Transmitter #6			
Location of transmitter:	N/A		
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

N/A