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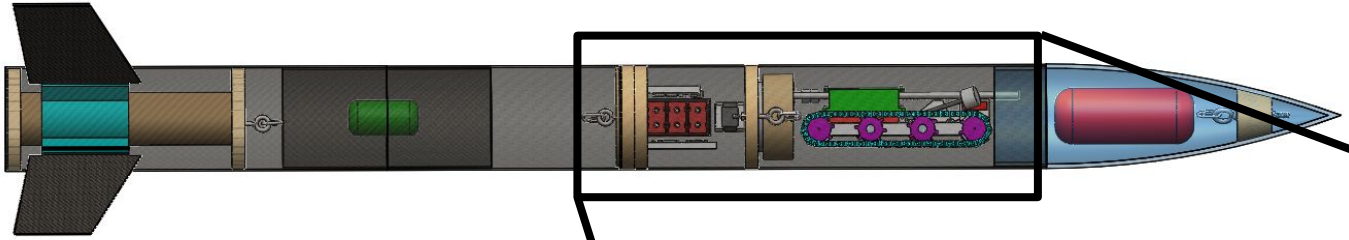
(LEXS)

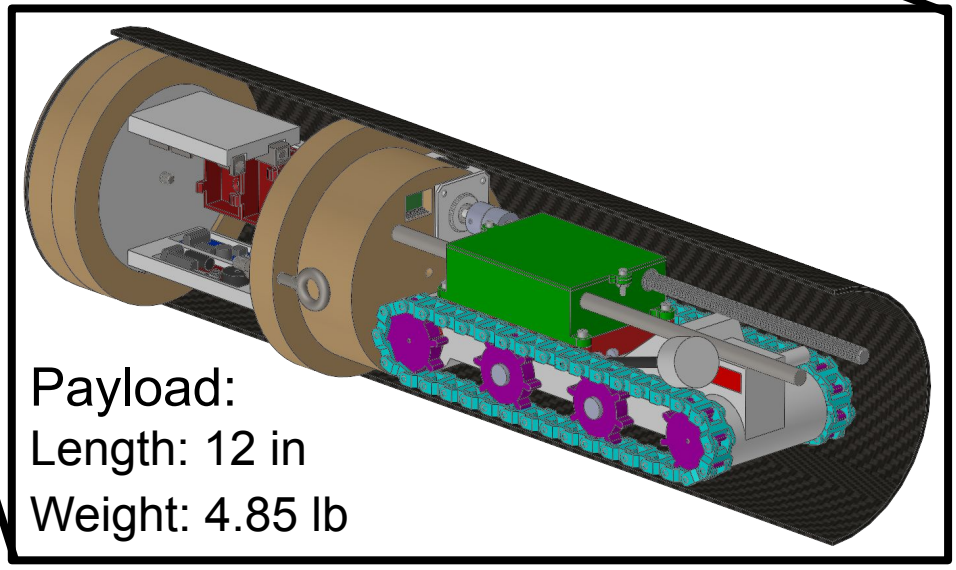
Lunar Environment eXcavation Simulation

FRR Overview



Launch Vehicle:
Length: 77 in
Weight: 28.5 lb

Motor Selection:
2856-L910-CS-0



Payload:
Length: 12 in
Weight: 4.85 lb

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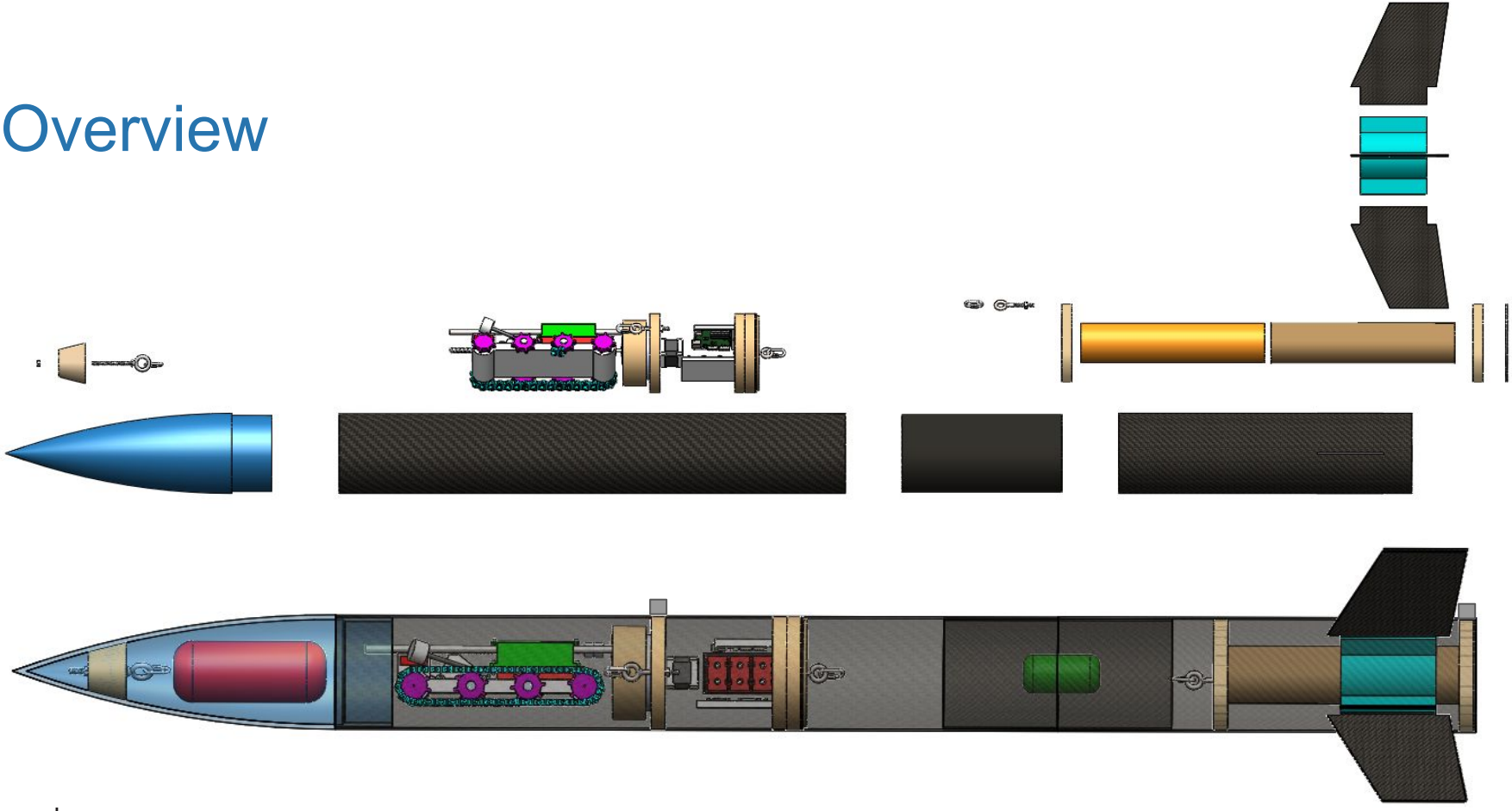
Overview



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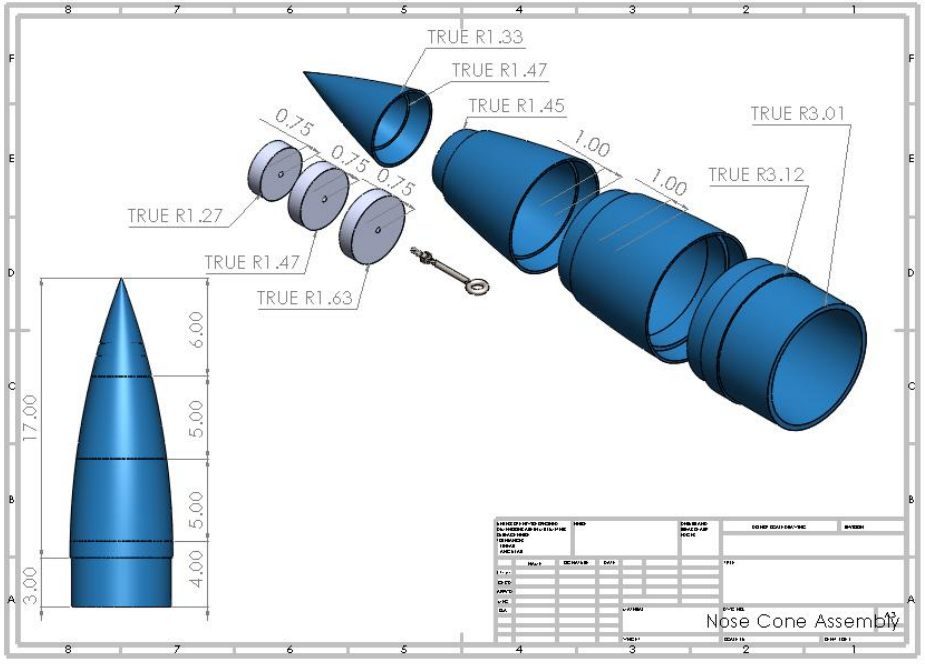
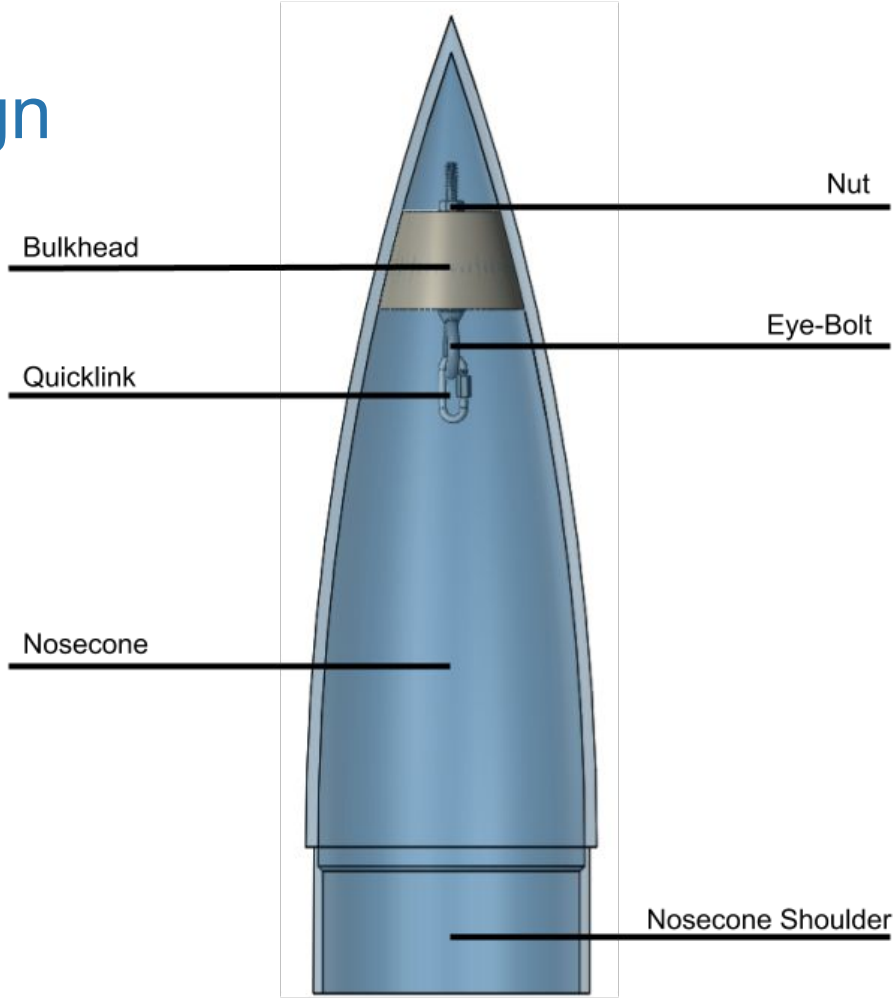
Launch Vehicle

Nose Cone Section - Design





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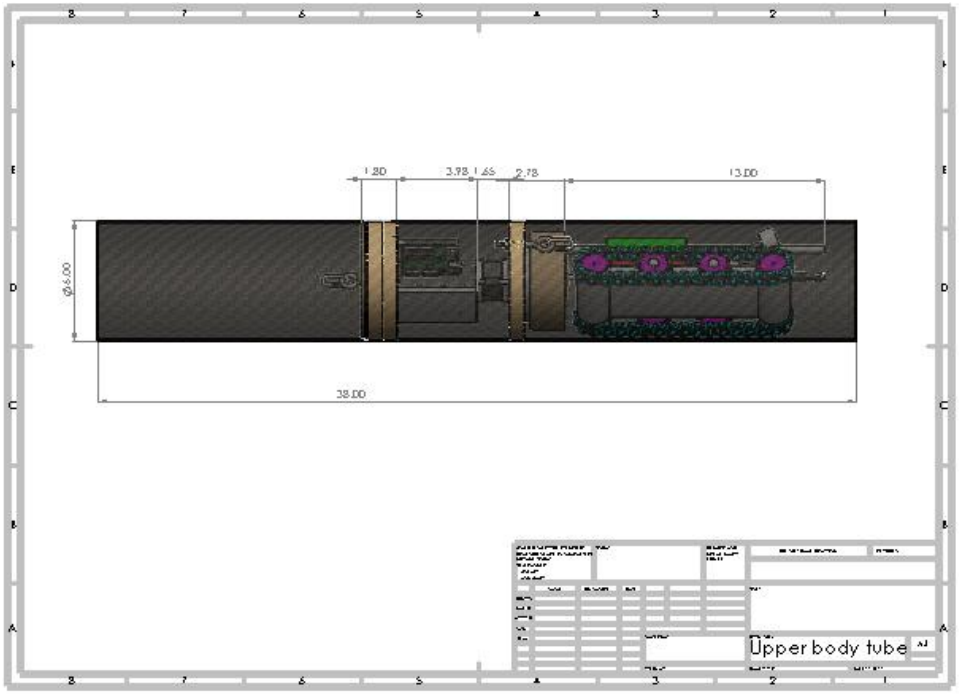
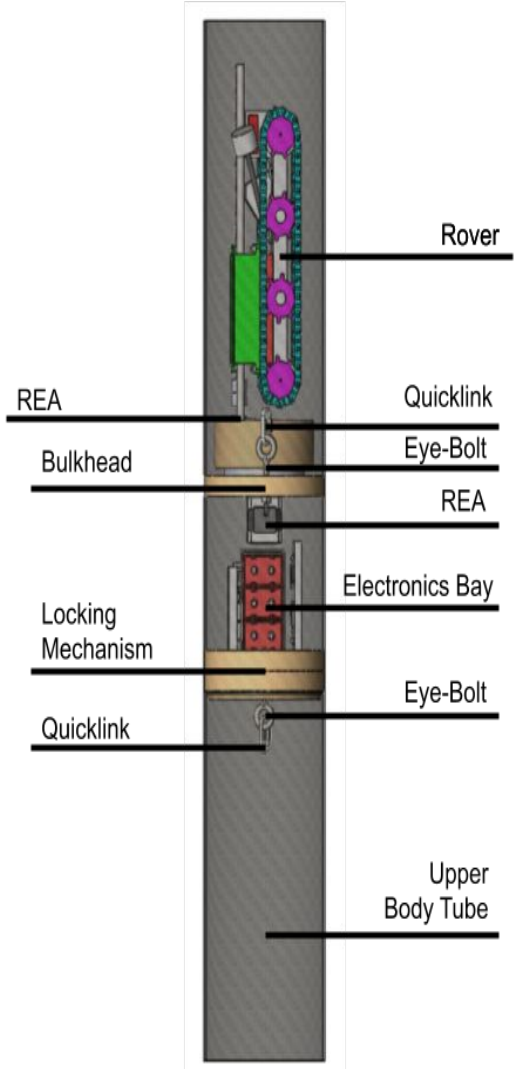
Section Mass:
1.98 lb.

Upper Body Tube Section - Design





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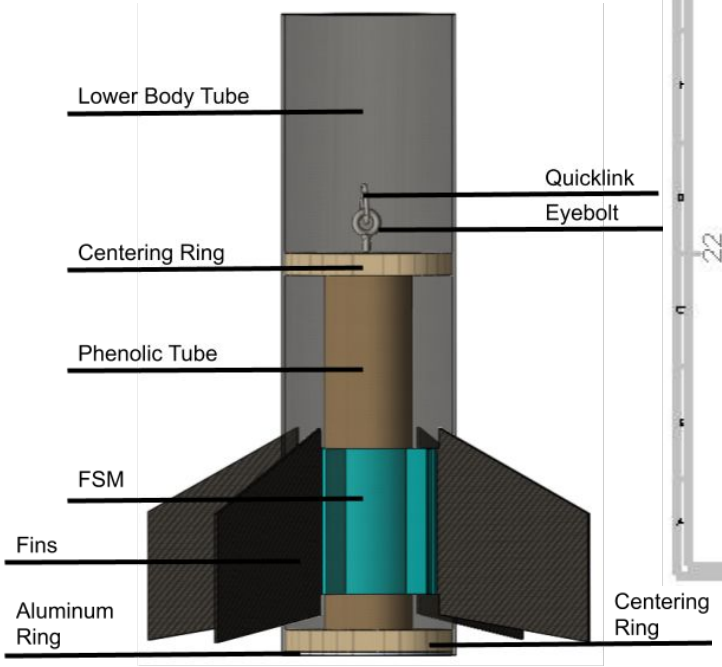
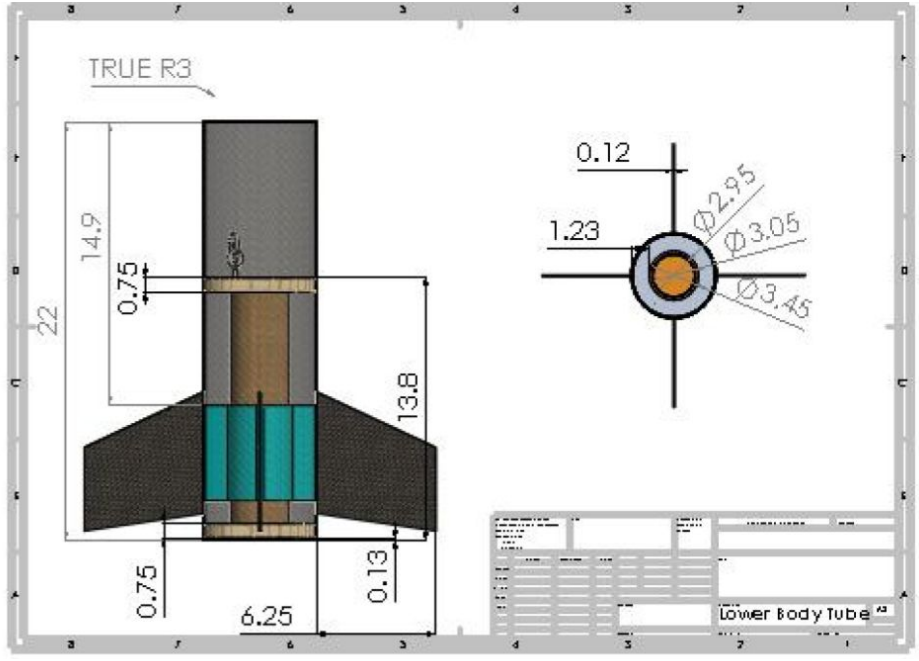
Section Mass:
10.68 lb

Lower Body Tube Section - Design



Side View



Section Mass:
12.16 lb

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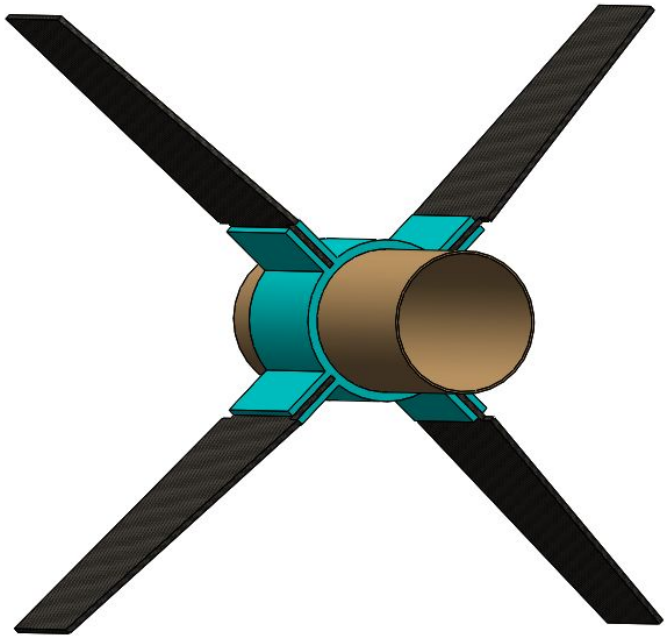
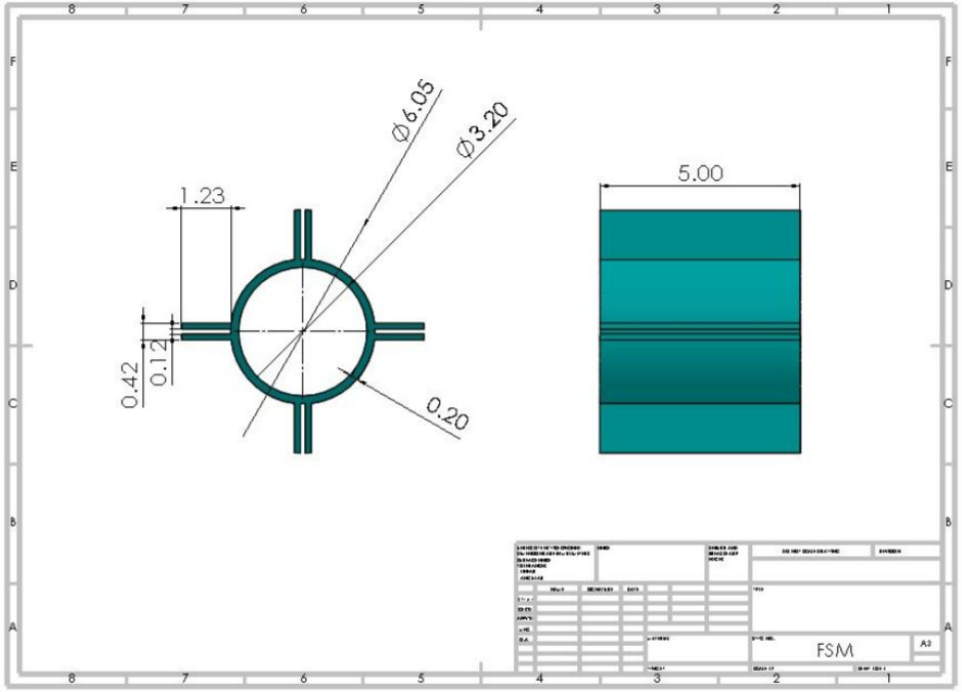
Lower Body Tube Section - Design (continued)





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Full-Scale Vehicle Demonstration Flight Analysis

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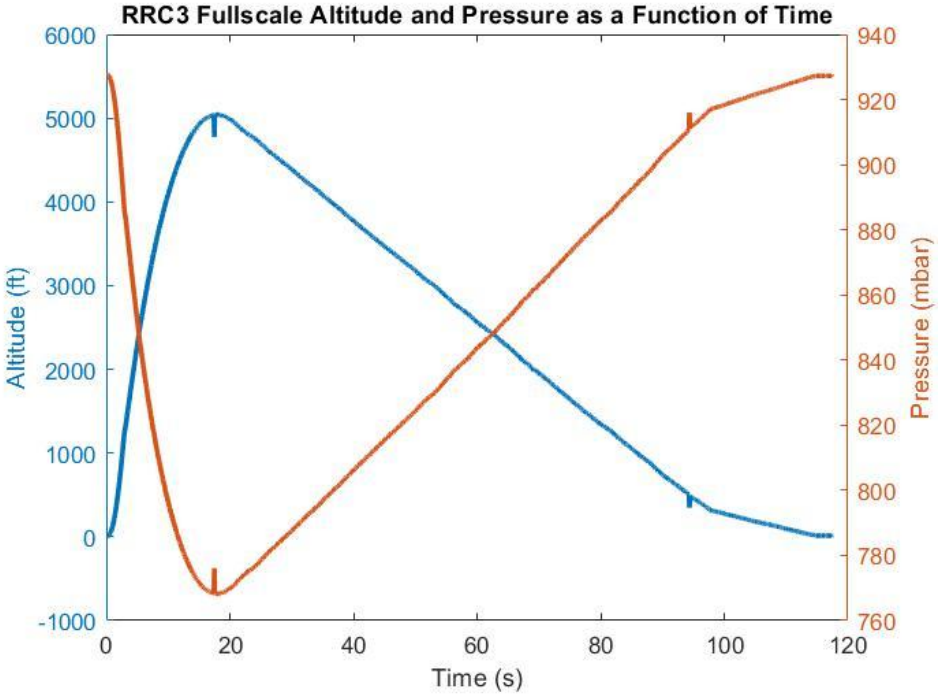
Full-Scale Vehicle Demonstration Flight Results

- Drag Coefficient Estimation: 0.39
- Apogee: 5044 ft AGL
- Descent Time: 96 s



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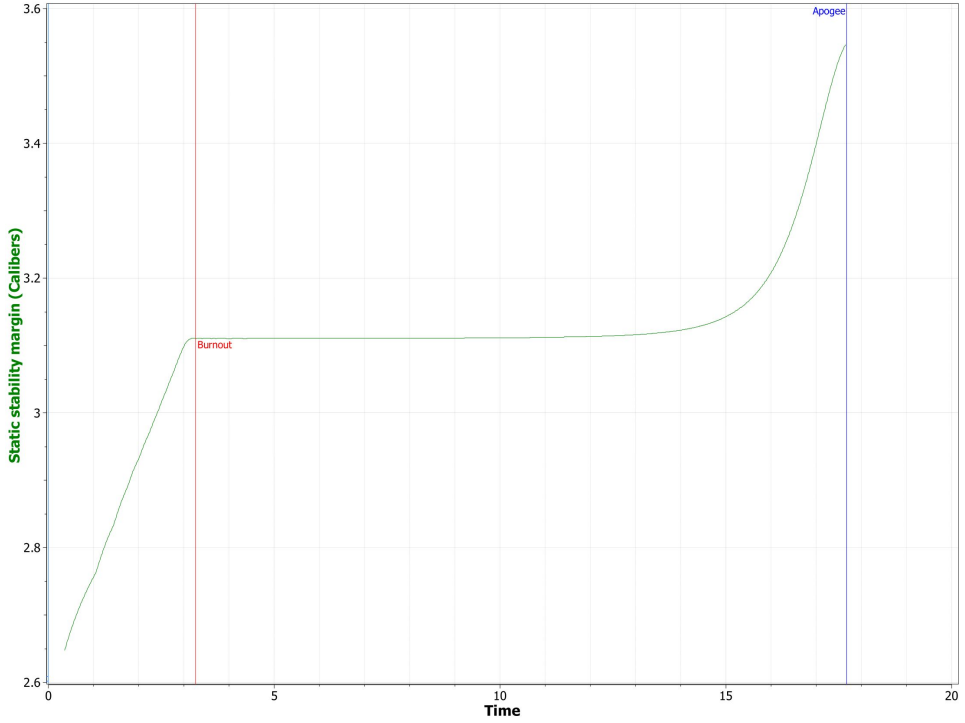
Parachute Characteristics

	Main Parachute	Drogue Chute
Diameter	12 ft	3 ft
Coefficient of Drag	0.97	0.8
Descent Rate (estimated)	14 fps	60 fps
Descent Rate (actual)	18 fps	58 fps

Mission Performance Predictions

Mission Performance (Ascent)

- Motor Selection: 2856-L910-CS-0
- Thrust-to-Weight Ratio: 7.15
- Rail Exit Velocity: 57.9 ft/s
- Static Stability: 2.60 cal
- Static Stability at Rail Exit: 2.66 cal



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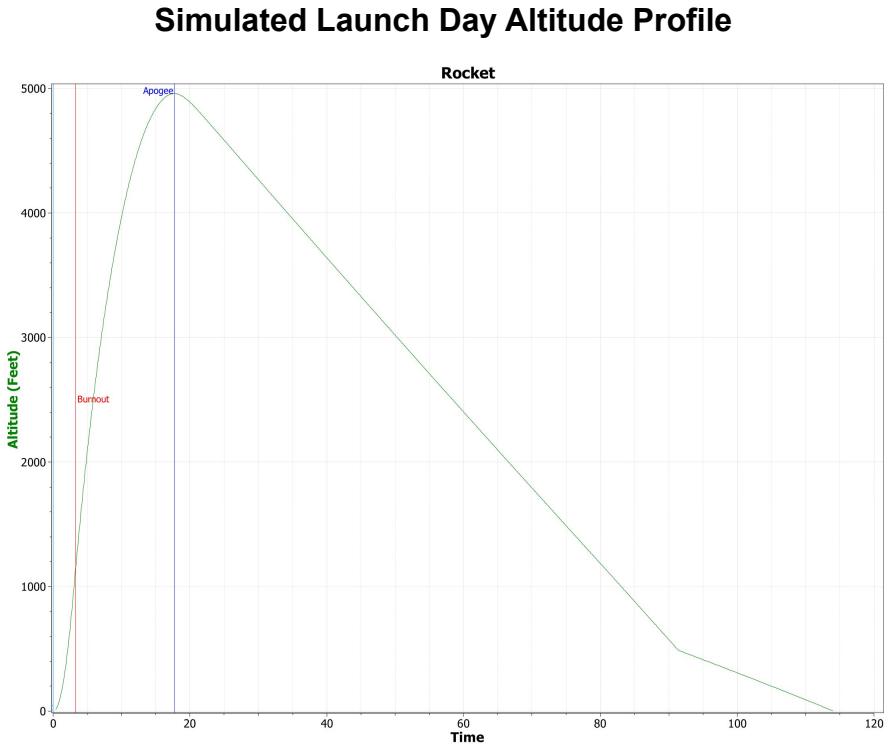
Mission Performance (Ascent)

Assuming launch rail is inclined 5 degrees:

Wind Speed	0 mph	5 mph	10 mph	15 mph	20 mph
Apogee	4929 ft AGL	4960 ft AGL	4978 ft AGL	4925 ft AGL	4830 ft AGL

Mission Performance (Descent)

- Descent Time: 88.9 s
- Descent Rate (drogue): 60.05 ft/s
- Descent Rate (main): 21.37 ft/s
- Landing Speed: 18.55 ft/s



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Mission Performance (Landing)

@ Main Parachute Deployment:

Vehicle Section	Nose Cone	Upper Body Tube	Lower Body Tube
Kinetic Energy	103.64 ft-lbf	557.88 ft-lbf	659.22 ft-lbf

@ Landing:

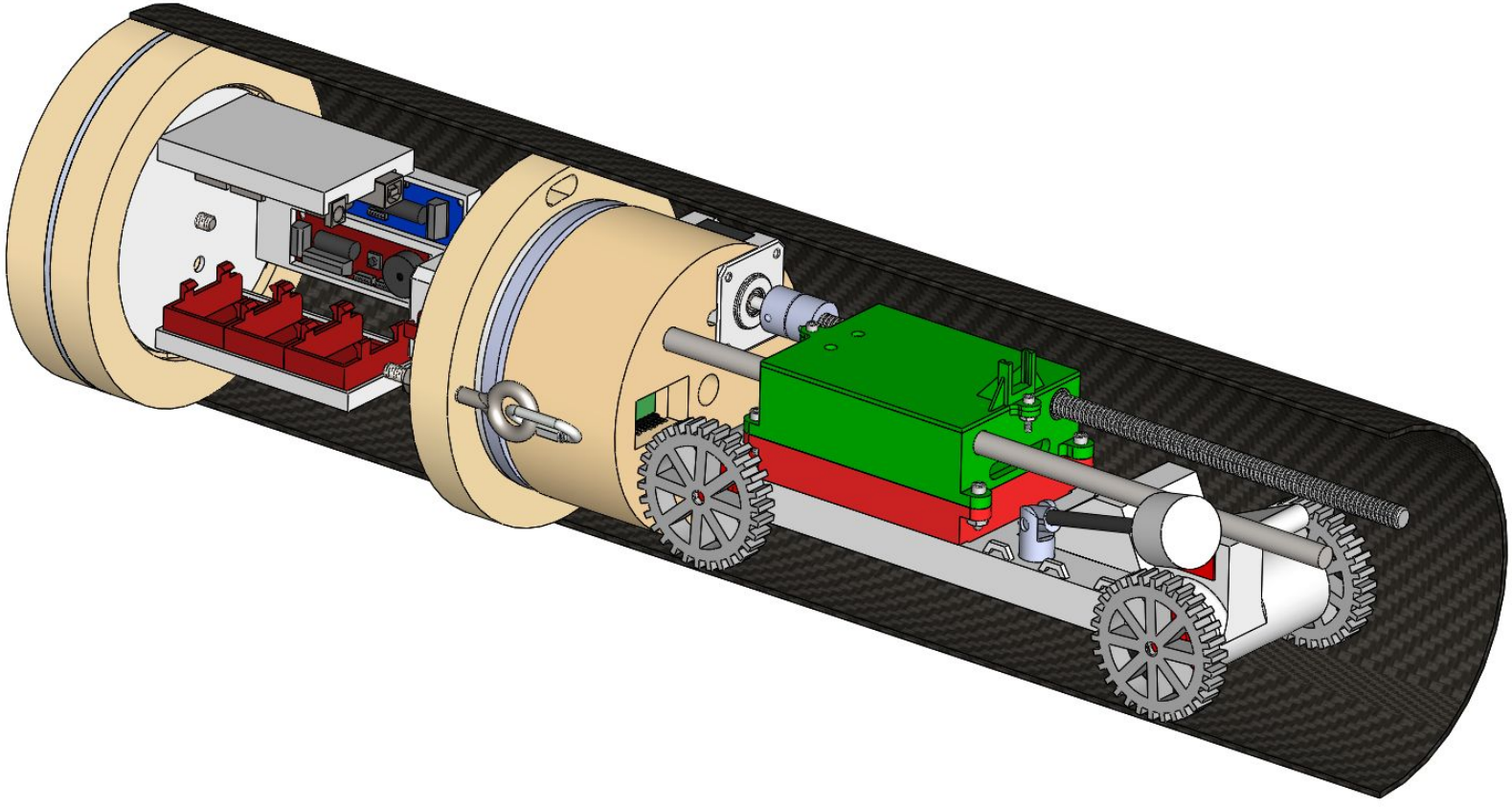
Vehicle Section	Nose Cone	Upper Body Tube	Lower Body Tube
Kinetic Energy	9.98 ft-lbf	53.73 ft-lbf	61.18 ft-lbf

Mission Performance (Landing) (cont'd)

Assuming apogee is reached directly above launch pad,
and launch rail is inclined 5 degrees:

Wind Speed	0 mph	5 mph	10 mph	15 mph	20 mph
Horizontal Drift	0 ft	1692 ft	1789 ft	2139 ft	2317 ft

Scientific Payload



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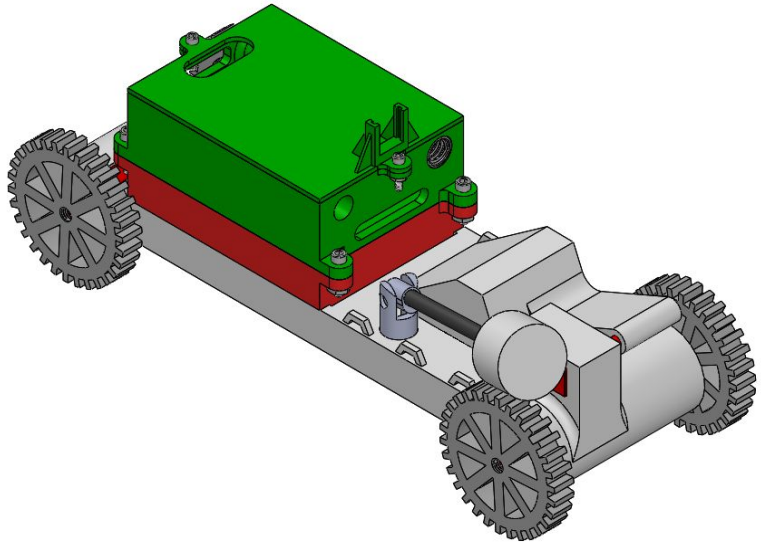
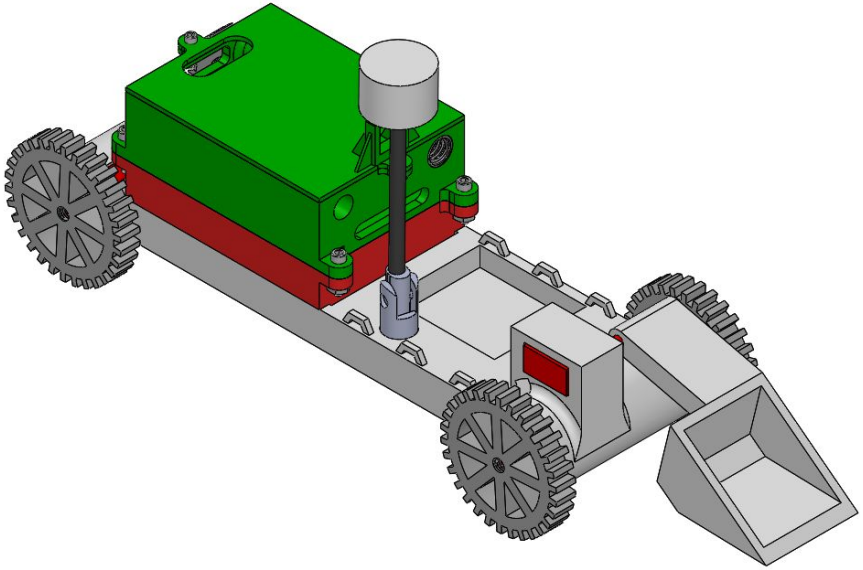
Rover





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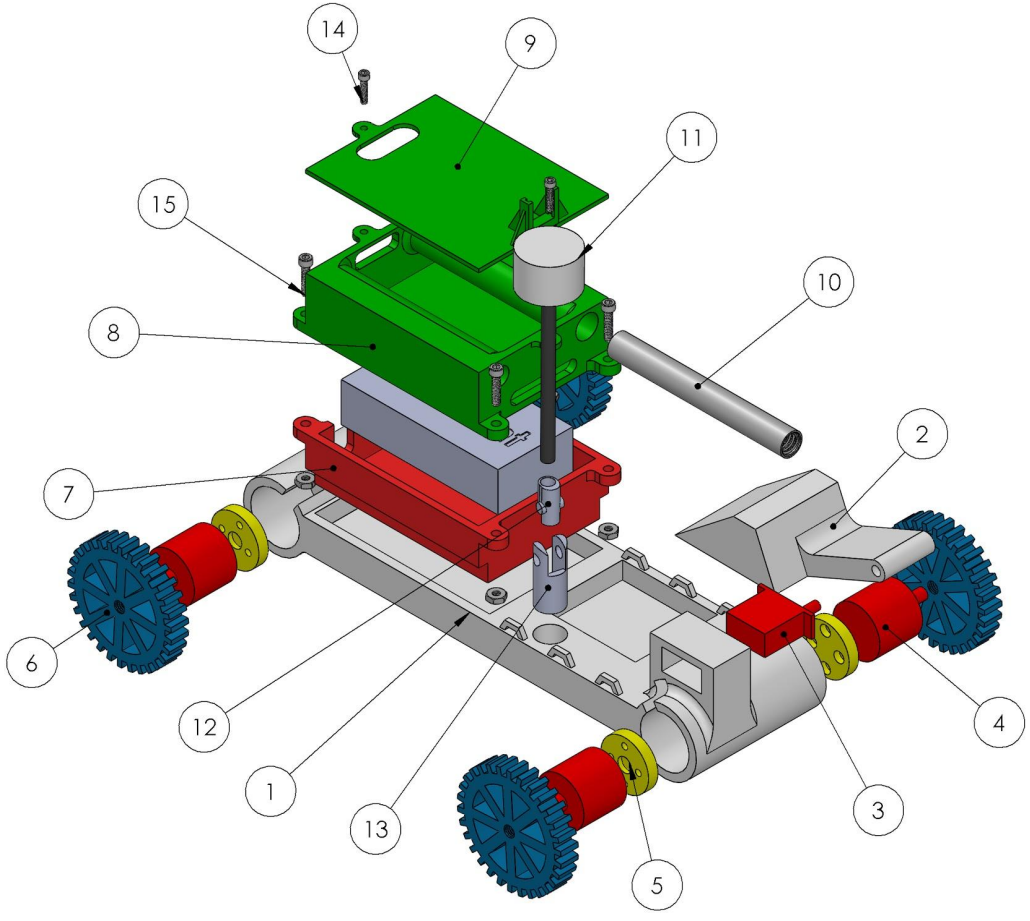

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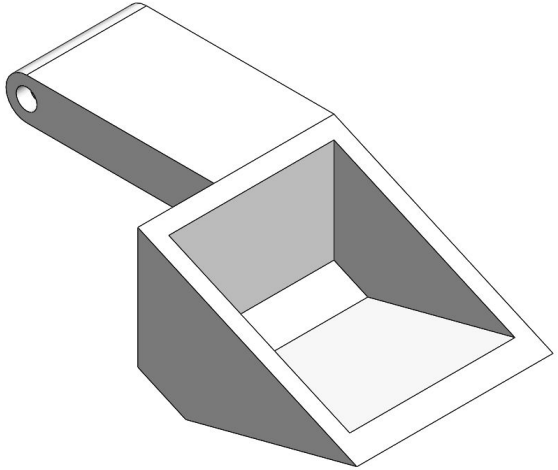
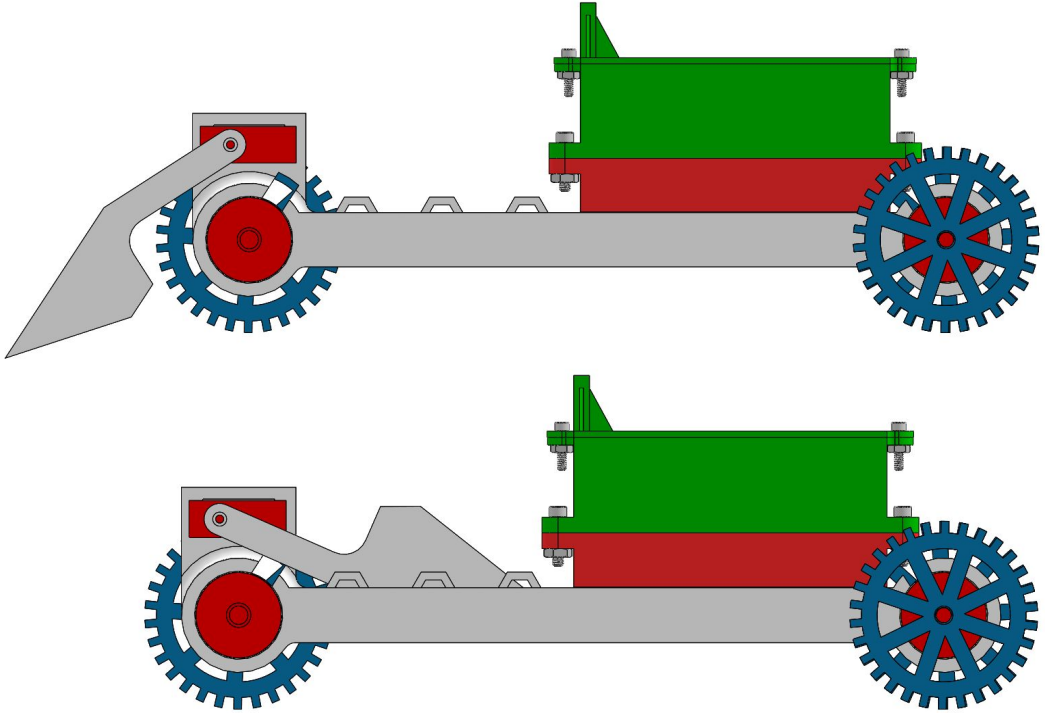
Collection Method





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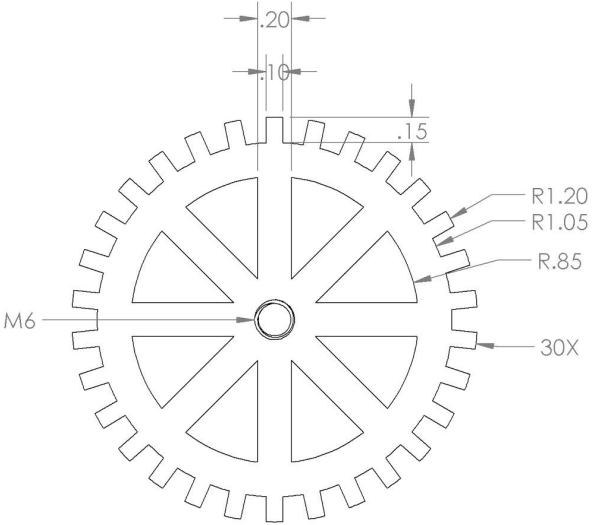
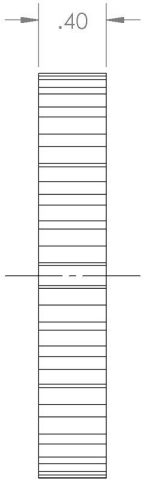
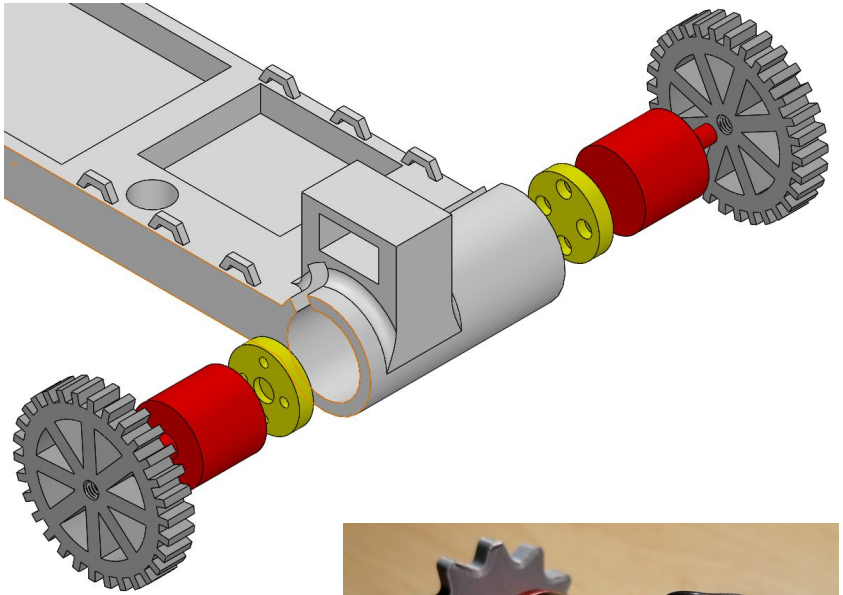
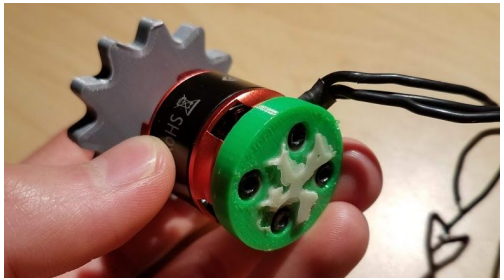
Wheel System









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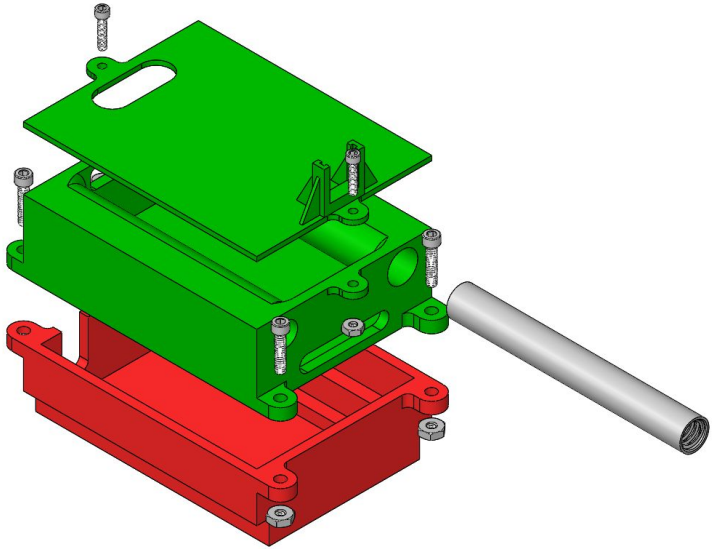
Rover Electronics



- ~~Flight Controller~~
- Antennas
- Receiver
- Video Transmitter
- DC Motors
- Electronic Speed Controllers
- Power Supply

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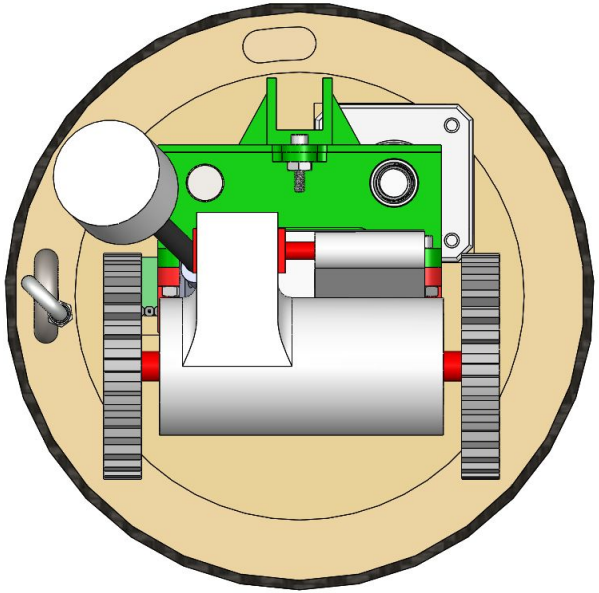
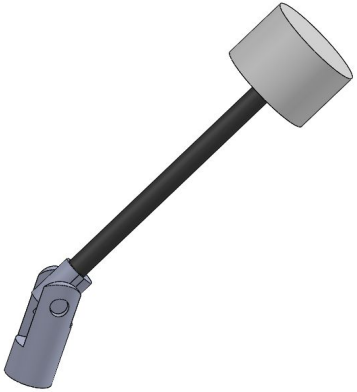
Rover Antenna

$$P_r = \frac{P_t G_t G_r \lambda^2}{(4\pi R)^2}$$



RX/VTX	Output Power (W)	Sensitivity (dBm)	Received (dBm)
RX	0.1	-104	-74.94
VTX	0.2	-90	-71.94



Circularly polarized directional antenna (1.6dBic)

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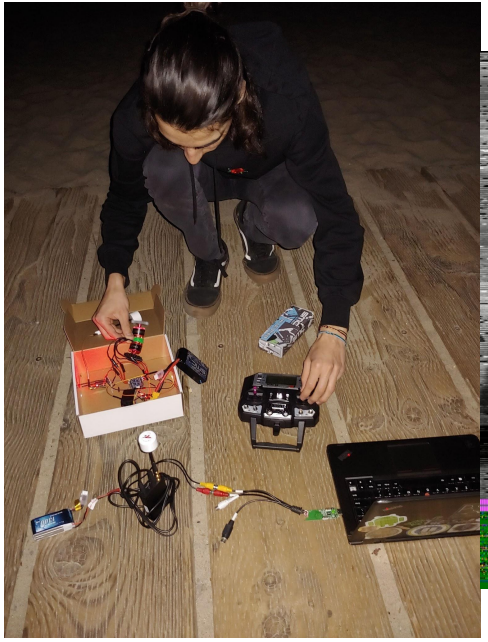
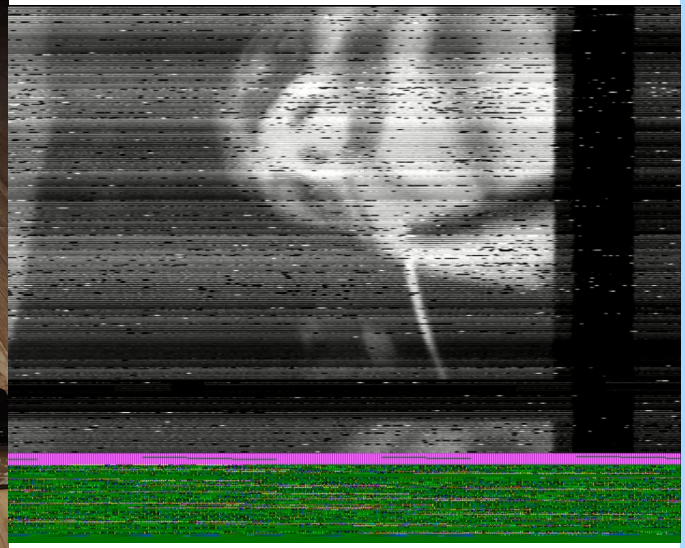
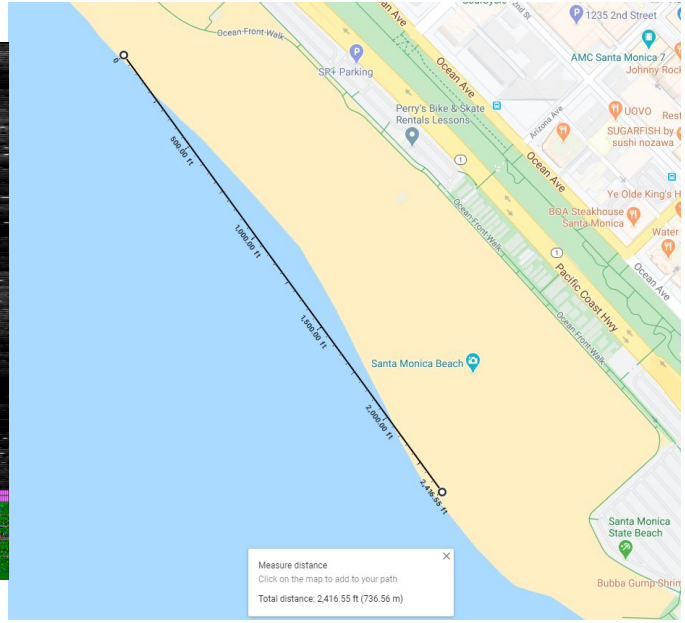
RF Testing



Setup



Video Feedback



Range

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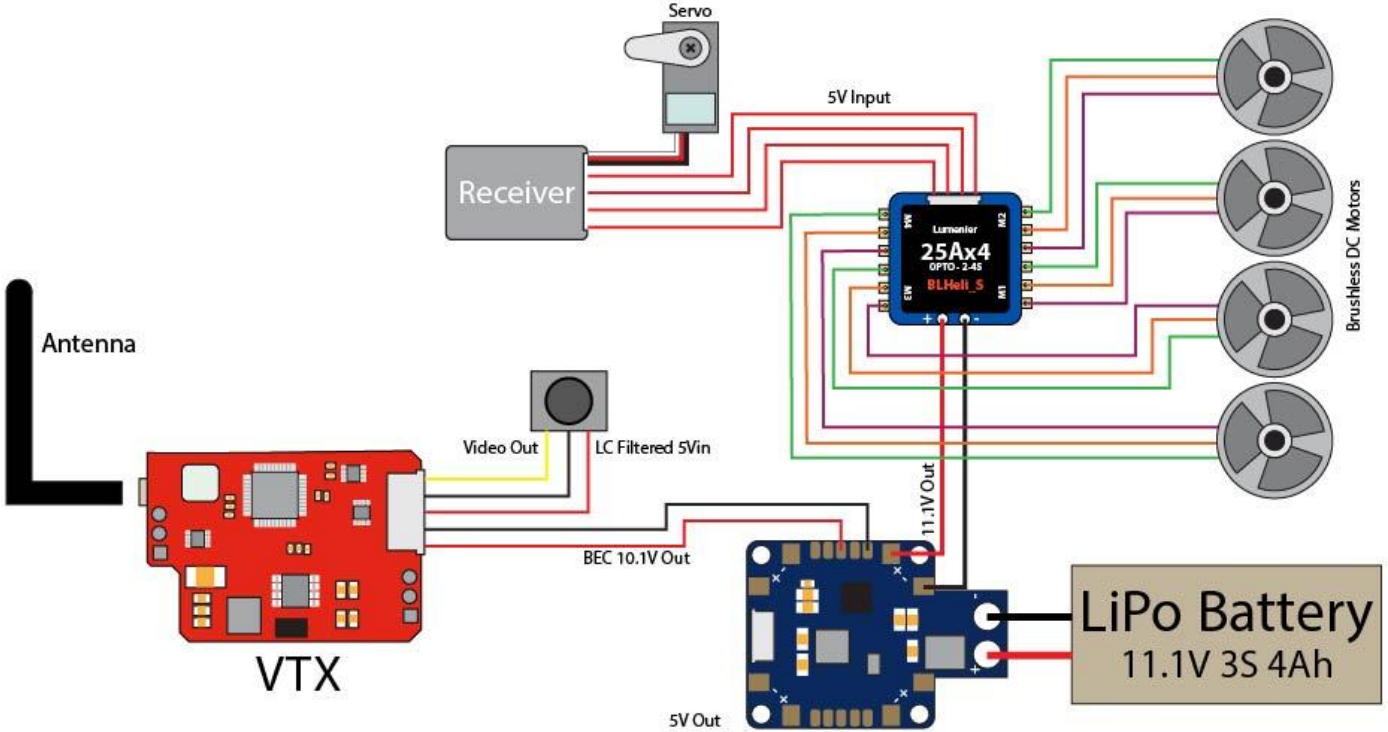
Rover Electronics Schematic



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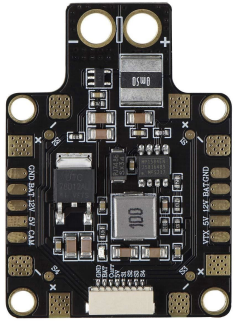
Current Ratings

ESC

25A continuous each

PDB



50A continuous each

DC Motor

11A max draw

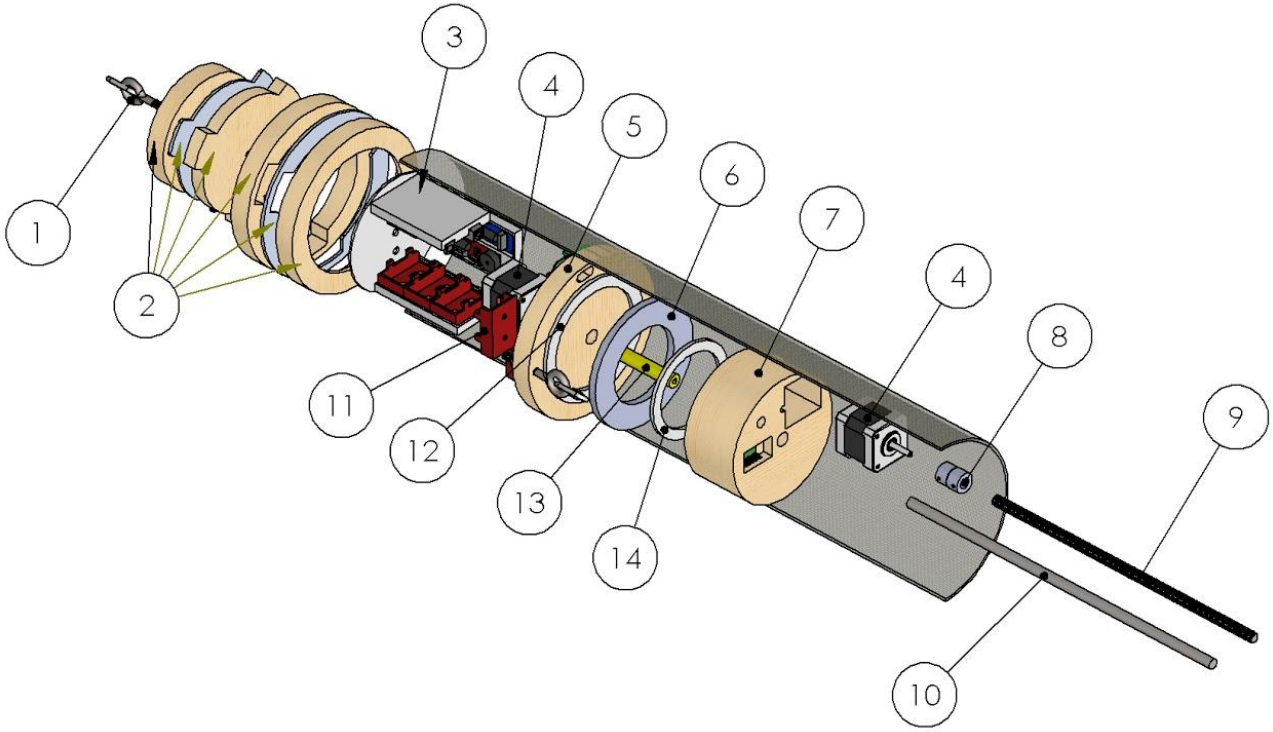
LiPo Battery

50C rating x 4Ah =
200A discharge rate

Electronic Overview

Section	Part	Voltage Range (V)	Current Draw (mA)	Hours (h)	mAh
Controls	DC Motor	6.6 - 7.2	1250	0.5	625
	DC Motor	6.6 - 7.2	1250	0.5	625
	DC Motor	6.6 - 7.2	1250	0.5	625
	DC Motor	6.6 - 7.2	1250	0.5	625
	Servo Motor	5	80	0.5	40
	Receiver	10	30	4	120
	Total	-	**5180**	-	**2660**
Video	Transmitter	7.4 - 25.2	90	4	360
	Camera	5	90	4	360
	Total	-	**180**	-	**720**
Final Total			**5360**		**3380**

REA



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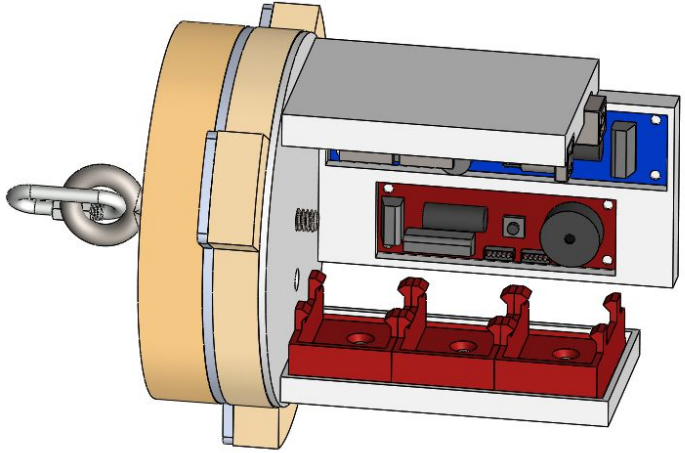
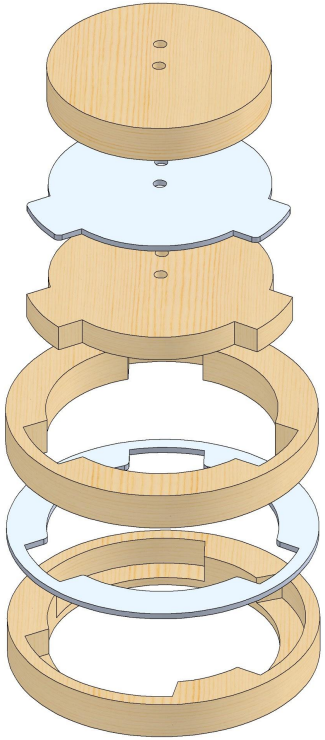
Locking Mechanism





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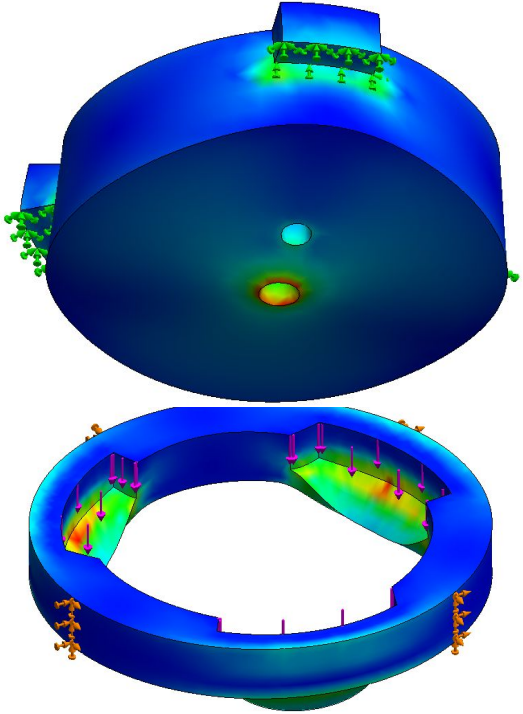
Locking Mechanism - Testing



Normal Stress:
Force Impossed: 27.8 lbf
Max Stress Felt:
Top: 103 psi
Bottom: 169 psi
Yeild Stress:899 psi
Passed - Physical Testing Planned

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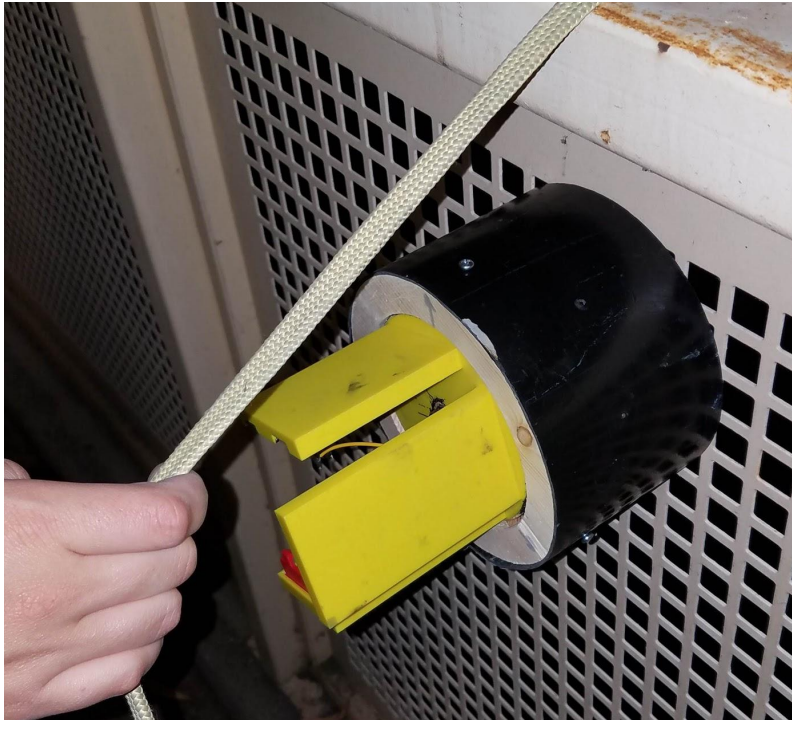
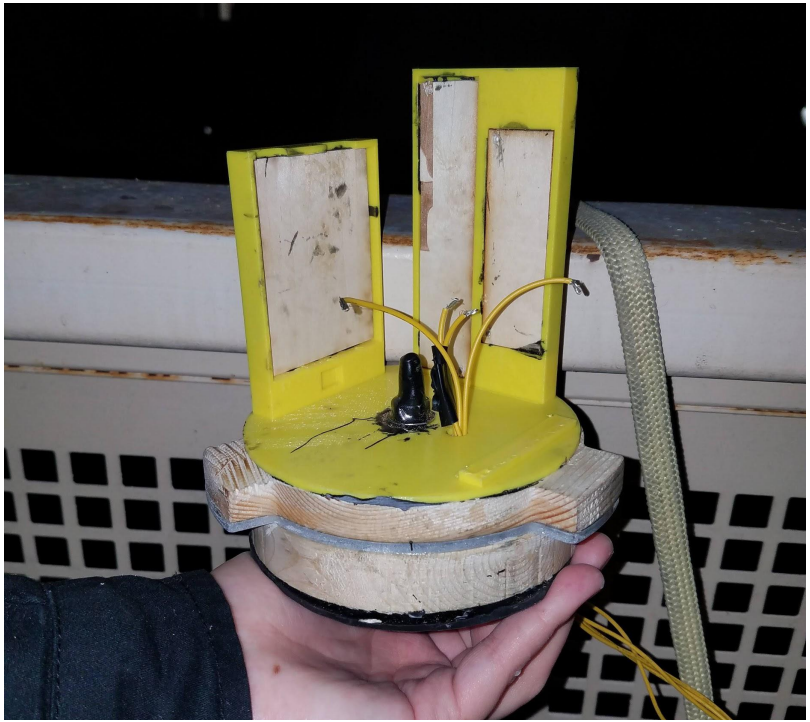
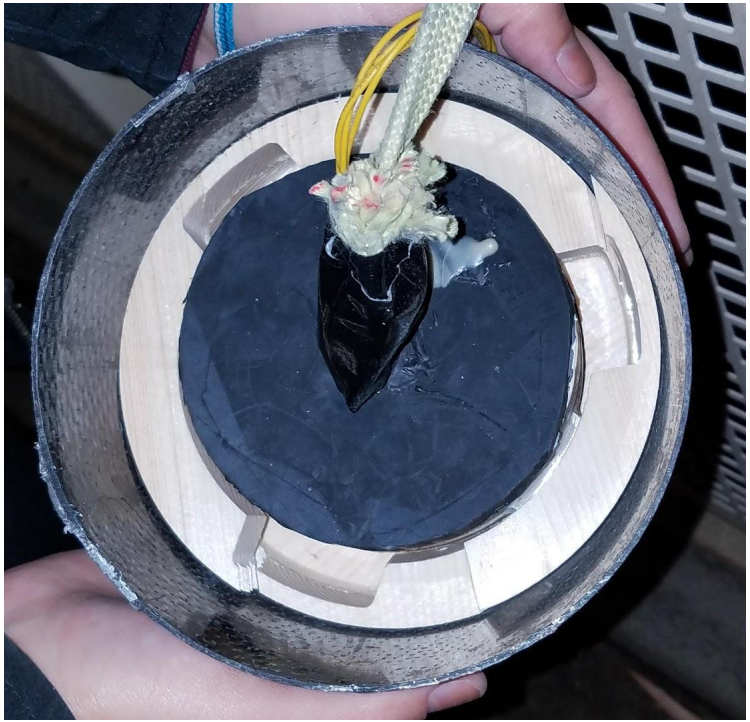
Locking Mechanism - Testing (Physical) Set Up



Locking Mehcanism - Testing (Physical) Results





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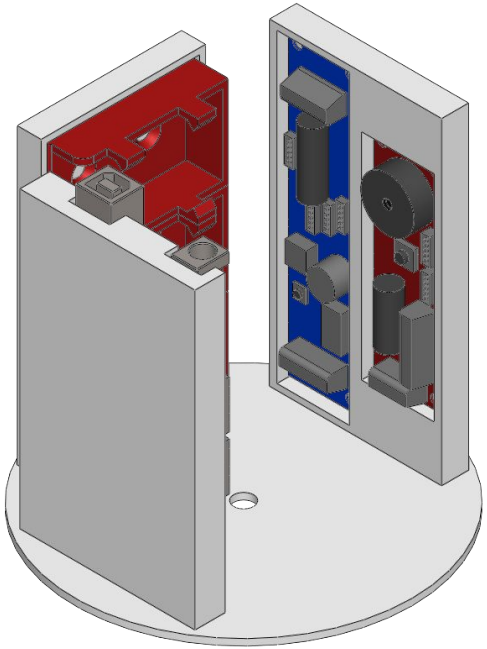
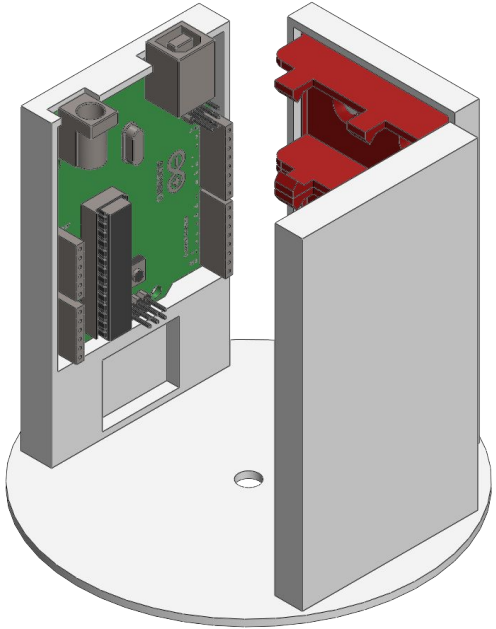
Avionics Bay





Altimeters
- Stratologger SL 100 Altimeter
- RRC3 Sports ALtimeter

REA
- Arduino Uno
- BMP180

Power
- 3x 9V Battery

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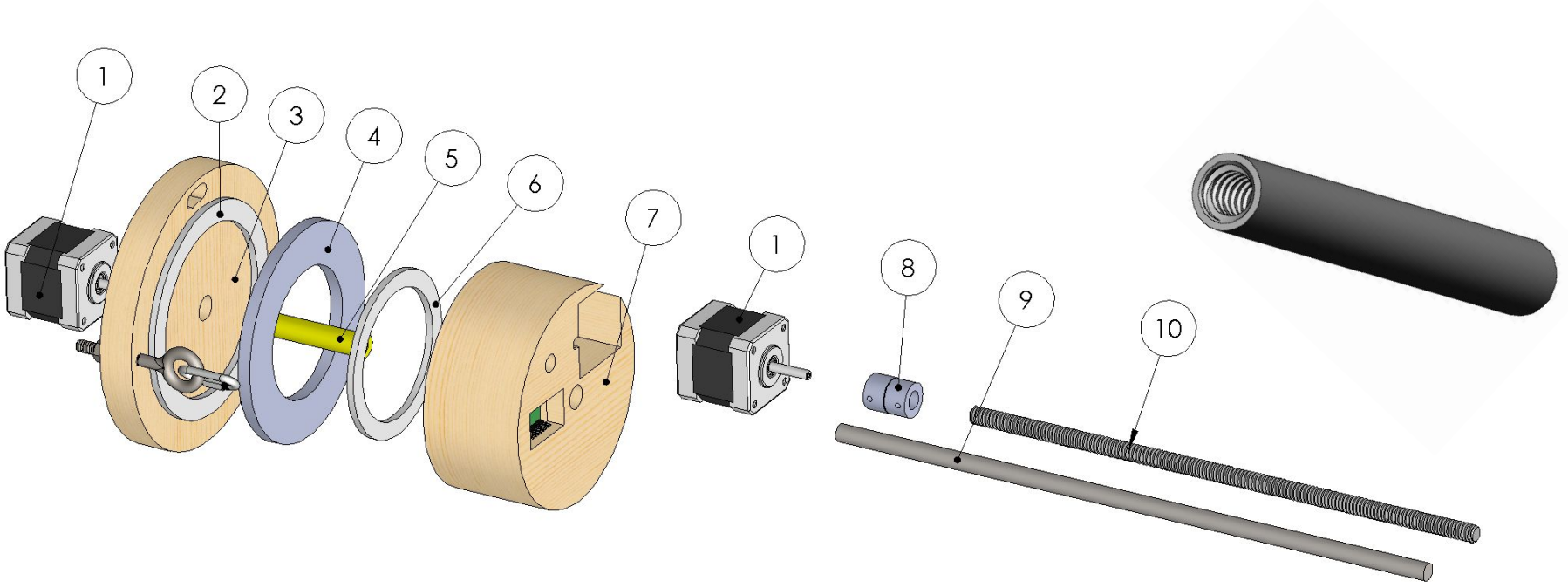
Rover Deployment



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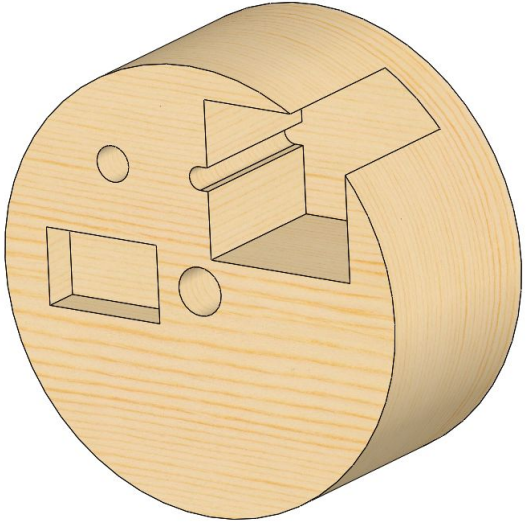
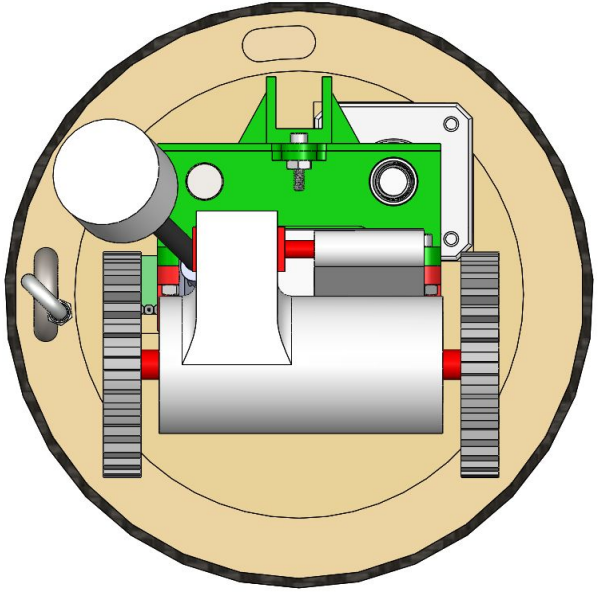
Unique Geometry - Circular Block Holder





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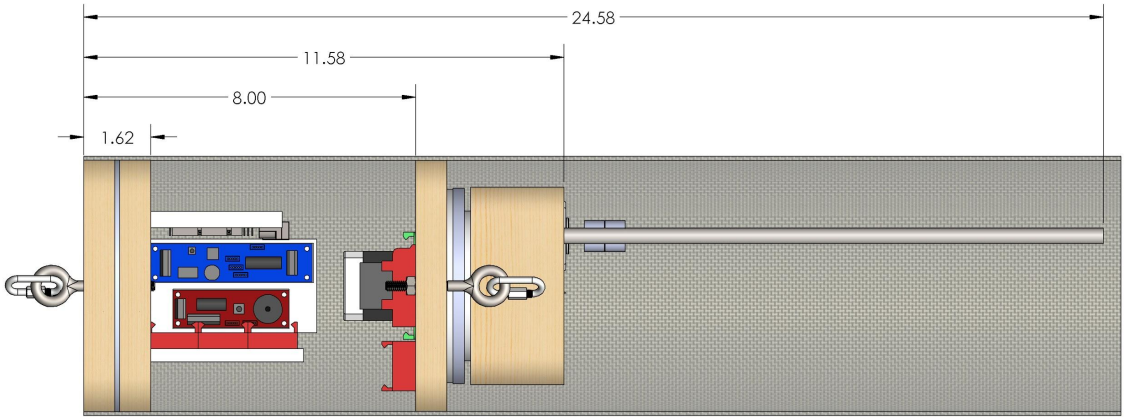
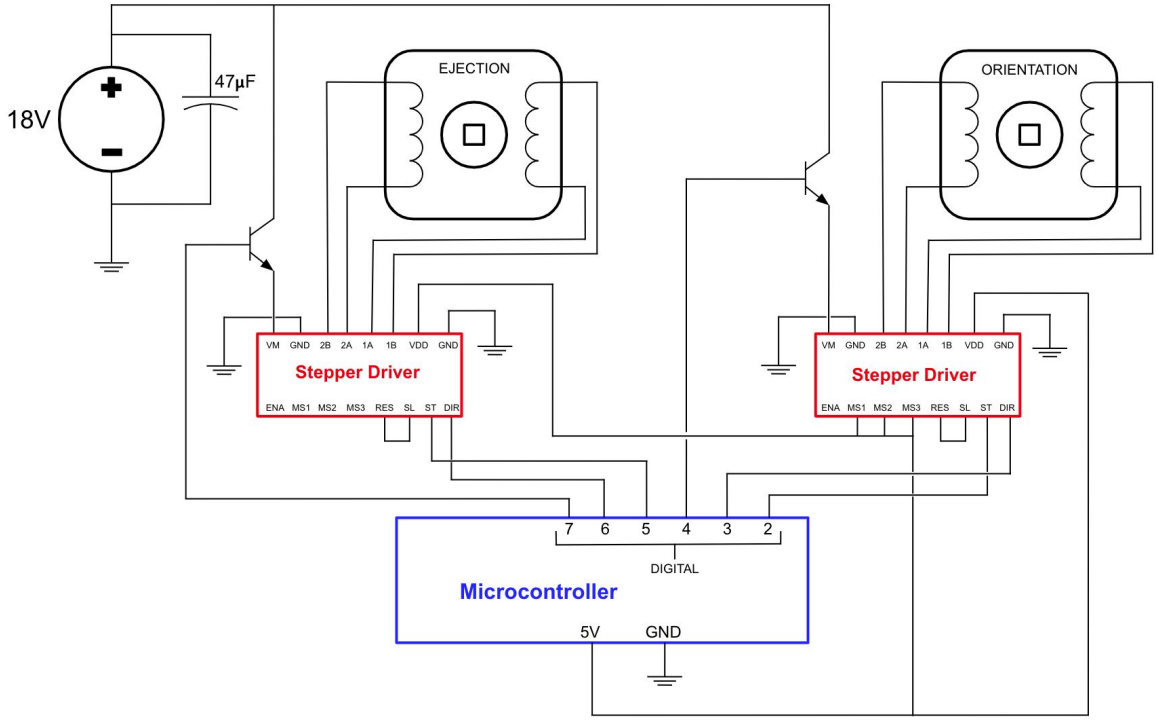
Rover Deployment Electronics



- Microcontroller: Arduino Uno
- Pressure Temperature Sensor: BMP180
- Accelerometer+Gyroscope Sensor: MPU6050
- Motor Driver: 2x A4988 Stepper Motor Driver
- Stepper Motors: 2x NEMA 17
- Power Supply: 2x 9V Alkaline Battery in series

Rover Deployment Schematic



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Questions?