

The Middle Tennessee State University Experimental Vehicles Program: Interdisciplinary Collaboration in Engineering Projects

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Abstract

Middle Tennessee State University (MTSU) decided to combine several competition vehicle projects into one Experimental Vehicles Program (EVP). The goal was to facilitate fundraising and resource sharing, and to improve chain of command within the various vehicle teams.

EVP is organized like a corporation with various branches representing the vehicle teams and a management team which oversees the financial and organizational end of the projects. The charter members of EVP (all engineering and engineering technology students from various concentrations) wanted to make the program available to students from different departments at MTSU. They created positions that could be filled by students from other majors within and outside of the College of Basic and Applied Sciences. Business majors, for instance, run the fundraising ventures of EVP, while a journalism major serves as public relations officer for the local and college papers and physics majors lead research efforts. The sharing of duties within EVP offers students from other departments the experience of running a company, while allowing Engineering Technology (ET) students to focus on their projects without having to worry as much about raising capital and attracting attention to the program.

The EVP founders established five appointed offices that focus on specific areas of the program, and are open to students from outside the Engineering Technology Department.

- Inter-project Manager
- Human Resources Manager
- Public Relations Manager
- Documentation Manager
- Industry Liaison

This paper follows students from different departments as they work together for a common goal. It describes their fundraising efforts and public awareness campaigns, and the impact of these ventures on the success of the projects themselves. The paper also highlights the benefits of a program like EVP to engineering education, and offers an organizational model that can be used for the foundation of similar programs at other schools.

Introduction

The Experimental Vehicles Program at Middle Tennessee State University (EVP at MTSU) was founded during the summer of 2004 by the local student chapters of the American Society of Mechanical Engineers (ASME) and the Society of Automotive Engineers (SAE)¹. Both organizations had recently completed their own competition vehicle programs, and were in the midst of analyzing their respective outcomes. These programs included the *Formula SAE*, sponsored by SAE, and *SolarBike Rayce USA* and *The Great Moonbuggy Race*, both of which are sponsored by ASME. These events are beginning to attract international attention. This new level of global competition gives the student teams unique insights into how engineering takes place throughout the world.

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. The organizational predecessor to EVP was tasked with raising funds for vehicle projects and generating interest among students in order to fill out the ranks of the vehicle teams.

Additionally, it was decided that this organization would oversee the managerial aspects of the three concurrent vehicle projects, which included allocation of funds, tools, and floor space, project planning and scheduling, and resolution of any disputes between vehicle projects.

The founders of EVP quickly recognized the importance of seeking the aid of talented individuals from outside of the Engineering Technology (ET) Department². Many of the EVP offices are now filled by students with diverse academic and international backgrounds.

The diversity of the program enhances the educational experience of both ET students and those students from other departments.



Figure 1: 2004 Solar Vehicle, 2nd Place



Figure 2: 2004 Moon Buggy, 4th place



Figure 3: 2005 Formula SAE design

Implementation

The EVP founders specified five main areas of interest for the organization: inter-project administration, Human Resources (HR) and Public Relations (PR) management³, project documentation, and sponsorship advertising. They drafted an organizational hierarchy that included detailed descriptions of the offices and roles they required.

The two engineering societies decided to ensure that the executive decisions of EVP remained under the influence of the ET Department by creating a controlling board of trustees made up of ASME and SAE members only. The EVP board is organized into five chairs, which represent the five vehicle programs currently managed by EVP. The board is led by a chairman, who is elected by the board.

The president of EVP must be a Junior or Senior level ET student. All other elected officials, including the vice-president, secretary, and treasurer, are open to any student at Middle Tennessee State University; however, all elected officials must be approved by the board.

The board also actively solicits talented individuals to fill unelected positions, such as the Human Resources and Public Relations officers. Candidates for these positions usually come from outside of the ET Department. These positions give students of other academic disciplines the opportunity to gain experience in their field and fulfill degree requirements.

Inter-project Manager

Each vehicle team is responsible for submitting a design and budget forecast before components are ordered and fabrication begins. Team leaders work closely with an Inter-project Manager, who helps to coordinate the funding, scheduling, and floor space sharing of the teams. The current Inter-project Manager is an ET student, and his staff is comprised mainly of business majors.

Of primary concern to the Inter-project Manager is financing the projects, which has proved difficult in years past. The projects range in cost from around \$2000 (for the Moon Buggy) to over \$15,000 (Formula SAE). Previous teams have often been forced to find their own financial backing, and a few have even resorted to using personal funds in the final days of a project. More often than not, these budgetary problems could have easily been avoided by carefully allocating funds from a common account, instead of maintaining each individual project account separately.

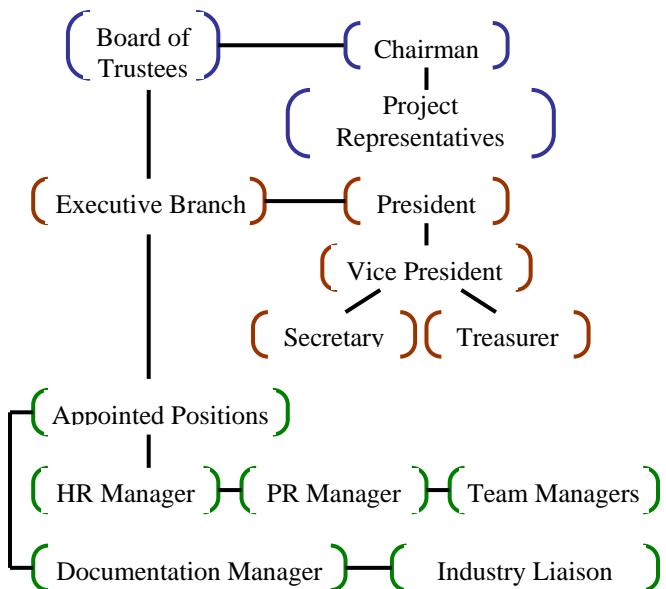


Figure 4: EVP Organizational Hierarchy

Currently, the primary source of funding for the vehicle projects is the Student Government Association (SGA) at MTSU. SGA accepts project proposals twice a year from student organizations seeking activity funds, including the EVP vehicle teams. SGA allocates the funds for each activity based on its value to the school and the SGA annual operating budget, which fluctuates greatly from year to year.

The inter-project management team of EVP funnels the funds from SGA for each vehicle project into one account, and ensures that each team has what they need when they need it. This arrangement eliminates redundant purchases (ie. when two projects require the same tool), and reduces wasteful spending by requiring teams to submit purchase orders for the components they require.

The question of floor space for the projects has become a larger concern due to the addition of two new projects. The ET Department has a limited amount of space for student projects, which means that the vehicle teams must work in confined areas.

The inter-project management solved this problem by using a clever workstation and project timeline concept whereby common aspects of each vehicle project were carried out in the same space. A welding area, for example, complete with worktable, cutting tools, and jig materials, was set up to assist each team with their welding operations, rather than have each team weld in their project areas and take up valuable space. By scheduling each task, teams could complete portions of their projects in the workstations without interfering with one another.

Human Resources Management

One of the original tasks of the HR branch of EVP was an aggressive awareness campaign to attract young ET students, as well as students from other disciplines, to EVP. The current HR manager is also a business major, and her ideas have led to an increase student awareness and involvement in the vehicle projects and an improvement in retention rates among EVP members.

Past vehicle teams experienced considerable trouble with recruitment, due in part to project scheduling. The HR office quickly recognized a cyclical trend among new student interest in the teams. At the beginning of a semester student interest peaked, but most of the teams were performing research and development on their vehicle projects and had little use for less experienced students. Younger students that did join the teams usually felt out of place among the more experienced students and often left the team.

Later, when the teams began fabricating, they required non-skilled laborers. Unfortunately, this portion of the project timeline usually occurs mid-semester, and the vehicle teams had difficulty finding volunteers.

The HR office remedied this situation by spreading out awareness meetings so that they occurred throughout the project cycle, instead of at the beginning of each semester. The office also encouraged experienced students within the vehicle teams to host meetings where they describe their projects in detail. These meetings help new students to understand past projects and where the present team is headed.

Public Relations Manager

The current PR Manager is a journalism major who has experience writing for the college paper. Although the office has only been in existence for half a year, he has already generated considerable exposure for the program, both from the college paper and other local news groups.

The PR manager is tasked with writing press releases about the vehicle teams, which usually highlight particular developments, like the completion of a design, or the beginning of vehicle fabrication.

Documentation Manager

One of the largest problems with the vehicle projects in the past has been document management. Vehicle teams in the past have rarely documented their design process, and left few clues as to how they made important decisions and what the consequences of those decisions were.

The Documentation Manager is responsible for archiving the various documents generated by the vehicle teams for reference by future teams. The archives will help to reduce the learning curve of the vehicle teams from year to year, and should improve vehicle designs and performance.

The 2005 Documentation Manager is a computer science major who excels at website development. His office is currently constructing an online database of all of the project documentation, including analysis spreadsheets, preferred suppliers lists, papers, and CAD models and drawings.

Future vehicle teams will be able to quickly search and find documents to aid in their research. Portions of this website will also be available to the public, so that vehicle teams from other schools will have a resource for designing their own vehicles.

Industry Liaison

Another area of concern for EVP management is obtaining sponsors for the vehicle teams to supplement the financial contributions of SGA. To aid in this task, EVP established an Industry Liaison office, whose sole duty is to generate interest in the vehicle programs among local businesses⁴.

The first task that the 2005 Industry Liaison, an ET major, undertook was the creation of a brochure that showcased the vehicle projects and described how businesses could sponsor the teams. This brochure was a significant success, and has already generated over \$30,000 for the vehicle teams from local sponsors.

The Industry Liaison is now building a database of present and potential sponsors, which will be used to coordinate communication between these businesses.

Conclusion

The talented students from nearly every department at MTSU have contributed greatly to EVP and the vehicle projects. The vehicle teams are now better funded and better organized due to the hard work of these individuals.

By attracting students from outside of the Engineering Technology Department, the Experimental Vehicles Program at MTSU provides a unique opportunity for those students and students within the ET Department to share the knowledge they have gained and work together towards a common goal.

The students from many different educational disciplines who fill the managerial positions of EVP gain valuable experience in their fields, and allow students working on the vehicle projects to focus on their tasks without concern for raising money, scheduling, and recruitment. These students also experience how teams from other countries approach the same engineering challenges at the vehicle competitions.

The projects offer a unique opportunity for international students to interact with their native peers. Many of the international students who have participated in the EVP projects report that their communication skills have improved, and that they are more confident in public speech settings.

Students from all nationalities who participate in EVP develop a profound sense for what it takes to accomplish an engineering challenge, and in so doing, develop leadership and professional skills. Perhaps most importantly, the EVP members learn to work as a team and to communicate their ideas effectively, a vital skill because the “engineering practice takes place in an intensely oral culture and while formal presentations are important to practicing engineers, daily work is characterized more by interpersonal and small group experiences”⁵.

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Biography

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Saeed Foroudastan is a Professor in the Engineering Technology and Industrial Studies Department. He received his B.S. in Civil Engineering (1980), his M.S. in Civil Engineering (1982), and his Ph.D. in Mechanical Engineering (1987) from Tennessee Technological University. Professor Foroudastan's employment vitae includes: Assistance Professor of Mechanical Engineering for Tennessee Technological University, Senior Engineer, Advanced Development Department, Textron Aerostructures, and Middle Tennessee State University. Professor Foroudastan is involved with several professional organizations and honor societies, and has many publications to his name. He also holds U.S. and European patents.

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