Objective

Two robots must work collaboratively in order to gather food and fuel inside a spatial station and move it towards special compartments within a spaceship.

Story

Not so long ago, two spaceships were exploring Mars when an oil leak caused the crash of one of them in the surface of the planet. The ship's crew was seriously injured. Luckily, there were two robots on the second ship that quickly rescued the survivors and took them to the other ship, which was safe.

This ship, when coming back to the Earth, required the service of special robots that performed several tasks like providing medicines to the survivors, and throwing away toxic residues. Now, the transshipping is out of fuel and out of provisions due to this unfortunate trip, but there is an old spatial station called TMC-4000 luckily near the ship, and it has being detected that this station has enough food and fuel for the ship and its crew.

The spaceship has now come together with the TMC-4000, nonetheless the chemical composition of the gases of that place is unknown and it is very likely the presence of toxic particles in the environment; for this reason, a robot will have to go to the station in order to risk no more human lives.

The spaceship has only one robot capable of dealing with this hostile environment, and it is important to point that this robot can only pick either fuel or food but not both because for healthy matters these two must not be mixed. Luckily, inside the spatial station there is another robot that might be able to help accomplish this task.

Also, for security reasons, the spaceship can only be assembled with the spatial station for a lapse of 5 minutes, so both robots should return to the spaceship before it leaves the spatial station.

Challenge Goal

The goal of the challenge is to bring to the spaceship fuel and food, as much as possible, in a lapse of 5 minutes.

Present Situation

The stage is divided in 2 parts: the ship's zone and the station zone. At the beginning, one robot is located at either the fuel zone or the food zone of the ship (figure 1) and the other

one is located at the spatial station zone, which will be divided in six sections. **The initial position of this robot will be one of these 6 possibilities randomly selected by the judge.** Likewise, **the judge randomly will point to the team which kind of objects (fuel or provisions) will the robot of the ship gather;** this will also define the initial point of this robot (fuel area or food area). The objects will be represented by either black or blue LEGO pieces cubes (figure 2).
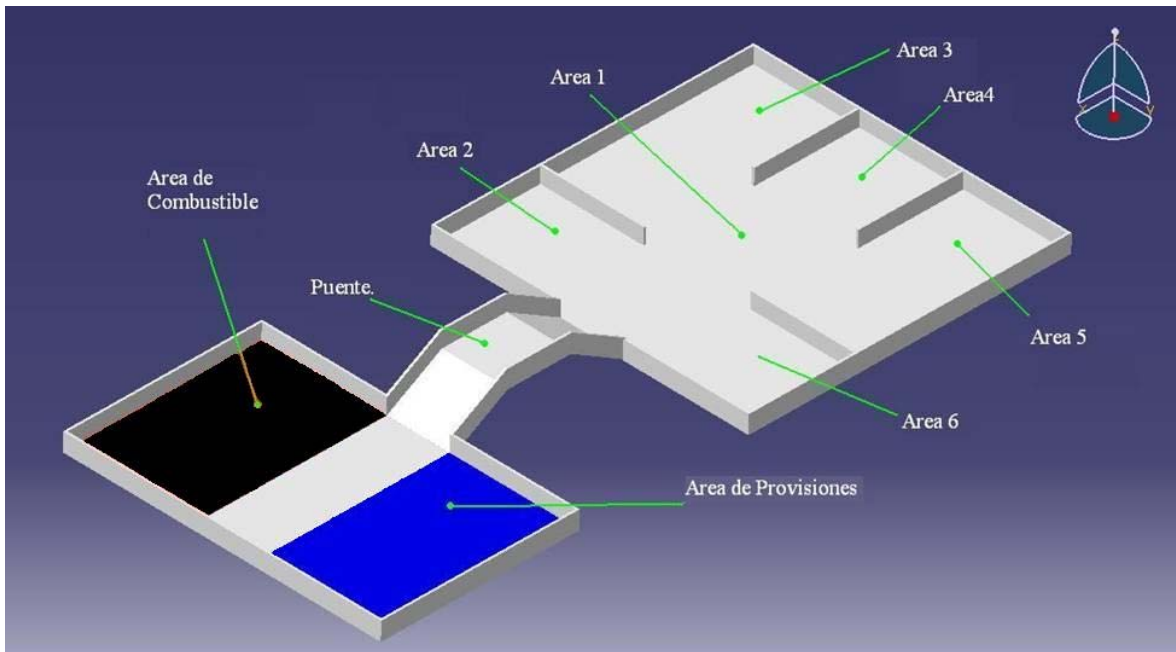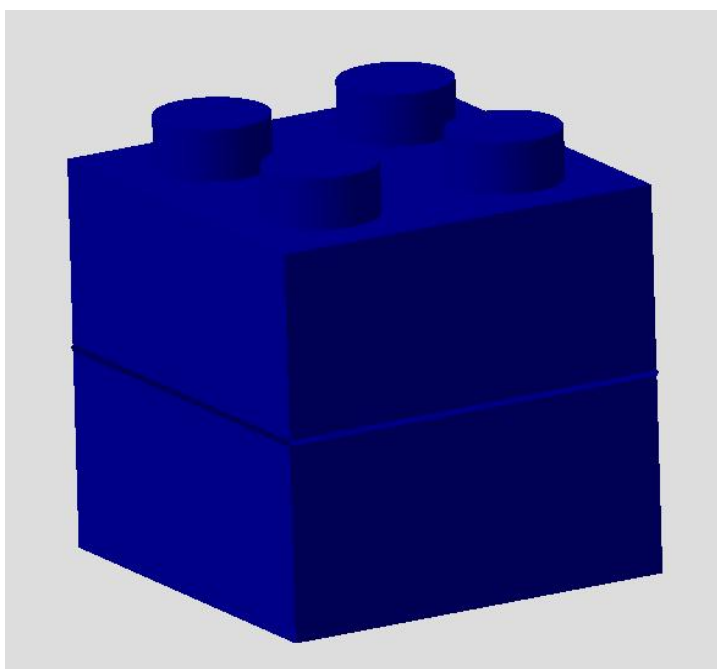

Figure 1

Figure 2 – Piece of provisions formed by two 2 by 2 LEGO blocks.

In order for the start of the robot of the spatial station, it is necessary that the spaceship one touches it physically and indicates it which pieces it must gather.

Within the region of the spatial station, there will be 10 objects of provisions and 10 of fuel spreaded randomly along the station. Besides, there will be from 3 to 10 garbage objects (green color, 2X2 LEGO Blocks like the others), which must be discarded by the robots.

At the part of the ship there are two defined delivery areas where the fuel and the food gathered will be placed. It is important to mention that the food must not be mixed with the fuel so each robot must not enter in the other region. (The food robot must not enter the fuel area and vice versa).

Each robot will be able to carry a maximum of two elements each time it crosses the bridge towards the spaceship.

In order to accomplish the gathering of the elements, both robots must be in their delivery areas and the number of elements delivered per robot must be the same one.
Example: If robot A delivered a fuel element, robot B must deliver a food element as well.

Preparation for the challenge:
In order to begin the challenge, the following steps must be followed at the indicated order:

1- The position of the station robot is chosen.

2- The station robot is placed in its position and its program is executed. (since this moment this robot must not be manipulated anymore and it must not move until it is physically touched by the other robot).

3- The pieces of the station are placed. (they will be placed in vertical position as shown on figure 2).

4- The initial position of the spaceship robot is chosen as well as the kind of piece that it must gather.

5- The spaceship robot's program is executed and the chronometer is started.

Rules Summary:
- During the challenge, both robots must act in an autonomous way; both robots must operate without human intervention
- The robots must not enter the other delivery region.
- The spatial station robot must wait for physical contact with the spaceship robot in order to start operating.
- The maximum time for completing the challenge is of 5 minutes.

- The teams will have 2 chances of restart by challenge, placing the robots in their initial positions with the current time counting.
- It is allowed to participate with both RCX or NXT platforms, participating all within the same category.
- The game is over:
  When the 5 minutes are gone
  When the 2 restarts have been used
  When the team let the judges know that they have finished the challenge, with the gained points until the moment.

About the robots:

It is important to remember that only pieces in their original state and official LEGO sensors are allowed; micro or regular LEGO motors can also be used. However, it is not allowed the use of glues of any kind to set the pieces.

Number of components: For this challenge, there is no limit of sensors and motors.

Measures: At all time, both robots must occupy a maximum space equal to a cube of 30cm per side, even when their parts are completely opened of expanded.
Antennas are not allowed unless they are within these limits.

Weight: There is no limit of weight for this challenge.

Colors and Marks:

Walls: White color
Floor: White color
Provisions area: Will be painted of Matte Blue color. (RGB 0 0 255)
Fuel area: Will be painted of Matte Black color.
Cubes of provisions: Blue LEGO cubes.
Cubes of fuel: Black LEGO cubes.
Cubes of garbage: Green LEGO cubes.

Grading Criteria:

First Criterion: Gained points at the challenge.

Punctuation:

2 points will be gained for every object delivered at the respective region if both robots are located at the delivery area and both deliver equal number of elements.
Example 1: if each robot deliver one correct piece, the score for this attempt will be of 4 points, (2 for each object)
Example 2: if a robot deliver one correct piece but the other do not deliver anything the score for this attempt will be of 0 points.

Example 3: if a robot deliver two correct pieces and the other one delivers only one, the score on that delivering attempt will be of 4 points (2 for each correct object).

1 point will be lost for every object that is left at an incorrect area (fuel at the provisions area or vice versa).

5 points will be gained for the **first** physical robot-robot contact.

4 points will be lost for the first restart.

2 points will be lost for the second restart.

1 point will be lost for every object delivered if both robots are not located at the delivery area.

2 points will be gained for every robot that stay in the spaceship at the end of the 5 minutes or when the team tells to the judge that they have concluded the challenge with both robots inside the spaceship.
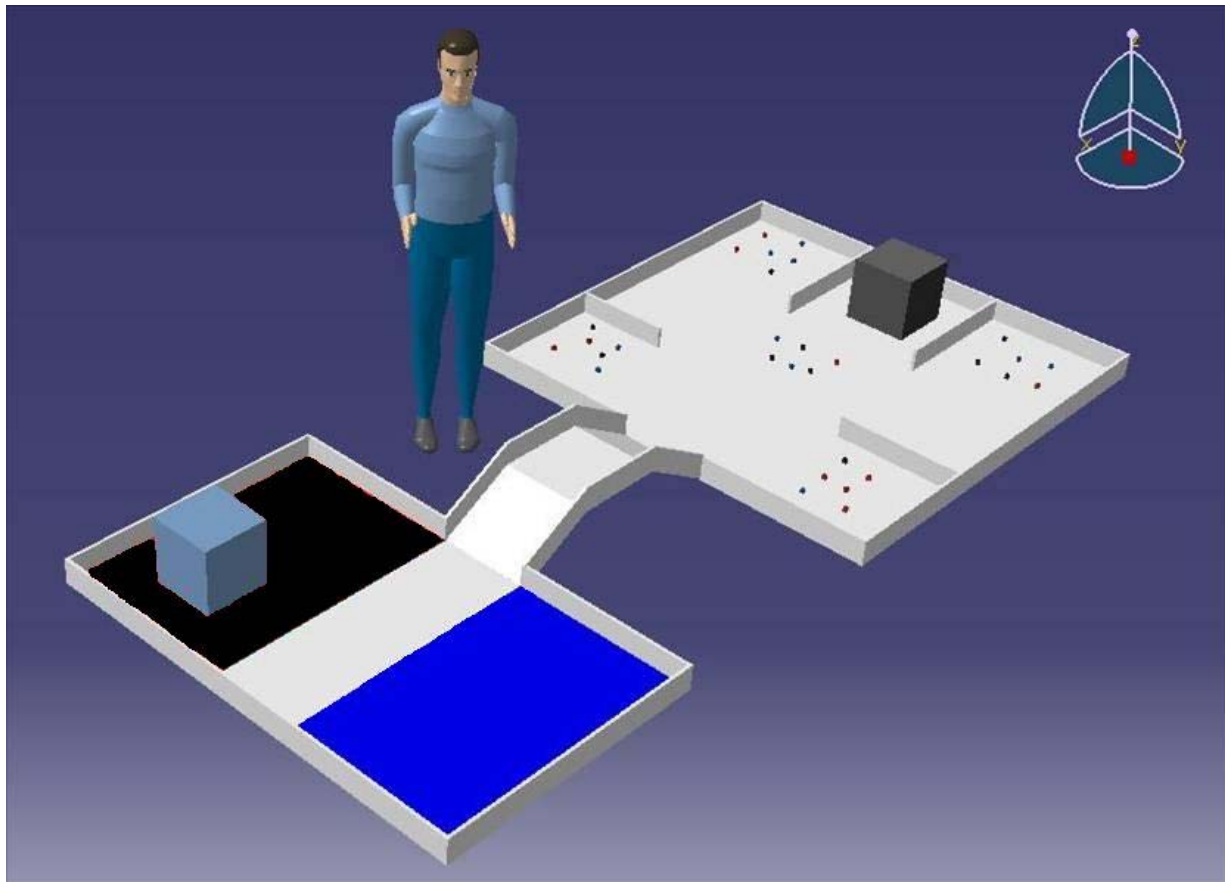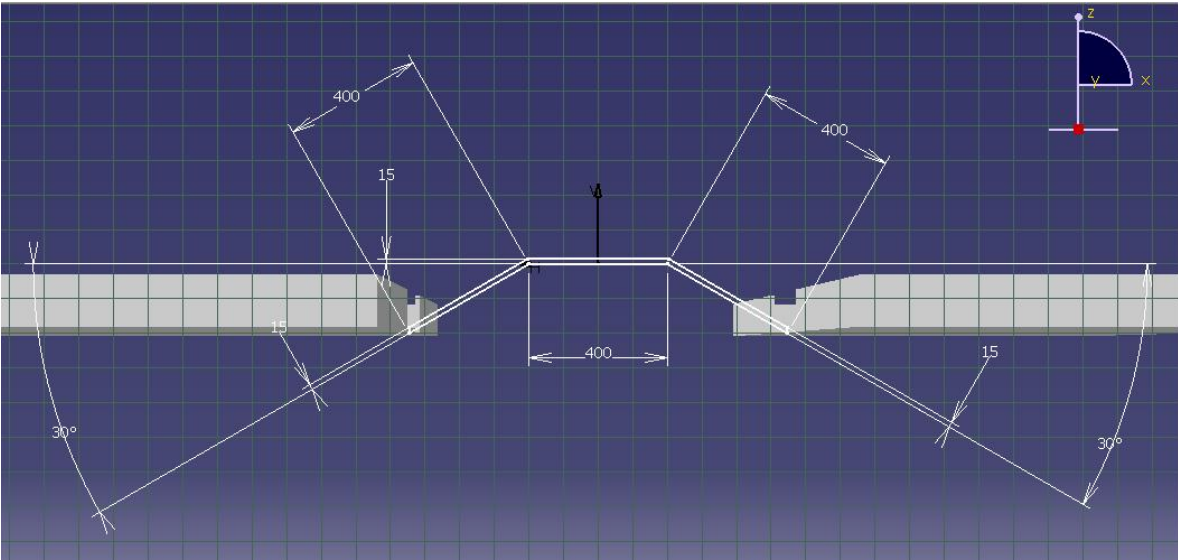
Arena specifications:

At the part of the spaceship, the stage will be a rectangular surface of 2m wide and 1.22m long.
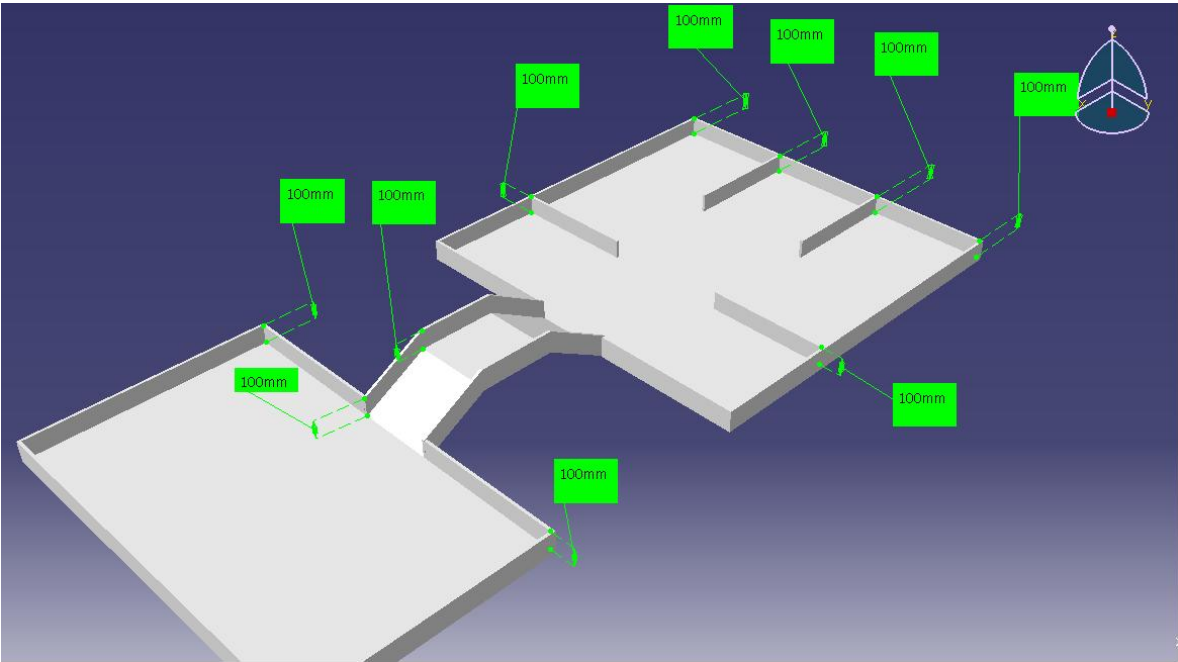
The spatial station area will be a square area of 2m per side.
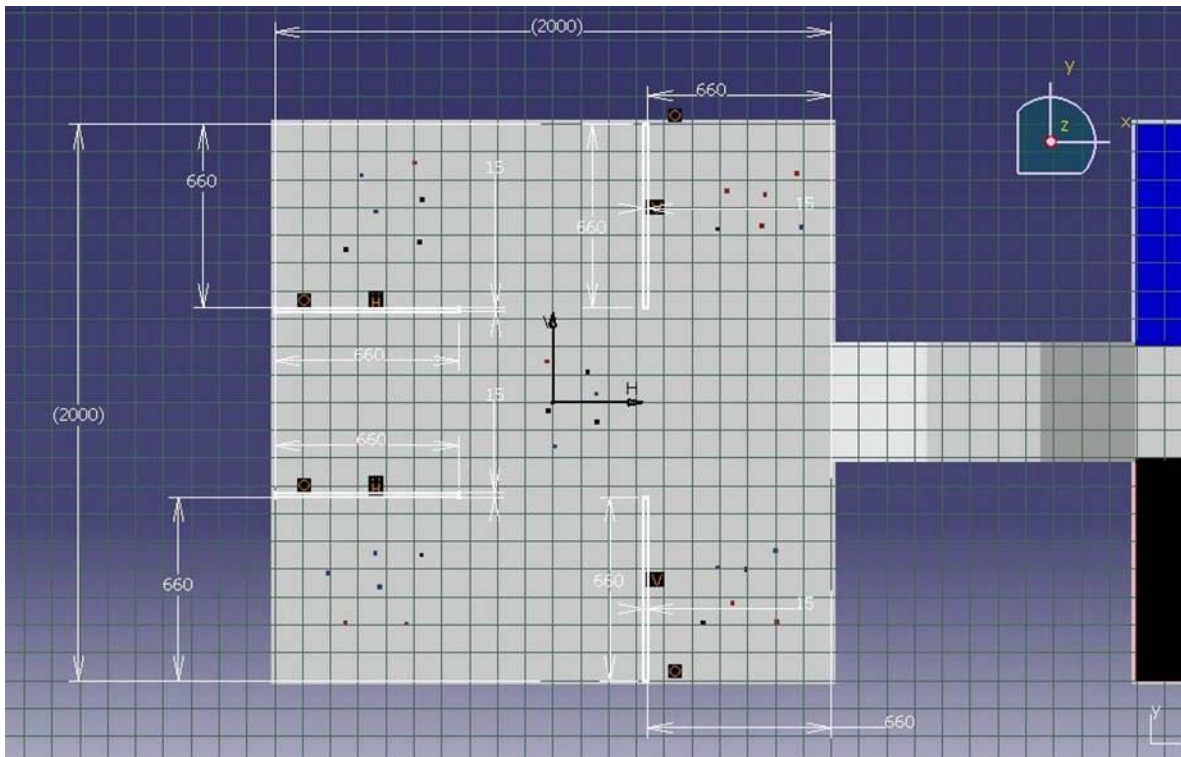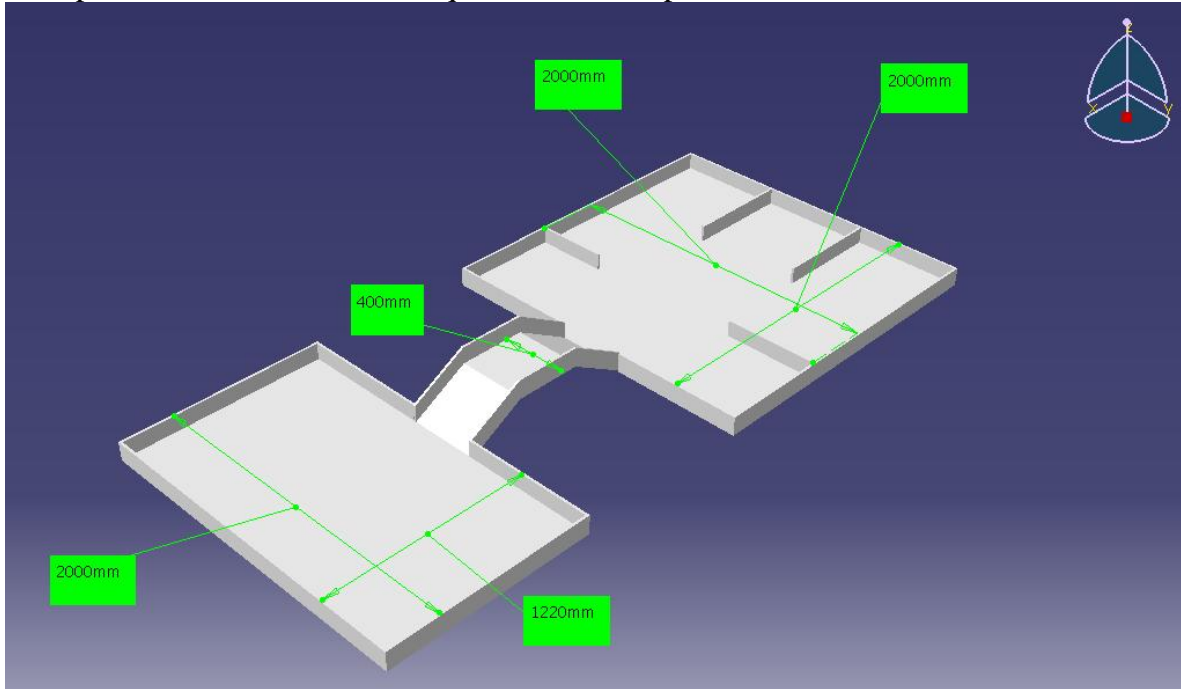
Bridge measures:

All walls must be 10cm high.

The dimensions are indicative ones and can vary some mm due to the thickness of the event's table.