Effect of High Altitude and Acceleration on the Life of a Bacterial Sample

Harvard-Westlake School

SLI Proposal

1. School Information

Harvard-Westlake is an independent college preparatory school in North Hollywood. Harvard-Westlake has approximately 300 students per grade, with an average of eight students per class. Harvard-Westlake is a coed school, with a 48% to 52% female to male ratio. Harvard-Westlake runs an eight period schedule, where classes meet for 45 minutes each period. There is no set lunch period; students eat during periods when they do not have class. Harvard-Westlake prides itself on its academic reputation. The average SAT score is 2110 (690 Critical Reading, 700 Math, 720 Writing). In 2007, 514 students took 1678 AP tests. 91% scored a 3 or higher.

Team Official

Dr. Huybrechts is the Head of Harvard-Westlake. She joined Harvard-Westlake in 1989 and has taught physics and chemistry. She has also served as a grade-level dean as well as the head of the middle school.

Dedicated Educators:

Mr. Jacob Hazard is the Computer-Science teacher at Harvard-Westlake. He teaches both the AP Computer Science A and AP Computer Science AB courses. Mr. Hazard was the faculty advisor for Harvard-Westlake's Rocketry Club last year, where he helped lead the team to 13th place.

Ms. Karen Hutchison is the AP Physics B teacher at Harvard-Westlake. Ms. Hutchison is the head of the robotics program at Harvard-Westlake, in which students compete in the annual FIRST competitions.

Team Members:

Ian	Project Manager
Justin	Construction Manager
Eric	Outreach Manager
Richard	Payload Specialist
Brendan	Web Page Designer
Spencer	Web Page Designer
Andrew	Financial Analyst
Brett	Fund Raising Manager
Monica	Safety Manager

Team Biographies:

<u>Ian</u>

Ian is a Junior at Harvard-Westlake. Ian founded Rocketry Club three years ago and has made it to the finals every year since then. Ian is also the captain of Harvard-Westlake's Robotics Club. In his free time, he enjoys rocketry, programming, and electronics. He has published one book, entitled "Programming Video Games for the Evil Genius" (McGraw-Hill, 2008). It has since been translated into French and Dutch.

Justin

Justin is in the 12th grade. He is assistant captain and treasurer of the Rocketry and Robotics Team and captain of the Science Bowl Team. Over the summer, he performed research at UCLA in the Watson Lab on Parkinson's Disease and the Colwell Lab on Circadian Neurobiology. By the end of this year, he will have completed all possible computer science and biology classes at Harvard-Westlake. This year, the science and math courses he is taking are AP Calculus BC, AP Statistics, AP Economics, Advanced Topics in Computer Science Honors, AP Physics B, and Genetics and Biotechnology.

Eric

Eric Arzoian is a senior at Harvard Westlake, where he is a member of the Rocketry and Robotics Clubs. He is an internationally ranked fencer and loves physics.

Richard

Richard is a Junior at Harvard-Westlake and currently participating in studies in scientific research and rocketry. He created an innovative specimen container and urine collection system two years ago and obtained several design patents. He helped Biomed, a medical supplies company, develop a corporate image, and introduced new designs for nitrile gloves. He is currently working on two projects: supersonic vehicle mach effect's impact on velocity and magnetic resistance on speeding vehicles to generate electricity.

Brendan

Brendan is a junior at Harvard-Westlake. An avid learner of math, he is currently taking Linear Algerbra and Multivariable Calculus, as well as AP Physics C. Brendan is also a nationally ranked tennis player, and is currently researching mobile research effectiveness for the U.N. funded Surya research project.

Spencer

Spencer Gordon loves math and science. He competes on math teams, reads math books, and thinks about math a lot. He also knows multiple programming languages and web languages. He reads a lot of books and plays squash.

Andrew

Andrew is a Junior at Harvard-Westlake and is currently finishing research on Axon transport deficiencies.

Brett

Brett participated in the Team America Rocketry Challenge in 2008 and finished in 13th place. He also enjoys playing water polo and reading.

Monica

Monica is a junior at Harvard-Westlake. She is a member of the rocketry, robotics, computer science, and science bowl team. She has also worked in numerous labs at both UCLA and Caltech.

Mr. Jacob Hazard

Mr. Jacob Hazard has been teaching math and computer science for 10 years but has only recently become involved in the student-led Rocketry club at Harvard-Westlake. He currently teaches two sections of AP Computer Science A, two sections of AP Computer Science AB, and one section of post-AP Computer Science called "Advanced Topics in Computer Science". Last year Mr. Hazard won Harvard-Westlake's 2008 Early Achievement award for his involvement in bringing technology to the school. He spearheaded the efforts to bring Moodle, an online course management system, to the school and is currently the school's Moodle administrator. Additionally, he sits on the Educational Technology committee, advises the Rocketry and Computer Science clubs, and previously coached baseball.

Ms. Karen Hutchison

Karen Hutchison has been teaching physics for five years, the last three at Harvard-Westlake. She currently teaches AP Physics B and Regular Physics, in addition to mentoring the Robotics Team. Karen has coached volleyball and softball. She is very excited that this group of students is going to teach her about rocketry.

2. Facilities

Meetings and build sessions will occur in Chalmers 304, the Computer Science Lab.

Chalmers 304 includes 15 computers with a T1 internet connection.

When situations require power tools, the Munger lab will be used.

When non-flight testing is required, Ted Slavin field will be used.

Munger 202, the Science Research lab, will be used to test the scientific payload.

Scale models will be flown at the Santa Fe Dam Recreational Area.

Required Equipment (to be purchased):

- Computer with RockSim v8
- Router to cut Fins and Airframe
- Epoxy to secure rocket components
    - Nitrile gloves, to protect from epoxy
- Drill Press to cut centering rings and bulkheads

Computing Equipment:

- Chalmers 304 provides all computer equipment required

    - Accessible: 7am to 10pm, 7 days a week
- Accessible Computers
    - Windows Vista Core Duo Computers
    - Rocksim v8 (CAD Program) Installed
    - T1 Internet
    - Internet Explorer for Web Access and Email
        - HWStudents.com email provided for students
    - PowerPoint, Photoshop CS3, and Dreamweaver Installed
- No video teleconferencing equipment is provided, but school provides Broadband internet, analog camera, etc

3. Safety

Harvard-Westlake will build and fly its rocket strictly following or surpassing all NAR and FAA rules and regulations. Launches will only be conducted when at least one faculty member can attend. All high-altitude waivers will be correctly filed with the FAA before flight.

During the SLI process, the Harvard-Westlake team will follow these procedures:

Harvard-Westlake Safety Procedures:

- Available Emergency Equipment:
    - Fire Extinguisher
    - Emergency Eye Wash
    - Emergency Body Wash

    - Safety Glasses
    - Nitrile Gloves
    - Fully stocked First Aid Kit
- Mandatory NAR Safety Guideline Meeting
    - Before the build process begins, all members will be required to attend a meeting outlining all of the Harvard-Westlake, NAR, and FAA rules and regulations. Each member must sign a form agreeing to follow the rules.
- Emergency Prevention
    - The following plan will be used to prevent injury:
        - Chemical Injury (burns, inhalation, etc)
            - Members will always wear nitrile gloves and safety goggles when dealing with chemicals. If appropriate, students will wear respirators.
        - Physical Injury (cuts, bruises, etc)
            - Members will always use caution when using sharp items. Students are required to warn those in the vicinity when using any type of power tool.
- Caution Signs
    - When working on the rocket, appropriate NFPA Triangle Signs will be posted.

NAR Member:

NAR Level 2 Member: Rick Dickinson (rtd@notesguy.com)

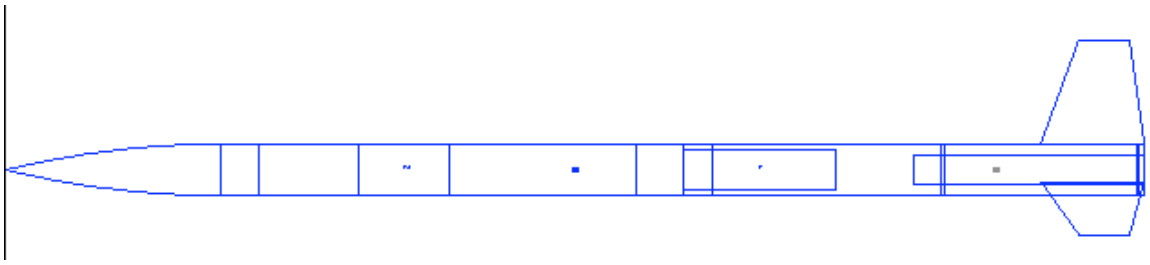
Mr. Dickinson will insure that all NAR and FAA regulations are followed during the design and assembly of the rocket.

4. Technical Design

Harvard-Westlake will first design the rocket using RockSim v8.0. Harvard-Westlake will overestimate the weight of all components (including the payload) in order to insure that the rocket can reach the one mile altitude goal. After the preliminary design, we will show our simulations to Rick Dickinson, so he can offer suggestions. Once we are in agreement, Harvard-Westlake will order the necessary components and begin the build.

Projected Vehicle Dimensions:

The vehicle will be 88.8in long and 4.0in in diameter. It will use three trapezoidal fins for stability. It will have a 54mm motor mount.



Projected Motor Size and Type:

The vehicle will use a J540R Aerotech rocket motor. The motor is made of APCP, Ammonium Perchlorate Composite Propellant. With a 14 second ejection delay, the rocket will exceed one mile in altitude. Minor ballast adjustments will change the altitude to exactly mile.

Projected Science Payload:

Harvard-Westlake plans to study the effects of high altitude and fast acceleration on bacteria. We will place an extremely safe and scientifically "constant" strain of

bacteria on a microscope slide. Using LEDs for lights and a wireless camera to record and send the image, Harvard-Westlake will see if the high acceleration forces affect the life of the bacteria. In addition, after the rocket is recovered, we will compare the bacteria to a control group to check if the bacteria in the rocket have a shorter life span. This can be highly helpful data for anyone considering doing experiments in space with bacteria.

Payload and Rocket Requirements:

The rocket will reach an altitude of one mile while remaining under the Speed of Sound. The payload will hold a small sample of extremely safe and harmless live bacteria. The payload will also contain LEDs and a wireless camera. In addition, flight computers will be inserted into the payload to insure accurate flight and speed data.

Major Challenges and Solutions:

Determining the correct strain of bacteria. We will consult UCLA professors in order to most efficiently determine the best strain.

Insuring the rocket reaches one mile in altitude. We will simulate the rocket with an added two pounds in weight, as RockSim tends to underestimate the Coefficient of Drag (cD).

5. Outreach:

In order to obtain community support, Harvard-Westlake will create several press releases for local businesses that may sponsor us. In addition, the Harvard-Westlake Science and Math Departments have agreed to help sponsor our project.

Harvard-Westlake will host two community outreach events.

1) Harvard-Westlake will design a program to get local Boy Scout Troops interested in aerospace. Harvard-Westlake will run a two hour class teaching the basics of rocketry (stability, center of gravity/pressure,etc). During the last hour of the class, Harvard-Westlake will help students build their own low powered rockets. Classes will take place in Harvard-Westlake classrooms.

2) During the second event, Harvard-Westlake will organize and run a launch for the Boy Scout Troops from the first class. We will teach them how to safely prepare, launch, and recover rockets. Launches will take place at the Santa Fe Dam Recreational Area.

6. Project Plan:

Timeline:

October 27th – First SLI Team Meeting. Review Safety procedures. Finalize Rocket design. Order necessary tools (power tools, glues, epoxies, etc.)

November 3rd – Order rocket airframe components. Order wireless camera, microscopic lens, and LEDs for science payload

November 10th – Break into separate teams for the science payload and rocket construction.

Science payload – Connect microscopic lens to wireless camera. Test range

Rocket construction – Begin constructing the fins of the rocket.

November 16th – Test fly scale rocket

November 17th – Work on team website, continue previous week's work.

November 24th – Connect fins to main airframe, attach motor mount. Finalize website

December 1st – Put rocket together and work on finishing touches

December 8th – Test scientific payload with live bacteria

January 12th – Work on scientific payload, obtain flight computers

February 2nd – Paint rocket

February 9th – Learn how to prepare rocket for flight. Create checklist

March 9h – Practice preparing rocket for flight

Budget:

Science payload components	$300
Rocket components (airframe, nose cone, motor mount, fins, parachute, shock cords, altimeters)	$600
Motors and reloads	$200
Scale Model	$100
Outreach program	$600
Air travel to/from Huntsville	$5000
Hotel/food accommodations	$5000
Rocket shipping	$300
TOTAL:	**$11800**
NASA FUNDS:	**$3700**
SCHOOL FUNDS:	**$5000**

SPONSORSHIPS: $3100