

# **A New Approach to Student Design**

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## **Abstract**

The Mars Rover Design Team (MRDT) is a Design Team affiliated with the Student Design and Experiential Learning Center (SDELC) at Missouri University of Science and Technology. The MRDT operates as a self-supporting engineering firm, with technical, administrative, and financial branches and is managed by two tiers of leadership. The overall design of the MRDT leadership and team structure is markedly different than the traditional approach found in many student groups, including Senior Design. Traditional approaches attempt to follow a strictly democratic model of leadership. This delineation of leadership is appropriate for elected governing bodies, but not for a group that operates like a small business and requires specialized skills and a clear division of duties. Previous design teams also emphasize fundraising, publicity, and other administrative duties as necessary but secondary functions. The MRDT embraces these aspects and places them on an equal level of importance with the design branch of team. This paper will detail the approach taken by MRDT rather than the traditional approach. Benefits of the MRDT model as well as Lessons Learned will also be discussed. Lastly, an important accomplishment of the MRDT, a Prototype Project, is also discussed.

## **Introduction**

One advantage of establishing any organization is the opportunity to rethink the accepted structures and implement innovative programs. The Student Design Teams of Missouri University of Science and Technology (Missouri S&T) strive to create an analog for real world design and construction problems by creating an experiential learning environment. In early 2012, the Mars Rover Design Team (MRDT) became the newest addition to their number.

The MRDT structure is organized like an engineering firm and operates like a small business with principle technical and administrative branches. The technical branch is run by a Chief Technical Officer who is responsible for the design, construction, and operation of the team's product. The administrative branch has Chief Executive, Financial, and Administrative Officers who ensure that the administrative, financial, and supporting aspects of the team are maintained. This delineation of duties creates positions for a wide variety of skills, making the MRDT uniquely interdisciplinary, already representing over fourteen majors.

## **MRDT Operations**

The founding operating philosophy of the team is to take a complex problem and break it down into smaller, manageable sections. Small teams work on each section, and then the final solution is assembled. The MRDT has organized this process in a novel way. The delegation of duties begins with the Executive Board, consisting of four officers (elected by the MRDT membership), each with a specific set of responsibilities. Each Executive Officer is equal in status, and is the authority in their office. There is a very clear set of checks and balances to

ensure members are treated fairly, and that no single Executive Officer can mandate team policy, thus ensuring that the members' interests are protected. Each Executive Officer's principle duty is to ensure that the teams are communicating with each other, and that the separate team solutions combine into one final comprehensive rover. There is a second tier of officers (Team Leads and Committee Chairs) who are appointed by the Executive Board, allowing students with necessary and specialized skills to be placed in an optimal position. Each Team Lead reports to an Executive Officer and may lead a sub-team of students. Further, each sub-team has a mission-specific task, and will develop the solutions to overcome it, such as powering the rover, or funding the project.

### **MRDT Accomplishments and Lessons Learned**

Since inception, the MRDT has learned how to effectively operate as a Design Team including incorporating aspects of publicity, recruitment, and collaboration with other University organizations. The MRDT strives to provide Missouri S&T students the opportunity to gain pertinent design experience and a chance to demonstrate their design results through intercollegiate competition. The team also hopes to provide a positive educational environment for students to further their studies. The interdisciplinary focus of the team aims to foster collaboration and communication across disciplines while promoting technologies with applications to space exploration.

One of the most unique and most valuable of the MRDT's actions in the past semester was the implementation of a Prototype Project. The concept was to use the newly formed sub-teams to design and construct a small remote-controlled car at nearly zero cost. There were five goals for this project. First, the Prototype Project provided team members with an opportunity to work on a technical design-to-construction project. Second, the Prototype project allowed team members to begin developing team synergy. The third goal of the Prototype Project was to test how the MRDT's structure of separated teams would work in practice. The fourth goal was to have a solid presentable product at the end of the semester. This also allowed the team to celebrate an accomplishment. The remote controlled car now serves as a publicity and demonstration tool. The final goal of the project was for the Executive Board to evaluate which members of the MRDT showed initiative and leadership potential.

This program was the most informative of the MRDT's early actions. Through the project, the team began to develop methods for inter-team communication and collaboration. They organized their own sub-team meetings, and integrated social media into their communication efforts. It became obvious that a distinct leader in each sub-team was necessary. Team members were also able to get a glimpse into the focus of each sub-team, and a few members changed their preferences. Some members gained experience with equipment and hardware, while the more experienced members were able to serve as instructors. After the completion of the Prototype Project, the second tier of MRDT officers were appointed. The Prototype Project fulfilled all of its goals, and was an important learning experience for MRDT leadership and general membership alike.

### **Conclusion**

Since every MRDT member is a full-time student (and many are involved in other university activities), finding a balance in work load is essential. The MRDT seeks to create a place where driven and hard working students can accomplish incredible things. The diversity that comes from being an interdisciplinary design team benefits both the organization and the

individuals. The principle of delegation of duties is paramount to most industry and technologies. However, the MRDT has shown that the delegation of duties can be accomplished through an entirely new and highly effective structure. The combination of elected and appointed leadership allows for a representative and efficient leadership body. The experiments in leadership, structure, and projects have provided an educational and innovative backdrop for this team to continue to grow and learn in the coming years.

### **Biographical Information**

MICHAEL BOUCHARD is a junior at Missouri S&T studying Geology and Geophysics, and is passionate about space exploration. Last year Bouchard founded the MRDT with a group of friends, as is responsible for much of the team structure. He currently serves as the teams CEO.

DR. KRISTEN M. DONNELL is an Assistant Professor in the Department of Electrical and Computer Engineering at Missouri University of Science and Technology. She also serves as a faculty advisor to the MRDT.

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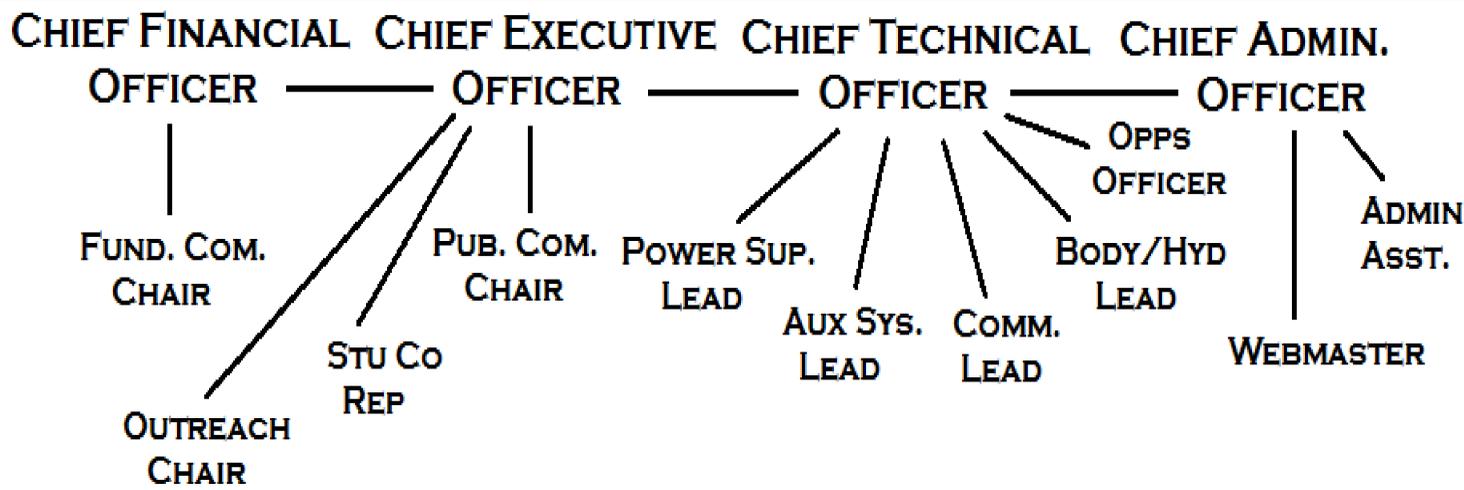
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Members pose with the St. Louis Science Center's Mars Globe

### MRDT Organization Chart:



### Two Tiered Leadership:

A second tier of officers (Team Leads and Committee Chairs) are appointed by the Executive Board, and allow students with necessary and specialized skills to be placed in their optimal positions. Each Team Lead reports to an Executive Officer and may lead a sub-team of students. Further, each sub-team has a mission-specific task, and will develop the solutions to overcome it, such as powering the rover, or funding the project.

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### Prototype Project:

1. Provided an opportunity to work on a technical design-to-construction project
2. Allowed team members to begin developing team synergy
3. Tested how the MRDT's structure would work in practice
4. Created a solid presentable product
5. Enabled the Executive Board to evaluate members of the MRDT for initiative and leadership potential



Founding MRDT members



"Steve" - the result of the Prototype Project