AIAA-NCS Volunteer Judges Choose the Area's Best Aerospace-Related Science Fair Projects

Editor: Nils Jespersen (The Aerospace Corporation)

From March 12th to March 19th, 2016, members of the American Institute of Aeronautics and Astronautics (AIAA) National Capital Section (NCS), reviewed hundreds of projects at regional STEM/Science & Engineering Fairs, interviewed students from grades 9-12, and awarded honors to the top performers for their aerospace-related projects. In addition to the Washington, DC STEM Fair, three were held in Maryland, and four in Northern Virginia. Although the bulk of the entries were individual projects, four winning projects came from teams of two or three students. In the team entries, it was evident that all members equally shared in developing, and understanding, the technology involved. In all cases, the students showed clear grasp of their work, and provided well-prepared presentations.

Again, this year, **NASA Goddard Space Flight Center (GSFC)** will be hosting our winners for a 3-day experiential learning visit at the Center's facilities and laboratories in Greenbelt, MD. As part of this experience the awardees will have a field trip to Wallops Island and get a tour of Virginia's premier launch facility. As part of this experience, the awardees will engage, one-on-one, with facility staff, and explore the Mission Lifecycle through active participation in the same critical phases NASA uses in mission design and execution. This very special program was realized owing to the creative efforts of past and present AIAA-NCS staff and associates. Ms. **Amanda C. E. Harvey**, Learning Expert in the NASA Goddard Space Flight Center, Office of Education, is coordinating this event for our science fair winners.

Uniformly, the AIAA-NCS volunteer judges had a very rewarding time interacting with these budding aerospace engineers and scientists. What follows is a sampling of what the judges experienced, at the individual fairs, and how they went about selecting the top projects for special recognition.

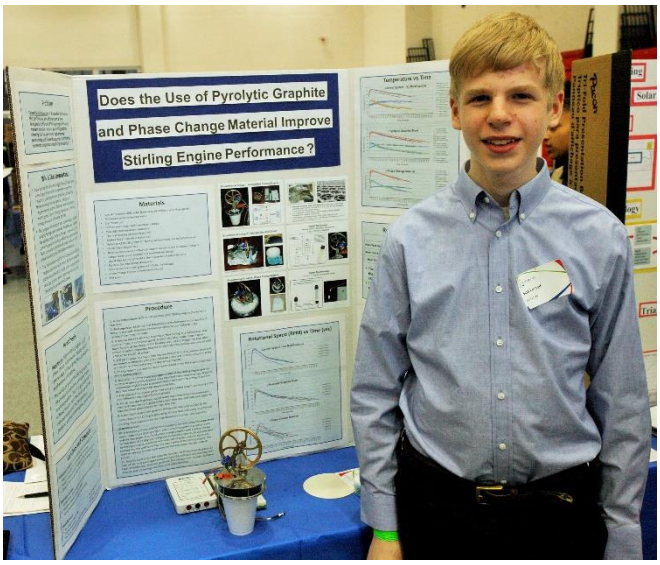
DC STEM Fair

On March 19, 2016, four representatives of AIAA-NCS collaborated to identify the best high school aerospace-related projects, at the Dunbar Senior High School, in Washington, DC. The judging team consisted of Mr. **Abhilash Malipeddi** (a PhD student at George Washington University specializing in computational fluid dynamics), Ms. **Sirisha Bandla** (a microgravity researcher for Virgin Galactic, Government Affairs), Mr. **Ian Ross** (a spacecraft navigation engineer with the firm ASRC Federal, supporting NOAA/NASA), and Dr. **Nils Jespersen** (a satellite systems engineer with The Aerospace Corporation).

The DC STEM Fair Judging Team (l to r): Mr. Abhilash Malipeddi, Ms. Sirisha Bandla, Dr. Nils Jespersen, and Mr. Ian Ross.

The science fair staff provided a pre-filtered list of projects that they deemed met the criteria that AIAA-NCS had indicated. While this list was a useful point of departure, the team decided to survey all of the potential projects on the floor and developed a short list of the most appropriate projects. From this short list, the team interviewed the students and, then, settled on the 1st, 2nd, and 3rd place finalists.

First Place: "Does the Use of Pyrolytic Graphite and Phase Change Material Improve Stirling Engine Performance?"



School Without Walls 9th grade student **Sam Lossef**, entered his project: "Does the Use of Pyrolytic Graphite and Phase Change Material Improve Stirling Engine Performance?" in the category of Engineering and Computer Science. Sam became intrigued by the intricacies of the Stirling cycle engine and, after having acquired a small, low temperature differential model, proceeded to look at ways to improve its efficiency. It occurred to him that if he could improve the heat sinking capability on the cold side of the engine, then performance might improve (as measured by the peak and average rpm of the engine). Pyrolytic graphite seemed "interesting" to him, so that was one candidate material. Also, he thought a phase change material might work as well in maintaining the cold end at a fixed temperature. So, he used encapsulated paraffin wax with the desired melting point. He hypothesized that the pyrolytic graphite might be the better of the two, and his experiments proved him correct.

The judges were very impressed with this young researcher on multiple fronts:

- He was articulate, excited about his work, and understood and could explain, the most intricate parts of his setup and the phenomenology in back of it.
- He integrated different sensors into the experiment and set up the data acquisition to a computer. He wrote his own LabView routine to acquire, plot, and reduce his experimental data.
- He had a clear grasp of accuracies and variabilities in the experimental process and, further, how to apply these ideas to his data presentation.
- He was able to point to how Stirling engines are actually applied in some spacecraft applications.

All in all, Sam did an outstanding job with his project, and the judges all agreed he was deserving of first place for aerospace-related projects at the DC STEM Fair.

Second Place: "Making Wind"

Noelle Pierce, an 11th grader from Washington MST, entered her project: "Making Wind" in the Earth/Space category of the science fair.

Noelle wanted to explore the attributes of wind turbine blades, both in total number and in shape, and how these characteristics affected the efficiency of the turbine system. She made a turbine stand from PVC tubing, and set up a simple wind source from a typical household fan. She used a small generator to measure output voltage from the rotating turbine. Noelle showed good scientific method by first experimenting with turbine blade shape and aspect ratio (the long, thin version was too flimsy for her use) and, once settled on a good shape, proceeded to change the number of blades in the turbine system: 2, 3, 4, and 5-blades. She even attempted one blade, but found that the system was too unbalanced for practical use. In the end, she discovered that the 2-blade system provided the best results. Her plotted results only showed three trials but, when the

judges questioned her about that, she said that she actually did 15 trials, but felt that it all would not fit on the paper.

Noelle's project exemplified the iterative design methodology. In all, the judges felt that Noelle showed good understanding about the underlying principles, and took a good approach to the experimental work, including appropriate repetition to assess experimental error.

Third Place: "Magnet Madness"

Bjorn Shockey, Noah Freedman, and Joseph Montrey comprised a 9th grade team that entered a project called: "Magnet Madness" in the Earth/Space category. This, very animated, team sought to explore how temperature affects the magnetic flux in fixed magnets. They used a hot plate for high temperatures, and dry ice for cold. For flux measurement they used a combination of a slide with embedded metal filings, and a cell phone application that records magnetic flux in proximity to its internal magnetometer. The team recognized the high degree of experimental error in their experimental arrangement and felt somewhat frustrated that they were unable to get access to more controlled apparatus (e.g. vacuum chamber). That said, the team had a well-rehearsed presentation, where all three participated, and were able to confidently field questions that the judges posed. They were one of the few to analyze the experimental data closely and were able to fit their data into a model.

Prince William-Manassas Regional Science Fair – 12 March 2016

AIAA-NCS was represented at the Prince William-Manassas Regional Fair, Saturday 12 March 2016 by members **Joe Marshall**, **Josh Powers** and **David Myre**. As organizational judges, they examined projects in the senior division. They chose three projects due to their outstanding quality and relevance to aerospace engineering.

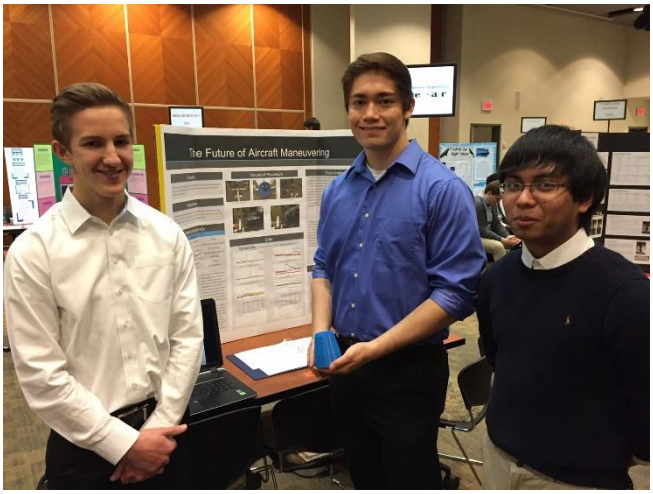
First Place: "Bee-Bot Rover"

First place went to **Alexander Giffen, Razi Rals** and **Chan Wook Mun** and their project "Bee-Bot Rover". Their project was motivated by indications that natural pollinator populations may be in danger and an artificial means may be necessary to address this concern. Their "Bee-Bot" was designed to transport pollen from one flowering plant to another. The project involved the development of a control station for operating the rover sensor and commanding the rover, a graphical user interface, flower image recognition, and the rover microprocessor program. Development environments included C++ and Python. Tradeoffs during the project included moving the processing from the rover to a remote computer for needed processor performance, and switching from a drone to a ground based rover that was easier to control. The team was highly energized, knowledgeable about all aspects of the project, and had an enthusiasm that was infectious to say the least.

Second Place: "Passive Acoustic Detection of a Quadcopter Drone"

Second place was awarded to **Anne Bray** for her thorough and insightful project "Passive Acoustic Detection of a Quadcopter Drone". She examined the means by which small non-cooperative drones, like a quadcopter, could be sensed remotely. The study led her to examine acoustic sensing of drones, despite having more limited range, since other signatures had an apparent lower probability of detection. Her project involved experiment design, complex acoustic signal analysis (including the application of Fourier transforms and the sonar equation), data acquisition, and reduction. She reversed the usual measurement approach by keeping the drone in place and moving microphones by it at different heights and distances. Results indicated that two distinct signatures were present: viz. that of the interaction between the air and quadcopter blades, as well as electric motor noise. Her thorough knowledge of all aspects of the project and heuristic assessment of the results made the project all the more compelling.

Third Place: "The Future of Aircraft Maneuvering"

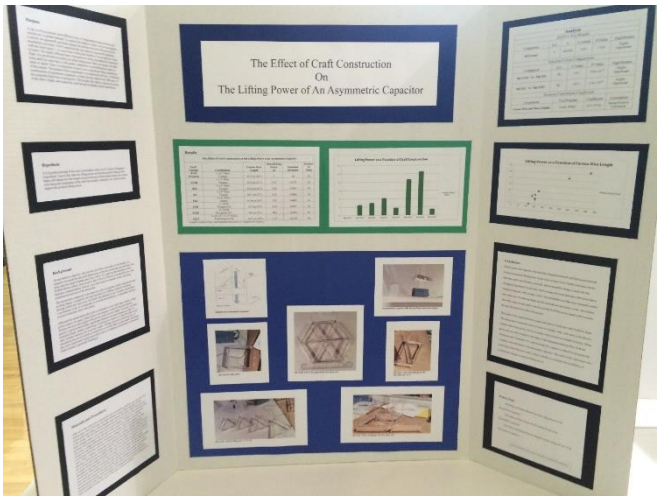


Third place went to **Will Perez, Jason Linus Gonzaga and Adam Tucker** for their project "The Future of Aircraft Maneuvering". This exciting project continued Will's exploration of the previous year into aircraft control actuators. In this project the team designed and fabricated a model aircraft nozzle, with thrust vectoring, through the use of multiple annular co-flow ports, allowing the articulation of blowing into the main nozzle flow. To test this nozzle, they used a force balance and mounted it at the center of gravity in a large-scale model. All three students showed real enthusiasm for aeronautics.

Northern Virginia Regional Science and Engineering Fair

The NoVA Science Fair was held at Wakefield High School, in Arlington, on March 12, 2016. **Aaron Botwin**, **Nitin Raghu**, and **Arthur Orton** comprised the AIAA-NCS judging team.

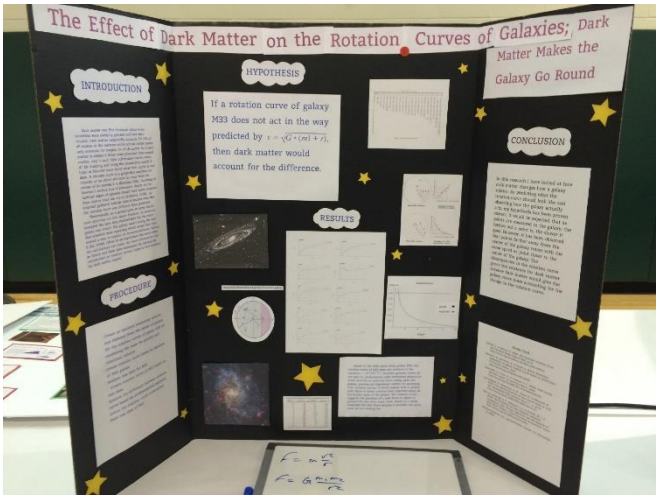
First Place: "The Effect of Craft Construction on the Lifting Power of an Asymmetric Capacitor"



This year's first place award was given to **Jayaprakash Kambhampaty**, a 10th grade student at Washington-Lee High School, for his project entitled "The Effect of Craft Construction on the Lifting Power of an Asymmetric Capacitor", which he entered in the Engineering category. Jayaprakash, who goes by Jaya, impressed the judges with great engineering work. He constructed several different design configurations of an ion propulsion hovercraft. He then identified trends between the total length of metal wire used for the propulsion system and the resulting lifting power of the craft.

Jaya demonstrated a lot of skill and drive with his work. Constructing a working vehicle of this nature is challenging enough, but Jaya went above and beyond by producing a design stable and precise enough to establish a performance trend with each incremental design change. His strong use of the scientific method was demonstrated by clear identification of variables, repeatable approach to measurement, and organized data reduction. It was clear to the judges that Jaya has the hallmarks of a great engineer.

Second Place: "The Effect of Dark Matter on the Rotation Curves of Galaxies"

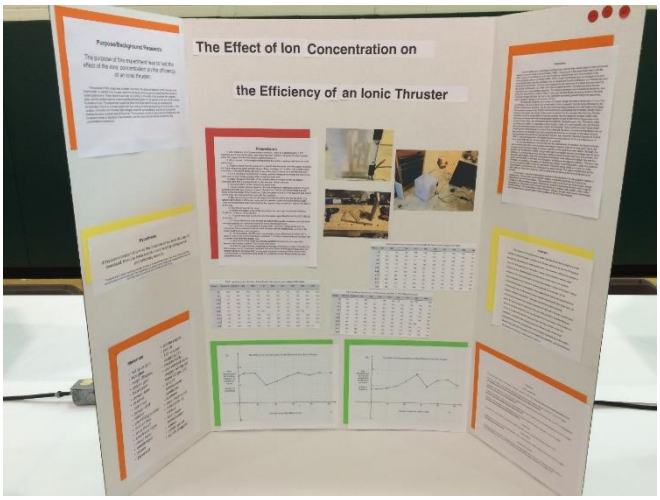


The second place award went to **Jessica C. Mellon**, an 11th grade student at T.C. Williams High School, for her project "The Effect of Dark Matter on the Rotation Curves of Galaxies", which she entered in the Physics category. Jessica showed the existence of dark matter through examining data on the rotational speed profile in spiral galaxies, known as rotation curves.

Jessica derived an equation that represents this galaxy rotation curve from Newton's laws. This equation showed that one would expect objects on the farthest edges of galaxies to have lower velocities than objects near the center. Jessica then gathered and examined velocity data observed from a large number of spiral galaxies. Comparing this velocity data to the prediction of her equation, she noticed discrepancies. By examining the resulting discrepancies she was able to show the existence of additional mass (known as dark matter) within the galaxy that accounts for these differences.

Jessica's curiosity and enthusiasm for astrophysics was apparent from the quality of her project and presentation. Her work impressed the judges as she showed excellent literature review, thought process, data analysis, conclusions, and a true understanding and appreciation of the subject matter.

Third Place: "The Effect of ionized Air Concentration on the Efficiency of an Ionic Thruster"



The third place award went to **Alexander Fogleson**, a 10th grade student at Yorktown High School, for his project "The Effect of ionized Air Concentration on the Efficiency of an Ionic Thruster", which he entered in the Physics category. Alexander attempted to better understand the effect of electrons in electric propulsion. He wanted to see that if an air ionizer were to be used to provide more ions, could similar, or greater, thrust be produced compared to using electrons as the ionizing agent.

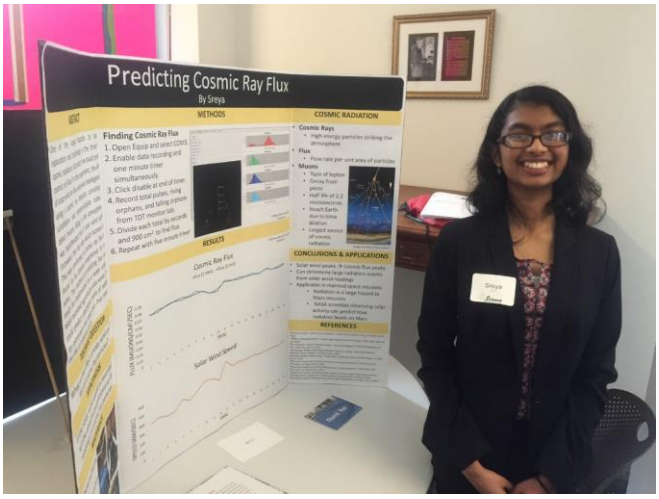
Alexander approached electric propulsion from an angle that is very different from what industry and academia are moving towards, by focusing on ion *concentration* rather than ion *acceleration*. Alexander's interest in space propulsion motivated him to build a functional Ion Thruster using fairly simple materials, which is quite the feat for a 10th grader. He understood the physics and engineering behind this project and conducted his experiment well, following the scientific method. Alexander is looking towards the aerospace field for a future career.

Montgomery County Science Fair

The Montgomery County (Maryland) Science Fair was held on Saturday, March 12, 2016 at the White Oak Campus of the Food and Drug Administration. **Thomas Noyes** represented AIAA-NCS as a special awards judge in the Senior (high school) Division.

There were several projects either directly related with aerospace engineering or involving problems whose solutions would further the field of the aerospace sciences. The judge ultimately chose four projects that were deemed the most well done – one 1st place winner, one 2nd place winner, and two 3rd place winners. The judge was not able to settle on just one winner for the 3rd place as both projects chosen were equally worthy of the award.

First Place: "Predicting Cosmic Ray Flux"



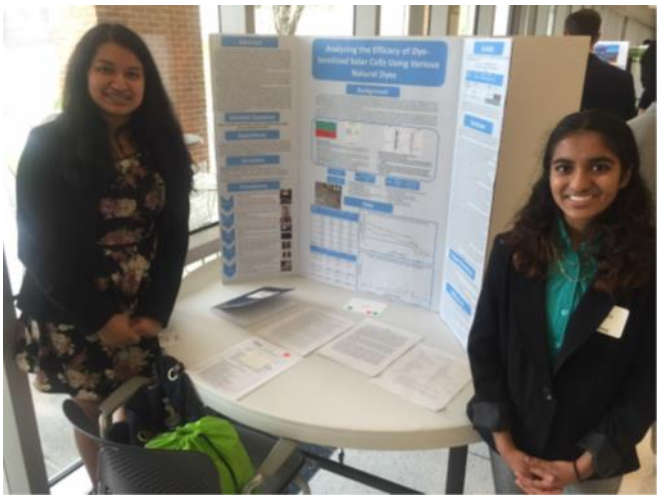
Sreya Vangara is a sophomore who is very knowledgeable in general relativity and particle physics. The judge enjoyed listening to her conversation with two category judges who were themselves physicists. The conversation sounded like it was one between peers, and not one between a high school student and two seasoned scientists. She currently has a 4.0 GPA and plans to attend MIT with a focus on astrodynamics.

In her project she studied the correlation between solar wind activity (specifically the velocity of the particles) and cosmic ray flux. She understood that radiation in the space environment can be harmful to astronauts and equipment, so a method for predicting increasing cosmic ray flux would be beneficial to NASA. She hypothesized that increases in solar wind velocity would correspond with increased cosmic ray flux.

Her experimental setup included detection equipment, such as scintillators and photomultiplier tubes, for sensing muons falling in the atmosphere. She performed measurements using this equipment outside her home, and then compared that data with the time stamped information she obtained from NASA's solar

observatory website. She found a correlation and concluded her hypothesis was correct. Overall, a very good project using a solid scientific method done by a student with a solid understanding of the science.

Second Place: "Analyzing the Efficacy of Dye-Sensitized Solar Cells Using Various Natural Dyes"

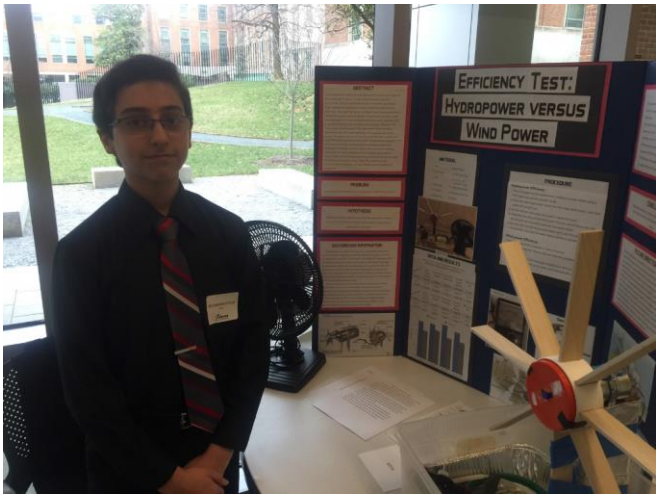


Aadya Bhaskaran and Divya Gandla are juniors who undertook this team project in order to develop a more environmentally friendly manufacturing process for solar cells. Miss Bhaskaran is interested in attending the University of Maryland, Johns Hopkins University, Boston University, or University of North Carolina and majoring in bioengineering or physics. Miss Gandla is interested in attending the University of Maryland, Johns Hopkins University, University of Pennsylvania, or Columbia University and majoring in environmental engineering.

These students make a great team – Miss Bhaskaran is strong in mathematics (she plans to take multivariable calculus during her senior year) and Miss Gandla is strong in the sciences (having taken several advanced placement courses in various disciplines). They approached this problem in a novel manner. Rather than using traditional silicon based solar cells, they chose to explore a solar cell based on organic dyes made from plants.

These dye-sensitized solar cells would mimic the process used by plants in photosynthesis and convert light into electricity. They found that this type of solar cell does indeed generate electricity, and the blackberry derived dye performed the best. This project had great visuals and a solid scientific method.

Third Place (tie): "Hydropower vs. Wind Power"

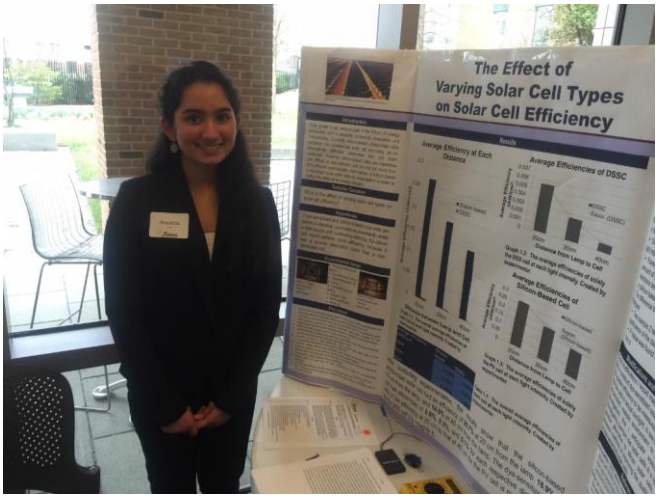


Mohammadreza Salimi is a junior who is very interested in aerodynamics and propulsion. He plans to attend the University of Maryland as an aerospace engineering major. While conceptually not extraordinary, his project did convey a solid understanding of the scientific method. He set out to determine which was more efficient at being converted into electricity – air or water flow.

The parameters he used to assess efficiency consisted of the following: given some input amount of electric power, how efficiently is that power transformed into fluid flow, by either a fan or a pump, run through either a propeller or water wheel, and then reconverted back to electric energy. He found that his setup produced higher efficiencies using the water versus the air as the working fluid.

The weakness of his project was that he did not identify many of the possible sources of power loss. During the various power conversions, loss mechanisms, like friction and mass flowing out of the system, were not consistently recognized. However, the interview went well, with him learning and understanding about these various issues as we went along.

Third Place (tie): "The Effect of Varying Solar Cell Types on Solar Cell Efficiency"



Anusha Dixit is a senior who is continuing her research into solar cell efficiency. This year's project is a follow-on to the project she did last year concerning the relationship between solar cell efficiency and humidity. She is interested in attending the University of Michigan, University of Maryland, or MIT and majoring in aerospace engineering with a focus on space flight dynamics. She was recently an intern at NASA Goddard doing work in space flight dynamics.

This project is similar to the team project award second place (above) in that dye-sensitized solar cells were used. Miss Dixit, however, did not create the dyes herself but instead used commercially available dyes in her experiments. Her hypothesis was that dye-sensitized solar cells would perform worse than the basic silicon solar cells. She wanted to show that light energy was absorbed by the dye but not as efficiently converted into electricity as was the case with the silicon based solar cell.

Her project followed a sound scientific method and had great visuals. Her results showed that indeed, the plain silicon based solar cells were more efficient at converting light into electricity than were the dye-sensitized solar cells.

Loudoun County Public Schools Regional Science & Engineering Fair

On Thursday morning, March 17, 2016, the judging team of **Carlos Neiderstrasser**, Orbital ATK; **Michael Poliszuk**, F-35 Joint Program Office; **José Guzman**, The Aerospace Corporation; and **Susan Bardenhagen**, AIAA Educator Associate, previewed the projects prior to the students' presentations. Upon review, ten were highlighted as possibly aerospace-related, in seven categories including Materials Science, Physics & Astronomy, and Robotic & Intelligent Machines. After a brief review of the projects at the fair, three were determined to not be aerospace-related after all; five additional projects were identified for consideration - making a total of twelve for the team's consideration.

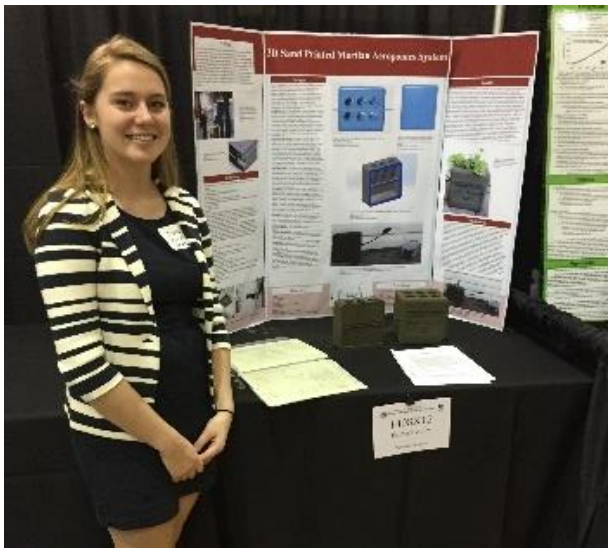
The judging team interviewed the students at each of the nine individual and three team projects together - asking probing questions, determining air and space applications, and evaluating innovative hypotheses. The team then met to reach consensus on awardees. The first place project was in the top three picks of all four judges. After discussion of the students' in-depth knowledge, their research, and their projects' potential for innovative ideas and practical application, the team narrowed down the selected five projects to the second and third place awardees.

First Place: "The Effect of Varying Frequencies and Durations of Light on Plant Growth under Simulated Microgravity"

For first place, sophomore **Gwenyth Schloer**'s "The Effect of Varying Frequencies and Durations of Light on Plant Growth under Simulated Microgravity", in the Plant Sciences category, was the unanimous choice. She constructed a unique apparatus to vary the plants' orientation as a way to simulate the zero-g environment in order to

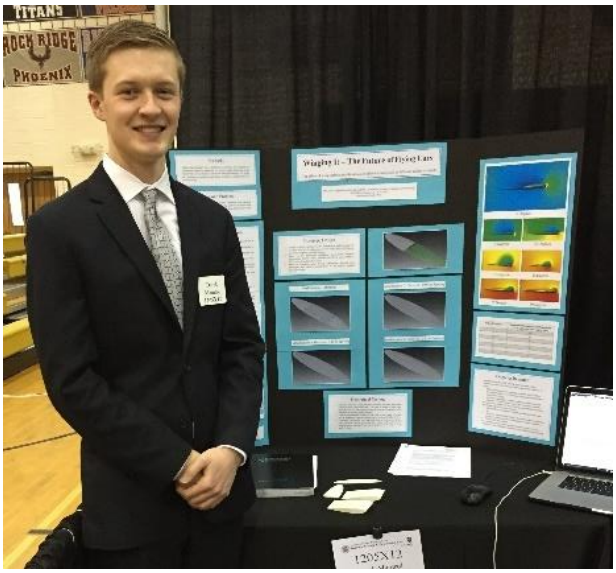
study the optimum lighting arrangement to grow plants. She researched phototropism and experimented with different approaches to simulate crops being grown in space. Using a high-powered microscope to make precise measurements, Gwenyth was able to measure the length of the cells to determine which of her four samples had the optimum amount of light. In 2015, she was an AIAA-NCS third place team project winner creating the simulation for micro-gravity. This year, her project expanded the research to examine phototropism. From her abstract: "In addition, the variables measured were changed based on conclusions made from the experiment last year showing that plant growth was random under microgravity conditions in the absence of light. The purpose of the experiment this year was to find a way to minimize the amount of energy used in space." She was, overall, very careful in constructing the experiment, gathering the data, and presenting the results.

Second Place: "3D Sand Printed Martian Aeroponics System"



The second place award went to senior **Emma Renner** for her project entitled, "3D Sand Printed Martian Aeroponics System," in the Materials Science category. Emma designed containers which allowed for filtration, recapturing of water, and containment of plants. From her abstract: "The aeroponics system was designed to be simple, durable, and a singular piece of equipment." Her designs were then created to her specifications by a manufacturing firm, since 3D sand printers are not cost-effective in a high school setting. Emma's premise was that a 3D printer would be a standard piece of equipment on a Mars mission, but using the Martian sand would negate the need for transporting the heavy mass of materials during the spaceflight to the planet. Since the Martian soil would not contain the nutrients necessary to grow plants, an aeroponic system, using the 3D sand printed "containers", would provide a way to grow crops for human consumption. Concerns addressed included the fact that the adhesive, used in the 3D printing process to bind the sand, is a consumable that must be transported from Earth. Emma's work showed a great understanding of the engineering process, she understood the concept of requirements and used them to design and build her prototype.

Third Place: "The Effect of Wing Surface Modifications on Elliptical Wing Stall at Different Angles of Attack"



Third place awardee **Derek Mamrol** entered his project, "The Effect of Wing Surface Modifications on Elliptical Wing Stall at Different Angles of Attack," in the Engineering-Mechanics category. The senior has an avid interest in vintage airplanes, specifically ones with elliptical wings. Derek's goal is to build a flying car, not another type of airplane. He conducted extensive simulations to determine a dimpled surface that would be most effective, and then created the wings with a 3D printer. From his abstract: "Elliptical aircraft wings are known to have

extremely low drag for a given aspect ratio, but suffer from undesirable stall characteristics that lead to little time for a pilot to correct before stalling. Delaying the onset of stall for elliptical wings could therefore allow pilots to operate elliptically winged aircraft in a wider range of angles of attack without stalling, making the elliptical wing form, known to be highly efficient, viable once again as planes using this wing form have not seen wide use since the mid-20th century." His research and experimenting is ongoing because of delays which resulted in incomplete collection of data. The judges determined that, despite Derek's project still being a work-in-progress, his knowledge of physics, engineering, and the principles that created his interest and its innovative nature, supported a third place award. His presentation style was also very professional and he clearly understood and articulated the limitations of his research.

Fairfax County Regional Science & Engineering Fair

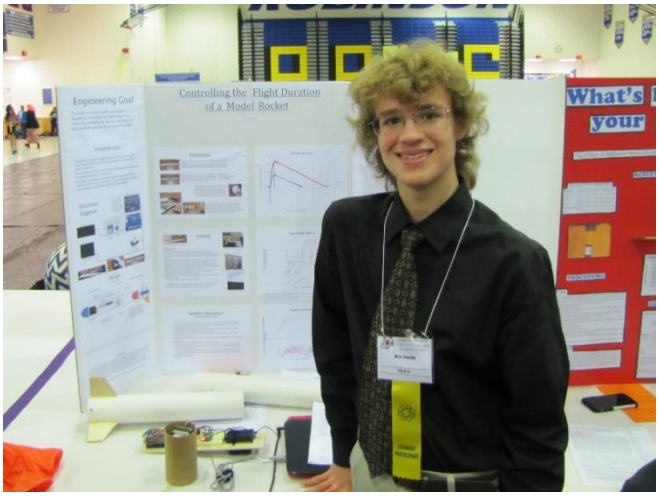
The Fairfax County Regional Science and Engineering Fair was held on March 12, 2016 at Robinson Secondary School in Fairfax, VA. The AIAA NCS judges were **Paul Frakes** (Omitron Inc.), **Chris Jones** (Northrup Grumman), **Corbin Robeck** (Corvid Technologies), and **Francis Szalay** (Waverly Group).

The Fairfax Regional Fair boasted over 440 projects this year, presented by students in grades 9-12. With the help of Science Fair Teams Lead, Dr. Natalia Sizov, the judges went through the large list of projects and selected the candidates that would be interviewed. After talking with a lot of excited students, and evaluating many impressive entries, the judges decided the following students deserved special recognition:

First Place: "The Hovercraft Project"

First place went to freshman **Joshua Buontempo**, from Lake Braddock SS, for his project "The Hovercraft Project", entered in the Engineering Mechanics category. Joshua's project involved designing and building a working hovercraft. Joshua's drive to learn the science behind how these vehicles worked, along with his engineering approach over multiple improving prototypes impressed the judges.

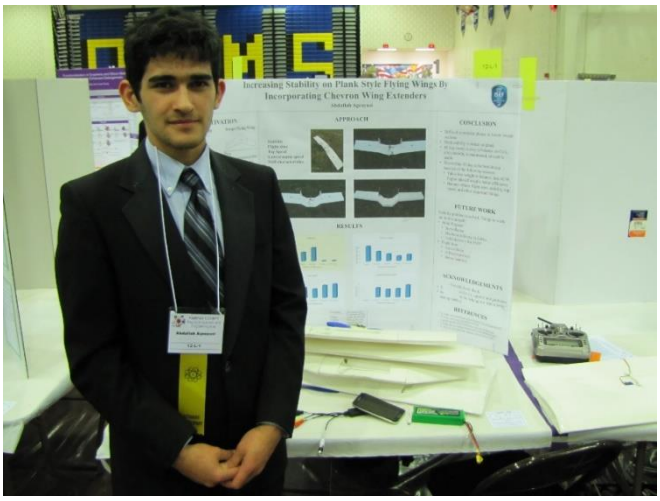
Second Place: "Controlling the flight Duration of a Model Rocket"



Second place went to sophomore **Eric Smith**, from Lake Braddock SS, for his project "Controlling the flight Duration of a Model Rocket", entered in the Embedded Systems category. Eric's project was his attempt at completing the National Association of Rocketry's challenge to fly a model rocket with a flight time of exactly 44-46 seconds. Eric's project saw him designing a system that measured the rocket's

altitude and then using an electronics package with a servo motor to adjust the parachute cord to control his rocket's decent rate. The judges really enjoyed Eric's creativity and drive to learn about the different technologies involved in his approach.

Third Place: "Increasing Stability for Plank Style Flying Wings Used for Surveillance"



Third place was awarded to senior **Abdullah Agcayazi**, from Robinson SS, for his project "Increasing Stability for Plank Style Flying Wings Used for Surveillance", entered in the Engineering Mechanics category. Abdullah constructed a modifiable flying wing system that allowed him to test different non-lifting extensions to test their effect on the flight characteristics of the flying wing. Abdullah's project demonstrated excellent engineering and technical understanding, with real world implications and a great working design. We look forward to good things from him as he heads to college next year, and hopefully a long association with AIAA.

Prince George's Area Science Fair

The Prince George's County (Maryland) Science Fair was held on Saturday, March 19, 2016 at the Charles Herbert Flowers High School. Five AIAA-NCS volunteers represented the AIAA as special awards judges in the Senior (high school) Division. The five judges were **Thomas Noyes** (lead judge), **Michael Barton**, **Doug Ramsay**, **Nathan Shumway**, and **Stan Underwood**. Judging proceeded nominally without any problems.

There were several projects either directly related with aerospace engineering or involving problems whose solutions would further the field of the aerospace sciences. The judges ultimately chose three projects that were deemed the most well done – one 1st place winner, one 2nd place winner, and one 3rd place winner.

The three winning projects are summarized below. The judges were very impressed with the level of expertise that each of these students showed in understanding the fundamental science behind their experiments and in the analysis of their results.

First Place: "Plasma Treatment of Spacecraft Coating"

Elizabeth Mulvey's project was very well done and conveyed her knowledge of the physics behind experiment well. In her project, she studied the use of plasma exposure as a pre-treatment prior to the application of spacecraft thermal coatings. She is a senior and is planning to attend the University of Maryland or University of Texas with a major in physics. She became interested in this topic during her time as an intern at NASA Goddard last year.

Traditional pre-treatments of spacecraft surfaces amount to simple abrasion of the material. She found that using a plasma to perform this 'abrasion' allowed her coatings to better adhere to the material. She tested adhesion in two ways – 1) she wrapped thin strips of coated material around a rod to determine if the bending of the material

would produce flaking of the coating, and 2) she applied and removed tape to/from the same strip of coated material, on the coated side, to determine if the coating could be pulled away.

She found that the plasma pre-treatment did indeed improve the adherence of the coating to the material. She has an extensive plan for follow-on experimentation. Overall, she had a great project with good visuals.

Second Place: "Viability of Hand Flora on Mars"

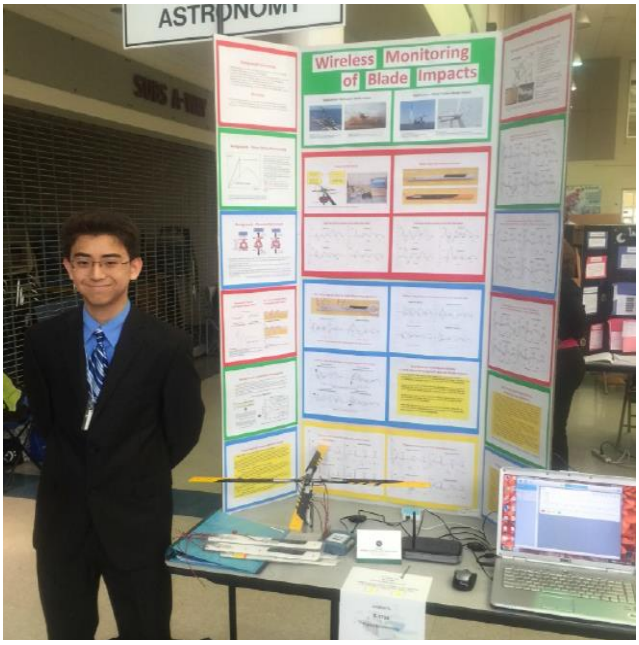
Ivy Antune's project was also very well done and focused on the possibility that robotic explorations of Mars may lead to bacterial contamination of the Martian landscape from Earth-based microorganisms. This condition would result in two negative outcomes – 1) the contamination of another world by Earth-based life, and 2) a false-positive for native Martian life. Ivy is a senior and plans to attend University of Massachusetts, University of Pittsburgh, Cornell University, or University of Southern California and major in pre-med.

Ivy's experimental setup was quite simple – she exposed one set of bacteria to a very low pressure and high carbon dioxide atmosphere similar to Mars, and another set (the control set) was left at Earth standard atmosphere and composition. She used a chamber, derived from a pressure-cooker that she pumped down to low pressure after filling it with carbon dioxide. She seeded the agar-filled petri dishes using bacteria collected from her hands.

The point of her research was to show that during spacecraft assembly, the engineers and mechanics may inadvertently leave traces of bacterial contamination on the vehicle. She wanted to determine if that bacteria could survive exposure to the Martian atmosphere and, therefore be the cause of the problems mentioned above. She understood that she was not taking into account the exposure to vacuum during spacecraft transit to Mars, nor the exposure to radiation during the entire trip.

She found that, indeed, bacteria could survive in the conditions that she created. It clearly did not thrive in the way of the control group but there were small bacterial colonies present in the petri dishes.

Third Place: "Wireless Monitoring of Blade Impacts"



Jonathan Yu had a very elaborate experimental setup and impressive visual display to convey his research regarding damage location determination on rotorcraft blades. He is a junior and is undecided as to college destination but does want to major in electrical engineering or computer science. This is a follow on project from similar work he did for last year's science fair.

His goal was to determine the location of blade impacts (and thus possible damage), along the length of a rotorcraft blade, using unique vibrational signatures detected by strain gauges placed on the blades. The motivation was to minimize maintenance downtime by first, showing that an impact had occurred, and second, directing maintenance personnel to the approximate location of the possible damage.

He found that tapping on certain points along the blade would produce a unique wave shape that was picked up by the strain gauges and output through his software. He demonstrated this to us live by tapping a blade with the data acquisition system operating. He showed us how to, then, compare the shape of the signal to his library of signals in order to determine the location of the impact.

The experiment worked well. The judge's only criticism was with his narrow focus on describing and interpreting the results. We attempted to see how well he understood the underlying physics of the vibrations he was inducing by asking various leading questions. He did not seem to pick up on what we were asking and kept repeating his standard 'script.'

Charles County Science Fair

The Charles County Science Fair was held on March 19th, 2016, at the St. Charles High School in Waldorf, MD. The AIAA-NCS judging team consisted of **David Kanter**, **Darrin Buck**, **Michael Moore**, **Lisa Sedares**, and **Jace Parales**.

Although the selection of aerospace-related science fair projects was very slim this year, the judging team was further disadvantaged by an unexpected policy change at the fair. Namely, the organizational judges were prohibited from actually interviewing the students at their projects or, indeed, at any time during the fair. Consequently, the AIAA-NCS judges had to rely strictly on the bare display material that remained on the tables, once the students had departed, in order to assess the quality of the selected projects.

In past years, Charles County had mandatory science projects. This year it was optional whether or not a student wanted to execute a science project. As a result, the overall quantity of projects was down, which further reduced the expected quantity of aerospace-related projects. The judges felt that the projects, overall, were weak compared to previous years. They gave this feedback to the science teachers directly and, by all accounts, they appreciated the comment.

The judges selected the winners based on the merit of the project's potential for aerospace application, demonstration of principal, and/or robustness of the actual experiment. While students have not always been available in past years, it is often better to get a feel for their efforts when the students are available to discuss their projects. Despite all of these hindrances, the judges selected the following projects for awards:

First Place: "Robot with a Memory "

Jacob Polis (10th grade, Thomas Stone High School)

Second Place: "How Well Can a Vehicle Steer Autonomously"

Michael Gill (9th grade, LaPlata High School)

Third Place: "The Myth of Multitasking.. A Study of Reaction Time"

Stephen Duranske (9th grade, St. Charles High School)

Plans for Next Year

AIAA-NCS intends to continue supporting the region's science fairs in 2017. While NCS leadership is committed to this very worthwhile endeavor, it only works with the robust support and participation of volunteer organizers judges. If you are interested in getting more involved in AIAA-NCS educational outreach programs, please contact **Michele McMurrer** at aiaancs1@aol.com.

Our sincere thanks to:

The Science Fair Judges:

- **Northern Virginia:**
  - Aaron Botwin
  - Nitin Raghu
  - Arthur Orton
- **Montgomery County:**
  - Thomas Noyes
- **Prince William-Manassas:**
  - Joe Marshall
  - Josh Powers
  - David Myre
- **Loudoun County:**
  - Carlos Neiderstrasser
  - Michael Poliszuk
  - José Guzman
  - Susan Bardenhagen
- **Fairfax County:**
  - Paul Frakes
  - Chris Jones
  - Corbin Robeck
  - Francis Szalay
- **Prince George's County:**
  - Thomas Noyes
  - Michael Barton
  - Doug Ramsay
  - Nathan Shumway
  - Stan Underwood

- **Charles County:**
  - David Kanter
  - Darrin Buck
  - Michael Moore
  - Lisa Sedares
  - Jace Parales
- **District of Columbia:**
  - Abhilash Malipeddi
  - Sirisha Bandla
  - Ian Ross
  - Nils Jespersen

And the AIAA-NCS Science Fair team:

During the 2015-2016 academic year, the following AIAA-NCS Science Fair Committee members worked very hard to make this year's AIAA science fair coverage a success:

- **Dr. Natalia Sizov**, AIAA-NCS Lead Science Fair Coordinator
- **Dr. Nils Jespersen**, Student Winner Liaison
- **Mr. Martin Frederick**, AIAA-NCS Chair
- **Ms. Michele McMurrer**, AIAA-NCS Administrator
- **Mr. Scott Fry**, Judging Coordinator