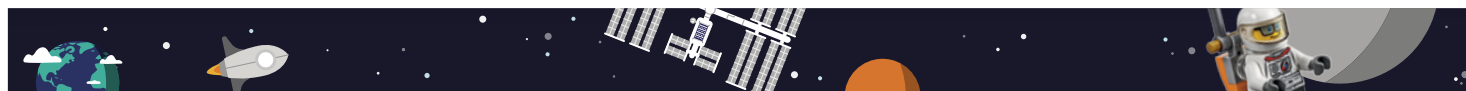


## CORE VALUES

### **Solve problems using: The FIRST® Core Values**

We express the FIRST® philosophies of *Gracious Professionalism®* and *Coopertition®* through our Core Values:

- ✦ **Discovery:** We explore new skills and ideas.
- ✦ **Innovation:** We use creativity and persistence to solve problems.
- ✦ **Impact:** We apply what we learn to improve our world.
- ✦ **Inclusion:** We respect each other and embrace our differences.
- ✦ **Teamwork:** We are stronger when we work together.
- ✦ **Fun:** We enjoy and celebrate what we do!



## Key Resources

Find these resources here:

- ✦ [Coaches' Handbook](#)
- ✦ [Rubrics](#)
- ✦ [INTO ORBIT<sup>SM</sup> Challenge](#)

## Optional

- ✦ [Engineering Notebook](#) (pilot)
- ✦ [Event Guide for Teams](#) (for teams attending Official Events)

## Solve problems in: The Robot Game

- Read the Robot Game Rules in the [Challenge Guide](#)
- Identify one or more Missions to solve
- Design a Robot using LEGO® MINDSTORMS® that can solve the Mission(s)

Missions as written below are only an overview. For full detail, go to <http://www.firstlegoleague.org/challenge> and download the complete Challenge Guide.

### M01–Space Travel

\* **Start each Payload clearly rolling** down the Space Travel Ramp.

- For each roll, the cart must **\* be Independent by the time it reaches the first track connection.**
- Vehicle Payload: **22 Points**
- Supply Payload: **14 Points**
- Crew Payload: **10 Points**



As a Mission requirement in any Mission, the word “Independent” means “not in contact with any of your Equipment.” As long as the cart clearly rolls Independently past the First Track Connection, it’s OK if it doesn’t roll all the way east.

### M02–Solar Panel Array

- Both Solar Panels are Angled toward the same Field:** 22 Points For Both Teams
- Your Solar Panel is Angled toward the other team’s Field:** 18 Points



### M03–3D Printing

- Eject the 2x4 Brick **\* by placing a Regolith Core Sample into the 3D Printer.**
- The 2x4 Brick ejected and **completely in the Northeast Planet Area:** 22 Points
- OR** The 2x4 Brick **ejected and not completely** in the Northeast Planet Area: **18 Points**



### M04–Crater Crossing

- All weight-bearing features of the crossing equipment must cross **\* completely between the towers.**
- Crossing must be **from east to west, and \* make it completely past the flattened Gate:** 20 Points



## Scoring Requirement Signals

- Within the Mission descriptions, specific **scoring requirements** are written in **GREEN**.
- Methods with an asterisk **\*** must be the **ONLY** ones used, and must be **OBSERVED** by the referee.
- Underlined RESULTS/CONDITIONS** must be visible at the **END** of the match.

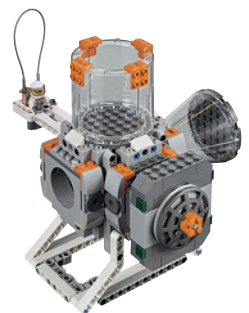
### M05–Extraction

- Move all **four Core Samples so they are no longer touching the axle that held them in the Core Site Model:** 16 Points
- Place the Gas Core Sample so it is **touching the mat, and completely in the Lander’s Target Circle:** 12 Points
- OR** Place the Gas Core Sample **completely in Base:** 10 Points
- Place the Water Core Sample so it is **supported only by the Food Growth Chamber:** 8 Points



### M06–Space Station Modules

- Inserted Modules must **not be touching anything except the Habitation Hub.**
- Move the Cone Module **completely into Base:** 16 Points
- Insert the Tube Module **into the Habitation Hub port, west side:** 16 Points
- Transfer/Insert the Dock Module **into the Habitation Hub port, east side:** 14 Points



### M07–Space Walk Emergency

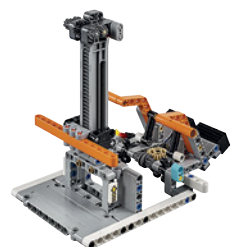
- Move Gerhard so his body is inserted **at least partly into the Habitation Hub’s Airlock Chamber.**
- Completely In: **22 Points**
- OR** Partly In: **18 Points**

For this Mission, the word “Body” includes all parts except the loop.



### M08–Aerobic Exercise

- Advance the Exercise Machine’s Pointer along its Dial **\* by moving one or both of the Handle Assemblies.**
- Get the Pointer tip **completely in orange, or partly covering either of orange’s end-borders:** 22 Points
- OR** Get the Pointer tip **completely in white:** 20 Points
- OR** Get the Pointer tip **completely in gray, or partly covering either of gray’s end-borders:** 18 Points





*What does it take to live on a space station or travel to another planet? Can you and your team create the critical innovation that will get earthlings to Mars? We can learn so much from overcoming the challenges of space exploration if you are willing to go INTO ORBIT<sup>SM</sup> and beyond with FIRST<sup>®</sup> LEGO<sup>®</sup> League!*

#### M09–Strength Exercise

- Lift the Strength Bar so the tooth-strip's 4th hole comes at least partly into view as shown: 16 Points



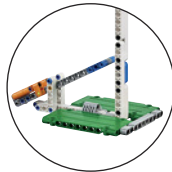
#### M10–Food Production

- Spin the Food Growth Chamber's colors so the gray weight is DROPPED after green, but before tan, \* by moving the Push Bar: 16 Points



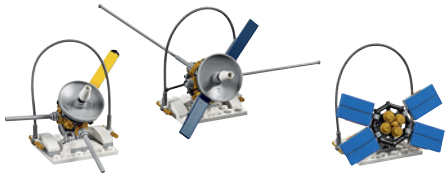
#### M11–Escape Velocity

- Get the spacecraft to go so fast and high that it stays up, \* by pressing/hitting the Strike Pad: 24 Points



#### M12–Satellite Orbits

- Move any part of a Satellite on or above the area between the two lines of the Outer Orbit: 8 Points Each



#### M13–Observatory

- Get the pointer tip completely in orange, or partly covering either of orange's end-borders: 20 Points
- OR Get the pointer tip completely in white: 18 Points
- OR Get the pointer tip completely in gray, or partly covering either of gray's end-borders: 16 Points



#### M14–Meteoroid Deflection

- Send Meteoroids \* over the Free-Line to touch the mat in the Meteoroid Catcher.
- The Meteoroids must be hit/released while they are \* clearly and completely west of the Free-Line.
- While between hit/release and scoring position, the Meteoroid \* must be clearly Independent.
- Meteoroids in the Center Section: **12 Points Each**
- Meteoroids in Either Side Section: **8 Points Each**



If ever the Ring-Set Meteoroid is off its Ring, you may remove the Ring from the Field by hand (this is a special exception to the Rules).

#### M15–Lander Touch-Down

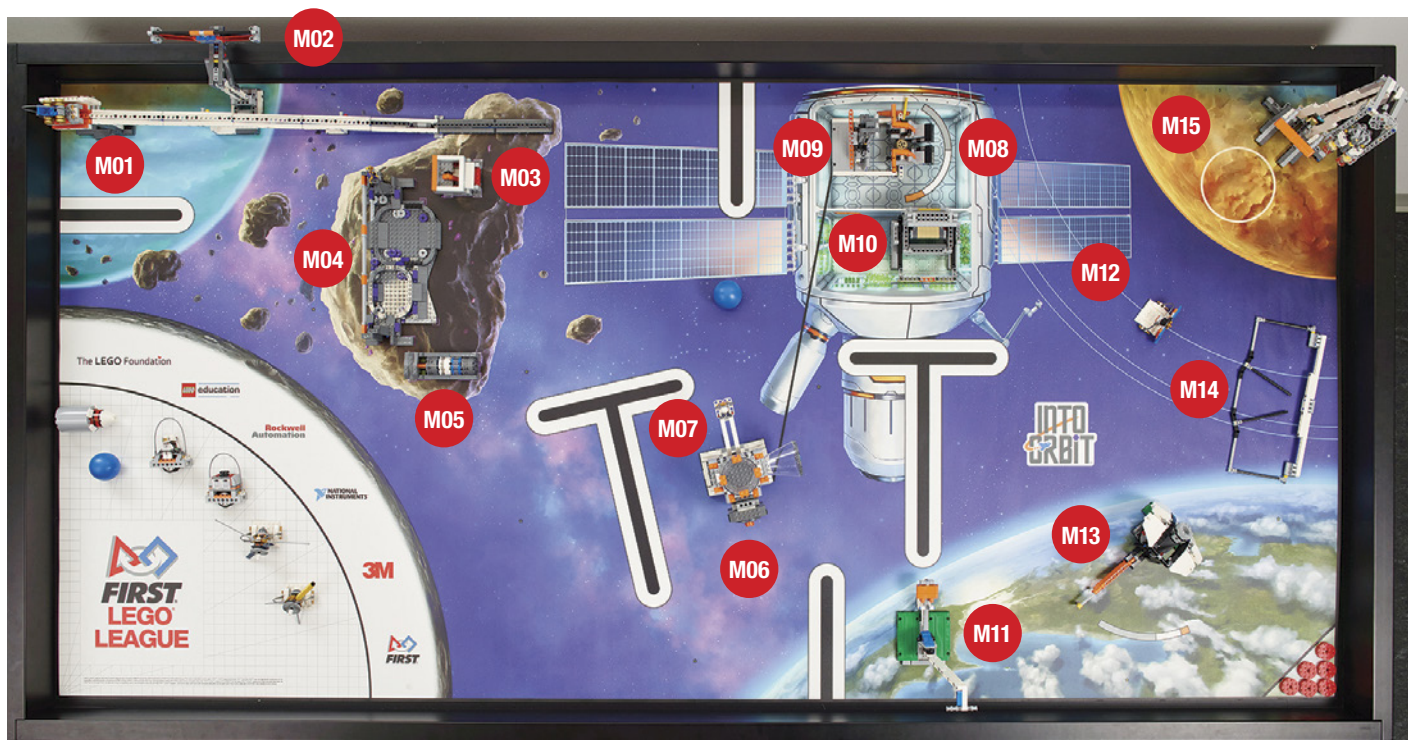
- Move the Lander to be intact, touching the Mat, and completely in its Target Circle: 22 Points
- OR Move the Lander to be intact, touching the Mat, and completely in the Northeast Planet Area: 20 Points
- OR Move both parts of the Lander completely into Base: 16 Points



The Lander is "Intact" if its parts are connected by at least two of its four tan location axles.

#### P01–Interruption Penalties

- If you \* Interrupt the Robot: **Minus 3 Points Each Time**
- Upon Penalty, the referee will place one Penalty Disc in the southeast triangle as a permanent Interruption marker. You can get up to six such Penalties.
- If a Penalty Disc comes off the triangle, it is simply returned, with no effect on score.



The Robot Game Missions can provide real-world examples for your Project research. Learn about the stories behind the Missions in the Challenge Guide: <http://www.firstlegoleague.org/challenge>.



## Solve problems in: The Project

- **Identify** a physical or social problem faced by humans during long duration space exploration
- **Design** a way to solve your problem
- **Share** your problem and solution with others

Sending people into space is one of the hardest challenges humans face. Rockets are complex and dangerous, and space is an unforgiving place. Space explorers face the **physical** problems of just staying alive, and if they are away from Earth for years at a time, they may also face **social** problems as well.

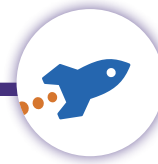
### Identify

Think about all the challenges humans must overcome to travel in our solar system for long periods of time. To name just a few: extreme temperatures; lack of air, water and food; waste disposal or recycling; loneliness and isolation; and the need for exercise in order to stay healthy.

After you select a problem, find out about the solutions that we are already using to try to fix it. Why is this problem hard to solve? Can you think of a new solution? Can you imagine a way to improve a current solution?



For the INTO ORBIT<sup>SM</sup> Challenge, a **physical problem** is one that impacts the immediate health or safety of a space explorer, such as the need for air, water, food or exercise. A **social problem** is one that could affect the long-term ability of a human to be productive in space, like isolation and boredom. “Long duration” space exploration means spending a year or more in outer space.



Your Project assignment for the INTO ORBIT<sup>SM</sup> season is to **identify a physical or social problem faced by humans during long duration space exploration within our Sun’s solar system and propose a solution.**

### Design

Next, think about possible solutions to your problem. Any solution is a good start. The goal is to design an **innovative** solution that solves your problem **by improving something that already exists, using something that exists in a new way, or inventing something totally new.**

### Share

Think about who your solution might help. Share your idea with at least one person. Present your solution to people who have an interest in space, human health, or who work in the aerospace industry. Maybe you could share with a professional or someone who helped you learn about your problem. You can find more out about the types of people in your community who might be able to help you in the INTO ORBIT<sup>SM</sup> [Challenge Guide](#).

### Prepare

Finally, prepare a **5-minute** presentation to share your work with the judges at a tournament. Your presentation must be live and may include posters, slideshows, models, multimedia clips, props, costumes, and more. Be creative, but make sure you introduce your problem, solution, and how you shared your idea.

