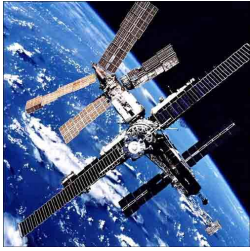


Prelude

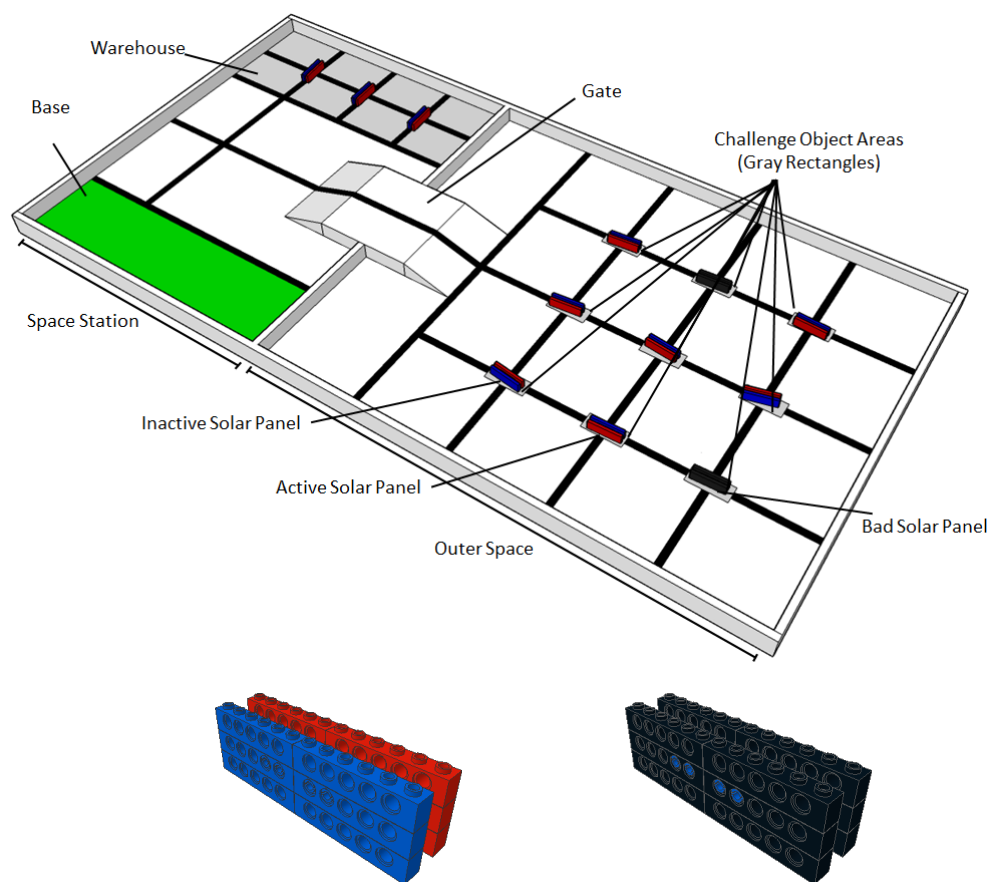


Yuri Gagarin is the first cosmonaut. He is the first human who visited outer space on the spacecraft Vostok 1 on April 12, 1961. The flight took just 108 minutes; the craft had limited amount of resources to sustain life. After that scientist and engineers from entire world started thinking of solution how to allow space stations to stay longer on the Earth orbit.

The most important thing every spacecraft needs to be equipped by is energy. Energy is used to power all electronic hardware on the board, to illuminate the spacecraft and to regenerate air and water for the space crew. There are several possible ways to get energy on a space station. One is big fields of solar panels around the station, another is to include a special module containing nuclear power plant. In both cases it is important to maintain this equipment otherwise absence of energy is the threat of life safety on the space station.

Challenge Overview

The robot begins in the Base area. The robot will have to pass through the Gate into Outer Space, check for bad Solar Panels (black color) and replace them with good ones from the Warehouse in the Space Station. The robot also needs to discover and activate inactive Colored Solar Panels. The robot must return in the Base zone after completing the task.



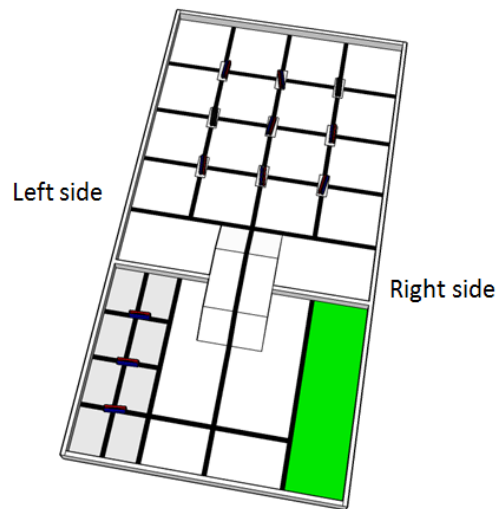
Colored Solar Panel represents electronic components in good conditions.

Bad Solar Panel represents faulty components.

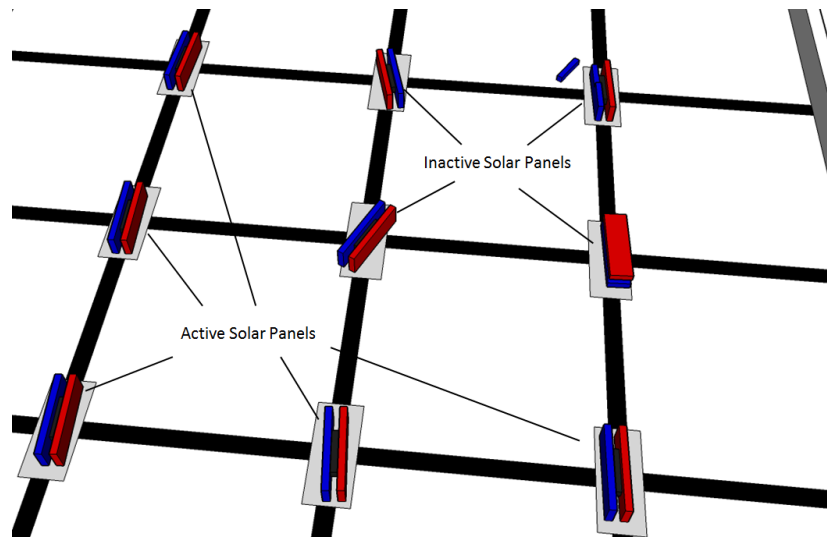
Rules & Regulation

1. The number of bad and inactive Panels is determined in the competition day before assembly time. In order to do this 5 Colored Solar Panels, 3 Bad Solar Panels and 3 Colored Solar Panels which represents inactive components ($5+3+3=11$ Panels in total) are put in a non-transparent box. After that two Panels are taken from the box one after another. The Panels remaining in the box will be used in all rounds during this competition day.

2. Before the round starts (post-quarantine) the Panels are taken from the box one after another and put to the Challenge Objects Areas (grey rectangles) on the field from left to right top-down. The Panels representing inactive components are set by their red side directed to the left side of the table, the active Panels are set by their blue side directed to the left side of the table. The positions of good and bad Solar Panels will be fixed for all participants in that particular round. This method to determine the Panels positions will be made for every round during the competition day.



3. Multiple programs in the robot are allowed. For scoring rounds, the participants are only allowed to choose a program and press the enter button to run it. Participants are not allowed to make any additional input or setting to the chosen program.
4. The robot begins in the Base area (green zone) and finishes in the same area.
5. The robot must start within the Base area. The robot must be placed completely in the Base area.
6. The robot must switch on inactive Solar Panels - perform a 180-degree turn. A Panel must be completely in the Grey Square area after this operation.
7. The robot must discover and replace faulty Solar Panels by the good Solar Panels from the Warehouse.
8. The replaced bad Solar Panels must be transported to the Space Station area or to the Warehouse area.
9. The robot is not allowed to throw the Panels over the barrier delimiting the Space Station from the Outer Space area. Such kind of Panels are not considered in the final scoring.
10. Scoring for the bad Solar Panels transportation to the Space Station area or to the Warehouse area will be done only if the bad Solar Panels are completely in the corresponding zone.
11. The robot must use the Gate to move to the Outer Space area (or return to the Space Station area). The robot must be in the zone during the passing of the Gate. The robot is not allowed to climb over the barrier. Any part of robot can touch the barrier during the passing of the Gate.
12. All good Solar Panels must be completely in the corresponding Grey Squares areas. Only one Panel is allowed to be in every Grey Square area.
13. Additional points will be added if there is just nine active Solar Panels in the Outer Space area after the finish.
14. If the robot moves an good/activated Solar Panel from the zone or drops a Solar Panel during the movement even if it is completely in the zone, these Panels considered as inactive.
15. If an good/activated Solar Panel loses one or more LEGO-elements, this Panel considered as inactive.



16. The attempt and time will end if:

- The robot enters to the Base area (it is enough to be [in the zone](#)).
- Any team member touches any object on the field or the robot after the attempt starts.
- Challenge time (2 minutes) has ended.
- The participant call for "Stop" of the match.
- Violation of the rules and regulations herein.

Scoring

1. Score will only be calculated at the end of the challenge or when time stops.
2. A Solar Panel is activated (stay in vertical position, its red side is facing right and the blue side is facing left at the end of the challenge) and [completely](#) in the Grey Square area = 10 points per panel (90 points max).
3. To get the "Activate Solar Panel Score" (2) the robot must at least have activated one of the inactive panels in the Outer Space area
4. Transportation of a bad Solar Panel in the Space Station area (but not in the Warehouse area) = 10 points per panel.
5. Transportation of a bad Solar Panel in the Warehouse area = 30 points per panel.
6. Replacement of a bad Solar Panel with a good one picked up from the Warehouse area = 20 points per panel.
7. There are no other Solar Panels in the Outer Space area besides 9 activated Solar Panels = 20 points
8. The robot finishes in the Base area (after activating one of the inactive Solar Panel or replacing one of bad Solar Panels) = 10 points
9. Maximum score = 300 points.

Activated Solar Panels (90 points max)	Replaced bad Solar Panels (60 points max, depends on the draw)	Bad Solar Panels brought to the Space Station area (but not in the Warehouse area) (30 points max, depends on the draw)	Bad Solar Panels brought to the Warehouse area (90 points max, depends on the draw)	9 activated Solar Panels are in the Outer Space area	Finish in Base
10 points per panel	20 points per panel	10 points per panel	30 points per panel	20 points	10 points

10. Scoring Example: there are 4 active Solar Panels, 2 inactive Solar Panels and 3 bad Solar Panels in the field.

The robot #1 picked all three good Solar Panels in the Warehouse, discovered the first inactive Solar Panel and activated it, discovered and activated the second inactive Solar Panel but the Panel was moved outside its Gray Square area during the activation process. Then the robot discovered all three bad Solar Panels and picked them up. Three good Solar Panels were unloaded from the robot but none of them were in the Gray Square area. All good Solar panels (active at the beginning of the round) remained on the same places. The robot unloaded the bad Panels in Base area and finished just after that.

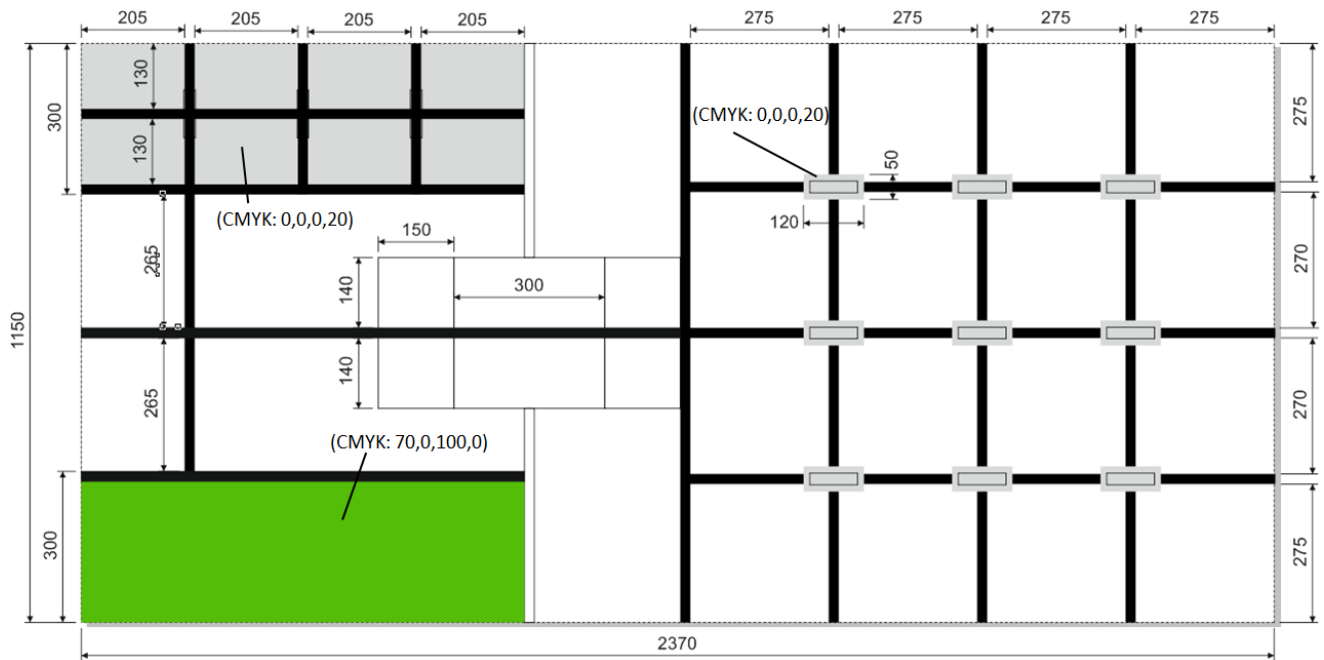
The robot #2 moved to the Outer Space area without visiting the Warehouse, discovered all two inactive Solar Panels and activated them. Discovered and picked all bad Solar Panels up. It moved back to the Space Station and unload the Panels outside the Warehouse area, picked up all good Panels from the Warehouse and transported them to the Outer Space. The time exceeded and all Panels remained inside the robot. All good Solar panels (active at the beginning of the round) remained on the same places.

The robot #3 picked all three good Solar Panels in the Warehouse, moved to the Outer Space and picked **ALL** Solar Panels. It threw all bad Panels over the barrier to the Warehouse and set successfully only 6 Solar Panels - one of them was placed on the same area where a bad Solar Panel situated before, other 3 Solar Panels were set incorrectly outside of the Gray Squares. The robot finished in the Base area.

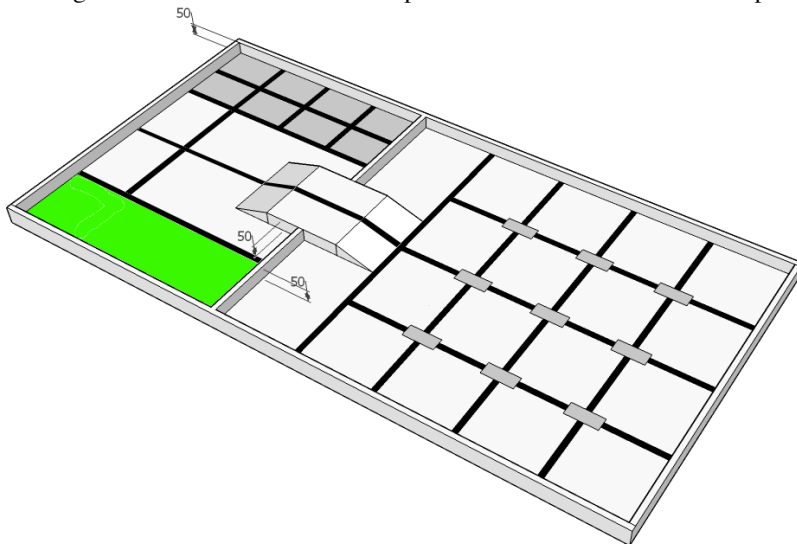
	Activated Solar Panels	Replaced bad Solar Panels	Bad Solar Panels moved from the Outer Space	9 activated Solar Panels are in the Outer Space	Finish in Base	Time	Total	Participant Signature
	10 points per panel, 90 points max	20 points per panel, 60 points max	10 or 30 points, 90 points max	0 or 20 points	0 or 10 points	120 seconds max	300 point max, depends on the draw	Signature means that the result is calculated correctly
Robot #1	50	0	30	20	10	84 sec	110	
Robot #2	60	0	30	0	0	120 sec	90	
Robot #3	60	20	0	20	10	115 sec	110	

Table Specification

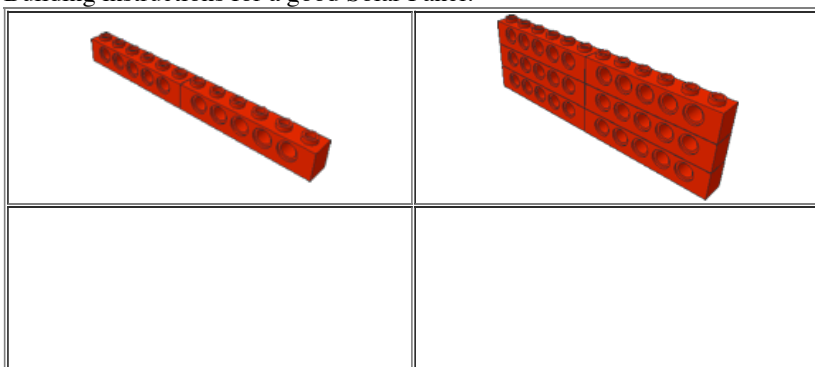
1. Horizontal Dimensions: 2370 mm × 1150 mm.
([download the mat in .ai](#))

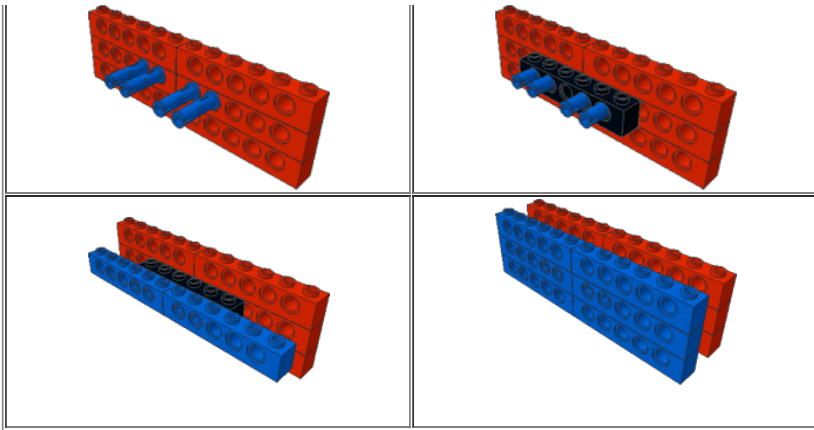


2. A wall that is 16 mm in width surrounds the table. The height of the wall is 50 mm.
3. The height of the barrier between the Space Station area and the Outer Space area is 50 mm.

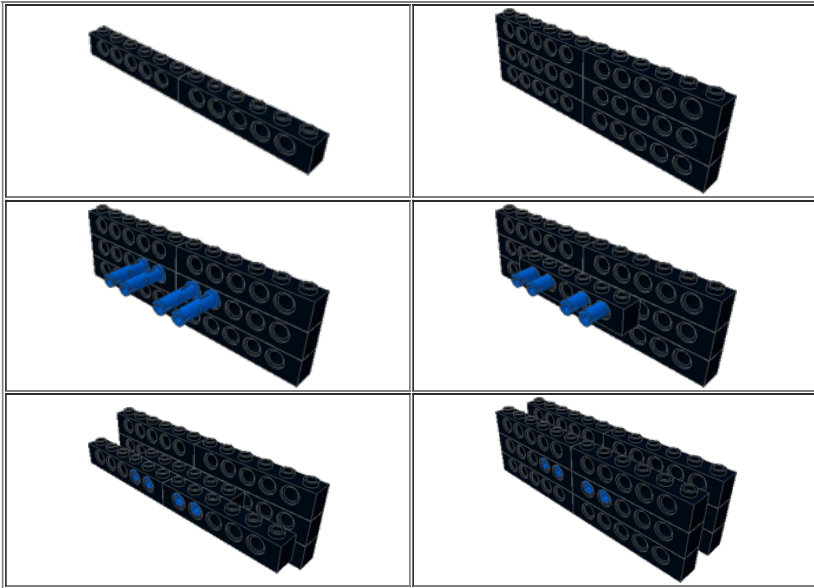


4. The width of the black line in the playing field area is 20 mm \pm 1 mm.
5. The part of the Gate that is in the Space Station area is considered as part of Space Station, another part of the Gate is considered as a part of the Outer Space area.
6. The table base color is white, except for the black line, Challenge Object Areas, Warehouse, and the Base area.
7. There are 9 rectangles in the Outer Space area that are 120 mm x 50 mm.
8. Three intersections of the black lines in the Warehouse are the places where the good Solar Panels are set at the beginning of every attempt.
9. The good Solar Panels are set in the Warehouse as so their red sides are in the Outer Space area direction.
10. The error tolerance of the field is \pm 10 mm.
11. Building instructions for a good Solar Panel.





12. Building instruction for a bad Solar Panel.



Comments

1. [All materials](#)