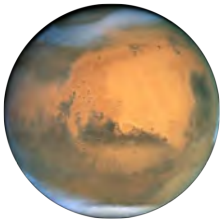
MAA | MOUNT ALVERNIA ACADEMY



Mars Project
Advisor- Maria Lyons

The Mars Rover project was a very fun and interesting project that took us from the classroom to Mars. In this project, we had to create a rover that was coded to navigate a small section of the Mars terrain to get from point A to point B. We also had to design the rover and make sure not to use more than 50% of our energy, so that the rover could get back to point A. Overall this project was a great way to practice our robotics and coding skills, and also to learn that it is very important to pay attention to all the little details when designing a robot. Maread

Goals

Students research the environment of Mars to determine the differences and similarities between the Martian and Earth environments, especially in the ability to do work, temperature, water, gravity and energy sources. Students relied on knowledge gained from last year's work on NEED Science of Energy.

Students use NASA, Hour of Code, to learn how to use block coding to make a vehicle move along a prescribed path.

Students learn how to build and operate Lego Mindstorm Robots donated by members of the Mount Alvernia Community. The students were in 10 teams of 3-4 students.

Students then design and construct a Martian Rover Robot that will be able to traverse their Martian Landscape.

Students construct a Mars landscape by extrapolating a course, given by NASA and Jet Propulsion Laboratory, onto a 6'x6' paper in the school hall.

Students program their Mars Rover to travel the surface of Mars, along their chosen course, without hitting a mountain or falling into a crater, from Base A to Base B.

Students determine the energy used during their voyage. The voyage must not use more than 50% of their energy supply. On Mars, they would need to get back to Base A.

Students learn to collaborate within their teams to get the best results on their project.

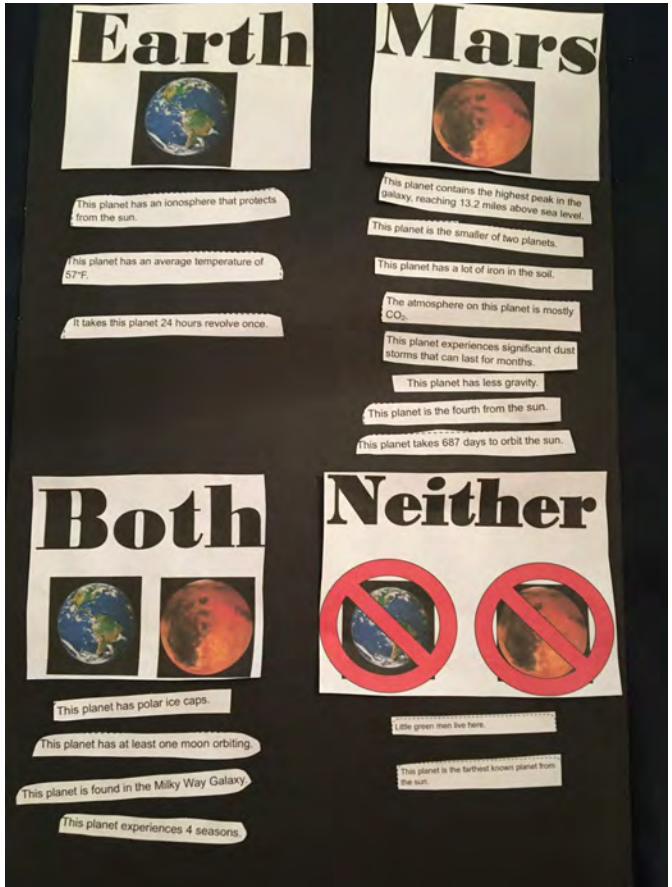
Students share their projects, in the halls of Mt Alvernia and on the school's social media sites.

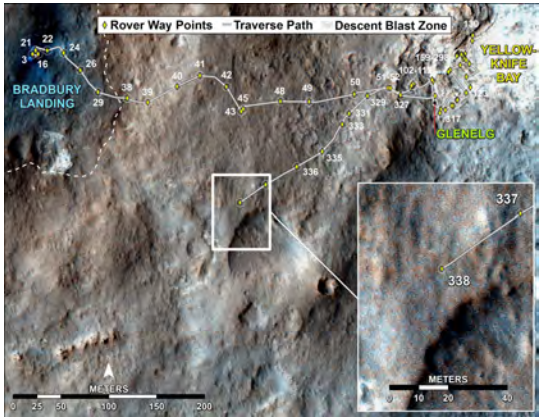
M Lyons

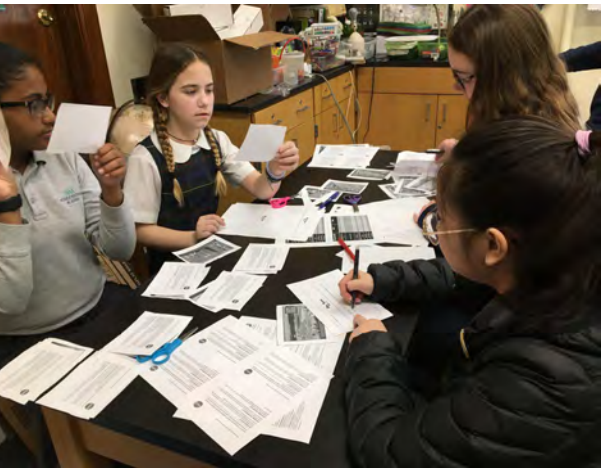
Mars vs Earth Research

ttps://marsed.mars.asu.edu/content/xtreme-o-philes

https://www.youtube.com/watch?v=VvqANiuGcyo







Making a Mars Rover

https://www.jpl.nasa.gov/edu/teach/activity/robotics-making-a-self-driving-rover/

JPL Education

CLASSROOM ACTIVITY

Robotics: Making a Self-Driving Rover

A student-made rover drives across a simulated Mars surface.
Credit: NASA/JPL-Caltech

Engineering constraints

- Once the challenge begins and the program has begun, users may not touch the rover without penalty.
- The rover must not cross over any of the crater edges.
- No sensors are to be used for navigation.
- The rover may not exceed 50% power on either motor.
- You should program your rover to maintain a safe distance of 3 cm from the edge of any crater.

Points for this challenge will be as follows:

The rover navigates from A to B maintaining a 3-cm safety margin for each crater.	60 points
Complete the course in the shortest time span	10 points
Motor exceeds 50% power position	-2 points for each second the robot moves using more than 50% power

NASA/JPL Edu – Robotics: Making a Self-Driving Rover | **Discover more:** www.jpl.nasa.gov/edu

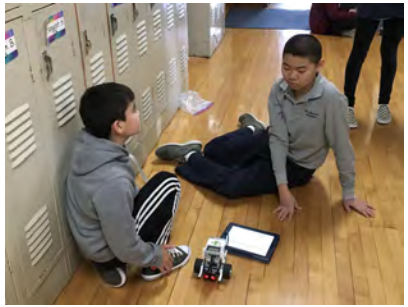
Programming

Our group decided not to take a lot of 90 degree turns, but instead to set a straight line in between the rocks. One issue was trying to get the bot to turn the right amount. The tires we were using meant that turning the tires 80 degrees would not result in the bot turning 80 degrees. We had to calibrate the robot a lot, but after a few attempts, we passed with a great score! I loved the project overall and hope our school continues doing it. Seth

Assisted by Computer Teacher Victoria Frieswick

Testing

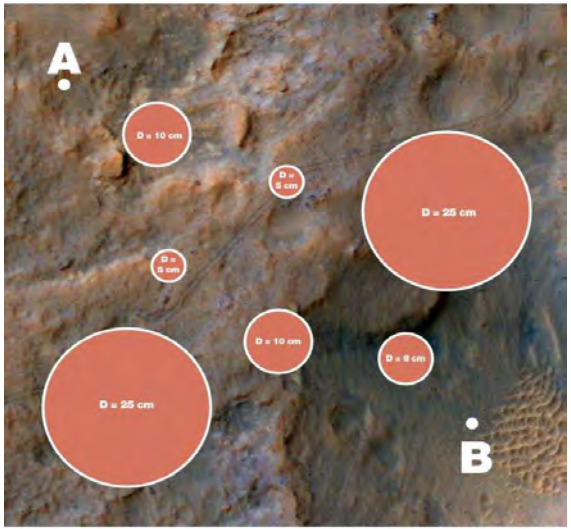
This Fall at MAA we did something that we've never before done, something I've never done before. That is, we built and programmed rovers. I learned a great deal about teamwork and precision, and I also learned using logics and what we know to program directions for the rover. Something interesting that I learned during this project is that volcanoes are not only found on planet earth but also found on the red planet, Mars. My favorite part of this project has to be the programming part, where we used the ratio of our map to the "Mars grounds" to figure out at what degree we should let the rover turn and how far the rover should go forward. I absolutely loved the Mars Rover Robotics Project. Adrianna



Jet Propulsion Laboratory
California Institute of Technology

Robotics: Making a Self-Driving Rover

Example: Mars Crater Map

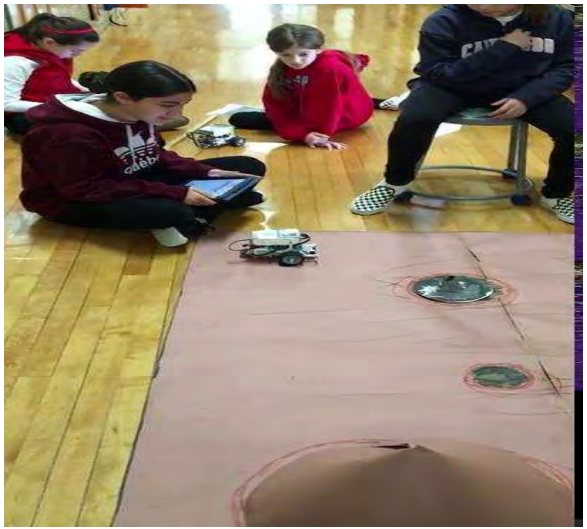


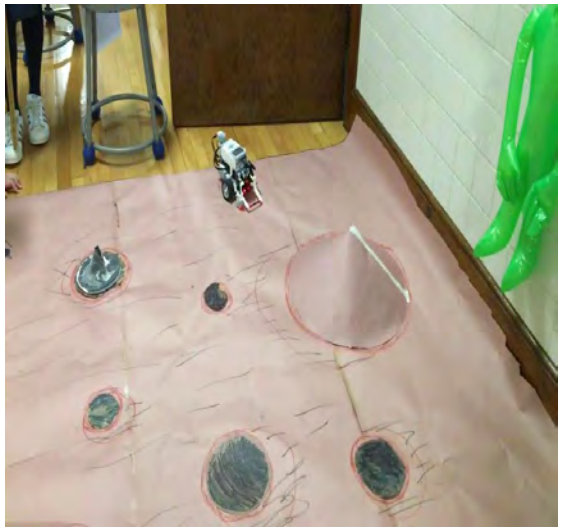
Students constructed a Martian Landscape by extrapolating dimensions given by NASA and by creating mountains and craters. This encorporated math and art into the project. STEAM!

Martian Landscape

First Attempts

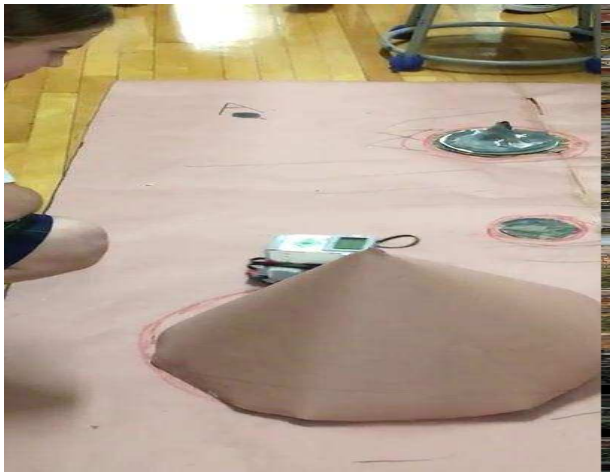
I really liked this project and I loved getting to put together the legos and program the machine. I've never done that stuff before and I learned a lot from doing it such how to program machines, measurements, and much more. I hope I get to do it again at BC High!! Greg

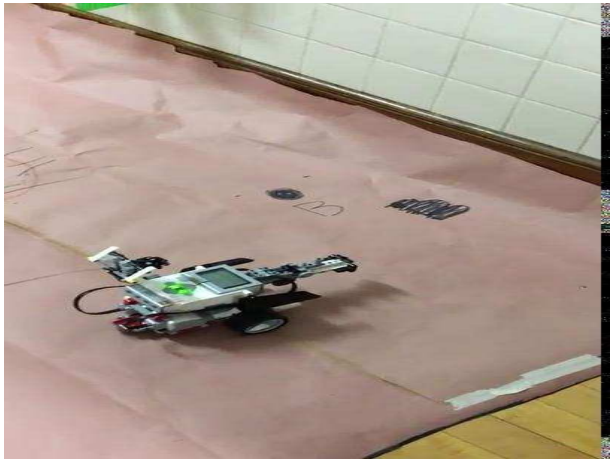




Some hit Mountains
Some hit Craters
Some ran out of Energy

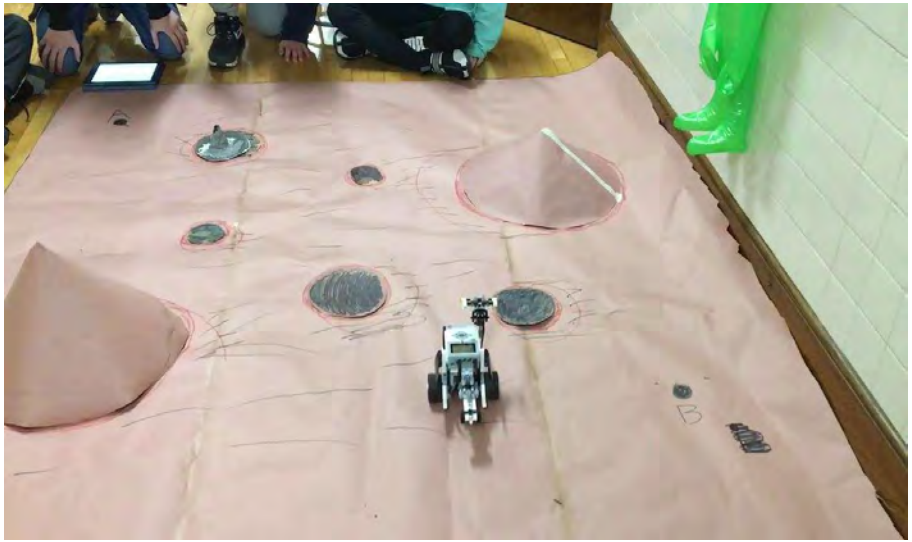
Students adjusted their programming



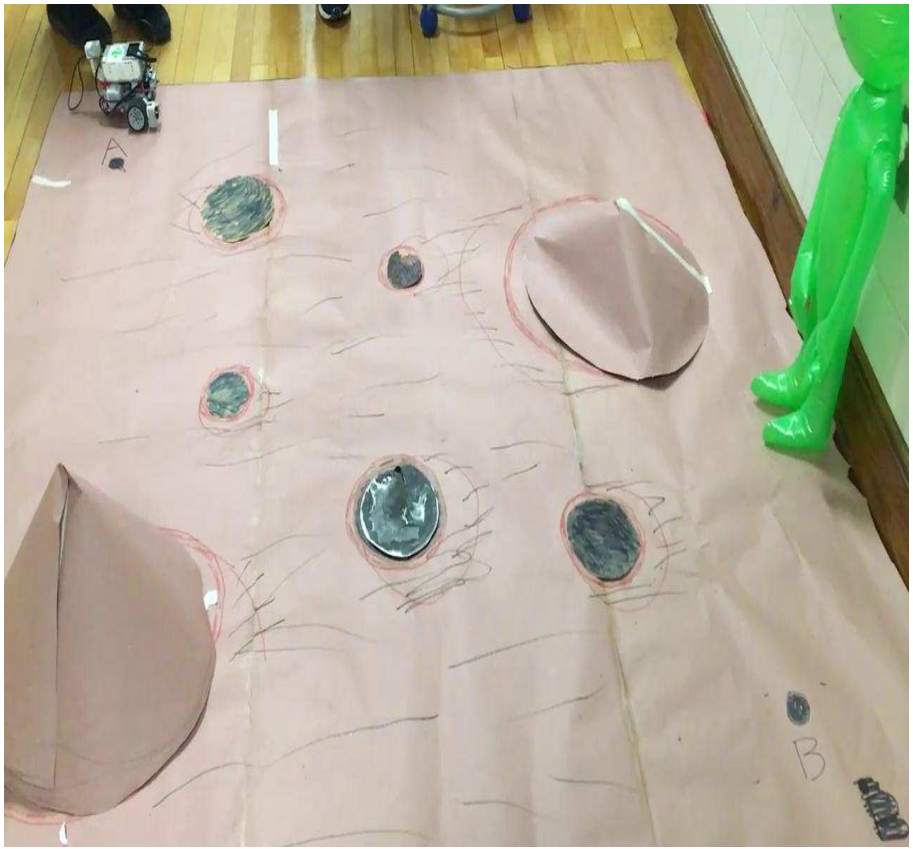


Success

I really enjoyed the mars robotics project because I got to learn new things and I got to be more creative. I really liked the setting/storyline of the project. I liked how we got to become astronauts that were building rovers to get across mars. I also liked how we got to build the rovers and then program them ourselves (so they can get across the craters and mountains.) I also learned a lot of new things, I learned how to program better and how to fix my mistakes. This was really important to me because we got to learn from our mistakes and we got to try again and fix our mistakes to make our rover even better. This project also taught me a lot about teamwork. My tablemates and I had to learn how to work together in order to make our rover work. We also learned how to be more cooperative and how to listen to each other's ideas so that we could build our rover successfully. My favorite part was either getting to program the rover or getting to do the math for how the rover will move (across mars.) Finally, this project was really fun to do and probably the best project I did this year. Fei



From Base A to Base B
Less than 50% of Energy Used



Robot Dancing

In the Mars Rover Project we were given the chance to do a little dance with our robot. My partners were Rahel, Alice, and of course, the robot. We programmed the robot so that it would walk up in front of us, and then it would spin around in a circle at the same time we did. At the end of the dance, we programmed the robot to make a big “boom” sound for the finale. To coordinate our dance with a robot, we counted how long the beginning of our dance was. When the robot was walking up, we did our dance, and then we had the robot spin around when we did. I enjoyed the project very much. It was something that we hadn’t done before at school, so it was super fun. Addie

Mars Mission Preparation

Students worked together, and used math, to determine how forces, gravity, aerodynamics, and energy transformations are used to land a spacecraft on Mars. This was to prepare them for their simulated Mars Mission at the **Christa McAuliffe Center for Integrated Science Learning.**


SCIENCE NEWS DAILY

August 2016

Aerobraking: The First Stop

By Denise Kopecky

How Aerobraking Lowers the Orbit


SCIENCE NEWS DAILY

August 2016

The Power of the Parachute

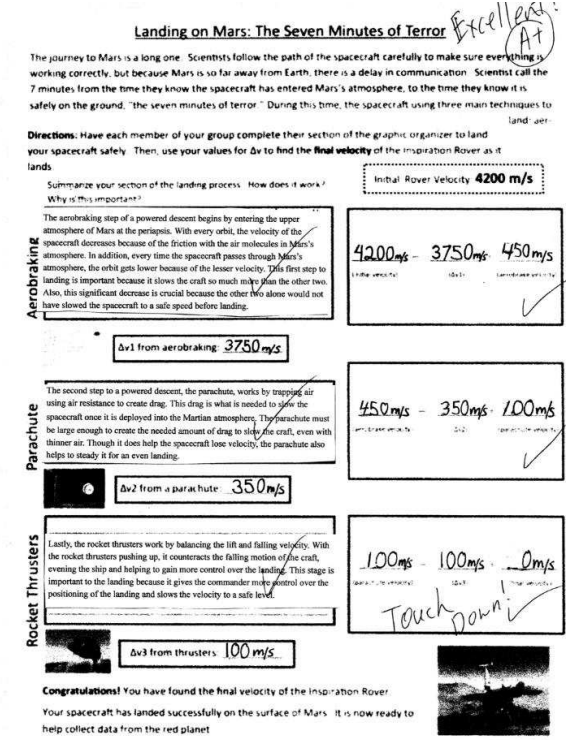
By Denise Kopecky


SCIENCE NEWS DAILY

August 2016

Rocket Thrusters: The Last Stop

By Lauren Phipps


Landing on Mars: The Seven Minutes of Terror

Excellent! A+

The journey to Mars is a long one. Scientists follow the path of the spacecraft carefully to make sure everything is working correctly, but because Mars is so far away from Earth, there is a delay in communication. Scientist call the 7 minutes from the time they know the spacecraft has entered Mars's atmosphere, to the time they know it is safely on the ground, "the seven minutes of terror." During this time, the spacecraft using three main techniques to land: aer

Directions. Have each member of your group complete their section of the graphic organizer to land your spacecraft safely. Then, use your values for Δv to find the **final velocity** of the inspiration Rover as it lands.

Summarize your section of the landing process. How does it work? Why is this important?

Initial Rover Velocity **4200 m/s**

Aerobraking

The aerobraking step of a powered descent begins by entering the upper atmosphere of Mars at the periapsis. With every orbit, the velocity of the spacecraft decreases because of the friction with the air molecules in Mars's atmosphere. In addition, every time the spacecraft passes through Mars's atmosphere, the orbit gets lower because of the lesser velocity. This first step to landing is important because it slows the craft so much more than the other two. Also, this significant decrease is crucial because the other two alone would not have slowed the spacecraft to a safe speed before landing.

4200 m/s - 3750 m/s - 450 m/s

Δv1 from aerobraking: 3750 m/s

Parachute

The second step to a powered descent, the parachute, works by trapping air using air resistance to create drag. This drag is what is needed to slow the spacecraft once it is deployed into the Martian atmosphere. The parachute must be large enough to create the needed amount of drag to slow the craft, even with thinner air. Though it does help the spacecraft lose velocity, the parachute also helps to steady it for an even landing.

450 m/s - 350 m/s - 100 m/s

Δv2 from a parachute: 350 m/s

Rocket Thrusters

Lastly, the rocket thrusters work by balancing the lift and falling velocity. With the rocket thrusters pushing up, it counteracts the falling motion of the craft, evening the ship and helping to gain more control over the landing. This stage is important to the landing because it gives the commander more control over the positioning of the landing and slows the velocity to a safe level.

100 m/s - 100 m/s - 0 m/s

Touch Down!

Δv3 from thrusters: 100 m/s

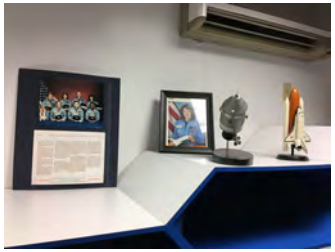
Congratulations! You have found the final velocity of the Inspiration Rover.

Your spacecraft has landed successfully on the surface of Mars. It is now ready to help collect data from the red planet

Isabella W

Christa McAuliffe Center for Integrated Science Learning

https://cm-center.org/clc

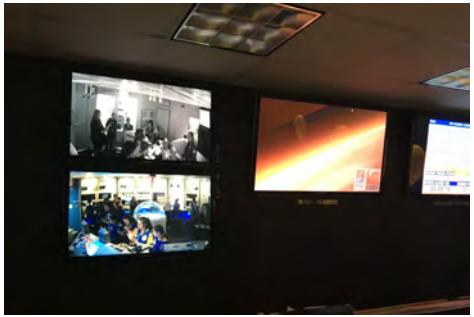


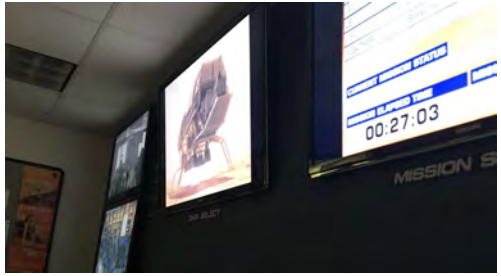
Expedition Mars

The year is 2076. Humans have solved some of the larger problems associated with a long-term Mars mission, including radiation exposure and landing large payloads safely on the surface. A handful of facilities have been established on the Martian surface including a greenhouse, a mobile geo survey base, and a centralized research habitat. The primary human habitat within the Mars system is not on Mars itself, but located approximately 9,376 km away on its moon, Phobos. This tiny moon provides an excellent location for a permanent base to continue studying Mars. A large shuttle regularly ferries astronauts and scientists between the base on Phobos and the surface of Mars. This shuttle, or Mars Transport Vehicle (MTV), serves as the spacecraft for the mission. The MTV carries parts to build a remotely operated vehicle (ROV) for hydrological exploration and it also carries one unmanned drone aircraft which can carry the ROV to a survey destination. However, when crew members discover a threat to their MTV base, they must act quickly to save their crew and their station.Challenger Center

After a NASA briefing, students were sent to Mission Control or the spacecraft. Upon a successful landing on Mars, they executed tasks on robotics, geology, biology and medical checkups. They communicated with Mission Control, monitored energy supply and weather and navigated the spacecraft.

After a few tense moments involving a near asteroid hit and low levels of energy, the students were able to safely return to their homebase.





I would love to be an astronaut while proudly representing the United States and discovering and exploring for answers throughout space. Because to be an American astronaut is something to take pride in."
Arianna

Conclusion

The Mars Rover was one of the most fun and yet complex projects that I have completed while at Mt. Alvernia Academy. The main goal of the project was to get our rover from point A on Mars to point B without using more than 50% of our energy. Of course, it wasn't that easy. We were given a map of the "area" where our rover would travel, and one of the first steps of the project was to make a scale and grid the map so we could see which paths would be the fastest and the safest. While the rover was on its "mission", it would have to dodge mountains and creators, and fit through narrow spaces. We were able to code the rovers through a special app on the school ipads. Although just getting the machine throughputs mission, was just the tip of our iceberg.

Another important part of the project was our design of the rover. We began with small step by step tutorials from the app, adding one small piece after another until we finished the basic design. After we completed the first stage of the design, our teacher let us have free reign on further design and add ons. The app used a similar tactic for teaching us it's coding, and once we finished the introduction course, we were ready to program our robots. Through trial and error, calculations, and measurement after measurement (I know my group went through a ton!),we were all able to complete the course, but not just by ourselves. I don't know a single group that could have succeeded without every single one of its members. In this project, we did not only meet our teacher's goal for programming and robotics, we also came together as individual teams and as an entire grade. This project has taught me many things, and I know that years from now, I will look back and remember how amazing it was, not only because of it's well thought out plan and execution, but how my teacher and classmates helped me through it! Mairead

Students assisting in this Slide Show

Mairead Gero

Seth Janchar

Adelina Corra

Fei Li

Gregory McGrath

Arianna Sun

Isabella Winey