



ITS Michigan NEWS

ITS Michigan and Square One Education Network: **Preparing the next generation for the future of connected and autonomous vehicles**

Most technology and transportation experts predict that within the next several decades, autonomous vehicles will become commonplace. Assuming that's the case, there is a lot of technological development that is likely to happen during those intervening years. So, how can we ensure there will be enough engineers, computer scientists and others with the technological knowhow to bring this technology to the masses?

That is a question that interests many Intelligent Transportation Society of Michigan (ITS Michigan) members, many of whom are involved in the technology and transportation fields. It is also the reason the organization has become an



enthusiastic sponsor and supporter of the Square One Education Network's Autonomous Innovative Vehicle Design

Challenge, which is helping to encourage middle- and high-school student involvement in the science, technology, engineering and math (STEM) fields.

"ITS Michigan is a sponsor of this competition because we support young people and encouraging their interest in the STEM field," explained ITS Michigan President Gary Piotrowicz, deputy managing director and county highway engineer at the Road Commission for Oakland County (RCOC). "There really are not enough opportunities like this for kids, and if we give them the opportunity, they will step up; additionally, we need to ensure there will be enough capable and enthusiastic professionals in this field in the coming years," he added.

The program – what is the Four Square competition?

The Challenge is a series of competitions open to high school and middle school students that involves designing and building or modifying vehicles ranging from full-scale electric vehicles to "Power Wheels"-sized autonomous vehicles to shoebox-sized autonomous vehicles to underwater remotely operated vehicles.



In particular, ITS Michigan sponsored and provided judging for the 2021 Autonomous Innovative Vehicle Design (IVD) competition in which high school students re-engineer a toddler motorized jeep platform to operate autonomously with a connected-vehicle theme. The students, under the guidance of a teacher/advisor, are introduced to computer programming, GPS and sensor technologies and other skills.

RCOC's Piotrowicz, as well as ITS

Michigan Secretary Tony Geara, ITS and traffic engineer for the City of Detroit, and Michele Mueller of the Michigan Department of Transportation (MDOT), were among the judges for this year's event May 18

and 19 at Flint's Kettering University.

"Each student on every team contributed to their project deliverables," Geara noted. "It was clear they learned and grew throughout the process. Additionally, the soft skills that the students picked up are invaluable to their futures. Not only did they design and build a piece of technology, they also prepared financial summaries, wrote progress reports and presented their project," he stated.

"There are very few programs similar to this that offer students these unique and

valuable professional skills. Additionally, programs such as this ensure we have an enthusiastic, competitive and prepared workforce in the ITS and connected/autonomous-vehicle (CAV) fields in the future."

Students are scored at the competition based on the level of autonomy and the complexity of tasks their vehicles are able to achieve, including collision avoidance, platooning and parallel parking. They are also scored on a variety of other skills necessary to manage such a project.

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The Square One program: More than engineering

The competition goes beyond the technical aspects.

Each student team is also rated on its teamwork, presentation, design and innovation. Additionally, the students are required to conduct outreach for their project, meeting with other, younger students or classes to explain what they are doing. They are also required to create an informational video about their project and are rated on the quality of the video.

“The whole competition really challenges the students and forces them to expand their skill sets and move outside of their comfort zones,” Piotrowicz noted. “While the engineering aspects of this competition alone are phenomenal, the participants actually benefit on so many more levels than just engineering. This also really helps them to develop the ‘soft’ skills they will need to succeed in the workplace in addition to the STEM skills.”

Piotrowicz added that the students who participate in the competition will be light years ahead of other students when they are ready to enter the workforce. “We’re talking about communication skills, prob-



lem-solving skills, public speaking and presentation skills, self-confidence – a whole raft of critical skills that go far beyond the technological fields,” he explained. “You could be the best engineer in the world, but if you can’t communicate your ideas or work cooperatively with others, you won’t succeed.”

This year’s Square One competition was conducted both in person and virtually due to COVID-19. Twenty-one teams competed in person, while another 17 competed virtually across all categories. Six teams competed in person for the Autonomous IVD competition. Each team is made up of at least five to 10 students

plus a certified teacher.

Teams are limited to a \$1,000 budget and typically spend the entire school year prior to the competition preparing for the event. Throughout that time, there are strict guidelines and milestones that each team must meet and meetings in which they must participate.

And the winners are...

This year’s Autonomous IVD competition winners were: Traverse Bay Area Career Tech Center (Innovation and Ambassadorship awards); Canyon Lake High School, Fischer Texas (Engineering Award); Divine Child High School, Dearborn Michigan (Performance Award, first place, and Craftsmanship Award); Northwest High School, Jackson Michigan (Performance Award, second place, Milestone Video Award and Execution Excellence Award); Grandville High School – two teams, Grandville Michigan (tied for Square One Award); Fitzgerald High School, Warren Michigan (Milestone Video Award, Presentation Award).

Who is Square One Education Network?

The future of mobility is likely to be filled with high-tech wonders, the likes of which we can only begin to imagine today. That future will also likely include many new careers that meld the skills of mechanical and electrical engineering with those of computer science. Part of the challenge of ensuring that future becomes reality is ensuring there are enough qualified individuals to fill those exciting new jobs.

A parallel challenge is making sure that today’s youth become aware of that impending future and position themselves to take advantage of the career options it will offer. At the juncture of those two needs lies an amazing Michigan-based non-profit organization that is striving to meet both goals.

Square One Education Network is committed to ensuring that the next-generation technical workforce is ready for that challenge. “We don’t want to just build a technical workforce,” explained Square One Executive Director Barb Land. “We want to create an innovative workforce that is tech savvy,

critical thinking.”

Land noted her organization is doing that by working with both students and teachers across Michigan as well as around the country to inspire students to want to pursue careers in the science, technology,



Square One Executive Director Barb Land at the Innovative Vehicle Design event.

engineering and math (STEM) fields. “We try to create projects that have a direct connection to the real world,” she noted. “The

goal is to get them interested in school through tangible activities that apply the abstract ideas they learn in the classroom. The projects are a hook that gets them excited about the STEM subjects.”

Because Square One is organizationally small, one of the most effective ways to reach large numbers of students is through teachers. To do that, the organization works with hundreds of teachers each year, providing professional development related to the STEM subjects and teaching the teachers how to introduce the hands-on Square One projects to the students.

To date, the effort has been wildly successful, with Square One competitions drawing hundreds of students from across the state each year. This year, because participating virtually was an option due to COVID, the organization also saw students involved from California, Texas, Florida and

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Square One and ITS Michigan forge partnership

It has long been one of ITS Michigan's goals to help ensure that the workforce of the future is prepared for the rapidly evolving career opportunities in the mobility and intelligent transportation space, and partnering with Square One perfectly aligned with this goal.

"Mobility/intelligent transportation is an emerging field with new college and university programs being developed to train and educate the future workforce for the industry," explained ITS Michigan Talent and Workforce Development Committee Chair and former President Yousuf Taufiq, vice president and mid-west district operations leader/central region PMCM operations leader for WSP.

"However, we know that to attract talent in this emerging field, we need to reach students in high school when they are starting to make decisions about which career path they are most interested in," he added. "Square One Education Network was already an established high school-focused mentorship program that enables students to take on real-world transportation challenges and participate in innovative vehicle designs. And Square One Executive Director Barb Land provides tremendous, inspirational leadership for the programs. Creating an alignment between ITS Michigan and Square One allows for early engagement with those students."

To support the efforts of Square One, ITS Michigan provided scholarships of \$1,500 in 2020 and 2021. Additionally, ITS Michigan sponsored a technology-

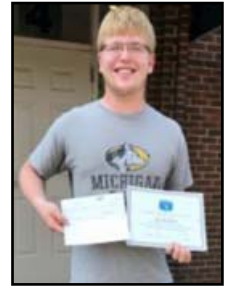
demonstration day at the American Center for Mobility (ACM) in Ypsilanti in 2019 as part of the ITS Michigan Annual Meeting.

For the demonstration day, ITS Michigan sponsored more than 80 students, allowing them to interact with vendors and witness connected- and automated-vehicle demonstrations at ACM.

In 2018, ITS Michigan sponsored a technology-showcase day as part of the ITS America Annual Meeting in Detroit, allowing more than 80 students to attend the ITS America annual meeting. This allowed the students to get a chance to walk the technology showroom, talk to vendors and see live demonstrations of technology that is being used to improve safety and enhance the operations of our transportation system.

Additionally, ITS Michigan has provided judges for the annual Square One competitions and organized Square One students to demonstrate their technology and compete for scholarships and prizes as part of the ITS America Annual meeting. This has included conducting a live demonstration for the director of the Michigan Department of Transportation (MDOT) and other executives attending the conference.

Taufiq reiterated that it is critical to the future of the mobility industry that there be programs such as those run by Square One. "When I was recruited into the ITS space 12 years ago, I did not have any formal training or guidance. Many colleges and programs did not have ITS- or mobility-focused courses, and most of the industry learned by doing.



ITS Michigan 2020 scholarship winners Victor Bailor, left, and Gabriel Krumlauf.

"Training the future of our workforce is important to ITS Michigan members, as we are continuously looking for new talent," he added.

Supporting STEM-oriented subjects and mentoring programs that are giving students exposure to ITS and mobility topics, means there will be a more prepared workforce in the future. This will make the mobility/ITS industry stronger, which benefits all ITS Michigan members and helps to provide new talent and fresh perspectives.

"We are looking to expand our support for Square One by creating a more formal ITS student chapter," Taufiq said. "This will create better industry alignment and support with the ITS Michigan Board, so we can better support mentorships, internship opportunities and scholarship opportunities and make sure we have alignment with the colleges and universities."

The critical role of sponsors and the vast logistics required

It's not only the students who must rise to the occasion to make the Square One competition a reality. Throughout the year leading up to the competition and during the two-day event itself, there are massive logistics that must be managed by Square One staff and a host of volunteers.

"To watch this competition in person is to see a finally tuned machine," Piotrowicz observed. "The logistics are really mind blowing – every element of the two-day event is managed, down to the smallest detail, so that the students can focus solely on the competition. Meanwhile, this incredible event is swirling around them, without ever missing a beat."

In addition to ITS Michigan, the following are sponsors of Square One's efforts:

- Kettering University
- Washtenaw Community College
- umlaut
- ITS America
- Michigan International Speedway
- MIAT College of Technology
- Michigan Department of Labor and Economic Opportunity
- American Center for Mobility
- Planet M
- WSP
- LIFT
- NDIA

- ARGO
- Carnegie Mellon University
- Texas A&M Transportation Institute
- ITS Florida
- Michigan Technological University
- MISTEM Network
- Oakland University
- Northern Michigan University
- SWRI
- Oakland Schools
- MISD
- Bay Arenac ISD
- Ann Arbor Public Schools
- Larry's Performance R/Cs
- Oakland County, Michigan
- Eisbrenner Public Relations
- good sense media

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Pennsylvania – many sponsored by other ITS state chapters.

Because the participating students are also required to do outreach about their projects and about Square One to other students, each year the organization directly or indirectly brings information about STEM-related activities to about 11,000 students.

In addition to the small Square One staff and the participating teachers and students, the effort also relies on a small army of volunteers, many of whom work in the STEM field in the automotive or mobility industries. One of those volunteers this year was Intelligent Transportation Society of Michigan (ITS Michigan) President Gary Piotrowicz.

Piotrowicz, the deputy managing director/county highway engineer at the Road Commission for Oakland County (RCOC) and a civil engineer by trade, served as a judge for Square One's Autonomous Innovative Vehicle Design competition that concluded with a massive challenge day on the campus of Kettering University in Flint on May 19.

"This was truly an amazing process," Piotrowicz noted. "These students had spent the entire year preparing for this event, and it was fantastic to see their enthusiasm for everything they had learned, created and achieved during that time."

Though it is focused on preparing students for the future, Square One is rooted in the past. Back in the 1970s, the worlds of mechanical and electrical engineering

within the automotive field were separate universes that had relatively little contact or overlap.

Some engineers, however, were perceptive enough to see, even in the 1970s, that these two fields would increasingly converge as technology grew in importance in the automotive industry. Consequently, these forward-thinking engineers formed a group to get the two groups talking. Ultimately that led to the establishment of the Convergence Conference that focused on, as the name implies, the convergence of the fields of mechanical and electrical engineering.

This event became very successful in the 1980s and 1990s, and ultimately generated revenue. The group's leaders, then, determined they wanted to do something with the revenue earned from the event that would help to further the group's goal of fostering cooperation among these fields for years to come.

The outcome of this effort was the formation of Square One Education Network. Now in its 25th year, the organization has been wildly successful getting youth interested in career paths that incorporate elements of mechanical and electrical engineering as well as computer science.

This effort is even more critical today



Barb Land

than it was when Square One was founded, as the world of autonomous and connected vehicles is quickly arriving. "Our competitions must tie to the real world," Land observed. "The challenges represent many of the things that engineers are currently working on in the industry."

Land noted the organization started out with the competition involving students building an electric-powered go-cart before expanding to a mini-autonomous vehicle and toddler jeep platform.

The most recent edition, she added is the Underwater Innovative Vehicle-Design competition. "This is a full-system engineering and robotics project," she explained. Interestingly, the underwater competition has proven to be a gateway to engineering for female and minority students who might otherwise be less interested in the wheeled vehicles.

However, once they have a taste for the excitement of the projects and the competition, Land noted, many of these students then move into the wheeled projects.

Land is confident the program will continue to expand as more schools get involved – both in Michigan and now outside of the state. "Teachers are hungry for hands-on STEM projects," she said. "The more they are exposed to these opportunities, the more it will grow."

For more information about Square One and its programs for youth or teachers, visit the organization's website at www.squareonenetwork.org.

The ITS Michigan Board



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