Spring Grove High School

SLI Rocketry Team Proposal

Project One Giant Leap

The Rocket Men

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General Information

1. School Information:

Name: Spring Grove High School

Mailing Address:
Spring Grove Area High School
1490 Roth's Church Road
Spring Grove, PA 17362

Name of Team:
The Rocket Men (TRM)

2. Adult Educators:
Rosemary Cugliari
Spring Grove Area High School Principal
Phone number: (717) 225-4731 ext. 7060
Email: Cugliarr@sgasd.org

Brian Hastings
Physics teacher, Rocket Scientist Club Coach
Phone number: (717) 225-4731 ext. 7220
Email: Hastingsb@sgasd.org
Education: Honors B.A. in secondary education physics, a masters in science education and 60 graduate credits past my masters degree- Teacher Education Institute

Renee Eaton
Biology teacher, Rocket Scientist Club Coach
Phone number: (717) 225-4731 ext. 7242
Email: EatonR@sgasd.org
Education: B.A. in Biology- Saint Vincent College 2007, Teaching Certificate- Millersville University 2008, MA in Classroom Technology- Wilkes University 2012

3. Safety Officer:
Tom Aument
NAR Representative
Phone number (cell): (717) 725-4632
Email: blocker1956@comcast.net

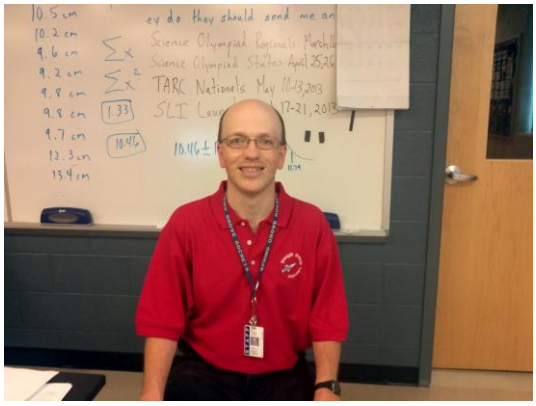
4. We are not part of a USLI team, we are a SLI team.

5. Key Managers:
Brian Hastings- Advisor and Supervisor of students
Renee Eaton- Advisor and Supervisor of students
Mr. Sengia- Instructional Technology Specialist
Laura Ohl- Student Team Leader

Student Participants

- Jordan- SGHS Senior, Safety Management
- Laura- SGHS Senior, Project Plan
- Melissa- SGHS Senior, General Information
- Mike- SGHS Senior , Facilities/Equipment
- Chad- SGHS Junior, Facilities/Equipment
- Matt- SGHS Junior, Facilities/Equipment
- Veer- SGHS Junior, Technical Design
- Albert- SGHS Sophomore, Technical Design
- Kyle- SGHS Sophomore, Technical Design
- Wyatt- SGHS Sophomore, Educational Engagement
- David- SGHS Freshman, Technical Design

Student and Mentor Biographies



Name: Brian Hastings

Job: Physics Instructor and Rocket Scientists' Coach

I have been a teacher at Spring Grove for 17 years, teaching Physics 1, Physics 1 Honors, and AP Physics B. I have an Honors B.A. in secondary education Physics, a masters in science education and 60 graduate credits past my Masters Degree. I have taught graduate courses to teachers, and for the past 12 years have taught fast - paced high school physics for Johns Hopkins University's Center for talented youth program. As a Rocket Scientists' coach, I have started a Science Olympiad team, a Vex Robotics Team, Physics Olympics Team, and a Team America Rocketry Challenge Team. The Science Olympiad team has advanced to the state level each of the last seven years. We have been participating in TARC for 8 years and have advanced to Nationals each of the past 4 years, placing fourth overall at Nationals in 2012.

Name: Renee Eaton
Job: Biology Teacher

I have been a Biology teacher at Spring Grove High School since 2009 . Since then, I have coached the Marching Band and Junior High Track and Field and have advised the Gay-Straight Alliance, Science Fair participants, and the Envirothon team. In addition, I have been a member of the York Jaycees, a local community service organization, since 2009. I am currently working towards my Master's degree in Classroom Technology, which I will finish by December of 2012. In my spare time,I enjoy spending time with my friends and family, hiking, biking, reading, and training for 5K races and half-marathons.

Name: Jordan
Age: 17
Grade: 12

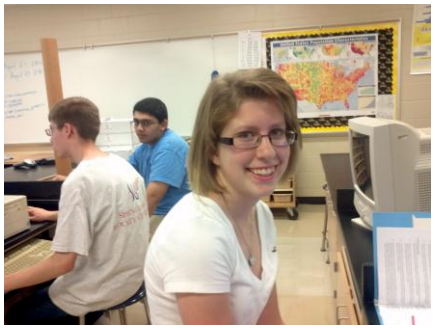
In fifth and sixth grade, I was the Math 24 champion at my school. I advanced to the county-level competition, and then to the regional competition, where I earned a gold and silver medal. In the eighth grade, I participated as a team member on the school's Math Counts team. That same year I joined the B team for Science Olympiad, and now I participate on the C team. I have earned six medals throughout my four years of participation in Science Olympiad. I earned three first medals at regionals and a fourth place medal at states. In my sophomore year I began participating in TARC, Team America Rocketry Challenge, and have since our team qualified as the third alternative team for the finals. In my junior year, I was introduced into the Spring Grove High School National Honor Society. I was also the Physics Olympics team captain.

Last year, I competed in the local schools VEX Robotics competition as a team captain in the fall and a team member in the spring.

Name: Laura
Age: 17
Grade: 12

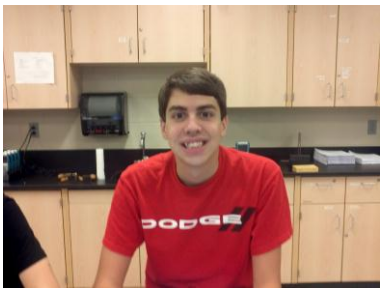
Throughout my education I have evolved immensely. In Middle School I started out in an improv group, where we were given subjects to perform a short skit in front of a live audience with no practice. When I moved on to high school I participated in Tech Crew for the school plays. I was the only freshman on the crew my first year. I managed a play in the summer school at my High School. That summer I became the new Stage Manager. In my freshman year I also joined Chess Club. We would compete with local communities to go off to a state competition. In our first year as a team we went to the state competition. Since it was my first year I played on the Junior Varsity team, and then my sophomore year I played Varsity and became the Chess Queen, which was a nickname for the President of the club. In that year I was also the only sophomore accepted into the Vocal Jazz Ensemble. I was also in a women's choir that met in the morning before school and was a member and photographer in NAHS. In the middle of my sophomore year, I transferred schools. After my transfer I joined the Vocal Jazz group, an a cappella singing group and another singing group called Expressions. This was also the first year I did Science Olympiad. My junior year was the best year in my high school career. On the side I worked the sound board in the plays and musicals. I took two AP Science courses, one was AP Chemistry and the other was AP Physics. I started AP Physics without any prior physics classes. Last year was my first year participating and leading a VEX Robotics team. I also started my first year of TARC as a Team Captain. My team consisted of all new students including myself and impressively enough we went on to Nationals. I participated in Science Olympiad again in the spring and won a few medals. At the regional level I won a first in Thermodynamics, a second in Astronomy and a first in Forensics. At the state level my sister and I were one place away from getting a medal. We came in sixth place. I am the student leader of the SLI Team at our School. This year I will have a VEX Robotics team again, and a TARC team. I also plan to participate in Science Olympiad. I am in Dual Enrollment and am going to Penn State York part time. I plan on going to UC Davis or IUPUI after I graduate. I plan on getting my BS, my MS, and my PhD. After my

PhD I will do Research. I plan on doing my research at a University where I may also be a professor.



Name: Melissa
Age: 17
Grade: 12

As a student, I am highly involved in our school's extracurricular activities. I have been a member of Science Olympiad for three years and have competed at the state level all three times. I have also been a member of Envirothon for five years and a member of TARC for two. From TARC, I have learned the importance of patience, teamwork, perseverance, and, at times, the frustration of Murphy's Law. I also am a member of our school's chapter of Tri-M music honor society and play french horn in marching band, brass ensemble, York county honors band and combined (chamber) orchestra. I am the president of National Honor Society at Spring Grove. I am also a member of link crew; a support organization for incoming freshmen at the high school. Outside of school, I tutor ESL students at the elementary school and am a camp counselor for children age four to twelve. After graduation, I aspire to enter a pre-medical program, or major in neuroscience, and later become a doctor.



Name: Mike
Age: 17
Grade: 12

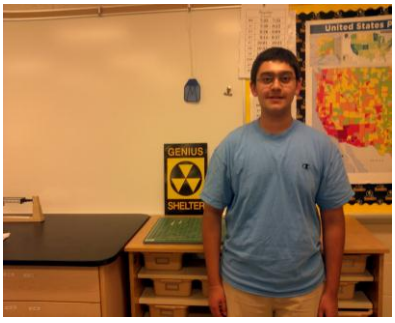
I am currently working on the SLI project. I will also be a member in a TARC team this year. My main interests include science and engineering. I have always had a passion for building things, as well as working with my hands. I am skilled in SolidWorks CAD programs, and I plan on attending Penn State University for engineering.

Name: Chad
Age:15
Grade: 11

I am currently participating in several clubs. This will be my second year participating in both TARC and Vex Robotics. During my first year in TARC our team made it to Nationals. I was also on our school's Science Olympiad team in 8th & 9th grade and made it to states both years. I was on the JV Basketball team in 10th grade as well. I plan attending college for Engineering or Architecture.

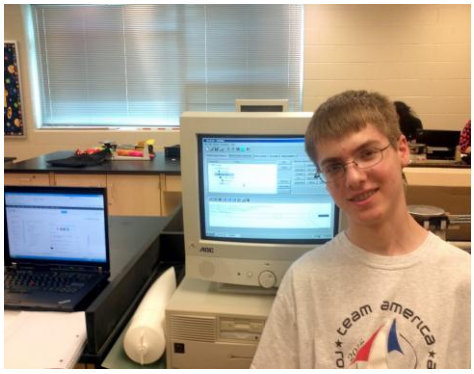
Name: Matt
Age: 16
Grade: 11

I am currently in TARC, which I have been a part of since 9th grade. Last year, our team made it to nationals. I'm also going to be in Vex robotics and Physics Olympics again this year. Last year, I got my black belt in Tae-Kwon-Do after four years. I plan on going to college to get a degree in Engineering.



Name: Veer
Age:16
Grade: 11

In 8th grade, I became part of Spring Grove's science clubs by joining Science Olympiad. Our school's teams have made it to the state level competition for the last seven years. In 9th grade, I joined a Team America Rocketry Challenge (TARC) team here. Last year I took initiative in my team to become the captain. We went to nationals, where we competed with 100 teams from across the nation. This was a very fun yet educational learning experience where I learned firsthand not only the basics of rocket science, but I also gained knowledge of how it feels to compete amongst so many people and how to cope up with the immense pressure generated at this level. I also acquired invaluable leadership skills through these experiences. I joined one of our school's VEX robotics teams in 9th grade as well. In the last few years Spring Grove's robotics teams have competed locally with other nearby schools districts. To compete in the competition you had to make a robot that could perform in various challenges. This competition runs in the spring and fall. Last year, I created my own team for the spring VEX competition and we placed third overall. I was part of our school's Physics Olympics team where we competed locally to test our knowledge of physics. In 7th grade, I received my black belt after four years in Tae-Kwon-Do. In 10th grade, I joined our school's tennis team. This year, I plan on participating in Science Olympiad, leading a TARC team, leading a VEX team, competing in Physics Olympics, participating in SLI, and playing tennis. In 5th grade, I became a part of John Hopkins Center for Talented Youth (CTY). I was in the program called Individually Paced Mathematics where I taught myself most of 6th grade math. I completed another course for CTY in my 6th grade summer called Robotics. There, I learned the basics of robot design and programming by working with Lego's Robot Mindstorm kits. I completed my last CTY class, Electrical Engineering, over the summer of my 8th grade year. In this program, I learned many basic principles and techniques ranging from solving problems, acquiring knowledge in the field, breadboarding and soldering circuits together. Thanks to this great experience, I plan on majoring in Electrical Engineering when I move on to college.



Name: Albert
Age: 15
Grade: 10

Rocketry is my main interest in life. Since first grade, I've been building and launching rockets. Recently I have been teaching myself advanced mathematics and basic aerodynamics. My goal is to become an aerospace engineer and computer scientist. I am going to be a team captain for TARC this year. I can't wait to launch a high power rocket.

Name: Kyle
Age: 15
Grade: 10

Science has been a passion of mine since 7th grade. After attending many summer clinics and competing in Science Olympiad. I competed in Science Olympiad for two years and decided to join the TI programs this year to help my fellow teammate, Albert. It has been an easy transition for me because I have worked with model rockets in my free time in eighth and ninth grade. When not in school much of my time is spent racing go-karts and playing basketball. My future dreams are to become a member of the medical or engineering field and settle down. My motto is "Never give up."

Name: Wyatt
Age: 15
Grade: 10

In 7th and 8th grade I participated in Mathcounts. On our 8th grade team we finished first in our county and placed at states too. Up until 7th grade I participated in soccer in my free time. In 9th grade I also participated in the Purple comet math competition. I have played violin since 3rd grade and I started Science Olympiad in 8th grade. This year I plan to participate in TARC and look forward to working on a team for SLI.

Name: David
Age:15
Grade: 9th

As of now, I am on a TARC team, a Science Olympiad team, and on the Junior Varsity high school football team. I hope to join VEX Robotics as well. I enjoy working on computers in my free time at my uncle's computer shop. I also like to repair old vehicles, like my dune buggy and go-cart. I started getting interested in rockets when I was about 11 years old. I joined my first TARC team when I was in 8th grade and I joined again this year. I think the engineering aspect is what actually drew me in at first, but I grew to love the physics behind it as well. I would love to have a scholarship to a great technical and engineering school like MIT or Drexel. While there, I would like to get my Masters in engineering and go to work for a space bound company or NASA. Then I could hopefully get my chance to go into space and get a ticket on the first human expedition to Mars.

6. NAR/TRA Advisor

Name: Tom Aument - Level 2 NAR certified

Facilities and Equipment

1. Facilities Available to All Students:

In room 135, Mr. Richard's room, we have a Gravograph LS100 30 watt laser/engraver/cutter, a Structural Stress Analyzer 1000, and computers that run Solidworks as well as Microsoft Office 2010.

In room 130, Mr. Paules' room, we have an AXYZ Automation Inc 2.2 Kilowatt 18,000 RPM TypeB 12-2 CNC router, a compound Dewalt miter saw, a Framar bandsaw, a 24" surface planer, and a Paasche FABSF-6 spray booth. There is also a Powermatic belt sand, drill press, Oliver table saw, and an orbital sander. The smaller tools within the room include router tables, routers, hammers, hand saws, coping saws, cordless hand drills, corded hand drills, and safety glasses.

In room 131, Mr. Wibel's room, we have a Lab Volt 5400 CNC Mill, a Lab volt Automation 5500-B0 CNC Lathe, an EMCO Concept Mill 55 and a General Model 480 jointer. We also have a Jet Benchtop drum sander, 4 Victor metal lathes, a Tennsmith sheet metal cutter, a Miller spot welder, 2 Baldor grinder/buffers, welding gloves and safety masks.

In room 220, Mr. Hastings' room, we can work and plan most of our project. It has numerous computers with Logger Pro and Rocksim 9. There is also a drill press, belt sander, and multiple Vernier LabQuests. We have original labquests and have a few new LabQuest 2's. In the room there is also a Craftsman reciprocating saw, a circular saw, and cordless drill.

In room 242, Mrs. Eaton's prep room, we have additional storage and workspace to use.

In room 221, Mrs. Kimber's room, there is access to two fume hoods, safety goggles, and a laptop cart with twenty-eight IBM ThinkPads.

2. Computer Equipment:

Conference Rooms 50 and 51 are distance learning classrooms that can be scheduled with advanced notice. It has IBM ThinkPad laptop computers running Microsoft XP with a USB web-camera. We also have a Cisco speakerphone and a wired network connection. Both rooms have been used in the past using WebEx before.

WebEx/connectivity Instructor Contact Information:

Instructional Technology Specialist: Mr. Sengia
Email: Sengiaj@sgasd.org
Phone number: (717) 225-4731 ext. 7060

All rooms are available for use Monday-Friday 7:25 A.M. until 2:30 P.M. After school availability is based on instructor schedule.

Needed Materials:

General Supplies:

All members have access to Gmail accounts and Google Docs. Our planned recovery system is an ELT System that will help us recover the rocket. A sensor put into the rocket and payload will be detected by the receiver and we will be recovering them both with it. We also have access to utility knives,

epoxy, and fiberglass for working on the rocket. The team website is located at springgrovesli.weebly.com

Launch Sites:

We have access to six different launch sites within 150 miles of the school. In Pennsylvania, they are located in Halifax and Fort Indiantown Gap. In Maryland there are three; located in Price, Rhodesdale, and Centerville. In Delaware there is a launch site located in Coverdale. The 2013 schedules have yet to be posted, and the team will schedule launches by appointment.

Rocket:

For the rocket we plan on using the following materials; a nose cone, PML tubing for the body, plywood for centering rings, a tube coupler, a large and small parachute, and a shock cord. We also plan on using a J motor for the rocket.

Payload:

The materials that will be used for the payload include a BT-300 tube, flexible solar panels, and a voltage data logger. We have access to a soldering iron and also solder, which are available during school hours Monday through Friday 7:25 A.M. until 2:30 P.M. and after school upon instructor availability.

3. The Spring Grove SLI Team will implement the Architectural and Transportation Barriers Compliance Board Electronic and Information Technology (EIT) Accessibility Standards (36 CFR Part 1194) Subpart B- Technical Standards 1194.21 (a-l), 1194.22 (a-p), and 1194.26 (a-d). They can be found at: http://ecfr.gpoaccess.gov/cgi/t/text/textidx?c=ecfr&tpl=/ecfrbrowse/Title36/36cfr1194_main_02.tpl

Safety

1. Safety Plan:

Before any work is done on the rocket, a second mandatory safety meeting will take place to re-inform students of the NAR safety code. When handling potentially hazardous materials, students will be required to read the Materials Safety Data Sheet (MSDS) on the hazardous material. This will be done before they can work with the material. Team members are to handle the material according to the Materials Safety Data Sheet, including its handling and storage.

The SLI rocket will be constructed in the Spring Grove Area High School. Students will have quick access to the following safety materials: Sellstrom SM Z87+FF Safety Goggles, Splash Aprons, Emergency Eye Wash Stations, Emergency Body Wash Stations, Cantflame Fire Blankets, BFPE type ABC Dry Chemical Fire Extinguishers regularly serviced by Dale E. Ness Inc., and Simplex Fire Alarms. In all rooms where rockets will be assembled and prepared, there are fire detection and

suppression systems present. There are also sprinklers in all rooms. We also plan on using nitrile gloves and respirators as the MSDS sheets suggest. These will be used for the handling of potentially hazardous materials. We are currently looking at prices and the dimensions for a Type 4 Indoor Magazine that can safely store the rocket motors used for the SLI project. We plan to purchase the indoor magazine so it will be ready for the rocket motors before the motors arrive for our use. The indoor magazine will ensure that we have proper storage for the J motors that we plan on using.

We have appointed a construction safety officer who is required to certify that all materials and building procedures are in conformance with the NAR High Power Rocketry Safety codes. This Construction Safety Officer has also been appointed as our range safety officer. He will also certify that the launch facility, rocket engine components, and environmental conditions are within safety regulation requirements. Our Safety Officer will be Tom Aument. Mr. Aument will be responsible for the safety and handling of the rocket motors. He is also responsible for the safety of the Spring Grove SLI participants when he is handling a motor. In addition, he will oversee the construction of the project and will ensure that the Safety Plan is being followed throughout the project. Mr. Aument is NAR Level 2 certified. Therefore, he will also be responsible for the ordering and storage of our rocket motors.

We will incorporate safety as an integral part of the design. The rocket will also be safely inspected and checked throughout the construction. In addition to the safety plan, we will be following the NAR High Power Safety Code guidelines as outlined below:

Risks	Probability of Risk *(1-10)	Impact on Project Progress	Mitigations
The payload may get lodged in rocket such that it comes down with the rocket and yields no usable data.	2	We will need to redesign, rebuild, or reload the payload. This would delay the progress of construction.	The team shall ensure that the payload is properly installed.
The rocket parachute does not deploy and rocket returns unsafely to	3	We lose a rocket and must build another one, losing work time and time to launch.	The team will carefully insert the parachute and make sure there is enough heat shield

the ground.			material to prevent flame up.
Injury could occur while using coping saw.	2	A leave of absence of a team member could occur due to minor or severe injury and possibly delay the rocket-building progress.	The team will be aware of limbs and fingers when using this tool.
Injury could occur during Exacto knife usage.	5	A small injury could occur, possibly delaying the rocket-building progress.	The team will carry the knife in cautious matter, cut away from oneself, and be aware fingers when using this tool.
Accidental combustion of rocket materials	3	In addition, possible injury and a delay of rocket-building progress could occur.	The team will keep 25 feet away from electrical outlets, open flame, and the indoor magazine.
Allergic reactions to chemicals involved in rocket production	2	Minor or severe chemical burns of team members and possible delay of rocket progress could occur.	The team will make all students aware of each other's allergies and stay away from possible allergens.
Electrocution during electrical outlet usage	1	Minor or severe injury could occur.	The team will only use electrical outlets if hands are dry and static free. The team will keep fingers away from prongs.
Adhesion to materials or self	4	Minor injury and very minor delay of rocket progress could occur.	The team will exercise proper caution when

when adhesives are in use			handling adhesive material and will not use too much of the material.
Injury during laser engraver usage	2	Possible combustion of rocket materials could lead to reordering of materials and delay progress.	The team will make sure the laser is on the proper power, speed, and focus settings, and ensure that the exhaust fan is on.
Injury during drill press usage	2	Severe injury and delay of progress could occur.	The team will keep clothing, hair, and body parts away from the drill bit and use safety glasses.
Tripping and falling hazards	3	Minor or severe injury, delay of rocket progress could occur.	The team will make sure the walking path is clear and keep clutter off of floor.
Abrasions and bruises caused by belt sander	2	Minor injury and delay of progress.	The team will keep hands and clothing away from the sandpaper.
Burning caused by soldering iron usage	2	Minor injury and delay of progress.	The team will use soldering iron in a proper manner and use safety gear.
Premature ignition of rocket motors	2	Possible minor or severe injury, the need to reorder rocket motors, and delay of rocket progress.	Ensure that only the proper level certified personal handle the rocket motors and installations as well as

			reloads
Team estrangement because of lack of cooperation	1	Delay of rocket progress.	The team will talk calmly and will not fight with one another. The team will respect each other and themselves.
Going over-budget	5	Delay of rocket progress due to the need for more time to fundraise	The team will carefully use all materials, order only the parts needed, keep track of materials, and use the budget wisely. The team will be diligent in fundraising endeavors.
Misuse or mishandling of hazardous materials	2	Minor or severe injury, leave of absence for team member affected, and delay of progress	The team will follow all safety code regulations, laws, and instructions.
Unforeseen rocket design complications	4	Delay of rocket design and rocket building progress	The team will design a stable rocket based on the locations of the center of pressure and center of gravity. The team will also have a NAR representative check rocket design.
Unforeseen payload design complications	3	Delay of payload design and production.	The team will design a payload that will be effective for the size body tube that is used and double-check that the components of the

			payload are properly wired and attached.
Complications during transportation of participants and materials to SLI or practice launch sites	3	Delay of rocket progress due to rocket repairs or cancellation of practice flights because of extensive damage.	The team will make sure that the launch date is known in advanced and that all specifications are planned out well in advanced. The team will pack the rocket well and make sure it is secure during transportation.
Accidental partial or complete destruction of building site	2	Damage to work environment, additional expenditures for repairs, possible progress delay.	The team will ensure that safety guidelines from NAR and the MSDS are being followed.
Team communication failure	3	Rocket/payload may be built incorrectly or too many of one part may be made, causing a slight to major delay of progress or loss of material.	Every team member will have access to other members' email addresses and have the ability to talk during the school day.
Shortage of rocket building materials	2	Major delay due to the need to order new material and wait for it to ship.	The team will double-check all materials before ordering and enforce a checklist while parts are being used.

Commitment complications among team members	2	Loss of time or team member if the complication is too great.	The team will make sure all team members make this their first priority and plan accordingly.
Inhalation of dangerous fumes	2	Minor to severe injury, time lost taking student to ER, delay of progress.	The team will wear proper safety gear, exercise proper use of fume hoods, and be aware of surroundings.
Accidental ingestion of rocket materials	1	Minor to severe injury, delay of progress, possible loss of material.	Only experienced students should work with dangerous materials under proper supervision.
Motor ignition delay	3	Launch delay, loss of motor if it does not ignite, minor to severe injury if motor ignites while personnel are approaching rocket.	The team will only use commercially available and Range Safety Officer-approved igniters.

Rocket catches fire on the launch pad	2	Possible loss of rocket, minor to severe injuries if fire is not properly extinguished.	The team will bring a fire extinguisher suitable for the needs of the fire and according to the MSDS of the motors being used.
Cancellation of launch due to poor conditions	4	Delay of testing.	The team will plan multiple days to launch, be flexible in scheduling practice launches, and practice patience.
Motor ignition failure	3	Delay of launch testing and rocket progress.	The team will ensure that commercially available igniters and motors are used and follow the NAR High Power Safety Code, which outlines what to do during motor ignition failure.

*Probability is rated on a scale of 1 to 10, where 1 represents a low probability that the risk will present a problem and a 10 represents a very high probability that the risk will present a problem. Risks that are rated at ten or close to ten will be dealt with as soon as possible and handled according to the mitigation and/ the best way to handle the problem.

2. Procedures for NAR/TRA Personnel to Perform:

Tom Aument is our Level II NAR mentor as well as our safety officer. He will be certifying that the rocket motors that we are using are certified and safe for launch. He will also be ensuring that the engine reload kits are certified and safe for us to use. Mr. Aument will also be overseeing the construction of the rocket to ensure that the rocket will only be constructed out of light-weight materials such as paper, wood, rubber, plastic, fiberglass, or, when necessary, ductile metal.

Mr. Aument will verify that the rocket engines and engine reload kits are not broken upon delivery. He will also store the engines and reload kits in a locked Type 4 magazine that meets the requirements of NFPA 1127. He will verify that no sources of fire or heat are within 15 feet of the locker and 25 feet of the rocket motors when they are being used. Mr. Aument will keep an inventory of the engines and reload kits and an adult supervisor will also ensure the completion of the above steps by the safety officer.

Mr. Aument will be responsible for controlling the inventory of all engines and rocket motor reload kits. When ready for use, he will also update the inventory of the rocket motors and reload kits to ensure that there are no missing supplies. Engines and reload kits that are not used for flight, but have been checked out for use, will be returned to Mr. Aument and accounted for in the inventory. Engines and reload kits will be documented with the launch location for that particular motor or reload kit, the date and time it was used in a flight, and the number of the flight (starting with Launch #1 for the first flight, Launch #2 for the second flight, and so forth). Mr. Aument will also be ensuring that safety equipment for hazardous materials and handling procedures for hazardous materials are being followed based on the Materials Safety Data Sheets for those materials.

3. Plan for Briefing Students:

Students have already been required to sit through an introductory meeting, which included the verbal reading of NAR High Power Rocketry Safety Code to all members of the team. Team members shall also be required to attend other meetings, which will cover the safety codes of the NFPA and FFA. During the meetings, NAR High Power Rocketry Safety Code shall be reviewed again. In addition to the mandatory meetings, brief meetings prior to launches shall occur to review safety codes. Students will also be made aware of hazards, methods for recognizing hazards, and methods for avoiding hazards and accidents.

4. Methods for Including Necessary Caution Statements:

In order to ensure that cautionary statements are included in plans, procedures, and other working documents, we plan to post warning signs on the entrances of the

room in which the indoor magazine will be placed. Cautionary statements will be placed on the entrance of room 220 to ensure that participants are aware that hazardous materials are being stored in the vicinity as well. To ensure hazardous adhesives and accelerants are handled with care, warnings will be posted on the door of the cabinet where they are stored to notify users of the risks involved with these materials. We plan on posting the Materials Safety Data Sheet for the motors being used outside of the room in which it will be stored for team members to read before entering the room

5. Plan for Complying with Laws:

In order to comply with federal, state, and local laws regarding unmanned rocket launches and motor handling, the Spring Grove SLI team shall launch its rocket so that it stays in a suborbital trajectory. The team shall also launch the rocket so that it does not cross into the territory of a foreign country and it shall be unmanned. The rocket shall be launched in a manner that does not create a hazard for any persons, property, or other aircraft. The team rocket shall also be subject to any additional operating limitations necessary to ensure that air traffic is not adversely affected, and to ensure that public safety is not jeopardized.

To ensure further compliance with FAA regulations, the team shall also avoid launching the rocket at any altitude where clouds or other obscuring phenomena of more than five-tenths coverage prevails. This shall include not launching the rocket at any altitude where the horizontal visibility is less than five miles and not launching the rocket into any cloud. The rocket shall not be launched between sunset and sunrise without prior authorization from the FAA and will not be launched within 9.26 kilometers of any airport boundary without prior authorization from the FAA. The team shall not launch the rocket in controlled airspace.

The Class 2 rocket shall not be launched unless the team observes that there are appropriate separation distances between the launch site and any person or property that is not associated with the operations. The separation should not be less than one-quarter the maximum expected altitude or 457meters (1,500 ft.), unless a person of at least eighteen years old is present and is charged with ensuring the safety of the operation, and has final approval from authority for initiating high-power rocket flight and unless reasonable precautions are provided to report and control a fire caused by rocket activities.

The Spring Grove SLI team shall give the FAA and ATC facility nearest to the place of intended operation the following information no less than 24 hours before and no more than three days before beginning the operation:

a) The name and address of the event launch coordinator, whose duties include coordination of the required launch data estimates and coordinating the launch event;

b) Date and time the activity will begin;

c) Radius of the affected area on the ground in nautical miles;

d) Location of the center of the affected area in latitude and longitudinal coordinates;

e) Highest affected altitude;

f) Duration of the activity;

g) Any other pertinent information requested by the ATC facility.

The Spring Grove SLI team shall also research state and local laws regarding rocketry in order to ensure compliance with all laws associated with rocketry in the vicinity of the rocket launch site. The team shall also be in compliance with all rules and regulations regarding rocket launch sites, rocket motor storage, and rocket launch safety described in NFPA 1127.

6. Plan for Motor Handling and Storage:

Rocket motors will be purchased through our NAR level II certified representative, Tom Aument. All motors will be stored within a Type 4 magazine and access will be granted solely to our NAR representative. Mr. Aument will be responsible for the safe transportation and construction of the rocket motor reloads. Any use of the motor will be under his supervision at all times.

7. Team Agreements:

Spring Grove SLI Team Agreements:

***Please see contracts pdf for all signed contracts.**

As a team member:

1. I agree to comply with all applicable local, federal and state laws.

2. I agree to use of airspace laws of Federal Aviation Regulations 14 CFR, Subchapter F, Part 101, Subpart C.

3. I agree to handle and use low explosives according to the Code of Federal Regulation 27 Part 55: Commerce in Explosives.

4. I also agree to follow all fire safety regulations according to NFPA 1127 “Code for High Power Rocket Motors.”

5. I will follow the NAR High Power Rocketry Safety Code.

6. I agree to read the Material Safety Data Sheet and follow all of its instructions. I will be aware of the hazards that are involved with the materials that we are using in our project. This includes, but is not limited to, the rocket motor.

7. I will use safety equipment in accordance to its safety regulations during the construction of the rocket.

8. I will obey all instructions given by the project manager and supervisors.

9. I agree to work with my team members in a constructive manner in order to make a safe environment for all team members to work together.

10. I am committed to working on this team until the completion of our project.

As a team:

A. We agree that there will be range safety inspections for each of our rockets before they are flown. Upon inspection, we will comply with the determination of the safety inspection.

B. We agree that The Range Safety Officer has the final say on all rocket safety issues. Therefore, The Range Safety Officer has the right to deny the launch of any of our rockets for safety reasons.

C. We agree that if our team that does not comply with the safety requirements we will not be able to launch our rocket.

I agree to the Spring Grove SLI Team Agreements above. I understand that any violation of these rules will result in consequences including getting taken off the team.

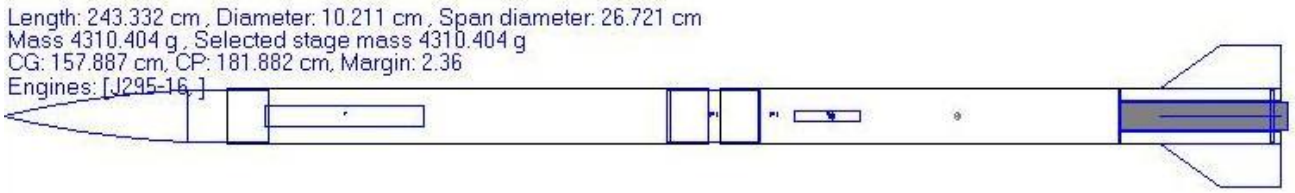
Name: _____ Signature: _____
Date:_____

Supervisor Contracts

I, _____ agree that all students will follow the safety regulations. I will oversee the project and intervene when there is a safety hazard. If any member violates these agreements, they will be taken off the team to ensure the safety of the team, supervisors, and community. After a violation, they will not be able to work on the rocket or with any of the team members for the rest of the project.

Supervisor's Name_____
Supervisor's Signature_____

Technical Design

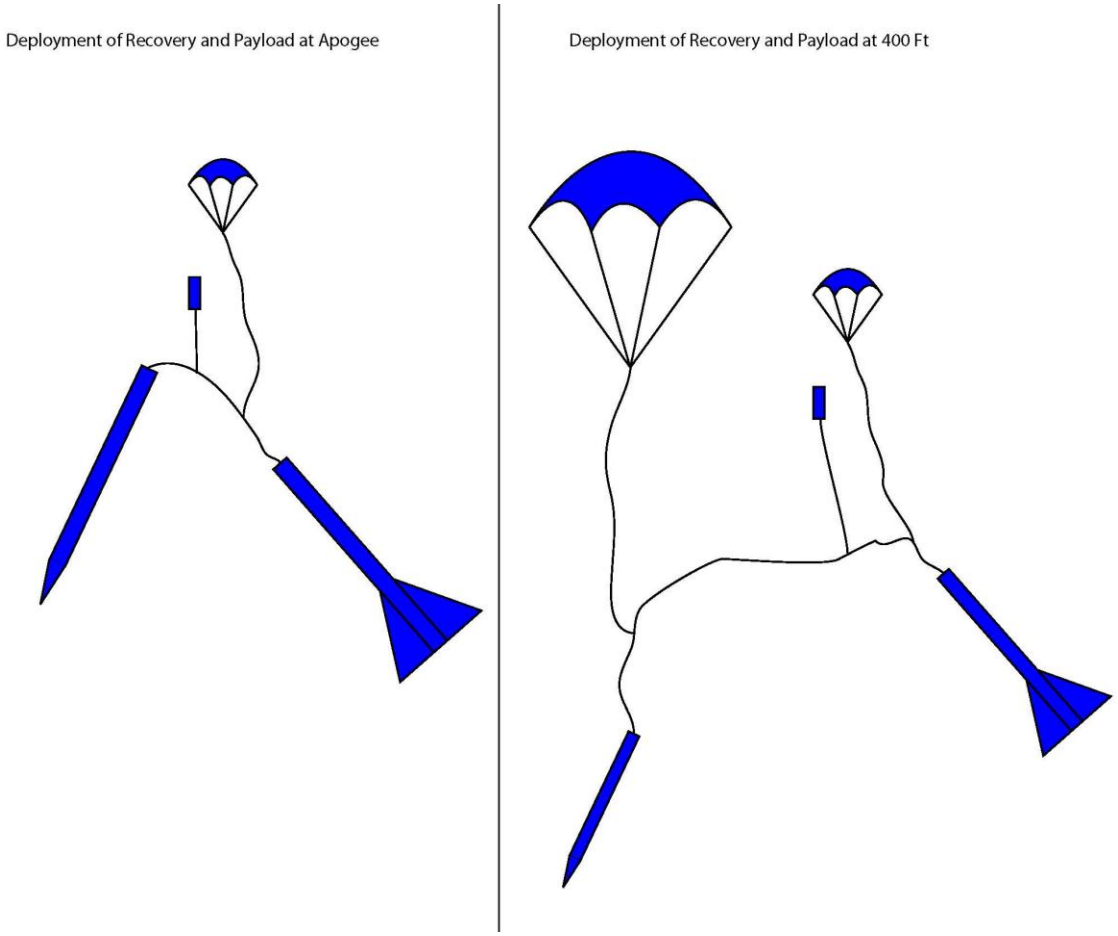


1. Proposed Rocket and Payload Design

    a. The projected length of the rocket is 243.332 centimeters and the projected width of the rocket is 10.211 centimeters. The estimated mass of the rocket is 4310.4 grams. The Center of Gravity is located 157.887 centimeters from the tip of the nosecone and the Center of Pressure is located 181.882 centimeters. The separation between the CP and CG is 2.36 times the diameter of the rocket, creating a stable design. The proposed materials are airframe tubing from Public Missiles Limited, as well as bulkheads, parachutes, and couplers, also from Public Missiles Limited. We propose to use an LOC Precision Electronics bay with altimeter. The PML tubing was selected for its strength. The LOC Electronics Bay was recommended by an advisor with NAR Level II certification.

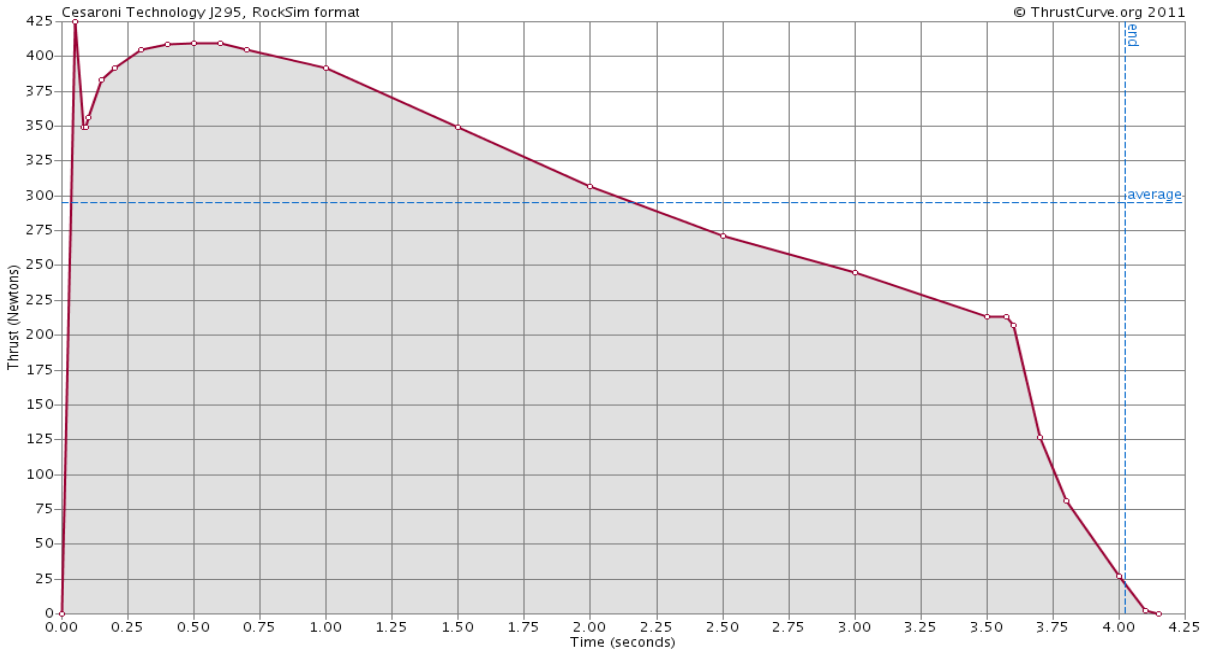
    b. The design concept for recovery of the rocket contains two parachutes. Each parachute is attached to the rocket by a shock cord, which attaches

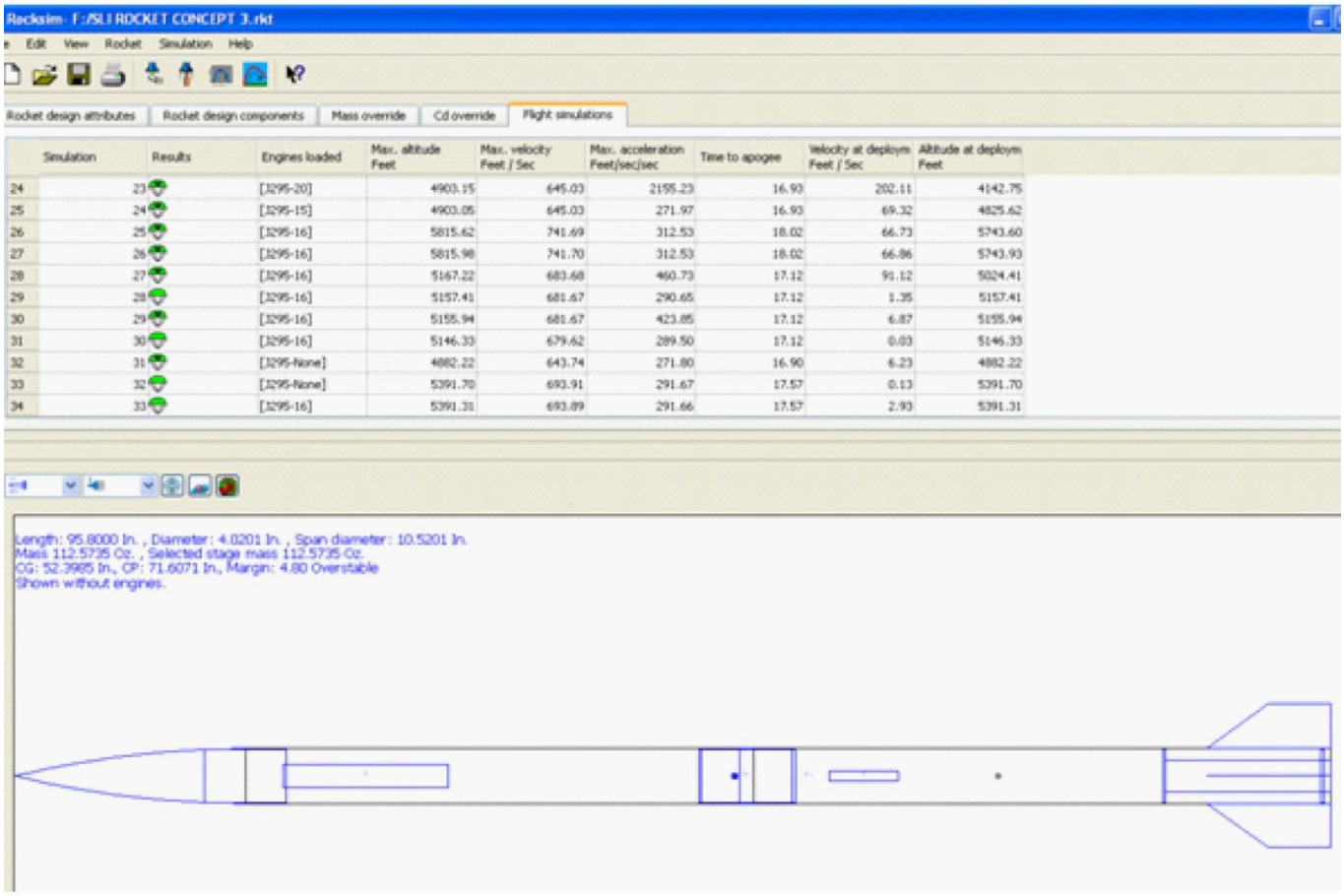
to the LOC Electronics Bay. The altimeter within the Electronics Bay will detect apogee as well as 400 feet above ground level. At apogee, the altimeter will send a signal to the drogue parachute, which comes out of the rocket with the payload at the bottom of the Electronics Bay. After the rocket descends to 400 feet, a second signal is sent to eject the main parachute and Electronics Bay from a charge at the top of the rocket. The main parachute will slow the descent rate to a projected speed of 6.1 meters/second. The payload will be hanging from the drogue parachute, while the body hangs from the main parachute.



c. The proposed motor for the rocket is a J295 from Cesaroni Technology. The casing is a 54 mm Cesaroni casing. The total impulse of the J295 is projected to be 1190 Newton-seconds. The average thrust is expected to be 290 Newtons. A graph of the thrust is shown below along with a test simulation of the rocket with the J motor that we plan to use.

A screen shot of the launch simulations with the full rocket design is above. As you can see the target altitude was reached since the maximum altitude was 5391ft with all components installed and selected motor.





d. Proposed Payload Design:

Our plan for the payload is to acquire a 3" diameter BT-80 tube. On the outside of it, we plan to epoxy two centering rings flush with the top and bottom of the tube. Then we will epoxy a bulkhead to the inside of the tube, closing off the bottom. On the inside of the tube, we will then epoxy a centering ring at the top inside of the tube. This will leave an opening for our voltage data logger wires to reach out and connect to the solar panels. The positive and negative wires will fit through the hole effectively. On the outside of the tube, we will wrap and glue a flexible solar panel around the BT-80. The wires will come out of the top of the payload. Through the hole, the wires will connect the solar panels on the outside to the voltage data logger on the inside.

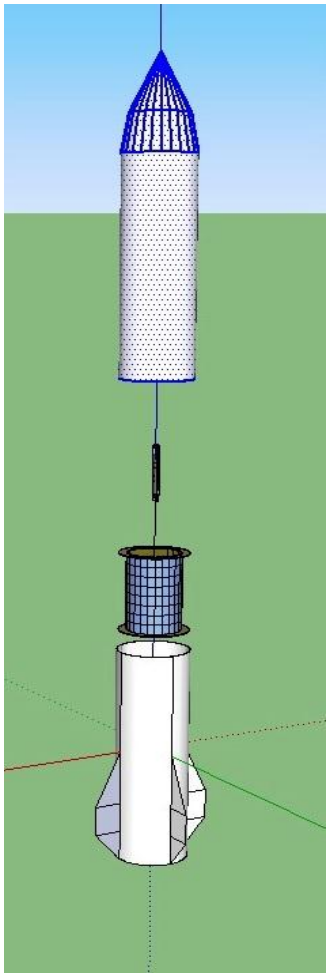
When the payload is safely in the rocket, the outer centering rings will keep the payload secured in the rocket's body tube. We plan on surrounding the payload with a form of cushioning (possibly Memory Foam) so that the voltage data logger is secure. This will ensure that safety data logger does not move within the payload.

Since the flexible solar panel will wrap all the way around the 3" BT-80 tube, we will make the parachute connect to the top of the payload. Considering that the parachute is connected this way, the orientation of the payload will not matter. The

surface area will be the same with this design. When the payload is deployed from the rocket at apogee, the payload will be able to gather data. The solar energy will be collected as the rocket descends.

All students are part of the Spring Grove High School. The majority of the members have participated in TARC for one to three years. There are two experienced TARC captains on the team and two new TARC Captains on the team. Most students have experience with model rockets; however the payload aspect of the project is new to all team members.

The goal of the solar panel payload is to determine if the current generated at apogee is larger than current generated on the ground with the same device. Since the current will be logged over time, we could also see how current changes over time on its descent and possibly determine the mathematical relationship between altitude and current generation. The hypothesis of the experiment is that the system will see very little difference between the current generated at altitude and at the ground due to the limited effect of the extra mile of atmosphere on the energy of the light striking the panel.



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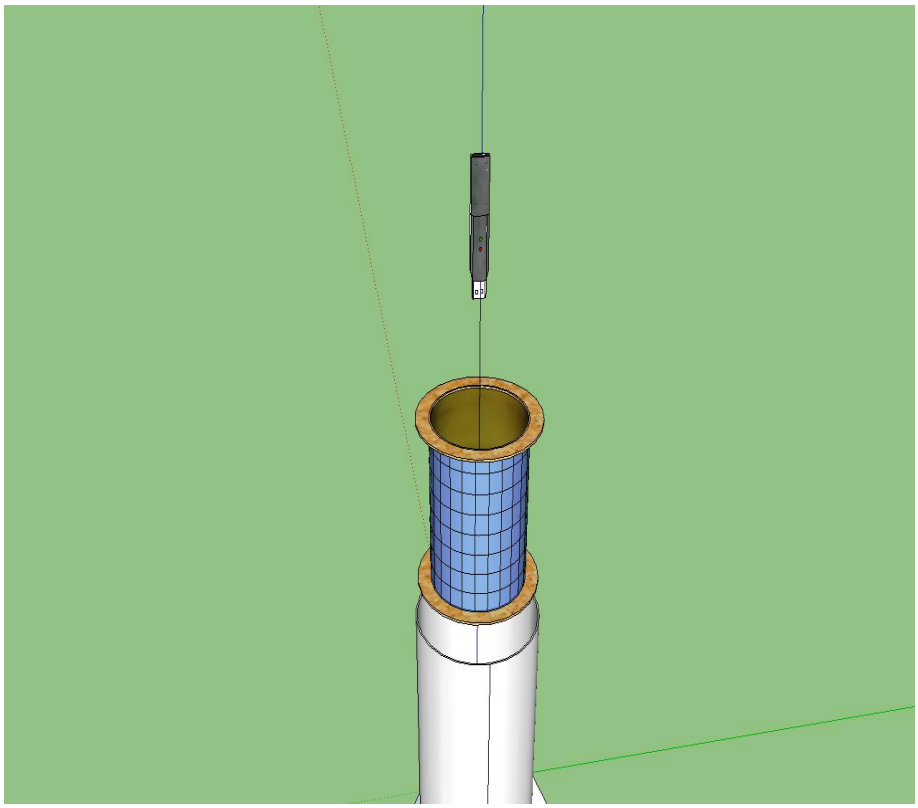
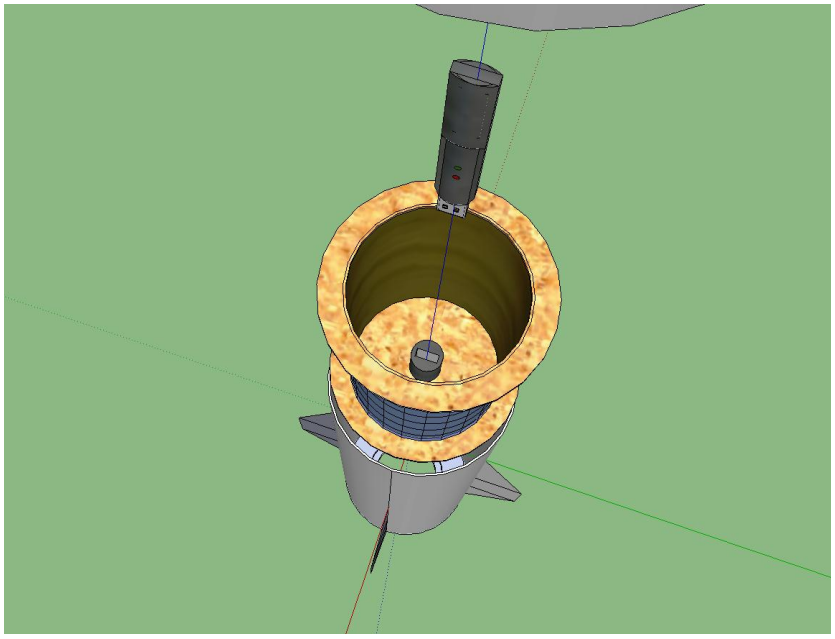
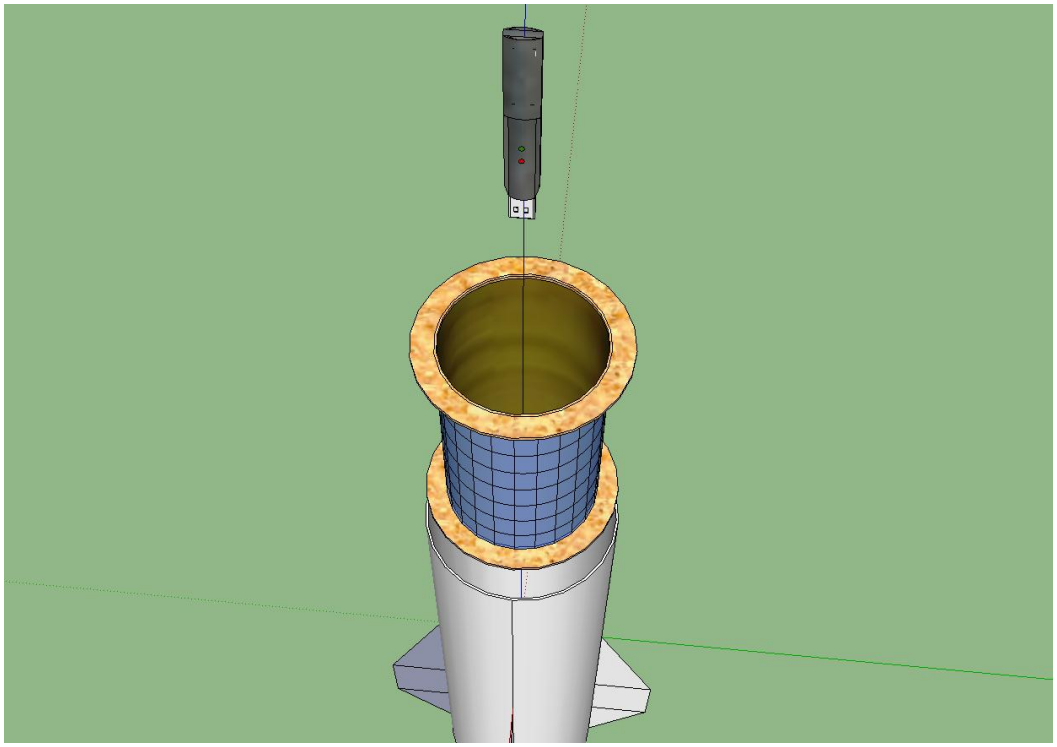
The drawing above shows the solar panel array being inserted into the back section of the rocket



Data logger added to payload section.



Top view of payload section.



e. Requirements Summary

Vehicle:

The rocket must go 1 mile above the ground. The simulations from our design show that it will go a little over a mile. This is because the simulation assumes perfect conditions. It assumes that the conditions and weather are perfect. The actual flights will be lower due to wind and air resistance. With this projection, every rocket should go up a mile. The rocket must be subsonic during the flight's duration. The projected velocities from the flight simulations show that the highest velocity will be 693.89 ft/s. The speed of sound is over 1000 ft/s, therefore the speed is shown to be subsonic.

The vehicle must be recoverable and reusable. The vehicle will have an adequate recovery system. The materials used are durable, and will be available for reuse in several launches.The vehicle will have a maximum of four independent sections. The design concept currently has two sections, and the a payload. So it is considered 3 sections.

The vehicle will be capable of being prepared in 2 hours. We will have to be prepared for rocket recovery and payload repairs.

f. Possible technical challenges and solutions:

A possible challenge could be protecting the payload, so that it is not damaged by ejection charges or large forces. A possible solution is to put a layer of memory foam with fireproofing cover that is proposed to either wrap around, or cover the bottom of the payload. Another problem that could arise could be that the Electronics Bay could be pulled out of its position at the first ejection causing a failure in the recovery plan. This is not a huge concern. The pressure from the first ejection should keep it in its position, while any recoil from the shock cord will be canceled out by elasticity and the fit of the electronics bay in the body. The recovery should not encounter this problem.

A possible concern is if a fins breaks off of the rocket upon ejection, landing, or takeoff. The solution to this possible problem is reinforcing the fins by putting them through the body and attaching them to the motor mount tube. The extra strength will cause the fins to stay attached, eliminating this problem. Fiberglass reinforcing material may also be used to strengthen the fins and body of the rocket. This may be due to incorrect cutting of the body where the fins will be attached. There are several solutions to this problem. A laser cutter is present at the school, and could be used to cut the slots for fins. A line could be sawed by an electric saw or a hand saw. After it is cut, we can use sandpaper to adjust the whole size until the fins fit into the whole. The body tubes could also be cut by the manufacturer before they are ordered, in the event we decide to not make the cuts manually.

Another issue that we could come across is if the payload does not fit in the rocket. Adjustments can be made to the payload design. This includes centering rings which can be sanded down or replaced if they are the wrong size. If any of the rocket parts break during construction or test launches, as a result of human clumsiness,

unpredictable circumstances, or failures of the engine/recovery system, We will have the necessary funding in order to buy new materials.

Educational Engagement

1. Educational Plans:

In order to spread awareness of rocketry programs at Spring Grove, we will create hands-on and learning based opportunities for kids in our community to explore. Possibilities include giving a presentation to inform students, in either Spring Grove Middle School or Spring Grove Intermediate School, about the engineering of rockets. We will teach about 250 students the fundamentals of rocketry and teamwork skills. After the presentations, we plan to break up into small groups to work together and build a rocket. Each group should have an SLI member directing the group to teach the students and help them to build the small rocket. Later on, we may even launch the rockets that were made in the workshop. We want to spread awareness of rocketry, so more students will be interested in joining TARC (Team America Rocketry Challenge) and potentially even SLI in the future. We plan to set up a TARC team in our Spring Grove Middle School, as well. We may ask the participating students to complete a survey to see how many are interested in rocketry or joining TARC and SLI . It is one of our goals, in giving this presentation to interest as many people as possible in joining our science clubs, and continuing the success we have achieved in TARC and SLI.

To spread public awareness we are planning to contact television stations, such as FOX 43 of the FOX corporation and WGAL 8, to see if they are interested in making a short segment on TARC and SLI of Spring Grove High School. We may also contact local radio stations such as 107.7 and 105.7 to see if they are interested in speaking on behalf of our program here at Spring Grove. We hope to involve local newspapers and our own self created website to educate and spread awareness of SLI in the local community. We plan to make posters to hang up in our schools and local businesses throughout York County as well.

Educational Workshop

The Spring Grove “Rocket” workshop will be performed to the students of either Spring Grove Middle School or Spring Grove Intermediate School. In the workshop we will use our planned $400 budget for the outreach program to supply the small model rockets being made in groups, paint (design) supplies, and fins /nose cones. We do not plan to launch these small rockets on account of safety and the large amount of rockets being designed. The rockets will be made of toilet paper tubes and plastic fins. Also along with the rockets we will

make and present a presentation on Microsoft PowerPoint, showing the parts of a rocket, basic safety, and the members of the team.

Planned Fundraising:

The Spring Grove SLI team plans to fundraise through sponsorships in local businesses. We plan to ask Glatfelter Paper Corporation, BAE Systems, UTZ, Hanover Brands, Snyder's of Hanover, and York to sponsor us. We may also reach out to local colleges in the area for sponsorships and advice. Possible colleges include Shippensburg, York College of PA, and Penn State York. We will put the sponsoring logos on our posters, team shirts, and on our rocket, to be launched in Huntsville, Alabama. We may create in-school raffles to continue fundraising throughout the school year as well. To generate additional revenue, we also may host a movie night, bake sale, or benefit dinner.

Educational Engagement Form

The form below will we used to record activities

Grade Level:
K-4 _____
5-8 _____
9-12 _____

Number of Participants:_____
Number of Educators:_____
Are the children involved in any groups?
_____
_____
Briefly describe the activities:
_____
_____
_____
_____
Extra
Info._____
_____
_____

Project Plan

1. Schedule and Timeline:

We will have mandatory team meetings every Wednesday. At the meetings we will discuss our progress on the project as a team. We will also discuss additional times to meet during the week for construction. Each students will be able to work throughout the week whenever it works in with their schedule. There will be a sign-in and sign-out sheet to keep track of personal time progress and make sure each student is putting in the effort.

In August, we will receive the Request for Proposal (RFP) and will work on the completion of the proposal, along with sending out the electronic copies to the proper contacts. On September 27th, we will be notified if we were selected or not. October 4th is a tentative date for our team teleconference with NASA scientist. The 11th the tentative date for the Preliminary Design Review Q&A session. The 22nd of October will be when we establish our web presence to be able to post the PDR reports, slides for the presentation, and flysheet on the 29th. During the week of November 7-16th is when we will be presenting our PDR to the scientist. December 3rd will be another Q&A session, this time about our Critical Design Review (CDR).

Looking into 2013, January 14th we will post CDR reports, presentation slides, and flysheet posted to the website. The 23-February 1st is the tentative date for our CDR presentation. The 11th of February is the tentative date for our Flight Readiness Review Q&A session. March 18th will be when our FRR reports, presentation slides, and flysheet are due on the website. The 25th-April 3rd are tentative dates for our FRR Presentations. April 17th, we will be arriving in Huntsville, Alabama, at 5:30 P.M. There will be a Team Lead meeting that all applicable members of the team will be attending. At 6:30 P.M. the Launch Readiness reviews will begin. The 18th and 19th, the Welcome to MSFC/LRRs will continue. Then the 20th is the set launch date, and the rain date is on the 21st. We will then return home and begin work on the Post Launch Assessment Review that will be posted on the team website by May 6th. The 17th of May the winning USLI team will be announced.

2. Proposed Budget:

Our proposed budget for the SLI program includes the rocket cost, educational engagement, travel expenses, lodging, food and practice launches. Total rocket expense is estimated to be $1,749.85, which accounts for about 16 percent of our total budget. The Huntsville trip which includes lodging, food and travel expenses adds up to about $8,535.00. This budget if based on 11 participants and 2 educators. That accounts for about 77 percent of our total budget. The practice launches which will take place up to 4 times and cost about $840 total which will account for the final 7% of our total budget. Included in the rocket price are 2 data loggers and flexible solar panels which will be used as our scientific payload.

Proposed Final Cost of SLI Program	
Item	***Price***
Outreach	$ 400.00
Travel	$ 1,640.00
Lodging	$ 4,165.00
Food	$ 2,730.00
Practice Trips	$ 840.00
Body Tube	$ 23.50
Nose Cone	$ 21.95
Altimeter	$ 129.95
Mount	$ 4.99
G-10 Fiberglass	$ 70.38
Fast-Hardener	$ 43.94
Resin	$ 84.96
Coupler Bulkhead Assembly	$ 33.68
Shock Cords	$ 71.70
Large Parachute	$ 73.95

Small Parachute	$ 18.95
Centering Rings	$ 38.40
Bulkplate	$ 144.30
J-295 Engine	$ 859.50
Motor Casing	$ 129.70
Proposed Final Cost-	$ 11,524.85

3. Funding Plan

The Spring Grove SLI team plans to fundraise through sponsorships in local businesses. We plan to ask Glatfelter Paper Corporation, BAE Systems, UTZ, Hanover Brands, and Snyder's of Hanover to sponsor us for our involvement in engineering, and our natural resource payload. We may also reach out to local colleges in the area for sponsorships and advice. Possible colleges include Shippensburg, York College of PA, and Penn State York. We will put the sponsoring logos on our posters, team shirts, and on our rocket to be launched in Huntsville, Alabama. We may create in-school raffles to continue fundraising throughout the school year as well. To generate additional revenue we also may host a movie night, bake sale, or benefit dinner.

Upon acceptance of our proposal, our team will receive the $3,700 grant from NASA. We received $1250 for finishing fourth in the TARC Nationals. Our school is also guaranteed a $1000 mini-grant upon acceptance of our proposal. We are currently asking local businesses to support us in our project. Many of these businesses have generously assisted our school in the past. We are currently awaiting their responses. We will add their logos and company name on our team shirt and possibly on our rocket to be launched in Huntsville. We are receiving help from a machinist named Tom Aument in order to effectively launch and safely recover our rocket.

4. Plan to get Community Support:

To spread public awareness we are planning to contact television stations, such as FOX 43 of the FOX corporation and WGAL 8, to see if they are interested in making a short segment on TARC and SLI of Spring Grove High School. We may also contact local radio stations such as 107.7 and 105.7 to see if they are interested in speaking on behalf of our program here at Spring Grove. We hope to involve local newspapers and our own self created website to educate and spread awareness of SLI in the local community. We plan to

make posters to hang up in our schools and local businesses throughout York County as well to hopefully bring in donations and sponsorships.

5. Major Challenges and Solutions:

Some major problems that we could run into are safety hazards and being over budget. A way to avoid safety hazards is to have students read the MSDS sheet before proceeding with any devices they will be using and follow the enclosed safety plan. We can address that if a student is uncomfortable with using a tool at any time, they are able and encouraged to not use that tool. To stay on budget, we could make records on what is spent and also do research for the best pricing of the materials. If we do go over budget, we can show companies our progress on the project and ask for sponsorship. Another solution to this problem is to have more fundraisers, or fundraisers that have a greater amount of income.

6. Plan for Sustainable Support of Rocket Project:

In the Spring Grove Area School District, we have availability to many educational opportunities and are privileged to be a part of the SLI program. We have access to many tools and educators as well as the privilege to be able to work with Tom Aument (Level 2 NRA Certified) for our official practice launches and motor placement. In order to make it to Huntsville in April, we have to work with our students here in Spring Grove, our local businesses and corporate sponsors. We plan on engaging our students and spreading awareness of rocketry programs at Spring Grove. In order to accomplish this, we will create hands-on and learning based opportunities for kids in our community to explore. Possibilities include giving a presentation to inform Spring Grove Middle or Spring Grove Intermediate students about the engineering of rockets. We will teach about 250 students the fundamentals of rocketry and teamwork skills. After the presentations, we plan to break up into small groups to work together and build a rocket. Each group will have an SLI member directing the group to teach the students and help them to build the small rocket. If it's feasible, we may even launch the rockets that the students constructed. The kids may also have the chance to decorate the rockets and make them their own creations. We want to educate our students about the significance of rocketry, so more students will be interested in joining TARC (Team America Rocketry Challenge) and potentially even SLI in the future. We plan to set up a TARC team in our Spring Grove Middle School as well. We will ask the participating students to complete a survey to see how many are interested in rocketry or joining TARC and SLI. It is one of our goals in giving this presentation to interest as many people as possible in joining our science clubs, and continuing the success we have achieved in TARC and SLI.

In order to spread public awareness, we are planning to contact television stations, such as FOX 43 of the FOX Corporation and WGAL 8 in the Susquehanna Valley, to see if they are interested in making a short segment on the SLI program of Spring Grove High School. We will also contact local radio

stations such as 107.7 and 105.7 to see if they are interested in speaking on behalf of our program here at Spring Grove. Since we have a good relationship with the local radio stations, we will also see if one or two group members could participate in an interview with the radio DJs with the intention of spreading safety and the fun of rocketry and engineering. We also hope to involve local newspapers and our own self-created website to educate and spread awareness of SLI in the local community. We hope to recruit future students to our SLI and TARC programs through our presentations, community involvement, and outreach programs.

We plan to include local businesses as honorary team members as a reward for donating money towards our fundraising efforts. As honorary members, we will inform them of how their money is being used in the project as well as our project progress. We will provide all necessary means to educate our young peers, spread public awareness and finally, have a successful launch in April.