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NASA Student Launch Proposal

Prepared for NASA by Boy Scout Troop 17 Student Launch Team

Date	Revision	Remarks
Sept 19, 2018	1.0	Initial Proposal

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1 General Information

1.1 Introduction

Boy Scout Troop 17 is very excited to have the opportunity to submit a proposal for the 2018-2019 NASA Student Launch Initiative (SLI) in our second year of eligibility. We successfully completed the 2017-2018 SLI program, and we are looking to build on that success and apply lessons learned to make the 2018-2019 season even more rewarding for our team members and the community we serve with our STEM education program. We have participated in the Team America Rocketry Challenge (TARC) since 2007 and qualified for the National Finals three times, we have large interest in and experience with hobby rocketry, we placed 11th in TARC for the 2016-2017 season, and we are honored to be invited by NASA to submit a proposal for SLI for a second year.

STEM education has long been an important but often under-recognized part of Boy Scouting. Even at the beginning of Boy Scouting in the early 1900's, almost one-third of the original 53 merit badges were STEM-related. The focus on STEM has increased since then, and 90% of merit badges introduced since 2009 have a STEM component. In 2012, BSA National introduced the STEM/Nova program as a focused STEM program. And in 2014, Troop 17 became one of the only Troops in Virginia to offer this program at the Troop level (in most areas, STEM/Nova is only offered at the Council level).

Rocketry fits into the Troop's STEM program in multiple ways:

- It serves as a challenging STEM event that fulfills BSA STEM/Nova requirements to earn the Supernova Medals (the highest awards in STEM/Nova).
- It allows us to offer STEM-related education and outreach within the Boy Scouts, including Scouts in our own Troop as well as Boy Scouts and Cub Scouts in other units. For example, we use the Rocketry program to teach merit badges including Space Exploration, Aviation, Electronics, Computer Programming, and others. We also use it as a way to reach younger youth in Cub Scouting.
- It also gives us an opportunity to promote STEM education and outreach within the community at large, including local schools and other community groups.
- It helps to create hands-on experience and passion for STEM that is very well aligned to the natural interests and talents of our youth.

Student Launch Team, Troop 17 (SLT17) was formed over the Summer of 2017 and we are now entering our second year. Interest in SLT17 was large in our first season, and has grown even more this year, with several new team members joining and all but two returning from the previous year. We have been conducting frequent meetings to organize, plan, and get the groundwork in place so we are ready for the RFP. With the skills, experience, and passion of our team members, the full commitment and support of our Troop's adult leadership, and the support of sponsors, we feel that SLT17 is strongly positioned for success in the 2019 NASA Student Launch.

1.2 Team Contacts

The following is contact information for SLT17 youth and adult leadership. To comply with BSA Youth Protection and Online Safety requirements, youth are referred to in this document (and all other public documents) by first name only and youth contact information is not provided here, but will be provided to NASA directly in a private communication.

Name	Title	Email	Phone
Steve Yates	Troop 17 STEM Chair	steveyates@embarqmail.com	434-825-2850
Ben Russell	Tripoli/NAR Mentor	ben.russell11@gmail.com	703-853-6060
Hunter	SLT17 Team Leader		
Mac	SLT17 Safety Officer		

All deliverables during the period of performance for the program, other than this proposal, will be delivered to NASA and made publicly available via the team's website, which is a sub-page under the existing Troop 17 website: http://www.troop17bsa.org.

New this year will be an active and engaging social media presence, with emphasis on Facebook and Instagram. The team's Public Relations subteam already is busy establishing our new social media presence, and getting groundwork laid for these new sites. The team is excited to make major efforts to improve our online presence and to make it active, updated, and engaging.

1.3 Team Structure and Members

SLT17 currently consists of 14 team members, one adult advisor, and a Tripoli Level 3 mentor. There was a focused recruiting effort over the summer of 2018, including multiple presentations to the Troop about SLI, along with informational meetings and Q&A sessions with prospective members. There are also two new Scouts in the troop who are likely to join SLT17 in the next week, so our membership may increase to 16. With the greater emphasis on subteams and work specialization, and the greater level of delegation and autonomy this year, having four more team members than last year is a benefit.

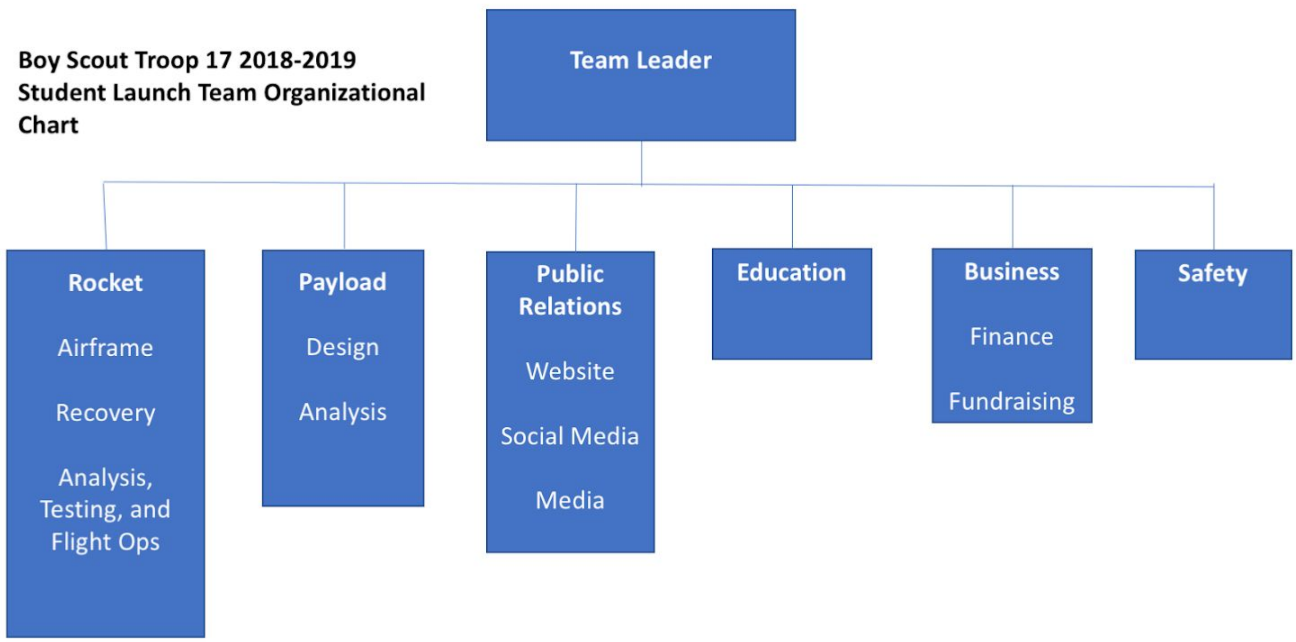
SLT17 is organized into six functional sub-teams: Rocket, Payload, Public Relations, Business, Education, and Safety. There were three main lessons learned from last year related to subteams on team structure, leadership, and day-to-day operations. First is that there needs to be more focus on subteams during day-to-day operations, document and report preparation, and regular team meetings. This year, the regular weekly team meetings will be subteam meetings instead of all-team meetings. Second is that due to our young team age (still mostly middle school) that we need a dedicated adult advisor separate from the team advisor and Tripoli mentor assigned to each subteam. Third is to divide the subteams into "full time" and "part time" categories and have individual SLT17 members play a role on two subteams, one from each category. The reason is that some of the subteams have ongoing full-time duties, such as the Rocket, Public Relations, and Payload. Last year, members of these subteams tended to stay more engaged and more satisfied with their SLI experience. But members of other subteams such as Business or Creative (the previous name of Public Relations) were part time, and the members of these teams were less engaged, had a harder time in the program, and were less satisfied with SLI.   We feel these changes will help improve the SLI experience for our participants. We have made Public Relations a full-time subteam, due to our much greater emphasis this year on social media and other public relations outlets.

Also new this year is that each subteam has an elected youth leader and also has a designated adult advisor with experience in that area. Last year, the lack of subteam leaders and adult advisors meant that the subteams did not have clear leadership or subteam-level mentorship, which reduced the effectiveness and increased the workload on the all-team leadership to the point that it created difficulties. By delegating many of the leadership tasks and the step-by-step work planning into the subteams, the subteams are more independent and effective, and can work autonomously and be less dependent and less held up waiting for instructions from senior leadership.

In order to maintain independence and full authority of Safety within SLT17, Safety is a separate functional team reporting directly to the Team Leader. Safety is discussed in more detail later, but we feel that structuring SLT17 so that Safety is an independent function stresses the importance of safety, while giving the Safety Officer the necessary independence and authority to truly create a culture of safety. We are very proud that we experienced no safety issues during our 2017-2018 SLI season, and it is critically important to us to repeat that result this year.

The following table and organization chart provide details on team members, their roles, and team structure. Note that for clarify, only the primary subteam assignment is listed for each team member.

Name	Role	Team
Hunter	Team Leader	
Mac	Safety Officer	
Beau	Subteam Leader	Rocket
Paul		Rocket
Kartik	Subteam Leader	Payload
Caleb		Payload
Josh	Subteam Leader	Public Relations
Bryce		Public Relations
Victor		Public Relations
Connor		Public Relations
Keaton		Public Relations
Shrey	Subteam Leader	Education
Jacob		Education
Shay	Subteam Leader	Business



1.4 Tripoli and NAR Assistance

Tripoli Central Virginia #25 has graciously offered its assistance to SLT17. This Tripoli prefecture is located very close to us, and is providing assistance including an expert mentor, design and documentation review, and what is probably the best high-power launch site in Virginia which is located near Culpeper, VA and typically has an FAA waiver of 15,000 feet AGL. Tripoli #25 is experienced working with SLI teams. Troop 17's TARC team has conducted launches with Tripoli #25 for 11 years. The prefecture also sponsors the "Battle of the Rockets" which is a well-established high school and college-level rocketry challenge that is similar in some ways to SLI.

We also will be working with the Northern Virginia Association of Rocketry (NOVAAR), NAR Section 205. NOVAAR is the sponsoring NAR section for the TARC finals, and they offer a wealth of mentoring as well as a backup launch site near Warrenton, VA with a 5,000 foot AGL FAA waiver (suitable for the subscale flight, if our primary site is unavailable).

Lastly, the Valley Aerospace Team (VAST) operates our second backup launch site near Monterey, VA, which typically has a 10,000 foot AGL FAA waiver.

2 Safety

2.1 Introduction

Priority one for SLT17 is safety. Priorities 2 and 3 are also safety. Safety is not a separate function, or something to be added after the fact.

SLT17 is firmly committed to the fact that safety is the foundation of everything we do, and safety is THE primary mission goal that's even more important than the science or flight objectives. Without safety, there can be no science, so safety is the cornerstone of the team.

As previously discussed, we have structured the team to highlight this founding principle.

We are very proud to have completed the 2017-2018 SLI program with zero safety incidents, and 100% successful and safe flights, including the high-power demonstration of our 2017-2018 full scale rocket at the TARC Finals in May 2018. But we are not complacent, and it is extremely important for us to repeat this spotless safety record in the 2018-2019 season.

2.2 Compliance with Boy Scout Safety Regulations

Since we are a part of a Boy Scouts of America unit, SLT17 is committed to fully complying with all safety regulations and guidelines as set forth by the Boy Scouts of America National Council. These BSA regulations include the following:

- Youth Protection (http://www.scouting.org/Training/YouthProtection.aspx)
- Cyber Protection (http://www.scouting.org/cyberchip.aspx)
- Youth use of power tools (http://www.scouting.org/filestore/healthsafety/pdf/680-028.pdf). This regulation states that youth under the age 14 cannot use power tools at all. Youth between 14 and 18 can only use small handheld sanders, drills, electric screwdrivers, and similar handheld tools. Only adults 18 and older can use power saws.
- Transportation (http://www.scouting.org/scoutsource/HealthandSafety/GSS/gss11.aspx)
- Use of chemicals (http://www.scouting.org/scoutsource/HealthandSafety/GSS/gss06.aspx)
- Adult leader training requirements applicable to SLT17's activities

We feel that the BSA safety guidelines are an advantage to SLT17, as they address many underlying issues of personal safety, online safety, and youth protection in a clear and coherent fashion. This contributes to our culture of safety.

The team's designated Safety Officer will oversee that all rules and regulations are followed at all times by all members of the team. The Safety Officer will brief all team members on the procedures outlined in the Safety Plan. Also, the NAR/TRA mentor and Safety Officer shall oversee launch operations and motor handling. The NAR/TRA mentor will be the official owner of the rocket for insurance purposes, and they will be the purchaser and user of rocket motors and black powder ejection charges for compliance with relevant laws and regulations.

Safety briefings conducted by the Safety Officer will utilize Safety Data Sheets and will come before every activity that requires tools and/or hazardous materials, as well as before all launches. Team members that are late will have to be briefed before they are allowed to begin work on the project. On launch days Flight, Post-Flight checklist and Safety Data Sheets will be handed out and reviewed to ensure the safety of the team members as well the general public. All team members will follow instructions given by NAR/TRA mentor, team leader and/or safety officer. All launches will be conducted in full compliance with all NAR and TRA Safety Code requirements.

The main facility that the team will utilize when fabricating the rocket is space at ADI Engineering building in Charlottesville Virginia. All members of the team must follow the BSA Guidelines that state youth under the age of 14 cannot any use power tools. Further, only adults 18 or older can use power saws. We will purchase pre-cut rocket components such as airframe tubes and fins to avoid the need to use saws. Only Scouts 14 and older will be allowed to use permitted small power tools such as drills and power screwdrivers.

2.3 Safety Briefings

The Safety Officer will be responsible for briefing the team of any possible risks that could occur throughout designing/build process, as well as before each launch. During the briefing, the Safety Officer will inform the team of all necessary procedures to avoid risks or hazards. The Safety Officer will regularly brief team members about these risks in order to create a safe environment. The Safety Officer will also be responsible for informing the team of any laws and regulations that may apply set by the NAR/TRA, including NFPA 1122 (code for Model rocketry) and NFPA 1127 (code for high power rocketry).

2.4 NAR/TRA Mentor

Ben Russell has again agreed to mentor our team and accompany our team to all launches and Launch Week in Huntsville in April 2019. He is a certified Level 3 with the TRA and NAR. His duties will include the purchase, storage, transportation and installation of rocket motors and black powder for ejection charges. Mr. Russell is already actively engaged, and has helped the team tremendously last year and again with this year's proposal stage.

Mr. Russell will be advising the team during design and construction, and during the handling of hazardous or restricted materials. He will also brief the team on launch safety and protocol prior to launch.

2.5 Procedures for Team Mentor to Perform

The team mentor shall maintain the proper certification required for the motor impulse used in the launch vehicle. The mentor shall have completed at least two flights in the proper flight class prior to PDR. The TRA certified mentor will purchase, store, and transport rocket motors, black powder, and electric matches. The mentor will be the owner of record for the rocket for TRA/NAR insurance purposes. The Safety Officer and mentor will work together to choose a location where the motor will not be damaged and is at least 25 feet away from any heat sources or flammable liquids. The motor shall be transported separately from the rest of the rocket. During transportation the motor will be protected to prevent any damage.

2.6 Procedures for TRA/NAR Personnel to Perform

The Safety Officer will work in conjunction with TRA/NAR personnel and the mentor to ensure that the team complies with the TRA/NAR High Power Safety Codes. The Safety Officer, mentor, and TRA/NAR personnel shall ensure that before launch all conditions are met for a safe launch. The Range Safety Officer (RSO) shall arm the launch system, and will ensure all members and spectators are not within 100 feet of the rocket. The RSO shall countdown from five before launch; if the vehicle does not launch, the RSO shall disarm the system and wait 60 seconds before investigating. TRA/NAR personnel along with the safety officer shall ensure no one attempts to catch the rocket on return or remove it from a dangerous location such as a power line.

2.7 Handling of Hazardous Materials

Some of the materials to be used will require extreme caution and care. Team members will be reminded of the safety rules based on which portion of the project they are working on by Safety Data Sheets.

The materials include but are not limited to fiberglass, black powder, epoxies and other adhesives, powdered aerogel, and rocket motors. The Safety Officer will be tasked with designing protocols for handling, storing, and disposing of these materials. The Safety Officer will be engaged before the purchase of any materials, to make certain that the existing Safety Plan is adequate to address any new safety issues, to proactively identify and acquire any Personal Protective Equipment (PPE) needed, and to collect and maintain all MSDS's and other safety information.

Also, the Safety Officer will be responsible for briefing all team members on protocols and regulations for the use of all materials. As fiberglass will be a primary hazard all team members that are working with this airframe material will be required to properly use PPE such as safety goggles and dust masks at all time when sanding, cutting, and painting to prevent dust from get into their eyes or lungs. Since we are using Aerogel in a power form as part of the payload, team members will be required to wear the proper PPE. Also, the proper clothing will be worn, including long sleeve shirt, jeans and gloves, to prevent injury to the legs or arms from sharp objects.

The Safety Officer shall brief team members on any other hazards associated with materials used in the rocket or the science payload. The Team will follow all of the BSA regulations as well those stated in the "Policy on the Storage, Handling, and Use of Chemical Fuels and Equipment."

2.8 Compliance with the Law

A mandatory team briefing will be done by the Safety Officer along with NAR/TRA mentor reviewing all guidelines and regulations upon proposal acceptance by NASA. BSA regulations will be followed at all times. Other relevant laws and regulations that the Safety Officer will educate all team members on that the team will be required to follows at all times are Federal Aviation Regulations 14 CFR, Subchapter F, Part 101, Subpart C; Amateur Rockets, Code of Federal Regulation 27 Part 55: Commerce in Explosives; and fire prevention, NFPA 1127 "Code for High Power Rocket Motors."

2.9 Safety Regulations Links:

- BSA Safety Guide: http://www.scouting.org/filestore/pdf/34416.pdf

- BSA Age Guidelines For Tools : http://www.scouting.org/filestore/healthsafety/pdf/680-028.pdf
- BSA Policy on the Storage, Handling, and Use of Chemical Fuels and Equipment":
- http://www.scouting.org/filestore/pdf/680-013WB.pdf
- Federal Aviation Regulations 14 CFR, Subchapter F, Part 101, Subpart C:
- https://www.law.cornell.edu/cfr/text/14/part-101
- Amateur Rockets, Code of Federal Regulation 27 Part 55 Commerce in Explosives:
- https://www.law.cornell.edu/cfr/text/27/555.141
- NFPA 1127 Code for High Power Rocket Motors:
- http://www.nar.org/safety-information/high-power-rocket-safety-code/
- MSDS for Rocketpoxy: https://www.apogeerockets.com/downloads/MSDS/ROCKETPOXY_MSDS.pdf
- MSDS for Acetone: http://www.sciencelab.com/msds.php?msdsId=9927062

2.10 Team Member Agreement to Comply with Safety Rules

After a mandatory safety briefing, all team members will sign a Safety Agreement to abide by the regulations discussed as well as the following safety regulations:

- Range safety inspections of each rocket before it is flown. Each team shall comply with the determination of the safety inspection or may be removed from the program.
- 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 rocket for safety reasons.
- Any team that does not comply with the safety requirements will not be allowed to launch their rocket. The Safety Agreement will also state that any violation of safety protocols can result with dismissal from the Team with no warnings.

Project Risks

Risk	Probability	Effect	Prevention
Team members dropping out	Moderate	Team will have to work hard and pull double rolls	Ensuring all members are able to commit time to the team. Making sure all roles can be filled by someone else if needed by cross training. Make sure prospective team members are aware of the time commitment and expectations up front so they do not drop out due to time conflicts.
Funding shortages	Moderate	Inability to purchase the necessary items to complete the project	We are soliciting funding pledges mainly from corporate donors, and we will also get some funds from the Troop. Should funding be inadequate, we may have to cut back on the amount of people who can go to Huntsville. Camping in Huntsville is always an option because we are Boy Scouts.
Falling behind schedule	Moderate	Inability to complete required tasks, causing time constraints and leading to suboptimal work or missed deadlines	Having enough team members to make sure work gets done, even if some members are short on time due to other commitments. Make sure that all team members have clear instructions and understand assignments and expectations. Start on tasks early, do not wait until the last minute to do design, simulation, flight testing, safety analysis, document writing and other tasks.
Launches cancelled	Moderate	Missing a full or sub-scale test launch	Launches will be at Battle Park in Culpeper VA but if a launch is cancelled we will go to VAST in Monterey VA or Great Meadow in The Plains VA. If necessary, the team will go to other high-power launches throughout NC, MD, DE, or VA.
Meeting and fabrication space at the ADI Offices become unavailable	Moderate	Inability to hold meetings or build rocket	It is possible that the unleased top floor of the ADI building will be leased during the SLI season. Should this happen, we have already arranged contingency plans to use Troop 17's regular meeting space at Church of the Incarnation for subteam and all team meetings, and we have obtained permission from the PSLT team to use their workshop at Oakhaven Farm to build our Subscale and Full scale rockets.

Motors in limited supply due to demand or production problem	Moderate	Inability to acquire needed motors for qualification or competition flights	Have backup motors from multiple manufacturers identified so that we are not dependent on a sole source motor manufacturer. Purchase enough motors to assure adequate stock even if the motors become unavailable on the open market.

Safety Risks

Risk	**Probability**	**Effect**	**Prevention**
Injury during fabrication	Low	Minor to serious injuries including cuts and burns	Receiving training in the safe use of all equipment, require PPE to be used at all times, follow BSA safety requirements, and make sure a first aid kit is always present during all team functions.
Injury during rocket launch	Low	Minor to serious injury	Following all launch safety procedures, such as staying the proper distance away and inspecting launch guide, motor casing, and other parts beforehand, and following all NAR/TRA safety code requirements. Also follow all BSA safety requirements, and make sure a first aid kit is always present during all team functions. Follow launch checklist to assure that the rocket is prepared for flight correctly and all safety critical items are addressed.
Accidental ignition or detonation of material	Low	Possible burns	Following safety procedures for the handling of flammable or explosive material; ensuring everyone is in a safe location in case of detonation on launch pad.
Injury during rocket recovery	Low	Minor burns	Follow all recovery safety procedures.
Motor mount failure	Low	Damage to rocket and potentially observers	Testing the motor mount in simulations, static fire tests, and experimental flights. Inspecting as specified by pre-launch checklist.

3 Facilities and Equipment

SLT17 will have access to necessary workspace and tools required to successfully and safety complete all aspects of the SLI program, from launch vehicle design, payload design, rocket and payload fabrication, ground and flight testing, team meetings, videoconferences with NASA SLI personnel, and post-flight data analysis.

3.1 ADI Engineering Office and Production Space

SLT17's main facility is the Troop's long-established TARC meeting and production space in the top floor of the ADI Engineering facilities in Charlottesville, VA. The top floor (approximately 2000 square feet) of the ADI facility is a currently unoccupied, unfinished space that is being used for Troop STEM activities, including SLI. In addition, the ADI facility has four conference rooms that are used for all-team and individual functional sub-team meetings, and which can readily be used for videoconferences.

The top floor is available without any time restrictions, 7 days a week, 24 hours a day. It is a separate locked and access controlled space. One of the conference rooms is in this top floor, so we also have meeting and videoconference access 24/7.

The ADI facility also has the equipment to manufacture and assemble the structural and electrical components of the rocket. The facility offers a full complement of work benches, small hand and power tools, and support equipment for fabricating in wood, metal, or fiberglass. It also has a fully equipped electronics lab that can be used to fabricate, integrate, test and if necessary debug the Arduino-based hardware and software.

Available equipment includes the following:

- Basic hand tools (e.g., saws, screwdrivers, hammers, etc.)
- Basic power tools (e.g., drills, Dremel, sanders, router, etc.)
- Small power saws (can be used only by adults per BSA regulations)
- Electronics assembly equipment (soldering irons, heat guns, microscopes)
- Electronics test equipment (digital multi-meters, oscilloscopes, benchtop power supplies)

As backup sites, SLT17 subteam and all team meetings will be held at Troop 17's sponsor's facility - The Church of the Incarnation in Charlottesville, VA. Also Piedmont Student Launch Team has graciously offered to allow us to use their workshop at Oakhaven Farm for the subscale and full scale rocket construction should we need it. There is a chance that the unleased ADI floor used by SLT17 will be leased this year, and we will use these backup facilities should that happen to prevent disruption of team activities.

With our strategy of modifying a commercial off the shelf (COTS) high power rocket kit, we do not anticipate the need for use of power saws (table saws, band saws). Avoidance of need for power tools that youth are prohibited from using under BSA regulations is a major reason we have adopted a strategy of basing the rocket on a COTS kit. Should cutting airframe tubes or other operations requiring the use of prohibited tool become required, SLT17 will attempt to outsource this to the commercial vendor supplying the parts. As a last result, it is possible an adult affiliated with the team will have to perform those operations, but we will keep it to a minimum and notify NASA if it becomes necessary (because the goal is for the youth team members to do everything).

3.2 Required Supplies

To complete the various elements of the project, the following supplies will be required. All of these supplies are commercially and readily available. Some will be donated directly by sponsors, and the rest will be purchased through the team budget.

- Fiberglass body tubes, sheets, and nose cone for the primary rocket and subscale, available as a kit to allow off-the-shelf purchasing.
- Recovery harnesses and equipment, including main and drogue parachutes.
- Electronic components including altimeters, flight computers, sensors, and microcontrollers such as Arduino.
- Tracking devices
- Mid and high-power rocket motors.
- Assorted hardware, wiring, adhesives (including JB Quik epoxy, Rocketpoxy, Loctite thread locker, and cyanoacrylate / super glue), and finishing materials such as primer, paint, topcoat, and sanding supplies.

3.3 Technical Tools

The following software and technical tools will be used by the team to facilitate collaboration, technical design/development, communication, and project management.

3.3.1 Google Drive

Google Drive is an online document sharing system that allows easy access to the files needed by the team. The team uses it to organize and compile documents in a central location as well as share important links and information such as meeting notes and agendas.

3.3.2 Arduino IDE

The Arduino IDE is a free software program that is used to program the Arduino microcontroller. An Arduino will be used as our temperature logger, so software must be developed and tested to perform the functions of reading temperatures from all sensors and storing this data on the SD card.

3.3.3 OpenRocket

OpenRocket is a free, open source rocket design and simulation program that is being used by the team to help design the rocket, analyze static stability margin, and predict rocket flight performance: apogee, velocity upon rail exit, max velocity, speed and therefore kinetic energy during descent, motor selection, ballast sizing, etc. OpenRocket was selected as our main rocket design and simulation software because it is freely available, and all team members who are interested can download and use it without paying any fees.

3.3.4 RockSim

RockSim is a commercial rocket design and simulation program that SLT17 already owns through our participation in TARC. However, we only have one license, and to prevent the expense of purchasing additional licenses, we are not using RockSim as our primary rocket software. Our plan is to use RockSim to validate the simulation results produced by OpenRocket before we fabricate or order rocket kits, parts, or motors.

3.3.5 Slack

SLT17 is using Slack as our primary team collaboration and communications platform through which members can send messages, post files, and pose questions, and brainstorm ideas. Especially in the case of SLT17, our team is spread across multiple different schools, so an efficient and accessible online team collaboration tool is critical to discuss issues and brainstorm and then analyze and implement solutions. Slack has already proved to be invaluable in the proposal phase.

Our Slack account is organized by functional teams, and there is a Slack channel for every team: Safety, Rocket, Payload, Business, Education, and Public Relations.

3.3.6 Teleconference Facilities

The ADI Engineering facilities have video conference equipment available for team use. The facility has a guest Wi-Fi network throughout and 250Mbps broadband service. These facilities will be available to the team for the required reviews with NASA.

4 Preliminary Launch Vehicle Design

Recognizing that SLT17 is composed mainly of middle school students, our approach is to de-risk the rocket design and construction to the greatest extent possible. This allows us to maximize safety and our chances of success. Our approach to doing this is to base our launch vehicle on a commercially-available high-power rocket kit and modify it to carry the science payload and to meet other SLI requirements (like 2.0 calibers of static margin). Basing the launch vehicle on a kit provides an example of a successful dual deployment high power rocket, and it also helps avoid possible issues with parts availability since the parts all come together.

We feel our approach even follows NASA's example of re-using existing technology for new missions, where possible. This approach is followed extensively in SLS, with the re-use of many designs and technologies developed for the Space Shuttle, adapting them as necessary.

We recognize that basing our design on a modified commercial off-the-shelf (modified COTS) kit does not reduce the need for design simulation, analysis, testing, or safety actives. We will undertake all these activities just like we had a scratch-designed rocket.

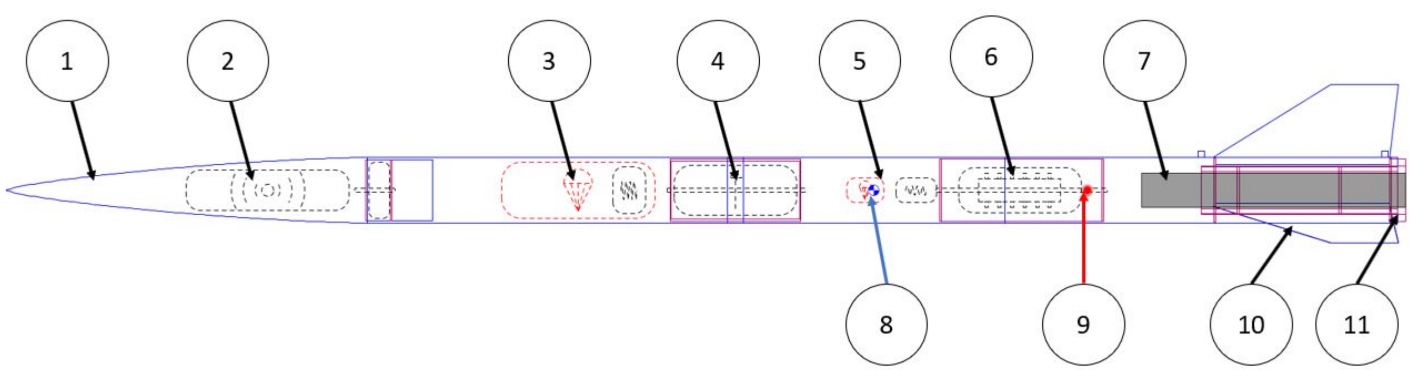
The projected launch vehicle is based on a modified Mad Cow Formula 98 with dual deployment. One advantage of this kit is that Mad Cow sells a subscale version that we can use as our sub-scale rocket: the fiberglass Mad Cow Formula 75. These kits were selected because they meet all of our mission requirements as shown in preliminary OpenRocket simulations and because they can be modified to carry our payload. Specific factors include: they are easy to build, they are strong, and they have been already been flight tested (though we are not reducing our testing or analysis).

These rockets will be built using the RocketPoxy structural epoxy. All appropriate PPE will be used during the construction of the rockets. These include but not limited to: protective eyewear, protective outer clothing, vented space, and the use of nitrile gloves. Additionally, dust masks will be used during any sanding. Good ventilation will be used when using solvents (acetone), epoxies, and paints.

The kits used as the basis of our rockets are the same types as last year, however we are building entirely new rockets and there are several changes to the designs being made based on this year's new payload and lessons learned from last year:

- The main parachute bay is being lengthened by 6" because we had trouble fitting our main into the original sized bay.
- The payload avionics bay is being lengthened by 2" to make more room for wiring and to make it easier to prepare the rocket for flight
- We are adding an externally-accessible power switch for the experiment so that it can be turned on and off when the rocket is assembled
- We are planning to make our TEG and temperature sensors removable once the rocket is fully built. Last year's payload also involved instrumenting the 54mm motor mount, and we had issues with not being able to access the sensors and cables inside the fully assembled rocket. Also, we had issues using smaller diameter motors with adapters for test or demo flights where the adapter did not make good thermal contact with the sensors and the data produced by the experiment was not valid. To address these issues, we are planning on building the full scale rocket with a 75mm motor mount that is fixed in place even though the rocket will not be flown with 75mm motors. Then we will build instrumented 54mm (full scale flight) and possibly 38mm (test or demo flight) adapters with the TEG and temperature sensors that can be removed, modified, repaired, or even replaced if necessary. In a similar way, we will build our subscale with a 54mm motor mount to be used with 38mm or even 29mm instrumented adapters to test out the concept and make totally sure it is satisfactory prior to CDR.

The Formula 98 is 4 inches in diameter, 85.6 inches in length with 3.25 calibers of stability as shown below:



Component Number	Description
1	5:1 Von Karman filament wound nosecone
2	Missile Works RTx Navigator for GPS tracking
3	Main Recovery - SkyAngle Classic II main chute with 25' kevlar recovery harness
4	Electronic bay - Marsa Systems MARSA33LDH and Missile Works RRC3 flight computers with separate LiPO batteries and black powder charges for redundancy
5	Apogee Recovery - SkyAngle 12" drouge and 25' of kevlar recovery harness
6	Arduino Uno science experiment data logger. Sensors and Thermal Electric Generator are mounted on the 54mm motor tube
7	Aerotech K805 motor
8	Center of Gravity (CG) - 53" from tip of nose cone
9	Center of Pressure (CP) - 66" from tip of nose cone
10	Fins - 3 G10 fiberglass ⅛" thick
12	Aeropak 75mm and 54mm motor retrainers

The projected motor is an Aerotech 54mm K805. OpenRocket was used to compare multiple motors and from that analysis, we have preliminarily selected the K805. This motor achieves the projected flight performance as detailed in the table below. Our preliminary altitude target would be 4890' AGL based on this result.

Motor	Velocity off Rail	Apogee	Max. Velocity	Max. Acceleration	Time to Apogee	Flight time	Landing velocity
Aerotech K805	83.6 ft/sec	4889 ft	640 ft/sec	359 ft/sec	17.2 sec	84.8 sec	18.8 ft/sec

The preliminary and backup deployment and altitude recording flight computers are:

- Marsa Systems MARSA33LHD as the primary
- Missile Works RRC3 as the back up

We propose to use two different models and manufacturers of altimeters to control the two fully redundant recovery deployment systems. The advantage of this is that a common issue in the rocket or altimeter design, construction, altimeter software bug, or altimeter configuration or usage problem will be also avoided. Redundant deployment systems built with two instances of the same altimeters meet NASA requirements, but we feel that it is better to have different altimeters to avoid common issues that may impact both.

Each of the flight computers will have their own power source and black powder charges. For apogee deployment, our preliminary plan is for the MARSA33LHD flight computer to be set to deploy the drogue at apogee and the RRC3 flight computer will be set to deploy the drogue 1 second after apogee. For main deployment, the MARSA33LHD will be set to deploy the main at 700’ and the RRC3 will be set to deploy the main at 500’. The exact altitudes and times are subject to change, but offsetting the firing of charges also eliminates the possibility of structural failure (and possible separate and uncontrolled recovery) of the rocket due to overpressure caused by simultaneous firing of both charges. If the first charge successfully deploys the chute, then the second charge will harmlessly fire out of the already open airframe tube. But if the primary charge fails for any reason, the backup provides critical safety redundancy, to greatly reduce the chances of an unsafe ballistic recovery.

Note that redundancy is neither required nor provided for the science payload. Since failure of the payload cannot result in any safety issues, it is not deemed necessary to make the payload redundant.

The Missile Works RTx Navigator will be used for tracking. Since all parts of our rocket remain tethered during recovery, only one tracking device is required per the NASA SLI requirements. The RTx provides GPS tracking over the 900 MHz unlicensed radio frequency band, with more than sufficient range in comparison with the SLI flight objectives. It will be placed in the nose cone. Missile Works also assures that the RTx will not interfere with recovery avionics and that shielding of the recovery avionics is not required.

For recovery of the vehicle, the SkyAngle Classic II has been preliminarily selected as our main parachute and the SkyAngle 12” for the drogue. The drogue will be deployed at apogee to control the descent of the rocket in a orderly and safe manner while keeping wind drift within the maximum specified by NASA. The main and drogue deployment charges will be ground tested to determine the charge sizes for deployment and to verify successful deployment prior to any flights. We will also analyze the descent and landing kinetic energies to assure they comply with the limits set by NASA.

The major technical challenges and the primary mitigation strategy for each includes the following:

- Motor not available – Obtain sufficient stock early on, select another motor if necessary
- Primary launch site availability – use one of two back ups
- Not enough space in the booster section for the payload – extend the booster section with an avionics bay to hold the Arduino.
- The size of the main chute doesn’t meet the required landing forces – select a larger chute which will pack in the same space.

5 Preliminary Science Payload Design

5.1 Overview

Our goal for the science payload is to attempt harvest the heat generated by the rocket motor during launch and transform it into electrical energy. To transform the heat to electricity, we will use a thermoelectric generator connected to a load resistor. When a temperature difference is created across the thermoelectric generator, it produces a current that will be sent through the load resistor.

To measure the electric power generated, we will measure the voltage across the load resistor and use the following formula to calculate the associated electric power:

$$P = \frac{V^2}{R} ,$$

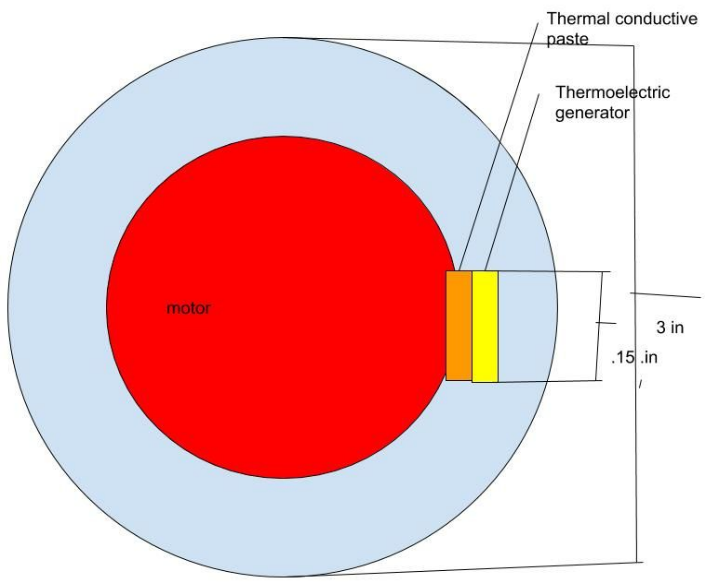
where V is the voltage across the resistor, R is the value of resistance in Ohms, and P is the power in Watts.

This technology can be used to potentially increase efficiency on launch vehicles by generating electricity from the excess heat created during launch and using that electricity to power onboard electronics. But the biggest use case we see is utilizing temperature differences throughout the launch vehicle to harvest small amounts of energy right where it is needed, without running wires all over the vehicle form a central power source. Freedom from power wiring means that truly wireless sensors can be used and put throughout the launch vehicle to monitor many more parameters than would be otherwise possible. For example, using the temperature delta between cryogenic fuels and the outside, point-of-use power could be harvested to outfit a cryogenic tank with many more sensors at multiple points to monitor temperature, pressure, ice buildup, fuel sloshing, and so on. There are many heat-producing systems in a vehicle that of course include fuel combustion, but also things like the heat produced by electronics, temperature deltas from cryogenics, and even solar heating. And energy can also be harvested from non-thermal sources including vibration, acceleration, and airflow (during atmospheric flight) to power small wireless devices. Our experiment only examines thermal harvesting, but these other sources are also possible candidates.

This experiment also builds on our successful 2017-2018 SLI payload, where we examined the thermal insulation performance of varying Aerogel thin films. In last year's experiment, we measured temperatures around the motor tube and logged the data to an Arduino. This year's experiment will build on the knowledge we gained of how large the temperature deltas produced by the motor are and how to instrument the motor mount, measure temperatures, and log the data.

Through our new experiment, we will attempt to determine the feasibility of the concept of thermal energy harvesting in a launch vehicle.

A diagram showing the placement of the TEG outside the motor adapter is shown below.



5.2 Thermal Electric Generator Overview

A thermoelectric generator (TEG), also called a Seebeck generator, is a solid state device that converts heat flux (temperature differences) directly into electrical energy through a phenomenon called the Seebeck effect (a form of thermoelectric effect). Thermoelectric generators function like heat engines, but are less bulky and have no moving parts. TEGs are typically more expensive and less efficient, however, our main use case only requires small amounts of power, so we are not concerned about the low efficiency of TEGs.

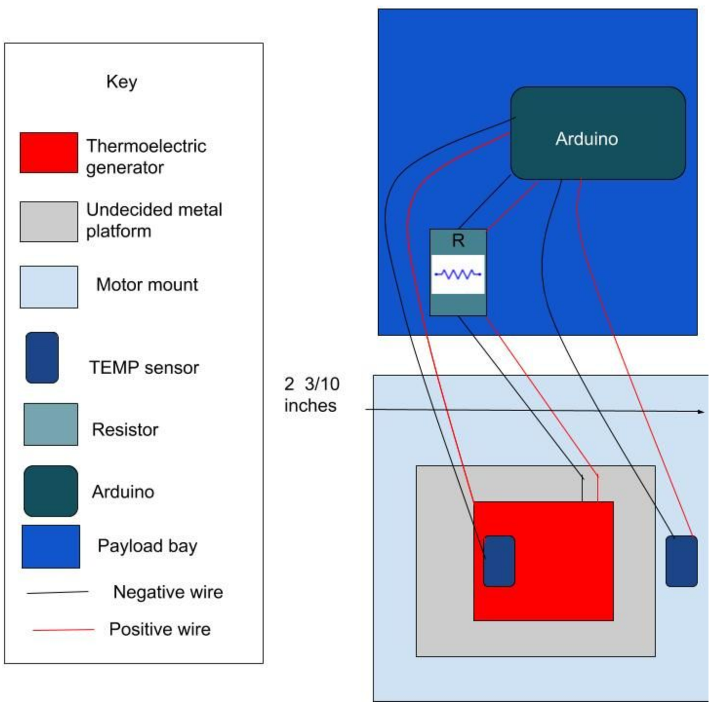
5.3 Measurement System

In order to determine the feasibility of using a thermoelectric generator, our system will take three different measurements during flight. We will use an Arduino Uno to measure the in-flight voltage across the load resistor, the temperature on the motor adapter (connected to the TEG hot side), and the temperature on the fixed motor mount (connected to the TEG cool side). As mentioned above, the electric power delivered to the load resistor will be calculated from the measured voltage and resistance. Since the load resistor will be 1 Ohm, the power will simply be the square of the TEG voltage. The temperatures will be measured using two TMP35 temperature sensors (we used these in last year's payload experiment). These temperature sensors generate an output voltage that directly proportional to the temperature. So the data logging system will consist of an Arduino Uno with three analog voltage inputs monitoring the TEG hot and cold side temperatures and the TEG output power. These voltages will be converted to a 12-bit digital number by the Arduino's on-board analog-to-digital converter. The digital values will be logged to an SD card for retrieval and post-flight data analysis.

We will compare the power delivered to the load resistor to the power the expected power from the TEG based on the measured temperature difference.

Parts Needed:

- Center Hole Thermoelectric Modules - SH Series SH14-15-06 MM Thermoelectric Generator
- Through hole resistor, 1 Ohm, 1/2 Watt
- Arduino Uno
- SD Shield for Arduino Uno
- SD Card
- Cables to connect TMP35's and TEG to Arduino
- LiPO battery for Arduino
- External switch to power on/off experiment when rocket is assembled
- Sled to hold Arduino and battery
- 2x TMP35 - temperature sensors
    - To measure TEG hot and cold plate temperatures



The Arduino will need a battery that can power it for at least an hour. Based on the power consumption of the Arduino Uno, the minimum battery size is 50 mAhr. A 650 mAhr LiPo battery weighing 59 g will power the measurement system for approximately 13 hrs.

The Arduino Uno with SD card shield and LiPo battery will need to be housed in a small bay located in the bottom part (booster) of the rocket. The Arduino cannot reside in the recovery avionics bay with the flight computers, because the temperature sensors and TEG must be wired to the Arduino and we need to isolate the recovery electronics due to safety concerns Therefore, an experiment avionics bay just forward of the motor mount will house the experiment and protect it from ejection gasses while providing each access to the TEG and sensors.

6 Educational Engagement

Educational Engagement is very important to SLT17, and we take pride in winning first place last year in this category. STEM education is something we are very passionate about, and we are actively working on improving our educational program to reach even more youth and have an even bigger impact than last year. Not only does STEM education fulfill our deliverables for SLI, but we view it as a major community service activity in line with the service mission of Boy Scouting and the culture within Troop 17.

Our STEM education focus is on (1) elementary age students (K-5), (2) economically disadvantaged youth, and (3) other Scouting units.

We are already fully underway with this year's education activities.

6.1 DoD STEM Day

SLT17 is excited to add this major new STEM education event to our program this year. The DoD STEM Day is described as the "world's biggest school field trip." It is held outdoors on the flight line at Oceana Naval Air Station in Virginia Beach, VA the day before the annual Oceana Airshow. This year's date is Friday September 21, 2018.

It is a major honor for SLT17 to be invited to have a booth at this event. It is extremely high visibility, and we believe we may be the only youth-led education booth allows to participate.

It is projected that 5,500 fifth graders from public and private schools all around the Virginia Beach and Norfolk area will attend. This year, the event is actually trying to set an official world record for the largest school field trip, and representatives from the Guinness Book of World Records are supposed to be on hand to confirm the record. The Navy's Blue Angels flight team will also perform.

SLT17 is very fortunate to have been given a STEM education booth at this event. We are focused on high-quality 1:1 interactions with visiting students, teaching Newton's Third Law of Motion and letting the students experimentally verify it using rocket balloons. We expect at least 1,000 high-quality youth interactions at this one event. And we have put in a request to actually fly our 2018-2019 SLI rocket as a live flight demo during next year's airshow program. We know that it is unlikely we will be eligible for SLI next year (we would like to participate in the future, as SLI has been tremendous for us, but it would require we place in the top 25 in TARC this year out of >800 teams, which may be difficult), but STEM education is something we are passionate about, and we are committing to continue with this mission regardless if we are eligible for SLI next year or not.

*6.2 Virginia Discovery Museum Kid*Vention*

Kid*Vention is an annual STEM fair held in Charlottesville for young elementary children in K-4 and their families. The focus is on quality, not just sheer quantity, and last year this event was a highlight for us. We are repeating again this year.

6.3 Scouting Units

Our main strategy for educational engagement is to use resources and contacts within the Boy Scouting organization to reach younger elementary and middle school youth. This is also aligned well with our other BSA STEM/Nova program goals, which include STEM education for younger Scouts in other units locally.

We will conduct STEM educational engagement with other Scouting units in several ways:

- At regional camporee weekends, we will have STEM Education tables that engage many Scouts. For example, at our District's Apple Harvest Camporee we have an activity that uses slingshots to explain and engage Scouts with a hands-on experiment in projectile motion. We also are discussing a similar STEM event at Winter Camp. We expect several hundred contacts at each Camporee.
- We will also contact local Cub Scout Packs and schedule a STEM program that we conduct at a Pack or Den meeting. To generate maximum attendance, we would lead the Cub Scouts in their Adventure in Science elective. This would likely be a hands-on activity involving model rocketry, such as a rocket build/fly session.
- Setup a display and hands-on activity at the Council Cub Scout day at the upcoming Apple Harvest camporee, which attracts many hundreds of Scouts from all across Central Virginia. Teach the basic principles of rocketry and allow Scouts to launch model or water rockets.

6.4 Boy's Life Magazine

Troop 17 already has the commitment from Boy's Life magazine to publish an educational article on how to build and fly a model rocket. We obtained this commitment from Boy's Life over the late Spring of 2017 but we and they decided to defer the article until the SLI program was underway, to preserve the opportunity to make this part of our educational engagement program, and to help publicize SLI to the Boy Scouting community.

We are not sure if this article could count toward an educational activity for NASA SLI. Our goal would be to teach something about rocketry in the article, so that it was educational in nature. Even if the article does not count toward our educational outreach requirements, it is still something we are going to do, because it helps promote some of the activities Troop 17 is undertaking and it helps to reinforce even more the STEM initiatives within Boy Scouting.

6.5 Boys and Girls Clubs

The Boys and Girls Clubs are an excellent way to reach economically disadvantaged youth. We held a very successful event last year, and plan on doing it again this year.

6.6 Collaborative Educational Events with Other Nearby SLI Teams

We collaborated with the Piedmont Student Launch Team last year and we would look for opportunities to do that again this year. Our idea is that by teaming, we have greater resources to undertake bigger and more impactful activities. While the collaboration is not yet defined in detail, we will look to collaborate with other SLI teams whenever possible.

7 Project Schedule

7.1 Schedule

The following is SLT17's preliminary schedule that demonstrates the feasibility of our plans and our ability to complete the deliverables on time. The schedule will be finalized during the PDR phase. Note that the subscale and full scale qualification flights will take place by the dates shown below assuming that we have to resort to backup launch sites and dates, so they are worst case dates. Do not interpret this schedule as indicating that our first launch attempt will be on the dates shown.

Task / Milestone	Start	End
Team recruiting, Organization and Setup	16-July-2018	03-September-2018
RFP Released		22-August-2018
Proposal Writing	22-August-2018	19-September-2018
Payload Selection	22-August-2018	05-September-2018
Conceptual Design	29-August-2018	12-September-2018
Technical Proposal Writing	22-August-2018	19-September-2019
Proposal Submission		19-September-2018
Kickoff and PDR Q&A		12-October-2018
Website and Social Media Presence Established	22-August-2018	12-September-2018
Preliminary Design	04-October-2018	25-October-2018
Prepare PDR Documents	18-October-2018	2-November-2018
PDR Video Teleconferences	05-November-2018	19-November-2018
CDR Q&A		27-October-2018
Critical Design	19-November-2018	04-January-2019
Build Subscale	19-November-2018	06-December-2018
Subscale Launch		09-December-2018
Prepare CDR Documents	09-December-2019	04-January-2019

Critical Design Review Documents Submitted		04-January-2019
Freeze Design of Full Scale	04-January-2019	04-January-2019
CDR Teleconference	07-January-2019	22-January-2019
FRR Q&A		25-January-2019
Final Design of Full Scale	26-January-2019	8-February-2019
Full Scale Design Freeze		8-February-2019
Full Scale Rocket Production	25-January-2019	27-February-2019
Full Scale Qualification Flight		02-March-2019
Prepare FRR Documents	18-January-2019	04-March-2019
Submit FRR Documents		04-March-2019
FRR Teleconference	08-March-2019	21-March-2019
Travel to Huntsville		03-April-2019
Launch Day		06-April-2019
Backup Launch Day		07-April-2019
Prepare PDAR Documents	08-April-2019	25-April-2019
Submit PDAR Documents		26-April-2019

8 Project Budget

8.1 Overview

The total cost for this project is estimated at an upper limit of $14,289. This includes two primary expense categories: rocket-related, and travel.

8.2 Rocket Expense

The rocket-based expenses are based on costs researched by team members online. It includes rocket kits, motors, computers and payload for a full-sized Formula 98 rocket ($1418), and the subscale Formula 75 rocket ($290). We have imputed $100 expenses for a budget safety margin, based on last year's actual expenses and the fact that we expect fewer contingencies this year. We've also imputed an estimated $100 for miscellaneous rocket expenses.

Our budget for rocket expenses is based on the fact that we can re-use the GPS tracker and receiver used last year. Also, some other items such as the RRC3 backup altimeter, Arduino Uno, SD Shield Board, SD Card, and LiPO batteries for the altimeters used last year are in excellent shape and can be re-used this year.

8.3 Travel Expense

The largest cost category for SLT17 by far is travel-related expenses. We have included an estimate of $9,480 for travel. This includes the following items:

- Transportation: $6,480 - It is 1,200 miles round trip to Huntsville, AL. from Charlottesville, VA. Based on the number of team members, we estimate seven personal vehicles making the trip at $0.54 per mile (IRS estimates)
- Lodging: $3,000 - We estimate 6 rooms with at 3 or more people in each room, at $100 per night, for five nights in Huntsville.
- Food $3,720 - We estimate a per diem of $30/day for 7 days for 31 people.

The plan is to apply funds raised first to rocket and payload and related equipment, and second to travel-related costs. That way, if there is a fundraising shortfall, the science and flight objectives are not impacted and we can compensate by reducing travel expenses.

Possibilities for covering travel expenses include the following:

- Renting or hiring small buses to transport the team to and from Huntsville, and/or sending the team to Huntsville by train. This may reduce the transportation cost. However, once the team arrives in Huntsville, we would have to rent one or two vans to shuttle the team between the hotel and the NASA launch, making this option less appealing.
- There is also a possibility that parents will absorb and share some or all of travel costs. This will require a team decision to be made closer to the time of the travel and on the basis of how much money has been raised.
- Depending upon fundraising success, Boy Scout Troop 17 may be willing to contribute in some funding to support the trip.
- The total cost per person for food, lodging, and transportation, is nearly $570. This may be more expensive than many will find possible to fund. So the number of Scouts attending may decline, but the ultimate cost per person would remain the same.

8.4 Budget Detail

In total, we will need $11,388 to cover all expenses. So we will need to do a lot of fundraising and hopefully get gracious sponsors.

	No. of units	Cost / Unit				
Sources of Funds						
Uses of Funds						**Comments**
Total Uses			**11,098**	**290**	**11,388**	The biggest costs are travel-related.
			Full Scale	**Sub Scale**	**Total**	

Rocket			**1,418**	**290**	**1,708**	
Full scale Formula 98	1	250	250		250	
Sub scale Formula 75	1	145		145	145	
Full scale reload - K805	3	115	345		345	
Full scale reload - J800	1	95	95		95	
Sub scale reload - I600	2	50		100	100	
Full scale motor hardware - K805	1	179	179		179	
Full scale motor hardware - J800	1	165	165		165	
Sub scale motor hardware - I600	1	45		45	45	
Flight Computer - Marsa 33	1	199	199		199	Replace RCC2 with Marsa 33; works for both rockets
Thermoelectric Generator	1	35	35		35	
Sensors and cables	1	50	50		50	
Safety Margin	1	100	100	0	100	Reduced from $500 estimated last year
			0	0	0	
Education			**200**	**0**	**200**	
Website			0	0	0	
Troop 17 website			0	0	0	
Educational Materials	1	200	200	0	200	General costs of material for educational activities
Design		1	0	0	0	
			0	0	0	
Travel			**9,480**	**0**	**9,480**	
Rooms 10 rooms @ $100/nt; 3 nights	30	100	3,000	0	3,000	Assume 10 of 11 families make it, for 3 nights (could be 4 nights)
Travel: 600 miles each way x $0.54/mi x 10 vehicles	**12,000**	**0.54**	6,480	0	6,480	31 people could be making the trip; assume 1 car/family, means 11 cars; we considered a bus, but determined the cost and lack of mobility was a problem; each family covered own travel costs
Food ($30/day x 4 days x 31 people)	124	30	3,720	0	3,720	Last year, everyone picked up their own meals

			0	0	0	
		Rooms	**Total**	**Adults**	**Youth**	
		1.0	3	1	2	Allen
		1.0	2	1	1	Barker
		1.0	2	1	1	Romanko
		1.0	4	1	3	Yates
		1.0	2	1	1	Fowlkes
		1.0	2	1	1	Orejudos
		1.0	3	2	1	Atienza
		1.0	4	3	1	Browning
		1.0	3	2	1	Sturdivant
		1.0	2	1	1	Scindia
		1.0	2	1	1	Shray
		1.0	2	1	1	Smith
		12.0	31	16	15	

8.5 Fundraising Plan

The SLT17 funding will come from several locations and sources. These include corporate sponsors, private donations, online sources, and fundraisers.

- First, we are contacting sponsors from last year to see if they are willing to support us again this year. So far, we do have a commitment from our biggest sponsor last year, which was the UVA Research Park.
- The Virginia Space Grant Consortium has indicated they are willing to donate, and we are contacting them to finalize their potential sponsorship.
- We are also contacting individuals who contributed last year to try to obtain their support again this year.
- We are trying to increase the effectiveness of our online fundraising, specifically our GoFundMe page. We see several key ways to improve:
    - First, this year we started much earlier. Last year, it took much longer than we expected to obtain our Boy Scout Council's approval for a SLI team specific fundraiser, but we have already obtained that for this year. So we can hit the ground running.
    - Second, we are greatly increasing our online presence year, including continuous real-time updates of team status and results on our Facebook, GoFundMe, Instagram, possibly Twitter, and team website

outlet. We are also linking to GoFundMe more clearly from all these places. We feel that having a dynamic social media presence will help us obtain more donations.

- We may do other fundraisers, time permitting, such as yard work, car washes, bake sales, and concession stands at UVA sporting events.
- Note that the BSA has strict policies and procedures on fundraisers that we must comply with, and fundraisers must be pre-approved by the local council (http://www.scouting.org/filestore/financeimpact/pdf/CFD-Manuals/Policies_and_Procedures.pdf)
- We will contact local stores and businesses to see if they would be willing to give us some percentage of their earnings or to sponsor us. ADI Engineering, who has sponsored our TARC team in the past, has also committed to supporting the SLI team. The key to success here seems to be moving quickly. Last year we waited and had a difficult time attracting corporate sponsors since they had already allocated their charitable gifts for the year.
- There has also been preliminary interest in donations expressed by some leading aerospace and defense companies, and we attempting to secure this funding.