

FIRST LEGO League
2003 MISSION MARS
Research Assignment

Acknowledgements

We would like to thank NASA, JPL and The Planetary Society for their knowledge, experience, awesome websites and other resources.

Why Do The Research?

Your FIRST LEGO League (FLL) team will experience very similar challenges encountered by the scientists and engineers at NASA. It takes all kinds of people and skills to fully understand and appreciate what the challenges are to get to Mars.

Your team will not only build and program a robot that will accomplish the missions on the FLL Playing Field, but through the Research Assignment the team will understand more fully why these missions were chosen and their significance to the real work being conducted by scientists around the world.

The exploration of the FLL Challenge MISSION MARS will enhance the overall FLL experience. FLL is not just building and competing with robots. Unlock the fascinating world that lives in the 2003 FLL Challenge MISSION MARS.

NOTE: FIRST LEGO League teams who want to be considered for the Director's Award must give a Research Presentation. Judging of the Research Presentation will count 25% towards the Director's Award. The FLL Manual has a description of the criteria for each award.

Getting Started

What Will Happen at the Tournament?

- ◆ On the day of the tournament, your team will have approximately five (5) minutes to present to a Research Presentation judge panel. There are endless possibilities and creative ways your team might present, such as: skits, formal presentations, and song to name a few.
- ◆ Judges will also look for your team's ability to have more than one, or all, team members participating in the Research Presentation.
- ◆ There are no right or wrong answers. The FLL Judges will present The Research Presentation Award to the team whose quality research, innovative solutions, and creative presentation best reflect an in-depth understanding of the various scientific disciplines and issues involved with the Research Assignment. See the chart at the end of this guide for details.

Research Assignment

2003 Research Assignment:

Choose one of the missions from the FLL MISSION MARS Challenge. What is an important question related to this mission? What is your design for a robotic expedition to answer this question?

What Should We Include?

- ◆ A clear question your team wants to answer.
- ◆ Research to support why this question is important.
- ◆ Your idea for a robotic expedition to answer this question.
- ◆ A plan for your robotic expedition. In other words, what are the steps, resources, experiments and technology needed to do your proposed robotic expedition? Think about everything involved in a NASA robotic expedition.
- ◆ Graphics, data, results or other information relevant to your team's robotic expedition.
- ◆ Conclusions your team came to based on the information you learned.
- ◆ A creative way to present this information. Like an infomercial, detailed model, skit, rap song, video, or an interview – just to name some examples.

Step 1: Read the Missions

Read each mission on the next page and decide which one your team wants to work on.

Step 2: Research The Mission

Once the team has chosen a mission, research that subject. Start with the list of websites on the FLL website under Research Assignment.

Step 3: Ask Questions

Think about not only what is known about Mars but also what is NOT known about Mars. Make a list of these questions. As a team decide which question to use for designing a robotic expedition.

Step 4: Do Detailed Research

When the team has decided on the question and mission, do more detailed research. Using Mars images, websites and other resources find out about existing and future instruments and scientific experiments that might be useful in your expedition. As a result of this research, you can get more ideas on how your team will answer the question.

Step 5: Design The Expedition

Just like NASA's expeditions, your team will need to think about the challenges your robot will face and what will it take to solve the expedition you chose. For instance, what scientific instruments, spacecraft, humans and other tools will you need in your expedition?

HINT: Invite guests from your local astronomy clubs, museums, and college or university researchers from the Astronomy, Engineering, and Marketing Departments to help the team design the expedition.

Step 6: Have Fun

Scientists, engineers and others have to make presentations to NASA officials if they want their ideas and experiments to go into space. Here is the chance to present your plan in your own way. You could put music to your presentation, create a play, make models, design posters, use a computer presentation, or other creative ideas.

Practice makes perfect! Present to your classmates or teachers. Involve your school, your sponsor, city social clubs and others.

Mission: Gusev Crater Landing Site

The Gusev Crater is the crater in BASE on the mat. This crater has been chosen by NASA as the landing site for Spirit, the first of the two rovers traveling to MARS in 2003 and 2004. NASA picked the Gusev Crater because this site has the best evidence of surface water on Mars. Scientists think that there were large floods in these areas creating the long and steep channels coming out from the crater.

Expedition Ideas:

- ◆ Create an expedition that could trace the history of water and floods on the surface of Mars. Did water exist everywhere? Why or why not? Make a model of the Martian landscape and which way the water flows. Which direction and how fast? What does the texture of the sand and rocks tell us about what happened long ago?
- ◆ Research other possible sites for a landing. Why would other sites be used for the next expedition to Mars? Design an expedition for another landing site.

Mission: Ice Cores

People have always been interested in finding life on Mars. The mission to get the ice cores from the crater shows NASA's curiosity for finding life on Mars. The 4.5 billion year old meteorite ALH84001, found in 1984 in Antarctica, may have ancient bacteria from Mars. If there is life on Mars, or evidence of life, ice might be a good place to look for it.

Expedition Ideas:

- ◆ Could life still be on Mars? Can it be found in cores of dirt and ice? Is there ice at all on Mars? If so, design an expedition on how scientists could get the ice. Also, how would you study the samples and send the answers back to Earth?
- ◆ Become a planetary paleontologist. What did the Martian landscape look like in the past? Was there a time in Mars' history that supported life? Create an expedition that would work at one of those sites and help collect the fossils.

Mission: MAV Launcher

The MAV (Mars Ascent Vehicle) is NASA's next big journey to Mars. This expedition, planned for 2019, is for an unmanned spacecraft to return to Earth with the rock, water and soil samples from the Martian landscape.

Expedition Ideas:

- ◆ What would your MAV look like? Would the MAV use a rocket? A catapult? What type of rooms would it have, and would it be able to carry people some time in the distant future?
- ◆ What samples would be the most valuable to return to Earth with? How would the samples be studied back on Earth?

Mission: Habitation Modules

The Habitation Modules are the "houses" where the astronauts would live when they arrived on Mars. These houses show some of NASA's challenges for putting people in space. In many plans to send humans to Mars, any habitation modules would need to be set up remotely using robots. The Biosphere II, in Arizona USA, is an example of a habitation experiment that was tried here on Earth.

Expedition Ideas:

- ◆ Create an expedition where robots would be used to set-up living space for humans. How could a robot build it remotely?
- ◆ What would this living space look like and how would it work? Where would the supplies come from? How would it keep humans alive and comfortable?

Mission: Alliance

Though there are no plans now to send a crew to Mars, NASA has picked 2038 as a year where we will know much about Mars, space technologies, and people's ability to live in space for long periods of time. If humans do go to Mars, it will probably be an international project with many countries helping. Within the United Nations there is a group called the Committee on the Peaceful Uses of Outer Space to promote cooperation in space science and technology.

Expedition Ideas:

- ◆ Design what the first expedition would be if humans landed on Mars. How would many nations work together to make this work?
- ◆ How have nations cooperated on the expeditions going to Mars now? What kind of cooperation will be needed for future projects?

Mission: Rover Recovery

NASA uses robots to do many science experiments and explore on the Martian landscape, but robots can get stuck and wear out. In 2003 and 2004, there will be more than one rover working on Mars at the same time. If robots are used to do more difficult things like building habitation modules, breakdowns might be more common.

Expedition Ideas:

- ◆ Create an expedition that will keep up, repair or get a broken rover. What are some of the things that could make a rover not work properly?
- ◆ Create an expedition with many small robots that work together, or with robots that can do different things to replace broken parts.

Judging Guidelines

Teams should focus on quality research, an innovative solution, and a creative presentation. Judges will also look for teamwork and the ability for teams to work independently from the team coach. Below are the guidelines the judges will use to assess your team's Research Presentation.

| Criteria | Areas of Consideration | Sample Questions |
|---------------------------------|---|--|
| Research Question | <ul style="list-style-type: none"> • Definition of Question • Effect of question on humanity, science, technology • Question tied to FLL Challenge | <ol style="list-style-type: none"> 1. Why did the team choose this research question? 2. Why is this question so important? |
| Background Research | <ul style="list-style-type: none"> • Variety of research materials used and cited • Ability to demonstrate an understanding of the topic chosen • Information presented relevant to the research question chosen | <ol style="list-style-type: none"> 1. How do the facts the team presents relate to the research question? 2. What information was most helpful in determining the choice for your research question? |
| Expedition Plan | <ul style="list-style-type: none"> • Explanation of expedition plan • Background information provided and applied to expedition plan • Expedition plan relates to research question | <ol style="list-style-type: none"> 1. How did the team develop the expedition plan? 2. What information was most helpful in determining the expedition plan? |
| Data and Graphics | <ul style="list-style-type: none"> • Uses relevant and informative visual aids • Visual aids support research question and expedition plan | <ol style="list-style-type: none"> 1. Why did you choose this data to support your expedition plan and research question? 2. How did conflicting data impact your expedition plan and research question? |
| Analysis and Conclusions | <ul style="list-style-type: none"> • Research and data used in analysis • Analysis supports conclusions • Solid understanding of Research Question | <ol style="list-style-type: none"> 1. How did you analyze data? 2. Did all the data support your conclusion? 3. How did this help you reach your conclusion? |
| Presentation | <ul style="list-style-type: none"> • Presentation is organized – beginning, middle, and end • Engaging and persuasive • Creative and imaginative | <ol style="list-style-type: none"> 1. Why did the team choose its presentation style? 2. What do you think was the most important aspect of your presentation? |