



# Husky Robotics Team

## Information Packet



### Introduction

We are a **student robotics team** at the **University of Washington** competing in the **University Rover Challenge** (URC). To compete, we bring together a team of diverse and motivated students to design, build, and operate a sophisticated mock **Mars Rover**. For the past four years our team has been selected out of an increasingly large pool of competitors to go to the Mars Desert Research Station in Utah at the end of May to compete against teams from across the world.

We design all aspects of the rover ourselves and our members do the vast majority of machining for rover parts. This year, to meet new competition challenges we are expanding to include **composite materials** and **computer vision** in our rover. Joining our team is an engineering, design, and manufacturing challenge most students do not encounter in their academic careers.

We placed **9th out of 82 teams** last year, and were the **3<sup>rd</sup> best team from the United States**. We believe this success was from iterating on our unique rover design, improving our mechanical and control systems, and significantly optimizing our team organization and manufacturing processes.

You can visit us at our website: [huskyrobotics.me](http://huskyrobotics.me).

## The University Rover Challenge

The URC is held annually at the Mars Society's Mars Desert Research Station near Hanksville, Utah, an arid desert location roughly analogous to that of Mars. To qualify, teams must submit a Preliminary Design Review (PDR), as well as a more thorough System Acceptance Review (SAR). The SAR is competitive and requires both written and video components. Husky Robotics Team has successfully qualified for the URC every year for the past four years. The competition consists of four tasks:

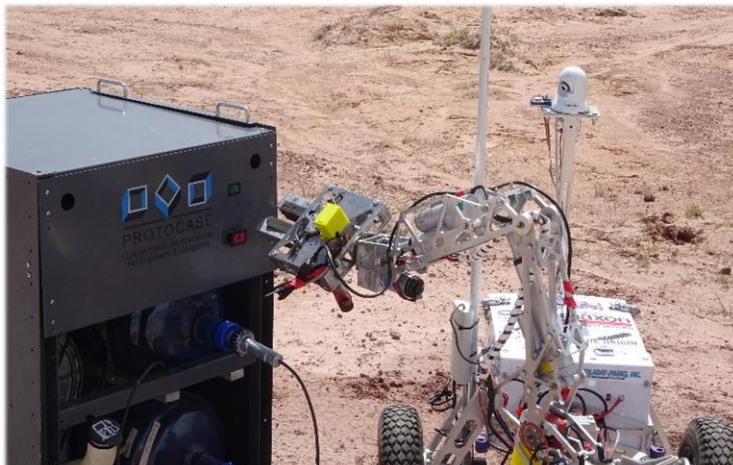
### Autonomous Traversal

The rover is given coordinates to travel towards without any driver control. Obstacles such as large boulders are overcome autonomously and without intervention.



### Equipment Servicing

The rover completes several dexterous tasks such as turning knobs and plugging in connectors.



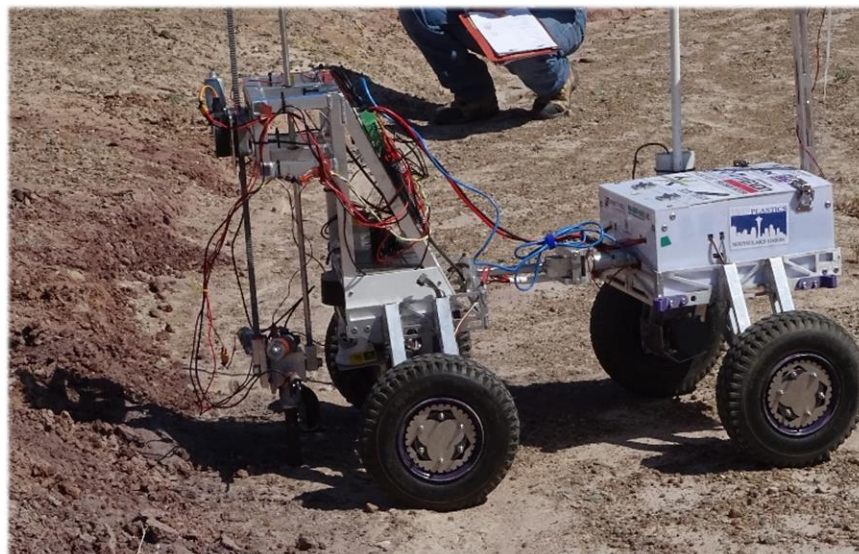
### Extreme Retrieval and Delivery

The rover is driven through rough terrain, and picks up items such as a tool box, and delivers it to a predetermined location.



### Science Cache

The rover takes measurements at various sites, and drills into the soil to take samples. The sample is then subjected to onboard tests, and is also sealed and stored for off-site testing later.





## Subsystems

Husky Robotics Team consists of 5 rover subsystems, the Manufacturing team, and the Business team.

### Arm

The Arm subsystem is responsible for the design, and construction of the rover's robotic arm. The arm must safely lift up to 5 kg, and needs to be dexterous enough to pick up tools, and perform complicated actions on a control panel. Members of this subsystem learn to design in Autodesk Inventor Pro, use the machine shop to manufacture parts, and perform maintenance and repairs should the need arise.



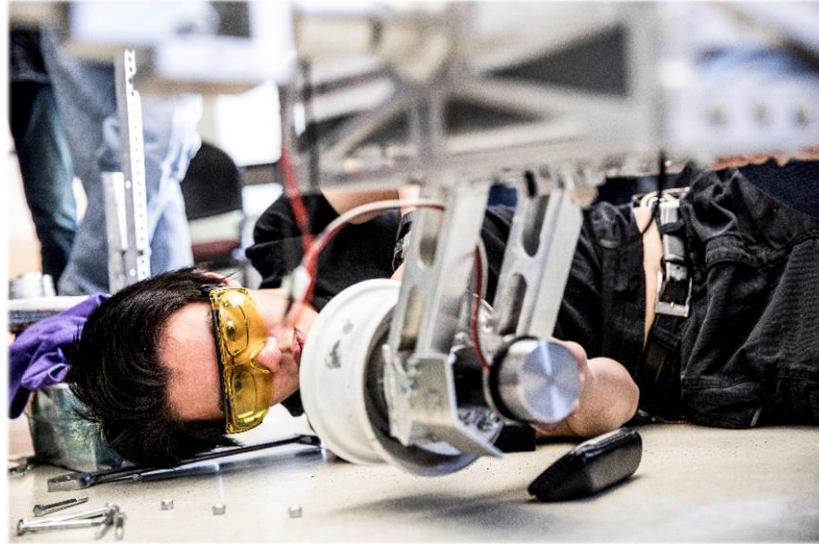
*Photo by Dennis Wise*

### Business

The Business team oversees fundraising, managing funds, seeking sponsorships, ordering parts, and making travel arrangements for the team to get to competition. The team also takes pictures, creates content for the web, and presents Husky Robotics Team to the UW, businesses, donors, and outside organizations. The business team emphasizes management of people, finances, and public profile, and works to provide opportunities to club members to develop valuable skills and find internships.

## Chassis

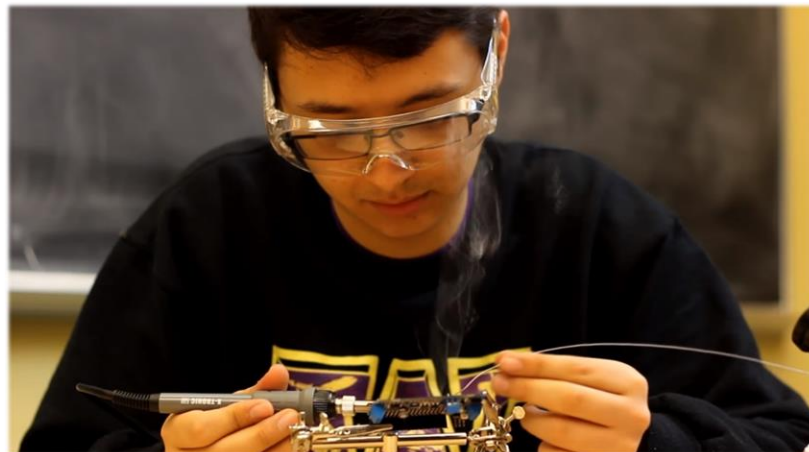
The Chassis subsystem creates a robust drive train to travel over the rough terrain of the competition while providing stable mounting points for the arm and science station. The group works with Computer Aided Design (CAD) software to create a digital rendering of the rover, so the Manufacturing team can turn it into reality. During fall quarter, the chassis team works to fully design the base of the rover. To offset the smaller workload during winter and spring quarters, many Chassis subsystem members are a part of the Manufacturing team.



*Photo by Dennis Wise*

## Electrical

The Electrical subsystem designs the architecture of electrical hardware that runs motors and sensors on the rover. It also designs the power distribution system and writes code to interface with electronics. Typical work for an Electrical member includes using **Eagle CAD** to create **printed circuit boards**, soldering, and testing motor control schemes.



*Photo by Dennis Wise*

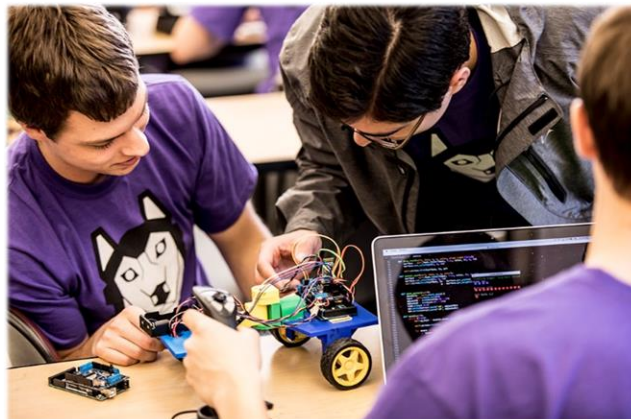
## Science

The Science subsystem is responsible for designing and building the Science Station, a module on the rover that **collects and analyzes soil samples**, providing information such as soil temperature and water content. The subsystem also chooses and develops a set of off-rover soil tests, such as **X-ray spectrometry**, and provides background information to contextualize any findings during the competition. To successfully design the science station, the group leverages the University of Washington's resources to get expert opinions and help from professors and graduate students.



## Software

The Software subsystem creates the brains of the rover, allowing it to be operated when it is out of sight of the driver. The group works with **LIDAR, depth sensors, drive algorithms, inverse kinematics, computer vision**, as well as interfacing with different controllers to make sure the rover operates quickly and intuitively for the driver. The software team also creates the user interfaces that the drivers use to control the rover including camera feeds, on screen controls for precision based operations such as working with the science system, and map based coordinate plotting. We use the **C#** programming language, Visual Studio, and general Linux skills to achieve our objectives.



*Photo by Dennis Wise*



## Manufacturing

Husky Robotics Team utilizes advanced manufacturing techniques such as CNC milling and welding to create custom parts for the rover.



*Photos by Dennis Wise*

## Sponsorships

We seek contributions from sponsors to help finance the purchase of electronics, metals, as well as pay for the costs of travelling to Utah. In addition to the helping promote the professional and educational development of our team members, some of the benefits of being a sponsor of Husky Robotics Team include logo placement, visits to your place to business, and recruitment assistance such as resume books, forwarding recruitment material via our mailing list, and opportunities to present at our general meetings.

### Here are our available sponsorship levels:

**\$250+**

T-shirt

Logo featured on T-shirt, website, rover

**\$500+ (Bronze)**

+Signed team photo

**\$1000+ (Silver)**

+Upgraded logo size and placement on t-shirt, website, and rover.

**\$1500+ (Gold)**

+Visit to your place of business (if within the Puget Sound area)

**\$3000+ (Husky)**

+Extra-large logo at top of t-shirt, website, and rover

As our sponsor, you will receive periodic updates and photos on how your contribution is being used, a thank you card at the end of the season, feature your name and logo on our website, and t-shirts\*. **All levels include the additional benefits from previous levels, plus one extra t-shirt per level.** We take both monetary and in-kind donations.

\*donations must be received by 12/10/17 for logos to appear on t-shirts

