

Connecting Industry and the Community to Engineering Students' Vehicle Projects at Middle Tennessee State University

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Abstract

The Experimental Vehicles Program (EVP) at Middle Tennessee State University (MTSU) has been successful in promoting engineering education through hands-on vehicle projects. EVP serves as a conduit between the vehicles projects at MTSU and representatives from local industry and the engineering community in the middle Tennessee area.

The successes in increasing local industry and student interest in competition vehicle programs illustrates how an umbrella organization like the EVP can facilitate MTSU students to compete with larger, higher-profile engineering university programs.

Introduction

Students at MTSU developed the EVP as an umbrella organization for the competition vehicle projects of two local student chapters: the American Society of Mechanical Engineers (ASME) and the Society of Automotive Engineers (SAE). Both organizations were independently producing student-led design and fabrication projects for at least two competition vehicles each.

Even though both groups collaborated with each other regarding lab space use, volunteers, and some resources, many inefficiencies still existed, including fundraising, community outreach, and student volunteer recruitment. Combining the groups' projects into the EVP helped eliminate many of those inefficiencies.

The primary goal of the EVP is to allow student volunteers to better focus on the engineering and technology aspects of their projects and to provide an umbrella organization for partnerships with local industries and the engineering community. Its successful implementation has produced positive outcomes ranging from high-profile competition awards to graduate job placement.

Fundraising

The EVP has provided students with a "single point-of-contact" for local industry and the engineering community. One of the first goals of the organization was to complete a brochure, which outlined their projects and successes. This brochure (Figure 1) was able to capture the attention of the local engineering community and facilitate partnerships and sponsorships in a

way that both student chapters, working independently, could not. Industries in middle Tennessee were now able to see the full range of competition vehicle programs and their positive effects on student success in a single, impactful document. Community partners can now sponsor a single entity, rather than one or several different projects; and the EVP can now allocate its resources and donations more efficiently.

Thanks to this change in community outreach, in its first year the EVP was able to raise over \$50,000 a year towards its projects. Additionally, the number and quality of industry partners has increased (Figure 2).



Figure 1: Some of EVP's Sponsors

Volunteer Recruitment

Another advantage of the promotional brochure created by the EVP has been an increase in student volunteer participation. These volunteers not only include an increase of female and under-represented minority students, but also cross-discipline, non-engineering students from across the university.

Many of the competitions, such as Baja SAE and Formula SAE, require teams to not only design and build their vehicles but also budget, fundraise, and produce project management-based timelines. Additionally, programming expertise is required for most of the projects. By combining resources and volunteers, the EVP has been able to recruit students from non-engineering disciplines to meet these criteria. Currently, non-engineering majors make up about 20% of EVP students.

Program Success

Through developing the EVP as an umbrella organization to house all of the vehicle programs for ASME and SAE chapters, students have been able to succeed in these competitions at the level of top engineering universities. Vehicle programs include the Human Exploration Rover, Solar Boat, Formula SAE, and SAE Baja. The awards and recognitions of the projects are listed below¹.

Human Exploration Rover Challenge (Figure 2)

2013: 1st place standing in the US and 3rd place standing internationally

2014: 2nd place standing in the US and 5th place standing internationally

2015: 1st place standing in the US and 3rd place standing internationally

2017: Drive Train Technology Challenge Award, Safety System Award, 6th place standing in the US and 9th place standing internationally



Figure 3: 2016 Human Exploration Rover Challenge



Figure 2: Solar Boat & Awards

Solar Boat (Figure 3)

2013: 2nd place sprint, design achievement, and outstanding workmanship awards

2014: 1st place qualifier, outstanding electrical system, outstanding drivetrain design, and outstanding workmanship awards

2015: 2nd place overall, 2nd place sprint, 2nd place qualifier, 1st place solar slalom, 4th place best technical report, 3rd place technical display, design achievement, outstanding workmanship, and sportsmanship awards

2016: 2nd place overall, 1st place qualifying event, 2nd place sprint, 1st place outstanding workmanship award, 3rd place visual display award

Formula SAE (Figure 4)

2016: top 50% overall

Baja SAE (Figure 5)

2007: 2nd place vote rookie of the year; top 50% overall out of 145 teams

Additionally, the EVP program as a whole received the 2012 Academic Excellence Award from the Tennessee Board of Regents.





Figure 4: Formula SAE

Figure 5: 2016 SAE Baja and Human Exploration Rover

Student Success

The primary goal of these vehicle competitions is to provide students with experiential learning that applies their classroom education and challenges their skills and creativity. This type of learning and experience is significantly enhanced by adequate budgets and resources, input from cross-disciplinary students, and feedback from industry leaders.

For example, increased fundraising allows possible design solutions to move from only simple and cheap to possibly more complex and more expensive. Students then must use the additional expertise of non-engineering students and of industry partners to understand the pros and cons of all choices, providing the group with real-world design challenges and management decisions that limited resources would not².

Student outcomes from participation in the EVP have been phenomenal. Over 95% of students who participate with the program are employed after graduation³, many of them acquiring competitive, highly sought-after positions because of the experience and knowledge gained through these design competitions. Increased interactions with industry partners has also provided students with more chances to network. Furthermore, seniors who fulfill their senior project requirement through working with the EVP report that it significantly benefited their professional and educational development⁴.

Acknowledgments

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Biography

Dr. Saeed Foroudastan is the Associate Dean for the College of Basic and Applied Sciences (CBAS). The CBAS oversees 10 departments at Middle Tennessee State University. He is also the current Director for the Masters of Science in Professional Science program and a professor of engineering technology at MTSU. Foroudastan received his B.S. in civil engineering, his M.S. in civil engineering, and his Ph.D. in mechanical engineering from Tennessee Technological University. Additionally, he has six years of industrial experience as a Senior Engineer and 17 years of academic experience as a professor, Associate Professor, and Assistant Professor. Foroudastan's academic experience includes teaching at Tennessee Technological University and Middle Tennessee State University in the areas of civil engineering, mechanical engineering, and engineering technology. He has actively advised undergraduate and graduate students, alumni, and minority students in academics and career guidance. Foroudastan has also served as Faculty Advisor for SAE, Mechanical Engineering Technology, Pre-engineering, ASME, Experimental Vehicles Program (EVP), and Tau Alpha Pi Honors Society. In addition to Foroudastan's teaching experience, he also has performed extensive research and published numerous technical papers. He has secured more than \$2 million in the form of both internal and external grants and research funding. Foroudastan is the faculty advisor, coordinator, and primary fundraiser for EVP teams entering national research project competitions such as the Formula SAE Collegiate Competition, the Baja SAE Race, the SolarBike Rayce, the Great Moonbuggy Race, and the Solar Boat Collegiate Competition. For his concern for and dedication to his students, Foroudastan received MTSU awards such as the 2002-03 Outstanding Teaching Award, the 2005-06 Outstanding Public Service Award, and the 2007 Faculty Advisor of the Year Award. He received the Excellence in Engineering Education Award and Faculty Advisor Award from the Society of Automotive Engineers (SAE). He was also nominated for the MTSU 2005 and 2009-11 Outstanding Research Award. He received two Academic Excellence awards from the Tennessee Board of Region in 2010-11. Foroudastan has also won many College of Basic and Applied Science awards. In addition to this, Foroudastan also reviews papers for journals and conference proceedings of ASEE, ASEE-SE, and ASME, and he has been a session moderator for several professional conferences.

Carey Snowden serves as the Graduate Coordinator for the Master of Science in Professional Science (MSPS) programs at MTSU, which includes the Engineering Management M.S. program. His duties include placing students into their capstone internships, recruiting students into the programs, and coordinating with the MSPS advisory board. Carey's passion is STEM student development, with an emphasis on developing programming and mentorships for under-represented minority, first generation, female, and LGBT+ STEM students. In his career, he has worked to create and re-start student clubs for these cohorts to develop impactful outreach, mentorship, and professional development opportunities.