Institution	Oregon State University

Milestone	CDR

Vehicle Properties	
Total Length (in)	109
Diameter (in)	6.25
Gross Lift Off Weigh (lb)	62
Airframe Material(s)	Carbon Fiber/fiberglass
Fin Material and Thickness (in)	Carbon Fiber 0.25
Coupler Length(s)/Shoulder Length(s) (in)	15/6.5

Motor Properties	
Motor Brand/Designation	AeroTech L2200G
Max/Average Thrust (lb)	697/504
Total Impulse (lbf-s)	1147
Mass Before/After Burn (lb)	10.5/4.93
Liftoff Thrust (lb)	557
Motor Retention Method	Bolted Retaining Ring

Stability Analysis	
Center of Pressure (in. from nose)	81.13
Center of Gravity (in. from nose)	62.04
Static Stability Margin (on pad)	2.98
Static Stability Margin (at rail exit)	3.04
Thrust-to-Weight Ratio	11.4
Rail Size/Type and Length (in)	1515/180
Rail Exit Velocity (ft/s)	90.1

Ascent Analysis	
Maximum Velocity (ft/s)	541
Maximum Mach Number	0.49
Maximum Acceleration (ft/s^2)	346
Target Apogee (ft)	4000
Predicted Apogee (From Sim.) (ft)	4427

Recovery System Properties - Overall	
Total Descent Time (s)	85.4
Total Drift in 20 mph winds (ft)	2400

Recovery System Properties - Energetics		
Ejection System Energetics (ex. Black Powder)		Black Powder
Energetics Mass - Drogue Chute (grams)	Primary	1.9 g
	Backup	3.8 g
Energetics Mass - Main Chute (grams)	Primary	4.8 g
	Backup	9.6 g
Energetics Mass - Other (grams) - If Applicable	Primary	N/A
	Backup	N/A

Payload Deployment	
Location: Air or Ground (if applicable)	Ground
Altitude of Deployment (if applicable)	0 ft AGL

Recovery System Properties - Recovery Electronics	
Primary Altimeter Make/Model	Missile Works RRC3 Altimete
Secondary Altimeter Make/Model	TE MS5038 - Avionics
Other Altimeters (if applicable)	TE MS5038 - BEAVS
Rocket Locator (Make/Model)	ublox SAM-M8Q -
Additional Locators (if applicable)	ublox SAM-M8Q -
Transmitting Frequencies (all - vehicle and payload)	***Required by CDR*** (Complete on pages 3 and 4)
Pad Stay Time (Launch Configuration)	10 hr
Describe Redundancy Plan (batteries, switches, etc.)	The avionics bay will have additional batteries for twice the required time with backups in BEAVS.

Recovery System Properties - Drogue Parachute				
Manufacturer/Model			Fruity Chutes Eliiptical	
Size or Diameter (in or ft)			18 in	
Main Altimeter Deployment Setting			4000ft	
Backup Altimeter Deployment Setting			3950ft	
Velocity at Deployment (ft/s)			1.7	
Terminal Velocity (ft/s)			136	
Recovery Harness Material, Size, and Type (examples - 1/2 in. tubular Nylon or 1 in. flat Kevlar strap)			1in flat Nylon Strap	
Recovery Harness Length (ft)			33ft	
Harness/Airframe Interfaces		Eye bolts		
Kinetic Energy (Ft-lbs)	Section 1	Section 2	Section 3	Section 4
	36.53	1.08	36.67	N/A

Recovery System Properties - Main Parachute				
Manufacturer/Model			Fruitychutes	
Size or Diameter (in or ft)			12ft	
Main Altimeter Deployment Setting (ft)			600	
Backup Altimeter Deployment Setting (ft)			500	
Velocity at Deployment (ft/s)			136	
Terminal Velocity (ft/s)			532	
Recovery Harness Material, Size, and Type (examples - 1/2 in. tubular Nylon or 1 in. flat Kevlar strap)			1in flat Nylon strap	
Recovery Harness Length (ft)			15ft	
Harness/Airframe Interfaces		Eyebolts and butterfly knot		
Kinetic Energy (Ft-lbs)	Section 1	Section 2	Section 3	Section 4
	36.53	1.08	36.67	N/A

Institution	Oregon State University	Milestone	CDR

Payload	
Payload 1 (official payload)	Overview The payload is retained in the fore section of the airframe by a lead screw styled ejection system. This system will eject the nose cone, then payload from the airframe. Ground operations will then be performed by a rover styled system. The rover utilizes a bi-axial dual motor drivetrain, and expandable wheels to navigate. The wheels collapse to a stowed diameter of 6.25 in. in the airframe, then expand to a 10 in. diameter once ejected from the airframe. At this point a carbon fiber tail will unfurl. This mechanical motion is used to switch a relay turning on the rover electronic system. The rover then uses a plow styled collection system, powered by a leadscrew linear actuator to collect and store the simulated ice sample. The rover itself is comprised of a laser cut wooden chassis, manual machined aluminum supports, and 3D printed PLA parts.
Payload 2 (non-scored payload)	Overview

Test Plans, Status, and Results	
Ejection Charge Tests	Subscale black powder ejection charge tests were conducted, and showed that the calculated charge size was able to fully deploy both the drogue and the main parachute in their respective tests. Therefore the subscale drogue and subscale main deployment tests were successful. The next step is to test full scale drogue and full scale main parachute deployments, however, in order to do this, the full scale parachutes need to be purchased and delivered, and the nomex blankets need to be created.
Sub-scale Test Flights	The subscale test flight took place under ideal conditions, having a clear sky and minimal wind. The launch rail was aimed directly up with no wind correction as per the RSO instructions. The launch vehicle left the rail accelerating straight up into the air and coasting past motor burnout arcing slightly above the launch site RSO table. Drogue deployed at apogee, with a noticeable deployment of the secondary charge 1 second later as programmed. The launch vehicle glided down to 600 ft AGL with the wind carrying it slightly past the launch rail, and deployed the main parachute. Again with a noticeable deployment of the secondary backup charge as the vehicle passed approximately 500 ft AGL. This was also exactly as designed and programed by OSRT. The launch vehicle then landed approximately 250 ft past the launch rail.
Vehicle Demon-stration Flights	
Payload Demon-stration Flights	The payload has not been present on any of the subscale flights.

Institution	Oregon State University	Milestone	CDR

Transmitter #1			
Location of transmitter:	Nose Cone		
Purpose of transmitter:	To track rocket altitude during flight		
Brand	HOPERF electronic	RF Output Power (mW)	100mW
Model	RFM95	Specific Frequency used by team (MHz)	915
Handshake or frequency hopping? (explain)	Yes, to ensure that payload is not ejected prematurely. It will involve handshakes and acknowledgement.		
Distance to closest e-match or altimeter (in)	38.95		
Description of shielding plan:	It will be separated by a bulk head and will be surrounded by a ground plane.		

Transmitter #2			
Location of transmitter:	Payload Bay		
Purpose of transmitter:	Ejection of Payload		
Brand	DIGI	RF Output Power (mW)	100mW
Model	XBee Pro XSC SC3B	Specific Frequency used by team (MHz)	915
Handshake or frequency hopping? (explain)	Handshake to verify correct reception of data.		
Distance to closest e-match or altimeter (in)	30		
Description of shielding plan:	It will be shielded by a bulk head and surrounded by the ground plane between itself and the altimeters.		

Transmitter #3			
Location of transmitter:	Rover		
Purpose of transmitter:	Rover Control		
Brand	DIGI	RF Output Power (mW)	100mW
Model	XBee Pro XSC SC3B	Specific Frequency used by team (MHz)	915
Handshake or frequency hopping? (explain)	Handshake to verify correct reception of data.		
Distance to closest e-match or altimeter (in)	38.95		
Description of shielding plan:	It will be off until the Payload is ejected from the rocket. It will also be surrounded by a ground plane		

Transmitter #4			
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:			

Institution	Oregon State University	Milestone	CDR

Transmitter #5			
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:			

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