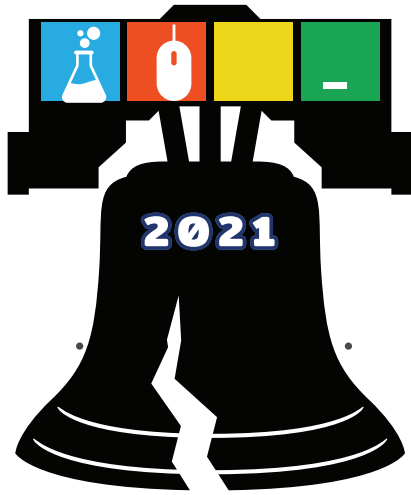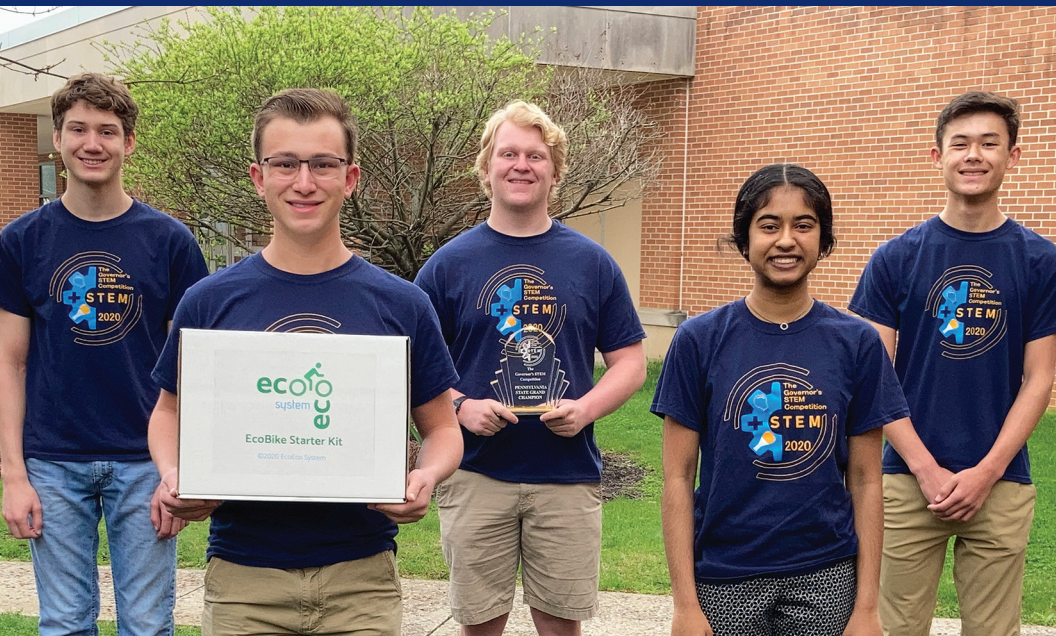# The Governor's STEM Competition
2021

2021

Virtual Edition

April and May 2021

The Governor's STEM Competition 2020 Grand Champions – Wilson High School
From left to right: Luke Kline, Cole Chmielewski, McCord Peterson,
Sanchita Bhusari, Colby Snyder

The Pennsylvania Department of Education (PDE) defines STEM (science, technology, engineering, and math) as an integrated, interdisciplinary, and student centered approach to learning that encourages curiosity, creativity, artistic expression, collaboration, communication, problem solving, critical thinking, and design thinking. Due to unusual circumstances, the 2021 Governor's STEM Competition was held virtually in April and May 2021.

The top placing teams in the 2020 competition were:
- Grand Champion: Wilson High School
- First Runner Up: Cedar Cliff High School
- Second Runner Up: South Fayette High School
- Third Runner Up: Bishop Shanahan High School

The following teams received the environmental impact awards:
- Sustainability: Tunkhannock Area High School
- Survivability: Bishop Shanahan High School
- Medical: South Fayette High School

2021 Pennsylvania Governor's STEM Competition

The Governor's STEM Competition was held virtually in April and May, with the theme "Improving Pennsylvania Through STEM." The Governor's STEM Competition challenges student teams from across the state to research, design, and present a device or project.

Teams were required to partner with a member of their local community, business, or educational entity to develop a solution to a real problem rooted in the commonwealth. This helps create an authentic experience for the students and provides opportunities for them to learn more about career pathways and employment possibilities based in STEM.

This year students prepared and submitted a video to present their findings to the state competition. This video overviewed and explained the practical applications of their device. The challenge tests the teams' communication, problem solving, and critical thinking skills while providing a unique opportunity to share their creativity with students from across the state.

The competition was open to students in grades 9 through 12 who attend a public, charter, or private school, a career and technical education center, or a student being homeschooled in Pennsylvania.

Overview

There was no regional qualifying competition this school year. There was one competition (the state competition) held in April 2021. This change, which is only applicable to the 2020-21 school year, was done to help maximize participation and support teams in experiencing the statewide competition.

This year there were two divisions for the 2020-21 state competition:

- Division 1: Those who competed in the STATE COMPETITION in the last 5 years

- Division 2: Those who have not competed in the STATE COMPETITION in the last 5 years

Identical awards were presented in each division.

Teams Participating in the Governor's STEM Competition 2021

	IU	School Name	School District Name	Advisor(s)
	1	Bethlehem Center High School	Bethlehem Center School District	Dawn Logan
	1	Peters Township High School	Peters Township School District	Christopher Allen
	3	North Allegheny High School	North Allegheny School District	Amy Bergman
	3	Fox Chapel Area High School	Fox Chapel Area School District	Lisa Gibson
	3	South Park High School	South Park School District	Eric Wisler
	3	South Fayette High School	South Fayette Township School District	James Hausman III
	3	Baldwin High School	Baldwin-Whitehall School District	Jared Hoffman
	3	Mt. Lebanon High School	Mt. Lebanon School District	Nicole Glover
	4	Neshannock Jr/Sr High School	Neshannock Township School District	Gregg Micsky
	4	Seneca Valley Senior High School	Seneca Valley School District	Dean Walker
	5	Eisenhower Middle High School and Sheffield Area High School	Warren County School District	Fallon Bachman Rebecca Downey* Meggi Brown*
	5	McDowell High School	Millcreek Township School District	Rick Fetzner
	6	Rocky Grove High School	Valley Grove School District	Bridget Kennedy
	7	Greensburg Salem High School	Greensburg Salem School District	Jeff Blanchetti
	8	Chestnut Ridge Senior High School	Chestnut Ridge School District	Keith Fleegle
	10	Central Mountain High School - Career and Technology Center	Keystone Central School District	Frederick Hoy
	10	Central Mountain High School	Keystone Central School District	Suzanne Hanna
	11	Southern Huntingdon County HSMS	Southern Huntingdon County School District	Nicolee Christophel

IU	School Name	School District Name	Advisor(s)
12	York Suburban High School	York Suburban School District	Korbin Shearer
12	William Penn Senior High School	York City School District	Erica Schmuck Wilson Megan Tyson*
12	Red Lion Area Senior High	Red Lion Area School District	Nathan Barrett
13	Fairland Program	Lancaster-Lebanon IU13	Andrea Fellows
13	Annville-Cleona High School	Annville-Cleona School District	Michael Hall
13	Warwick High School	Warwick School District	Janice Beitzel
13	Solanco High School	Solanco School District	Caley Roark
13	Lampeter-Strasburg High School	Lampeter-Strasburg School District	Pamela Kochel
14	Wyomissing Area Jr/Sr High School	Wyomissing Area School District	Dr. Brian Liskey
14	Hamburg Area High School	Hamburg Area School District	Terence Laughlin
14	Wilson High School	Wilson School District	Beth Levan
14	Exeter Township Senior High School	Exeter Township School District	Zach Potter
14	Conrad Weiser High School	Conrad Weiser Area School District	John Siefert
14	Governor Mifflin High School	Governor Mifflin School District	Tyler Smith
15	Shippensburg Area High School	Shippensburg Area School District	Mylinda Fowler
15	Harrisburg High School SciTech Campus	Harrisburg School District	Tina Klotzbeecher

*Denotes name of secondary advisor(s).

Division 1 Participant

Division 2 Participant

IU	School Name	School District Name	Advisor(s)
15	Mechanicsburg Area Senior High	Mechanicsburg Area School District	James Statler
15	Lower Dauphin High School	Lower Dauphin School District	Elizabeth Kirman
15	Red Land High School	West Shore School District	Matthew Wagoner
16	Midd-West High School	Midd-West School District	Ed Gunkle Matt Dietz*
16	Central Columbia High School	Central Columbia School District	Thomas Gill
18	Pittston Area High School	Pittston Area School District	Tara Turkos Craig
18	Wyoming Area Secondary Center	Wyoming Area School District	Trudy Chapple McAndrew
19	Wallenpaupack Area High School	Wallenpaupack Area School District	Aimee Wentzell Erin SanClementi*
20	Delaware Valley High School	Delaware Valley School District	Robert Curtis
21	Whitehall High School	Whitehall-Coplay School District	David Wacker
22	Bensalem High School	Bensalem Township School District	Daniel Lubacz
22	Pennridge High School	Pennridge School District	Melissa O'Brien Jim Rutkowski*
23	Lower Moreland High School	Lower Moreland Township School District	Nick Solomon
23	Pottstown High School	Pottstown School District	Andrew R. Bachman
23	Merion Mercy Academy	Nonpublic	Benjamin York
24	Bishop Shanahan High School	Archdiocese of Philadelphia Secondary Schools	Dr. John P. Janasik
25	Episcopal Academy	Nonpublic	Dr. Katalin Malcolm

	IU	School Name	School District Name	Advisor(s)
	25	Marple Newtown High School	Marple Newtown School District	Anne Lanshe
	25	Archbishop John Carroll High School	Archdiocese of Philadelphia	Joshua Scaralia
	26	Philadelphia Academy Charter High School	Philadelphia Academy Charter Schools	Robert Mottershead
	29	Nativity BVM	Diocese of Allentown	Maureen Challenger
	29	North Schuylkill Jr/Sr High School	North Schuylkill School District	Kelly Stone

*Denotes name of secondary advisor(s).

Division 1 Participant

Division 2 Participant

Project Descriptions

IU1

Bethlehem Center High School

Aller-genius: This is an app designed to assist people with allergies or food sensitivities when shopping. It will enable users to assess if a food product is viable and safe for consumers when compared to the user's allergy, gluten sensitivity, or disease. This will save time when shopping so that not every label has to be scrutinized for particular allergies, a simple search and the user will get feedback if the item is safe.

Peters Township High School

Build-a-Bot is a low-cost option for schools to introduce S.T.E.M. concepts through robotic engineering, problem-solving, and industrial design. The product consists of the mechanical and technical components that teams of students can use to build a core robot body. These new components will be used as attachments to the core robot- allowing students to participate in robotic battles and other challenges.

IU3

North Allegheny High School

Our team is working on creating a redesigned, ergonomic and eco-friendly facemask.

Fox Chapel Area High School

The goal of this project is to design an efficient human detection software that analyzes and provides demographic data regarding people in public spaces. A potential application for this technology is determining the safety of public buildings based on social distancing guidelines and customer counts throughout and beyond the COVID-19 pandemic.

South Park High School

We are focusing our attention on walking aids especially for people who are over the age of 65. The goal is to create a more ergonomic walking aid that meets the needs of individuals who use them on a more consistent basis, and address the need of being able to maneuver on a variety of terrain.

South Fayette High School

Every winter more than 10,000 people are injured at home while shoveling snow. Our solution is an autonomous robot, SNONOMO that removes snow so you do not have to. SNONOMO utilizes intelligent mapping to navigate users' driveways and walkways, and its intuitive, easy-to-use app allows users to monitor and adjust SNONOMO's progress.

Baldwin High School

The COVID dashboard is an informational tool to be used by parents, students, and administrators for a quick and easy way to view the number of cases active in the school district. This information would allow parents to keep their kids home when there are active cases, and populations of the student body who are at risk would see the level of risk they would be taking going to school.Our goal is to have this tool put onto the district website until the pandemic has ended to keep the community informed and safe.

Mt. Lebanon High School

The team designed an application that is a new, engaging way in which people can stay mentally and physically fit. Though everyone can use their app, it is mainly directed toward students, as this is a large demographic that is significantly affected by the pandemic. By being able to act as a personal trainer, this app helps students stay active, healthy, and engaged during online classes.

IU4

Midwestern Intermediate Unit IV
Making a Difference in Education

Neshannock Jr/Sr High School

We seek to combat the issue of personal safety with the creation of a discreet personal safety app, Lulu. The app hosts articles about safety, lists abuse hotlines, and safety ratings in the user's area. The app is linked to a Bluetooth keychain that notifies emergency contacts or the authorities of the user's location, and sends live audio/visual from the user's phone.

Seneca Valley Senior High School

We are designing a foot pedal to control temperature and pressure of handwashing sinks for retrofitting in public restrooms.

IU5

Eisenhower Middle High School and Sheffield Area High School

The project the students are working on is an automated liquid medication dispenser to aide patients with physical limitations and to assist with consistent medication administration and safety.

McDowell High School

According to the Bureau of Labor Statistics, 84% of workers that sustained head injuries were not wearing a hard hat. In response, our proposed system updates whether workers are currently wearing hard hats. The collected data allows construction managers to ensure all employees are wearing the proper head protection without having to surveil each one in person.

IU6

Rocky Grove High School

With the remote and ever-changing models of instruction occurring this year, students are struggling to keep track of their classes and assignments. They may also be having problems with so much screen time and being inactive during the day. Therefore, we decided to develop an app that would help students to organize their school day and give them health reminders through the day.

IU7

Greensburg Salem High School

Our students have developed a prototype called, "Black Box." Clean your products with this ultraviolet lighting sanitizing system. Avoid colds, the flu, and the Covid 19 Virus and clean your store items with the "Black Box."

IU8

Chestnut Ridge Senior High School

We are designing a cafeteria mask holder and protector. As we go into 2021, we realize that the key to being able to get our lives back to normal is wearing sanitary masks and hand sanitizer. The one problem that we have noticed at our schools and restaurants is that during meals students are putting their masks on the table so we want to create a sanitary holder.

IU10

Central Mountain High School - Career and Technology Center

Our team is developing a device that used to determine road conditions on various roads in Clinton County. In addition, we will be developing an app available to drivers, to be used to access the information in real time. Our hope is to reduce the number of driving accidents that occur due to inclement weather, etc.

Central Mountain High School

We will be producing a prototype of a building that uses oils produced by algae for biofuel. The architectural design will incorporate areas for growth of the algae as well as equipment for the extraction and circulation of the oil.

IU11

Southern Huntingdon County HSMS

The Spotted Laternfly is a menace to many industries and plant species, which in turn affects many Pennsylvanians. Our design goal is to lure and trap the Spotted Laternfly to prevent such damage.

IU12

York Suburban High School

The SafeHiking Hiking Backpack is the ultimate pack for all of your hiking endeavors. From its advanced cliff detection technology to its energy efficient frame, this hiking backpack will allow you to hike farther and safer.

William Penn Senior High School

Considering the challenges the past year has created for families including Covid-19, job loss, quarantining, and supply shortages, we have decided to focus on helping those most affected during this season. We are creating care packages for the homeless to help them through this difficult time and to help keep them safe.

Red Lion Area Senior High

Our device incorporates an augmented reality system into a bike helmet. The goal is to make bike riding more accessible to individuals with visual impairments or other impairments that limit their ability to bicycle safely.

IU13

Fairland

This year our team is creating a device that will help people stand up from a seated position. We are innovating the design of current seat-lift devices to be a smaller profile, rechargeable, and to tilt in various directions.

Annville-Cleona High School

Our project is a bullet-resistant protective cover for doors. The purpose of this project is to protect the occupants of the building or room from threats.

Warwick

In order to allow everyone to have accessible communication, the IU13 Deaf and Hard of Hearing class has designed a desk that provides both function and ease of access for communication. The desk also includes a visual attention-getting device that was coded by the Deaf/HH class.

Solanco High School

Over the past century, brook trout have experienced extensive population declines throughout Pennsylvania. Inspired by the Tesla valve, the PULSE (Passive Underwater Low-Impact Sediment Extractor) is designed to filter out the worst sediment in brook trout habitats, helping to restore the population of Pennsylvania's State Fish and the ecosystems where they live.

Lampeter-Strasburg High School

We are working to recycle plastic, mixed with asphalt, as pothole-filling material for road surfaces. The project will investigate layering versus interspersing the plastic and asphalt for effectiveness.

IU14

Wyomissing Area Jr./Sr High School

Our project will be examine hydroponics systems to expand the availability of fresh foods within an urban community. We are using knowledge of botany, chemistry, electronics, and engineering to create a sustainable food source for the next "green revolution."

Hamburg Area High School

Our project is a real-time, geospatial monitoring system for methane emissions and other atmospheric data to be used as a health and safety alert system. Our teams include the: 1) GIS team, creating an online dashboard to display real-time data, 2) Programming team, programming a raspberry pi to collect and transmit sensor data over Wi-Fi, and, 3) Engineering team, designing and using 3D print stands, fasteners, and containers to secure the units at various locations throughout the district.

Wilson High School

Our project is a fully autonomous vertical garden capable of growing organic food and creating portable green spaces in domestic, corporate, and industrial capacities. This product, which employs an Arduino microcontroller, a solenoid valve, and aquarium tubing, among other components, targets the issues of mental health, nutrition, and sustainability. There is also a non-autonomous version with similar capabilities used to reduce stress in corporate and home environments.

Exeter Township Senior High School

We are working on a device that will help prevent microplastics, specifically tire wear particles (TWP), from reaching waterways and affecting wildlife and ecosystems.

Conrad Weiser High School

Concrete is one of the most widely used materials and estimates suggest that its total mass now outweighs the total mass of plants on Earth. It is considered by many environmentalists to be the most destructive material developed by humanity. Recognizing the negative environmental and growing economic problems with concrete, we developed an alternative: living concrete. It incorporates photosynthetic bacteria which return oxygen to the environment and significantly reduce raw products needed for manufacturing.

Governor Mifflin High School

Project Law Enforcement Traffic Assistance Robot (LETAR) aims to reduce the tension present during law enforcement traffic stops. Project LETAR will act as a nonviolent intermediary between the police officer and stopped civilians by auditing questions posed by the police officer and providing the civilian's responses. As an intermediary, Project LETAR will ensure a greater level of safety and accountability at traffic stops.

IU15

Shippensburg Area High School

The team is attempting to develop a process of "cleaning" one-time use of cardboard (ex. pizza boxes) to make it recyclable.

Harrisburg High School SciTech Campus

In the midst of COVID-19, restaurants, stores, and schools have had to change from using items and equipment that require frequent hand contact. For our project, we are changing how condiment dispersers are used, specifically for schools, by creating a hands-free condiment dispenser for children of all ages.

Mechanicsburg Area Senior High

Our project is a low cost, transportable, LED crosswalk sign to be used at various pedestrian crossings in the borough of Mechanicsburg. This crosswalk detects pedestrians with ultrasonic sensing that illuminates a crosswalk sign to slow down and stop drivers. The crosswalk can easily be set up and moved based on the needs of the borough..

Lower Dauphin High School

The W.I.S.E. (Women in STEM Education) App will address the statewide problem that women comprise only 24 percent of professionals in the STEM fields. The app is designed for upper-elementary to middle-school students to educate them about the contributions of Women in STEM, past and present. This younger age group is important to educate because students form a career identity by middle school. It features push notifications, fun facts, and links to biographies.

Red Land High School

Redesign of 4-way stop signs to be interactive. Signs will start as 4-way Yield signs, as a car approaches from one side, that side will remain yield and the other directions will turn to stop. This increases efficiency, as cars are able to drive through when no other cars are present, saving energy and time.

IU16

Midd-West High School

MOM Mitigating Opioid Misuse: The prescription opioid epidemic is a critical public health crisis in Pennsylvania. Our solution is a biometric locking pillbox used for keeping an individual's prescribed medication protected from theft and redistribution. The device also aims to prevent addiction from starting in the first place by combating misuse and overdosing through a mechanism that only distributes appropriate doses at specific times of the day.

Central Columbia High School

The Central Columbia project is to design a device to determine the ripeness of fruit. Currently, we are investigating using the impedances to determine how ripe fruits are, in addition to methods related to measuring the amplitude differences in the harmonic frequencies of tapping on a piece of fruit. Through these non-invasive methods, we hope to address issues related to food waste in both grocery stores and in the harvesting of crops, as fruits that are closer to being ripe can be sorted out.

IU18

Pittston Area High School

In the midst of the ongoing COVID-19 pandemic, masks have become an essential part of all of our day-to-day lives. Our invention, a portable UV ray mask cleaner, will improve the lives of Pennsylvanians by allowing for an efficient, convenient and portable way to always maintain a clean facemask, hence eliminating any trepidations about not having a facemask to wear in situations where social distancing is not possible.

Wyoming Area Secondary Center

Power in Numbers: A facial recognition system to acknowledge/remind individuals to properly wear a facemask to help prevent the spread of COVID-19. The current health crisis has affected every citizen; this non-confrontational method will alert if an individual is wearing proper facial protection, and signal a reminder if not.

IU19

Wallenpaupack Area High School

The Wallenpaupack team is developing a sanitation device to clean conveyor belts in grocery stores and food processing plants.

IU20

Delaware Valley High School

Volunteer firefighters in our area encounter dangerous conditions in their duties. One area of concern is fighting fires on building roofs, which are weakened and can collapse. Our team developed a firefighting drone to alleviate these issues.

IU21

Whitehall High School

Our team project is focusing on an ecofriendly alternative to the use of residential rock salt during the winter months.

IU22

Bensalem High School

Our team is developing a device that improves gripping ability for persons with Muscular Dystrophy.

Pennridge High School

The Pennridge Nerd Squad worked to design a 3-D printed drone kit that makes learning STEM skills a reality for all students. We collaborated with elementary schools in our district to create a kit that includes the materials and lesson plans to help teachers lead students through the engineering design process and develop key STEM skills.

IU23

Lower Moreland High School

We are working on collecting excess energy from the electricity grid in times of plenty to redistribute in times of need without using batteries.

Pottstown High School

The Lanternfly Egg Scraper and Collector provides easy removal and collection of this invasive species egg sacs from trees for easy disposal, thereby mitigated the damage the insects cause.

Merion Mercy Academy

"The Carbon ConTRAPtion" is designed to use an electrochemical redox reaction to capture pure carbon from car exhaust, thus reducing additional carbon emissions. This preventative measure will minimize future global warming.

IU24

Bishop Shanahan High School

MATT (a mat) ensures that emergency services are contacted in the event of a fall, especially for someone that is bed-ridden or injured. MATT holds a system of pressure sensors that can be powered independently, allowing individuals to be contacted immediately regardless of the victim's state of consciousness. It can be placed in various locations and environments, and has a waterproof coating. MATT is intended for use in hospitals, care facilities, and homes.

IU25

Episcopal Academy

Easy Vent™ is an ultra-low-cost, noninvasive ventilator is simple, cost efficient, easily assembled and operated for emergency relief, allowing ventilators to become a household item. This product will solve the ventilator and operator shortage issues locally and worldwide. Due to its agile design and mobility, it will also help EMTs and Paramedics to save lives during emergencies.

Marple Newtown High School

The team considered the process of anaerobic digestion. They are engineering a prototype of a biogas generator for use at a local level.

Archbishop John Carroll High School

The core concept of this creation is a device that can communicate the location, vitals, and oxygen saturation of other users. This is intended to be worn by Emergency Responders, whether it be police, medical personnel, or firefighters.

IU26

Philadelphia Academy Charter High School

The project this year was an attempt to create a simple, yet affective, trap for Spotted Lanternflies. The trap must be made with simple supplies that are easily accessible by all, but the students are also looking at utilizing different natural chemicals to see if they can improve on the attraction rate.

Nativity BVM

Our project is a high-tech vertical garden system. The system is self-watering, and includes a solar-powered pulley system for ease of harvesting. Sustainable materials are being used.

North Schuylkill Jr/Sr High School

In Pennsylvania, we have problems with deer roaming around roadways; our project will reduce or eliminate this problem.

We would like to thank the following for their commitment to The Governor's STEM Competition 2021:

We wish to thank the many individuals at the intermediate units across the commonwealth for their support of The Governor's STEM Competition and to all the students, advisors, and teams who met the challenge of the this year's virtual edition.

Special Thanks to:

Richard Askey, President of PSEA, and Partner for teacher awards

Many thanks to our judges who took time out of their daily schedules to participate:

Brittany Anderson	Kenneth Gabel	Mary Jane Podboy
Mike Baker	James Gates	Jason Reisinger
Sarah Brambley	Rebecca Gibboney	Lori Rodgers
Earl Brown	Ryan Gill	Kendy Schiffert
Jared Campbell	Judith Hawthorn	Joanne Shipe
Scott Cicero	Tim Heffernan	Lindsey Sides
Katie Clever	Heather Heimer	Glenn Singer
Leann Cox	Karen Henrichs	Craig Stonaha
Dr. Camille Dempsey	Marsha Hughes	Hartono Tjoe
Cara Devine	Rich Mackrell	Dan Tomaso
Maureen Dunbar	Diane McGaffic	Brian Varmecky
Sarah D'Urzo	Deanna Mennig	Jamal Wakeem
Jill Foys	Michelle Neiswender	Hiyam Wakeem

Penn State University judges for the Environmental categories:

Reuben Selase Asempapa

Jesse Middaugh

Ola Hamada Rashwan

Robert T. Richardson

The Pennsylvania Department of Education Designated Planning Team:

Angela Kirby
PaTTAN Harrisburg Director

Chris Cherny

Corey Dickey

Melissa Howell

Mike Onofrey

Judd Pittman

Charlie Trovato
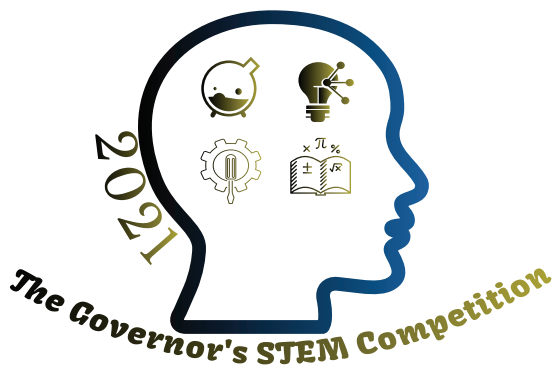
Deborah Wire

PaTTAN Tech Team

Front & Back Covers: Logos designed by students in the Lampeter-Strasburg High School classrooms of Andrea Fellows and James Snyder.

The Governor's STEM Competition 2021

Tom Wolf, Governor

Noe Ortega, Acting Secretary, Department of Education

Pam Smith, Acting Executive Deputy Secretary

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

David Volkman, Special Advisor to the Secretary