BEYOND ORBIT 2019 BONUS CHALLENGE

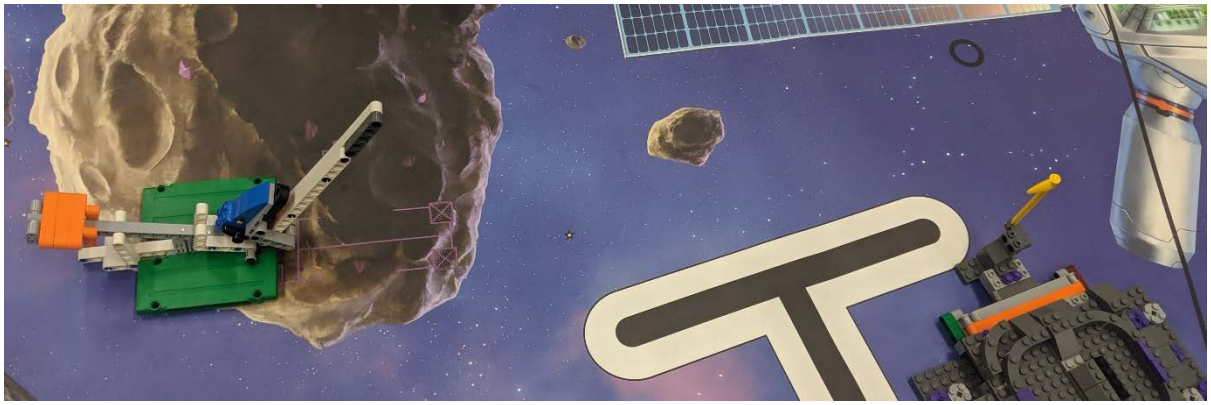
Asia Pacific Open Championship, Sydney, Australia

All general rules in Beyond Orbit are the same as 2018-2019 Into Orbit; only the missions are different.

You will be working together with another team on this, as well as sharing your field with a different alliance. So remember: Gracious Professionalism!

M1 Escape Velocity

Points: *10 points if the rocket is no longer in contact with the mission model + 30 if it landed in the right spot of its own volition.*



The speed required for launching rockets into space needs to be very carefully calibrated. Attempt to shoot your rocket with just the right speed to land in the goal area.

Clarifications:

- The rocket must be actuated purely by the orange lever.
- The rocket's final position is counted for scoring, not first contact.
- To count as scored, the rocket must be on the East side of the thin black line but NOT within the rings around the red planet.

M2 Crater Crossing

Points: *15points if the robot crosses from one side of the crater to the other, passing completely between the two flags.*

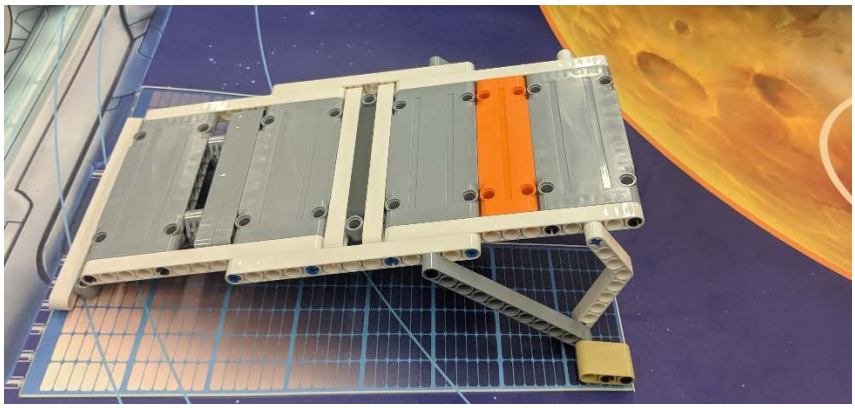
Planets and moons are hard to drive on using conventional wheels; try to cross the rough terrain without getting stuck!

Clarifications:

- The entire robot must pass between the two flags.
- To count as crossing, the robot must not in be contact with the crater model, then pass completely between the two flags, and finish not in contact with the crater model.

M3 Controlled Descent

Points: *10 points if the robot drives off the east side of the ramp and can drive afterwards.*



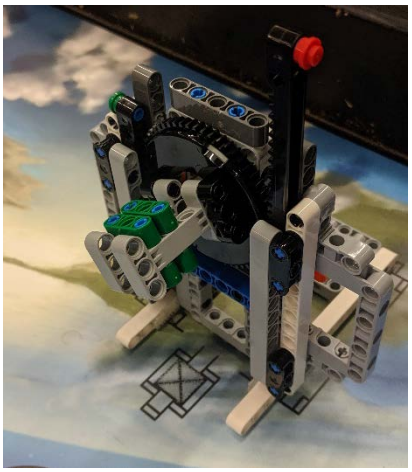
When landing on objects in space, you have to be very careful to control your speed and direction in order to touch down safely. The Curiosity rover utilised a sky crane to descend gently onto the surface of Mars – how will your robot keep from crash landing?

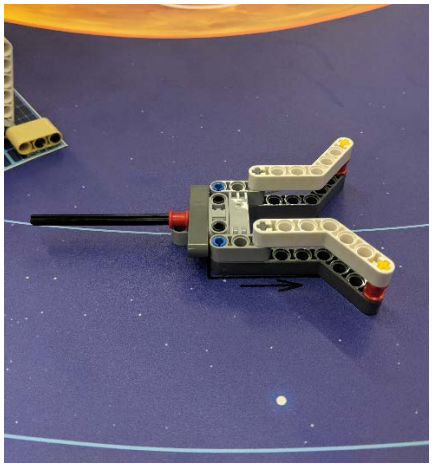
Clarifications:

- The robot must contact the end plate of the ramp, then descend purely by travelling East.
- After leaving the ramp, the robot must purposely travel in a direction to prove that it can still affect its own motion.
- The referee has the final call on what constitutes a descent as well as purposeful travel.

M4 Tool Use

Points: *50 points if the green flag is raised purely by using the tool on the mission model.*





Without human hands around to help out, robots in space must be able to operate tools on its own. Mars rovers are equipped with a variety of tools to do everything from extracting core samples to taking pictures of its surroundings.

Clarifications:

- The green flag must be raised purely by rotation of the green bar while in contact with both white bars on the tool.

M5 Spacewalk Rescue

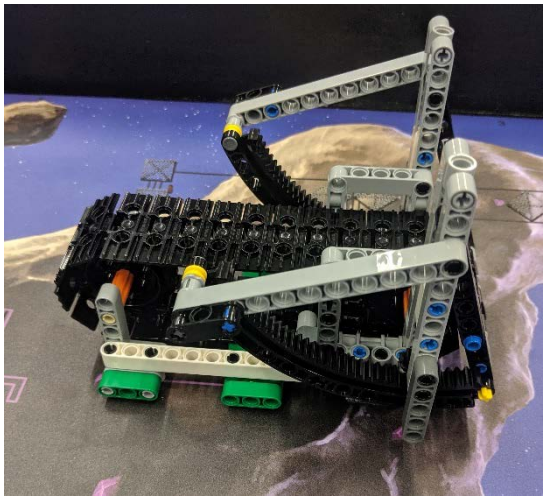
Points: *20 points if any part of the astronaut crosses the black line by the spinner, due solely to the rotation of the spinner.*

When humans are involved in space travel, it's important to remember space is dangerous! When performing extra-vehicular activities, astronauts should always stay tethered to their vehicle so they can be retrieved in an emergency.

Clarifications:

- If the astronaut is pushed down the rod by the robot, it does not count as scored.
- To be considered scored, all motion of the astronaut must be due to the pulling of the string by the turning of the barrel.
- This model is finicky – if the string catches, points may be awarded if the referee judges the fault as a mission model failure.

M6 Treadmill



Points: *20 points if the bar raises most of the way (the last row of holes beyond the dark grey pointers), only by the action of the treadmill.*

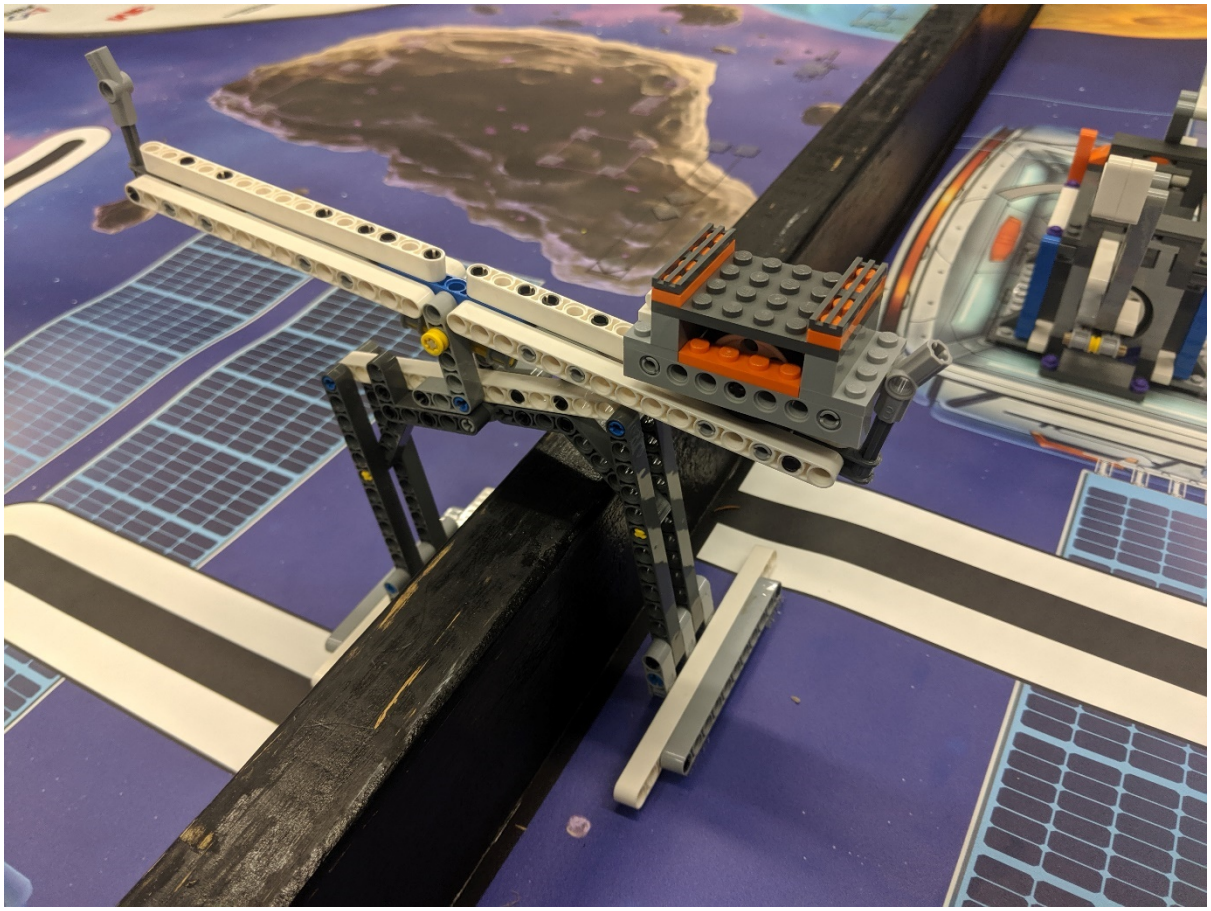
Unlike robots, humans can suffer severe health problems in low-gravity environments, and must exercise regularly to keep their muscles working correctly. During the 2007 Boston Marathon, astronaut Sunita Williams joined in using her treadmill on the International Space Station while her sister ran the same distance on Earth.

Clarifications:

- If the bar is raised manually (without contacting the treadmill tracks), no points will be awarded.

M7 LONG RANGE COMMUNICATIONS

Points: *5 points each time the communication packet is sent to the opposing team's end stop, up to a maximum of 50 points per team.*



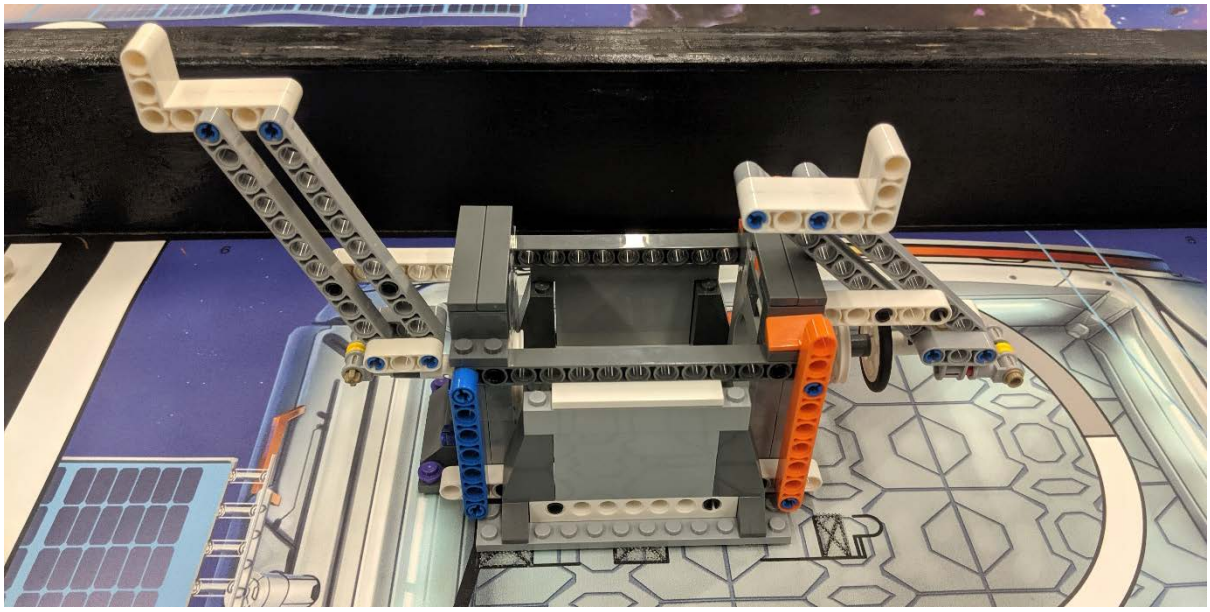
A critical part of space activity is to maintain communications with the homeworld, but it's no trivial task. Sending messages requires precision and careful timing, and you have to hope someone is listening on the other end.

Clarifications:

- To consider it scored, the referee must see the communication packet touch the end stop and stop moving. If it is not clearly delivered before being sent back, no point will be awarded. If the packet falls off the track, it can no longer be scored.
- The communication packet can only be "sent" if the opposing robot contacts the mission model – no pulling the communication back towards yourself!

M8 AIRLOCK

Points: *5 points for closing the orange door + 20 points for opening the blue door, but only if the orange door was closed when the blue door opened.*



Controlled environments are critical for maintaining life while operating in a vacuum. You should never open a door to the outside world unless all doors to the inside are fully sealed.

Clarifications:

- The blue door is considered "closed" if the black tire breaks the plane of the outer circular opening.
- The orange door is considered "open" if the black tire is no longer breaking the plane of the outer circular opening.

M9 INTERSTELLAR MINING

Points: *10 points per Mineral moved from Base into the blue planet area.*

Space is full of objects made of useful materials while our home planet is slowly being depleted. The collection, analysis and application of these resources can help further humanity's expansion. Take the minerals from the Base asteroid to be used in the exploration and development of the Blue Planet.

Clarifications:

- For this mission, the colour of the Mineral is unimportant.