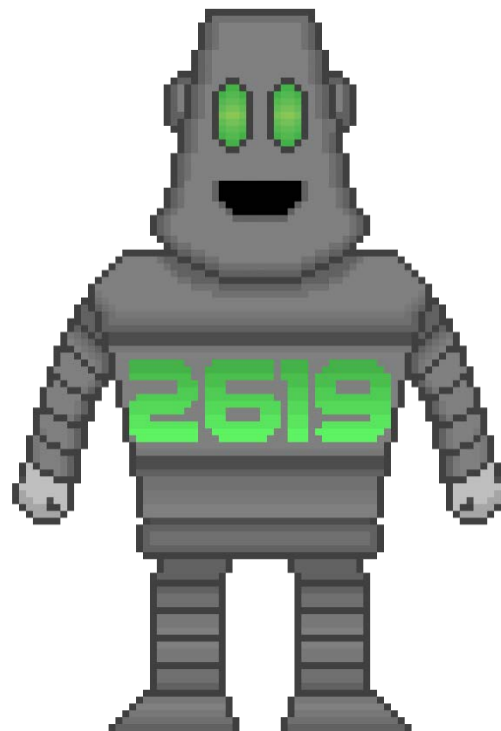


THE CHARGE MMDCLXIX

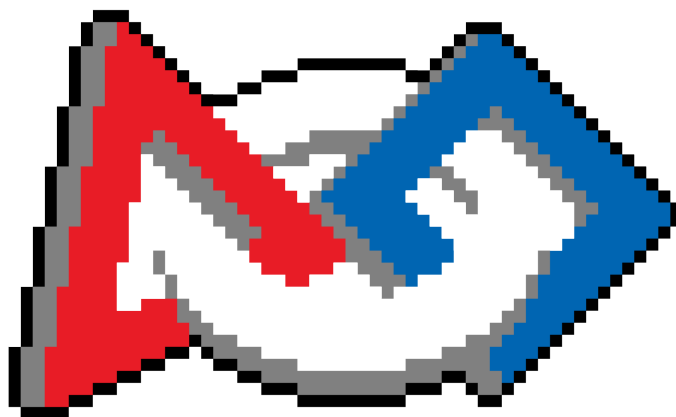


INSPIRING FUTURE
ENGINEERS!

Contents

Summary	3
Team 2619 Recruiting Initiatives	4
Great Lakes Bay Science and Engineering Festival	4
Creating & Hosting FIRST of the Great Lakes Bay Region BOT-BASH(es)	5
Hosting Multiple H.H. Dow High FIRST District Competitions	6
Elementary School Science Fair (Siebert Elementary)	6
Grace A. Dow Library Reading Program.....	6
Collaboration with FIRST of the Great Lakes Bay Region Non-Profit.....	7
Reaching Outside the Team for FIRST.....	8
Golf-Bot Partnering with Dow SYMBIO® Hydraulic Fluid	8
The Bicycle Generator.....	10
American Association of University Women Presentation.....	11
Rotary Club Presentation.....	11
The RADD Display.....	11
Robot RADD Display.....	12
The Outstanding Use of Technology Award	13
The Noise-O-Meter	15
STEM Camp	16
The MagLev.....	16
Great Lakes Loons Exhibitions and Pitch Bot.....	17
FIRST of Michigan Electrical Distribution Panel Fabrication	18
Grant Writing	19
Committed to STEM Everywhere!	20
Middle School Sound Safety Presentation.....	20
FLL and FTC Mock Competitions Held at Build Site	21
Mentoring FTC Teams.....	21
STEM Summit Presentation	22
Nomad Motor Controller Board.....	23
Star Project.....	24
American Institute of Chemical Engineers Presentation	27
Michigan Society of Professional Engineers Luncheon.....	27
Continued Education in STEM Beyond Team 2619.....	31
Dow Mentors in “brown bag” Luncheon Meetings	32
Mentoring Philosophy.....	32

Practice Field	32
Advanced Material Use in Robots.....	33
FIRST Mission Beyond Team 2619	34
Presentation to Midland Public Schools Board.....	34
Battery Study and Report	35
Battery Test Kiosk	36
Women in Science Video	39
Battery Charger Cart Plans.....	41
Tour of Dow Chemical Robotics Research Department	42
Advertising STEM in Partnership with Dow Chemical	42



Summary

Team 2619 strives to inspire its students to become leaders in STEM fields in many ways. Our mentors work hard to give students opportunities to explore the many facets of STEM skills in both off season projects, robot build projects and community events. The students of this team have risen to the challenge of communicating the successes of FIRST to our corporate sponsors, area businesses and educational institutions. Through videos, reports, presentations and offsite events, our goal is to demonstrate the value of STEM and to bring awareness to future students that may ultimately choose STEM fields in higher education and beyond.

Our team's culture is to make STEM fun by creating opportunities in STEM skills, leadership and communication for our students. Many of our off-season projects have either become mainstays during the competitions (such as the RADD Display and Battery Charger Cart) or have become icons of "The-Charge" during our off-season events (such as the Golf-Bot and Bicycle Generator). This dual purpose serves the team by driving the process of continuously thinking of new ways to communicate STEM. In addition, our students have been involved in Grant-Writing; which not only provides opportunities to fulfill team missions, but it also provides a valuable experience.

In the community of practicing engineers, Team 2619 has hosted luncheons with the Michigan Society of Professional Engineers, has participated in tours of Dow Chemical's robotics research laboratories and presented to the American Institute of Chemical Engineers to name a few. In light of promoting women in STEM, the Team helped to create a video that celebrates Women in Science as well as presenting to the American Association of University Women.

Some of our internal projects have grown to be recognized outside of the team which is a wonderful way to exemplify "Gracious Professionalism" – a hallmark of FIRST. The team suffered a setback during a qualifying match in 2014 that was traced to a poorly performing battery. From that time, a plan was put together to better understand how batteries perform. An extensive battery report was written which greatly helped the team and was thought to be a value to others and made available on the web. This was further pursued and enhanced in 2018, creating a more accurate test through match simulation. The team also created a skill-building "Star" project which included recognition from the Governor of Michigan.

Although "The Charge" has accomplished many things in STEM through the team and beyond, our work continues. The team strives to provide creative opportunities for existing team members as well as new recruits with projects, leadership and communication. Our mission is ongoing and we plan to innovate to ultimately help our young people succeed regardless of the fields they choose to pursue.

Team 2619 Recruiting Initiatives

The team's promotion of STEM begins with recruiting students to Team 2619. Our team has experienced consistent and tremendous growth since 2014. For example, our student population has more than doubled since the 2014 competition season (27 to 55). This is in large part due to the tremendous effort the team put into creating the district competition at H.H. Dow High in 2014. Having this on-site event during the school day on a Friday provided key access to students that had never heard of FIRST, or were not aware of the exciting competition. The team put a great deal of energy into off season events and projects as well to not only help retain students interested in STEM, but to also bring in new students interested in fun and stimulating activities. The outcome of these efforts is clearly successful, as our alumni are now either seeking STEM degrees, or have graduated from higher education and have launched careers in this area.

The incredible growth of "The Charge" is even more impressive when considering that there are three other FRC teams in the city of Midland – all established in 2014. It was only a few short years ago that "The Charge" was the only team in the city, consisting of students from both H.H. Dow High and Midland High. Now that Midland High has their own team, "The Charge" is now focused only on Dow High; yet still grew substantially this year. Through FIRST of the Great Lakes Bay Region, a supportive foundation created by "The Charge", these other FRC teams have found strong footing and continue to experience great success.

Great Lakes Bay Science and Engineering Festival

Delta College held its inaugural Great Lakes Bay Science and Engineering Festival in October of 2013. The purpose of this festival was to highlight the many facets of STEM to middle school students in the Great Lakes Bay region. Over a thousand middle school students were entertained and challenged by the various displays. "The Charge" brought its FIRST robot, the Golf-Bot, the Noise-O-Meter, the MagLev, and the Bicycle Generator for displays. This was an excellent opportunity for students on the team to communicate the mission of FIRST to possible future team recruits. It also gave the students on the team the opportunity to meet with the Michigan Technological University's "Mind-Trekkers". These Michigan Tech students travel the state promoting STEM, giving high school students an understanding of what it's like in a university STEM program. They brought their university projects as well to demonstrate high level research and testing. Positive feedback from the "Mind Trekkers" spurred inviting Team 2619 and the FIRST demonstrations back to this festival in 2018 and planned for 2019.

Creating & Hosting FIRST of the Great Lakes Bay Region BOT-BASH(es)

With the proliferation of area rookie teams in 2014, it became apparent that more opportunities were needed to have offseason robotics events. “The Charge” made it a routine fall ritual to travel to Kettering University for their “Kettering Kickoff”. These offseason events are a great way to recruit new students and give them an idea of what a FIRST robotics competition is like. Team 2619 decided to spearhead the inclusion of a totally new offseason event taking place at H.H. Dow High School. In collaboration with FIRST of the Great Lakes Bay Region, a complete event was created which consisted of logistics, invitation of teams and mobilization of a phalanx of volunteers. This event was a great success, and has become a staple event of H. H. Dow High. It has already been planned again for October of 2018. As an added side benefit, having this competition at H.H. Dow High enables the team to attract new freshman to STEM that were not on-site during the spring FIRST district event.



Inaugural FIRST of the Great Lakes Bay Region Bot-Bash Flyer

Hosting Multiple H.H. Dow High FIRST District Competitions

A common theme across the state of Michigan is the proliferation of FIRST teams in the past few years. This has required FIRST of Michigan to create new district events to accommodate the growing number of FIRST teams. Led by Team 2619, the inaugural district competition at H.H. Dow High was held in 2014. This was an extensive undertaking that was over six months in the making before the event. Studies were conducted on feasibility, volunteers were sought out and mobilized, funding was raised which resulted in a successful event. The event was collaborated with FIRST of the Great Lakes Bay Region, which included the manpower of the other teams in this organization. Ultimately, FIRST of Michigan complimented this event as one of the best 1st year events ever undertaken. VIP presentations were made to the media, local and state government officials, as well as corporate sponsors. We continue to host this event, bringing in more coordination from a greater group of teams and more sponsor participation. It is this effort that continues to define our district as one of the best in the state.

Elementary School Science Fair (Siebert Elementary)

To bring awareness of FIRST to a younger audience, Team 2619 helped to host a STEM science fair at one of the local elementary schools. Over 50 science projects created by elementary school students at Siebert Elementary in Midland were displayed. “The Charge” not only helped facilitate the fair, but had a display with a FIRST robot and answered questions about FIRST and helped plant seeds for future recruits. The team was also involved in judging the science fair participants.

Grace A. Dow Library Reading Program

Team 2619 was invited to the main library in the city (Grace A. Dow Library) to be a part of the summer reading program kick-off. Several students from the team created a short presentation on FIRST robotics and brought a robot to the reading program. The audience ranged from elementary to high school students from the area. Participants were encouraged to see close up what a robot in FIRST is comprised of and had the opportunity to interact with members of “The Charge” to better understand FIRST, its mission and how STEM is being implemented within the team. It was an excellent opportunity to communicate the message of FIRST to a new audience in the community as well as to encourage future recruitment to the team.

Collaboration with FIRST of the Great Lakes Bay Region Non-Profit

Until 2012, Team 2619 was the only FIRST team in Midland County. As of today, there are seven FRC teams, 3 FTC and 5 FLL in the county. As the number of teams has grown, funding, nurturing and mentoring these teams in a local geographic area can become cumbersome. To alleviate some of the overlap and to create synergy amongst the teams, one of the mentors of Team 2619 established FIRST of the Great Lakes Bay Region. This entity is a non-profit organization whose mission is to help teams from the Great Lakes Bay Region (not only Midland County). It is strongly linked to Team 2619, which provides STEM collaboration among the teams associated with this organization. The teams of this organization help each other out, host events (such as the Bot-Bash), collaborate in STEM events at local community colleges, and bring together mentors and students. FIRST of the Great Lakes Bay Region also helps teams with funding and startup logistics. The more experienced teams help and give advice to the rookie teams. Currently, three of the FIRST of the Great Lakes Bay Region FRC teams share a build site in Midland. These are Team 2619 (Midland H.H. Dow High), Team 5509 (Midland High) and Team 5424 (Midland Home School Team). Having them under the same roof as “The Charge” gives our team the opportunity to help and lead the teams and share ideas as well as equipment. This shared build site also has a fully functional 3-quarter sized FRC competition playing field so that the robots of the region can come and test their hardware. Outside of FRC, we host several FLL fields and a fully functioning FTC field. This collaboration has proven to be fruitful to our team from a FIRST mission standpoint and has developed the new teams faster than if they were on their own.



***FIRST[®] of the
Great Lakes Bay Region***

Reaching Outside the Team for FIRST

Team 2619's outreach beyond the team is bolstered by the extensive use of off-season projects. The purpose of these projects is to engage the students on the team with skill building efforts, stimulate STEM and to create outcomes that are fun. These projects are also designed to provide outreach to the community, whether it's a public event, or to demonstrate engineering and science principles to elementary and middle school students.

Golf-Bot Partnering with Dow SYMBIO® Hydraulic Fluid

The Golf-Bot was an off-season project that the team constructed while partnering with Dow. The Golf-Bot features Dow's SYMBIO® environmentally friendly hydraulic fluid. Hydraulic fluids are not used in our FIRST robots, so this was a great opportunity for the team to work with a new engineering system.

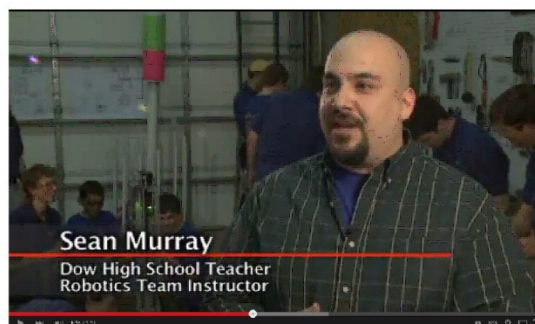
The Golf-Bot uses hydraulic actuation to operate a user controlled putter. The user can dial in a strength of swing as well as position the putter's angle. If the putt is successful, sensors will detect this and make a gopher dance and sing. This project encompassed electrical controls, mechanical design as well as an inviting and attractive design

The Golf-Bot had its public debut at a Tribology trade show in Orlando, it was then featured at the Dow Shareholder's Annual meeting in Midland, Michigan with students from the team getting the privilege of demonstrating its operation and encouraging the shareholders to try to putt using its automated controls.

Dow featured the Golf-Bot in a Youtube video that promotes the SYMBIO® product. Highlights of this video are on the next page.

Since constructing the Golf-Bot, it has been featured in many events, including:

- Dow Chemical Shareholder's Annual Meeting, Midland, MI (2009, 2014)
- USA Science and Engineering Festival, Washington DC (2014)
- Great Lakes Bay Science and Engineering Festival, Delta College, Michigan (2013, 2014, 2015, 2016, 2017, planned for 2018)



DOW™ SYMBIO Used by High School Robotic Team - The Dow Chemical Company

The Dow Chemical Company



Subscribe

4,061

You Tube

384 views



Add to



Share



More



2



0

Screen-Shots of Dow's YouTube Video on SYMBIO® Hydraulic Fluid
Used in Team 2619's Golf-Bot

<http://www.dow.com/ucon/symbio/>

The Bicycle Generator

The Bicycle Generator is a device that graphically depicts power generated by a person on a bike with a 20 segment bar-graph that stands 5 feet tall. The bicycle is stationary and spins a generator which is connected to the bar graph display. Each segment on the bar-graph represents 10 Watts of power. The purpose of the bicycle generator is to bring awareness to young people on the physical nature of power generation – that it's quite an effort to get the bar graph to sustain a reasonable amount of power. Young people can then relate the bar-graph to common items that consume electrical power such as a television, a gaming system or a light bulb. The human effort required is also an effective way to convey the purpose of energy conservation.



The Bicycle Generator in Action at the
Great Lakes Bay Science and Engineering Festival, Delta College

American Association of University Women Presentation

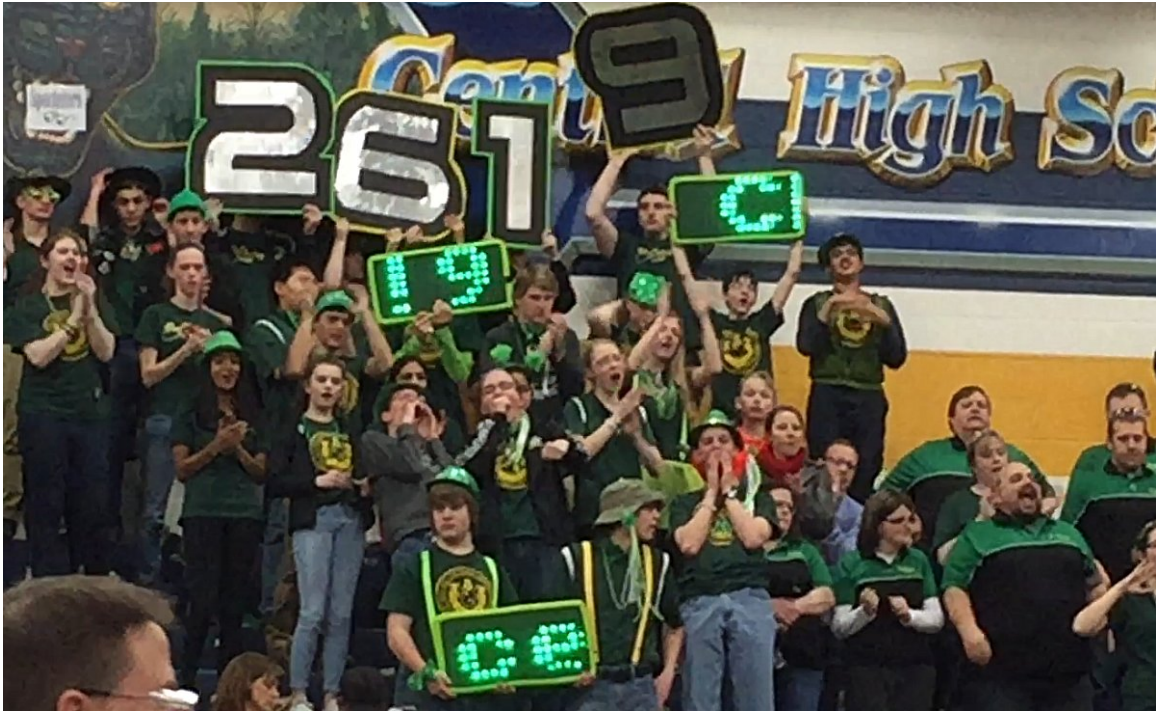
“The Charge” had the opportunity to present to the Midland chapter of the AAUW’s annual open house. This organization has a mission of promoting higher educational opportunities for women. The missions of both this organization and FIRST made it a natural combination. The students of Team 2619 demonstrated a robot at the open house as well as promote the efforts of STEM throughout the community. It is important to advance the efforts of women in STEM careers, and Team 2619 highlights this presentation along with the “Women in Science” video that was sponsored by Dow Chemical.

Rotary Club Presentation

Communicating the mission of FIRST throughout the community takes effort. “The Charge” led several such presentations to organizations that are willing to listen and help. The Midland Rotary Club was such an organization. A mainstay of Rotary’s purpose is to bring together business and professional leaders of a community for the greater good. Such is also an integral part of Team 2619’s mission of broadcasting the importance of STEM and STEM related events in the community. The leadership of Team 2619 created a professional presentation on what FIRST is all about with video clips of a real competition. The team’s organization and fund raising goals and strategies were also presented.

The RADD Display

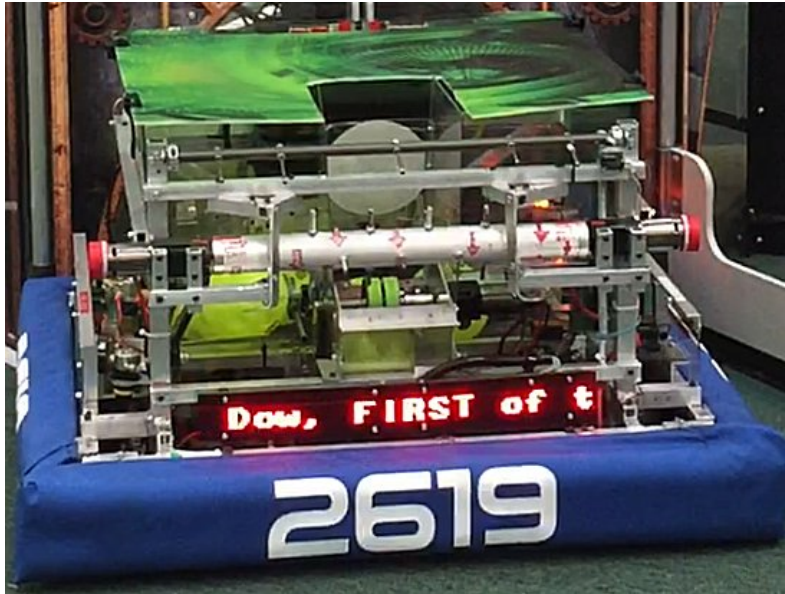
RADD stands for the “Radiant Audience Display Device”. It is a portable 24” x 12” battery operated scrolling LED display that allows the team to pre-program cheer slogans. Its 128 LEDs are easily visible from across the arena are a focal point of Team 2619’s cheering section. The displays were built by the team and are unique in FIRST. Powered by 4 AA batteries, they are rugged and with custom circuit boards, have withstood the rigors of travel and life in the bleachers. The scrolling LED motif was also used in the creation of the Robot RADD and the “Outstanding Use of Technology Award”, both of which will be highlighted later.



Team 2619 Utilizes Three RADD Displays in the Cheering Section, Standish District Competition, February 2016

Robot RADD Display

To recognize our sponsors and to make a splash, the team decided to build a 'RADD' – Radiant Audience Display Device, essentially a scrolling LED sign on the Robot with pre-programmed sponsor information that scrolls while the robot is driven during the match. The scrolling LED display that comprises the RADD consists of 16 – 8x8 dot matrix LEDs, a total of 1024 individual pixels. The display can select one of 16 pre-programmed alphanumeric phrases which are selected by the Robot's host processor, the RoboRIO via a digital interface. The RADD display incorporates its own microprocessor which manages the display and scrolling speed. The addition of this display to our robot not only honors our sponsors, but it provided a means to build a custom circuit and add a unique feature to our robot that no other FIRST team has undertaken.



The RADD Display on 2017's Robot

The Outstanding Use of Technology Award

During the course of a FIRST competition, some teams take the initiative to present awards to other teams to celebrate and recognize achievements in the spirit of FIRST. The “Outstanding Use of Technology Award” was created and built by Team 2619 in the image of our mascot, Sparky – to highlight a special feature in technology of other FIRST teams. During the competition, students canvass the other teams and reach a consensus on three teams that will receive this award. The students then create a phrase that is permanently programmed into the award, which is continuously scrolled across the “mouth” of Sparky when turned on. The award is then programmed and presented to the winning teams at the competition. This makes the award unique to the team it is presented to, as a memento of that particular competition. In addition, the use of the scrolling LEDs mimics the motif of RADD displays that the students proudly use to cheer in the audience.



The “Outstanding Use of Technology Award”, designed and built by Team 2619



Presentation of the “Outstanding Use of Technology Award” to Team 5926 “DA MOOse”, at the Kettering Week 2 District Competition, February 2018

The Noise-O-Meter

The Noise-O-Meter was an off-season project that the team achieved to promote skills in engineering as well as bring awareness to hearing safety at competitions in a very visually stimulating way. The display portion incorporates 1600 high brightness LEDs that indicate sound level from 0 to 120 Decibels. Its display measures approximately six feet wide, wired to a control board and powered by a standard FIRST battery. The students learned about electrical wiring, soldering and managing all of the connections necessary to make the unit portable and rugged. With high visibility, it has become a signature of the team in the pit area of the FIRST competitions. The team has taken the Noise-O-Meter to teach about the nature of sound waves, promoting science and engineering to elementary and middle school students. Its visual feedback nature makes it attractive to students of all ages.



Excerpt From the
Noise-O-Meter Brochure



Students Soldering the Noise-O-Meter Boards



The Noise-O-Meter Lights up the FIRST Pit

STEM Camp

In the Summer of 2015, students of “The Charge” hosted a week-long STEM Camp for youngsters who would be in the third to fifth grade during the following Fall. This camp, which was completely designed and lead by “The Charge” students, was a great way for these youngsters to learn, experience, and take interest in many STEM-related activities, presented in a fun manner. Some of these include buoyancy through constructed boats, electrical conductivity through modified Play-Doh, civil engineering with balsa wood, and magnetism with the MagLev Tracks, which is highlighted later. The team received such positive feedback that the camp was hosted again in December of the same year and July of the next year. The impact and success of the camp is evident through the growth from its inaugural year to its most recent instance. The youngsters enrolled have tripled (8 to 24), and nearly 90% of that population is female. STEM Camp has proved as valuable for introducing science as something that can be fun and rewarding.



Members of the Charge and the STEM Summer Camp Students, July 2016

The MagLev

The MagLev stands for “Magnetic Levitation”. It is a 10-foot-long track comprised of four angular aluminum bars and four magnetic strips, all of which are mounted on a wooden base. Small Lego baseplates are fitted with two magnet strips, two springs, and a fan wired into the springs. The magnetic strips on the Lego baseplates are in opposition to the magnetic track, thus levitating the Lego base and anything this built on them. The aluminum bars are electrified and make a continuous circuit through the springs and power the fan. Youngsters take these and construct their own designs which they can race on the track with a competitor. The purpose of the MagLev is to demonstrate the physics of electricity and magnetism, as well as propulsion and friction. Students can use their imagination to create these levitation vehicles and compete with each other, then go back and modify their designs with what they learned.



Mentor of “The Charge” operates the MagLev during the STEM Summer Camp, July 2016

Great Lakes Loons Exhibitions and Pitch Bot

For many years, “The Charge” has consistently exhibited at the Great Lakes Loons, the local AAA minor league baseball team. Each time, members of the team spark the interest of children at the event. Many creations of the team are brought along to promote interest in STEM, like the current FIRST robot, the Golf-Bot, the Noise-O-Meter, and the Bicycle Generator. This is not only an outstanding chance to stimulate interest in science, but it also gives students the opportunity to spread the mission of FIRST to possible future team recruits and the community. Most recently, “The Charge” was given the chance to throw the first pitch by Nexteer Corporation, a major sponsor. To further promote science and technology, students designed and constructed a robot specifically for throwing a baseball pitch.



Students of “The Charge” debut “Pitch Bot”, July 2017

FIRST of Michigan Electrical Distribution Panel Fabrication

When we first hosted a FRC District Competition, we noticed a lack of safe power distribution from the generator to the pits. We built a single panel for our event. Each district competition requires substantial power distribution for all the teams participating in the pit areas. The expansion of district competitions in the State of Michigan required additional electrical distribution panels at the new event sites. Team 2619 volunteered to fabricate enough three phase panels so that all district competitions would have the necessary equipment required. Students learned about large gauge wiring, electrical panels and circuit breakers. Licensed electricians were on-hand to assist and verify that the work was done correctly. This type of wiring is not typically done with robotics and was an excellent exposure for the students on the team.



Team 2619 Building Electrical Panels for FIRST of Michigan



Grant Writing

One of the aspects of teaching STEM to students of “The Charge” is exposure to grants and grant writing. This involves research by the students on the grants that are available, timelines for submission and the sometimes rigorous and lengthy requirements they entail. It also gives an opportunity for the Team to network with community organizations that may have not been exposed to FIRST or the STEM initiatives that are involved. Students have learned that communication, both oral and written is a fundamental skill that is required to be effective in a STEM related education or career. The team has received several grants in the past, including grants that have given us a new team robot trailer, milling machine, uniforms and funds for students that can’t afford travel to name a few.



For **good**. For **ever**.

P1 / INTRO
All aboard! The Northern Star has arrived in Midland.

P2 / GRANTS
Learn which projects were funded through our quarterly grant cycle.

P3 / CAREER + COLLEGE
Our newest collaboration: The Midland County Career + College Access Network.

P4 / SCHOLARSHIPS
Important announcement regarding community foundation scholarships!

MACF Connect

ISSUE 8 / 4th QUARTER 2014 EDITION

4th Quarter Grants = \$40,100

NORTHWOOD UNIVERSITY - \$20,000

GRANT TO FUND: The FIRST Robotics/Northwood University (NU) Business Training Program. NU Students will work with high school FIRST Robotics teams in the region to help heighten business acumen. Grant dollars will go toward technology costs associated with the project.
Total project cost = \$40,000



FIRST Robotics - The Dow Charger Robotics team poses with their machine during the 2014 Great Lakes Bay Bot Bash

“The Charge” Obtained a Grant from the Midland Area Community Foundation and was featured in their 2014-4th Quarter Newsletter

Committed to STEM Everywhere!

The team is heavily involved in promoting STEM at many levels. Many of our off season projects are not only teaching our students about engineering skills, but the end result of the projects are then used to promote STEM in the events that we take the projects to. The description of some of these projects was outlined in the previous section. In addition to these “transportable” projects, the team has many other STEM related commitments that are worthy of note.

Middle School Sound Safety Presentation

Sound safety was the topic that was presented to middle school students and it featured an interactive display using the Noise-O-Meter. A microphone was connected to the Noise-O-Meter and it gave the students a chance to “see” what certain levels of sound were, which emphasized the need for hearing protection at a certain level. Several presentations were made in the science and math classes.



Middle School Sound Safety Presentation Featuring the Noise-O-Meter

FLL and FTC Mock Competitions Held at Build Site

The students of “Team 2619” organized and ran a mock competition for the FLL teams in the region. This competition was held at the build site of “Team 2619” and featured a fully sized FLL competition arena. By giving these elementary school students exposure to one another, in addition to the members of “Team 2619”, helped foster a sense of belonging to the “*FIRST* family”. This was an excellent opportunity to recruit future “Team 2619” students by explaining and showing what was involved at the high school level robotics. Furthermore, the FLL teams were able to compete with one another extensively and fix the bugs of their respective robots before the real competition.



Team 2619 Supervises a Mock FLL Competition at the Team’s Build Site

Mentoring FTC Teams

A few years ago, three FTC teams were created within Midland. Before this, there was no FTC presence. Since then, many students from “The Charge” have volunteered their time to mentor the teams. Our students help with everything from design and fabrication to programming and presentation skills. Moreover, “The Charge” provided a build space for one of these teams when they had trouble finding one. By incorporating them into our robotics center, we were able to share our resources and assemble a full game field in our gym. This was made available to all FTC teams in FIRST of the Great Lakes Bay Region. One week before the FTC competition season began, live matches were hosted for these new teams to plan and refine strategies.



All three of the new Midland FTC teams from the fall of 2015.



STEM Summit Presentation

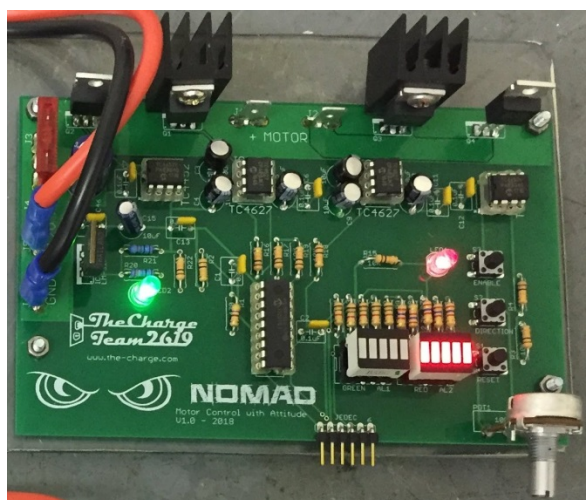
Students of “The Charge” were invited to present at Delta College regarding *FIRST* Robotics Programs. These students put together a presentation that encompassed all levels of *FIRST* Robotics and presented it at the STEM Summit in the fall of 2017. The purpose of this conference was to introduce aspects of STEM and the impact of *FIRST* robotics to the community. Through this endeavor, STEM and *FIRST* ideals were presented alongside other key STEM initiatives in the Great Lakes Bay Region.



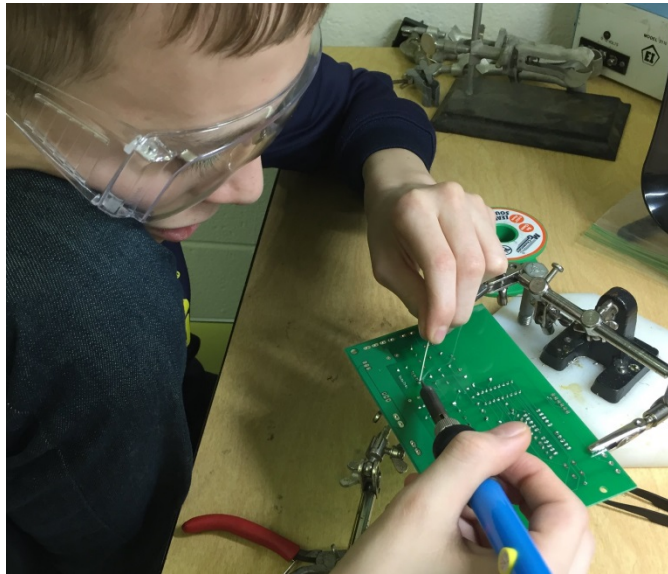
Students of “The Charge” present at the STEM Summit, October 2017

Nomad Motor Controller Board

During the prototyping phase of build season, often times it becomes necessary to test subsystems of the robot, including drive motors. Unfortunately, the motor controllers that are used on the final robot build require the RoboRIO main processor or some other means of intelligent control device to operate. This complicates the build process and leads to delays. To solve this problem, the team created an in-house designed motor controller board called the ‘Nomad’. As the name implies, this device needs no other supporting electronics, just a battery. This board allows quick prototyping of motor driven subsystems with an intuitive LED user interface and simple forward / reverse speed control using a potentiometer. The boards were built and tested by the students and are available for rapid deployment to assure that the subsystems perform as designed without the need to incorporate the entire robot’s control system. They have proven to be invaluable in allowing the rapid prototyping and evolution of the robot’s design.



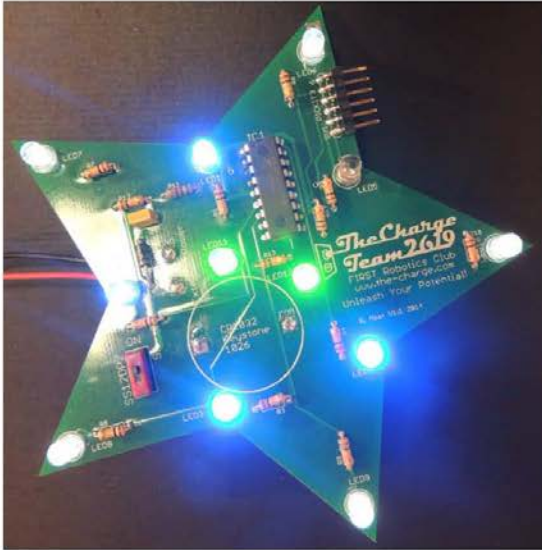
Nomad Motor Controller Board



Student Building a Nomad Board

Star Project

“The Charge” Star is a skill building project that brings together electronics and programming. Students start with a custom designed star printed circuit board and learn how to identify electronic components and solder them onto the board. The students have the choice of LED colors on the star to customize them to their own tastes. Once the star is complete, the students can then use the default blinking program on the star or program their own custom blinking pattern using C programming. For most students, it is their first experience with soldering, identifying electronic components and programming in C. A customized star was given to Michigan Governor Rick Snyder who visited the Team at the State Championships in 2013 and again in 2014.



The Charge Star



Student Building a Star



Students Showing Their Individualized Stars



STATE OF MICHIGAN
EXECUTIVE OFFICE
LANSING

RICK SNYDER
GOVERNOR

BRIAN CALLEY
LT. GOVERNOR

January 12, 2015

Mr. Robert Most
The Charge - Team 2619
2829 E Siebert Road
Midland, MI 48642

Dear Mr. Most:

Thank you for the light up star. It was incredibly kind of you to give this and I really appreciate your generosity and thoughtfulness.

Thank you for your continued support as we reinvent Michigan.

Sincerely,

Rick Snyder
Governor



American Institute of Chemical Engineers Presentation

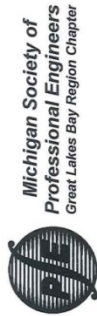
“The Charge” Partnered with Team 3770 (BlitzCreek) to make a featured presentation for the American Institute of Chemical Engineers (AIChE). The presentation included a prepared talk, robot displays, and spirited discussion afterward. This same AIChE group recognized one of our Chemical Engineer mentors for their work with STEM and FIRST Robotics specifically.



Students from Team 2619 Present to the American Institute of Chemical Engineers

Michigan Society of Professional Engineers Luncheon

The Michigan Society of Professional Engineers (MSPE) held a luncheon at Team 2619’s build site. The purpose of this meeting was to allow students to meet with professional engineers from many different disciplines. The Professional Engineers explained what a Professional Engineer is and the value of being a licensed Professional Engineer. Students were able to ask questions and interact with professionals who have used their respective STEM educations to further the field of engineering. In addition, the meeting brought awareness of the mission of FIRST to the MSPE. Students were able to demonstrate their robots and provide tours of the team’s build site.



Michigan Society of
Professional Engineers
Great Lakes Bay Region Chapter

January 2015 Newsletter

FIRST® Robotics Team #2619 “THE CHARGE” - Midland, MI

Date: January 22, 2014
Time: Noon - 2:00 pm
Location: Franklin Center, 2900 Dauer Street, Midland, MI
Schedule: Beginning with lunch at 12pm, followed by a tour of the Franklin Center robotics build site while learning about the FIRST Robotics program and student efforts.
Cost: \$15.00 covers lunch on-site any organizational expenses.

Hosted by GLBR Chapter Member, Jeff Zawisza, P.E. and Mechanical Mentor to Midland's First Robotics Team "The Charge", the MSPE Membership will experience the impact of the FIRST robotics program on STEM education by interacting with their student leadership, touring their build center, and learning about their plans for the upcoming build season and competition. Your attendance at this event helps demonstrate one of the MSPE mission goals to promote education and the engineering profession.

RSVP to mrcmo@agdmwntownship.net before JANUARY 20th to accommodate appropriate lunch arrangements.



The Charge (Team 2619) is the FIRST robotics team from Midland, Michigan, working "to create a world where science and technology are celebrated, where young people dream of becoming science and technology heroes".

The HH Dow High School FIRST Robotics Team is a group of high school students and adult mentors who participate in FIRST (For Inspiration and Recognition of Science and Technology, <http://www.usfirst.org>) robotics competitions.

The Charge is organized as a club within HH Dow High School and Midland Public Schools. The primary focus of the robotics team is to design, fabricate, construct, and test a large-scale robot for regional, state, and international competitions. The team brings together skills in areas of business, communications, fund raising, electrical engineering, mechanical engineering, and programming to effectively compete in the FIRST Robotics Competitions. The team is an opportunity for the students to work with a wide range of mentors with industry experience to gain hands-on technical and teamwork skills in a high energy environment.

Sponsors of The Charge include FIRST of the Great Lakes Bay Region, The Dow Chemical Company, Nexteer, Midland Steel, and Midland Public Schools.

FOR INSPIRATION AND RECOGNITION OF SCIENCE AND TECHNOLOGY



The FIRST mission is to show students of every age that science, technology, and problem-solving are not only fun and rewarding, but are proven paths to successful careers and a bright future for us all. FIRST kids are significantly more likely to attend college, major in science or engineering, and be outstanding future employees and citizens. FIRST is about changing our culture.....for the better.

JANUARY 22, 2015 CHAPTER MEETING



About a dozen GLBR-MSPE members and seven of the student leadership of FIRST Robotics Team "The Charge" (Team #2619) gathered on January 22nd in Midland, MI at their "Franklin Robotics Center" to discuss the upcoming build season and Spring competition.



After lunch together, GLBR-MSPE member and Midland's FIRST Robotics Team Mechanical Mentor, Jeff Zawisza, P.E. gave a PowerPoint presentation on the process and value of licensure as a Professional Engineer. MSPE members added their knowledge and experiences to the group discussion. Thereafter, several student's described the FIRST program, their particular roles, why they got involved, and what their future plans included.

Following the classroom and at-lunch discussions, The FIRST student's gave MSPE a tour of their build center including the electronics work area, machining area, and practice "field" where they demonstrated several of the robots and their capabilities.

**Michigan Society of
Professional Engineers
Great Lakes Bay Region
Chapter**
4980 Shattuck Rd.
Saginaw, MI 48603



The Charge will be competing locally at the **Great Lakes Bay Region District Robotics Competition** on Friday, March 20th and Saturday, March 21st at H.H. Dow High School – 3901 N. Saginaw Rd., Midland, MI 48640 from 8am to 10pm.



FIRST Robotics Competition is a program where the students are given a new challenge each year. After the challenge is given, they have 6 weeks to design and build their 120 lb robots. Mentors from industry and the local schools work with the students to learn new skills and introduce them to the different facets of STEM. *The Charge* (FRC Team 2619), is a team from Midland Public Schools that was founded 8 years ago. The team has made several trips to competitions at the State level and has made 3 trips to the World Competition (most recently held in St. Louis). However, the real success of the team is the impact on the students and introducing them to the opportunities in the fields of Science, Technology, Engineering and Math.

The new build season started on January 3rd and our MSPE meeting on January 22nd will be an opportunity for our MSPE Chapter to meet/interact with the student leadership of *The Charge*, see the team's progress, and share MSPE perspectives with the students.



SERVING THE
ENGINEERING
PROFESSION
SINCE 1946

**Michigan Society of Professional Engineers
Great Lakes Bay Region Chapter**

February 11, 2015

"The Charge"

C/o Mr. J. Zawisza, P.E.
2562 Pine Oak Ct.
Midland, MI 48642

Dear Jeff,

On behalf of the Members and Officers of the Great Lakes Bay Region Chapter of the Michigan Society of Professional Engineers, please accept our heartfelt thanks for hosting our organization on January 22nd and providing access and a tour of the FIRST Robotics Build Center.

As you know, an MSPE mission goal is to promote education and the engineering profession. In speaking with the MSPE Members in attendance, everyone was impressed by the spirit and enthusiasm of the FIRST students and feel that the future holds great promise for these young men and women.

After this exposure, I, for one, am planning on attending the March competition to root for The Charge. Regardless of the competition's outcome, these students are already successful and creating a foundation for a bright future.

It is abundantly clear that the FIRST experience helps build, science, engineering, and technology skills while inspiring innovation. Additionally, we can see where FIRST has fostered well-rounded life capabilities including self-confidence, communication, and leadership.

Thank you again for your consideration and good luck in March.

Sincerely,

A handwritten signature in black ink, reading 'Matthew Reno', with a long, sweeping horizontal line extending to the right.

Matthew Reno, P.E.

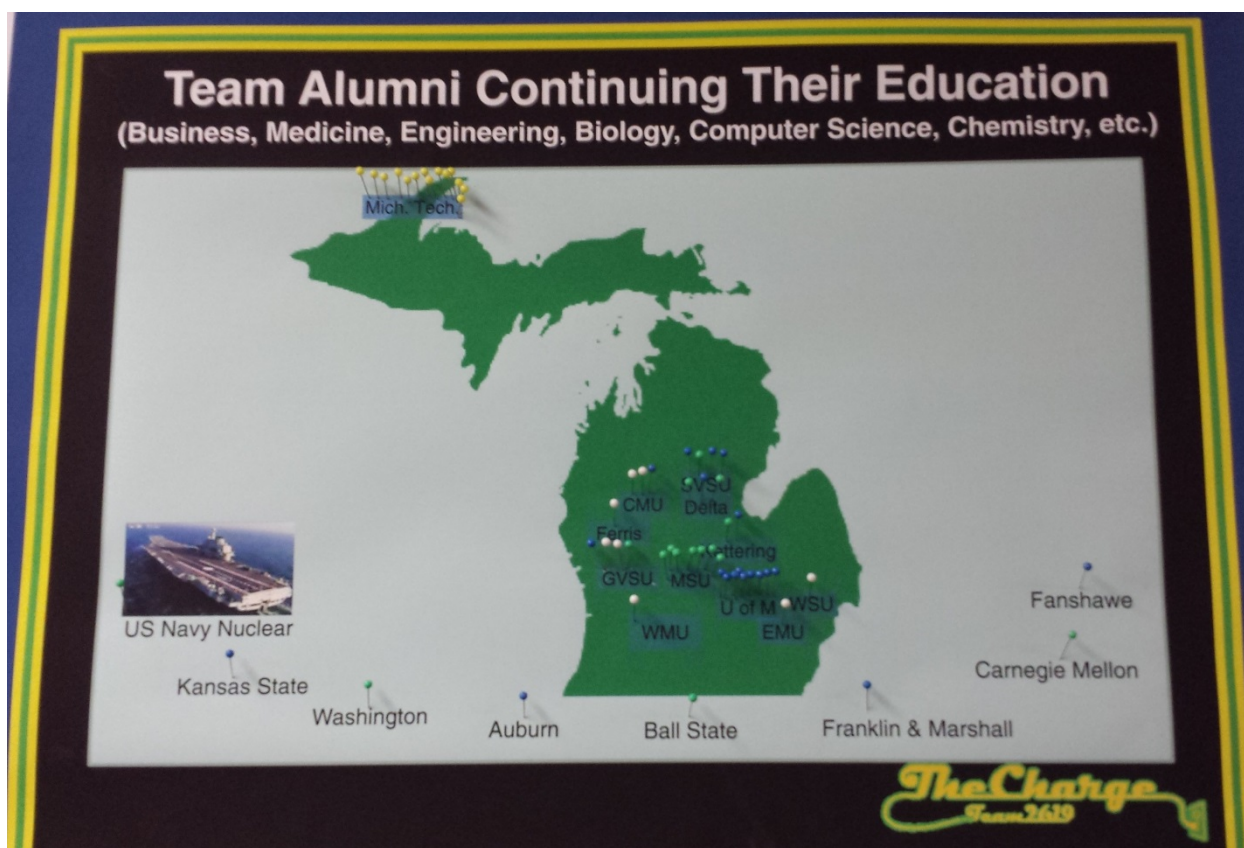
President
GLBR Chapter – MSPE

Great Lakes Bay Region President:
M. Reno, PE
4980 Shattuck Rd.
Saginaw, MI 48603
989/791/9852
mreno@saginawtownship.net

Continued Education in STEM Beyond Team 2619

One of the significant emphases for the team is showing our students what careers are available to them. To help with this, we obtain information on quality summer youth programs in STEM related fields as well as general university information and make it available to the students. “The Charge” tracks the continuing education destinations of our alumni. This is charted on a map in the lobby of our building. Destinations span the country as well as other programs such as the Navy Nuclear program. Now that there are three teams in the building, the impact of our university efforts is even further than just “The Charge”.

Mentors of “The Charge” provide support for students in searching for their continuing education in many ways. We have even had mentors volunteer to take our students to tour university engineering programs. When one of our female students was invited to the women in leadership program at Michigan Tech and did not have transportation, one of our mentors personally provided transportation.



Team 2619 Alumni Map from the “Build Site”

Dow Mentors in “brown bag” Luncheon Meetings

With the huge expansion of FIRST Robotics in the Great Lakes Bay Region this year, many employees working at The Dow Chemical Company have volunteered with FIRST Robotics teams. Many of those new mentors are helping with rookie teams. To help those new mentors and the newer teams they represent, “The Charge” organized a weekly brown bag lunch within Dow’s Michigan Operations. The lunches hosted as many 20 mentors.

The lunch discussion typically included topics of general interest, such as making the most out of FIRST Choice, as well as general discussion on mentoring approaches to keep the students engaged, learning, and having fun. Other common topics were also included such as rookie gear box assembly and defect issues.

Mentoring Philosophy

“The Charge” has great mentors. The philosophy of the Team and the mentors is to keep the students engaged, learning, and having fun. The team is about giving the students the opportunity for hands-on exposure and learning in the STEM areas. The mentors of “The Charge” are known for coaching and asking questions to promote thought and learning of the engineering process. Students connect with and retain what they learn much better than hearing a lecture or watching mentors do what the students are capable of. To solidify the mentoring philosophy, a mentoring handbook has been created to help mentors coach/enable the students and interact with others. “The Charge” actively recruits mentors and has an application process to help insure the fit of new mentors.

Practice Field

To enable the many teams within FIRST of the Great Lakes Bay Region to practice with their robots, “The Charge” has organized the building of a practice field within our robotics center gym. Each year we use the combined efforts of the three FRC teams in the building, our sponsors and parents, and plenty of hours to create half of the entire field. The field is made to be durable and has consisted of many materials including steel, polycarbonate, and wood. Time and again this has proved invaluable to the teams within our region. Not only does it allow for teams to test mechanisms and plan strategies, but it creates a sense of solidarity between all the teams who use it.

Advanced Material Use in Robots

Team 2619 has both used advanced materials from Dow Chemical, as well as creating our own. We created a material we dubbed “Styrominium” – which was a lightweight strong material that consisted of a core of Dow Styrofoam™ sandwiched and bonded with thin aluminum. The light weight and high strength were conducive to our robotics application because FIRST robots have weight limits in competition. The use of this material on our robot was a contributing factor in winning a FIRST Engineering Excellence Award; but it was more importantly used as a training tool for our students to understand an aspect of mechanical engineering and material science. We were able to communicate the benefits of “Styrominium” to other FIRST teams by demonstrating a sample of it in our pits at the district and state competitions.

Although aluminum has been a mainstay in our robot’s chassis fabrication, sometimes welds or other bonding methods such as screws, bolts and rivets may not be practical – especially if a smooth unaltered surface is required. Through one of the mentors on the team, we were able to incorporate a new advanced material from Dow Chemical’s Automotive Systems Group. This was the application of BETAMATE™ adhesive. This adhesive has the advantage of being able to bond materials that are hard to weld, are dissimilar or require a degree of flexibility. It has high strength and environmental properties that made it suitable to our robotics applications. The students were able to study this adhesive by testing it in our build environment and found it to be useful in several areas during the robot build.

“The Charge” has even learned about carbon fiber composites. The students created a new arm for recycling bin retrieval that was done during the FRC competition in 2015. The arm extending from the robot was designed and fabricated by the team using carbon fiber braid and epoxy over a thin walled PVC cured core. The purpose of using this material was to create a light weight but very strong arm. Other methods would have put the robot over the FIRST weight limit restrictions. This was the first time the team had used carbon fiber composites as part of the robot build. Since this advanced material is used from aerospace to the blades on wind power turbines, our students were able investigate and fabricate a unique solution in a FIRST robotics application.

FIRST Mission Beyond Team 2619

Our mission is to give students opportunities in STEM skills year-round. This includes team leadership, writing, speaking as well as hands-on learning. The culture of Team 2619 is to not only develop our students, but to reach out to the FIRST community and beyond. Many of our projects have been made available to other FIRST teams so that they can also benefit from them. Our outreach through corporate sponsorship has led to STEM advertising and promotion. In addition, to develop new teams, we were instrumental in establishing a non-profit for FIRST in the Great Lakes Bay Region.

Presentation to Midland Public Schools Board

Prior to the inaugural H.H. Dow High FIRST District Competition, “The Charge” had to convince the Midland Public Schools Board that FIRST robotics is a worthy endeavor and sought to bring the message of FIRST directly to the board members. Many of the board members did not have an understanding of the extent of STEM, mentor involvement and value of FIRST. The team brought a robot to the board meeting and the students presented a mini-seminar on FIRST, its ideals and goals. It was this critical juncture that the merits of FIRST robotics became “on the screen” for the members of the Midland Public Schools board of directors. The team gained approval for the H.H. Dow High District Competition and since that time, a second Midland Public Schools robotics team was born (Team 5509 – Midland High School). Midland Public Schools has also dedicated an entire building (The Franklin Center) to FIRST robotics (otherwise referred to as “the build site”). This building holds three Midland FRC teams (Team 2619, Team 5509 and Team 5424). It is also the meeting site for a number of FLL teams and FTC teams. The importance of having the Midland Public Schools Board’s support cannot be understated. FIRST and STEM in have been substantially furthered with this support.

“The Charge” has also presented to the Midland Public Schools Board regarding the availability of a Varsity Letter for robotics students. After realizing the incredible commitment and dedication it takes to succeed in robotics, students began crafting proposals in 2012. After many presentations to Midland Public Schools Board about FIRST robotics to extend the board members understanding, it was finally granted. Since 2016, “The Charge” has awarded the most dedicated students with a varsity letter. Now that all teams in our school district are authorized to use Varsity Letters, it has set a precedent for other teams in the region.

Battery Study and Report

In 2014, one of the team's "good" batteries failed during a competition rendering the robot useless in the arena. The team decided that it needed to assess all of its batteries, researching industry standards, testing, analysis and finally writing an extensive engineering report. The results were literally "eye-opening" and provided insight that the team has found to be very valuable. In a nutshell, it ranked our batteries from first to worst so that the team would choose the best batteries for competitions. This battery report, which outlined all of the testing procedures and analysis used, was made available to all FIRST teams via "The Charge" website, as well as the FIRST robotics forums on Chief-Delphi. In one week, this 48 page report was downloaded over 250 times with many positive comments from mentors and students across the country. The report is provided under separate cover in this binder.

Since then, "The Charge" has taken great strides to improve upon their work. Through extensive research, a new methodology was developed this year. Batteries are now able to be tested in a fraction of the time it previously took (under a minute versus over an hour). Furthermore, batteries are now able to be tested through a match simulator, which mirrors the stresses of a real FRC match. Because of these large advances, a new report is currently being written by students. Moreover, "The Charge" will be hosting a seminar during the 2018 FIRST World Championship in Detroit regarding their findings.



Student Testing Batteries

RANK	Battery ID	RANK	Battery ID
1	2015-1	9	2014-1-A
2	2015-2	10	2012-3
3	2015-3	11	2014-4
4	2013-1	12	2014-1-B
5	2012-4	13	2013-3
6	2014-2	14	2014-3
7	2013-2	15	2012-1
8	2012-5	16	2010-4

Final Battery Rankings from
Study

Some comments from the Chief Delphi forums online:

“Congratulations to your team on a spectacular paper demonstrating battery life and operational issues in FRC robot batteries. Your students should be very proud of the work they have performed.” (Mentor Team 111)

“I will certainly include a lesson strongly referencing this paper in this summer's robocamp. The test descriptions are well done, as are the summaries of the research done prior to testing.” (Mentor Team 3946)

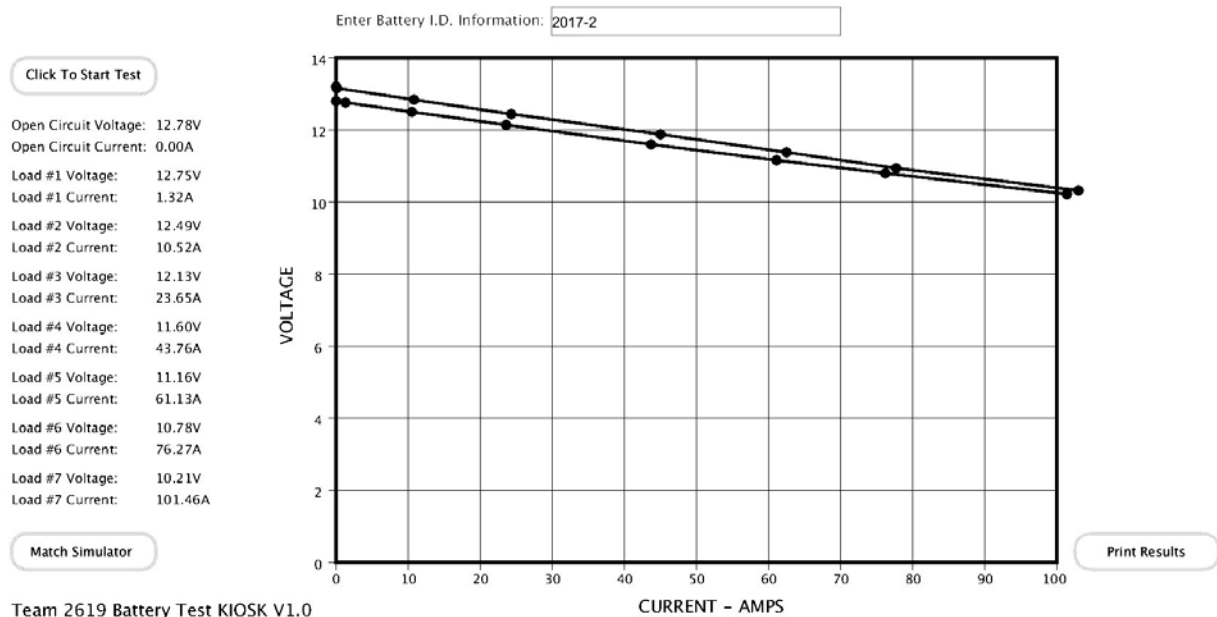
Battery Test Kiosk

Testing battery performance has been an emphasis for Team 2619 since 2014, when an underperforming battery cost the team a critical match in the playoffs. To better understand battery performance, several criteria were set forth in engineering this device:

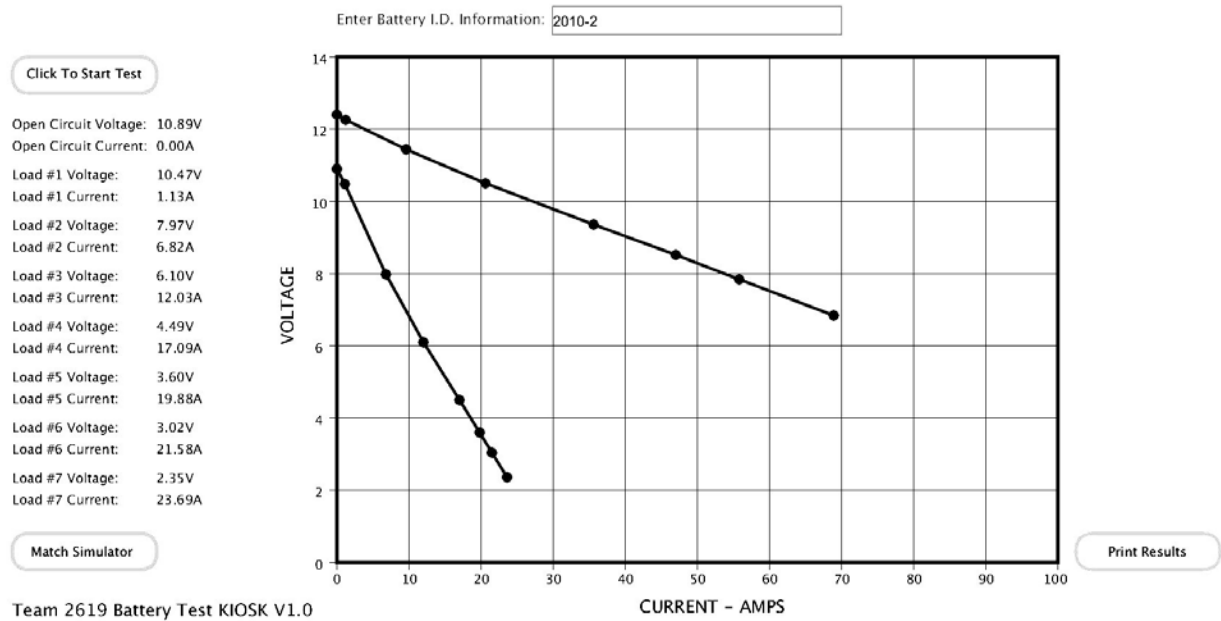
- A rapid graphically oriented battery performance graph.
- A match simulator so that a battery can undergo a rigorous match without being placed in a robot.
- A means to document the battery performance so that analysis can be done later.
- A portable device that can be taken to competitions so that other teams can also test their batteries.
- Provide the plans and high-level software to any team that wants to build their own kiosk.
- Create a new battery report that outlines our analysis and findings.

The Battery Test Kiosk utilizes a bank of heavy duty resistors which are driven by a microprocessor control board. As the load on the battery is varied, the control board measures the current and voltage of the battery and reports these values to the host PC where custom software graphs the battery's performance in real time. In addition, the controller board has the capability of simulating a FIRST Robotics match and sequences through a variable load for the two minute match period, including both autonomous and tele-operated modes. The match simulation's variable load was programmed from actual data taken from a real robotics match. The team used a data acquisition system circuit and monitored robot battery load during a match and uploaded that information to create the simulation in this device. The battery Test Kiosk is capable of loading the battery from zero to 125 Amps, which is sufficient to accurately assess a battery's performance under the most demanding of robot loads.

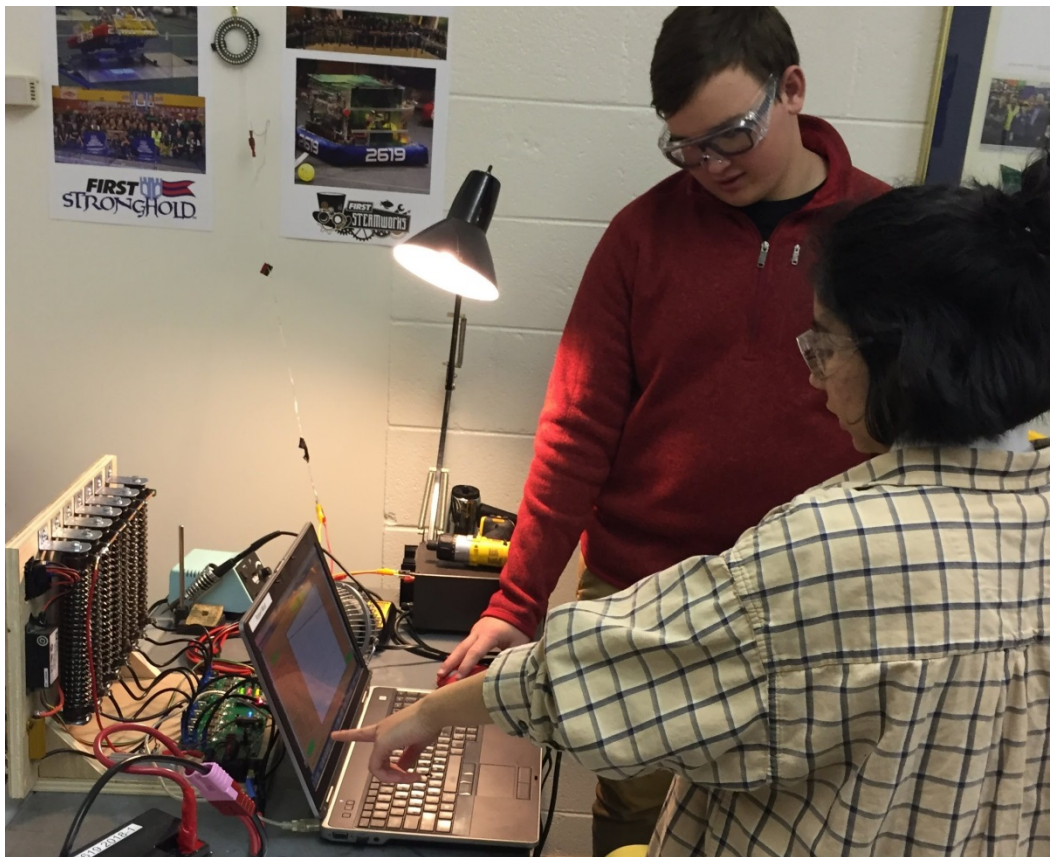
The students begin by charging a battery and letting it “soak” for 30 minutes prior to test. The battery is then confirmed to be “ok for use” by the use of a common battery test device called a “Battery Beak” which most FIRST teams have. After this, the battery is connected to the Battery Test Kiosk and an initial load analysis is done and a line is shown on the custom software indicating the battery’s performance. Then the battery undergoes a simulation of a match which lasts 2 minutes. Finally, a second load analysis is done where another line is drawn on the screen. A low performing battery will be easy to spot as there will be a large delta between the two lines. A high performing battery will not only have a gradual slope, but will also have a small delta between initial and final load analysis. This type of diagnosis has proven to quickly help the team understand its batteries and make good decisions on which batteries to take to competitions. It has also enabled students to better understand that engineering often times requires research and analysis in making sound decisions.



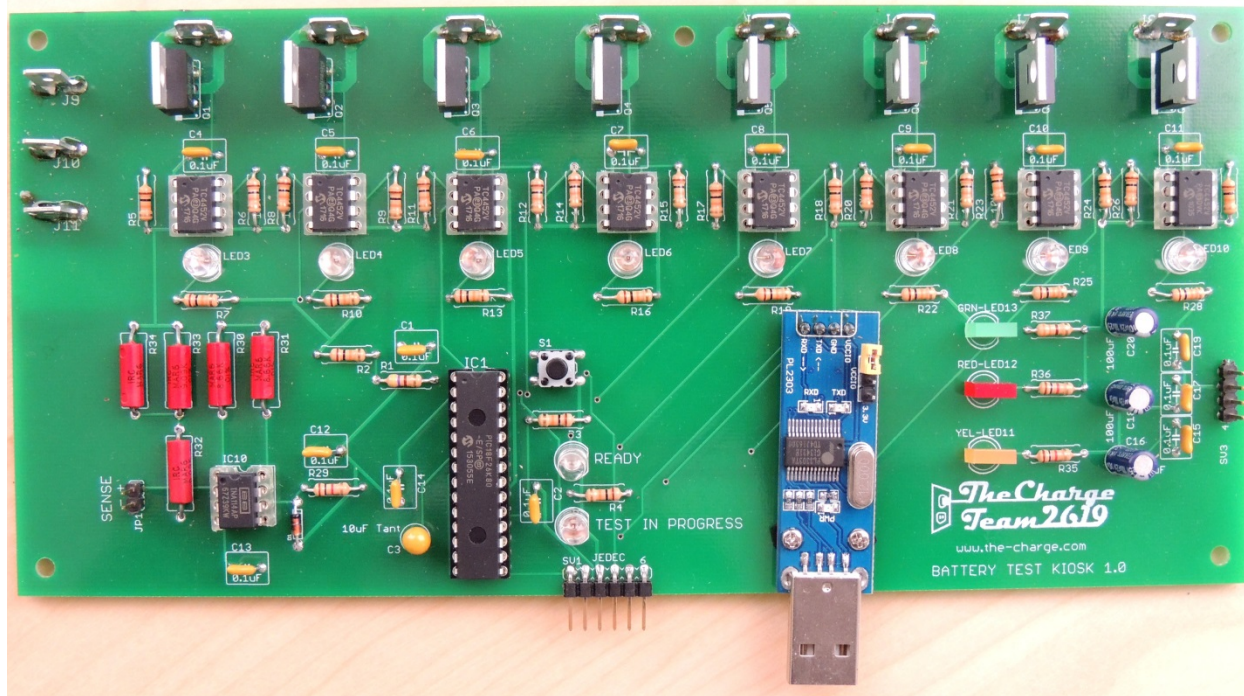
Graphical Output of Battery Performance Curves – Good Battery



Graphical Output of a Poor Performing Battery



Students Running Battery Tests



Battery Test Kiosk Controller Board



Battery Test Kiosk Power Resistors

Women in Science Video

Dow Chemical sponsored a “Women in Science” video that promotes STEM at all levels for women. Team 2619 was asked to include female students and mentors in the video in order to highlight the achievements of “Women in Science” from the level of high school student on up.

This exciting video was created and currently shown internally at Dow, and is available to view on YouTube.



Screen-Shots of Dow's YouTube Video on Women in Science
Featuring Students and Mentors from Team 2619

<https://www.youtube.com/watch?v=Ffd6bbWozlk>

Battery Charger Cart Plans

As an off-season project, the team used CAD to design a mobile battery charger cart. The students then fabricated the battery cart and then made the plans available to all FIRST teams. This battery cart has since been taken to our competitions making the bulky transport of batteries and chargers far easier. This project involved both mechanical and electrical design, fabrication and troubleshooting providing our students valuable experiences and skills.



Battery Charger Cart

Tour of Dow Chemical Robotics Research Department

Team 2619 had the wonderful opportunity of touring the research and development environment of Dow Chemical's robotics research department. Students had the unique opportunity to see what robots do in industry. The students also were exposed to engineers and scientists at the corporation to better understand careers in these fields. It also provided an opportunity for Dow's scientists and engineers to have an exposure to FIRST robotics, its mission and the STEM initiatives that are forwarded by Team 2619.

Advertising STEM in Partnership with Dow Chemical

The Dow Chemical Company's commitment to STEM is growing and to facilitate that growth, Dow asked mentors and students of Team 2619 to participate in the advertising of STEM, featuring FIRST robotics. These ads are currently being displayed in places like the Saginaw Events Center and featured in magazines such as Great Lakes Bay Magazine.



STEM Advertisement in the Saginaw Event Center Featuring Dow and Team 2619



PUTTING OUR COMMUNITIES *FIRST*®

Inspiring Innovation

FIRST® Robotics mentors and Dow employees, Jeff Zawisza and Mike Rehberg, are helping to build the workforce of tomorrow by exposing students to the world of science, technology, engineering and math (STEM). Dow mentors dedicate more than 1,000 hours every year to help students build robots, and more importantly build their interests in STEM. Employees like Jeff and Mike may solve world challenges at Dow, but outside of work, they are putting their community *FIRST*.

The Human Element At Work.



Michigan Operations:
MiOps, YourCareer, OurCommunity

®™The DOW Diamond Logo is a trademark of The Dow Chemical Company © 2014



PUTTING OUR COMMUNITIES *FIRST*®

Inspiring Innovation

FIRST® Robotics mentor and Dow employee, Jeff Zawisza, is helping to build the workforce of tomorrow by exposing students to the world of science, technology, engineering and math (STEM). Dow mentors dedicate more than 1,000 hours every year to help students build robots, and more importantly build their interests in STEM. Employees like Jeff may solve world challenges at Dow, but outside of work, they are putting their community *FIRST*.

The Human Element At Work.



Michigan Operations:
MiOps, YourCareer, OurCommunity

®™The DOW Diamond Logo is a trademark of The Dow Chemical Company © 2014