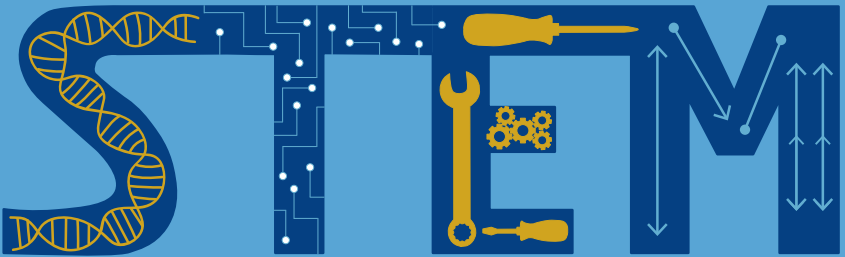


**2019**



The Governor's STEM Competition

**May 9th-10th**

**Dixon University Center  
Harrisburg, Pennsylvania**



## 2018 Grand Champions – the South Fayette High School STEM team

The following text is part of a display at Rock Litz. The Governor's STEM Competition students toured the facility in May 2018:

Rock Litz is a one of a kind production community that supports innovative creativity within the live event industry. With resources ranging from design, engineering and manufacturing through rehearsals, and beyond, Rock Litz is a one-stop-shop to collaborate on any live experience.

The Rock Litz Community was able to welcome over 250 students on campus last year in various capacities. Perhaps the coolest, was playing proud host to the state finalists for the Pennsylvania Governor's STEM Competition, with interactive workshops by ATOMIC, Clair Global, Pyrotek Special Effects, TAIT, Upstage Video and Rock Litz, to show how science and technology contribute to live events.

## Pennsylvania State Regional Winners

Intermediate Unit	Regional Winners	School District	Team Advisor(s)
Intermediate Unit 1	Bethlehem Center High School	Bethlehem Center School District	Dawn Logan
Pittsburgh - Mt. Oliver IU 2	Pittsburgh Central Catholic High School	Diocese of Pittsburgh	Maddie Ranade
Allegheny IU 3	South Park Senior High School	South Park School District	Ryan Siniawski
Midwestern IU 4	Shenango High School	Shenango School District	Joe Merlino
Northwest Tri-County IU 5	Fairview High School	Fairview School District	Andrew Burt
Riverview IU 6	Oil City High School	Oil City Area School District	Wendy Masters
Westmoreland IU 7	Eastern Westmoreland Career and Technology Center		Ian Dunlap
Appalachia IU 8	Chestnut Ridge High School	Chestnut Ridge School District	William Tantorno Keith Fleege
Central IU 10	State College Area High School	State College Area School District	Bob White
Tuscarora IU 11	Southern Huntingdon County High School	Southern Huntingdon School District	Nicolee Christophel
Lincoln IU 12	Red Lion Area Senior High School	Red Lion Area School District	Nate Barrett
Lancaster-Lebanon IU 13	Solanco High School	Solanco School District	Caley Roark
Berks County IU 14	Conrad Weiser High School	Conrad Weiser Area School District	Adelle Schade
Capital Area IU 15	Cedar Cliff High School	West Shore School District	Amy Dando
Central Susquehanna IU 16	Mid-West High School	Mid-West School District	Matthew Dietz Ed Gunkle
BLaST IU 17	Williamsport Area High School	Williamsport Area School District	Andy Paulhamus
Luzerne IU 18	Tunkhannock Area High School	Tunkhannock Area School District	Karen Kutish Andrew Neely

continued . . .

## Pennsylvania State Winners continued . . .

Intermediate Unit	Regional Winners	School District	Team Advisor(s)
Northeastern Educational IU 19	Forest City Regional High School	Forest City Regional School District	William Graziano
Colonial IU 20	Delaware Valley High School	Delaware Valley School District	Robert Curtis
Carbon Lehigh IU 21	Parkland High School	Parkland School District	Christopher Gahman
Bucks IU 22	Penndel High School	Penndel School District	Melissa O'Brien Dina Dormer
Montgomery County IU 23	Lower Moreland High School	Lower Moreland School District	Nick Soloman
Chester County IU 24	Bishop Shanahan High School	Archdiocese of Philadelphia	Dr. John Janasik
Delaware County IU 25	Garnet Valley High School	Garnet Valley School District	Dr. Elizabeth Bish
City of Philadelphia	Philadelphia Academy Charter High School		Robert Mottershead
Schuylkill IU 29	North Schuylkill Junior Senior High School	North Schuylkill School District	Kelly Stone

## Project Titles and Descriptions

### IU1 School: Bethlehem Center High School Title: STYROFILL



Styrofill is an alternative to repairing potholes with asphalt. Using Styrofoam, which would otherwise enter landfills, as the primary ingredient, Styrofill hopes to be more efficient and environmentally friendly than its petroleum-based counterpart. Using precise ratios of ingredients, a simple Styrofoam plate or lunch tray can be transformed into a sticky, soft compound that will then harden into a light, yet dense, material that has a variety of practical uses. These other uses include a binding agent for projects, in repairs on roofs and pipes, as well as in expansion joints. The main purpose of Styrofill is to simultaneously reduce the amount of non-biodegradable Styrofoam in landfills while fixing Pennsylvania's many issues with potholes. Our project is designed to be a strong, yet flexible, sealant and filler for holes and cracks of any proportion or shape. Thus Styrofill is a viable and eco-friendly product for nearly any need one has!

**IU2 School: Pittsburgh Central Catholic High School**  
**Title: Hydrophobic Cost-Efficient Pothole Patch**



Our project is a pothole patch created by using recycled plastic. It is cost effective, durable, hydrophobic, permanent solution. Lindy Paving is our business partner and PennDot will be our prospective user because we will create an app for them based on our project.

**IU3 School: South Park Senior High School**  
**Title: Recycling Shredder**



The South Park School District, a small suburban school located in the southern portion of Allegheny County, serves approximately 2,200 students. Occupying nine square miles, nearly one-third of the township consists of county parks. Since the majority of our community is nestled within the natural environment, our design team decided to improve our district recycling to reduce our carbon footprint and promote environmental awareness. At South Park High School, the cafeteria sells large quantities of recyclable products, the majority of which being PET-plastic bottles. Although detrimental to the environment, ninety percent of students throw these items away. A solution to this problem must increase participation in our recycling program while handling the increased output efficiently and with fiscal responsibility. Our initial research and multi-faceted solution involved marketing and infrastructure changes, but no major prototyping and testing to fulfill the competition design requirements. Therefore, our team decided to build a shredding device that would require 3-dimensional design and modeling, applied physics calculations, and advanced fabrication. The final device will be used to process a portion of the plastic bottles into a reusable product that will further promote and advance our recycling goals.

**IU4 School: Shenango High School**  
**Title: Hunter's Life Line**



We have decided upon a smart safety harness for hunters to wear while they are in a tree stand. If the hunter falls from the stand, it causes a circuit to break and sends a distress signal. This ensures that the wearer will be assisted in a timely manner.

**IU5 School: Fairview High School**  
**Title: Preventative Vehicle Safety Using Wheel Well Heaters**



According to PennDot, 38.7 percent of all crashes were related to tire/wheel defects in 2016. Reducing unnecessary winter-time tire wear can prolong safer driving equipment while curbing the potential for environmentally related vehicular accidents. An electric heating system was developed to eliminate the wet snow that continually builds up inside a vehicle's wheel wells and consequently freezes. This can reduce preventable tire wear while increasing the vehicle's stability, efficiency,

and steering performance. Electric current will be passed through conductive material lining a vehicle's wheel well, subsequently heating the material for a specified duration, similar to a rear window defroster. Utilizing the vehicle's existing electrical system, a microcontroller is programmed to deliver and monitor the heating process. The system is designed to be either installed by the vehicle manufacturer during production, or by the user as an additional feature, providing some additional safety and peace of mind for a minimal accessory cost. Considering our regional climate, individuals can preemptively increase the safety systems of their personal vehicles and hopefully avoid dangerous or accidental situations.

**IU6 School: Oil City High School**  
**Title: Cuptastrophe**



Survival cup that melts snow and ice, filters impurities, etc., ideal for outdoor enthusiasts of every season.

**IU7 School: Eastern Westmoreland Career and Technology Center**  
**Title: A Better Hypodermic Trade System in PA**



One of the largest issues that has plagued our area has been the improper method of disposing needles within prominent places in our community. To help rectify this, we created a "Hypodermic Trade System" to help alleviate this problem. Our general goal for this product is to protect the general public from the negative effects of coming into contact with one of the aforementioned needles. How this product will work is that one person who wants to dispose of one or more needles inserts one needle into the top of the box, which is then stored in a separate container, and a clean needle with an alcohol preparation pad will be dispensed at the bottom.

**IU8 School: Chestnut Ridge High School**  
**Title: A Smarter State Park**



The year 2018 was record-breaking in terms of rainfall for areas across the state of Pennsylvania, which led to extensive, disastrous flooding. Research was performed by the Chestnut Ridge STEM team to identify areas where an effective improvement could be implemented to make a difference for that area if similar or worse flooding were to occur. The team's view was directed to Shawnee State Park, a regular visit for campers, hikers, runners and bikers. The team designed and built a system that can detect rising waters levels at points that are particularly prone to flooding and relay that information to separate places where park-goers can view this information as a warning before entering a trail. The same warning system can be used in nearby roadways, bridges, and underpasses to alert vehicular traffic to high water conditions. This is a real world problem documented and discussed with the Pennsylvania Department of Conservation and Natural Resources at Shawnee State Park. A second smarter State Park feature is the addition of ultrasonic sensor illuminated guide signs at critical intersections for RV campers entering the park at night. It is not uncommon for an RV to make an wrong turn due to small signs and no lighting at night.

**IU10 School: State College Area High School**  
**Title: The Thermoelectric Composter**



The device improves upon existing compost devices and utilizes the waste heat produced as a by-product of decomposition to generate electricity using thermoelectric elements.

**IU11 School: Southern Huntingdon County HSMS**  
**Title: Germ Stop**



This device is a small, inexpensive unit that is securely attached to the interior and/or exterior of the bottom of public restroom doors to eliminate touching door handle surfaces to minimize the risk of contracting disease-causing pathogens found on the handles.

**IU12 School: Red Lion Area Senior High School**  
**Title: LifeStrap: The Smart Fall Solution**



Our device, LifeStrap, is a wearable, automated medical alert system. LifeStrap uses sensors to monitor for medical emergencies, like falls. When a medical emergency is detected the device will send an alert to a designated loved one or medical institution. Because it functions automatically, the LifeStrap is ideal for individuals who may become incapacitated and unable to call for help on their own.

**IU13 School: Solanco High School**  
**Title: CLAD (Classroom Lockdown Assistance Device)**



The CLAD is a remotely deployable security system that, when activated, covers and secures a classroom door in the event of an intruder. Three main components increase classroom safety: a Kevlar curtain obscures views into the classroom and enhances door stability, a nylon strap cinches the door closer, preventing the door from opening, security magnets trigger, locking the door. All of this is achieved without putting a student or teacher near the door, the most dangerous area in the classroom during an intrusion.

**IU14 School: Conrad Weiser High School**  
**Title: Fabrication of organically-**



**based glass as a solution for Pennsylvania poultry waste crisis**

This research aims to develop organically based building materials through the use of processed chicken waste. A major obstacle preventing growth in Pennsylvania's poultry industry is the ever-increasing amount of chicken manure, a commodity Pennsylvania is struggling to accommodate. This research proposes the use of dehydrated chicken manure in glass manufacturing. It is hypothesized that a dried manure powder could be mixed with minimal raw material in the production of glass as a method of repurposing Pennsylvania's poultry waste. In the long-term, our solution will reduce the amount excess manure in Pennsylvania as this waste will be

utilized for building materials. Further, our solution provides for job creation and monetary gain from chicken manure, a material that would otherwise continue to harm farmers and the state economy.

**IU15 School: Cedar Cliff High School**  
**Title: RFID E-Cigarette Detector**



The team from Cedar Cliff High School created a prototype to prevent and control vaping with RFID technology. Inspired by the need to address the overabundance of vaping devices in their school and surrounding area, the team developed a prototype capable of detecting vaping devices. To do so, they incorporated a small RFID module into each vaping device that notifies a transmitter when it enters an area where vaping is prohibited. This technology is beneficial to school administrators combating vaping in their schools, but can also be implemented by business owners. For the regional competition, the team designed sensors to be placed in classrooms or other common areas within schools. However, moving forward, advancements are being made to the design to incorporate the sensors into existing monitoring systems, i.e., metal detectors, already present in local high schools.

**IU16 School: Midd-West High School**  
**Title: Midd-West Horsepower**



Our proposal is to employ the use of a vertical axis wind turbine along roadsides to reclaim the energy that is lost as cars drive along the road. The technology of the vertical axis wind turbine are fins mounted on a vertical center rod that, as they spin, the rod turns the generator at the bottom of the device to turn mechanical energy to electrical energy. This type of turbine is smaller than the horizontal wind turbines, making them cheaper and environmentally friendly, as well as bird safe. We propose to set these in the middle of the I-83 bridge. We chose this location due to the mass traffic and high wind speeds experienced in this bridge. Our goal for the current phase of the project is to determine the amount of turbines needed to power the capital building.

**IU17 School: Williamsport Area High School**  
**Title: "Cup of Grow" Organically Produced Soil Amendment**



The WASD STEM team developed a natural soil amendment using repurposed industry waste. Soil amendments are materials that are added to the soil to enhance its physical properties. Our soil amendment is made by composting used coffee grounds, spent tea leaves, brewery grain byproducts, and sawdust. This specially formulated soil amendment helps plant growth, improves soil quality, decreases the need for harmful fertilizer and pesticides, and reduces the amount of organic waste that goes into landfills.



## **IU18 School: Tunhannock High School**

### **Title: Soak 'N' Stop**



Soak 'N' Stop is a highly absorbent, reusable flood preventative and flood barrier. It is a flexible, spandex sack filled with the compound sodium polyacrylate, which is then covered in a durable layer of burlap. The sodium polyacrylate is sewn shut into the spandex, which is then sealed into the protective burlap layer. Soak 'N' Stop's aim is to prevent runoff and flooding in the community. Soak 'N' Stop uses the problem of flooding to prevent further issues. It has several improvements compared to its competitors. It is immensely cheap to manufacture, at about five dollars per 288 square inch model. Prior to water exposure, it is remarkably lightweight, at only about a half a pound to carry. Furthermore, it is reusable and entirely environmentally safe.

## **IU19 School: Forest City Regional High School**

### **Title: Grippy No Slippy**



Students sought to prove the need for, design, fabricate, and test a shin guard for Pennsylvania soccer players that provides the necessary protection, does not shift on the shin while playing, and is affordable.

## **IU20 School: Delaware Valley High School**

### **Title: Bear Blocker**



This garbage can defense mechanism utilizes a 12 volt battery powered magnet to ensure that the garbage can lid remains locked under the circumstances of a bear attempting to open the can to obtain the food and garbage located inside. The BEAR BLOCKER also utilizes a 12 volt solar panel as an additional method to charge the battery located inside. The BEAR BLOCKER is accompanied with a created application that allows for the magnetized feature of the garbage can to be deactivated via an electronic device. An additional emergency switch, located within the right wheel well of the garbage can, allows for the magnetized feature to be manually deactivated.

## **IU21 School: Parkland High School**

### **Title: "Snow-X"**



Snow-X is a snow removal tool specifically for removing snow from the roof of SUVs or trucks, where it can be hard to reach, but is dangerous to other motorists if left on the vehicle. It uses a telescoping pole for reach and is designed to attach to an electric weed whacker as a swappable attachment.

## **IU22 School: Pennridge High School**

### **Title: 3-D Printing Prosthetics with Recycled Filament**



The Pennridge High School Nerd Squad has been developing a 3-D printed prosthetic finger. The first prototype for the regional competition was made using MakerBot PLA filament. The blueprint for the prototype was originally designed for a child. Our

team is working with a community member to develop a customized prosthetic to meet his needs. Dale Tennett is the owner of Tennett Manufacturing Inc. in Telford, Pennsylvania. Mr. Tennett lost part of his finger during a work accident. Our team created a blueprint and prosthetic that fits Mr. Tennett's hand. The goal for our second prototype is to create a working prosthetic finger out of recycled filament and flexible filament for added dexterity. Our team is also hoping to work with local companies to turn plastic bottle caps into our own recycled filament.

### **IU 23 School: Lower Moreland High School**

#### **Title: A.C.E.**



A device to safely remove the cap from a water bottle so the two types of plastic can be recycled separately.

### **IU24 School: Bishop Shanahan High School**

#### **Title: CRLA: Cardiopulmonary Resuscitation**

#### **Life-saving Assistant**



In the event of a sudden cardiac arrest, properly performed and effective CPR is essential to keep the victim alive. However, less than 30 percent of US citizens know how to perform CPR, and only 60 percent of trained medical professionals perform CPR correctly. This lack of proper CPR leads to over 315,000 deaths due to sudden cardiac arrests a year. Our device, the CRLA, enables those who are untrained or inexperienced with CPR to take action when someone is in need of CPR. CRLA is a mat designed to monitor the compression force and rate of CPR administrators and indicates to the administrator if they are pressing too hard or too soft, or if they are compressing at the incorrect pace.

### **IU25 School: Garnet Valley High School**

#### **Title: Waste Bin Stabilizer**



A device that prevents instability in trash cans due to weather conditions, such as high winds. The device secures a trash can to the curb, preventing any road hazards or damage to cars. A metal band is secured around the trash can and connected to a motorized or mechanical locking system, which secures the entire device to the curb.

### **IU29 School: North Schuylkill Junior Senior High School**

#### **Title: Digital Work Zone**



Signage and Speed Pacing device designed to guide drivers safely through a construction zone.

### **School: Philadelphia Academy Charter High School**

#### **Title: Affordable Indoor Aquaponics!**



PACHS Ecology students focused on creating an indoor aquaponic system to grow herbs and vegetables. This can tackle several issues including inaccessible fresh produce in urban areas (food deserts), as well as cleaning the indoor air quality. The project is both affordable and self-sufficient, with little need for major upkeep.

## **We would like to thank the following individuals for their commitment to The Governor’s STEM Competition 2019:**

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B-Company: Sergeant Benjamin Flanders  
C-Company: Sergeant First Class Justin Roberts  
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Management



**continued ...**



The State Museum of Pennsylvania

PENNSYLVANIA HISTORICAL AND MUSEUM COMMISSION



Cumberland Perry Area  
Vocational  
Technical School





## The Governor's STEM Competition 2019

Tom Wolf, Governor

Pedro A. Rivera, Secretary, Department of Education

David Volkman, Executive Deputy Secretary

Matthew S. Stem, Deputy Secretary, Office of Elementary and Secondary Education



Front Cover: Logo designed by Caitlyn Bleacher, the winner of the logo design contest.

Back Cover: Logo designed by Erin Dugan-Smith , runner up.

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