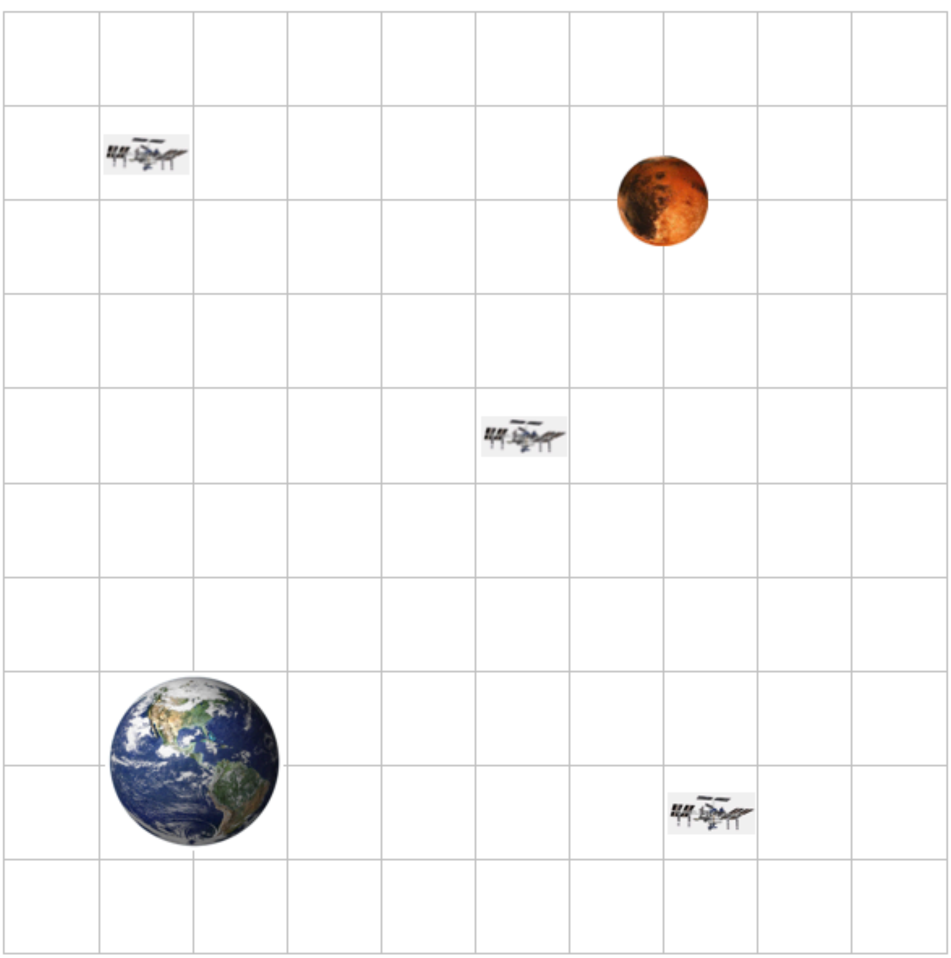
Autonomous Maze *(Mission To Mars)*: GPI, TI, or API

Description: Autonomous programming of the robot.

Rules

1. All courses must be completed in five minutes for full credit.
2. Participants may modify ("engineer") the robot to assist in completion of the challenge.
3. Participants will be given the exact dimensions of the course and the tasks prior to the event so that it can be programmed to complete the challenge (see Figure 1).
4. The robot will begin at a "launch site" for each challenge.
5. Participants will be allowed to restart the course as many times as they can during the allotted time.
6. The best score and fastest time will be used for final scoring and ranking.

Figure 1. Mission to Mars (one course, 10' x 10' area (1' x 1' spacing))



7. All wheels must remain in contact with the ground. (Judges discretion).
8. Once the robot begins a challenge ("mission"), it should not be touched
9. If the participant chooses to move the robot for a slight route adjustment, the student must first inform the judge of the adjustment.
10. For each adjustment, the following penalties will be enforced:

   - 1st course adjustment - 20 sec. penalty
   - 2nd course adjustment - 30 sec. penalty
   - 3rd course adjustment - start over (without time stoppage)

11. Only if due to a "start over" and the participants' choice to "scratch" the challenge attempt, the participants will have the opportunity to complete the challenge *after all teams have had the opportunity to complete the challenge*. This depends on if time permits in the competition portion of the Expo.

<u>Note 1</u>: Cargo containers will be constructed of two ¾" PVC plugs and one ¾" PVC coupling (FPTxFPT). The plugs will be screwed into the ends of the coupling.

Supply the Space Stations (Elementary Level):

1. This challenge ("mission") requires precision delivery of cargo containers to three space stations (see Figure 1).
2. The cargo containers will be approximately ¾" diameter by 3" long cylinders that are flat at each end (see Note 1).
3. The start requires one wheel (max.) touching the Earth ("launch site").
4. **The same "launch site" and orientation must be used for each launch attempted.**
5. The three space stations will be located in the space between Earth and Mars (see Figure 1).
6. The cargo containers must be delivered and remain at each space station (i.e., placed <u>within the one square area</u> of the space station, see Figure 1).
7. Five (5) points will be awarded for cargo delivered successfully to a space station. Five (5) points will be awarded for a successful return to Earth.
8. The clock will stop once the cargo is delivered to a space station or successful return to Earth. Final time will be a summation of the three times necessary to complete the challenge, if less than five minutes (5 min.).
9. Scoring is based on total points, as well as time to complete the cargo delivery to the three space stations.
10. Total points determine the leader, with the fastest completion time determining ranking and tiebreakers.

Mission: Mars Prep (Middle Level):

1. This challenge ("mission") requires precision cargo containers' retrieval and delivery from any two space stations back to Earth (see Figure 1).
2. The cargo containers will be approximately ¾" diameter by 3" long cylinders that are flat at each end (see Note 1).
3. The start requires one wheel (max.) touching the Earth ("launch site").
4. The same "launch site" and orientation must be used for each launch attempted.
5. The three space stations will be located in the space between Earth and Mars (see Figure 1).
6. **Students will have to engineer an apparatus to retrieve and deliver the cargo containers from the space stations to Earth using a servo motor.**
7. The cargo containers must be returned to Earth (i.e., placed within the four square area of Earth, see Figure 1).
8. Five (5) points will be awarded for each cargo container retrieved and delivered successfully to Earth.
9. The clock will stop once the cargo containers from two space stations are retrieved and returned to Earth, or when time elapses. The clock will stop to prepare for the second launch, then resume upon launch.
10. Scoring is based on total points, as well as time to complete the cargo containers' retrieval and delivery to Earth from two space stations.
11. Total points determine the leader, with the fastest course completion time determining ranking and tiebreakers.

Mars or Bust! (High School Level):

1. This challenge ("mission") requires cargo containers' retrieval and storage from the three space stations and achieving two orbits of Mars.
2. The cargo containers will be approximately ¾" diameter by 3" long cylinders that are flat at each end (see Note 1).
3. The start requires one wheel (max.) touching the Earth ("launch site").
4. The three space stations will be located in the space between Earth and Mars (see Figure 1).
5. **Students will have to engineer an apparatus to retrieve and deliver the cargo from the three space stations to an orbit around Mars using a servo motor(s).**
6. **Students will have to complete two orbits of Mars.**
7. An orbit is considered a "smooth curve", non-angular path around Mars while remaining on the course (see Figure 1).
8. The clock will stop once the cargo is retrieved and stored from the three space stations and two complete orbits of Mars is achieved, or when time elapses.
9. Five (5) points will be awarded for each cargo container retrieved and delivered successfully to Mars. Five (5) points will be awarded for each complete orbit of Mars. *Five (5) points will be deducted for each "impact" (contact) with Mars.*
10. Scoring is based on total points, as well as time to complete the mission.
11. Total points determine the leader, with the fastest course completion time determining ranking and tiebreakers.