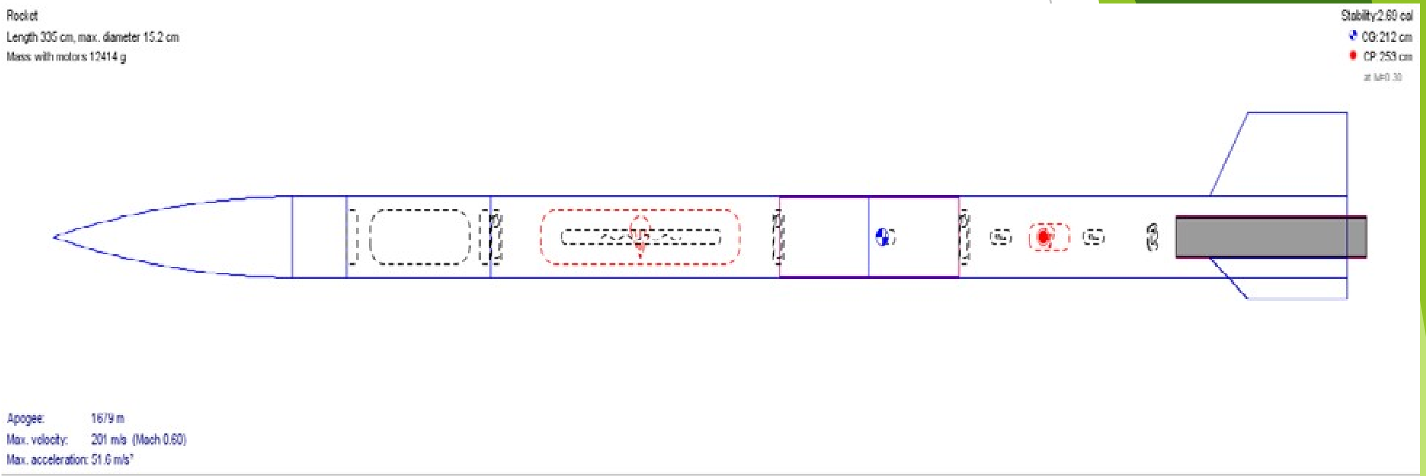
Preliminary Design Review

YCP Student Launch

Vehicle Dimensions

- **Overall length**: 131 inches
  - **Bottom body tube**:
    48 inches
  - **Middle body tube**:
    38 inches
  - **Top body tube**:
    22 inches
- **Diameter**: 6 inches
- **Fin Dimensions** :
  Chord Root: 36 cm
  Chord Tip: 25 cm
  Height: 17.25 cm



Components	Ultimate Strength (KSI)	Weight (lb/in^3)	Max Temperature (F)	Poisson's Ratio
Kevlar	522	0.052	850	0.36
Fiberglass	300	0.055	2030	0.21
Wood (Birch)	5.8	0.024	446	0.40
Carbon Fiber	595	0.047	6332	0.10-0.20
Phenolic	35	0.049	257	0.24
Aluminum	45	0.098	1120	0.33

Fig 3A.1: Material Properties

Factors	Score Used in Decision Matrix
Safety	1-6; Highest Safety Material Gets a 1
Weight (Weighted By 2)	1-6; Lightest Weight Material Gets a 1
Cost (Weighted By 2)	1-6; Cheapest Material Gets a 1
Strength	1-6; Strongest Material Gets a 1
Poisson's Ratio	1-6; Lowest Poisson's Ratio Gets a 1

Fig 3A.2: Scoring Chart for Decision Matrix

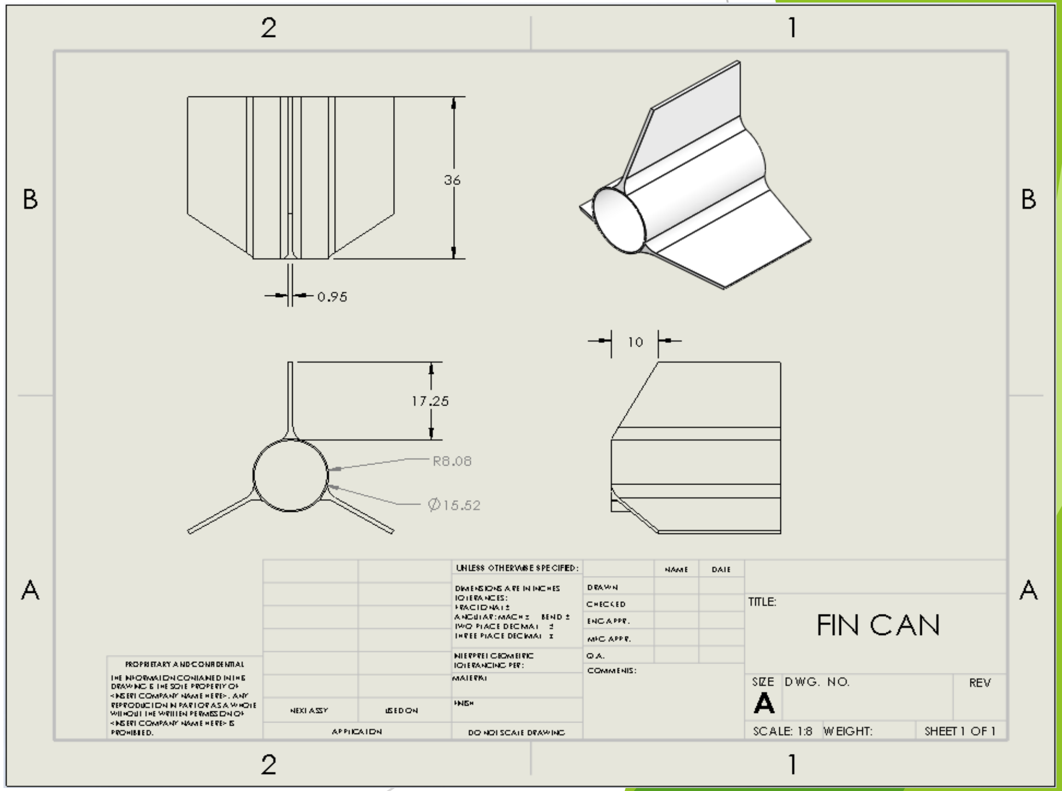
Components	Safety	Weight (X 2)	Cost (X 2)	Strength	Poisson	Total
Kevlar	3	8	10	2	5	28
Fiberglass	4	10	6	3	2	25
Wood(Birch)	6	2	2	6	6	22
Carbon Fiber	2	4	12	1	1	20
Phenolic	5	6	4	5	3	23
Aluminum	1	12	8	4	4	29

Fig 3A.3: Decision Matrix

Decisions

Materials and Justifications

- **Airframe**: Fiberglass wrapped phenolic tubing vs. Carbon fiber tubing
- **Fins**: Ultem plastic vs. ABS plastic vs. PLA plastic
- **Couplers**: Phenolic tubing
- **Nosecone**: Fiberglass vs. PLA plastic
- **Bulkheads**: Wood
- **Key Switches** : SPDT Switch 11-3360 (Surplus Center)
- **Battery Terminals** : Keystone 1295 (Mouser Electronics)



Component Masses

Component	Weight (lb)
Nose Cone	2.50
Upper Body Tube	1.49
Payload	3.00
U-Bolts in Upper Body	0.18
Middle Body Tube	2.58
Coupler	0.65
Electronics Bay	1.50
Main parachute	1.02
U-Bolts in Middle Body	0.18
Shock Cord in Middle Body	0.30
Lower Body Tube	3.25
Motor Tube	0.60
Drogue Parachute	0.194
Shock Cord in Lower Body	0.30
U-Bolts in Lower Body	0.18
Motor	8.27
Fins	1.22
Total Weight	27.41
Simulation Mass	27.36

Major Calculations

- All calculations verified via OpenRocket simulation and by hand calculations

Static Stability Margin

2.85 cal (Meets the design goal between with 2.5 < SM < 3.5)

Thrust to Weight Ratio

5.33 : 1

Center of Pressure

101.1 inches from nose

Center of Gravity

84.08 inches from nose

Rail Exit Velocity (from OpenRocket)

61.02 ft/s with a 12 ft long 1515 rail launch guide

Mission Preformance calculations

Maximum velocity at touchdown

one lbf = 32.174049 $\frac{\text{ft} - \text{lbs}}{s^2}$

total kenetic energy is 75ft-lbf therefore,

```
Ke=75*32.174049;
```

Ke= 2413.1 $\frac{\text{ft}^2 - \text{lbs}}{s^2}$

to find the maximum velocity allowed at landing we use the equation

$$\text{Ke} = \frac{1}{2} * m * v^2$$

where m is the mass of the rocket and v is the velocity it is traveling. The mass of the rocket is 27.412 lbs and kenetic energy was given. using this equation it can be rearranged to solve for v.

$$v = \sqrt{\frac{2 * \text{Ke}}{m}}$$

```
m=27.412;
v=sqrt((2*Ke)/m);
```

The maximum velocity the rocket can be traveling when it hits the ground is 13.269 $\frac{\text{ft}}{s}$ or 9.047 mph.

Kenetic energy by component

For the rocket when each component is seperated from the rocket but attached by shock cord they will have the same velocity. Given the mass of each component, and the velocity,the kenetic energy of each component can be calculated.

For the nose cone and upper body tube section the the Kenetic energy is:

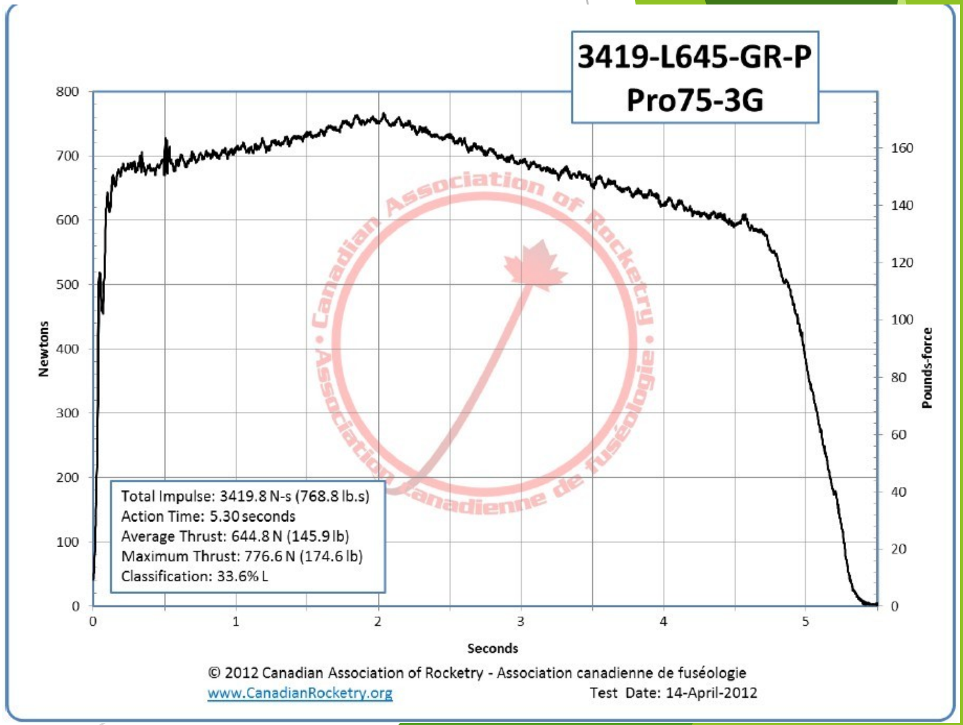
```
Mcu=2.5+4.67;
Kcu=.5*Mcu*(v^2);
```

The Kenetic energy of the nose cone/ upper tube will be 631.169 $\frac{\text{ft}^2 - \text{lbs}}{s^2}$ or 19.617 $\text{ft} - \text{lbf}$.

Where K_{cu} is the kenetic energy of the nose cone/upper body tube section and M_{cu} is the mass of the nose cone/upper tube section.

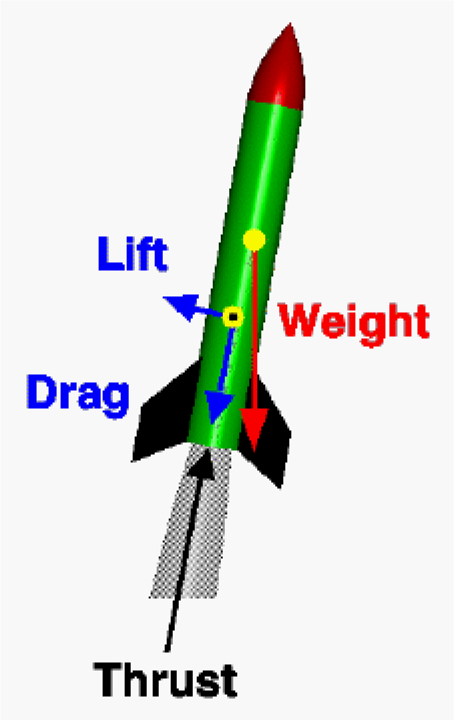
Preliminary Motor

- Motor Designation: CTI L645-P
- Max average thrust: 145.9 pounds
- Impulse of 3419 Newton-seconds over a burn time of 5.30 seconds
- Backup motor: L 1045-P
- Impulse of 3727 Newton-seconds



Justifications

- The main proposed motor should work due to the estimated 5% increase in weight of the rocket due to added supports, epoxy weight, and clay weight.
- Originally calculated point of apogee was 5504 feet but with the added weight it should be 5228 feet



Recovery Subsystem

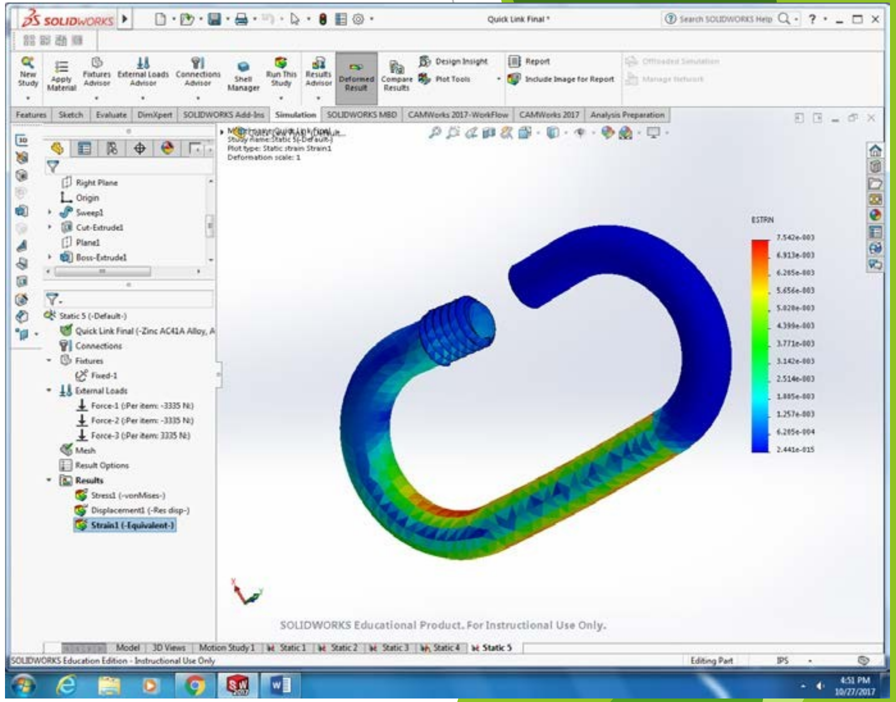
- 3.5g of black powder mass for both top and bottom sections respectively
- Force of Ejection: 755N
- Initial acceleration of front nose cone and payload section: 237.8
- Shock cord will be 4 times the length of the front body tube which is 38 inches long

m

s2

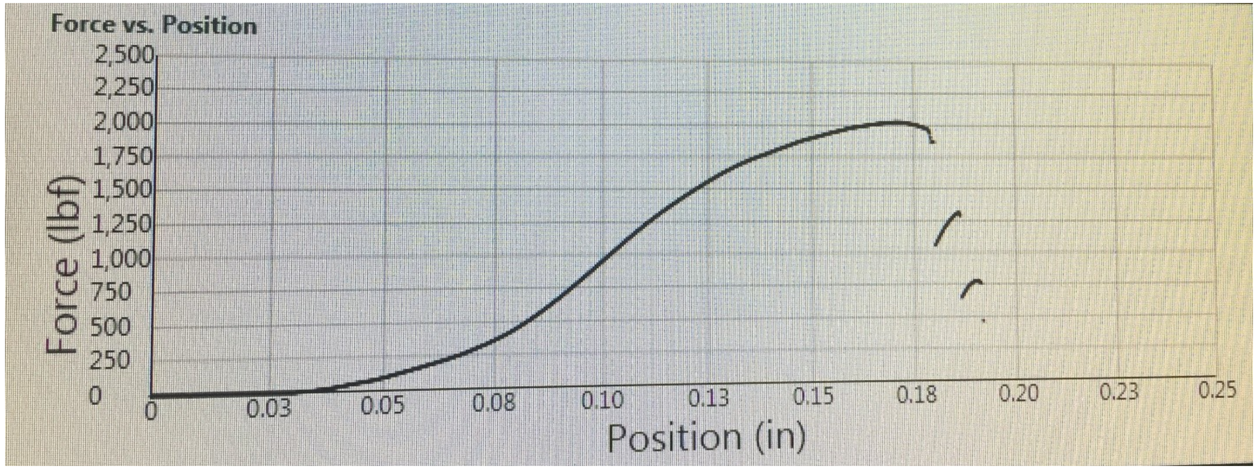
Recovery Subsystem: Components

- Quick links: Six, ¼ inch zinc coated
- Shock Cords: 1 inch Tubular Nylon
- U-bolts: Four, ¾ inch thick
- Drogue: 24 inches in diameter made by Fruity Chutes
- Main Parachute: 120 inches in diameter made by MediChutes



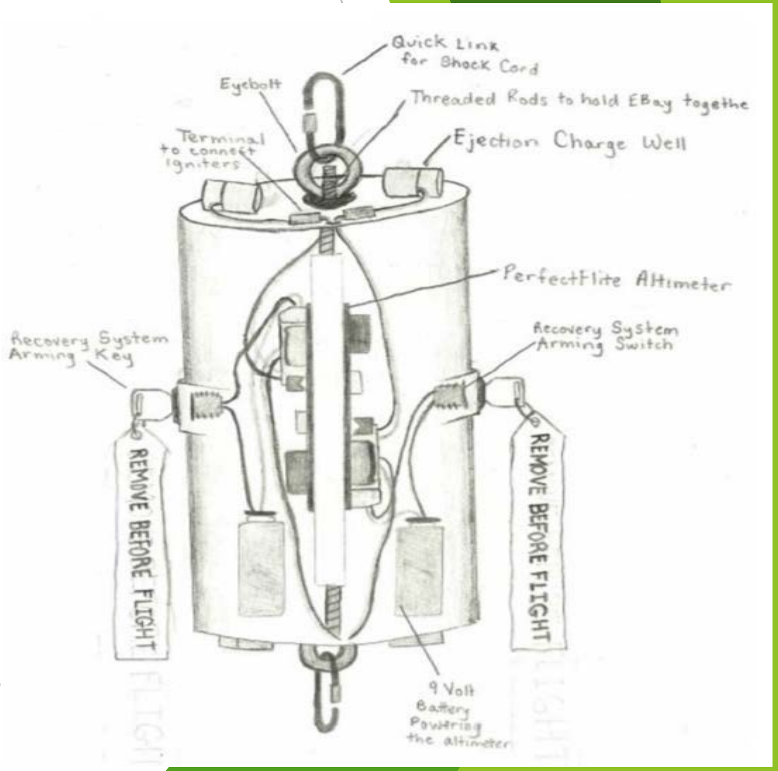
Justification

- Quick links: Able to withstand static forces up to 2030 pounds.
- Shock Cords: Yield of 4000 pounds and its less abrasive compared to Kevlar
- U-bolts: Yield of over 1000 pounds
- Drogue: Able to slow the rocket to terminal velocity
- Main Parachute: Calculations done to determine the size



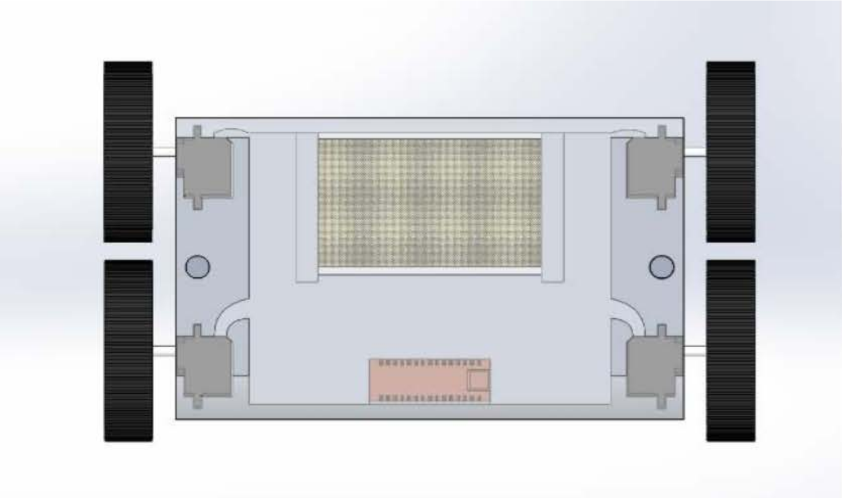
E-Bay: Recovery Electronics

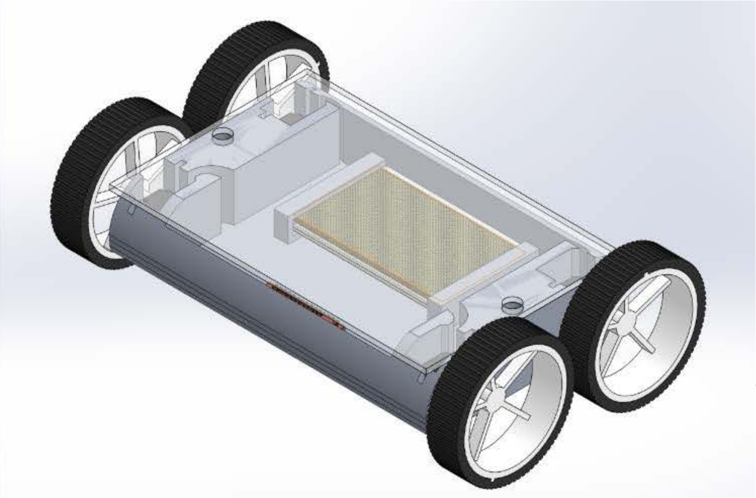
- Altimeters: PerfectFliteStratologger
- Redundancy plan: 2 Altimeters in the E-bay, one main and one as backup
- Pad stay time: 3 hours, we will be using 9V batteries



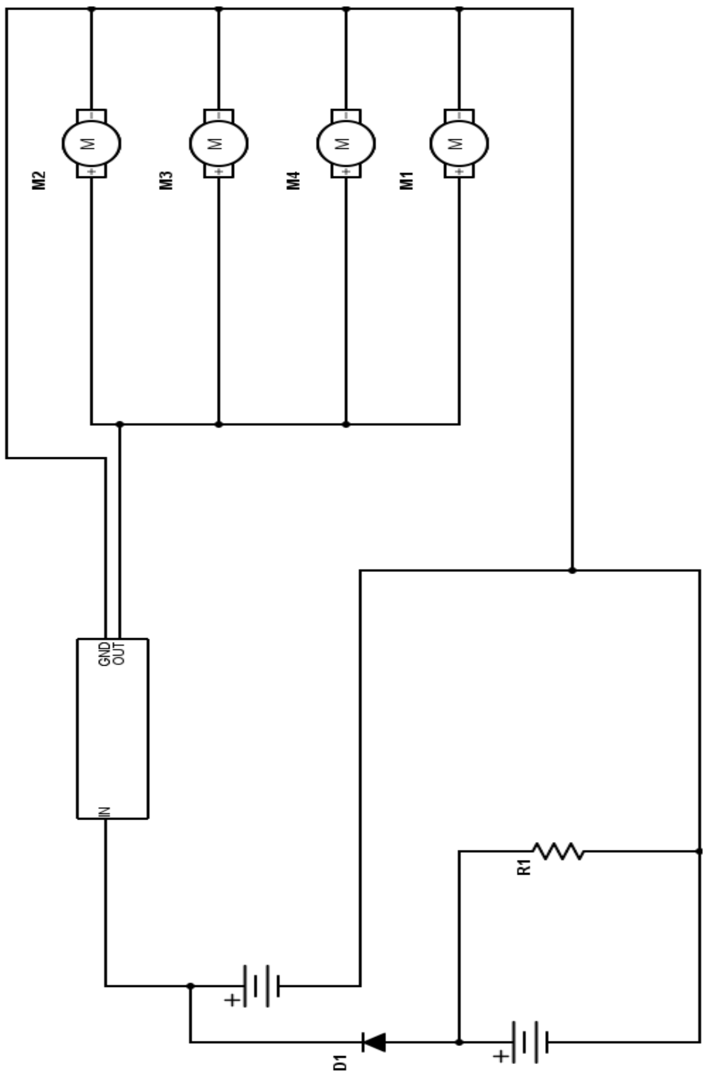
Preliminary Payload Design: Rover

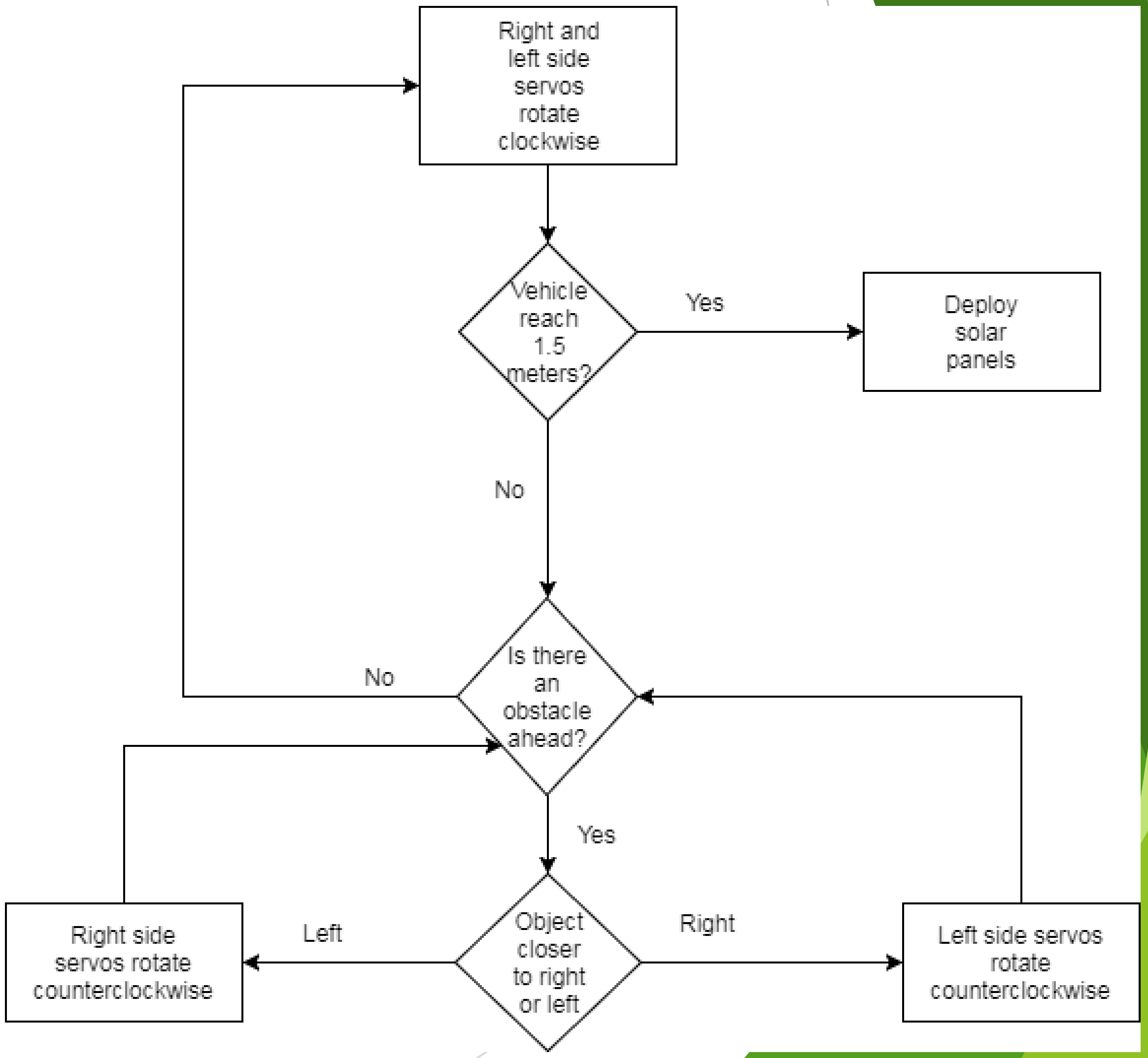
- Electrical parts: Arduino Nano, Ultrasonic sensor, Servos, Voltage regulator, Solar panels, GPS
- Each wheel has a servo motor
- Gaps implemented in the top plate to cool the electronics





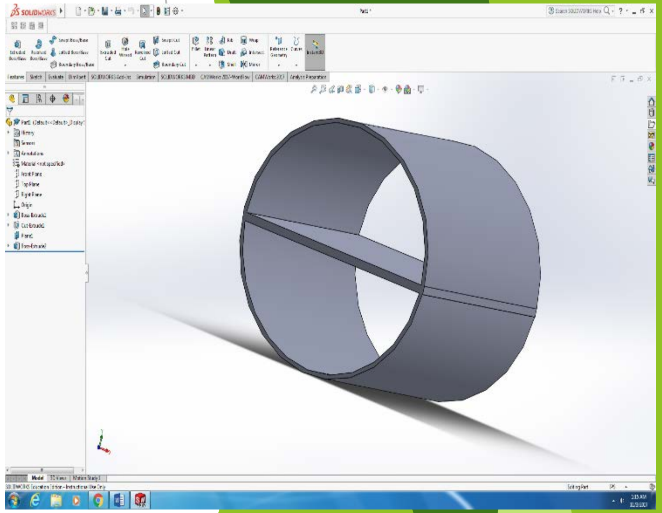
Preliminary Payload Design: Rover





Payload Integration

- The payload will be located in the 22 inch long front body tube section attached to the nose cone during flight
- After launch…
  - The nose cone and front body tube will become disconnected via the disconnection of an electromagnetic lock
  - The payload (rover) will be gently pushed out the front of the body tube by a series of solenoids located on the back bulkhead of the front body tube
  - The payload will then be able to perform its required functions
- The payload will fit within the front body tube and will be locked in place by its size
  - The board as seen below will be constructed to keep the payload from shifting around side to side during flight (may be reconfigured based on testing results)
    - Testing will take place with a mock payload to ensure that design functionality will work before CDR



Requirement Compliance Plan

6.1 – Verification Plan

General Requirements	Verify	Plan
Students on the team will do 100% of the project, including design, construction, written reports, presentations, and flight preparation with the exception of assembling the motors and handling black powder or any variant of ejection charges, or preparing and installing electric matches (to be done by the team's mentor).	Demonstration	Each component of the rocket has been divided between the team members.
The team will provide and maintain a project plan to include, but not limited to the following items: project milestones, budget and community support, checklists, personnel assigned, educational engagement events, and risks and mitigations.	Demonstration	Project plan included in the PDR.
Foreign National (FN) team members must be identified by the Preliminary Design Review (PDR) and may or may not have access to certain activities during launch week due to security restrictions. In addition, FN's may be separated from their team during these activities.	N/A	N/A
The team must identify all team members attending launch week activities by the Critical Design Review (CDR). Team members will include: 1.4.1. Students actively engaged in the project throughout the entire year. 1.4.2. One mentor (see requirement 1.14). 1.4.3. No more than two adult educators.	Demonstration	The final list will be presented in the CDR.
The team will engage a minimum of 200 participants in educational, hands-on science, technology, engineering, and mathematics (STEM) activities, as defined in the Educational Engagement Activity Report, by FRR. An educational engagement activity report will be completed and submitted within two weeks after completion of an event. A sample of the educational engagement activity report can be found on page 31 of the handbook. To satisfy this requirement, all events must occur between project acceptance and the FRR due date.	Demonstration	We have arranged to work with the York Country Day school where we will be holding demonstrations and workshops.
The team will develop and host a Web site for project documentation	Demonstration	The website has already been created. www.ycprocketry.weebly.com
Teams will post, and make available for download, the required deliverables to the team Web site by the due dates specified in the project timeline.	Demonstration	The proposal was added when it was due and the PDR will also be added by due date.
All deliverables must be in PDF format.	Demonstration	All files will be converted to PDF format.
In every report, teams will provide a table of contents including major sections and their respective subsections.	Demonstration	Table of contents has been included.
In every report, the team will include the page number at the bottom of the page.	Demonstration	Page number has been included.
The team will provide any computer equipment necessary to perform a video teleconference with the review panel. This includes, but is not limited to, a computer system, video camera, speaker telephone, and a broadband Internet connection. Cellular phones can be used for speakerphone capability only as a last resort.	Demonstration	York College of PA I.T. department has arranged for all the necessary equipment for the teleconference.
All teams will be required to use the launch pads provided by Student Launch's launch service provider. No custom pads will be permitted on the launch field. Launch services will have 8 ft. 1010 rails, and 8 and 12 ft. 1515 rails available for use.	Demonstration	We will be using 12 ft 15 x 15 rail.
Teams must implement the Architectural and Transportation Barriers Compliance Board Electronic and Information Technology (EIT) Accessibility Standards (36 CFR Part 1194) Subpart B-Technical Standards (http://www.section508.gov): 1194.21 Software applications and operating systems. 1194.22 Web-based intranet and Internet information and applications.	Demonstration	We will allow any person that is interested in joining our team the ability to join as long as he/she is a part of York College of PA.
Each team must identify a "mentor." A mentor is defined as an adult who is included as a team member, who will be supporting the team (or multiple teams) throughout the project year, and may or may not be affiliated with the school, institution, or organization. The mentor must maintain a current certification, and be in good standing, through the National Association of Rocketry (NAR) or Tripoli Rocketry Association (TRA) for the motor impulse of the launch vehicle and must have flown and successfully recovered (using electronic, staged recovery) a minimum of 2 flights in this or a higher impulse class, prior to PDR. The mentor is designated as the individual owner of the rocket for liability purposes and must travel with the team to launch week. One travel stipend will be provided per mentor regardless of the number of teams he or she supports. The stipend will only be provided if the team passes FRR and the team and mentor attends launch week in April.	Demonstration	Our mentor is Dr. Ericson who is a mechanical engineering professor here at York College of PA.
The vehicle will deliver the payload to an apogee altitude of 5,280 feet above ground level (AGL)	Test	We have verified this using Open simulation.
The vehicle will carry one commercially available, barometric altimeter for recording the official altitude used in determining the altitude award winner. Teams will receive the maximum number of altitude points (5,280) if the official scoring altimeter reads a value of exactly 5280 feet AGL. The team will lose one point for every foot above or below the required altitude.	Test	We plan on testing the altimeters by performing a sub scale launch.
Each altimeter will be armed by a dedicated arming switch that is accessible from the exterior of the rocket airframe when the rocket is in the launch configuration on the launch pad.	Demonstration	The arming switches have been integrated in the E-bay design.
Each altimeter will have a dedicated power supply	Demonstration	Each altimeter has been provided with its own power source.
Each arming switch will be capable of being locked in the ON position for launch (i.e. cannot be disarmed due to flight forces).	Demonstration Inspection	We will use Key Switches that are capable of being in the "locked" position with the insertion of a key.
The launch vehicle will be designed to be recoverable and reusable. Reusable is defined as being able to launch again on the same day without repairs or modifications.	Analysis	Most of the rocket components are reusable right away.
The launch vehicle will have a maximum of four (4) independent sections. An independent section is defined as a section that is either tethered to the main vehicle or is recovered separately from the main vehicle using its own parachute.	Demonstration	Our design for the rocket has 3 independent sections.
The launch vehicle will be limited to a single stage	Test	One motor, a "CTI L-645" will be used.
The launch vehicle will be capable of being prepared for flight at the launch site within 3 hours of the time the Federal Aviation Administration flight waiver opens.	Analysis	We plan on practicing for assembling the launch vehicle in the allocated tie slot.
The launch vehicle will be capable of remaining in launch-ready configuration at the pad for a minimum of 1 hour without losing the functionality of any critical on-board components.	Test	The launch vehicle is operated by 9V batteries which can last up to 3 hrs. Additional test will be performed to verify the data.
The launch vehicle will be capable of being launched by a standard 12-volt direct current firing system. The firing system will be provided by the NASA-designated Range Services Provider.	Demonstration	We are using a commercially available rocket motor that is also capable of being fired with a standard 12-volt firing system.
The launch vehicle will require no external circuitry or special ground support equipment to initiate launch (other than what is provided by Range Services).	Demonstration	No external ground support will be needed for launch.
The launch vehicle will use a commercially available solid motor propulsion system using ammonium perchlorate composite propellant (APCP) which is approved and certified by the National Association of Rocketry (NAR), Tripoli Rocketry Association (TRA), and/or the Canadian Association of Rocketry (CAR). 2.13.1. Final motor choices must be made by the Critical Design Review (CDR). 2.13.2. Any motor changes after CDR must be approved by the NASA Range Safety Officer (RSO), and will only be approved if the change is for the sole purpose of increasing the safety margin.	Demonstration	We plan on using a L-class motor. Specifically we are using the "CTI L-645 Motor" from Cesaroni Technology Incorporated.
Pressure vessels on the vehicle will be approved by the RSO and will meet the following criteria: 2.14.1. The minimum factor of safety (Burst or Ultimate pressure versus Max Expected Operating Pressure) will be 4:1 with supporting design documentation included in all milestone reviews. 2.14.2. Each pressure vessel will include a pressure relief valve that sees the full pressure of the valve that is capable of withstanding the maximum pressure and flow rate of the tank.	N/A	N/A
2.14.3. Full pedigree of the tank will be described, including the application for which the tank was designed, and the history of the tank, including the number of pressure cycles put on the tank, by whom, and when.		
The total impulse provided by a College and/or University launch vehicle will not exceed 5,120 Newton-seconds (L-class).	Analysis	We plan on using an L-class motor.
The launch vehicle will have a minimum static stability margin of 2.0 at the point of rail exit. Rail exit is defined at the point where the forward rail button loses contact with the rail.	Demonstration Testing	Our current calculations in both the simulation and by hand have our rocket with a stability margin of 2.85.
The launch vehicle will accelerate to a minimum velocity of 52 fps at rail exit	Demonstration Testing	Our current calculations in both the simulation and by hand have our rocket with a rail exit velocity of 61.02 ft/s.
All teams will successfully launch and recover a subscale model of their rocket prior to CDR. Subscales are not required to be high power rockets. 2.18.1. The subscale model should resemble and perform as similarly as possible to the full-scale model, however, the full-scale will not be used as the subscale model. 2.18.2. The subscale model will carry an altimeter capable of reporting the model's apogee altitude.	Demonstration	We plan on launching a subscale rocket before the CDR so the altimeters can be tested.
All teams will successfully launch and recover their fullscale rocket prior to FRR in its final flight configuration. The rocket flown at FRR must be the same rocket to be flown on launch day. The purpose of the full-scale demonstration flight is to demonstrate the launch vehicle's stability, structural integrity, recovery systems, and the team's ability to prepare the launch vehicle for flight. A successful flight is defined as a launch in which all hardware is functioning properly (i.e. drogue chute at apogee, main chute at a lower altitude, functioning tracking devices, etc.). The following criteria must be met during the full scale demonstration flight: 2.19.1. The vehicle and recovery system will have functioned as designed. 2.19.2. The payload does not have to be flown during the full-scale test flight. The following requirements still apply: 2.19.2.1. If the payload is not flown, mass simulators will be used to simulate the payload mass.	Demonstration	The team plans to test launch the full-scale rocket during the MDRA February and March Launches which will occur before the FRR is due. The mass simulators will be located in the same spot as the
2.19.2.1.1. The mass simulators will be located in the same approximate location on the rocket as the missing payload mass.		payload during sub-scale and fullscale launching.
If the payload changes the external surfaces of the rocket (such as with camera housings or external probes) or manages the total energy of the vehicle, those systems will be active during the full-scale demonstration flight.	N/A	N/A
The full-scale motor does not have to be flown during the full-scale test flight. However, it is recommended that the full-scale motor be used to demonstrate full flight readiness and altitude verification. If the fullscale motor is not flown during the full-scale flight, it is desired that the motor simulates, as closely as possible, the predicted maximum velocity and maximum acceleration of the launch day flight.	Demonstration	The full-scale motor will be flown during full scale flight testing.
The vehicle must be flown in its fully ballasted configuration during the full-scale test flight. Fully ballasted refers to the same amount of ballast that will be flown during the launch day flight. Additional ballast may not be added without a re-flight of the fullscale launch vehicle.	Demonstration	The full-scale rocket will be flown like it will be during the National Flyoff in Huntsville, AL.
After successfully completing the full-scale demonstration flight, the launch vehicle or any of its components will not be modified without the concurrence of the NASA Range Safety Officer (RSO).	Demonstration	The rocket will not be modified after full-scale testing.
Full scale flights must be completed by the start of FRRs (March 6th, 2018). If the Student Launch office determines that a re-flight is necessary, then an extension to March 28th, 2018 will be granted. This extension is only valid for re-flights; not first-time flights.	Demonstration	The rocket will be flown before March 6th, 2018.
Any structural protuberance on the rocket will be located aft of the burnout center of gravity.	N/A	Agree
Vehicle Prohibitions	N/A	Agree
The launch vehicle will not utilize forward canards.	N/A	Agree
The launch vehicle will not utilize forward firing motors.	N/A	Agree
The launch vehicle will not utilize motors that expel titanium sponges (Sparky, Skidmark, MetalStorm, etc.)	N/A	Agree
The launch vehicle will not utilize hybrid motors.	N/A	Agree
The launch vehicle will not utilize a cluster of motors	N/A	Agree
The launch vehicle will not utilize friction fitting for motors	Demonstration	The team will utilize a motor retainer for motor retention purposes.
The launch vehicle will not exceed Mach 1 at any point during flight.	Demonstration Simulation	The rocket will not exceed Mach 1, and will reach a maximum speed of Mach 0.667
Vehicle ballast will not exceed 10% of the total weight of the rocket.	Demonstration	The vehicle ballast will not exceed 10% of the total weight of the rocket.
The launch vehicle will stage the deployment of its recovery devices, where a drogue parachute is deployed at apogee and a main parachute is deployed at a lower altitude. Tumble or streamer recovery from apogee to main parachute deployment is also permissible, provided that kinetic energy during drogue-stage descent is reasonable, as deemed by the RSO.	Demonstration	This system will be set up through redundancy of the altimeters within the electronics bay.
Each team must perform a successful ground ejection test for both the drogue and main parachutes. This must be done prior to the initial subscale and full-scale launches.	Testing	We will perform ground ejection testing here at York College to ensure that the ejection charge masses are sufficient for the launch vehicle.
At landing, each independent sections of the launch vehicle will have a maximum kinetic energy of 75 ft-lbf.	Demonstration Calculations	As seen in section 3C, the kinetic energy of each section is less than 75 ft-lb.
The recovery system electrical circuits will be completely independent of any payload electrical circuits.	Demonstration Construction	The electronics bay will be independent of all payload and other circuitry.
All recovery electronics will be powered by commercially available batteries	Demonstration	The electronics bay will be powered by a commercially available 9V battery.
The recovery system will contain redundant, commercially available altimeters. The term "altimeters" includes both simple altimeters and more sophisticated flight computers.	Demonstration Construction	There will be 2 altimeters in the electronics bay to provide redundancy.
Motor ejection is not a permissible form of primary or secondary deployment.	Demonstration	The motor will not be ejected during flight.
Removable shear pins will be used for both the main parachute compartment and the drogue parachute compartment.	Demonstration	Removable shear pins will be used for both the drogue and main parachute ejections.
Recovery area will be limited to a 2500 ft. radius from the launch pads	Demonstration	As seen in section 3C, the recovery area of our rocket is less than 2500 feet, even in 15 mph winds.
An electronic tracking device will be installed in the launch vehicle and will transmit the position of the	Demonstration	A tracker will be used within our rocket.
tethered vehicle or any independent section to a ground receiver. 3.10.1. Any rocket section, or payload component, which lands untethered to the launch vehicle, will also carry an active electronic tracking device. 3.10.2. The electronic tracking device will be fully functional during the official flight on launch day.		
The recovery system electronics will not be adversely affected by any other on-board electronic devices during flight (from launch until landing). 3.11.1. The recovery system altimeters will be physically located in a separate compartment within the vehicle from any other radio frequency transmitting device and/or magnetic wave producing device. 3.11.2. The recovery system electronics will be shielded from all onboard transmitting devices, to avoid inadvertent excitation of the recovery system electronics. 3.11.3. The recovery system electronics will be shielded from all onboard devices which may generate magnetic waves (such as generators, solenoid valves, and Tesla coils) to avoid inadvertent excitation of the recovery system. 3.11.4. The recovery system electronics will be shielded from any other onboard devices which may adversely affect the proper operation of the recovery system electronics.	Demonstration	No wires will connect between independent sections.
Each team will choose one design experiment option from the following list	Demonstration	We plan using option 2. We have already designed a rover for the payload.
Additional experiments (limit of 1) are allowed, and may be flown, but they will not contribute to scoring.	N/A	N/A
If the team chooses to fly additional experiments, they will provide the appropriate documentation in all design reports, so experiments may be reviewed for flight safety.	N/A	N/A
All not applicable	N/A	N/A
Teams will design a custom rover that will deploy from the internal structure of the launch vehicle.	Analysis	We already have design for the rover completed.
At landing, the team will remotely activate a trigger to deploy the rover from the rocket.	Demonstration Construction	A trigger will be activated after landing to deploy the rover from the rocket.
After deployment, the rover will autonomously move at least 5 ft. (in any direction) from the launch vehicle.	Demonstration Wiring	The rover will be programmed via and Arduino to move at least 5 feet away from the rocket while also avoiding any obstacle
		in its' way by sensor recognition to reach its target destination.
Once the rover has reached its final destination, it will deploy a set of foldable solar cell panels.	Demonstration	A set of solar panels will open up after the rover reaches its final destination.
All not applicable	N/A	N/A
Each team will use a launch and safety checklist. The final checklists will be included in the FRR report and used during the Launch Readiness Review (LRR) and any launch day operations.	Demonstration	A safety and launch checklist are in the process of being constructed. They will be completed by FRR at the latest.
Each team must identify a student safety officer who will be responsible for all items in section 5.3.	Demonstration	Our assigned safety officer is Jacob Van Brunt.
The role and responsibilities of each safety officer will include, but not limited to: 5.3.1. Monitor team activities with an emphasis on Safety during: 5.3.1.1. Design of vehicle and payload 5.3.1.2. Construction of vehicle and payload 5.3.1.3. Assembly of vehicle and payload 5.3.1.4. Ground testing of vehicle and payload 5.3.1.5. Sub-scale launch test(s) 5.3.1.6. Full-scale launch test(s) 5.3.1.7. Launch day 5.3.1.8. Recovery activities 5.3.1.9. Educational Engagement Activities	Demonstration	Jacob Van Brunt has been assigned to monitor team activities
Implement procedures developed by the team for construction, assembly, launch, and recovery activities	Demonstration	We have begun to implement such procedures.
Manage and maintain current revisions of the team's hazard analyses, failure modes analyses, procedures, and MSDS/chemical inventory data	Completed	MSDS Sheets are currently posted in the team workspace.
During test flights, teams will abide by the rules and guidance of the local rocketry club's RSO. The allowance of certain vehicle configurations and/or payloads at the NASA Student Launch Initiative does not give explicit or implicit authority for teams to fly those certain vehicle configurations and/or payloads at other club launches. Teams should communicate their intentions to the local club's President or Prefect and RSO before attending any NAR or TRA launch.	Demonstration	We will listen to Bob Utley and Brian Hastings, both Level 3 certified mentors who will be at the MDRA launches when we are testing both our sub-scale and full-scale rocket.
Teams will abide by all rules set forth by the FAA.	Demonstration	Rules will be followed.