WyomingView: Integrating Landsat-based Earth Observation in Sixth Grade Science Curricula

The Sea, Air, and Land Challenge. Why are STEM Programs important?
The students were presented with the scenario of people trapped in a city building after an earthquake. The task was to find, pick up, carry and deposit objects in a drop box. The systems are then used to compete in challenges that mimic missions encountered by the military, national security agencies and first responders. The background image is of a remote control airplane used for the Air Challenge. The students were presented with the issue of forest fires that require aerial water drops. This Challenge provided the students with an opportunity to build a payload that could one day perform these types of tasks on an unmanned aircraft. The adaptively increased scale parameter (AISP) strategy determines scale parameters dynamically to produce nested multi-scale segmentations for high-spatial resolution remote sensing images. The images in the bottom two inset are ground robots designed by students for the Land Challenge. In this scenario it was assumed that people were trapped in a city building after an earthquake. The task was to find, pick up, carry and deposit objects in a drop box. For more information about the Sea, Air and Land Challenge read the interview on page 432. Images courtesy of Mayson Kiser Photography.
An interview with Dr. William L. Kiser, Senior Director of Penn State Electro-Optics Center and the founder of Sea, Air and Land Challenge. He is a medical physicist by training and develops prototype and production imaging systems for the Department of Defense (DoD) applications. As a research scientist, he believes exposing young minds to science, technology, engineering and math (STEM) will dynamically change the world and ensure the continued superiority of the United States military. Dr. Kiser’s passion and determination to inspire young adults to pursue careers in STEM education is admirable.

Why was the Sea Air and Land Challenge developed?
The Sea Air and Land Challenge was developed for several reasons. The first is to provide high school students, predominantly juniors and seniors, with an exciting opportunity to tackle a difficult engineering task while still in high school. As part of the development, we want them to embrace good engineering process and work as a team to achieve fairly lofty performance goals. The other reason is to provide the students insight into tremendous technical careers available in the Department of Defense and Armed Forces. The Defense industry struggles to maintain a continuous flow of high quality engineers and scientists. It is also facing daunting retirement possibilities in the next 10 years without a sufficient pipeline for replacing these experts. If we combine an exciting technical challenge, with a clear understanding of how the skills learned in the challenge can eventually be applied to an exciting career that affects national security, our objectives are met.

How is this program different from other STEM base programs?
This program focuses on challenges that are relevant to problems the military encounters and gives the students a chance to solve these problems. We make sure they are learning about how to use good processes to achieve their goals, and start to move them away from “trial and error” engineering. Plus, we don’t know of any other STEM activities where the kids get to interact with US Navy SEALS, US Army Green Berets, and other special operation forces.

Who designs the challenges?
The scientists and engineers at the Penn State Electro-Optic Center, our Special Forces collaborators, and our advisory board, which is comprised of participants from the military, government, industry and academia.

Are the challenges regional or nationwide?
We are in our third year of the regional challenges; however we are expanding to three or four other national sites next year. Our goal is to have the support structure, (e.g. website, support documents, webinars, and support networks) sufficiently developed to enable anyone in the US to utilize the materials to establish their own regional challenge by August of 2016.
Are YOU up for the Challenge?

How does it work?

Challenges are made possible due to the dedication and kindness of the many sponsors, mentors, judges, educators, military personnel and volunteers. The generosity of these individuals, businesses and companies make it possible for us to inspire and challenge the next generation in STEM.

How can someone get involved?

Anyone can become a Challenge Sponsor through financial support or become a Challenge Volunteer by donating time to the program. For more information and to find out how you can help contact Penny Ward, Program Manager, The Pennsylvania State University Electro-Optics Center, 222 Northpointe Boulevard, Freeport, PA 16229 (724) 295-7000, ext. 7135 or pward@eoc.psu.edu.

Sea Challenge

Underwater manned exploration is limited by the dangers of exposing humans to extreme pressure and temperature. In this challenge, students develop a submersible to search an ancient ship wreckage for artifacts that will be placed into a museum. They must be able to discover and identify objects that are located on the sea floor and pick them up, then place them into a vessel. There is no direct viewing of the tank during the run, cameras and sensors are used to complete the mission.

Air Challenge

There are a number of contained forest fires that require precise, aerial water drops due to their remote location. The exact location of these fires is not known, so a pilot must detect the correct location for the drop, and then carefully target the location with water drop. Unlike a manned aircraft, which has an experienced pilot, the unmanned aircraft must carry its own sensors to detect the fire, and a method to remotely actuate the payload to drop the water. The cameras that are used to detect the fire, may also be used to determine the location of firefighters, fire trucks or structures. The team is unable to see the course during the run, cameras and sensors are used to complete the mission.

Land Challenge

Ground robots are becoming increasingly more sophisticated and utilized in multiple different types of applications including emergency situations. This application of the technology keeps first responders out of harm’s way, but still provides a critical link to injured or stranded people. In this challenge, there are people trapped in a city building after an earthquake. The path to the building is deemed unsafe because of fear the structure will collapse. The team must deliver supplies to the trapped people and remove hazardous materials and obstacles that are preventing rescue personnel from safely entering the structure. The team is unable to see the course during the run, cameras and sensors are used to complete this mission.

...WE are!
Air & Land Combined Challenge
There are people trapped in a city building after an earthquake. Supplies must be air lifted in due to the destruction of the road network in the aftermath of the earthquake. The surrounding area has been determined to be structurally unsound to send personnel in yet. The task is to land in the designated safe zone and release the ground robot to deliver the supplies to the trapped victims. After the supplies are delivered the robot must return to the air vehicle to be returned to a safe area for reloading and refueling. The team is unable to see the course during the run, cameras and sensors are used to complete this mission.

How are the entries judged?
The entries are scored throughout the entire development process. It is novel because there are points to be earned throughout the entire process. Only 40% of the total score can be earned on challenge day, and through the performance of the system. In addition, the challenge day scoring rubrics are varied and take into account more criteria than simply how the system performs. This shows that there is more to a successful engineering effort than simply building a Rube-Goldberg machine.

Has the program grown since its inception? How?
The program has grown from a handful of teams in the first year to a maximum of 22 this year. We have been very careful to manage growth to insure we worked all the bugs out of our challenges before we expanded. It is very important not to overwhelm the educators and mentors, and this is best achieved through good structure, thorough educator training, and clear, concise support materials. We have also had to develop a significant support network of mentors and volunteers to ensure the costs are kept low and the experience for the kids is rewarding.

How does the use of SOF (Special Operations Forces) help the students participating in the Challenge?
Special Operations Forces are the best of the best. They have received considerable publicity during the recent global wars on terror and receive tremendous respect throughout the country. They are good communicators, willing participants, and the technology utilized in their asymmetric style engagements fit perfectly into the types of challenges we believe will help train the next generation of scientists and engineers.

What has been the most positive outcome of the Challenge? The most negative?
Challenge day is one of the most fulfilling days I have ever personally encountered. The participants are almost universally excited about STEM careers and thankful they have been given the opportunity to jump-start their professional development. We have anecdotal evidence from several students that indicates the program influenced their career choices. Some of the year-one students are already pursuing internships in the government and with DoD primes.

Teacher and mentor participation has been very disappointing thus far. There are exceptional teachers that embrace the program, who teach themselves, embrace our training, and are dedicated to using the program as a valuable teaching tool. However, there are also several teachers that are unwilling to dedicate the time and personal effort required to use the challenge to help their students. The same can be said for the required

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industry mentor that each team must have before they can participate. While there is never any shortage of volunteers for coaching athletic teams, there is a paucity of willing team mentors. In spite of all of the good things we can do with the regional challenge, it will not be successful unless we can find a way to better encourage volunteers to assist with bringing the experience to students across the nation.

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The Penn State Electro-Optics Center, who developed and executes the program, is one of the Defense Related Research Units of the Pennslyvania State University. They are the Navy’s ManTech Center of Excellence in Electro-Optics and a part of the Penn State Applied Research Lab’s Navy University Affiliated Research Center (UARC). They are located in Freeport, PA and have recognized expertise in directed energy, fiber optics and photonics, and sensor systems (including remote sensing).

Images courtesy of Mayson Kiser Photography.

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