SuperAI Super Track Competition 2023

Theme and Rules of "Star Alliance" Race

1. Introduction to 2023 Super Track Competition

In the year 2120 of the New Era, two interstellar exploration teams with Human Helios Project, after a long and arduous interstellar journey, met in the depths of the universe on the planet Y1799 and decided to build a prosperous and vibrant interstellar base for mankind on this beautiful and strange planet.

Through the construction of the necessary facilities for production and living, the new home has taken shape. To further improve production and living standards, they will form an interstellar alliance to protect the new home, and will drive a new ship through the stars to start a new round of interstellar exploration.

Through the construction of the necessary facilities for production and living in the early stage, the new homeland has begun to take shape. In order to further improve the production and living standards, human beings will form an interstellar alliance to jointly protect the new home, and will drive a new spaceship across the interstellar space to start a new round of interstellar exploration journey.

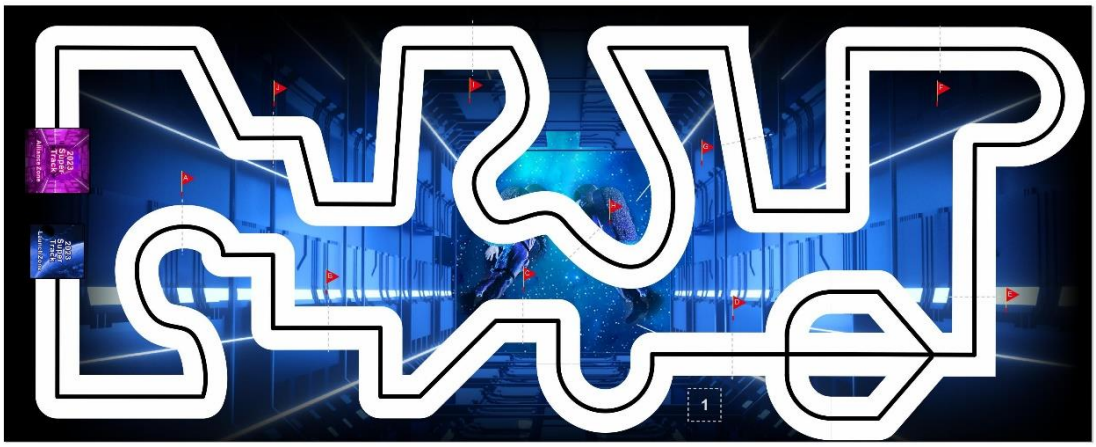
This competition requires young students to use self-made robots to write programs at the competition site, and to perform debugging and complete competition tasks. The theme of this competition is "Star Alliance". The process of interstellar exploration and alliance building will be presented in the form of tasks. While popularizing scientific knowledge, it will exercise and improve participants' thinking ability, response ability, hands-on coordination ability and team spirit.

2. Team Formation

The competition is divided into three groups: elementary school, middle school, and high school, and is completed in teams. Each team consists of 1 to 2 contestants and 1 to 2 tutors, and the contestants must be current students until June 2023.

3. Competition Arena

3.1 About the competition map



3.2 Specifications of the arena

3.2.1 The competition map is based on the one announced at the competition site, where the maximum field size is 5000mm long and 2000mm wide.

3.2.2 The competition map has an irregularly distributed flight path consisting of a black track line of 20mm to 30mm in width and a white background, and the flight path is the main area for robot activities.

3.2.3 On the left side of the map, there is a 250mm long and 250mm wide “Launch Zone” in blue, which is the area where the robot starts. The robot starts here to go to each mission area and reach the finish area after the match starts.

3.2.4 On the left side of the map, there is a 300mm long and 300mm wide “Alliance Zone” in red, which is the end zone where the robot will travel.

3.2.5 The flight path is distributed with one fixed mission area, which is marked with a symbol such as "1" and the corresponding mission model is fixed in the selected mission area by the referee.

3.3 The environment of the arena

3.3.1 Local power standard connections are provided at the competition site. If the team needs any voltage or frequency converter, please prepare it by yourself. The nearest power connector may be some distance away from the

designated debugging table of the team, so please bring your own sufficiently long power extension cable, and also pay attention to fixing and safety when using the extension cable at the site.

3.3.2 The competition site is equipped with daily lighting. The Organizing Committee of the competition does not guarantee that the site lighting will be absolutely constant. The site may have sunlight that varies with time, and may be affected by camera or camcorder flashes, fill lights or other unknown light of the event.

3.3.3 The map is laid on the race platform. The Organizing Committee tries its best to ensure the flatness of the laying map, but it does not exclude that it has folds or height difference of not more than 5mm. The stage is placed on the ground and may also be elevated.

4. Robot

4.1 Requirements for building equipment

The event requires contestants to design and build their own robots to complete the corresponding tasks, but the competition does not require on-site construction. Robots are limited to electronic parts with plastic shells, plastic building blocks, and no 3D printed parts.

All parts of the robot, except for the motor, battery box, sensor and camera, must not be screwed or welded together. Those who register for the competition are considered to have the final right of interpretation of these rules by the organizing committee by default.

4.2 Requirements for robot design

Items	Requirements
Quantity	Each team uses 1 robot.
Specification	The maximum size of the robot in the starting area is 25cm × 25cm × 50cm (L×W×H). After leaving the start-up area, the robot's mechanism can be extended.
Controller	Only one controller is allowed per robot. No more than 4 controller motor ports and no more than 8 input and output ports. Built-in 2.4 color LCD display.

Sensor	There is no limit to the type, number, and installation position of sensors allowed for the robot.
Motor	When motors are used for driving, there can only be a maximum of four motors providing driving force, and a single motor can only drive a single wheel that lands. There is no limit to the number of other motors used to assist in the task.
Structure	The robot must be built with design dimensions based on standard 10mm plastic building block parts, no 3D printed parts, no screws, screws, rivets, glue, tape, rubber bands or other auxiliary connecting materials.
Battery	Each robot must not exceed a rated input voltage of 9 volts and must not have a boost circuit. Competitors must use safe and reliable batteries, and the organizer reserves the right to require competitors to replace batteries that are deemed unsafe or a safety hazard.
Checking	**The robot is allowed to enter as a complete machine** prior to the first round of entry, but must pass a thorough inspection to ensure compliance with the regulations. Contestants should fix and improve any areas that do not meet the regulations before participating in the competition.

5. Description of the mission

There is an irregular flight path distributed on the field. The robot needs to start from the Launch Zone and follow the flight path, complete the tasks set on the flight path and arrive at the Alliance Zone to end the competition before the end of the competition.

Before the start of the competition, the referee team or the organizing committee will draw lots to decide the placement and direction of the task model. The main frame of the task model will refer to the task description schematic, and the construction of the actual competition task model may vary, such as the actual use of beams, pins and other structures of different colors, or slightly different sizes and heights.

Participants should have the ability to adjust to the actual situation, and once the location of the model has been determined, the model should be as identical

as possible for all sessions of the competition.

Throughout the competition, the robot will be required to complete various tasks along the flight path, and the vertical projection of the main structure of the machine must not be out of the flight path throughout the task.

5.1 Tasks of the robot

In the following robot tasks, "Alliance Route Planning" is an additional task. The judge will specify the flight path before the start of programming and debugging for the elementary school group, while the middle school and high school groups will be required to complete the task according to the standard, but the completion of the task will not affect the remaining time points.

The rest of the tasks are basic tasks, and the task area of the basic tasks are set according to the requirements of the task rules and the corresponding task area in the venue. The task of "Space-Time Energy Transfer" is only set for the middle school and high school groups.

5.1.1 Successful Launching (Basic Task)

5.1.1.1 The robot leaves the Launch Zone.

5.1.1.2 Complete separation of the robot's vertical projection from the Launch Zone during the start phase (recorded only once per round of the competition task) is scored 25 points per robot out of 50 points.

5.1.2 Flight Path (Basic Task)

5.1.2.1 On the flight path of the entire field, there are a number of dividing lines perpendicular to the flight path, dividing the entire flight path into several flight path areas, which are marked in alphabetical order with "A, B, C" next to the dividing lines. There may be a section of colored flight paths for the junior and senior groups.

5.1.2.2 The robot must move forward in the direction of the flight path throughout the mission, except for a short period of time when the robot is moving off the current flight path for the purpose of completing the mission and reversing (after completion, it must return to the off-line position and continue driving).

5.1.2.3 If any of the robot's drive wheels touches the dividing line of a flight

path, 5 points are recorded out of 50.

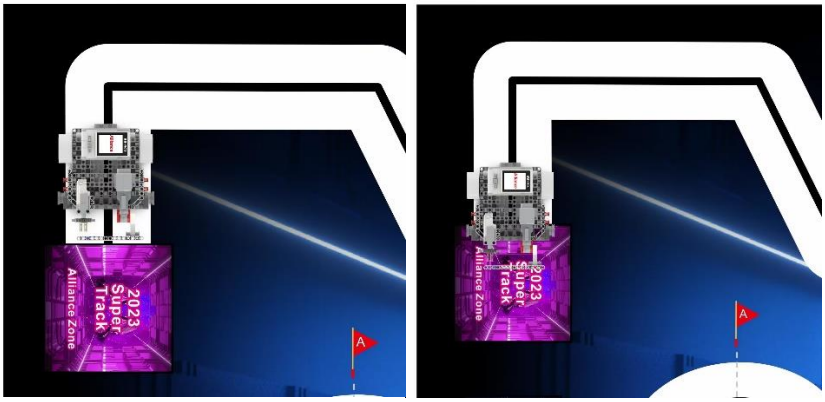
Diagram: Dividing line of flight path

5.1.3 Alliance Victory Reunion (Basic Task)

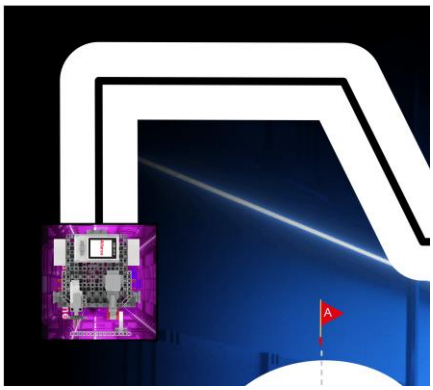
5.1.3.1 The robot travels along the flight path and finally reaches the alliance area.

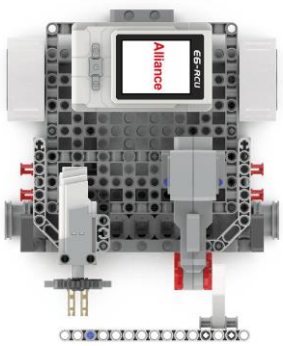
5.1.3.2 Before the timing ends, if the vertical projection of the robot completely enters the alliance area, 50 points will be scored. If the vertical projection part enters the league zone, 20 points will be scored.

5.1.3.3 When the robot enters the alliance area, the controller screen must clearly display the "Alliance" font in red on a white background, and 20 points will be added.



The state of the robot not entering and partially entering the alliance zone





The state of completely entering the alliance zone, the pattern displayed on the screen

5.1.4 Activate the Alliance System (Basic Task)

5.1.4.1 The task model for activating the alliance system is mainly composed of a sensor module and a control module. The robot needs to use a magnetic card module with data to touch the sensor module to activate the alliance system.

5.1.4.2 When the system is activated, the control system will display the X mark and score 50 points.

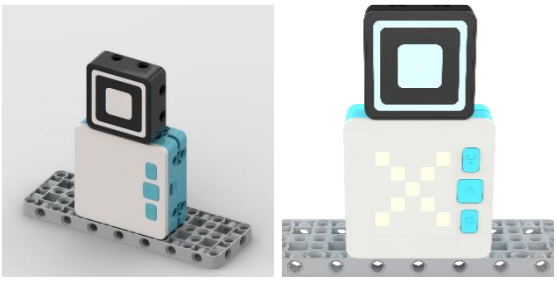


Diagram: the state of the task model

(The Alliance System is not activated and it is activated.)

5.1.5 Space-Time Energy Transfer (Basic Task)

5.1.5.1 The task model consists of a turning handle (vertical downward), a wheel and 2 to 3 energy blocks. The primary school group does not set this task, the junior high school group places 2 energy blocks, and the high school group places 3 energy blocks.

5.1.5.2 The energy blocks are worn on the roulette, and the robot needs to turn the handle to make the roulette rotate and drive the energy blocks to fall.

5.1.5.3 If one energy block does not touch the roulette wheel, 20 points will be scored.

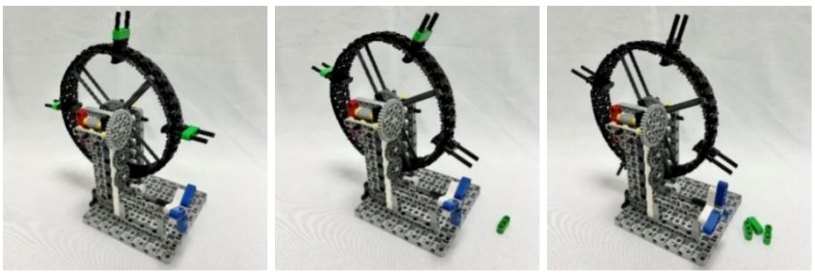


Diagram: the state of “Space-Time Energy Transfer” model

5.1.6 Alliance Route Planning (Additional Task)

5.1.6.1 The site map has an alliance route area consisting of three flight paths and a fixed task area 1. The mission model of the alliance route planning

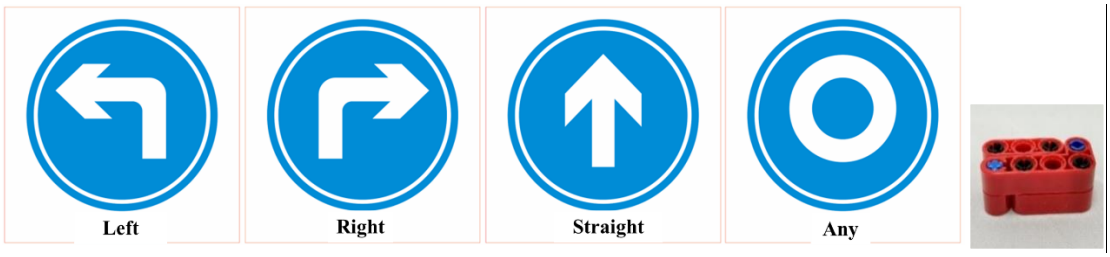
is fixed in mission area 1 and faces the adjacent flight paths. The black track lines of the three flight paths intersected with the marker lines and each had one obstacle that could be moved.

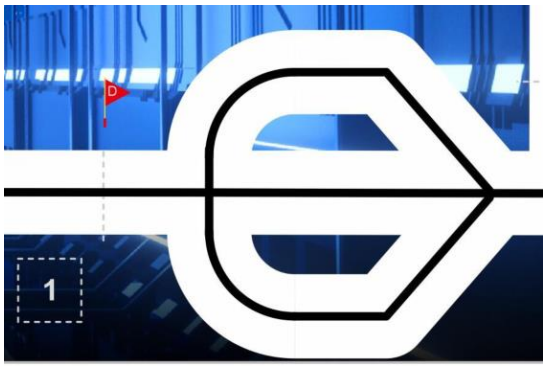
5.1.6.2 The cubes of the alliance route planning task model are respectively set with four types of patterns: left, right, straight, and any (three routes are acceptable).

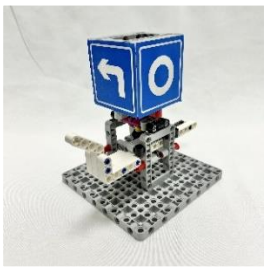
5.1.6.3 The robots in the middle school group and the high school group need to pull out the joystick to make the cube rotate more than one circle, and randomly display a pattern. The pattern perpendicular to the direction in which the joystick is pulled out is the effective pattern, and the robot can adjust the task model appropriately by vibrating it. Otherwise, the mission fails (the mission model has magnets, which will correct the pattern panel by vibrating). The pattern of cubes facing the flight path specifies which flight path the robot needs to follow.

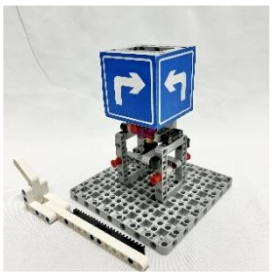
5.1.6.4 For the elementary school group, the judges will randomly designate a flight path to pass before the programming debugging starts.

5.1.6.5 If the robot travels along the flight path corresponding to the pattern on the front of the cube, and the obstacles on the flight path leave the meeting point, 60 points will be scored. Only one obstacle is allowed to be moved, otherwise no points are scored.









5.2 Randomness of tasks

Except for the "Alliance Route Planning" task, the positions of the "Activate Alliance System" and "Space-Time Energy Transmission" task models are not fixed, and the position and direction of the task will be determined by the referee drawing lots before programming and debugging starts. Once the location and orientation are determined, the task model locations for the same group are kept consistent across all epochs.

5.3 Duration

The duration of a single round is 180 seconds.

5.4 Remaining Time Score

Only when all the basic tasks and random tasks set by this group get full marks within the specified time can the "Remaining Time Score" be obtained. After the game is over, the contestants should immediately signal the referee to stop the timing. Seconds of the remaining time will be converted to minutes of the remaining time. (Take the integer part of the remaining time, such as 2 seconds for 2.97 seconds, and 10 seconds for 10.3 seconds.)

6. The Process of Competition

6.1 Order of participation

The competition is a points competition, not divided into preliminary and final rounds. Participating teams will draw lots on site to determine the grouping and order of participation, and the teams will take turns to play in the order determined by the lottery, and the organizing committee will ensure that different teams of the same group have the same opportunity to play, generally not less than two rounds. When the previous team starts the competition, the next team will be notified to wait for the preparation. Teams that do not show up within the specified time will be considered as abandoning the competition.

6.2 Programming and Debugging

Teams will have at least 90 minutes to build and debug their robot before the first round begins. After the first round, teams will have at least 30 minutes for the second round of debugging. The judging team may adjust the debugging time according to the actual situation and will announce it to all teams before each round of debugging.

Team members are required to line up in an orderly manner for programming and debugging in accordance with the order of the competition, and teams not following the order may be disqualified from the competition. After programming and debugging, all teams will be required to place their robots in the judge's designated location and seal them, and team members will not be allowed to touch the robots without permission, or they will be disqualified.

After the referee signals the start of the competition, teams that are still not ready will lose the opportunity to compete in this round, but will not be affected in the next round.

6.3 Preparation before the race

When preparing to play, players take their own robots and enter the competition area under the leadership of referees or staff. Teams that do not show up within the specified time will be deemed to have abstained. Student players stand near the Launch Zone when they enter the field. The team members put the robot into the Launch Zone by themselves. At this time, any part of the robot and its projection on the ground cannot exceed the Launch Zone.

6.4 Starting the Robot

6.4.1 After the referee confirms that the team is ready, he/she will issue a countdown start command of "3, 2, 1, start". As the countdown begins, the team can slowly approach the robot with their hands and, upon hearing the first word of the "Start" command, the team can touch a physical button on the controller to start the robot.

6.4.2 Starting the robot before the "start" command is considered a "false start" and will result in a warning or penalty. Once the robot is started, the team member may not touch the robot (except in the case of a reset).

6.4.3 The activated robot must not separate parts or drop mechanical parts on the field. Robot parts that fall off accidentally will be cleared out of the field by the referee at any time. It is against the law to separate parts for the sake of strategy. If the activated robot completely crosses the boundary of the field due to excessive speed or program errors, or throws the objects it carries out of the field, the robot and the objects cannot return to the field.

6.5 Reset

The following situations require the robot to be reset back to the start zone:

(1) The player applies to the referee for reset;

(2) When the robot completes the task, it becomes stuck;

(3) The robot leaves the competition field;

(4) Players touch task models or robots without permission;

(5) The robot destroys the task device.

(6) The robot is offline.

Every time a reset occurs, the total score will be reduced by 10 points, up to a maximum of 100 points.

When resetting the robot back to the starting area, all mission models on the corresponding flight path of the robot (except the Alliance Victory Reunion task) need to be restored to the initial state; the reset process will not suspend the timing.

6.6 Offline

The vertical projection of the main body of the robot (that is, the state before departure in the starting area) must not deviate from the flight path throughout the mission, otherwise it will be judged as reset.

6.7 End of the competition

The following conditions of the competing teams will be stopped by the referee's whistle and the time will be recorded.

(1) The robot fails to perform the task and is unable to continue with subsequent tasks;

(2) The team completes the "alliance rendezvous" task;

(3) The clock reaches 180 seconds.

(4) The team signals to the referee to end the competition;

6.8 Final Score

The single game score of the team is to be calculated after each game. The single game score is the sum of the task score, the remaining time score, and the reset deduction score. The task score is based on the final state of the model at the end of the game, and is scored based on the task completion criteria, as

described in section 5.1. The remaining time score is the number of seconds of time left at the end of the game. Only the full score of all basic tasks and random tasks set in this group can be attached to the remaining time score. After all rounds are completed, the sum of each individual score will be used as the total score of the team.

6.9 Ranking

After all matches in a particular category are completed, the teams are ranked according to their total points. In the event of a partial tie, ties will be broken in the following order:

(1) The team with fewer total resets in both rounds is ranked first.

(2) The team with the higher score in a single round will be ranked first.

(3) The one with the lower total time spent in both rounds is ranked first.

(4) The robot with the lower number of motors and sensors combined is ranked first.

7. Violations

7.1 Each team is allowed one robot "false start" per round, and the second offense will result in 0 points for the round if it is a team competition, and a direct elimination for the final round.

7.2 If a contestant touches objects or robots on the field after the contest has started without the permission of the referee, he/she will receive a warning for the first time and 0 points for the second time.

7.3 Any tutor or parent who gives oral instructions to a contestant that affects the contest, or who participates in building and debugging tasks, or who touches or fixes the work, etc., will be given a score of 0 for the round if found guilty.

7.4 A robot may not intentionally separate parts or drop parts on the field for strategic reasons after it has been started, as this is a foul, and a warning will be given by the referee, and a second foul will result in a score of 0 points for the round.

7.5 Contestants who do not follow the instructions of the referee will be warned, given a 0 point in the preliminary round, eliminated from the final round, or even disqualified from the event, depending on the severity of the situation, as determined by the referee.

Appendix 1.

Scoring Sheet - Star Alliance

Team： _____ **Group：** _____

Basic Task			
Task	**Score**	**Round 1**	**Round 2**
Successful Launching	50 points for leaving the Launch Zone		
Flight Path	5 points for each touch of a marked line, out of 50 points		
Alliance Victory Reunion	20 points for entering the projection part; 50 points for fully entering		
	The screen displays "Alliance" correctly, score 20 points		
Activate the Alliance System System	If the control module successfully displays "X", score 50 points		
Space-Time Energy Transfer	When the energy block falls and touches the field, score 20 points/piece		
Additional Task（Does not affect remaining time score）			
Alliance Route Planning	Correct obstacle removed, score 60 points		
Remaining time minutes (=180-completion time) (1 minute/second) (basically full marks)			
Reset point deduction (-10 points/time, up to 100 points deducted)			
Score for a single round (=task points + remaining time points + reset deductions)			
Total Score			

Referee： _____ **Constants：** _____

Flight Path Marker

Round	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
First										
Second										