MROVER

MICHIGAN MARS ROVER TEAM

2022-2023

We are MRover

We are MRover, the Michigan Mars Rover Team.

We are the **largest** multidisciplinary robotics team at the University of Michigan. MRover designs and builds a rover to compete in the University Rover Challenge (URC) and Canadian International Rover Challenge (CIRC). URC brings together over thirty teams from around the world to test their rovers in a simulated Martian environment. In June 2022 we **placed first** at URC and in 2020 we received the **highest** qualifying score for the competition. In August 2022, we competed in CIRC for the first time and placed **first** with a lead of 110 points.

In both competitions, teams must complete a series of missions with their rovers using a remote base station. The competitions evaluate each rover's capabilities at performing specific tasks including:

- Driving over the vast, unpredictable martian-like landscape
- Manipulating objects and controls with a robotic arm
- Acquiring soil samples from the ground to detect life
- Navigate autonomously with accuracy in an precarious environment

Our Mission

Our mission is to promote space exploration, give students valuable hands-on engineering experience, and inspire younger students to pursue science and engineering. Being one of the highest performing teams in the world gives our members this opportunity, and our outreach programs gives others this opportunity as well.

We organize several outreach events each year, such as giving demonstrations of our rover at the FIRST World Championship and the NSBE STEAMfest convention, and we are always looking for more opportunities to promote STEM education in our community. We love interacting with younger students, especially those who share our passion for space, and we understand the importance of inspiring the next generation of scientists and engineers.

The Team

MRover is a diverse and dynamic team of over **200** undergraduate and graduate students at the University of Michigan. Our team is composed primarily of engineering and science students, although we welcome students of all majors.

We organize our team into four technical branches: mechanical, software, electrical, and science. Each branch is divided further into sub teams that focus on specific systems on the Rover.

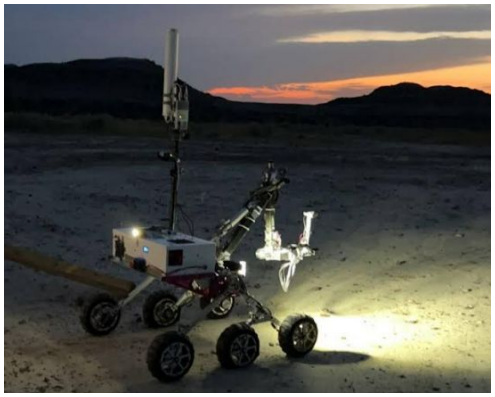
The Competitions

Who: MRover and 35 other teams from around the world attend the University Rover Challenge (URC), which is hosted by the Mars Society. The URC chooses these teams from a pool of around 90 applicants. The Canadian International Rover Challenge (CIRC), is hosted by the Canadian Space Technology Advancement Group.

What: The rover must compete in missions designed to simulate operations that a future Mars rover would have to carry out to assist astronauts. The tasks include autonomous traversal, science, extreme retrieval and delivery, and equipment servicing.

When: URC is held annually at the beginning of June and CIRC is held mid August.

Where: URC takes place at the Mars Desert Research Station in Utah. CIRC is held at Badlands Community Facility in downtown Drumheller, Alberta, Canada. The terrain at each location serve as a close match to that of the rocky Mars surface.



Our Rover

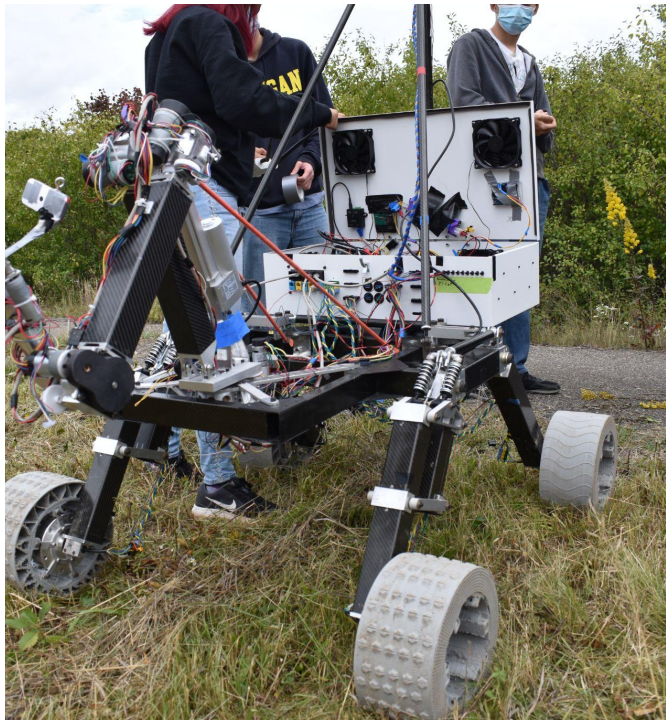
The University Rover Challenge demands creative design and requires systems that are robust and versatile. Constraints placed on the rover for onboard cost ($18,000) and mass (70kg) require innovative solutions that combine advanced technologies with highly efficient design, resulting in tight integration of mechanical and control system components.

Mechanical

Robotic Arm - With six degrees of freedom, our arm can lift toolboxes, type on a keyboard, manipulate switches, and open drawers.

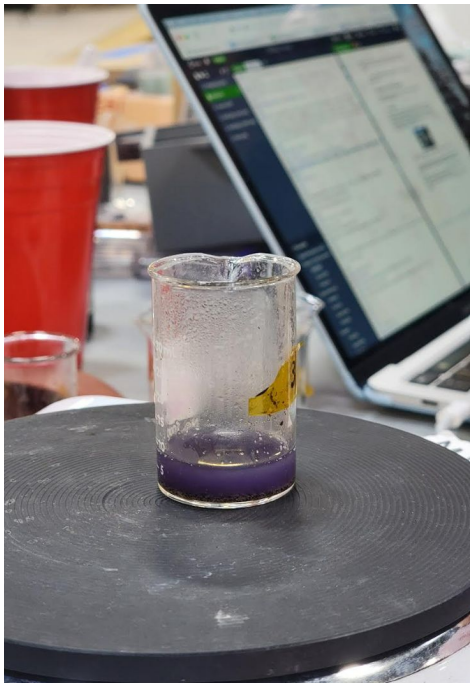
Chassis and Mounts - Our rover features a aluminum alloy chassis with a modular mounting system, allowing us to optimize our configuration of subsystems for each task.

Mobility - Our mobility system allows our rover to drive rough terrain and uses a system of shock absorbers and a differential bar to absorb downward and frontal impact.



Mechanical

Instruments and Sample Handling (ISH) - Our rover must be able to acquire soil samples and scan them for life. ISH brings together our Raman spectrometer, microscope positioner, and sample handling boxes to ensure tests run smoothly.



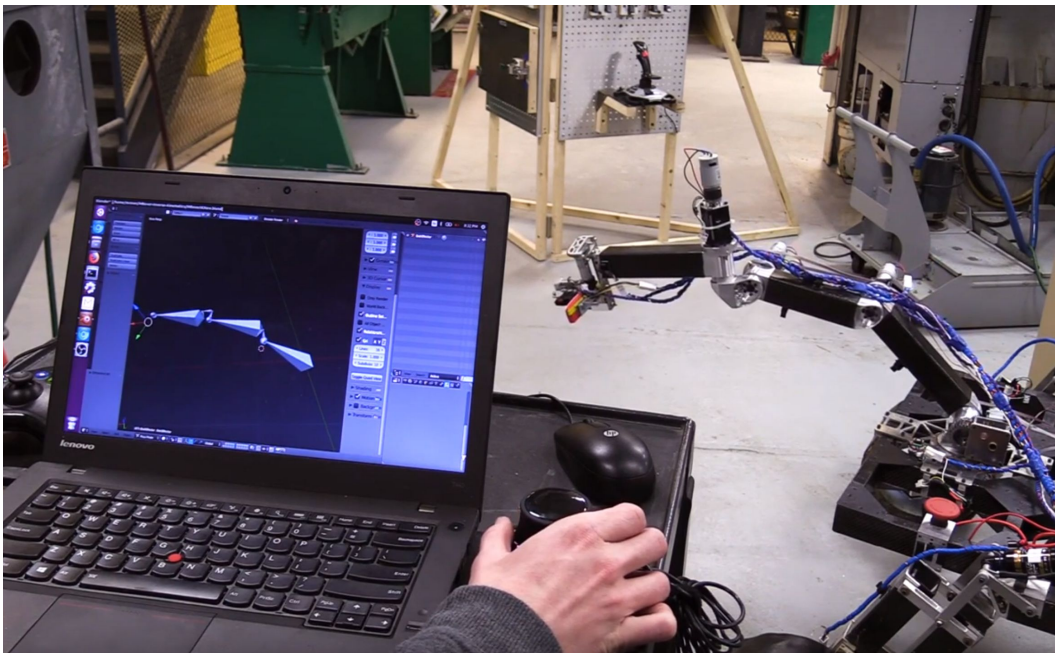
Sample Acquisition (SA) - Focuses on developing and testing the mechanics of soil collection. Previously, that has included a combination of an auger drill to extract the soil and mechanised scoop to deliver soil to the ISH system.

Software

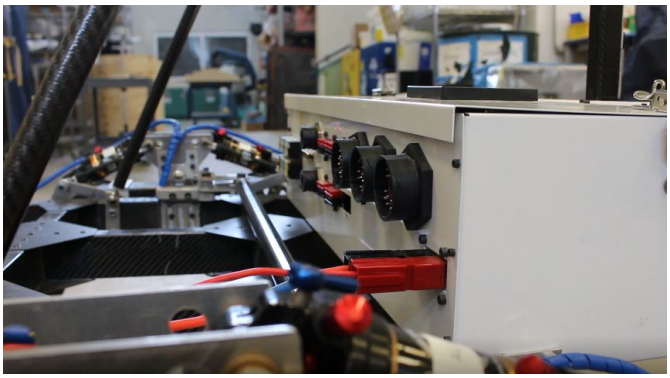
Autonomy – Our Autonomy team is further divided into 4 more subteams: Navigation, Perception, Localization, and Simulator. Navigation plans and executes a path for the rover to search an area while avoiding obstacles. Localization tracks the position and orientation of the rover. Perception identifies key features of the environment (objective markers) and obstacles in the rover path. Simulator creates a test environment for the subteams.

Teleoperated Control – The Teleoperated Control subteam develops the control schemes for each rover subsystem as well as the GUI for the base station.

Embedded Software – Our Embedded Software subteam writes drivers and other low-level code to ensure all the features of our many pieces of hardware can be accessed in software.



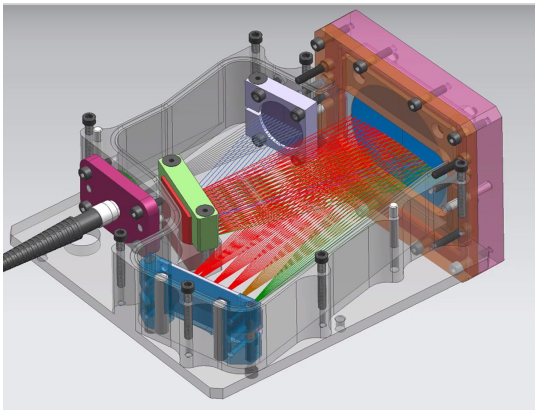
Electrical

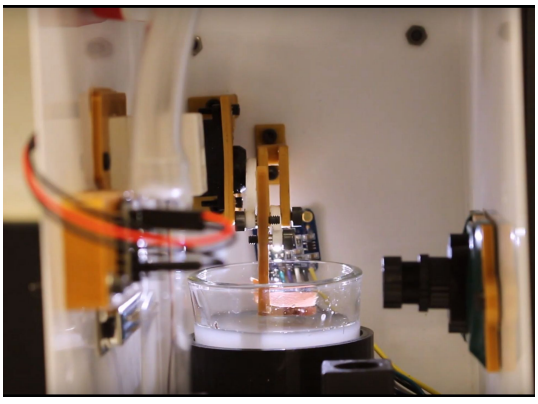


Power – The power subteam is responsible for delivering power from our 21 amp-hour battery to all subsystems on the rover.

Embedded Hardware (EHW) - The EHW team handles the physical connection of all logic signals passed between systems and sensors onboard the rover as well as PCB design.

Communications – Our Communications subteam is responsible for ensuring a reliable radio connection between the rover and the base station at all times.



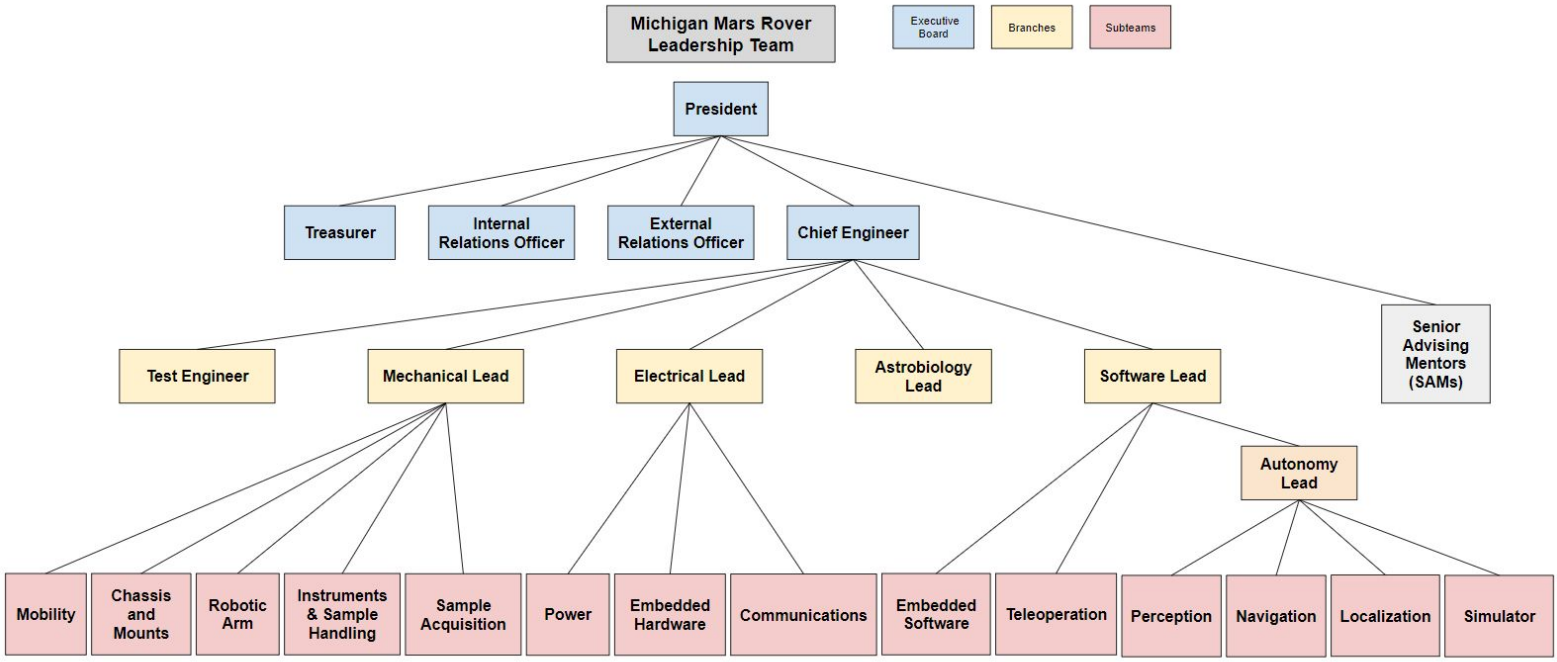


Astrobiology

Science and Life Detection - Our Science team researches biochemical tests to implement into the life detection system onboard the rover. After our rover has tested the soil, they must prepare a report about their findings and present it to URC/CIRC officials.

Team Leadership

MROVER has about 90 members each year which necessitates a large leadership structure. Executive Board members are elected by popular vote and Subteam leads are appointed by the past Subteam Lead.



Sponsorship Benefits

Access to the team: *Direct avenue of networking* among MRover's talented, dedicated, and ambitious team members.

A resume book: *Access* to the resumes of our team members.

Publicity: *International exposure* at our competitions.

Excellent brand development through our social media platform, team apparel, and outreach events.

Corporate Events: *Expert assistance* in organizing an event for Michigan students, whether for our team, several project teams, or a larger audience.

We rely on sponsorship to purchase materials, create prototypes, and improve our toolset. We greatly appreciate your support to help us continue our growth as a team.

MRover also accepts material and equipment donations.
All monetary donations are tax deductible.

Please contact **Sydney Shanahan** at shanahsy@umich.edu if you are interested in becoming a sponsor.

Sponsorship Levels

PLATINUM SPONSOR $5,000 or greater

*Includes **gold, silver** and **bronze** sponsorship benefits and the following:*

- Featured logo on our rover during competition
- Most prominent logos on website, t-shirts, and presentations
- Access to the team for videos, case studies, etc.

GOLD SPONSOR $3,000 or greater

*Includes **silver** and **bronze** sponsorship benefits and the following:*

- Exclusive access to networking events hosted by MRover
- Primary logos on website, t-shirts, and presentations
- Social media post recognizing/thanking the sponsor

SILVER SPONSOR $1,000 or greater

*Includes **bronze** sponsorship benefits and the following:*

- Secondary logos on website, t-shirts, and presentations
- Exclusive meetings with the MRover team

BRONZE SPONSOR $500 or greater

- Monthly updates via email newsletter
- Tertiary logo on website, t-shirts, and all official presentations
- Access to our resume book

All material donations will be considered as monetary sponsorships of equal value.

2022-2023 Budget

Budget Overview	Cost
Electrical	**$14,000**
Mechanical	**$23,250**
Science	**$3,000**
Software	**$10,200**
Competition Expenses	**$38,387**
Other	**$21,500**
Total	**$110,337**

Electrical	**$14,000**
Embedded Hardware	$3,000
Power	$6,500
Communications	$3,000
Electrical Testing/R&D	$1,500

Mechanical	**$23,250**
Chassis and Mounts	$3,000
Mobility	$5,000
Robotic Arm	$4,000
ISH	$3,250
Sample Acquisition	$3,000
Manufacturing	$3,500
Mechanical testing/ R&D	$1,500

Science	**$3,000**
Beakers, testing, R&D	$3,000

2022-2023 Budget

Software	**$10,200**
Software licenses	$125
Dual Sensor ZED cameras	$1,200
Jetsons, microcontrollers, Odrives, motor controllers thermistors leds special triad	$6,300
GPS and IMU	$400
Pi cameras, Base Station, controllers	$1,500
Controller	$75
Drone	$600

Competition Expenses	**$38,387**
Systems	$500
Travel Expenses	$36,000
Canadian International Rover Challenge Registration	$280
University Rover Challenge Registration	$107
Food	$1,500

Other	**$21,500**
Emergency Fund	$17,000
Organization	$2,500
Outreach	$2,000

2021-2022 Sponsors

ALTAIR

Ford

FUTEK
ADVANCED SENSOR TECHNOLOGY, INC.

Red Bull

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MICHIGAN ENGINEERING
UNIVERSITY OF MICHIGAN

SWANTON WELDING COMPANY INC.

BLUE ORIGIN

ECE ELECTRICAL & COMPUTER ENGINEERING
UNIVERSITY OF MICHIGAN

CSE COMPUTER SCIENCE AND ENGINEERING
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Raytheon

COLLEGE OF ENGINEERING
MECHANICAL ENGINEERING
UNIVERSITY OF MICHIGAN

APTIV

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Texas Instruments

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UNIVERSITY OF MICHIGAN