# 4-H REC.

# SPACE RACE!

# 2026 4-H ROBOTICS ENGINEERING CHALLENGE

## Table of Contents

# 1. Maryland 4-H Robotics Engineering Challenge

The Maryland 4-H Robotics Engineering Challenge (REC) provides an opportunity for 4-H members interested in STEM (Science, Technology, Engineering, Math) to participate in a hands-on, team-based activity where they build robots and program them to complete tasks. Successful teams will display technical excellence in robot design, engineering, and programming, as well as a high level of skill on the field in competition. The REC theme changes every year and integrates hot topic issues plus 4-H and University of Maryland priorities to bridge connections between youth, UMD, and industry.

The regional event for REC will be held on the Eastern Shore on Saturday, August 15 at the Talbot County Ag Center. **To register for the 2026 Maryland 4-H Robotics Engineering Challenge, please complete the following Jotform by June 1, 2026.**

https://forms.gle/PqY5F8dyRXNF2gXL6

# 2. STEM Connections & The Essence of the Game

## *2.1 Introduction & Field Layout*

Maryland 4-H Robotics Engineering Challenge (REC) teams are tasked with building a robot using sensors, motors, and other components to complete missions and score points on the REC game field. The theme for 2026 REC is "Space Race," which was originally the game used in 2020 & 2021 to celebrate the 50th anniversary of the Apollo moon landing in 1969. The 2020 and 2021 National 4-H STEM Challenges also connected to NASA directives for manned missions to Mars, highlighting that space science is at the forefront of technological innovation. An image of the full REC field follows.

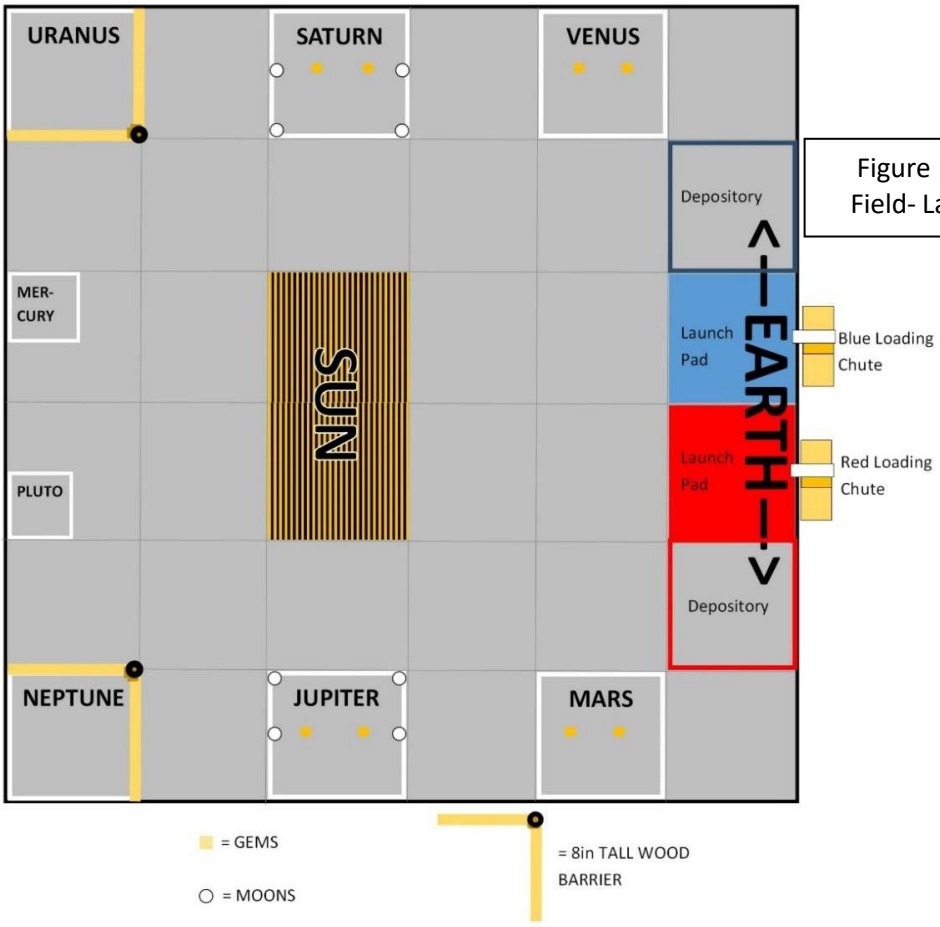



Figure 1: REC Field- Labeled

## *2.2 Gameplay Overview*

Robots will start, as human beings would, on “Earth” and attempt to make their way to the 8 other “Extraterrestrial Planets” featured on the REC field (including dwarf planet Pluto). The field is in no way an accurate representation of our actual heliocentric (sun-centered) solar system, and relative distances between planets are also not meant to be scientifically accurate, as this would be difficult to represent on a REC field and within the space constraints.

For symmetry, the 8 Extraterrestrial planets are separated distinctly from each other and each planet has a corresponding “partner” located on the opposite side of the field. Either team can score using any or all of these planets. The setup and missions for corresponding partner planets are the same (just with their orientation symmetrically flipped if needed), however the following should be noted:

- Successful scoring by a team on a planet is not dependent on any other planets or missions.
- A team is not required to do any specific mission(s) on the field.
- A team is not required to score with one planet in order to score with another, including a planet’s partner on the opposite side of the field.
- Teams are not allowed to descore their opponent’s astronauts nor gems.

Scoring is primarily done by delivering Astronauts to the 8 Extraterrestrial Planets, each with their own unique setup that may affect a team’s robot’s (and Astronauts’) safe arrival. Other scoring mechanisms also exist, and missions have a range in difficulty, intended to challenge veteran teams while also allowing for new teams to have a chance to compete. Considering these factors, teams will need to be comfortable operating their robot and its attachments with precision and within tight space constraints.

## *2.3 STEM Connections (Our Solar System!)*

The game missions are based upon interesting characteristics about the planets, through centuries of work by scientists, engineers, NASA, the ESA, and others. Planet partners were chosen due to common characteristics they share. For example, Venus and Mars are the two planets closest to Earth, our “neighbors,” and the most well-studied of the Extraterrestrial planets in our solar system, so they are “partners” in the REC game. Numerous pictures and research with telescopes and satellites have helped us learn about their surfaces and atmospheres. Mars is similar in many ways to Earth, but with a much thinner atmosphere and a cold, rocky, dusty surface. However, Venus’s atmosphere is toxic, comprised primarily of Carbon Dioxide and clouds of Sulfuric Acid. Because of this, Venus is actually the hottest planet in the solar system, even though it is not the closest to the sun! The setup of Venus and Mars on the REC field reflects their proximity to Earth.

Saturn and Jupiter are another partner group, as they are the largest planets in our solar system. Saturn and Jupiter are called “gas giants” because of their enormous size and the largely gaseous composition of their volumes. They also have the largest number of moons of any in our solar system, Jupiter’s being especially noteworthy due to the work of Galileo. Jupiter’s moons Ganymede, Callisto, Io, and Europa are called the “Galilean Moons” because he discovered them in the early 17$^{th}$ century with his famous invention, the telescope. They are the 4 largest satellites of Jupiter and 4 of the largest moons in our solar system overall. Saturn has the second largest number of moons, including the 4 Cassinian moons Tethys, Dione, Iapetus, and Rhea, discovered by Giovanni Domenico Cassini in the 17$^{th}$ century. REC missions for Jupiter and Saturn allude to these planets’ moons.

Neptune and Uranus are also partners. They are called “Ice Giants” because of their very low average temperatures, size, and overall similar composition. Their extreme temperatures make it difficult for Astronauts and vehicles to enter their atmospheres and survive, so any Astronauts that land on these planets must be careful in their approach. REC missions for Neptune and Uranus reflect this.

Finally, two smaller but well-known bodies in our solar system, Pluto and Mercury, have the smallest footprints. Mercury is the smallest planet by definition, according to the modern classification of planets, while Pluto's classification changed from a regular planet to a "Dwarf Planet" in 2006. With their smaller comparative size, the goal of "landing" Astronauts on them can be significantly more difficult, with a high level of accuracy needed to ensure space vehicles don't miss or "overshoot" their targets. The smaller sizes of Pluto and Mercury on the REC field were designed with this in mind.

## *2.4 Scoring Elements*

Each team will start with 16 Astronauts. Each Astronaut is an Andymark "Climber" from the 2016 FTC game "Res-Q." Astronauts will be partly blue or red to represent which team they belong to. Before a match, a team can start with 2 Astronauts preloaded on or next to their robot, on their side of Earth. After the match begins, teams must use their "loading chute" to deposit their remaining Astronauts onto their side of Earth. When Astronauts are deposited, they are allowed to land directly on the field itself, or onto the team's robot so they can be navigated to the 8 Extraterrestrial planets to score.

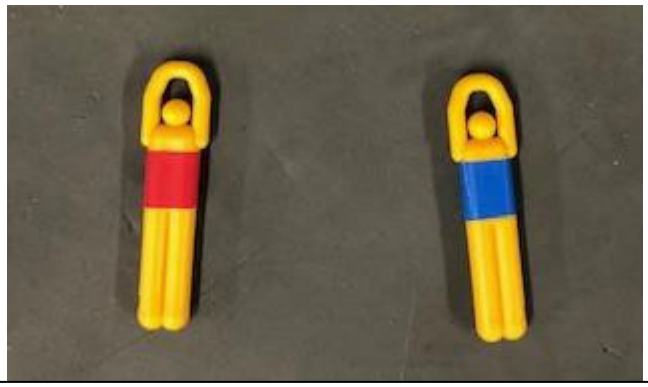


Figure 2: The Red and Blue Astronauts; each team starts with 16 of their own color.

A team can only have 2 of their own Astronauts within the boundaries of Earth at any one time. If more than two Astronauts are on a team's side of Earth, only the first two deposited will count and be allowed to score. Excess Astronauts will be decommissioned and not able to be scored with. If a team's Astronaut makes its way onto the REC field through any means besides the team's loading chute, it will be decommissioned and not able to be scored with. There is no penalty or issue if an Astronaut is deposited through the chute appropriately and bounces outside of the boundaries of Earth.

For an Astronaut to successfully land or "colonize," the Astronaut must be ENTIRELY within a planet's borders on the field. This means the entirety of the figure must be within the outside edge of a planet's border. If an Astronaut is not fully in a planet's borders when deposited, but is partly contained in the planet's borders, it won't count for points at that time, but can be moved by the robot fully onto the planet to score. A team CANNOT interfere with their opponent's Astronauts anywhere on the field.

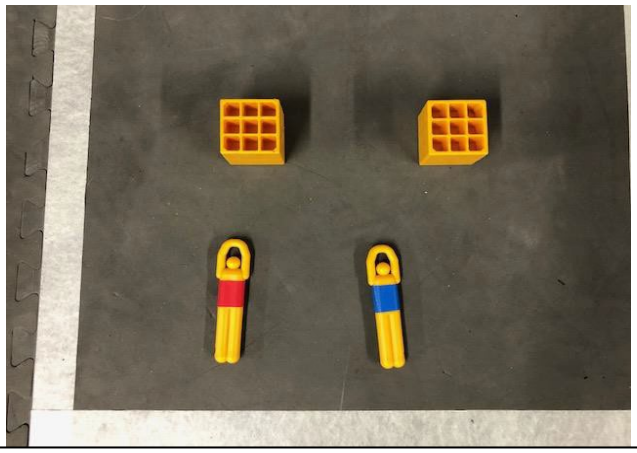


Figure 3: Red and Blue Astronauts Successfully Landed Inside Mars

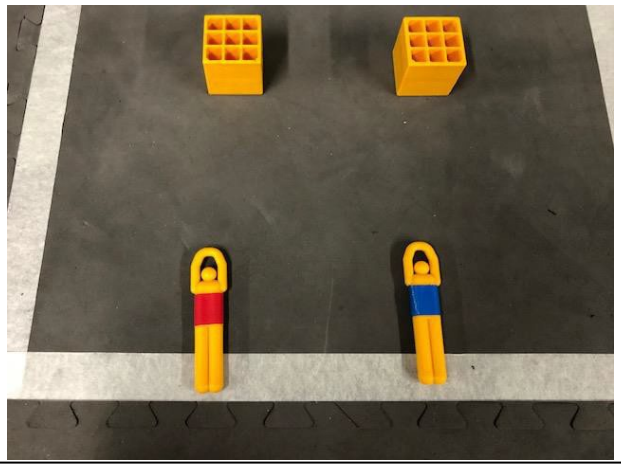


Figure 4: Red and Blue Astronauts are on the taped border, but both have successfully colonized Mars and will earn points for their teams.

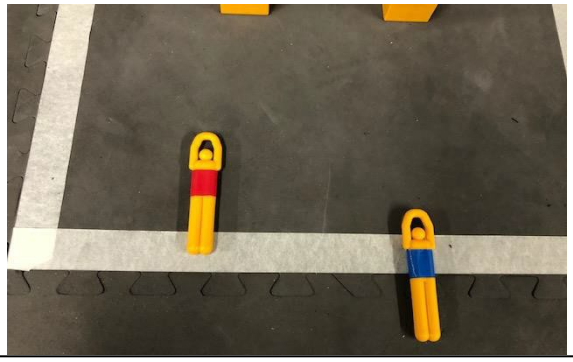


Figure 5: Red Astronaut has successfully colonized Mars, but the Blue Astronaut is NOT fully on the planet, and thus will not earn points if left in this state at the end of a match.

Jupiter and Saturn are each surrounded by 4 moons that are obstacles for a team's robot to get around. The Moons are regulation baseball size (approximately 2.75" in diameter) wiffle balls and used in the 2018/2019 FTC game "Rover Ruckus." Four moons will be positioned around the perimeter of each of the planets Saturn and Jupiter. If a team's robot comes into contact with a planet's moon, they will lose 5 points for each moon that is dislocated from the O-ring it sits atop of, aka "crashed" into.

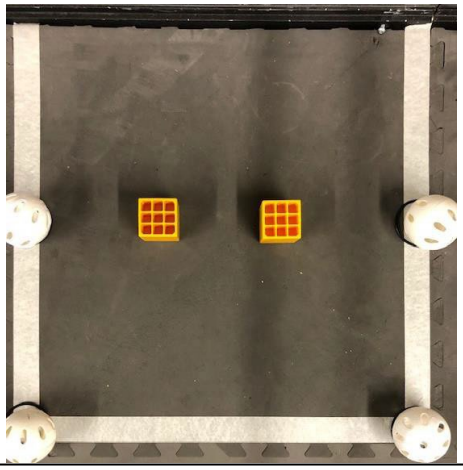


Figure 6: Jupiter and Saturn each have 4 Moons (the wiffle balls) located on their perimeter tape line. Both planets also contain 2 Gems, represented by the gold blocks.

When a team successfully delivers at least one Astronaut to a planet, that team has “Colonized” that planet. At the end of the game, teams will receive an additional “Colonization Bonus” based on how many planets they have colonized successfully. The bonus is exponential in value, and follows the table below:

| Planets Colonized (n) | Colonization Bonus (2^n) |
|---|---|
| 1 | 2 |
| 2 | 4 |
| 3 | 8 |
| 4 | 16 |
| 5 | 32 |
| 6 | 64 |
| 7 | 128 |
| 8 | 256 |

Gems, located on Mars, Venus, Jupiter, and Saturn, are also valuable resources, represented by gold cubes 2’’ each in length, width, and height, and used in the 2018/2019 FTC game “Rover Ruckus.” To score points, a team must return the Gems to Earth; specifically, to a team’s designated “Depository,” located adjacent to the team’s Launchpad, to score 10 points each. Gems need to be fully contained within a Depository to earn points. Gem points are counted only at the end of a match.

# 3. The Field and Field Elements

## *The Field*

Matches are played on a standard 12’ x 12’ VEX VRC field, with a perimeter 12” high, and standard foam VEX or AndyMark FTC tiles measuring 24” x 24”. Before each match, each team is assigned one of the starting tiles – either red or blue. The starting tiles are on one side of the field, colored solid red or blue. These tiles are specifically called “Launchpads.” The red and blue Launchpads are

directly next to each other on Earth. Each team will also have a designated “Depository” that is one tile in size, located directly next to the team’s Launchpad (left of Launchpad for red, right of Launchpad for blue, from the driver’s perspective).

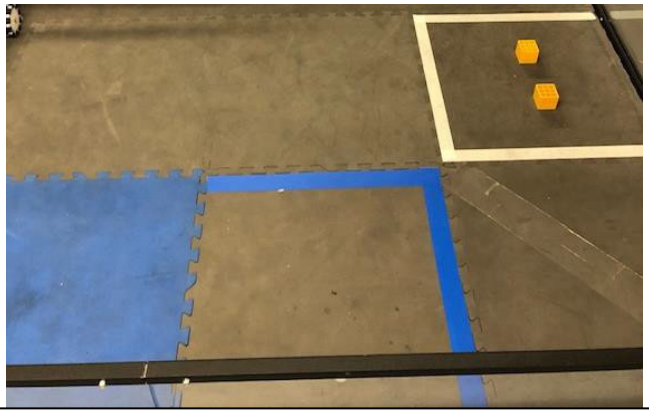


Figure 7: The Depository for the blue team is the grey foam tile bounded by and including the blue tape. Note its position next to blue’s Launchpad and Venus.

## *Field Elements*

Field elements are organized by the planets featured and what the goals are for each. “Partner Planets” are located symmetrically opposite from each other on the field, and any team can score with any of the 8 extraterrestrial planets. Teams must make the determination, with the distances involved compared to where they “Launch” from, what is the best use of the time they have to score points.

### *Earth*

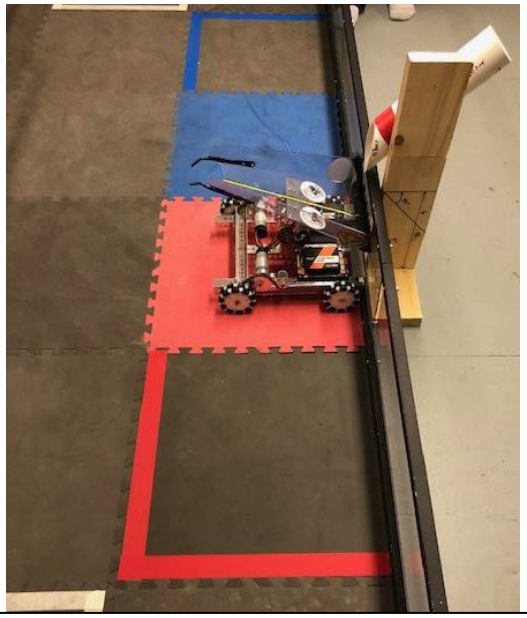


Figure 8: The layout of Earth, at the start of a match, with a robot in place and ready on the red Launchpad. Note the Loading Chute is aligned center with the red Launchpad.

The four tiles comprising the two Launchpads and Depositories are “Earth” and where matches begin. Earth’s red and blue sides are distinguished by appropriately colored foam tiles for the Launchpads and one taped-off adjacent tile, for each team, representing their Depository. Earth has an invisible 2-

foot height. All robots, attachments, and components must start a match FULLY in Earth (while also noting “Robot Rule” 4). Each team will be provided 16 “Astronauts.”. Teams must use their provided “loading chute” to load them onto their robot or Launchpad. The loading chute is located outside the field next to a team’s Launchpad.

A team can only have a maximum of 2 of their own Astronauts on Earth at any time. If a team deposits a third Astronaut onto Earth or their robot in Earth, the third Astronaut will be decommissioned and cannot be scored for points. To score points, teams will transport their Astronauts around the field to the 8 Extraterrestrial (non-Earth) planets in order to “colonize” them and score points. Only a maximum of two Astronauts can be placed on a planet by a team’s robot. A team with more than 2 of their Astronauts located on a planet at the end of the match will only have 2 of the Astronauts count for points. The Jupiter side of Earth is the red team’s side of the planet, while the Saturn side of Earth is the blue team’s side of the planet.

While any team can score points on any of the 8 Extraterrestrial planets, teams CANNOT enter (park, pass through, etc.), interfere, or manipulate their opponent’s side of Earth, with one exception. If a team’s Astronaut, whether through the dynamics of the Loading Chutes or their own robot, ends up on their opponent’s side of Earth, they can retrieve their own team’s Astronaut ONLY and bring it back to their side. Teams, however, CANNOT interact with their opponent’s Astronauts anywhere, nor with their opponent’s Gems. Robots can also ONLY be “launched” into space from a team’s designated Launchpad, and can only park in their Launchpad to score “Parking” points.

### *Venus and Mars*

Venus and Mars are located on opposite ends of the field and are the closest planets to the teams’ Launchpads. Each planet comprises a 2ft-by-2ft tile. Each Astronaut successfully landed on Venus and/or Mars is worth 5 points apiece (20 points max=2 Astronauts X 2 Planets X 5 Points).

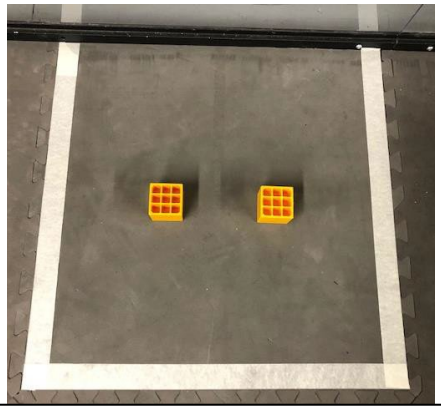


Figure 9: Venus and Mars have the simplest setup on the field and are the easiest for teams’ astronauts to reach. Note the 2 gold blocks representing Gems placed towards the middle.

On Venus and Mars are 2 “Gems” apiece (4 total between the two). A robot can bring theGems back to their side’s “Depository” on Earth to score points. Gems fully inside a team’s Depository at the end of a match are worth 10 points apiece. Gems are distributed evenly on the two planets, aligned halfway between the front and back of each planet as seen from the middle of the field. One gem is placed 7 inches inside the left inner line of the planet’s taped border, and the other gem is placed 7 inches inside the right inner line (opposite side of the planet) of the tape border. If done correctly, this means the gemsshould be 5 inches apart from each other.

## *Saturn and Jupiter*

Saturn and Jupiter are situated on opposite sides of the REC field. They are each surrounded by 4 moons, represented by wiffle balls. Each planet comprises a 2ft by 2ft tile.

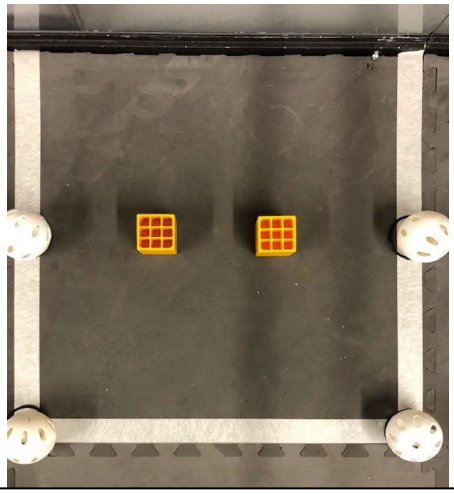


Figure 10: Jupiter and Saturn each have 2 Gems, located in the same positions on the planets as with Mars and Venus, and are each surrounded by 4 Moons held in place by rubber O-Rings.

The mission is for Astronauts to successfully reach Jupiter and/ Saturn WITHOUT interfering or making contact with the moons (aka, a crash). Successfully depositing a max of 2 Astronauts apiece onto Saturn and/or Jupiter without causing wiffle balls to move is worth 6 points per Astronaut (24 points max=2 Astronauts X 2 Planets X 6 Points). If a team's robot makes contact with a planet's moon, a 5-point penalty is applied for each moon dislocated, or "crashed" into.

Moons will be located in the same places on the field each game, held in place by rubber O-rings. If a moon is dislocated from its original position due to factors besides robot contact (wind, vibrations, etc.), teams will not lose points or be penalized. The moon will return to its original location before the next match. Only when the actions of a team, their robot, the Gems under their control, and/or other actions by a team cause a moon to dislocate will penalties be applied.

Also, on Jupiter and Saturn are 2 Gems apiece (4 total between the two). Gems fully inside ateam's Depository at the end of a match are worth 10 points apiece. Gems are distributed evenly, aligned halfway between the front and back of each planet as seen from the middle of the field. One Gem is placed 7 inches inside the left inner line of the planet's taped border, and the other Gem is placed 7 inches inside the right inner line (opposite side of the planet) of the tape border. This means the Gems should be 5 inches apart from each other.

## *Neptune and Uranus*

Neptune and Uranus are each one 2ft by 2ft tile in size. Both have an 8in tall barrier representing their hostile terrains. Robots must maneuver their Astronauts onto these surfaces (the foam tiles), inside the barriers. Each successfully landed Astronaut is worth 10 points per Astronaut (60 points max=2 Astronauts X 2 Planets X 15 Points). **Note:** As described in the general robot rules, objects cannot be "thrown" or "launched" to become airborne on the REC field, as this presents a safety hazard. The walls also cannot be moved on the field by teams or the robot. Any of these actions will result in a penalty applied to the team, and depending on the severity, possible disqualification.

Figure 11: Neptune and Uranus are each surrounded by an L-shaped wood barrier that is 8 inches tall and encloses each planet in a 2ft x 2ft square. The 2 wood pieces are hinged together for easy storage.

### *Pluto and Mercury*

Pluto and Mercury are only 1ft by 1ft in size on the REC playing field, making successful delivery of Astronauts to these planets much more difficult.

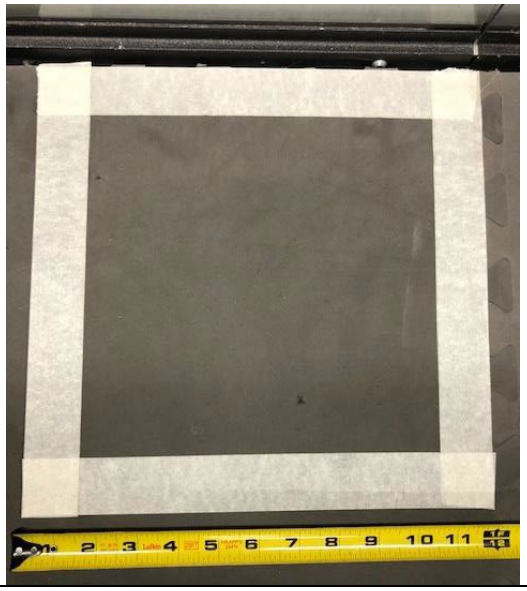



Figure 12: Pluto and Mercury are each represented by simple taped off squares that are 1ft x 1ft in size. Note the tape measure showing the size and size of the taped area with respect to the foam tile.

Each Astronaut successfully colonizing Pluto and/or Mercury (fully inside the planet!) is worth 10 points per Astronaut (40 points max=2 Astronauts X 2 Planets X 10 Points). NOTE: See “Field Elements” and “Scoring Elements” sections for specific information regarding what a successful “Landing” is on an Extraterrestrial Planet in this game.

Attached to the glass, centered above 6 of the planets, will be an image of that planet that teams can use to help align and direct their robot to that planet (using Vuforia or other imaging software). Images of these

planets are included in the appendix and can be printed on 8.5x11 sheetsof paper to be can taped to the field perimeter itself. The images should be taped to the field in portrait orientation. The 6 planets are Mercury, Venus, Jupiter, Saturn, Mercury, and Pluto.

The terms “Space” or “Outer Space” may be used interchangeably to describe areas between planets not designated specifically as anything else (including Earth). The four sides of the field are identified by the planet(s) near their center. Earth is located directly opposite of Pluto and Mercury, and Jupiter is opposite of Saturn (Jupiter closest to red Launchpad and Saturn closest to blue).

# 4. Vocabulary, Terms, and Definitions

Astronaut: A figurine that teams use their robots to deliver to the 8 extraterrestrial planets on the REC field. Each team gets 16 astronauts at the game’s start. Astronauts are deposited onto the field via the team’s *Loading Chute*. A team can have a maximum of 2 of their Astronauts on the entirety of *Earth* at a time (including the opposing team’s side of *Earth*). See Figure 2 for a visual. By virtue of the rules regarding transport, a robot can carry only a maximum of 2 Astronauts at any time during a match.

Autonomous Period: The first 30 seconds of a REC match is called the Autonomous Period. As opposed to the *Driver-Controlled Period*, this is when a team’s robot must operate on its own without the use of human input through a controller. A team will have to write an autonomous code before competing, and can have multiple autonomous codes created, but can only run one per match.

Blocking: This is defined as inhibiting a robot’s access to scoring elements. Temporary blocking while in congested areas is expected, but strategic blocking to limit opponent’s ability to score is not allowed.

Colonization (Bonus): The ability for a team to have successfully landed at least one of their *Astronauts* on a planet is called Colonization. Each Astronaut that successfully colonizes an *Extraterrestrial Planet* is worth from 5 to 15 points, depending on the planet. A maximum of 2 of a team’s *Astronauts* can colonize any one *Extraterrestrial Planet*. A Colonization “Bonus” is awarded to teams at the end of a match depending on the number of planets they have successfully Colonized during the match. The Colonization Bonus is exponential in value, with 1 *Extraterrestrial Planet* colonized by a team worth 2 bonus points and all 8 *Extraterrestrial Planets* being colonized by that team worth 256 bonus points.

Control/Controlling: Items are considered to be Controlled by a team’s robot if the item(s) is/are following the movement of the team’s robot. Examples include but may not be limited to: Pushing an item in any form, holding or carrying an item, grabbing and/or releasing an item. While there is no limit on the number of *Gems* a robot can control at a time, a robot can only control 2 *Astronauts* at a time by virtue of their rules.

Crash: When a team’s robot runs into one or more of the *Moons* located on the borders of *Jupiter* or *Saturn*, they have “Crashed.” This results in a penalty that will cost a team 5 points per *Moon* dislocated from its original position, or the equivalent of one successful *Astronaut* landing on *Jupiter* or *Saturn*.

Depository: The taped-off area next to a team’s *Launchpad* is called the Depository. This is the area where teams deposit any *Gems* they collect during a match and is approximately the size of one foam field tile (2ft by 2ft). A Depository is considered part of that team’s side of Earth and extends from the outer edge of a team’s correspondingly-colored tape borders through to the edge of the field perimeter and the team’s *Launchpad*.

Driver-Controlled (TeleOperation) Period: The Driver-Controlled Period follows the 30-second *Autonomous Period* and lasts 2 minutes. Teams control their robots directly using remote controls that communicate with the robot’s electronics to operate. The end of the Driver-Controlled Period constitutes the end of a match.

Driver-Station: The area where drivers are required to stand during matches and will be marked at the contest with red or blue tape. This area will extend back three feet from the *Field Perimeter*. Drive-teams must remain here for the entirety of a match. If a drive-team member leaves this area during a match, they may forfeit points scored, as determined by the referees.

Drive-Team: Up to three youth team members may be active "at" the field for any one match. This is the active Drive Team. These members must stay in the *Driver Station* area for the duration of the match, and they are the only people able to handle the robot controls or provide any coaching during the match.

Earth: Earth is the starting area for robots in the 2026 REC game. It is split into two halves, corresponding to the two teams (red and blue) competing in a match. In addition, each team's side of Earth consists of a *Launchpad* tile and a *Depository* tile. A team's robot is started in their *Launchpad* and can be parked in their *Launchpad* at specific times throughout a match to earn points. Teams deposit collected *Gems* into their designated *Depository* throughout a match. A team also loads their *Astronauts* via *the Loading Chute* onto Earth during a match, and only a maximum of two of a team's *Astronauts* are allowed in the entirety of Earth (including on the opposing team's side) at any point during a match.

Event Official: Any individual who is leading or assisting with the operation and execution of refereeing, judging, scoring, and officiating a REC tournament is considered an Event Official. Decisions made by them are believed to be unbiased and using their best judgment. These individuals have been asked to assist in some manner with a REC tournament by, and report to, the 4-H Robotics Superintendent and 4-H STEM Specialist. Questions about decisions made by robot game referees must be brought to their attention immediately following a match when a referee asks a team to review and sign-off on their score sheet. After a match's scoring has been posted, it is considered final and CANNOT be changed.

Extraterrestrial Planets: These are the 8 non-*Earth* planets in the game. **Either team can score with any of the planets.** Specific descriptions follow:

> Mars: Mars is a 2ft x 2ft sized planet on the red side of the REC *Field* which features a white taped border and two *Gems* to collect near its center. *Astronauts* deposited onto Mars are worth 5 points each (with a maximum of 2 allowed per team). Its *Partner Planet* is *Venus*.
>
> Venus: Venus is a 2ft x 2ft sized planet on the blue side of the REC *Field* which features a whitetaped border and two *Gems* to collect near its center. *Astronauts* deposited onto Venus are worth 5 points each (with a maximum of 2 allowed perteam). Its *Partner Planet* is *Mars*.
>
> Jupiter: Jupiter is a 2ft x 2ft sized planet on the red side of the REC *Field* which features a whitetaped border and two *Gems* to collect near its center. It also features four *Moons* on its perimeter that teams must avoid or else result in 5-point penalties applied for each *Moon Crashed* into. *Astronauts* deposited onto Jupiter are worth 5 points each (with a maximum of 2 allowed per team). Its *Partner Planet* is *Saturn*.
>
> Saturn: Saturn is a 2ft x 2ft sized planet on the blue side of the REC *Field* which features a white taped border and two *Gems* to collect near its center. It also features four *Moons* on its perimeter that teams must avoid or else result in 5-point penalties applied for each *Moon Crashed* into. *Astronauts* deposited onto Saturn are worth 5 points each (with a maximum of 2 allowed per team). Its *Partner Planet* is *Jupiter*.
>
> Neptune: Neptune is a 2ft x 2ft sized planet on the REC *Field,* in the far corner opposite the redside of *Earth*. It features an 8-in-tall wooden border on its interior edges facing the *Sun*, with therest of its border dictated by the *Field Perimeter*. *Astronauts* deposited over the wooden border onto its surface on the *Field* are worth 10 pointseach (with a maximum of 2 allowed per

team). Its *Partner Planet* is *Uranus*.

Uranus: Uranus is a 2ft x 2ft sized planet on the REC *Field,* in the far corner opposite the blue side of *Earth*. It features an 8-in-tall wooden border on its interior edges facing the *Sun*, with the rest of its border dictated by the *Field Perimeter. Astronauts* deposited over the wooden border onto its surface on the *Field* are worth 10 points each (with a max of 2 allowed per team). Its *Partner Planet* is *Neptune*.

Pluto: Pluto is a small 1ft x 1ft sized planet on the opposite side of the field from the Red Launchpad*,* featuring a white taped border. *Astronauts* deposited onto Pluto are worth 10 points each (with a maximum of 2 allowed per team). Its *Partner Planet* is *Mercury*.

Mercury: Mercury is a small 1ft x 1ft sized planet on the opposite side of the field from the Blue Launchpad on the REC *Field,* with a white taped border. *Astronauts* deposited onto Mercury are worth 10 points each (with a maximum of 2 allowed per team). Its *Partner Planet* is *Pluto*.

Field: The 12ft by 12ft playing area for the REC game. The field consists of the foam tiles and all game elements that are located within the *Field Perimeter.* It is expected that, during the course of a REC match, all robots, robot components, game elements, and scoring elements (outside of any yet-to-be-inserted Astronauts), will remain on the Field or robot and within the *Field Perimeter*.

Field Perimeter: The 1ft tall black aluminum and clear acrylic border of a REC Field, whose purpose is to keep all *Field* elements contained within its borders throughout the game. The Field Perimeter is 12ftin length on each side and can be a VEX VRC Field Perimeter or FTC Field Perimeter from Andymark.

Gems: Gems are valuable resources that robots can collect to score points. They are represented by 2in gold blocks, and two each can be found in: *Mars, Venus, Jupiter,* and *Saturn*. The goal for robots are to deliver Gems to their side's *Depository*, which is worth 10 points for each Gem. A Gem must be FULLY contained in a team's *Depository* when time is called, for points to count. A robot can carry as many gems at a time they want, noting the risks if a robot loses control of them while on the field.

Images: Above 6 of the planets are Images that teams can use for easy identification. If desired, they can use these images in conjunction with imaging programs such as Vuforia to assist with their robot's movement and operation around the field. Neptune and Uranus will have their images on the field itself.

Launchpad: A team's Launchpad is the 2ft x 2ft foam tile, contained fully within that team's side of *Earth*, where their robot begins a match and where it must be fully parked to score *Parking* points. A team's Launchpad is located directly adjacent to their *Depository* on the *Earth* side of the REC *Field*.

Loading Chute: The Loading Chute is a custom mechanism by which *Astronauts* are inserted onto the *Field*. Each team will need a human player to insert *Astronauts* through the top of the Loading Chute pipe, which will direct them towards their side of *Earth*. The Loading Chute is built using a 3in diameter PVC pipe and is approximately 26in tall. A chute's exit aligns with the middle of a team's *Launchpad* as viewed when facing the field from behind *Earth*. Team members are NOT ALLOWED to insert any parts of their body into the Loading Chutes themselves, for the purposes of loading *Astronauts* or otherwise.

Minor Penalty: A Minor Penalty is assessed when certain infractions of game rules are broken. Minor Penalties issued to a team subtract 10 points from their final score at the end of a match. These penalties are designed so that even though teams may have broken a core rule of the 2025 4-H REC game, they are still able to continue playing.

Moons: Moons are located on the borders of *Jupiter* and *Saturn*. They are represented by white wiffle balls approximately 2.75in in diameter, situated on a black rubber O-Ring. If a robot dislocates a Moon

from its O-Ring, this is called a *Crash* and will cost that team 5 points for every Moon they crash into.

Parking (Landing): A team's robot is said to have successfully Parked (or Landed) when it is FULLY contained in that team's *Launchpad* at the end of the *Autonomous* and *Driver-Controlled* Periods. Successfully Parking (Landing) a team's robot requires it to fully leave the *Launchpad* area during that portion of the match. Successful Parking (Landing) at the end of *Autonomous* is worth 10 points to a team. Successful Parking (Landing) at the end of *Driver-Control* is worth 20 points to that team.

"Partner" Planets: Partner Planets are located on opposite sides of the *Field*, are oriented symmetrically to each other (as viewed from the *Earth* side of the *Field* if an invisible line ran down the middle through the *Sun* and between *Pluto* and *Mercury*), and have the same mission structures and points. The 4 sets of Planet Partners are: *Mars* & *Venus, Jupiter* & *Saturn, Neptune* & *Uranus,* and *Pluto* & *Mercury*.

Penalties: Penalties will be assessed for behavior which typically provides an unfair advantage or prevents an opponent from actively attempting to score. Penalties are defined throughout this document, and when applied they will be deducted from a team's score.

Pinning: This is defined as contact with an opposing robot, not allowing it to move. This typically applies to holding an opponent against the *Field Perimeter* or another field element. **It is not allowed.**

Planets (also see *Extraterrestrial Planets*): The term Planets encompasses both the *Extraterrestrial Planets* plus *Earth* in the 2026 REC game. Some rules apply only to *Earth* or to the *Extraterrestrial Planets*, while some rules apply to both. See the individual rules and definitions for both which explicitly define the rules for these specific components of the REC *Field*.

Resources (See *Gems*): The term Resources is used synonymously with *Gems* in the 2026 game.

Space (Outer Space): The areas between planets where most of the movement during a REC match will occur is referred to in general as Space or Outer Space. Incidental contact between robots in this area may occur, especially during *Autonomous*, but repeated incidents and/or deliberate contact with or disruption of another team's robot will lead to penalties and possible disqualification for a match.

Sun: Represented by corrugated plastic roofing pieces, the Sun is towards the center of the REC *Field*, comprising a 4ft x 2ft area normally filled by two foam tiles, and is meant as an obstacle for teams to contend with when moving around. Much as in the solar system, the Sun is a significant obstacle that most instruments need to stay a great distance away from or else significant damage can occur. The position of the Sun vs. Earth and the other planets over time must also be taken into account when satellites and other devices are launched to study space phenomenon.

Figure 13: The "Sun," as represented on the REC Field. At some tournaments, the color might vary, but its size, dimensions, and field position will always be the same.

Teleoperation (TeleOp): See *Driver-Controlled Period*.

More information on the materials used to build the REC field components can be found in the REC Build Guide on the MD 4-H STEM Website, including websites where items can be purchased.

# 5. Challenge Overview

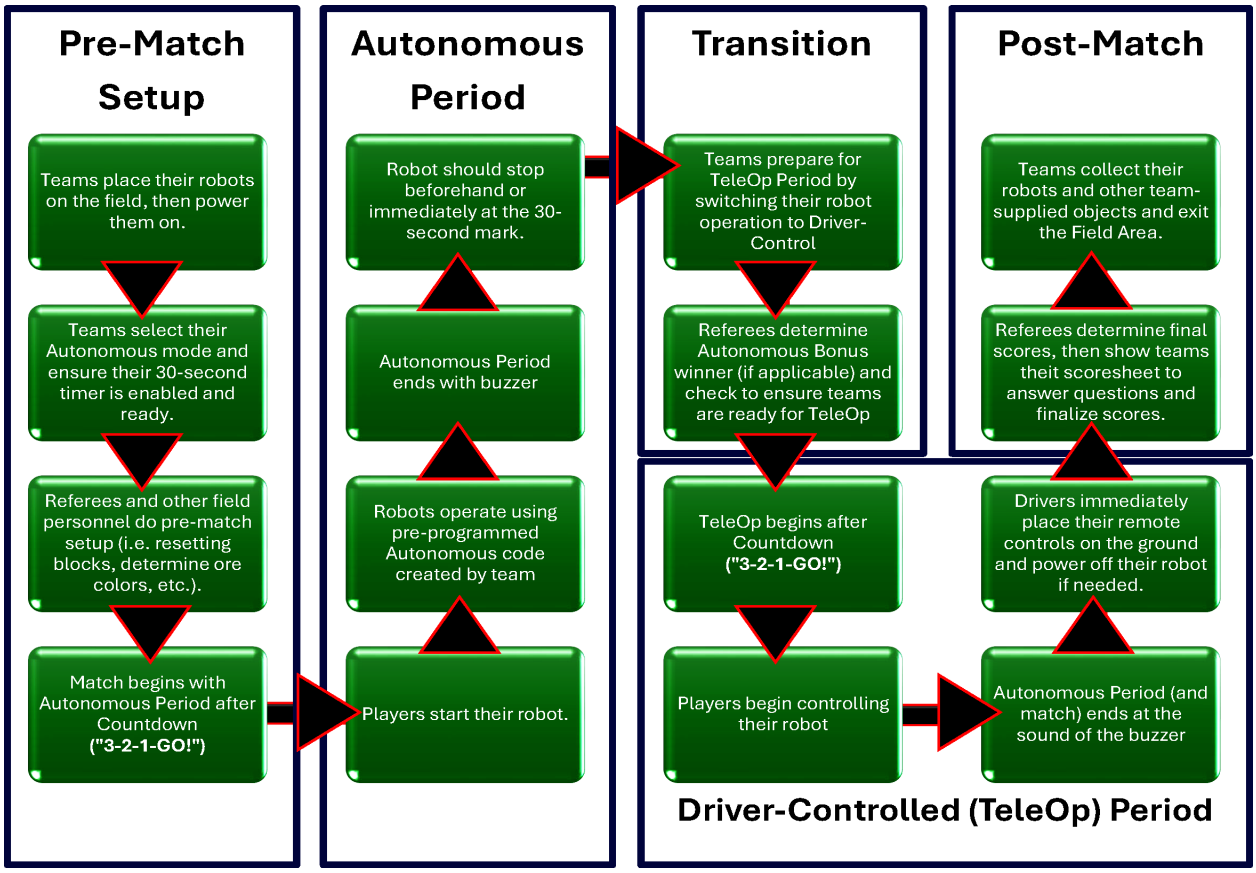
## *5.1 Robot Game Structure*

During each match, two teams will compete head-to-head, and will compete in multiple matches. Each match lasts a total of 2 minutes 30 seconds, divided into two separate time periods, as follows.

1. *Autonomous Period:* Teams will have 30 seconds to score points using only code previously installed on their robot, without any direct operator control. Remote controls must be out of the drivers' hands during this period. The robot must remain in its final resting position at the end of the Autonomous period and cannot be moved until the start of the Driver Control period.

2. *Driver Control (Teleoperation) Period:* Shortly after the conclusion of the Autonomous period, Teams will have 2 minutes to operate their robot by remote control.

Scores will be tallied by referees and other event officials at the end of the Driver Control period. Scores may not immediately be revealed to teams, but will be posted shortly after a match's conclusion, after scoring officials have verified and entered them into the system. Following is a flowchart that may be helpful for teams to review to understand the processes and flow of 4-H REC games.




## *5.2 Judging and the Engineering Notebook*

During the season, teams should document their work in an Engineering Notebook, which should summarize the team's entire process of designing, building, programming, and testing their robot. It is expected teams will update their Engineering Notebook *every meeting*. Items to add can include, but aren't limited to: prototype & CAD drawings, obstacles the team encountered, lessons learned, code used, development processes, design failures & successes, testing procedures and results, and relevant community outreach or club efforts. Any format may be used.

At the start of the Tournament, teams must submit their Engineering Notebook when they check-in. Judges will *not* review Engineering Notebooks before judging rounds begin. Each team will have a scheduled time to give a presentation about their work during the season, both technical and non-technical, to a panel of judges. These sessions will last approximately 10 minutes, **but teams must leave time for judges to ask questions**. It's recommended teams have presentations last 5 minutes with 5 minutes left for questions. If judges feel a team's presentation is running too long, they reserve the right to stop the team at whatever point deemed necessary, and judges will score the team on what they heard and the questions they can ask with time left. The team's Engineering Notebook and their presentation will determine their final judging score. The rubric used by judges to score notebooks and presentations can be found in the Appendix B.

## *5.3 State Competition Structure*

During the 4-H REC Tournament, REC teams will compete in at least 3 matches against other teams. The team's age division is determined by the age of the oldest member of the competing team, and the age group that individual would fall under will be the age group the team, as a whole, will compete in for REC.

There are two components that combine equally to form a team's overall tournament score and subsequent ranking: Robot Performance and the Engineering Presentation/Notebook. The percentage score for these two components is added and the resulting sum is used to rank the teams. After 3 matches, the team's scores will be averaged to get their final robot game score. The highest possible final judging score for the technical presentation will be equal to the highest possible point total a team can earn at the tournament (this would be 500 points). The judging score will then be added to the robot game score in order to attain the team's final overall scorefor the competition, which would be out of 1000 points (500+500).

The team with the highest combined total will be declared this year's Maryland 4-H REC Champion.

# 6. General REC Challenge & Game Rules

## *6.1 Robot Rules*

1. Robots can weigh a maximum of 20 lbs (including batteries). A scale may be used at inspection to ensure the robot meets this requirement.
2. Robots may be constructed using a variety of materials. Creativity is encouraged! Legos,VEX parts, FIRST components, plastic, cardboard, duct tape, fasteners of various types, etc. are all permitted.
3. Components that pose risk of harm to an opponent's robot are not permitted, even if the risk is unintentional or rare. This includes, but is not limited to, sharp, explosive, radioactive, or liquid components. Robot inspectors, judges, and referees will all be monitoring for these potential risks and have the authority to disqualify a robot from competing until identified issues are fixed.
4. At the beginning of a match, no robot may exceed 18 inches in any dimension, height, width, orlength. Robots identified as being too large will be required to reduce their size before being able to compete.
5. Once a match begins, a robot may expand in size but may not exceed 24 inches in length,width, or height. Teams are urged to use common sense when designing their robot expansions.
6. No component of a robot may be intentionally detached during a match. This can be a safety hazard.
7. The robot's power source CANNOT exceed a total of 12 volts.
8. The total capacity of the robot's power source CANNOT exceed 6000 mAh.
9. During a match, robots MUST be controlled wirelessly. No tethered or wired connections are allowed.
10. A robot's Autonomous program, if it has one, MUST be able to be started remotely by a team. After being placed in its starting position on the field, touching the robot or its components in anyway to start it, change its programming or operation, or otherwise physically control it by hand insome manner, is not allowed until after event officials signal it is clear for robots to be removed. Starting and/or controlling robots by hand in this manner could present safety hazards.
11. Any microprocessor may be used in the robot's design.
12. Any wireless controller may be used, as long as the setup allows for the robot's operation in Autonomous and Driver Control to be done remotely, in accordance with Robot Rule 10 above.
13. A robot can have a MAXIMUM of 10 motors and/or servos total.
14. On challenge day, all robots must be inspected before they can compete in matches. Any issues the judges find with a robot design or setup must be rectified first before it is allowed to compete.

## *6.2 Participation Restrictions*

1. 4-H REC Teams may consist of 3 up to 8 4-H youth members total.
2. All team members MUST be enrolled in 4-H Online in order to participate in the state REC tournament. Failure to be an enrolled 4-H member, paid in full, and in good standing will result in those individuals not being able to participate in the challenge in any form.
3. Each group of youth must have two certified 4-H mentors and/or volunteers established tocompete and remain in compliance with established 4-H program rules and protocols.
4. Coaches and Mentors **are** allowed to run, assist, and/or oversee more than one 4-H REC team.
5. The division a REC team competes in is determined by the oldest member of the team. 4-H age

divisions are as follows (Note: 4-H age is determined by a child's age as of 1/1/2026)

- **Senior Age:** 14+ years old; **Intermediate Age:** 11-13 years old; **Junior Age:** 8-10 years old

## *6.3 Safety Rules*

1. Everybody at the field during a match must wear safety glasses. NO EXCEPTIONS!
2. If a robot becomes disabled or behaves erratically, an event official may authorize a team member to enter the field of play and shut off the robot. This is the ONLY time a team membermay be allowed to enter the field while play is ongoing. Penalties may be applied if team members enter the field without permission by an event official, while a match is ongoing.
3. Robots that repeatedly or purposefully damage other robots and/or the field or field elementsmay be removed from the tournament by an event official.

## *6.4 General Robot Round Rules*

1. All decisions regarding scoring and rules violations are made by event officials. Every effort will be made to ensure matches are fairly and evenly officiated. Concerns about match scoring, penalties, and violations must be brought to the attention of event officials at the end of the match in question, and before the robots are removed from the playing field.
2. Unless given explicit permission by an event official, team members must remain in the designated driver station area for the duration of a match.
3. During matches, NOBODY other than active drive-team members may give coaching or instruction.
4. Each match will last 2.5 minutes total: 30 seconds for Autonomous and 2 minutes for Driver Control.
5. After robots have been set up on the field and event officials have given the "ready" signal, teams CANNOT enter the field or change the robot's position without explicit permission from officials.
6. A countdown timer will be clearly visible to all teams competing during a current match.
7. Event officials are encouraged, but not required, to give a countdown in the closing seconds of a match.
8. A buzzer sound will indicate time has expired for each match. At this point, teams must IMMEDIATELY set down their controller to make it obvious they are no longer operating their robot. Any missions completed after the 2.5 minute period will not count towards the scoring.
9. If a robot malfunctions at the conclusion of a match such that the robot continues to operate, teams must receive an "OK" from the event official before manually disabling their robot
10. If a team continues to operate their robot after time expires, an event official will give a **Warning** for the first violation. Additional violations may result in a team being disqualified from the current match and subsequent matches.
11. If and only if extreme circumstances arise that compromise the integrity of the game, as decided by event officials, the decision to replay a match or a portion of it may be made.
12. **Egregious and Unsportsmanlike Conduct:** If the referee determines that a team's behavior or actions, on or off the field, is meant to damage another team's robot or is unsportsmanlike conduct, the team will be issued a warning. The referee will explain the warning to the team. If the behaviors or actions continue, the referee may disqualify the team from the competition.
13. To receive parking points at the end of both the autonomous and driver-controlled periods of a match, a robot MUST fully leave Earth (their Launchpad) before returning to the Launchpad.
14. A team can only have a maximum of 2 of their Astronauts within Earth's boundaries at any time, including if their Astronauts end up on their opponent's side of Earth.
15. If team has a third astronaut (or more) end up on Earth at one time during a game, those astronauts past the first two that arrived on Earth will be decommissioned and CANNOT be scored for points. When deemed necessary or due to an interference, an Event Official has theright to remove these decommissioned Astronauts from the field during a match.
16. A team CANNOT interfere with their opponent's Astronauts, Gems, or other materials, except for incidental contact. Final scoring will be determined at the end of the match.
17. If and only if extreme circumstances arise that compromise the integrity of the game, as decidedby

event officials, the decision to replay a match or a portion of it may be made.

## *6.5 Autonomous Period*

1. The Autonomous period will last for the first 30 seconds of the match.
2. Teams are recommended to use a VEXNET match controller or the FTC Robot Controller app to stop their Autonomous program or must have another pre-approved method to stop their robot's Autonomous function immediately upon expiration of the 30-second Autonomous period.
3. **Incidental** contact between robots will be excused during the Autonomous period. **Intentional** contact is not permitted in any form and may result in penalties being applied.
4. During the *Autonomous* period, a team must not handle their remote control.
5. Once the *Autonomous* period has begun, teams may not touch their robot for any reason unless they have received explicit approval from an event official.
6. If a robot continues operation past the end of the *Autonomous* period, any missions it completes after the 30-second time will NOT count for points. The first time a team's robot does this, they will get a Warning. The 2nd time, their robot will be disqualified from scoring in the Autonomous portion of matches for the rest of the competition.
7. At the conclusion of the Autonomous period, event officials will calculate the score of each team.
    - During this time, teams may ask permission to enter the field if they need to switch manually from Autonomous to Driver Control modes. **Teams must declare this requirement to an event official beforehand.** After Autonomous has concluded, those teams may not enter the field to do this until permission is granted. Teams may not reposition the robot or touch any other game piece.

## *6.6 Driver Control Period*

1. The Driver Control period will last for 2 minutes.
2. During Driver Control, each team must control their robot exclusively through wireless controllers.
3. Controlling the robot using wired or tethered means is not permitted.
4. During the Driver Control period, teams may not touch their robot for any reason unless the team has received explicit permission from an event official to do so.
5. During Driver Control, incidental contact between robots is expected, but this is not *Battle-Bots*, so behavior which causes damage to another robot (intentional or accidental) will be penalized.
6. On the first violation of rules regarding robot contact and/or damage, a referee will issue the offending team a **Warning**. Subsequent infractions by the same team will result in disqualification from a match.
7. At the conclusion of Driver Control, teams may not touch, move, or otherwise handle their robot until granted permission from an event official. This is to ensure final scoring is done accurately.
8. Once the signal is given for robots to be removed from the field, all scoring decisions are **final.**
9. Teams may ask for scoring or rules clarification before removing their robot from the field of play.
10. Teams may not block an opponent's access to a planet and/or to their Launchpad or Depository.
11. Teams may not intentionally make contact with their opponent's Astronauts at any time, or intentionally make contact with their opponent's Gems once collected and deposited.
12. At the conclusion of Driver Control, teams may not touch, move, or otherwise handle their robot until granted permission from an event official. This is to ensure final scoring is done accurately.

## *6.7 Match Scoring*

1. Before scoring is begun at the end of the match, any robot in contact with a field element may be moved by an event official in order to break contact between the robot and field element.
2. Teams may ask for scoring or rules clarification before removing their robot from the field of play.
3. Once the signal i given for robots to be removed from the field, **all scoring decisions are final.**
4. Astronauts may be determined to be on a planet by using a flat plate placed on the outer edge of the planet's tapeline or wood barrier. To count for points, the Astronaut must rest entirely within the

invisible plane extending upward from the outer edge of that planet's tapeline or wood barrier.

5. Any Gems (Resources) located fully in a team's Depository will award 10 points to that team. These points will be calculated based on the final state of the field at the end of Driver Control.
6. For a robot to be considered "parked" at the end of the Autonomous and/or Robot Control periods, it must be contained ENTIRELY within their assigned "Launchpad" on their side of Earth. This includes the wheels, extensions, arms, and any other robot components.
7. If a robot is holding Gems and correctly "parked" in Earth at the end of a match, Gems would thus **not** be in a team's Depository so the Gems would NOT count for any points.
8. The team in the lead at the end of the Autonomous portion of the game will receive a 5-point bonus. If there is a tie at the end of Autonomous, both teams will receive 5 bonus points.
9. A theoretical maximum of **500 points** can be scored by a team in a single match:
    - Two Astronauts landed on each of the 8 planets: **144 points.**
        - Venus & Mars: 20 points
        - Jupiter & Saturn: 24 points
        - Pluto & Mercury: 40 points
        - Neptune & Uranus: 60 points
    - Robot parked fully in Launchpad both times: **15 points.**
        - End of Autonomous: 10 points
        - End of Driver Controlled: 5 points.
    - Resources successfully returned to Team's Depository: **80 points.**
        - Gems: 8 x 10 points each = 80 points
    - Autonomous Bonus: **5 points**
    - Planet Colonization Bonus: **256 points**
        - 2^n points, n=number of planets with at least one of a team's Astronauts successfully landed on it

## Appendix A TENTATIVE Referee Scoring Sheet

TEAM NAME_____ MATCH NUMBER_____ **RED or BLUE**?

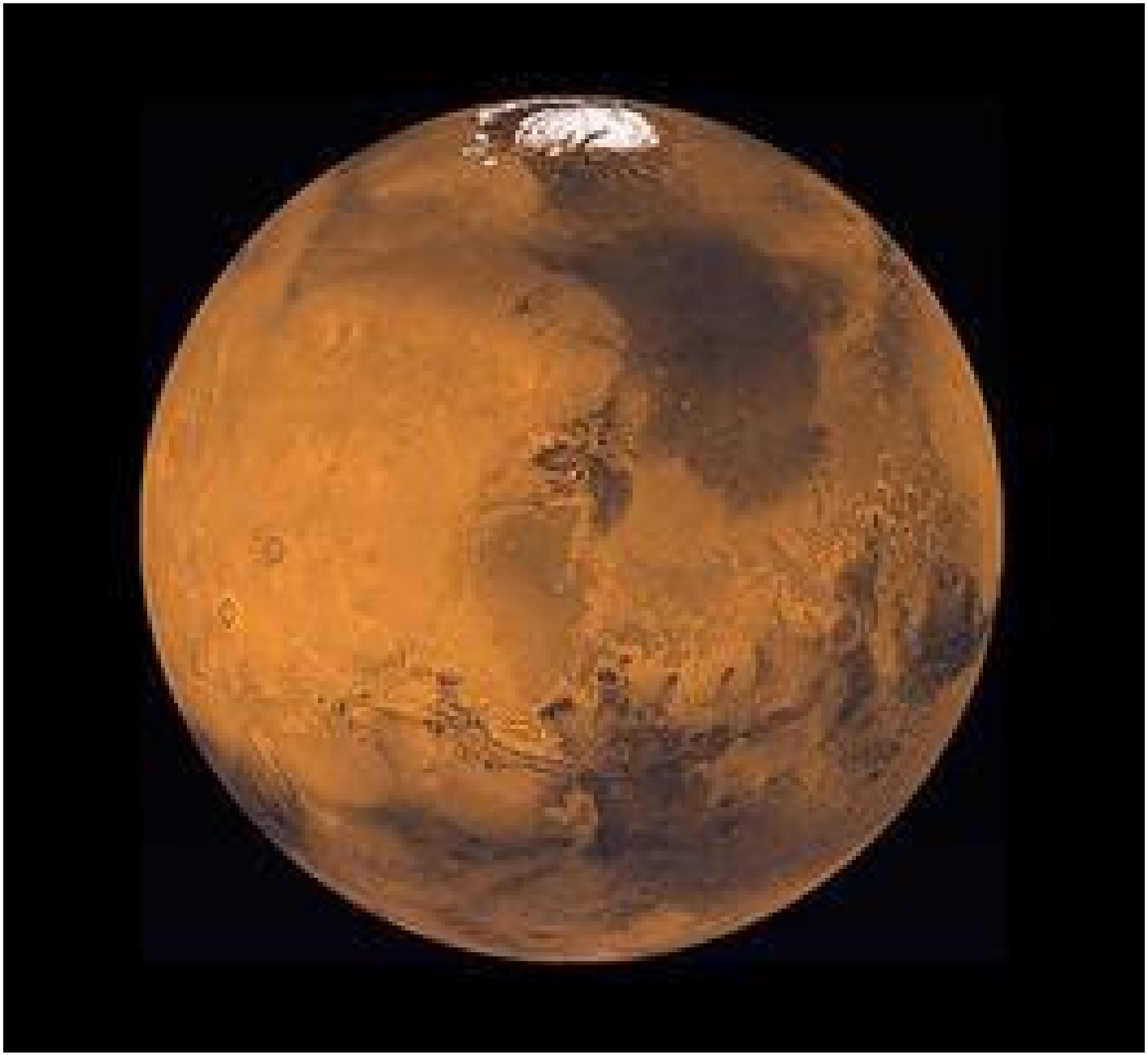
| MISSION | DONE? YES/NO | QUANTITY (IF APPLICABLE) | POINTS +/- | | TOTAL | OUT OF (MAX) |
|---|---|---|---|---|---|---|
| | | | AUTO | TELEOP | | |
| **ASTRONAUTS DEPOSITED ON VENUS & MARS (5 Points per Astronaut, 2 MAX)** | | | | | | |
| Venus | | | | | | /10 |
| Mars | | | | | | /10 |
| **ASTRONAUTS DEPOSITED ON JUPITER & SATURN (6 Points per Astronaut, 2 MAX)** | | | | | | |
| Jupiter | | | | | | /12 |
| Saturn | | | | | | /12 |
| **ASTRONAUTS DEPOSITED ON NEPTUNE & URANUS (15 Points per Astronaut, 2 MAX)** | | | | | | |
| Neptune | | | | | | /30 |
| Uranus | | | | | | /30 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **ASTRONAUTS DEPOSITED ON PLUTO & MERCURY (10 Points per Astronaut, 2 MAX)** | | | | | | |
| Pluto | | | | | | /20 |
| Mercury | | | | | | /20 |
| **PARKING: Robot MUST be fully within Launchpad (20 Points-Auto, 10 Points-TeleOp)** | | | | | | |
| Autonomous PARK | | | | | | /10 |
| TeleOp PARK | | | | | | /5 |
| **GEMS COLLECTED AND RETURNED (FULLY) IN DEPOSITORY (10 Points Each, 8 MAX)** | | | | | | |
| Gems in Depository | | | | | | /80 |
| **BONUS FOR LEADING TEAM AT AUTO END (10 Points, Tie=10 Points for both teams)** | | | | | | |
| Autonomous Bonus | | | | | | /5 |
| **COLONIZATION BONUS FOR PLANETS TEAM HAS DEPOSITED ASTRONAUTS ONTO (Exponential, 2^n Points for "n" number of planets colonized, n=0-8, 256 Points Maximum)** | | | | | | |
| Colonization Bonus | | | | | | /256 |
| **TEAM MEMBER INITIALS** | | **TOTALS:** | | | | **/500** |

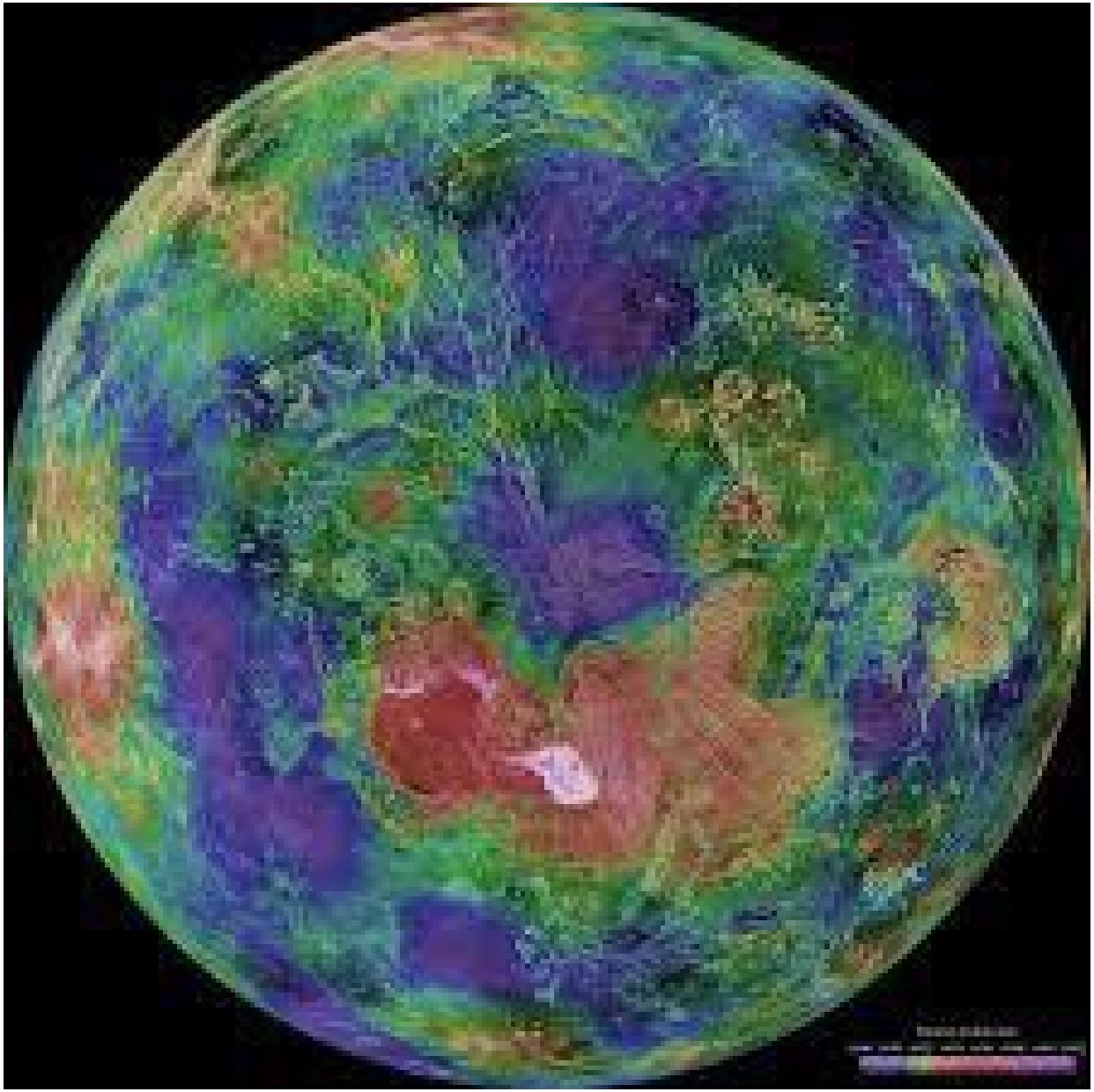
## Appendix B Presentation & Notebook Judging Rubric

| | | Awarded Points | Possible Points |
|---|---|---|---|
| **Quality of Display Elements** | | | |
| | Visual elements were well organized. | | 5 |
| | Visual elements were helpful (i.e. not just "eye candy"). | | 5 |
| | **SECTION TOTAL:** | | **/ 10** |
| **Quality of Presentation** | | | |
| | Each team member spoke, and information presented matches what is recorded in Engineering Notebook. | | 5 |
| | Team clearly presented overview and technical information on major subsystems of robot (scoring mechanisms, drivetrain, battery/power supply, choice of materials, gear ratios, etc.). | | 10 |

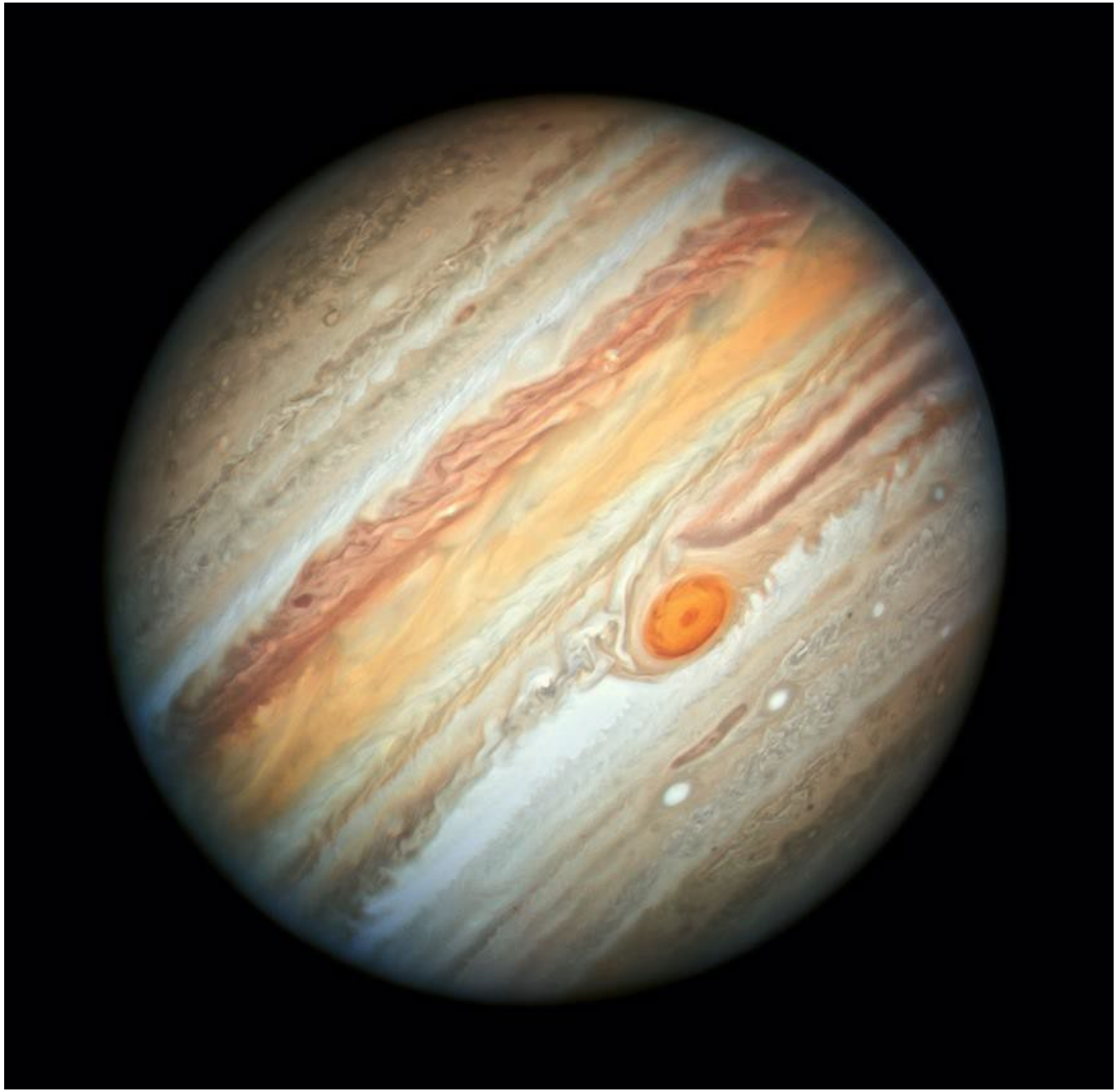
| | | | |
|---|---|---|---|
| | Team provided clear and detailed explanation of code and programming. | | 10 |
| | Team provided an explanation of design process, problem solving process. | | 10 |
| | Clearly demonstrated understanding of game, rules, and strategy. | | 5 |
| | **SECTION TOTAL:** | | **/ 40** |
| **Quality of Engineering Notebook** | | | |
| | Each team member has a brief biography in notebook. | | 5 |
| | The team includes information, matching what is in their presentation, about their service projects throughout the year that align with the goals & priorities of 4-H and REC. | | 10 |
| | The team clearly demonstrates & records their process of robot design, building, programming, and testing, including goals, important milestones, significant changes, evaluation and testing methods, etc. | | 20 |
| | The team clearly demonstrates the problems they identified, the work they did to solve each particular problem, the testing methods used to verify the solutions, and adequately explained the resolutions. | | 15 |
| | **SECTION TOTAL:** | | **/ 50** |
| | **GRAND TOTAL** | | **/ 100** |



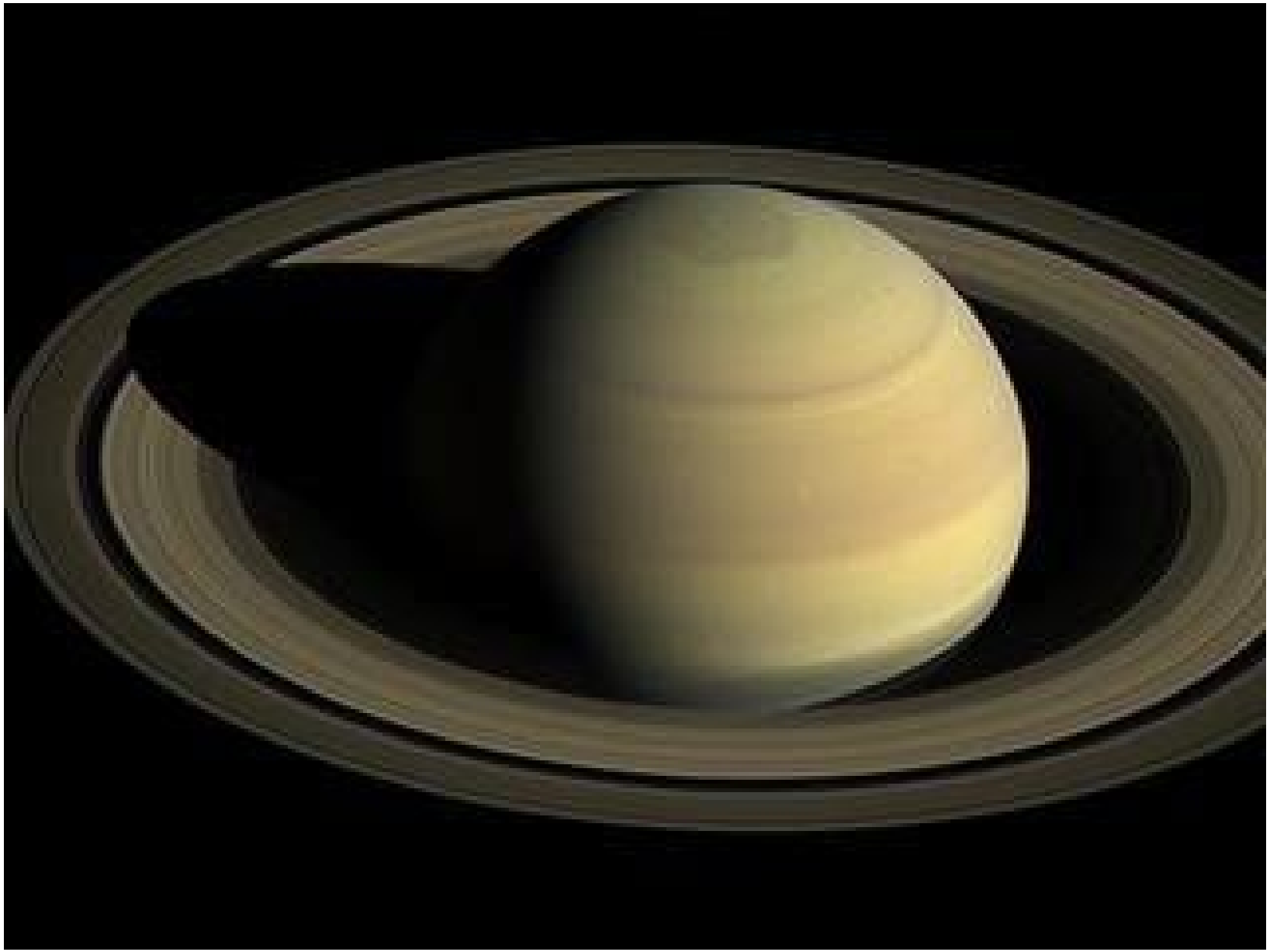
MARS (*Image courtesy of NASA*)



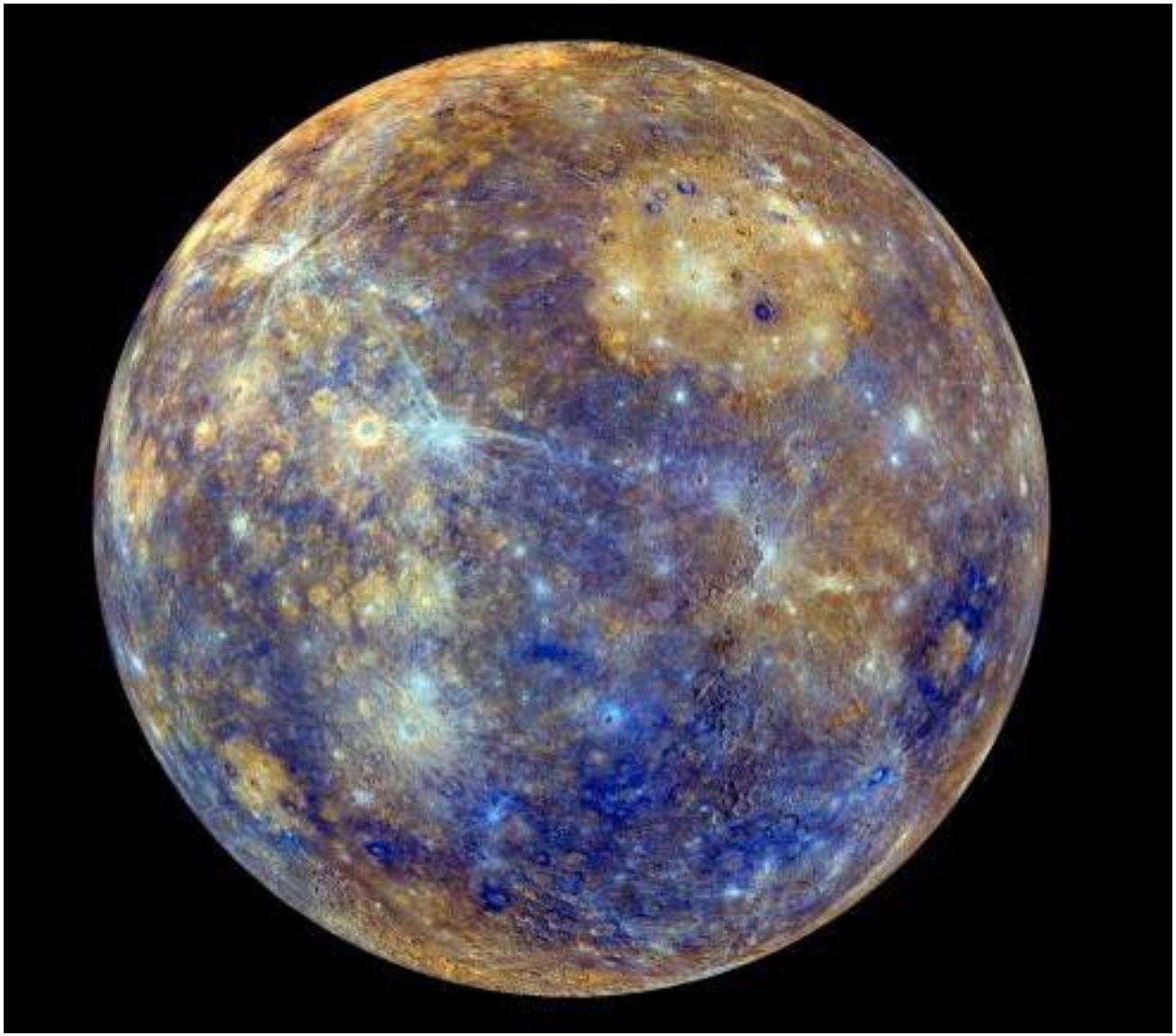
VENUS (*Image courtesy of NASA*)



JUPITER (*Image courtesy of NASA*)



SATURN (*Image courtesy of NASA*)



MERCURY (*Image courtesy of NASA*)

PLUTO (*Image courtesy of NASA*)

NEPTUNE (*Image courtesy of NASA*)

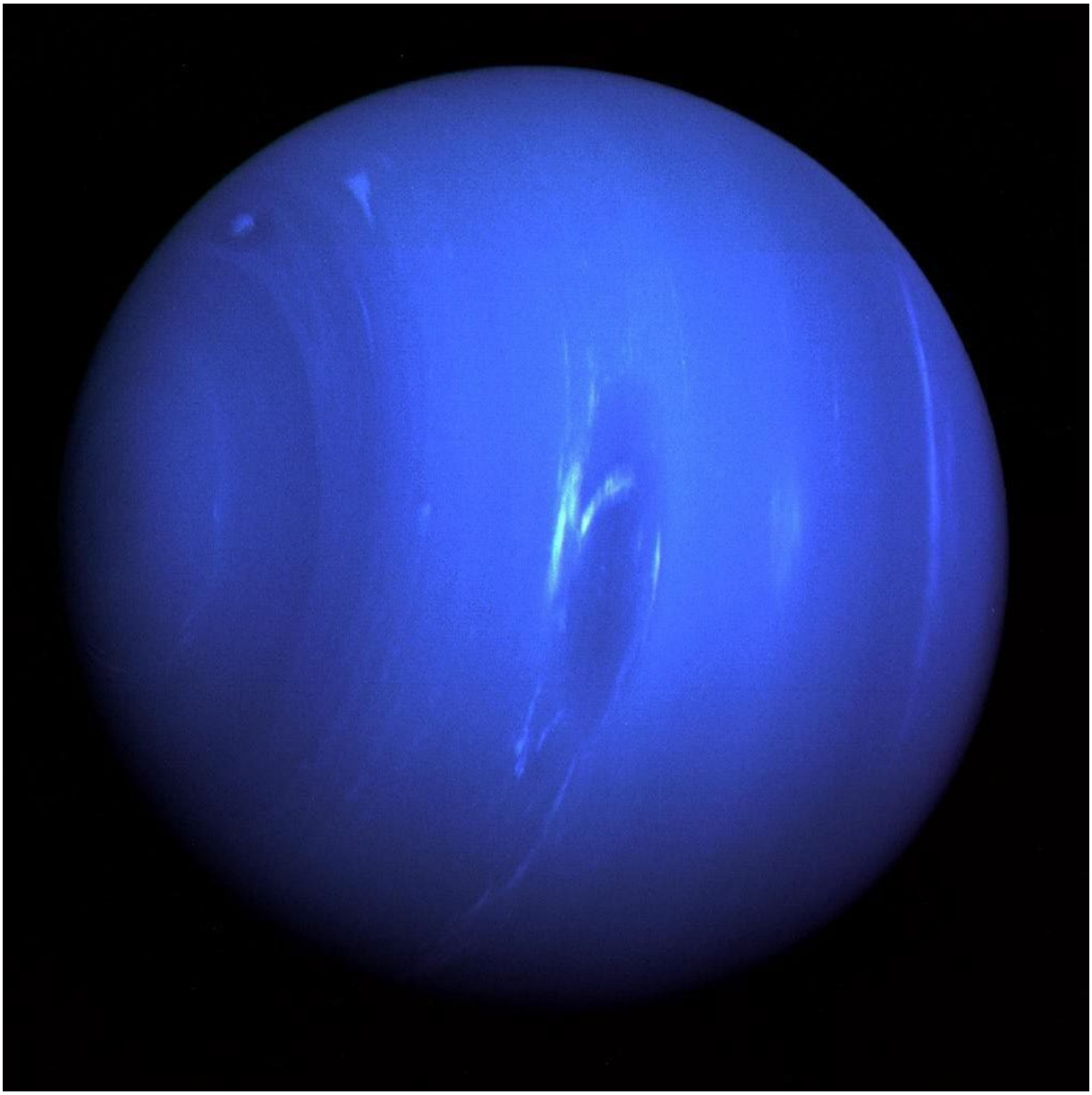


**Image will be located on Floor of Neptune for Audience Recognition and Understanding

URANUS (*Image courtesy of NASA*)

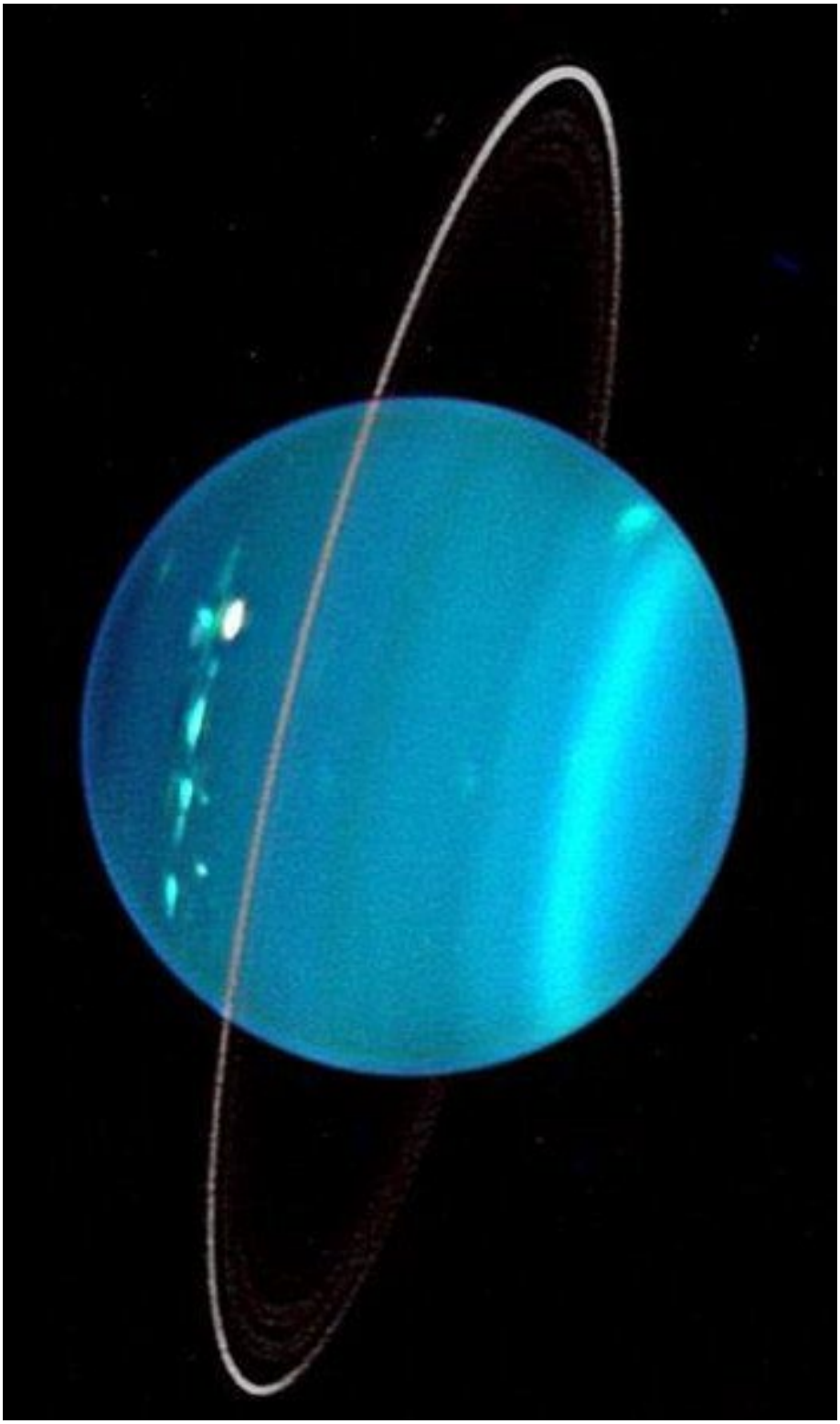


**Image will be located on Floor of Uranus for Audience Recognition and Understanding