GAR 2027 Space Technology - Lunar Exploration

GAR 2027 - Version B

1. Scope of Competition

1) Competition groups: primary school group (grade 1-3)
2) Number of participants: 1-3 contestants/team.
3) Coach: 1 person (optional).
4) Each person is limited to participating in 1 event and 1 team.
5) Group determination: based on the level of study of the contestants as determined by the local education administrative department (education committee, education department, education bureau).

2. Competition Theme

Space technology continuously pushes the boundaries of human engineering, driving iterative innovation across various cutting-edge fields; it serves as the fundamental pillar supporting deep-space engineering and the long-term development of the aerospace industry. As the celestial body closest to Earth, the Moon offers a natural, cost-effective, and highly valuable platform for the practical testing and validation of diverse deep-space systems.

Centered on the theme "Space Technology - Lunar Exploration", this robotics competition simulates the complex environments and scientific missions of lunar exploration, focusing on intelligent unmanned reconnaissance and autonomous operations. The event features core challenges such as lunar surface navigation and sampling, paying tribute to the spirit of aerospace through technological innovation and embarking on a new journey of deep-space exploration through ingenuity and practical action.

3. Competition Process

1) Registration. Contestants must register in the prescribed manner and within the specified time frame; successful registration qualifies them to participate in the competition.
2) Competition. Contestants compete within the allotted time, and first, second, and third-place prizes are awarded.

4. Competition Environment

1) Programming system: Use micro-brain programming.

2) Forbidden equipment: USB flash drives, mobile phones, tablets, intercom, etc.

3) Competition venue: The size of the competition map is 2362mm*1143mm.

The map images used in these rules are for illustrative purposes only; the actual dimensions, marked points, and the material, size, and weight of props for the competition map shall be as provided at the venue.



Map

4) Base: There are two bases, each measuring 1100mm * 250mm. During the competition, participating teams may stay within the base to adjust their equipment's structure and programming, or to temporarily store task-related prop modules.





5. Competition Equipment

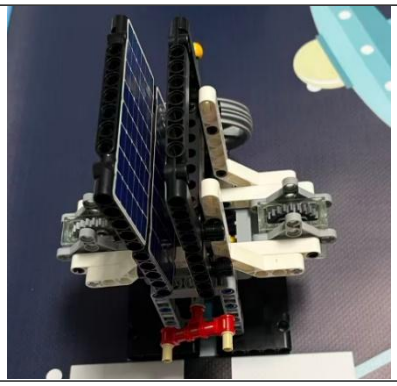
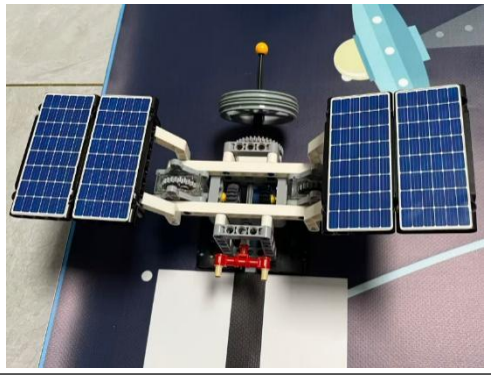
1) Each team is limited to one robot.
2) Before activation, the robot's maximum dimensions (length, width, and height) must not exceed 25cm x 25cm x 25cm; there are no size restrictions after activation.
3) Limited to 1 controller; the controller must include at least 2 motor ports and at least 2 sensor ports, and feature no fewer than 20 buttons on the controller unit itself.
4) The robot's structure must be built using plastic blocks based on the 8mm construction system.

6. Competition Tasks

Basic Tasks:

Task One: Solar Array Deployment Operation

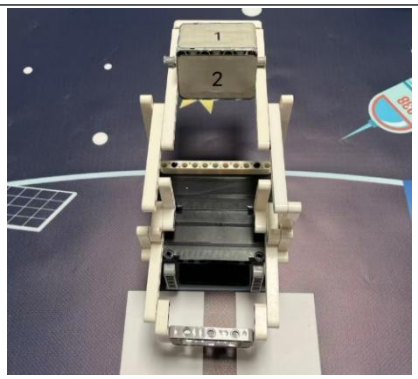
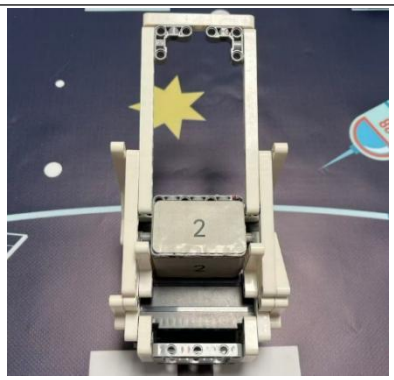
The simulated satellite arrives in lunar orbit, automatically unfolds its stowed solar arrays, and completes the deployment of the solar power generation system.

	
Initial Status	Completion Status

The satellite model is secured at position A. Initially, both of its solar wings are completely retracted. The task is considered successful—earning 30 points—if the robot triggers the model's deployment mechanism, causing both solar wings to fully extend (with each individual wing rotating by at least 90°).

Task Two: Obtaining Scientific Research Missions

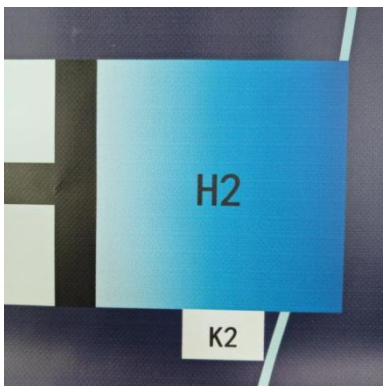
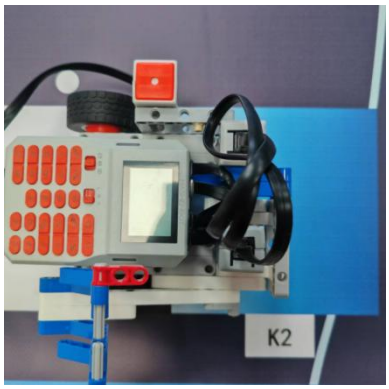
Arrive at the lunar surface command dispatch station to receive randomized scientific research missions, as well as ad-hoc exploration assignments issued from Earth, ensuring that lunar scientific research missions can be flexibly adjusted and advanced.

	
Initial Status	Completion Status

The command dispatch station model is fixed at position B. The robot must trigger the model to cause a task card to roll down onto the model's platform; the number facing upward on the task card indicates the assigned task. Successfully triggering the random-selection model so that a task card falls onto the platform earns 20 points.

Task Three: Polar Water-Ice Exploration

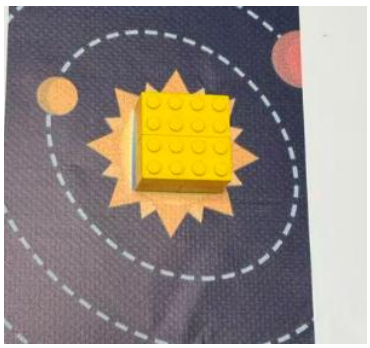
The permanently shadowed regions at the lunar north and south poles contain valuable water-ice resources. Since water can be broken down into rocket fuel and drinking water, identifying the locations of these water-ice deposits will provide essential data for selecting sites for future permanent lunar bases.

	
Initial Status	Completion Status

The exploration zone is determined based on the assigned task: if the number on the task card is 1, the target is Zone H1; if it is 2, the target is Zone H2. The robot must move to the designated exploration zone to perform an inspection and emit a feedback signal. The location of the single water-ice model (either K1 or K2) is determined by a draw conducted by the judges before debugging. If a water-ice model is present in the exploration zone, a red light will illuminate; if no water-ice model is present, a buzzer will emit a "beep-beep-beep" sound. A score of 20 points is awarded if the robot's vertical projection makes contact with the correct exploration zone and it emits the corresponding correct feedback signal.

Task Four: Lunar Soil Sampling

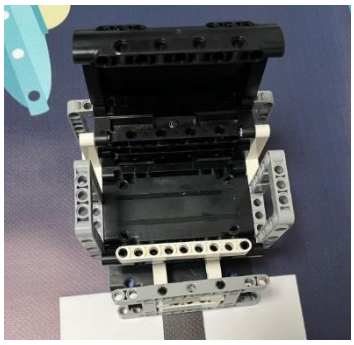
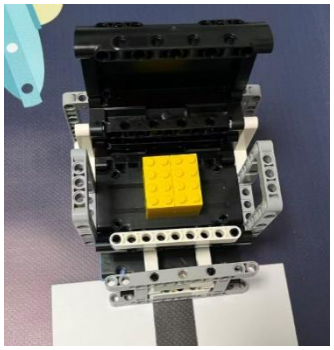
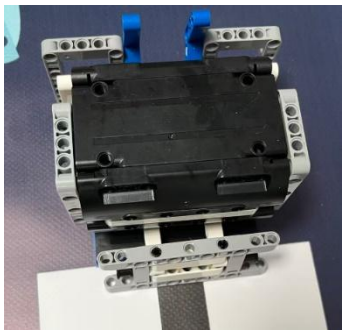
Lunar soil contains rare energy-related minerals such as Helium-3, which serve as key raw materials for energy development in deep space. Robotic systems are used to collect lunar soil samples, enabling in-situ sampling on the lunar surface.

	
Initial Status	Completion Status

There are two lunar soil models, placed at positions C1 and C2. The robot must transport these models back to the base; each model earns 20 points, provided its vertical projection lies entirely within the base area, for a maximum total of 40 points.

Task Five: Lunar Soil Analysis

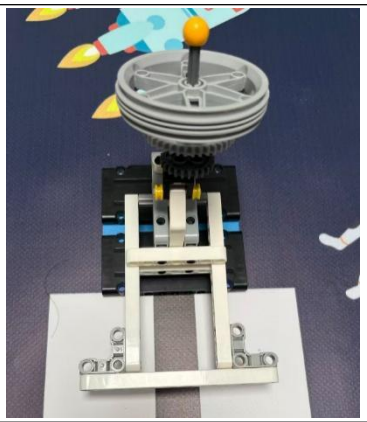
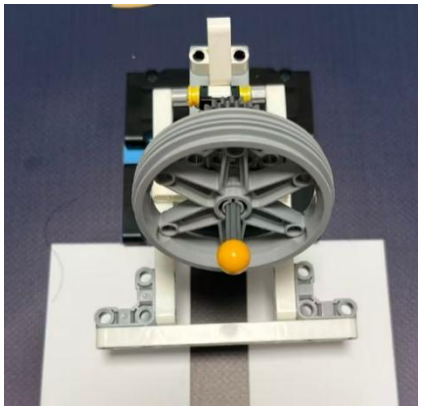
Once collected, lunar soil must undergo compositional analysis. This task simulates the laboratory testing procedures conducted on the lunar surface, verifying data on the soil's mineral content and moisture levels to determine whether the area is suitable for the construction of a scientific research base.

		
Initial Status	Placement Status	Completion Status

The detection unit is fixed at position D, and the device is initially open. The robot must select one of the collected lunar soil samples, place it into the detection unit, and then use the transmission mechanism to close the unit for analysis. Successfully placing the lunar soil sample completely inside the detection unit earns 20 points; successfully closing the detection unit completely earns another 20 points.

Task Six: Earth-Moon Base Station Networking

Since the far side of the Moon cannot communicate directly with Earth, relay communication base stations serve as the lifeline for data transmission between the two; by deploying base station modules, a stable communication link between Earth and the Moon can be established.

	
Initial Status	Completion Status

The base station model is fixed at position E. The robot must change the orientation of the signal emitter on the base station model. By triggering the model's transmission mechanism to successfully alter the orientation of the signal emitter, the robot earns 20 points.

Task Seven: Return to Base

The robot needs to return to base after completing an individual task.

	
Completion Status	Failure Status

When the robot completes the six tasks mentioned above, it must return to the base autonomously after finishing each task. For each return to the base, the robot's vertical projection must make contact with the base to earn 20 points; if the robot's vertical projection fails to make contact with the base upon any return, no points are awarded for that task.

Challenge Tasks:

There are 1 challenge task in total. The task models and scoring requirements will be announced prior to the on-site debugging phase.

7. Time and Frequency

Group	On-site Programming and Debugging Time	Task Duration	Task Frequency
Primary School Group (grade 1-3)	Confirmed by the on-site judge team	180s/times	2 times
1. On-site programming and debugging time: During this time, all participating teams in each group will perform programming and debugging uniformly. 2. Specified task time: The start and end time specified by the robot to complete the competition. If the competition is not completed within the specified time, the competition will be forced to end.			

8. Operation and End

8.1 Robot Operation

1) Robot Start-up and Operation: Robots must remain stationary before starting from the base. Initiating the robot by "pressing a button" is permitted; once started, the robot must operate autonomously.
2) No pauses are permitted within the time limit allotted for completing the task.
3) If any structural components detach from a robot during the allotted task time, the participants may retrieve the detached parts—provided that the robot's continued operation is not compromised—and continue using them.
4) Robots may not be replaced during a match (though functional structural components required for specific tasks may be swapped out). Modifications to a robot's structure or programming are permitted only while the robot is in the base.
5) The order in which participants compete will be determined by the judges on-site.

8.2 End of Competition

1) Complete all tasks within the allotted time.
2) The allotted time has ended.

9. Evaluation Criteria

9.1 Score Calculation

1) If only a portion of the task is completed within the allotted time, the score will be calculated based on the actual number of tasks completed.
2) The sum of the two scores will be taken.
3) The higher score will be ranked higher. If scores are tied, the shorter time will be ranked higher. If both scores and time are tied, the shorter number of restarts will be ranked higher. If all three are tied, the teams will be ranked tied.

9.2 No Awards

1) The contestant arrives more than 10 minutes late.

2) The contestant intentionally damages the competition venue.

3) The contestant fails to follow the instructions of the referee (or judges).

4) The contestant is absent from the competition.

5) The contestant receives a score of zero.

6) A complaint is filed against the contestant and is subsequently upheld.

7) The contestant participates in multiple competition categories.

8) The robot is operated via manual remote control after it has been started.

10. Related Notes

1) Each contestant is limited to participating in only one competition category. Duplicate or fraudulent registrations are strictly prohibited; any such instances discovered or reported will result in disqualification.

2) Contestants may form teams with students from the same institution or with students from other institutions within the same prefecture-level city. Forming teams across provincial or prefecture-level city boundaries is not permitted; any such instances discovered or reported will result in disqualification.

3) These rules serve as the basis for officiating. Judges have the final authority on all decisions during the competition. Any matters not covered by these rules shall be determined by the panel of judges.

GAR 2027 Space Technology - Lunar Exploration Competition Score Sheet

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Primary School Group (Grade 1-3)

Name: Contestant 1: Contestant 2: Contestant 3:			Group: Primary School Group (1-3)	
	Tasks	Score	Round 1 Scoring	Round 2 Scoring
1	Solar Array Deployment Operation	30		
2	Obtaining Scientific Research Missions	20		
3	Polar Water-Ice Exploration	20		
4	Lunar Soil Sampling	40		
5	Lunar Soil Analysis	40		
6	Earth-Moon Base Station Networking	20		
7	Return to Base	20		
8	Challenge Task 1			
	Restart Times		Times:_____	Times:_____
	Time	180s	_____min_____s	_____min_____s
	Total Score (max. 190 scores, not including challenge tasks' scores)			
Team Signature			**Judge Signature**	