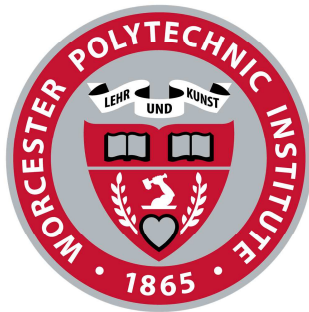


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# WPI

## Space-Technology Essay Contest In Worcester Public Schools

An Interactive Qualifying Project  
Submitted to the  
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## Introduction

In the 2012-13 academic year, a pilot essay contest was created as part of an IQP. This IQP group worked closely with the fifth- and sixth-graders at Elm Park Community School to increase interest in STEM (Science, technology, engineering, and mathematics) topics. The group worked with the fifth- and sixth-grade teachers to create a more interesting curriculum by planning and facilitating exciting STEM demonstrations and activities. One of these activities was an essay contest centered on Dr. Alfred Bortz's book *Seven Wonders of Space Technology*. Students from each grade received a copy of one of the chapters from the book, as well as a prompt with several questions. They were asked to think critically and creatively about the questions, and to go beyond the facts presented in the chapter. The essays were judged by the students in the IQP group as well as Dr. Bortz. An award ceremony was held at Elm Park, where the authors of the three winning essays from each grade received an autographed copy of Bortz's book.

The goal of the 2013 – 14 IQP project was to run the contest again and expand its scope. Much of the project was based on the pilot from the previous year. The schedule was adapted to fit this academic year and the expanded scope. The overall schedule remained the same: the students wrote the essays, the teachers read the essays and selected the semifinalists, the project group read and selected finalists, which were sent to Dr. Bortz, who selected the winners. There was then an award ceremony to announce the winners and give the students a chance to speak with Dr. Bortz. However, the schedule needed to be lengthened in order to accommodate the larger number of students participating this year. Aspects of the prompts were used again this year, including the

length requirement and overall format. Similar background information and comments on the logistics of the contest were included in the prompt, but the questions that the students needed to answer in their essays were different. The same chapters from Dr. Bortz's book were used again this year.

One of the objectives was to expand the contest beyond a single school. Because of this, it was initially unclear what the scope of the project would be. The project group was not certain if the project would be run throughout schools in Worcester, throughout schools in the Doherty quadrant, or at just a couple of schools. Because the contest was being expanded, a new letter of proposal to teachers and principals who were interested in running the contest at their school needed to be drafted.

The larger scope of the project created some new challenges. Because the group was dealing with multiple schools, scheduling became an issue. Dealing with hundreds of students also led to logistical problems, as well as concerns regarding how the group would be able to cover the costs associated with running the larger contest. Over the course of the academic year, these problems were solved and the ultimate goal of the project was achieved.

## Methodology

### PROPOSAL

At the start of this project we knew, from looking at the IQP report from the previous year, that for this essay contest to be successful certain core elements of the contest needed to be completed. With the guidance of Professor James Dempsey and Taymon Beal, a member of the previous year's team, the group came to the conclusion that our initial actions should be focused on communicating with the Worcester Public Schools. When contacting the schools, it was necessary that the group have an official proposal letter to discuss the group's intentions and plan for implementing the essay contest. It was decided that the proposal would have two parts. The first part would be an overview of what the group was planning on implementing, as well as the rationale behind the essay contest. The second part would be more logistical, explaining the rules for the contest, the theoretical timeline for the project, and the expected cost of the project. The purpose of this breakdown was to show that the group had a plan for the entire essay contest, while partitioning the sections off to make it more reader-friendly. The proposal was finalized by late October and e-mailed out by early November, and can be seen in the Appendix.

The rationale of the contest was laid out in the proposal. In brief, this contest was designed both to stimulate the student's interest in the STEM fields and to help improve reading and writing skills. This contest was also designed to help students prepare for standardized testing, like the Massachusetts Comprehensive Assessment System or MCAS testing. The reason the previous team had used the theme of space it was felt that this topic would stimulate the curiosity of children in the fifth- and sixth-grades. The

contest was also designed to help students with their reading, researching, and writing skills. This contest would challenge the student to go above and beyond what they already knew or were being taught. It would require the student to draw information from independent research and apply that newfound knowledge.

The rules of the contest were initially laid out in the proposal that the group sent to the teachers who were administering the contest. It was decided the students would write an expository essay over a period of two weeks. Teachers would narrow down the entries to around ten semifinalists per school. The essay group would then further narrow down the entries to twenty total finalists. Their essays would then be sent to Dr. Bortz, who would choose the top three in each grade. All finalists would be notified and invited to an award ceremony.

The team also included a proposed schedule for the project together with a general timeline for the contest. This can be seen in more detail in the Appendix. Teachers were presented with a flexible schedule to allow them to accommodate for the contest within their personal curriculums. The schedule consisted of one week in which the students would complete their essays, two weeks for the group to collect these essays and choose the twenty best that would be sent to Dr. Bortz. Finally, two weeks were allotted to Dr. Bortz to judge the essays.

The last part of the proposal concerned cost. Expenses included royalties for printing and distributing the chapters in the book, and the books that were required by the publisher to be bought. It also covered the ways in which the group expected to pay for the contest.

## PROMPT

The topics for the prompt were largely decided at the beginning of this year. Since *Seven Wonders of Space Technology* was once again the main resource for the essay contest, the students would have research materials similar to those that they had during the pilot in the previous year. Because of this, it was decided that the same two chapters from the book would be the basis of the prompts. The fifth-grade prompt would focus on water on the Moon, while the sixth-grade prompt would focus around the Mars rovers.

By end of the first term, several Worcester Public Schools and a charter school had shown interest in participating in the essay contest. Using the fifth-grade prompt from the previous year as a guide, questions revolving around lunar water were brainstormed by the group. Similarly, the sixth-grade prompt from the previous year was used as inspiration to brainstorm questions about Mars rovers. A lengthy list of possible questions for each was created for each prompt, and included critical thinking questions such as “What are the implications of finding water on the moon?” and factual questions such as “What instruments do the rovers have and what are they used for?”.

A major difference from the previous year’s essay contest was a stronger focus on expository writing as opposed to creative thinking, as suggested by Phyllis Goldstein’s, the English and Language Arts liaison for the Worcester Public Schools,. Last year, the project group included creative thinking questions such as “Can you imagine other ways to explore Mars than with a rover?” It was felt that a more expository approach would provide better practice for the type of writing required by the MCAS exam. It was important that the project conformed to the objectives of the English Language Arts and Science programs, which is why the group worked closely with Ms. Goldstein and Kathy



Berube, who is the Science and Engineering liaison for the Worcester Public Schools. The essay contest this year stressed the importance of synthesizing information from different sources to create a complete and eloquent essay that answers several different questions, with information that could be found in the provided research materials.

The list of potential prompt questions was e-mailed to Ms. Berube and Ms. Goldstein. Later, one member of the group met with Ms. Goldstein to discuss the newest developments in the project, including the prompt and the rubric. After the meeting, it was decided that each prompt should have one research-based question and one critical thinking question. For example, the fifth-grade prompt would have one question about how water was discovered on the moon, and one question about the implications of finding water on the moon. The sixth-grade prompt would have one question that compared and contrasted the different Mars rovers, and another question about the challenges involved with landing a rover on Mars.

The group used Ms. Goldstein's suggestions and the previous year's prompts to create the final prompts. In a meeting with the members of the project group, the official wording and number of questions was determined. It was important to choose questions that could be answered with the research materials collected. The questions also needed to be specific and not open to many different interpretations. This would make grading easier. With each prompt having two questions, there were four questions in total across the fifth- and sixth-grade prompts. Each member of the group chose one of the questions. He or she then looked through all of the additional research materials to find in which articles there was information to answer the question. An answer key was created that listed where the answers to each question could be found in each article. This answer key

was created to ensure that students would be able to sufficiently answer each question with the provided materials, and possibly to give to teachers so that they could guide their students in the right direction, if necessary. In the end, the answer key was not given to teachers due to insufficient time to organize it in a presentable way.

After the questions were determined, final drafts of the prompts were created. These can be seen in the Appendix. Again, the group looked at the prompts from the previous year to determine what information other than the questions was necessary to include. Much of the first paragraph was copied and edited to reflect the changes the group made to the project (for example, the inclusion of several different sources). The structure of the actual prompt question paragraph was also similar to the structure of last year's prompt: it started with a few introductory sentences to explain the problem, and then stated the two prompt questions. For example, the fifth-grade prompt included a brief explanation of the history of searching for water on the moon, while the sixth-grade prompt introduced the students to the Spirit, Opportunity, and Curiosity rovers. The word count requirement from the previous contest was used again in this year's contest. The group discussed changing the word count to a page count, but it was determined that a page count would be less reliable due to the inability to assure that all students had access to a computer and the fact that the handwriting of each student is very different. Requirements to use at least one source other than Dr. Bortz's book and citations were added, criteria that were not necessary in the previous year's contest. Much of the rest of the prompt was copied from the previous year and edited to reflect the changes the group made to the contest. For example, a sentence reflecting the shortened time to complete the essay was added to the prompt. The final paragraph briefly explained the logistics of

the contest, including who would be judging the essays and the prize for the authors of the three best essays from each grade. It also included the group's e-mail address, which could be contacted if any teachers or students had any questions. This final draft of the prompt was e-mailed to Ms. Berube and Ms. Goldstein to review and suggest any modifications or changes.

Once the final drafts of the prompts and rubric were approved by Ms. Goldstein and Ms. Berube, the group worked on creating the final packets that would be distributed to the fifth- and sixth-graders. These packets would contain photocopies of the respective chapter from *Seven Wonders of Space Technology* as well as copies of the additional articles that were found. Each article was downloaded as a PDF and combined with the PDF of the photocopied chapter from Dr. Bortz's book. This packet, along with the final prompts and rubric, was sent to the participating teachers in order to get any suggestions or feedback. The packet PDFs were also sent to the WPI print shop.

## RESEARCH MATERIALS

With the finalized version of the prompt distributed, the group focused on the other items that were integral to writing the essay: the prompt, rubric, and the research material. It was determined that Dr. Bortz's book would again be part of the essential reading material. The two chapters that were previously used were "Mars Rovers" and "Water on the Moon". In a meeting with Ms. Goldstein, it was brought to the group's attention that the students needed to have more substantial research materials. It was also noted that not everyone participating in the contest would access to additional research materials, such as a library or a computer. It was then decided that, to keep the essay contest as fair as possible, all of the additional resources that the students needed would

be provided. These resources would be composed of a PDF version of a chapter in the book as well as a PDF version of different online resources.

Because of the new focus on drawing information from several different sources, it was necessary to find new sources of information outside of Dr. Bortz's book. The additional research materials were found online. Each group member researched articles that could be used by the students. Articles from reputable sources such as Time for Kids, NASA, and Scholastic were found and compiled. These were then divided among the fifth- and sixth-grades. The fifth-grade articles were centered around lunar water, how it was discovered, and missions important to the discovery of water on the moon. The sixth-grade articles were focused on the different Mars rovers, including Spirit, Opportunity, and Curiosity. In particular, there were many current articles detailing Curiosity's landing. The group went through the list of articles and determined which ones were most useful. It was important to keep in mind that printing a large number of articles or more lengthy articles meant an increased cost. Five extra articles for the fifth-graders and three extra articles for the sixth-graders were included.

When looking for new sources, it was important to keep in mind the students who would be using these articles in their essays. There was a wide range of reading ability in the students throughout the several participating schools, so it was important to confirm that the outside articles were appropriate. While Ms. Goldstein insisted that it was acceptable to challenge the students, it was also important to make sure the sources were not so difficult as to inhibit comprehension of the article. In order to gauge the difficulty of the outside research materials that were found, the Lexile score for each article was determined. The Lexile framework allows the reading level of a piece of writing to be

quantified based on the difficulty of individual words and the length of sentences. According to the Lexile Framework's official website, the Lexile Range for a typical fifth-grader with average reading abilities is between 700L and 980L, while the typical sixth-grader with average reading abilities has a Range of 780L to 1040L. The same website was used to determine the Lexile Measure of the articles that were found. By analyzing a paragraph from each article with the Lexile Test Measure, it was determined that the measure of each article either fell within the average range or was slightly higher than the range. This added difficulty is most likely due to the scientific terms in the articles that students of these ages might not be familiar with.

## RUBRIC

Alongside the development of the prompt, the group developed the rubric that would be given to the teachers. The teachers used this rubric to grade their students' essays, narrowing it down to ten essays from each grade from each school participating. The members of the group then used this rubric as a guideline to discuss these essays and choose the finalists, which were sent to Dr. Bortz. The rubric was designed to keep the grading of all of the essays uniform. It showed the teachers and students what aspects of essay writing were most important (spelling, grammar, structure, factual evidence, etc.). Having both the teachers and the group evaluate the students' essays helped to ensure that all of the essays were judged fairly and equally. The group initially discussed which categories the rubric should include, deciding upon scientific accuracy and content, comprehension of material, spelling and grammar, and organization. It was suggested by Ms. Goldstein to have one of the requirements be to cite multiple sources in the essay. This would cement the necessity to synthesize information from multiple sources, as well

as to cite them properly. The rubric encouraged students to practice the essay writing skills that will be tested on in standardized testing.

With the overall requirements for the rubric finalized, the group looked at several different English essay and scientific essay rubrics in order to familiarize themselves with rubric format and categories. The formerly brainstormed categories for the rubric were condensed to four categories: “Scientific Accuracy”, “Spelling and Grammar”, “Organization”, and “Comprehension”. “Scientific Accuracy” accounted for complete and accurate answers to the questions. “Spelling and Grammar” accounted for correct spelling and proper grammar usage throughout the essay. “Organization” accounted for proper essay structure (introduction, body, and conclusion) and transitions. “Comprehension” accounted for the complexity and accuracy of the details used, as well as the requirement to use multiple sources.

The group decided to use a five-point scale for each category. To earn five points in a category, a student showed mastery and complete understanding of the category. To earn four points in a category, a student generally showed comprehension of the category with only a few mistakes. Three points in a category showed partial understanding of the category with some errors or mistakes. To earn two points, a student showed some understanding of a category but there are many mistakes or errors. To earn one point in a category, a student showed little to no understanding of a category, or had severe errors in the essay.

To properly demonstrate the group’s preference to which categories were more important, it was decided that the rubric would be weighted. Scientific accuracy and comprehension of the material were determined to be more important than the spelling,

grammar and organization of the essay because the purpose of this essay contest was to spark interest in STEM topics. Scientific accuracy and comprehension were given a weight of 1.5. This meant that the scores from this category would be multiplied by 1.5 before being added into the total score for the essay. The final grade or score of the essay was out of twenty five points. The score could be used by teachers for their own purposes, and helped determine which essays would be sent to Dr. Bortz as finalists.

## Contact with Outside Groups (non-funding related)

### GETTING STARTED

The project depended a lot on the cooperation from groups and individuals outside our IQP team, including the Worcester Public Schools, the American Institute for Aeronautics and Astronautics (AIAA), and Dr. Bortz. Failing to contact these parties sooner was the group's first mistake. The group realized this at its first meeting during the academic year, when it was stressed by Professor John Wilkes and Professor Dempsey that contact should have been made over the summer. At this meeting it was established that the group needed to contact the Worcester Public Schools to find out if they were interested in participating and, if so, what schools and grades were interested. The first step was to create a group e-mail alias that would allow anyone to contact the entire project group, including Professor Dempsey, through one e-mail.

### CONTACT WITH ADMINISTRATORS, TEACHERS, AND OTHERS

At this point, the group thought it would be a good idea to have a formal letter at the ready for any person interested in the contest. This letter can be found in the Appendix. It was decided that the letter should contain background on the contest, how it was run in the past, what the group planned to do this year, the responsibilities of the teachers and WPI students, and the intended benefits to the students participating. This letter is referred to as our letter of intent for the project.

Professor Wilkes and Mr. Beal attended most of our meetings in A-Term and provided a lot of important insight into how the project should be approached. It was recommended that coordination between other IQP teams that were working in the



Worcester Public Schools would be a good idea if there ended up being any instances where different IQP groups were working with the same teachers or classrooms.

Professor Wilkes provided the group with some information about several important people and advice about how they might be useful to the project.

The group was informed that Martha Cyr was the Executive Director of the STEM Education Center at WPI, and that initial contact with the Worcester Public Schools should be made through her. Paula Proctor had been the principal of the Elm Park Community School during the previous year, where the pilot contest was run. Larisa Schelkin was an executive at a nonprofit called the Global Tech and Engineering Consortium that has access to a large network of schools across the globe, and could bring the essay contest to other schools outside Worcester. Dolores Gribouski is the manager for the Doherty Quadrant of the Worcester Public Schools, and WPI does a lot of educational outreach to that quadrant. Our first effort in contacting outside entities was to reach out to these individuals, along with Dr. Bortz.

Professor Wilkes had a connection with Ms. Schelkin and had her attend one of our meetings. At this meeting, the group explained how the pilot had been run the previous year and what the group wanted to do differently this year. Ms. Schelkin was receptive and liked how the project was focused on increasing interest in STEM fields in young students. She proposed that the group expand the project to include a school in Russia. Worcester students could communicate with the Russian students via video chat and collaborate on the project. The group thought this idea was very interesting, but felt that it would not have the resources to run both a large scale essay contest in Worcester schools and an international essay contest. After a discussion with Professor Dempsey,

the group decided to focus on the initial plan of an essay contest in Worcester Public Schools.

The first step in contacting the Worcester Public Schools was to contact Martha Cyr, since the group was under the impression that all contact with the Worcester Public Schools was to go through her. She suggested we meet with Ms. Goldstein, and set up a meeting with her for the group. Martha Cyr also assisted by looking over the letter of intent.

Ms. Goldstein came to WPI to meet with the project group. Professor Dempsey, Mr. Beal, and members of our group were in attendance. Mr. Beal summarized what happened with the essay contest last year. The group then explained its hope to expand the contest to multiple schools in the Worcester school district. She explained that both she and Ms. Berube would be working with the group on the project, so communication could go through both of them. She was enthusiastic about having schools participate and was eager to work with the group to make the essay contest fit with the schools' new ELA standards and rigorous curriculum. She agreed that the chapters from *Seven Wonders of Space Technology* should remain the focus and that the main grades involved would still be the fifth- and sixth-grades. She had several suggestions to modify the assignment to make it more rigorous and to make it fit better with the new goals for ELA in the Worcester Public Schools. A full coverage of the discussion with her and her ideas for the project can be found in the prompt section on page eight.

The group then had to decide which schools should participate. Professor Wilkes explained to the group how the public school system in Worcester is structured. He explained that all of the elementary schools were divided into quadrants and that each

quadrant's elementary schools feed students to a specific middle school, and then to a specific high school. The group was also informed that each quadrant had a college or university in Worcester that worked with them for special projects. WPI was associated with the Doherty quadrant. The group mentioned this to Ms. Goldstein and Ms. Berube and suggested that the contest be expanded to schools within the Doherty quadrant. However, Ms. Goldstein and Ms. Berube responded with a recommendation for eight schools in different quadrants. They provided the group with a list of recommended schools, along with the teacher that would run the contest at that school and what grade would participate. This list can be found below.

- Woodland Academy, Bill Foster, grade 5
- Sullivan Middle, Michelle Fulk, grade 6
- Midland, Cecilia Gray, grade 6
- Flagg St, Deb Conn, grade 6
- Norrback, Jan Davini, grade 6
- Vernon Hill, Fran Shepard, grade 5
- Clark St, Carolyn Piccolo, grade 5
- Tatnuck Magnet, Chris Lloyd, grade 5

Using this list, the group sent an e-mail to these teachers with our official proposal. This can be found in the Appendix.

About half of the teachers responded to the initial e-mail. These teachers seemed interested and motivated but wanted to make sure that there would be no cost to them or the school before they committed to the project. The teachers also provided the group with the number of students they believed would participate in the contest. This led to an

estimate of approximately 50 students per school per grade. As the group shifted its focus to working on other aspects of the project, the group continued to send e-mails encouraging the teachers that had not responded to reply to its previous attempts to reach them.

While the group was contacting the teachers in the Worcester Public Schools, it was informed by Professor Wilkes that several local charter schools were interested in participating as well. The school that demonstrated the most interest was the Abby Kelley Foster School in Framingham, Massachusetts. The principal, Amy Puliafico, contacted him with a request for more information on WPI STEM projects in local schools. After she was informed about the project, she expressed interest in having her school participate. She also informed the group that she had already bought the copies of *Seven Wonders of Space Technology* for her school. She had 144 sixth-graders that would be participating. At this time, it had been determined that the maximum number of students that the group could facilitate was around 500, and that the Worcester Public Schools would take up a majority of that number. When the group relayed this information to Ms. Puliafico, she provided the solution that her school would pay for their royalty costs as well as do all the printing at their school. The group happily agreed to have them participate in the contest. She informed the group that the school would try to fit the assignment in before Christmas break, and the group provided her with the contest materials.

Elm Park Community School was not on the list of schools given to us by Ms. Berube and Ms. Goldstein. However, because the contest was held there the previous year and because of the preexisting relationship between WPI and the Elm Park

Community School, Professor Wilkes and the AIAA were eager to have them participate. Professor Wilkes arranged meetings with their fifth- and sixth-grade teachers to discuss the project. Teachers from both grades tentatively agreed to run the contest. The AIAA also gave the group additional funding specifically for the Elm Park Community School. A condition of this funding was that all essays from Elm Park would be evaluated by one member of our team and one member from another IQP group that was working with teachers from Elm Park on evaluating the current science curriculum.

## Cost and Funding

When considering supplying the schools with all of the materials necessary to run the contest, the group had to look into where the funding for all of the supplies would come from. Extensive research was done about fundraising, including the group's own financial support for the project. The main focus was looking into outside organizations for possible grant money to help cover the costs of the contest, which were determined by finding information on the cost of books, photocopies, royalty payments, and other copyright related costs that would need to be covered. For this specific project, the group was successful in acquiring all of the necessary funds to accomplish its specific goals.

### GRANTS TO COVER COSTS

At the beginning of the term, the group knew that each member would have to contribute his or her own money to the completion of the project. All IQP students are expected to spend \$150 of their own personal money towards materials required to complete the project. However, due to the expected scale of the essay contest, it became apparent that more sources of funding were necessary. Therefore, a large part of the beginning of this project was dedicated to looking for additional funding and grants through outside organizations.

One of the first options for funding was the Worcester Education Collaborative. The group got initial indication of a possible grant from them, wasn't able to come up with any donations after several follow ups. Similar issues were encountered with the Global Tech and Engineering Consortium, as the group attempted to contact them and heard even less back from them.

The group also looked briefly into the Ecotarium in Worcester as a possible joint effort for donations as well as a location to host the awards ceremony for the contest. The Ecotarium is an indoor-outdoor interactive museum in Worcester that allows its visitors to explore various exhibits that depict different ecological systems from jungle treetops to wandering through our galaxy. The group thought that, because of its appeal to students, it would be a good place to hold our award ceremony and also gain some recognition for the Ecotarium itself. However, the group was informed that the Ecotarium would not be able to support such an event on short notice, and they do not give out donations regularly.

The group had slightly more success with other organizations after initial contact. Most notably, the group contacted the Worcester Pipeline Collaboration for other options. The grant writer spent some time researching into the possibility of a grant for the project. The group was told that its chances were hopeful for a possible grant, and that the writer asked for around \$1,250. Professor Dempsey had a personal contact that was pursued for a grant as well. This contact, Allen Fletcher, was able to provide the group with \$1000 to go towards the awards ceremony at the conclusion of the contest.

The greatest opportunity for funding, however, was the American Institute of Aeronautics and Astronautics (AIAA). Professor Wilkes is associated with the branch of the AIAA on campus and was a constant liaison between the project group and the AIAA throughout the year in order to pursue a possible grant from the association. The group was informed of the AIAA's involvement with the essay contest in the previous year and decided to inquire about possible funds for this year's contest as well.

An initial grant proposal was written, to be presented at the AIAA New England Section Council meeting held on the WPI campus on October 16<sup>th</sup>, 2013. One of the group members read the proposal in front of the officers of the New England chapter to be decided on at a later date. The official proposal requested a \$500 grant from the AIAA to cover material costs for six schools and \$300 specifically for the contest to be run at Elm Park Community School.

In the beginning of November, the group was informed of a \$500 grant to be provided to the project. There was no news of the \$300 requested for Elm Park. A member of the group attended another AIAA Council meeting on November 13<sup>th</sup>, 2013 to further present the intentions for the contest this year. A few days after that meeting, the group was informed that through some other negotiations the grant was bumped up to \$700 and then \$800 about a week later, with the additional \$300 being set aside specifically for Elm Park. With this increase in donations the final total for funds coming from the AIAA was \$1,100.

#### **CONTACT WITH DR. BORTZ**

Throughout much of the year, the group was in constant contact with Dr. Bortz about the use of his material in the contest. He requested that the books be bought directly from him, as well as pay the royalties to him for any copies of the chapters within his book. He also charged a fee for judging the finalist essays.

Professor Wilkes has been the primary link between the team and Dr. Bortz because of the past relationship they had with last year's essay contest team. He had been trying to get Dr. Bortz to visit the area as part of his trip in New England. If this were to happen, then Professor Wilkes could the AIAA to sponsor the trip and mitigate some of



the travel costs involved with his visit to the schools. The fees that Dr. Bortz has requested are in the section below.

### ESTIMATED CONTEST COSTS

It was determined that the essential materials for the contest would be the books needed for the chapters, the photocopies of all of the book chapters and research materials, as well as royalty costs for the use of Dr. Bortz's material and the judging fee for Dr. Bortz to determine the winning essays. All nonessential costs for the contest included the awards ceremony as well as either Dr. Bortz coming to Worcester himself or sending the group a video presentation from 2011 to show to the participating students.

For the essential costs, the books were bought directly from Dr. Bortz for a price of \$25 each, plus shipping and handling costs. Each of the photocopies made of the chapters would cost one dollar per student copy in royalties, as well as an estimated one dollar per student copy for the printing costs on top of that. For the conclusion of the contest, Dr. Bortz offered to judge the final essays for \$2.50 per essay with a minimum of 20 essays, totaling a minimum payment of \$50. Initial estimates for the maximum amount of participants in the contest (20 classrooms of around 500 students total) resulted in a total cost of \$1,550 for essential materials. Adding in the \$1,250 per day that Dr. Bortz charges for travel costs plus lodging and meals made a grand total of \$2,800. This was more than the group was able to raise.

To minimize costs, it was decided to only purchase books for the first, second, and third prize winners of the contest, which would be autographed copies from Dr. Bortz himself, and use photocopies of the specific chapters and additional materials to give to each of the students with their essay prompt. It was then decided to begin exploring

options for printing the packets, and decided to go through the WPI print shop because of its convenience and the opportunity to get a volume discount. Because we were expecting around 10,000 pages of material with the maximum amount of participants, a volume discount would be very beneficial to minimizing the cost. After an initial estimate of \$520 for the maximum pages, the group was given a final quote of \$348 for all of the packets that would be needed for the contest, which was billed to David Guo of the AIAA directly.

The group would cover the cost of project materials for most of the participating schools. However, the Abbey Kelly Foster School offered to cover all of the printing costs, which led to a lower quote from the print shop. To organize our available funds, the group opened a joint bank account at Bank of America, where each member deposited his or her contribution to the project and to have an accurate record of how much money had been spent on the project. The printing costs were taken out of the \$800 allotted to the project by the AIAA.

### FINAL CONTEST PAYMENTS

The focus of the first half of the year was determining the costs associated with running the contest and acquiring the funds to cover these costs. During C term, much of the acquired funds were spent. The group had three major sources of funding: the AIAA had provided an \$800 grant, alongside an additional \$300 to specifically cover the costs associated with Elm Park, Allen Fletcher's generous donation of \$1,000 (which was initially written as a check to one of the group members and later deposited into the group's bank account), and \$150 contributed by each group member. This covered most

of the expected costs, but some new, unexpected costs related to the award ceremony were paid out of the pockets of the group members.

In addition to the original number of packets printed for the contest, it was later determined that fifty more sixth-grade packets needed to be printed out. This was due to Bill Foster of Woodland Academy running the contest at the sixth-grade level instead of the fifth-grade level as originally thought. This was paid for by the \$600 the group had in its bank account. Originally, the group was going to print the prompts for the contest separately, using the library printers. However, the group later decided that it would be easier and cheaper to print the prompts through the WPI print shop as well. The group was able to get 215 sixth-grade prompts and 120 fifth-grade prompts printed for \$16.75. This was paid using the money in the group's bank account.

The second major expense was the royalty payment for the photocopied chapters of Dr. Bortz's book. The cost of the royalties was one dollar per student. The cost of the royalties was covered completely by the AIAA. Out of the general \$800 allotted for the contest, \$268 was used to pay for the royalties of all of the participating students except for those from Elm Park and the Abby Kelley Foster charter school. The Abby Kelley Foster charter school offered to cover all of the costs associated with running the contest as their school. 124 students from Elm Park participated in the contest, so \$124 of the \$300 grant was used to cover the cost of Elm Park's royalties.

Another major expense that the group expected was the cost of the books. Some of these books were distributed to the libraries of the participating schools, while others were signed by Dr. Bortz and given to the authors of the winning essays as prizes. Each book cost \$25. The cost of the two books for Elm Park (one for each grade participating)

was \$50, and this was taken from the \$300 specifically for Elm Park's expenses. In total, fourteen other books were ordered. The \$350 needed to cover the costs was paid for by check from the group's bank account. The books were shipped to Professor Wilkes' office. They were then picked up and distributed to the students and teachers at the award ceremony.

The final major expense that the group expected to cover was the cost of having Dr. Bortz in attendance at the award ceremony. Initially, the group expected to need to pay \$1,250 as a base fee, plus the cost of travel expenses (gas, lodging, meals, etc.). When it became clear to the group that there was not enough money to cover this cost, Dr. Bortz was contacted and asked if a flat \$1,250 would be sufficient. Dr. Bortz was extremely flexible and thought that this was an acceptable price. The group was able to write a check for one thousand dollars due to the donation of Allen Fletcher. The remaining \$250 was covered using the remaining funds from the AIAA.

As the group proceeded to plan the award ceremony, it quickly became apparent that there would be some unforeseen costs associated with it. Because of the desire to have the award ceremony on campus, it was necessary to reserve a room through the WPI Events Office. Due to the timing and size of the event, there would be a charge of \$31.80 per hour to cover custodial staff. For a four-hour event, this was an unexpected \$127.80 expense. The group had enough money in its bank account to cover this fee. The final fee associated with the award ceremony was the cost of refreshments for the reception. Because there was very little money left in the bank account or from grants, the group decided to pay for the food out of pocket. The total cost of refreshments was roughly \$80.

## Execution of the Contest

### INITIAL CONTACT

The first step in running the contest was to establish who was going to participate in the contest. The group had received a list from Ms. Berube and Ms. Goldstein that included all the schools in the Worcester Public School district that would possibly have an interest. The list also included the names and e-mail addresses of all the teachers that would be responsible for running the contest in their respective schools. The group sent out an e-mail to all the teachers on that list to explain the contest, seek their participation, and ask them to calculate how many students from each grade would participate. The Abby Kelly Foster charter school was also included in this e-mail along with the Elm Park Community School, where the contest was run last year.

Initially, the group did not hear back from many teachers, so Ms. Berube and Ms. Goldstein were contacted again. They reached out to the teachers, and the group started to hear positive responses.

### COLLECTION AND PRINTING OF MATERIALS

Once the group had a rough estimate for the number of students that would be participating, the necessary materials were printed, including the prompts and research material. The grading rubric was printed for the teachers as well. This totaled about 20 pages per packet. The group started looking into places that could print large volumes of pages. At this point, there were about 500 students participating before winter break, and most of them were in fifth-grade. It was decided that three hundred fifth-grade packets and two hundred sixth-grade packets would be printed. The group considered chain stores such as Staples, and went online to find out how much each packet would cost. It was

determined that it would be about one dollar per packet if Staples' services were used. It was decided that this would be too expensive, and the group started looking for other print shops.

The group then considered the printing possibilities at Worcester Polytechnic Institute. Being an IQP, the group initially thought that there would be a possibility that the ATC could print our materials for free. However, the ATC informed the group that it could not print for free, but told the group about the print shop in the basement of Boynton Hall. The group approached the print shop and described the project. The print shop informed the group that it would be possible to print the packets through them. The group decided that the prompts could be printed separately, while the print shop would print the research material packets. The group placed its order with the print shop and waited to hear back from them.

#### DISTRIBUTION OF MATERIALS

After the packets were printed, the group needed to deliver the materials to the schools. The first school that needed materials was the Abby Kelley Foster charter school. At this time, the group did not have enough resources to provide their school with the printed materials needed to run the contest. Digital copies of the prompts and materials were sent to Ms. Puliafico, and the materials for the Abby Kelley Foster charter school were printed on location. At this point, the group was in direct contact with the teacher running the contest at the Abby Kelley Foster charter school, Ms. Fuhr. The group was informed that she could run the contest after right after winter break.

Next, the group turned its attention to the Worcester Public Schools. There were two schools that needed the packets before the group members returned from winter

break. The Tatnuck Magnet Public School in Worcester needed them before winter break. The teacher that ran the contest for Tatnuck Magnet was Christine Lloyd, and she informed the group that she was going to assign the project over winter break as an extra credit assignment. The Clark Street Public School also needed the packets before the group returned from winter break, but they needed the packets in early January. Because one of the group members lived locally, the packets were able to be dropped off at Tatnuck Magnet before break and at Clark Street on the 6<sup>th</sup> of January.

When the group returned to school for C-Term, it was informed that a school had withdrawn from the contest and another two schools had to change how they could participate in the contest. Bill Foster, who was the teacher at Woodland Academy, informed the group that he was teaching sixth-grade instead of fifth-grade. This resulted in the need to print 50 more sixth-grade packets at a cost of \$28.50. The group also heard from Debb Conn, the teacher from the Flagg St Public School. She informed the group that she could no longer participate. Christine Lloyd also informed the group that only three students from Tatnuck Magnet had completed the assignment. Despite this unfortunate news, there were still more than 425 students and eight schools participating.

At this time, Professor Wilkes reminded us that the Elm Park Community School needed to be contacted, as they were the ones that ran the pilot project last year. He was kind enough to arrange a meeting between the group and the sixth-grade teachers from Elm Park. However, the meeting did not go as expected. When the group members showed up, they were told that they only had a few minutes to explain the project because the meeting was actually a weekly staff meeting. The group members did not actually get an opportunity to talk to the teachers because, as the meeting was about to start, the

school's fire alarm sounded. However, the group members did wait outside during the fire drill and talked briefly with Rachel Henry, one of the sixth- grade teachers from Elm Park. She was receptive to the idea of running the contest again at the school and provided the group with her e-mail address.

After the meeting at Elm Park, the teachers from the Abby Kelley charter school, Clark Street , and Tatnuck Magnet had all finished running the contest in the classroom and selected the semifinalists. The group received digital copies of the semifinalists' essays from the Tatnuck Magnet School and the Abby Kelley School, and picked up all the essays from the Clark Street School. All of the semifinalist essays were scanned and uploaded to a dedicated folder in the group's Dropbox folder. This first round of essays was received by the end of January.

The next group of schools that were going to run the contest needed the material in the beginning of February. These schools were Woodland Academy, Sullivan Middle School, the Midland School, and the Elm Park Community School. Because Bill Foster was now running the contest with sixth-graders, more sixth- grade packets were needed. After the group had received another 100 packets from the print shop, the necessary materials were delivered to those schools. When the packets were dropped off, members of the group also talked to the teachers if they were available to make sure they understood their part in running the contest. With all the material now delivered, the group expected to receive the rest of the essays by the end of February. At this point, the group was informed that the Midland School would not be able to participate because excessive snow days had forced them to alter their curriculum. It was also informed that Sullivan Middle School could not fit the contest in as an official assignment. The group



suggested that the contest could be run as an optional assignment. Michelle Fulk, the teacher at Sullivan Middle School, found this agreeable. In the end, four students from Sullivan Middle completed the assignment.

### SELECTION OF THE FINALISTS

After all of the essays were received at the end of February, the group evaluated them in two groups. The group needed to evaluate all of the essays from Elm Park because of the condition set by AIAA attached to the funds they donated to the project. Another IQP project group was evaluating the scientific curriculum at Elm Park, and members of that group helped to evaluate the essays from Elm Park. While one member of our group evaluated the essays from Elm Park along with the members from the separated IQP group, the rest of the group evaluated the essays from the other schools.

The group had initially planned for two semifinalists to be selected from each school, but this would have resulted in only eight to ten finalists. Because Dr. Bortz was charging the group to evaluate a minimum of 20 essays, at least two semifinalists were selected from each school. Only one semifinalist was selected from Tatnuck Magnet because the group only received three essays from that school. A complete list of the finalists can be seen in the Appendix.

After the finalists were selected, the essays were sent to Dr. Bortz. He was to select a first, second, and third place winner for each grade. However, he proposed that instead he select the top three winners from each grade in an unranked fashion. The group found this acceptable. The fifth-grade winners were Kalu Anya from Elm Park, Natalie Dervishian from Tatnuck Magnet, and Maggie McCarthy from Clark Street. The sixth-grade winners were Benjamin Duby from Abby Kelly, Elvis Morocho from Elm Park,

and Hazel Rivera from Elm Park. All of the finalists were invited to the awards ceremony that was held in early March.

## Award Ceremony

The culmination of the project was the award ceremony, which was held at the Worcester Polytechnic Institute campus on March 12<sup>th</sup>, 2014. This event was in planning from the beginning of the project and was organized around the trip that Dr. Bortz took through the New England area at that time. This section outlines the planning of the event as well as the culmination of the events of that day.

### ORGANIZATION AND LOCATION

The project team felt that, in order to bring an appropriate end to the essay contest, an award ceremony would be held for the participants of the contest to be recognized for their outstanding achievements. The group decided to hold this event at the conclusion of the project once the finalists were selected. This ceremony would be held to recognize and congratulate the students for their participation and the hard work they put into their essays. This event would involve a presentation by Dr. Bortz himself, and the date of the ceremony was dependent on his travel schedule as he was making a few stops in the Massachusetts area. In concurrence with his schedule, the project team decided to hold the event on March 12<sup>th</sup>, which occurred during the group's spring break. This meant that only two of the four group members of the group were able to attend.

The decision to bring Dr. Bortz to campus to speak to the participants was made by the advisors and the project team as a way to entice the students to come to the ceremony as well as give them a chance to listen to the man who wrote the material they had read for the contest. In order to accommodate him for his travels, Dr. Bortz initially gave the group an estimate of \$1,250 for travel and lodging expenses. This was the price

given to the group under the assumption that he would be staying for multiple days in the area. When it was determined that he would only be in Worcester for one day, the price was dropped down to \$1,000 for the day. Thanks to the generous donation from Allen Fletcher, the group was able to afford these expenses.

For the location of the event, the group had originally considered the Ecotarium,. It was eventually decided upon that the group would host the event on the WPI campus in one of the larger lecture halls available to WPI students. The group contacted the Events Office and reserved Atwater Kent room 116 for the date of the event. A custodial charge was placed on the room for the duration of the event to cover any cleanup that was necessary at the end of the event.

#### REFRESHMENTS AND SUPPLEMENTAL MATERIALS

When considering the refreshments for the event, the group initially looked into catering through the school as well. WPI has a contact with Chartwells, but it quickly apparent that their services were out of the group's budget range. Instead, the group decided to purchase the food separately through a local Stop & Shop. An assortment of snacks were chosen to appeal to both the children and their parents. The group decided on four bags of chips, two boxes of cookies, a fruit platter, several juices and sodas and a Box O' Joe from Dunkin Donuts, as well as plates, cups and silverware to go along with the food. In total, roughly \$80 was spent on the refreshments for the event.

In addition to the refreshments, the group also created a template for certificates to be given to each of the finalists at the ceremony. The top ten students from each grade were invited to the ceremony and each of them received a certificate congratulating them

for their individual contribution to the contest itself. The top three students in each grade received an autographed copy of *The Seven Wonders of Space Technology* by Dr. Bortz. The template itself was created using Microsoft Word and graphite paper was purchased at a local Staples on which to print the certificate. This cost the group another \$10.

Once all of these were organized, specific invitations were created to send out to all those involved in the contest, as well as certain faculty members at WPI that were an integral part of the contest and project as a whole. Those invited included but were not limited to Professors Dempsey and Wilkes, Kathy Berube, Phyllis Goldstein, Martha Cyr, Allen Fletcher and all of the participating teachers and students and their families. These invitations were also created using Microsoft Word and included all relevant details about the event as well as a map of the WPI campus outlining where the guests can park and the location of the ceremony itself. The student invites were sent out via e-mail to the teachers to be distributed by them to their respective students in order to avoid any complications with communication and contact. The non-student invites were sent directly to the invitees via their personal e-mails.

## ORDER OF EVENTS

On the day of the ceremony, the group purchased all of the supplies and food for the event early in the afternoon. The group members arrived roughly an hour before the event to organize the food and sort out the schedule. It was decided that the event would start off with a brief introduction about the contest itself and the overall process of grading the essays. This would be followed by thanking those who helped the group organize the contest. Then the floor would be given to Dr. Bortz to give his presentation

to the students that he had prepared prior to coming to WPI. This presentation was then followed by the presentation of all certificates and awards to the finalists, leaving some time at the end for questions and to speak personally to Dr. Bortz and the group.

The event itself went very smoothly. Almost all of the finalists were able to attend, and no one seemed to have any trouble with finding the location on campus. The presentation made by Dr. Bortz seemed to be well received by all those who attended as well. The kids seemed to be really excited about the event as a whole, and the teachers of the participating schools continued to thank the group for the work they put into this event.

## Conclusions and Recommendations

Overall, the project was successful in achieving its goals. The group was able to create a coherent and challenging assignment for students to complete. This assignment offered students a chance to learn about a topic that is interesting to them. It also provided the students an opportunity to work on skills that are tested during the MCAS exam, such as reading scientific articles and synthesizing information from different sources. Some of the additional articles included in the contest challenged the students' reading abilities due to the scientific nature of the articles. This helped the students work on their reading and comprehension skills as well.

In total, 360 students (110 fifth-graders and 250 sixth-graders) participated in the contest. This means that the group was successful in expanding the scope of the project. The pilot contest had taken place only at Elm Park Community School. At the beginning of the year, eight schools expressed interest in participating in the project. Ultimately, the contest was run at a total of six schools: Woodland Academy, Clark Street, Tatnuck Magnet, Sullivan Middle, Abby Kelley Foster, and Elm Park.

Feedback from the teachers was generally positive. Both the teachers and students seemed to enjoy participating in the project. The students were excited to be recognized for their hard work. The teachers appreciated the challenge that the research materials provided for their students, and generally thought that the project itself was good practice for the MCAS exam. The biggest suggestion that the teachers had for the group would be to give the students more time to complete the assignment. Several teachers felt that one week was not enough time for the students to read and comprehend the challenging articles that were provided. Two weeks would give the students time to read through the

articles and discuss what they read, improving their comprehension. One teacher also recommended more face-to-face contact between the teachers and the group, as well as the students. This teacher felt that an introduction to the project by a WPI student might have been helpful to the students and increased excitement. The final suggestion from a teacher was to hold the contest earlier in the year, such as in October.

The most important recommendation from the project group would be to start the project earlier. While this year's group was registered to complete the project during B, C, and D terms, it is recommended to be registered for A, B, and C terms, if not the entire year. Though not officially registered for the project, the group found that it was necessary to do much of the preparatory work for the project during A term. Ideally, contact with important administrators would be made over the summer, before the school year starts. These people include Ms. Cyr, Ms. Berube, and Ms. Goldstein. A schedule for the contest should be determined as early as possible, giving schools and teachers ample time to fit the contest into their curriculum and personal schedules. Finally, avenues for funds should be explored as early as possible. This includes contacting non-profit organizations or other outside organizations that may possibly offer the project a grant, as well as brainstorming other ways the group can raise funds.



## Appendix

### LETTER OF INTENT

To Whom It May Concern

We are proposing to host an essay contest, focused on space exploration, for fifth- and sixth-grade students in the Worcester public school district. The primary purpose of the contest is to stimulate interest in STEM, science, technology, engineering, and mathematics. This contest will use Dr. Fred Bortz's book *Seven Wonders of Space Technology* as the primary resource text for the essays. The book is a nonfiction text that explores the history and future of space exploration written for a fifth- and sixth- grade reading level. This contest will test the students' ability to create a well-written essay that includes factual information from their research as well as their own unique and creative ideas. We also hope this contest will provide an opportunity for students to combine writing skills with scientific knowledge.

In the past this essay contest has been run in the months of November and December and with a planned run time of 3 weeks from introducing the prompt to picking up the student essays. We are prepared to do the same this year, However because we understand that teachers have a curriculum that is already in place, we are prepared to move the start and end dates if the district would prefer a different time.

A pilot essay contest was run by a similar student project group in the 2012-2013 school year. However, this group was not focused solely on running an essay contest. Instead, they ran this contest in order to supplement their space-enriched science curriculum and classroom activities. The overall goal of the project was to enhance the science curriculum by exposing students to the ideas of space exploration through many different aspects, such as science kits, field trips and the essay contest. Last year's group was unable to implement the essay contest in a large group of schools, and so focused on Elm Park elementary school.

Our group will be focused solely on the essay contest, with other project groups taking the lead on the curriculum itself. We feel we can build on last year's efforts, and run an effective, multi-school contest. A priority of this project is to minimize the disruption that our project has on the existing curriculum. We understand that introducing this contest into the curriculum with such a small amount of prior notice is difficult, and we are prepared to be as flexible and accommodating as possible.

Teachers would be asked to administer the prompts and reading material and identify the two or three strongest essays per class, which will be submitted as semi-finalists and be further judged by a committee of WPI students. Teachers will have the flexibility to decide how much class time they would like to dedicate to this assignment based on how it fits in the curriculum and the level of support they believe their students need.

The responsibilities of the WPI students involved with this project will include providing the initial material for the project such as prompts, and possibly photocopies of the required reading if it is convenient to the school. After the essay assignment has been completed, WPI students will pick up the semi-finalist essays and judge these essays to determine a number of winners (criteria and number to be determined later). These winners will be invited to an awards ceremony at WPI.

We are exploring all avenues to minimize the monetary cost to schools. Costs include photocopying of required reading, licensing and royalty costs per photocopy, and purchasing copies of the book *Seven Wonders of Space Technology*. In order to minimize this cost each WPI student involved with this project has already personally committed to provide limited funding and an application has already made for funds from the Greater Worcester Community Foundation. If we are successful in finding sufficient outside funding the monetary cost to schools will be zero.

## CONTEST PROPOSAL

WPI Essay Contest IQP 2013-2014

Initial Proposal

### **Overview:**

We are proposing to run an essay contest for fifth and sixth grade students in schools around and in Worcester. This contest will be focused on space technology and will primarily use the book *Seven Wonders of Space Technology*, a nonfiction children's book written by Dr. Fred Bortz about recent achievements in space technology. This contest would test students reading and writing skills as well as their scientific literacy and comprehension. We also hope that this essay contest will help encourage an enthusiasm for science, and identify promising students who show a great interest in science. As of right now Dr. Bortz would be involved in the contest and will be responsible for selecting the winners of the contest for each grade.

### **Rational:**

The core purpose of the proposed essay contest is twofold: to stimulate interest in STEM topics, to improve writing skills and literacy. Ultimately, the contest will also help to prepare students for the MCAS.

The theme of the essay contest is space, a topic students are naturally curious about. This contest would give the students the opportunity to learn more about subjects with real world implications and fields that the students may be interested in pursuing further. Space exploration is the new frontier of science and discovery, and the contest will stimulate the students' interest in these current challenges. For example, the *Curiosity* rover that landed on Mars last year is currently gathering data on the surface of Mars. Recently, the rover discovered that the soil of Mars contains water, which has interesting implications to the scientific community. Students who participate in this contest may find themselves more interested in the field, and thus look to pursue a further understanding of the topic.

The contest will also give the students some experience in writing an essay that is more focused on the facts from the readings and the knowledge they gain from those readings. This focus on expository writing in a fun and interesting topic will help improve the student's skills in writing informational pieces of text and will serve as practice in composing research papers.

Students who participate in this contest will practice drawing information from different sources to write a cohesive essay. Students will be able to improve upon their

reading comprehension skills, as the material provided for the essay contains challenging vocabulary. This essay contest will serve as practice for the MCAS, as students will need to read and understand the material and then fully answer the prompt. Furthermore, teachers can give students copies of sample essays after the contest is completed and have their students assess why those essays' writers did well and where the students can improve. This would serve to help teach the students strategies for writing a successful MCAS essay.

## **Logistics:**

### **Rules:**

Each teacher will distribute the initial material to their students. This material includes a contest introduction sheet including information about the contest for the students, photocopies of a chapter from Dr. Fred Bortz's book *Seven Wonders of Space Technology* as well as other research materials, and possibly a glossary of scientific terms that the students might not be familiar with. The introduction sheet will include an essay prompt related to their grades' chapter, guidelines for the essay like a minimum and maximum word or page count, formatting, and an explanation of the grading criteria and rubric. The IQP team at WPI will be responsible for writing the introduction sheet and glossary, as well as selecting the chapter and other research materials for each grade. Students participating in this contest will be able to write the essay with the provided materials and what they have already learned in class.

After the students are given their initial materials they will have one week to compose their essay. After the students are finished, they will turn in their essays to their teachers. The teachers will choose the best 10 per grade per school as semifinalists. The teachers will choose the semifinalists based on which essays meet the provided judging criteria the best. These semifinalists will be submitted to the IQP team at WPI.

The IQP team at WPI will then be responsible for the selection of the finalists. There will be a finalist and honorable mention selected for each grade in each school. We are expecting about 10 schools to participate which will yield a total of 20 finalists, assuming each school has two grades participating. All finalists and their parents will be invited to an awards ceremony at WPI where each finalist will receive a copy of *Seven Wonders of Space Technology* signed by the author. At this awards ceremony a first, second, and third place winner will be selected for each grade by Dr. Bortz.

### **Proposed Schedule:**

All of the information regarding the contest and costs for the schools will be collected and distributed to the administrators and teachers of the schools expressing interest in the contest. Below is a general, step-by-step timeline for each of the schools to follow for the contest and implement them where it fits within their curriculum.

**Week 1:** Students receive photocopies of the necessary chapters and research materials, along with the essay prompts and glossaries with useful vocabulary.

**Week 2-3:** Essays are due back to the teachers for assessment after the one week writing period at the beginning of the second week. The teachers are given these two weeks to pick two semifinalists from the submitted essays

**Week 4-5:** Semifinalist essays are sent to WPI to be judged by the essay contest team after the teachers select them. Finalists and honorable mentions will be selected by the essay contest team during these two weeks are sent to Dr. Bortz for him to select the winner.

Once the winners are selected by Dr. Bortz an awards ceremony for finalists and honorable mentions will be held at WPI. The exact date of the ceremony will be determined at a later date but initial timeline estimates put the ceremony in mid-March.

#### **Costs:**

Most of our projected costs are going to come from gathering the materials necessary for the essay contest to run. This includes getting copies of the essay prompts, the chapters from *Seven Wonders of Space Technology*, and any other research materials to each student, as well as securing copies of the books to be used as prizes for the finalists of the competition. We were also looking into possibly running some sort of Awards Ceremony for the finalists after they have been selected.

We have been in contact with Dr. Bortz, the author of *Seven Wonders of Space Technology*, and he has informed us he will be charging \$25 per book plus any shipping costs that are added on top of that. He will also charge \$1 in royalties for every photocopy the students receive of the necessary chapters for the contest itself. Initial estimates using an average of 25 students per classroom and assuming a max of 20 fifth- and sixth- grade classes, the costs from the books and royalties will be about \$1000. Further costs related to the judging of the essays and the awards ceremony have yet to be determined, and are hoping to be covered by outside sources.

We are currently researching into grants from organizations that are willing to help support the contest. We have also committed funds of our own to this project. We understand that money is an issue and we are committed to exploring all options to decrease the cost of this project.

FIFTH-GRADE PROMPT

# FIFTH-GRADE SPACE EXPLORATION ESSAY CONTEST

The New England chapter of the American Institute of Aeronautics and Astronautics is sponsoring an essay contest, based around the book *Seven Wonders of Space Technology* by Dr. Fred Bortz. You will receive a photocopy of the book's fourth chapter, "Moon Bases and Moon Water," along with additional research materials. Read through the materials given, then write an essay that answers the following prompt:

The first Apollo mission to the moon provided inconclusive results about the presence of water on the moon. This meant that prior to 2008, many scientists were unsure about the existence of water on the moon. In 2009 NASA confirmed the presence of water on the moon using LCROSS (Lunar Crater Observation and Sensing Satellite). Describe NASA's process for confirming water on the moon and what tools were used. Also describe the implication of this discovery, and why water is important in the field of space exploration.

Your essay must be between 500 and 800 words. You must use at least one of the other provided sources beyond the chapter, and you must cite those sources.

You should aim to write an essay that answers the questions in the prompt, is well-organized, correctly describes the factual information in the chapter and outside sources, and shows your understanding of it. Your essay will be judged by the criteria stated in the attached rubric. The contest judging is separate from your teacher's grading of your essay.

Remember to:

- Read the prompt carefully.
- Explain your answer.
- Add supporting details.
- Proofread your work.

You must turn your essay in to your teacher one week after the essay is assigned. The essays will then be judged by Dr. Bortz and a committee of WPI students. A finalist from each school will be selected to attend an awards ceremony where the three best essays will be announced. The authors of those essays will each receive a copy of *Seven Wonders of Space Technology*, autographed by Dr. Bortz.

If you have any questions about the contest, talk to your teacher or send an e-mail to WPI Contest Coordinators at [essayIQP2013@wpi.edu](mailto:essayIQP2013@wpi.edu).

#### SIXTH-GRADE PROMPT

# SIXTH-GRADE SPACE EXPLORATION ESSAY CONTEST

The New England chapter of the American Institute of Aeronautics and Astronautics is sponsoring an essay contest, based around the book *Seven Wonders of Space Technology* by Dr. Fred Bortz. You will receive a photocopy of the book's fifth chapter, "Mars Rovers," along with additional research materials. Read through the materials given, then write an essay that answers the following prompt:

A little over a year ago, the rover Curiosity landed on Mars, marking the beginning of a new adventure and another chance to learn more about the "Red Planet". Two other rovers, Spirit and Opportunity, landed in 2004. Spirit is no longer operational, but Opportunity still provides us with valuable data. Describe the differences among the rovers Spirit, Opportunity, and Curiosity, including their tools, their power sources, and their goals. What challenges did NASA have to overcome when preparing to land on Mars?

Your essay must be between 500 and 1000 words. You must use at least one of the other provided sources beyond the chapter, and you must cite those sources.

You should aim to write an essay that answers the questions in the prompt, is well-organized, correctly describes the factual information in the chapter and outside sources, and shows your understanding of it. Your essay will be judged by the criteria stated in the attached rubric. The contest judging is separate from your teacher's grading of your essay.

Remember to:

- Read the prompt carefully.
- Explain your answer.
- Add supporting details.
- Proofread your work.

You must turn your essay in to your teacher one week after the essay is assigned. The essays will then be judged by Dr. Bortz and a committee of WPI students. A finalist from each school will be selected to attend an awards ceremony where the three best essays

will be announced. The authors of those essays will each receive a copy of *Seven Wonders of Space Technology*, autographed by Dr. Bortz.

If you have any questions about the contest, talk to your teacher or send an e-mail to WPI Contest Coordinators at [essayIQP2013@wpi.edu](mailto:essayIQP2013@wpi.edu).

## AIAA FUNDS PROPOSAL

WPI Essay Contest IQP 2013-2014

AIAA Funds Proposal

### **Overview:**

We are proposing to run an essay contest for fifth- and sixth- grade students in schools around and in Worcester. This contest will be focused on space technology and will primarily use the book *Seven Wonders of Space Technology*, a nonfiction children's book written by Dr. Fred Bortz about recent achievements in space technology. This contest would test students reading and writing skills as well as their scientific literacy and comprehension. We also hope that this essay contest will help encourage an enthusiasm for science, and identify promising students who show a great interest in science. As of right now Dr. Bortz would be involved in the contest and will be responsible for selecting the winners of the contest for each grade.

### **Costs:**

Most of our projected costs are going to come from gathering the materials necessary for the essay contest to run. This will primarily include the cost of printed material for each student in the contest. As of right now we are expecting 8 schools to participate with 1 grade level per school and approximately 40 students per grade level. This means that we are estimating 500 students will participate.

Because we cannot assume that each student will have access to the internet all reading that the students do will have to come from printed handouts. The printed handouts will consist of a photocopied chapter from Dr. Bortz's book *Seven Wonders of Space Technology* and any additional reading material. We have been in contact with Dr. Bortz and the royalty cost per copy of photocopied chapter will be \$1. Because we are looking for supplemental material that is free to use for educational purposes there would be no royalty cost for supplemental reading material. This means that cost per student would be equal to the royalty cost for Dr. Bortz and the cost of printing for the handouts. We are estimating that the cost of printing for the handouts could be anywhere from \$0.50 – \$1.00 per copy. Because this is an IQP the group is committed to providing funds of our own in the amount of \$600 (\$150 per group member) which we are hoping covers the royalty costs. This leaves us with an estimated cost of approximately \$500 for the printing costs.

Due to copy rights issues for the use of the book *Seven Wonders of Space Technology*, by Dr. Bortz, it is required of the group to buy a copy for each grade in each



school that is participating. Normally this book is a \$35 book, but with the help of Dr. Bortz the price of each book will be \$25. With 8 schools participating, the financial need that arises to cover the cost of this is \$200.

We are hoping that the AIAA would sponsor the contest and assist with this \$700 of essential funding. That is needed to make this contest a success.

### COST AND FUNDING SPREADSHEET

| Essay Contest Expenses |               |  |                |                      |
|------------------------|---------------|--|----------------|----------------------|
| Item                   | Initial Price | Details  | Expected Count | Final Expected Price |
| Books                  | \$ 25.00      | Per book*  | 20             | \$ 500.00            |
| Photocopy Royalties    | \$ 1.00       | Per student per school copy*                                       | 500            | \$ 500.00            |
| Judging Fee            | \$ 2.50       | Per essay, minimum 20 essays                                       | 20             | \$ 50.00             |
| Printing Cost          | \$ 1.00       | Per student per school copy*                                       | 500            | \$ 500.00            |
|                        |               |  |                | \$ -                 |
| Shipping               | \$ -          | costs for books to get here  | 20             | \$ -                 |
| <b>Essential Total</b> |               |  |                | <b>\$ 1,550.00</b>   |
| NON ESSENTIAL          |               |  |                |                      |
|                        |               |  |                | \$ -                 |
| Presentation Fee       | \$ 100.00     | Per showing up to 100 students, over \$100 = \$1 per student over* | 10             | \$ 1,000.00          |
| Awards Ceremony        | \$ -          | Finalists come to WPI?   | 1              | \$ -                 |
| Visit by dr. bortz     | \$ 1,250.00   | per day plus expenses  | 1              | \$ 1,250.00          |
| <b>Total</b>           |               |  |                | <b>\$ 3,800.00</b>   |
|                        |               |  |                |                      |
|                        |               |  |                |                      |
|                        |               |  |                |                      |
| Essay Contest Funding  |               |  |                |                      |
|                        |               |  |                |                      |
| Group Contributions    | \$ 150.00     | Per member   | 4              | \$ 600.00            |
| AIAA                   | \$ 800.00     | Flat   | 1              | \$ 800.00            |
| <b>Total</b>           |               |  |                | <b>\$ 1,400.00</b>   |

ORIGINAL PARTICIPANTS SPREADSHEET (AS OF DEC. 14<sup>TH</sup>, 2013)

| Essay Contest        |                 |                   |                          | Number of students participating |
|----------------------|-----------------|-------------------|--------------------------|----------------------------------|
| Participant Schools  | Grades          | Contact Teachers  | Email                    |                                  |
| Woodland Academy     | 5th             | Bill Foster       | FosterW@worc.k12.ma.us   | 68                               |
| Vernon Hill          | 5th             | Fran Shepard      | ShepardFr@worc.k12.ma.us |                                  |
| Clark St             | 5th             | Carolyn Piccolo   | PiccoloC@worc.k12.ma.us  | 39                               |
| Tatnuck Magnet       | 5th             | Christine Lloyd   | LloydC@worc.k12.ma.us    | 35                               |
| Sullivan Middle      | 6th             | Michelle Fulk     | FulkM@worc.k12.ma.us     | 48                               |
| Midland              | 5th             | Zohar Badenhausen | BadenhausenZ@worc.k12.m  | 42                               |
|                      | 6th             |                   |                          | 36                               |
| Flagg St             | 6th             | Deb Conn          | ConnD@worc.k12.ma.us     | 64                               |
| Abby Kelley Foster   | 6 <sup>th</sup> | Amy Puliafico     | apuliafico@akfcs.org     | 122                              |
| Elm Park             | 5th             |                   | coxk@worc.k12.ma.us      |                                  |
|                      | 5th             |                   | holtt@worc.k12.ma.us     | 23                               |
|                      | 5th             |                   | fordp@worc.k12.ma.us     | 23                               |
|                      | 5th             |                   | ridickk@worc.k12.ma.us   |                                  |
|                      | 5th             |                   | mahoneyf@worc.k12.ma.us  | 22                               |
|                      | 6th             |                   | henryr@worc.k12.ma.us    |                                  |
| Total participants   | 522             |                   |                          |                                  |
| not including Abby K | 400             |                   |                          |                                  |
| 5th grade total      | 252             |                   |                          |                                  |
| 6th grade total      | 148             |                   |                          |                                  |

## FINAL PARTICIPANTS SPREADSHEET

| Essay Contest Participant Schools | Grades          | Contact Teachers | Email                      | Number of students participating |
|-----------------------------------|-----------------|------------------|----------------------------|----------------------------------|
| Woodland Academy                  | 6th             | Bill Foster      | FosterW@worc.k12.ma.us     | 68                               |
| Clark St                          | 5th             | Carolyn Piccolo  | PiccoloC@worc.k12.ma.us    | 39                               |
| Tatnuck Magnet                    | 5th             | Christine Lloyd  | LloydC@worc.k12.ma.us      | 3                                |
| Sullivan Middle                   | 6th             | Michelle Fulk    | FulkM@worc.k12.ma.us       | 4                                |
| Abby Kelley Foster (Charter)      | 6 <sup>th</sup> | Amy Puliafico    | apuliafico@akfcs.org       | 122                              |
| Elm Park                          | 5th             |                  | coxk@worc.k12.ma.us        |                                  |
|                                   | 5th             |                  | holtt@worc.k12.ma.us       | 23                               |
|                                   | 5th             |                  | fordp@worc.k12.ma.us       | 23                               |
|                                   | 5th             |                  | ridickk@worc.k12.ma.us     |                                  |
|                                   | 5th             |                  | mahoneyf@worc.k12.ma.us    | 22                               |
|                                   | 6th             |                  | henryr@worc.k12.ma.us      | 56                               |
| Total participants                | 360             |                  |                            |                                  |
| not including Abby Kelly          | 238             |                  |                            |                                  |
| 5th grade total                   | 110             |                  | Non Elm Park or Abby Kelly | 114                              |
| 6th grade total                   | 250             |                  |                            |                                  |

## TEACHER GRADING RUBRIC

| Category             | 5  | 4   | 3  | 2   | 1   | Raw Score | Scaler | Weighted Score           |
|----------------------|--|---|--|---|---|-----------|--------|--------------------------|
| Scientific Accuracy  | All questions are answered accurately and completely.  | Most questions are answered accurately.   | Half of the questions are answered accurately.   | A few of the questions are answered accurately.   | No questions are answered.  |           | 1.5    | 0                        |
| Spelling and Grammar | Correct spelling and grammar used throughout the essay.  | Few spelling and grammar mistakes.  | Some spelling and grammar mistakes.  | Many spelling and grammar mistakes. Essay is difficult to read.                                 | Severe spelling and grammar mistakes. Essay is almost unreadable. |           | 1      | 0                        |
| Organization         | The introduction is interesting. The body supports the focus. The conclusion works well. Transitions are used. | The essay is divided into an introduction, a body, and a conclusion. Some transitions are used. | The introduction or conclusion is weak. The body needs a paragraph for each answer. More transitions are needed. | The introduction, body, and conclusion all run together. Paragraphs and transitions are needed. | The essay should be reorganized.                                  |           | 1      | 0                        |
| Comprehension        | Used many specific details correctly and shows complete understanding. Used two or more sources.               | Used many specific details correctly. Used two or more sources.                                 | Used some specific details. Used two or more sources.  | Used some specific details. Only one source used.   | Used few or inaccurate details. Only one source used.             |           | 1.5    | 0                        |
|                      |  |   |  |   |   |           |        | <b>Total Score (/25)</b> |
|                      |  |   |  |   |   |           |        | <b>0</b>                 |

# Congratulations!

You have been selected as a finalist for the WPI AIAA Space Technology Essay Contest! You and your parents or guardians are invited to an award ceremony at WPI!

Your essay is currently being reviewed by Dr. Fred Bortz, the author of *Seven Wonders of Space Technology*. He will be announcing the top three essays for each grade at the award ceremony at WPI.

The award ceremony will be held on **March 12<sup>th</sup> at WPI in Atwater Kent Laboratories room 116 from 4pm to 7pm**. The attached map shows the location of the ceremony, as well as where to park. The ceremony will include a speech by Dr. Fred Bortz. He will then present the awards to the top three essays from each grade. After, there will be refreshments and a reception where Dr. Fred Bortz will be available for one on one questions.

**Please RSVP by Monday, March 10<sup>th</sup> with the number of guests that plan on attending. You can RSVP by e-mailing [essayIQP2013@wpi.edu](mailto:essayIQP2013@wpi.edu) or calling 781-252-9003.**



# Campus Map

## CAMPUS STRUCTURES

- 1 Air Force and Aerospace Studies
- 2 Alden Memorial
- 3 Alumni Gym
- 4 Atwater Kent Laboratories
- 5 Bartlett Center
- 6 Boynton Hall
- 7 Campus Center
- 8 Campus Police
- 9 Collegiate Religious Ctr
- 10 20 Trowbridge Road
- 11 Fuller Laboratories
- 12 Gateway Phase II
- 13 Goddard Hall
- 14 Gordon Library
- 15 Hackfeld House
- 16 Harrington Auditorium
- 17 Health Center
- 18 Higgins House
- 19 Higgins Laboratories
- 20 Hughes House
- 21 International House
- 22 Jepson House (One Drury Lane)
- 23 Kaven Hall
- 24 OASIS
- 25 Olin Hall
- 26 37 Lee Street
- 27 Power House
- 28 Project Center
- 29 Salisbury Laboratories
- 30 Skull Tomb
- 31 Sports & Recreation Center
- 32 Stratton Hall
- 33 Student Development and Counseling Center
- 34 Washburn Shops and Stoddard Laboratories
- 35 WPI Life Sciences and Bioengineering Center
- 36 85 Prescott Street

- 37 Lee Street
- 38 Power House
- 39 Project Center
- 40 Salisbury Laboratories
- 41 Skull Tomb
- 42 Sports & Recreation Center
- 43 Stratton Hall
- 44 Student Development and Counseling Center
- 45 Washburn Shops and Stoddard Laboratories
- 46 WPI Life Sciences and Bioengineering Center
- 47 85 Prescott Street

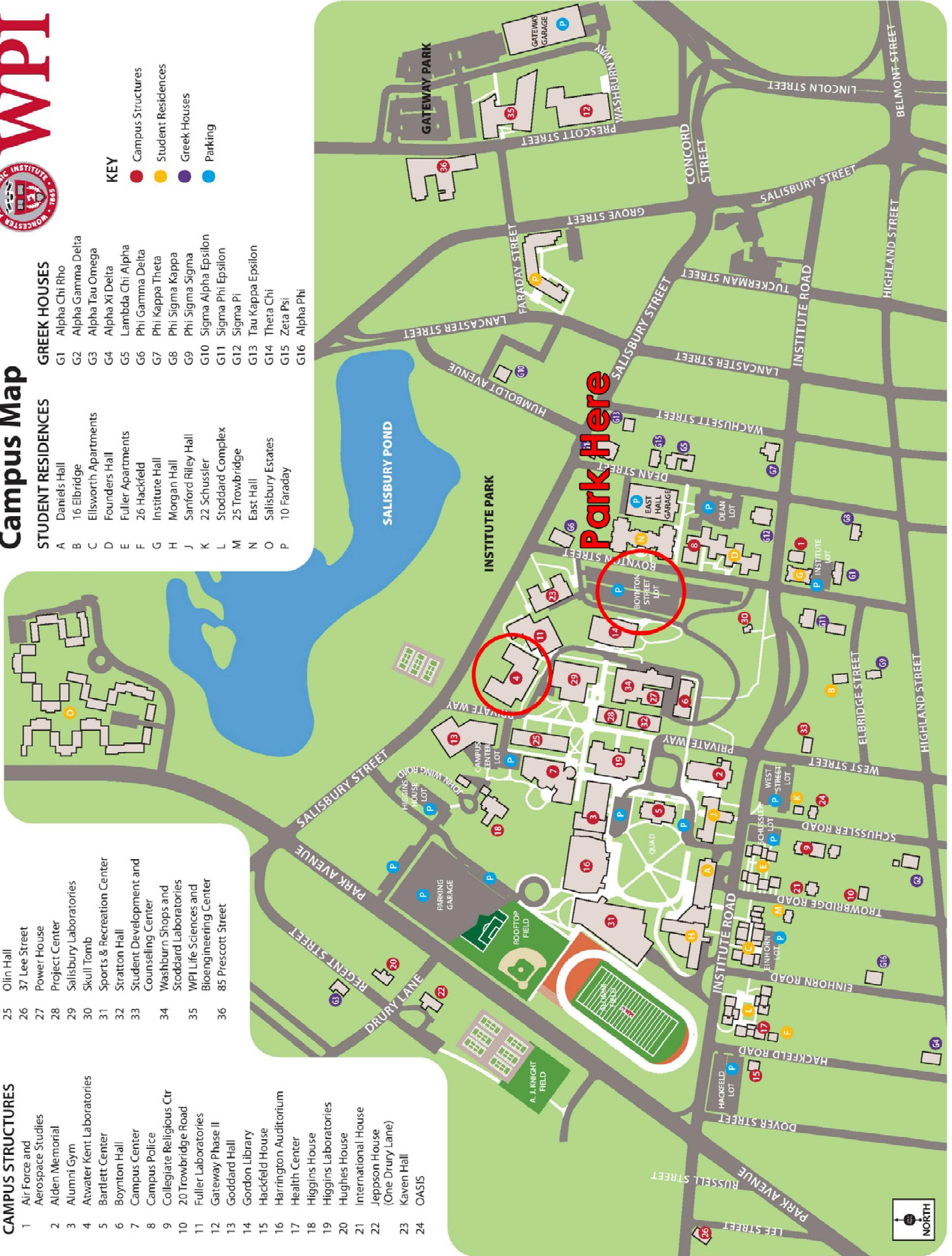
## STUDENT RESIDENCES

- A Daniels Hall
- B 16 Elbridge
- C Ellsworth Apartments
- D Founders Hall
- E Fuller Apartments
- F 26 Hackfeld
- G Institute Hall
- H Morgan Hall
- J Sanford Riley Hall
- K 22 Schussler
- L Stoddard Complex
- M 25 Trowbridge
- N East Hall
- O Salisbury Estates
- P 10 Faraday

## GREEK HOUSES

- G1 Alpha Chi Rho
- G2 Alpha Gamma Delta
- G3 Alpha Tau Omega
- G4 Alpha Xi Delta
- G5 Lambda Chi Alpha
- G6 Phi Gamma Delta
- G7 Phi Kappa Theta
- G8 Phi Sigma Kappa
- G9 Phi Sigma Sigma
- G10 Sigma Alpha Epsilon
- G11 Sigma Phi Epsilon
- G12 Sigma Pi
- G13 Tau Kappa Epsilon
- G14 Theta Chi
- G15 Zeta Psi
- G16 Alpha Phi

- KEY**
- Campus Structures
  - Student Residences
  - Greek Houses
  - Parking



## NON STUDENT INVITES

You have been invited to attend the award ceremony for the WPI AIAA Space Technology Essay Contest. This contest challenged fifth- and sixth- grade students in the Worcester area to write an essay based on a specific subject in space technology. Dr. Fred Bortz, the author of *Seven Wonders of Space Technology*, will be in attendance and announcing the winners of the contest.

The award ceremony will be held on March 12<sup>th</sup> at WPI in Atwater Kent Laboratories room 116, from 4pm to 7pm. The ceremony will include a speech by Dr. Fred Bortz. He will then present the awards to the top three essays for each grade. After, there will be refreshments and a reception where Dr. Fred Bortz will be available for one on one questions.

Please RSVP by Monday, March 10<sup>th</sup> with the number of guests that plan on attending. You can RSVP by e-mailing [essayIQP2013@wpi.edu](mailto:essayIQP2013@wpi.edu) or calling 781-252-9003.

★ **Certificate of Excellence** ★

is presented to

Insert STUDENT'S NAME here

for

WPI Space Technology Essay Contest

*"Dr. Fred" Bortz*  
Signature

**March 12<sup>th</sup>, 2014**  
Date

Insert SCHOOL/CLASS NAME here



## ESSAY CONTEST FINALISTS

### Essay Contest Finalists:

- 5<sup>th</sup> Grade
  - o Clark Street
    - Luke Woodard Kadia (21.5) pg 10-11
    - Maggie McCarthy (19.5) pg 16-17
    - Kaylee St. Pierre (18.5) pg 5-6
    - Hunter Malone (18.5) pg 14-15
  - o Elm Park
    - Truc Nguyen (21.5)
    - Kalu Anya (20)
    - Anna Aziz (20)
    - Narmean Khaled (19)
  - o Tatnuck Magnet
    - Natalie Dervishian (21)
    - Demetrios Kennedy (20.5)
- 6<sup>th</sup> Grade
  - o Abby Kelly
    - Marek Konopka (24)
    - Benjamin Duby (22.5) (4,5,4,5)
    - Ramona Ansung (22.5) (4,4,5,5)
    - Grace Schwartz (22.5) (4,4,5,5)
  - o Elm Park
    - Elvis Morocho (24.5)
    - Hazel Rivera (24)
    - Gabriel Hernandez (23.75)
  - o Sullivan
    - Jacob Boatright
  - o Woodland
    - Pha Phan (22.5)
    - Kevin Ngo (21.5)