

Industry Partnerships Provide Students With Irreplaceable Opportunities at Middle Tennessee State University

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Abstract

Dr. Saeed Foroudastan created the Experimental Vehicles Program (EVP) at Middle Tennessee State University (MTSU) in 2004. The EVP provides students with a chance to get hands on experience outside of the classroom. It started with three different project options and has since disposed of and added some projects to now include the human-powered lunar rover (formerly known as The Great Moonbuggy Race), powered off-road Baja, a gasoline-powered formula car, and an all-electric solar boat.

The EVP at MTSU has been greatly enhanced with the help of industry partnerships. A team of students is put together for each project in the EVP. The students are responsible for coming up with the ideas and plans for their product and for building and improving that product. Different industry partners provide help both financially and by advising the students throughout the project. The benefits the industry partners provide are invaluable. Students are able to not only increase their knowledge on the subject but develop other skills such as teamwork, project management, effective communication, and are able to apply what they are learning in the classroom to a real life project.

Overall, the EVP at MTSU is a win-win situation for students and industry providing both sides with great benefits. What students learn in the classroom is no longer enough to make them qualified job candidates. The students' innovative ideas to design and build the projects for the EVP provide them with work-like experience and provide industries with highly skilled, job-ready candidates to hire.

Key Words

Experimental Vehicles Program, Rover, teamwork, industry partnerships, hands-on experience

Introduction

The Experimental Vehicles Program (EVP) at Middle Tennessee State University (MTSU) is a student group that builds and races a variety of vehicles in competitions around the country and the world. The EVP was established in 2004 by the local student chapters of the American Society of Mechanical Engineers (ASME) and the Society of Automotive Engineers (SAE). Both programs had recently completed their own competition vehicle programs and were in the midst of analyzing their respective outcomes. Although students within both organizations collaborated heavily on each project, the various projects lacked unity of purpose and efficient sharing of resources. Realizing this disparity, the organizations jointly decided to develop a blanket program to facilitate the procurement and distribution of financial, intellectual, and human resources. The purpose of this entity, which eventually became EVP, was to act as the financial

and public relations arm of the vehicle programs, tasks for which engineers are notoriously ill equipped [1].

The EVP has been tremendously impacted by industry partnerships since its beginning. Each project in the EVP is completed from student ideas and student work, but the students are able to use faculty and industry partners as advisors. Although these projects are geared towards mechatronic engineering and engineering technology majors, any MTSU student is welcome to become a part of a team in the EVP. While working on these projects, students are not only increasing knowledge, but developing key skills that cannot be obtained in the classroom.

Projects

The EVP currently offers four different projects students can choose to be a part of that are each completed over two semesters. These projects include the human-powered lunar rover (formerly known as The Great Moonbuggy Race), powered off-road Baja, a gasoline-powered formula car, and an all-electric solar boat.

The human-powered lunar rover, shown in Figure 1, originally started as The Great Moonbuggy Race. It provides a unique challenge because the rover the students create must be able to collapse into a five-foot cube for transportation space. It must also be human powered and able to be carried by two people, one male and one female. Once the team has completed the design, they get to race their rover on the same track used to qualify the actual lunar rover.

The powered off-road Baja, shown in Figure 2, team works to design and build an off-road vehicle that will survive the severe punishment of rough terrain. The race for this competition is four hours long and judging is broken down into eight categories.

The gasoline-powered formula car, shown in Figure 3, is an open wheeled racer and must adhere to strict guidelines set forth by the Society of Automotive Engineers. The car is not judged on its performance during the race alone. The students are also judged on



Figure 1



Figure 2



Figure 3



Figure 4

their technical and engineering innovation, among other design factors, before the car ever gets on the track.

The all-electric solar boat, shown in Figure 4, must be powered completely by batteries and a solar array. It needs to be very efficient hydro-dynamically and be able to use its power extremely effectively. The solar boat competition is a five-day event, and teams compete in sprint, maneuverability, endurance and speed competitions and go through a thorough technical inspection of their boat.

Benefits of the Experimental Vehicles Program

The benefits the EVP provides seem to be endless. Just going to class and getting a degree does not seem to be enough anymore. Employers are looking for real, work-like experience and that is exactly what the EVP can provide. These projects make what the students learn in the classroom real and tangible and ultimately make them more engaged in the material.

Besides faculty advisors, the EVP includes a president, vice president, secretary, and treasurer. The president of the EVP must be a junior or senior level engineering or engineering technology student. All other elected offices are open to any student at MTSU [2]. Both students in the officer positions and those who are just team members are gaining highly valued skills. More than 80 percent of employers responding to a survey about fresh college graduates said they look for evidence of leadership skills on the candidate's resume, and nearly as many see out indications that the candidate is able to work on a team [3]. On top of gaining leadership experience and learning to be a team player, students are gaining skills like effective communication, perseverance, time management, problem solving, and the list goes on. The U.S. workforce is undoubtedly becoming more diverse [4]. The teams in the EVP are also extremely diverse. Each team includes different races, nationalities, genders, and majors. As each member contributes, it helps students to learn to consider these projects from all different points of view. Since these students will undoubtedly enter a diverse workplace, this project can be a great tool to help them become accustomed to such an environment.



Figure 5



Figure 6

Competing against other universities and teams at these competitions has been great throughout the years of the EVP, winning many awards. Figure 5 shows some of the awards the Solar Boat team has won and Figure 6 shows the Lunar Rover team receiving the Neil Armstrong Best Design Award. Competing also allows the students to see how other people approached the same project. Sometimes it is hard to imagine different ways to do something once a specific idea has already been decided upon and executed. These competitions can help students realize how many different ways to do the same thing are possible and increase their creativity.

Industry Partnerships

The EVP is made possible by industry partnerships and the industry partners stick around year after year because they see the benefits that are provided for them as employers and for the students and future employees. Industry partners, such as the ones listed in Figure 7, help both with funding and in advising the different teams. These partners can choose to sponsor a single entity or several different projects. This allows the EVP to allocate its resources and donations more efficiently. Students also have the opportunity to visit these industries often.



Figure 7

Lane Motor Museum has donated over \$100,000 over the last ten years on top of sponsoring and mentoring a team. Tennessee Valley Authority and Precision Metalforming Association also mentor teams and contribute financially. NASA and Tennessee Board of Regents (TBR) have both awarded the EVP grants. The grants from NASA total over \$50,000 over the last five years specifically for the Lunar Rover project.

On top of the grant from TBR, the EVP received the TBR Academic Excellence award because of how much it is benefiting the local industry. MTSU also received the Excellence in Engineering Education award in 2013 due to the relationships that have been formed with the industries because of the EVP.

With the projects the students complete in the EVP being very similar to something the students could end up doing in the future at actual engineering jobs, the advising from the industry partners is immeasurable. The students are getting to interact with people who are already actively working in the field and learn how projects might run once they are able to enter the field.

Student Feedback

MTSU performs an exit survey when students graduate and reaches out to students five years after graduation. The table shows some feedback from the students and how the EVP affected them. Students are able to elaborate if they wanted to. Out of the many responses, listed below are experiences from four students who had positive experiences in the EVP.

Exit Survey and 5 Year Program Review Questions	EVP Alumni Responses
Did the technical skills learned help prepare you for work in the industry?	100%
Do you feel like the interpersonal/teamwork skills learned prepared you for the workplace?	87%
Was the EVP a talking point in your interview process to be hired? If so, do you feel like being a part of the EVP helped you in acquiring your job?	100%

Jeremy Posey, an Electrical Engineering Technology major, received his bachelors in December of 2012 and graduated with a Master of Science in Professional Science in Engineering Management in 2015. He found immediate employment after graduation as a Powertrain Controls Engineer at FCA, Fiat Chrysler Automobiles, in Detroit, MI, describes his experience within the EVP as follows: “It provided me with a way to gain CADD and machining experience that, as an Electrical Engineering Technology major, I would not have otherwise been able to obtain. I worked on every project within the program during the three years prior to my graduation and feel that the overall experience was a major boost in terms of my leadership and management skills.”

Brian Julian, a Mechanical Engineering Technology major who graduated in December of 2013 and found immediate employment as a Manufacturing Engineer at Gastite in Portland, TN, describes his experience as follows: “I worked primarily on the NASA Human Exploration Rover during my last two years at MTSU, the first year as a team member and the second year as the captain. The rover I designed won many awards at the 2013 NASA Human Exploration Rover Challenge, to include being the 1st place US entry, 3rd place internationally, and 1st place most improved. When I went for my interview with Gastite, I took all of my CADD drawing, the design report, and photos of the rover as proof of my engineering abilities. I also showed them pictures of the other vehicles the EVP produces and explained to them how my success within the program bolstered confidence in my engineering abilities. They hired me on the spot.”

Nicolas Cronin, a Mechatronics major and current student at MTSU, was able to reach the position of Lead Engineer at The Davis Groupe in Murfreesboro, TN, while still in school as a result of his work within the EVP. He describes his experience as follows: “I had been eyeing an engineering position at The Davis Groupe, where I was employed, and I wanted to be able to show them that I was good with electrical systems. By working on the solar boat team for two years and helping the team increase their performance each year I was a member, I was able to prove to my boss that I had what it took to be promoted to the position of Lead Engineer. While I no longer have the free time to commit to the EVP or the solar boat team, I’m grateful that I was able to work on the boat and use that work to prove my worth to my boss and advance to a position that I thought I would have to wait until I graduated to obtain.”

Dustin Taylor, a Mechanical Engineering Technology major who graduated in December of 2014, started his own company specializing in freelance CADD work immediately after he graduated. His description of his EVP experience is as follows: “My physics study partner encouraged me to become involved with the EVP as he was working on the solar boat team at the time. While working in the lab, I became involved with the Baja, the rover, and the solar boat, helping each team as needed. This provided me with an opportunity to learn how to use Solid Works, design curriculum that was not a part of MTSU’s MET curriculum at the time. I also found that working in the lab caused me to look forward to going to campus every day and working with all of the new friends I had made in the lab. Frequently we would also work on homework problems together in the lab as well as most of us were in the same classes together. Some of the most meaningful relationships I formed while on campus were with individuals that I met while working in the EVP [5].”

Conclusion

Without the EVP, many students would not have the opportunity to be challenged and enriched the way this program provides. From being part of a team to management-like experience, from designing to physically constructing, and from interacting with peers to interacting with professionals, any time a student spends working on a project through the EVP is time that student is building knowledge and a skill base that will stick with them forever. Employers are able to benefit just as much from the EVP by having candidates who are much more qualified for hire right out of college than ever before. Industry partnerships are what make the EVP possible and the EVP truly does provide irreplaceable opportunities for students at MTSU.

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