Spring Grove Area School District

Biology Team SLI Rocketry 2015-16

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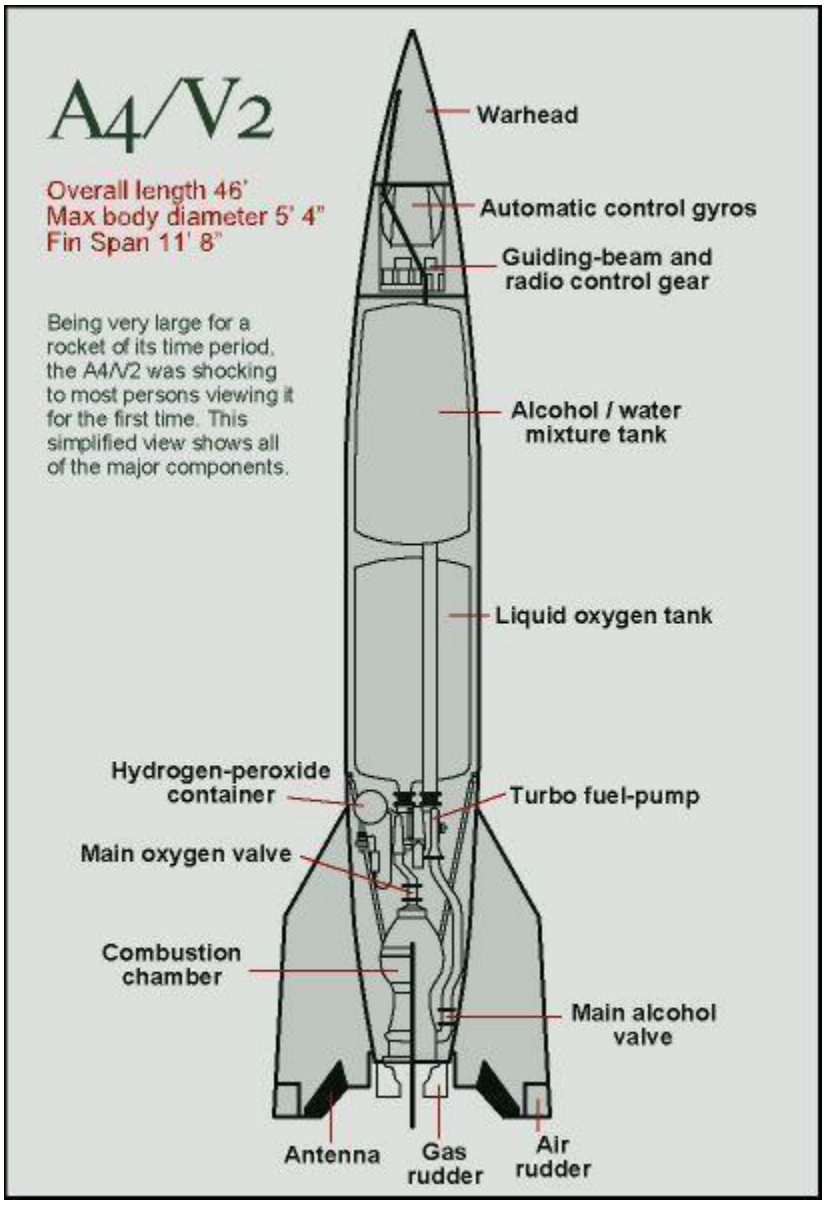


Team Darwin

General Information

1. School Information

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

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

- Renee Bosak
  Biology teacher, Rocket Scientist Club Coach
  Phone number: (717) 225-4731 ext. 7242
  Email: EatonR@sgasd.org

3. Safety Officer:

- Brian Hastings
  Level two NAR Representative
  Phone number: (717) 225-4731 ext. 7220
  NAR 96571 SR

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

5. Key Managers:

- Brian Hastings - Advisor and NAR representative of students
- Renee Eaton - Advisor and Supervisor of students
- Mr. Sengia - Instructional Technology Specialist
- Josh St. - Co-Captain and Student Safety Officer
- Adam - Co-Captain (Rocket Design Leader)

6. For Launch Assistance, Mentoring, and Reviewing our team will be working with the local NRA representatives along with MDRA (Maryland-Delaware Rocketry Association) for all questions and launches

Team Members

Mrs. Bosak: Biology Teacher and Assistant Coach

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, the Envirothon team, and the SLI team. In addition, I have been a member of the York Jaycees, a local community service organization, since 2009. I finished my Master's degree in Classroom Technology in 2013. In my spare time, I enjoy spending time with my friends and family, hiking, biking, reading, and training for 5K races and half-marathons. I am a NAR member and have a level 2 certification.

Brian Hastings: Instructor and Head Coach

I have been a teacher at Spring Grove for 19 years, teaching Physics 1, Physics 1 Honors, and AP Physics 1 and 2. I have an Honors B.A. in secondary education Physics, a masters in science education and 60 graduate credits past my Master's Degree. I have taught graduate courses to teachers and for the past 15 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 ten years. We have been participating in TARC for 9 years and have advanced to Nationals each of the past 6 years, placing fourth overall at Nationals in 2012, and eighth at the Nationals in 2013. I am a NAR member and have a level 1 certification. Currently I am building a rocket for level 2 NAR certification.

Adam Cavanaugh 17 Senior: Co-Captain and Rocket Design Leader

Ever since my sophomore year, after my first physics class, I have been more interested in sciences than any other subject. I became a “rocket scientist” last year, my junior year, when I really got involved in our rocketry teams and our science Olympiad team at Spring Grove. My sophomore year intrigued by the rocketry teams at our school but didn’t join. My junior year our TARC team placed 8th in the national competition. I also helped with the Spring Grove SL team, but was not a member. It was a learning experience last year and this year is my chance to apply it all. Outside of school I am an involved youth member at my church and I am a boy scout. I also enjoy golfing and being out in nature. This year I am very much looking forward to being a member of the SL team and the other opportunities that come with this large task.

Josh Staley 18 Senior: Co-Captain and Student Safety Officer

I became interested in science when I joined the Envirothon team in 7th grade. I began taking part in Science Olympiad the following year and have made it to the State competition each year since joining the team. I started learning about rockets in my freshmen year when I took part in Team America Rocket Challenge. I have now had 2.5 years of experience in high powered rocketry and have been an NAR member for 1 year now. I am also a member of the Maryland Rocketry Association and am level 1 certified. I look forward to working with NASA and hope to have a successful year in the SL program.

Carson Buffalow 16 Sophomore: Electronics Bay

When I was in middle school, I was introduced to science Olympiad. I took great interest in this and enjoyed the science field as a whole. Now as a sophomore, I have found SL. I enjoy rockets and working as part of a team so I figured I would enjoy being a part of the Spring Grove team. I like to do graphic design and play lacrosse and am very creative and like to design things so I thought this would be the club for me. I am hoping to use this as an outlet to help me pursue my possible career in engineering and have a lot of fun doing it.

Hannah Sheffer 17 Senior: Budget and Funding Plan

As a student I have always been interested in Math and Science for as long as I can remember. I like being able to solve no matter the difficulty. Being my first year in SLI, I think it will be a new and exciting challenge for me. In addition to SLI I am a member of National Honor Society, a player on Spring Grove's Varsity Field Hockey Team, and President of German National Honor Society. Being a part of SLI will help me to gain more experience in the Math and Science field. I am looking forward to being a member of SLI. After high school I plan to go to college to further my career in Math and Science.

Tre Colbert 15 Sophomore: Chief of Introduction and Table of Contents and Interfaces and Integration

I have always found interest in engineering throughout my time at Spring Grove. It wasn't until the end of last year when I found SL. After speaking with my history teacher about potential engineering fields and colleges to go to she mentioned getting involved in SL to find out if I would have interest in aviation. I see SL as a great opportunity to learn about my own interests and to enhance my knowledge in the engineering field. I also see SL as a great resume builder for college. I have very much enjoyed the short amount of time I have spent in the program and hopefully I will learn a lot this year both from my instructors and returning team members so that I can better support the team in the years to come.

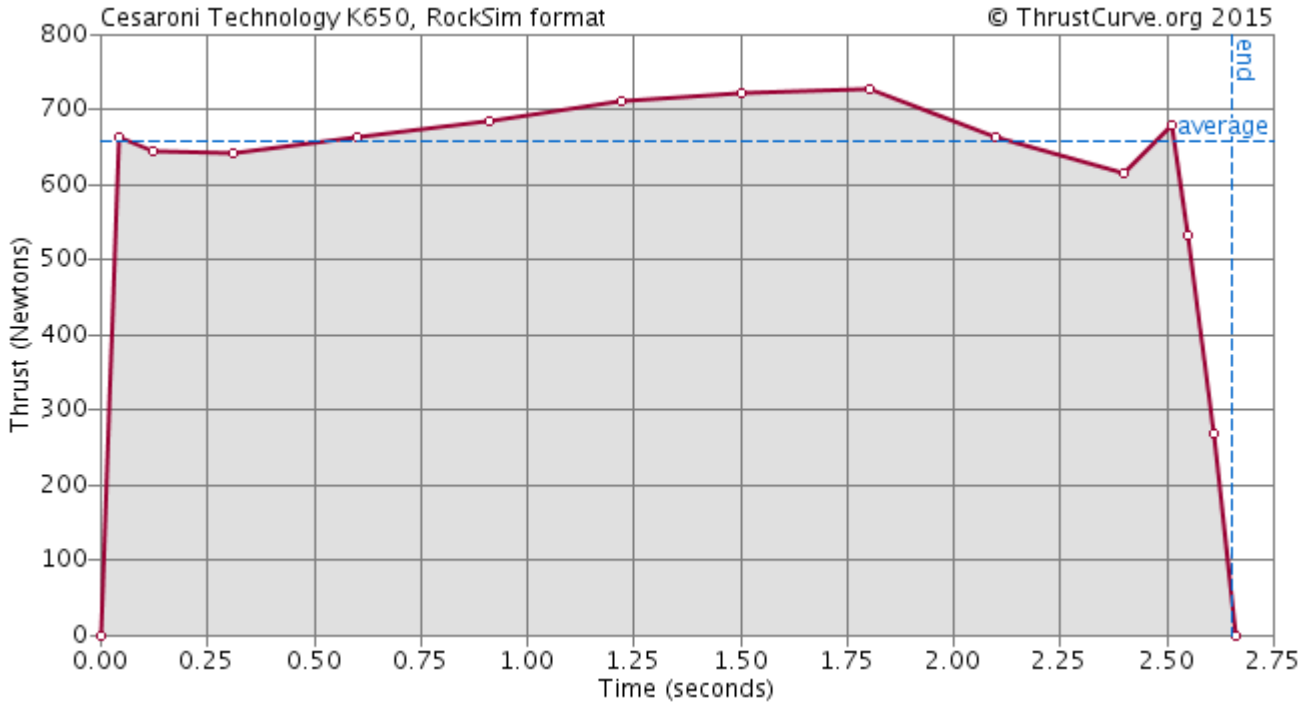
Sarah Staley 15 Freshman: Educational Engagement

I was in the TARC program last year and am excited to be a part of the 2015-2016 SL team. Over the last couple of years I have been to many SL launches for my siblings and I am thrilled to have the chance to be a part of the program this year. I am the vice president of my class and a member of the competition cheerleading squad, orchestra and the German American Partnership Program. I like being around people and working in groups to accomplish our goals. I hope to learn from my teammates and have a great year with the SL team.

Emily Edsall 15 Sophomore

The reason I joined Student Launch was because of my one friend. He talked me into joining with him. This will be my first year in this club as a sophomore. I hope it will be helpful and interesting. Other extracurricular activities that I am a part of our book club, piano, and I'm the treasurer of our school's language club.

Motor used Cessaroni K-650 Smoky Sam



Payload Summary

Our payload for this year will be located in the nose cone of our rocket. It will consist of an internal bulkhead with all thread running through it and connecting it to a second bulkhead at the back of the nose cone. We will have a piece of coupler between the two bulkheads which will be secured in place by 6 pop-rivets running between the coupler and the nosecone. We will then fill the area between the two bulkheads with a type of insulation. Our current choice is to use expanding foam but we can experiment with different types if this does not work. We will cut 2 cavities in the insulation that will firmly hold our test tubes that contain the planaria. We will have a second payload that is an exact copy of the one placed on the rocket that is for our control. We are using soda-bottle preforms as our test tubes.

The payload will test the effects that a rocket launch has on the growth of a planarian. More specifically it will be testing how the stress provided by the acceleration of the rocket affect their regrowth. The planaria have the capability to regrow if they are cut when they are cut in half. This is because of a special of stem cells that they have. The experiment will begin with 12 planarian being cut in half. Six of those will be loaded into two test tubes and put in the rocket. A control group of planarian will be kept separate from the rocket and will remain on the ground. They will be kept in petri dishes and labels. The experimental group of planaria will be inserted into the nose cone. This group will each be placed into small tubes which will be held in place with foam that will have 4 holes drilled into it to keep the test tubes in place. After the flight the planarian in the experimental group will be compared to their control group counterparts in order to see what effects the flight had on them.

Vehicle Summary

- Length – 84.5 inches
  - Bottom Half- 27.75 inches
  - Front Half- 37.75
- Mass- 17.8 pounds in Huntsville
- Diameter- 4 inch G-10 fiberglass
- Fins-Through the wall fiberglass fins
- Major Parts-
  - Payload
  - Electronics Bay
- Recovery: 2 Parachutes
  - Drogue Chute- 24in Diameter by Fruity Chutes
    - Released at apogee from back half of rocket
  - Main Chute-72in Diameter by Fruity Chutes
    - Released at 700ft from nose cone and slows rocket to 12.6 ft/s

Altitude Reached

In Huntsville, Alabama our rocket achieved an altitude of 4,645 feet. This height was 635 feet off from our intended height of 5,280 feet. It was not as close to our goal as we had hoped but the flight went very well and we were able to successfully recover our rocket.

Vehicle summary

At the back body tube we used a 3 fiberglass, through the wall fins. These fins gave us the strength we needed so that we never had to replace any fins from hard impacts. These fins were cut and fitted by the members of our team. We mounted a 54mm motor mount in the back body tube with 3 centering rings. We placed these wood centering rings so that we had just enough room to fit the base of the fin in between. At the top of the motor casing we had a metal machined piece that had an I-bolt attached to it. The I-bolt had shock cord going from it to the drogue parachute and then to the bottom of the E-bay. Between

our motor and E-bay, was our 24 inch drogue parachute attached to shock cord. The shock cord that holds the drogue parachute went to the electronics bay which had a U-bolt on both sides. The electronics bay coupled the back body tube to the front body tube and housed the ejection charges with the altimeters. Above the electronics bay in the front body tube was shock cord attached to a U-bolt on the front of E-bay which was attached to a 72 inch iris ultra-main parachute. The shock cord then went from the main parachute went to a U-bolt attached to our payload at in the nosecone of the rocket. The rocket overall with all of these components was 84.5 inches in length and was comprised of a 4 inch body tube made from G-10 fiberglass tubing. The tubing withstood the flight very well and did not show any signs of damage. The nosecone was made up of the same type of fiberglass and was fitted to the payload with pop rivets so that it did not fall off of the payload. Overall the vehicle worked really well and was structurally intact from the flight.

Data Analysis

In Huntsville the rocket took a very straight and stable flight off of the pad and took data with the two redundant altimeters that were in the electronics bay. The first altimeter read a height of *4645* feet while the second altimeter had a power loss during flights due to a battery coming loose from impact, but still recorded a height at apogee of *4647 feet*.

The rocket then ejected the drogue parachute at apogee and drifted down to 600 feet without the main parachute ejecting. At 600 feet the ejection charge went off for the main parachute and the main chute deployed as intended. The rocket landed approximately 1000 feet from the launch pad though once on the ground the wind pulled in almost 2000 feet further away.

Payload - Data

Due to a bad batch of worms (unfed and no clean water) four of the six planarians that flew up in the rocket died. The control group for this experiment however only had one or two deaths. The Planarians have been given fresh water every day and a piece of liver once a week. By limiting different factors like, only watering half or the planarian each day, I have come to the conclusion that the acceleration the experimental group underwent in the rocket added more stress to them, contributing to the larger number of deaths compared to the group that stayed on the ground.

Visual Data

On the day of the launch in Huntsville, we had mostly clear skies with a strong wind in the morning that died down slightly as the day went on. During our launch the engine worked correctly and our rocket had a very straight trajectory with no instability at all during launch. Our drogue parachute correctly deployed and opened without any problems or complications. The main parachute then deployed at 600 feet with no complications either. Our rocket landed about ¼ of a mile away but while on the ground, the wind caught the parachute and dragged it across the field almost another ¼ mile away. Other than that minor inconvenience the rocket landed safely with our rocket and our data fully recoverable. The launch was a success.

Lessons Learned

During the course of this project and the final stage in Huntsville we had a variety of challenges and problems that we had to solve and overcome. These included limited battery life for onboard electronics, issues with building materials and necessary design changes. These have provided us with experience and knowledge of how we can be better prepared for next year. The first is that we can never expect that everything will go right and that we must be prepared if something goes wrong. During the testing of our subscale we had many different malfunctions that hindered the completion of that part of the program. This included bad motors and parts of our design that do not work as they were intended. To mitigate this, we learned to always have more than one functioning rocket for each launch and to always bring any tools or materials that we could possibly need. Lastly we should

never assume that a design is final as we had to continue to make adjustments throughout.

Overall Experience

Overall the experience was helpful and constructive to all of the students that took part in it. We all learned a lot and gained invaluable skills from being on the project. The paperwork was not overly difficult to complete though it did take a lot of time and effort. Unfortunately the program did not get up and running until later than it usually would so we did not have as much time to complete all of the parts as we normally would. This placed a little more stress and responsibility on every member but did not overly impact our ability to complete our paperwork on time. The teleconferences and evaluations of our documents was mostly streamlined and without any major problems or complications. All video conferences had some minor problems due to inexperience with the programs and devices involved on our part but this did not impact the content, quality, or timeframe of said conferences. All feedback was useful and constructive on our project. During the building of our subscale and full scale we had only construction issues that were derived from translating our design on paper to the actual rocket. This included strength and integrity of materials and construction processes. At times this meant an increased amount of time and effort was exerted for different parts of construction. This did not affect our ability to meet deadlines and specifications. All trips were planned out well enough and all necessities and special cases were taken into account. In Huntsville we had excellent accommodations and assistance was readily available. All tours and activities were well planned and organized. All were constructive and interesting to be a part of. All debriefing and safety checks went smoothly for the most part. All transportation was comfortable and more than satisfactory. On launch day we had adequate room and on-site resources. Our team had enough time to prep and launch our rocket. It was great to have a successful flight this year. Overall the program was very constructive and interesting.

Educational Engagement Overview

Involving and educating our community about what we do in SLI is very important to the continuation of this program and STEM programs offered in the high school as well. Without the approval of our community we would never get the chance to take part in a

once in a lifetime opportunity to fly our SLI rocket down in Huntsville Alabama. As a group we diligently work to prove that SLI is a program that affects our members positively for years. In turn we have received respect and support from our community and we wish to keep this positive relationship going on for the future SLI teams.

This year we plan to hold similar events as the members of the 2014 SLI team did so last year; to educate the younger SG students. By focusing on the younger grade levels we have the opportunity to spark the imagination of these kids and hopefully inspire them to join one of the programs offered in the high school. We will achieve this by holding a presentation in the middle school to inform the students of what we do in SLI, why they should care, and how they can join when they come to the high school. The event will be held at the Middle School March 16, 2016. A survey sheet will also be given out to the students in order for us to get feedback on what we did well and what we can improve on for following years (see figure 1). These presentations help keep our STEM programs going by motivating the younger Spring Grove students to join and continue this positive program.

NASA would like us to focus on students in grades 5 through 9 specifically. In addition to the presentation, we will be holding a rocket building workshop for these age groups. Signup sheets will be in the guidance office and the workshop will be scheduled May 15 based on the weather and interest (see figure 2). Our workshop will give the students a chance to experience rocketry first hand, by allowing them to assemble their very own in a safe and educational environment. Rocket designs will be created by members of the 2015 SLI team to ensure the students safety and the ability of the rocket to fly with little to no complications. These students will be working in groups of 3 to 4 along with a mentor from the SLI team to assist the students in the building of their rockets. Before the workshop, the students will attend a brief seminar where they will learn the basics of rocket designing and how the rockets they are building (previously designed by a member of the SLI team) were constructed. By doing this rocket building workshop we will help widen the students' knowledge of the rocketry process, and enhance their experience with the SLI team positively.

As mentioned above, SLI team members will be assisting in the workshop by showing the students how to properly use tools and inform them about safety precautions throughout the building process. Following the workshop, students will be able to launch

their rockets. This will hopefully inspire them to continue with their interest in STEM programs. After the rocket launch, students will be encouraged to ask questions and give comments about the SLI and rocketry programs. They will also be able to see a more in depth look at what the SLI team does.

Students will be able to enroll in this workshop, by filling out a signup sheet in the guidance office of the middle school, and will bring home a consent form for their guardian or parent to sign (see figure 3). There will also be a meeting prior to the workshop for these students and parents to receive more information about the project. This meeting will be held April 3rd in room 220 at 5:00 to 5:30 in the High School.

Funding Total

We obtained all funding necessary to reach Huntsville, Alabama in April. Through many grant applications and generous donations we reached our goal. Near the conclusion of our project, we have found funding from TE Connectivity (4800), The Spring Grove Educational Fund (5000), Aquaphoenix Scientific (2000), The Engineering Society of York (1000),Penn Waste (250), and numerous other small sponsors and donators that have helped us achieve the ultimate goal and be able to reach Huntsville, Alabama .