

2025 MARC -Designer – Space Power Ranger

2024.12.26 v1

The MARC (Master AI Robot Cup) – Designer Tournament includes a presentation (or written review) and a competition. Teams are required to build a robot using the MATRIX Metal Kit and create a project proposal from their R&D process to present to the judges during the oral presentation. The competition is a collaborative event where two teams work together to accomplish a designated task, earning points in the process. Within the given time limit, alliances are required to gather space energy cubes from the playfield and earn points by successfully placing them in the alliance base. Teams could gain additional points by occupying the landing zones or maneuvering their opponents' alliance robots out of the field. The alliance that earns more points in this way accumulates points for the round. The team with the highest score becomes the leading team and gets to choose a partner team to compete in the Alliance Elimination Match.

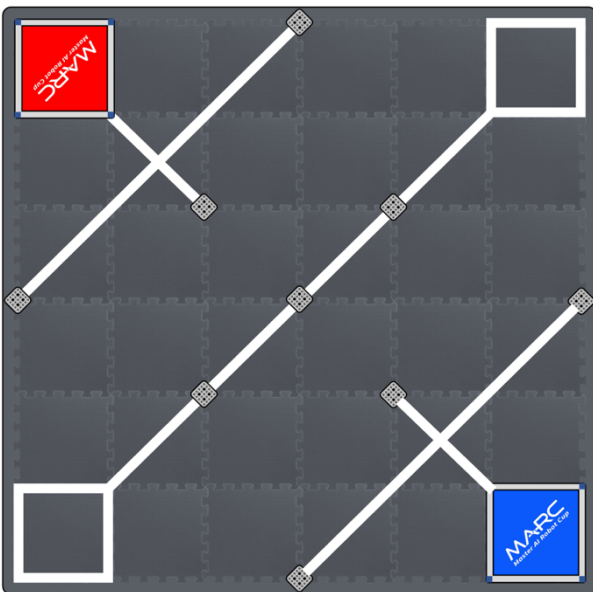


Figure 1-1. Game Field of Group A.

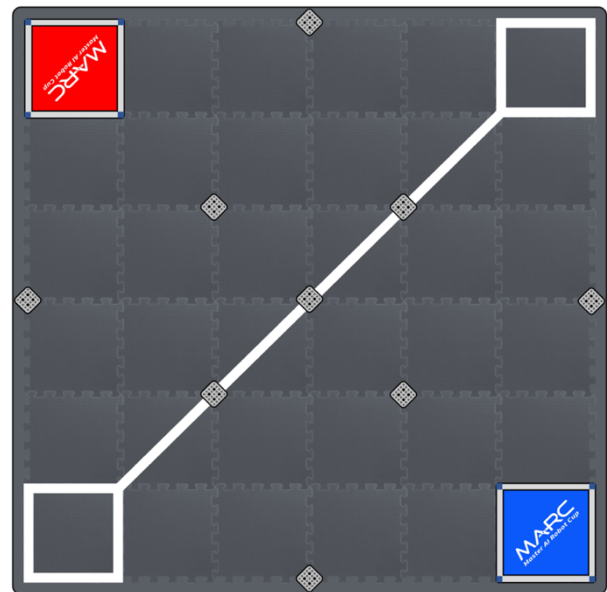


Figure 1-2. Game Field of Group B.

Eligibility and Programs

Grouping of Levels:

- Group A: Elementary school students from 1st grade to 1st grade in junior high school (7 to 13 years old).
 - (Team members may form teams across schools and grades)
- Group B: Junior high school to senior high school students (14 to 18 years old).
 - (Team members may form teams across schools and grades)

Team size:

- 2-4 students who are in the appropriate grade level or corresponding age for the group.

Mentor:

- Must be 18+, limited to 1~2 people, and can teach across schools.

*Note: 1 student and 1 mentor are not considered a team and will not be able to compete.

[Presentation format]

- A. The total presentation time for each team is 5 minutes, including 1.5 minutes for the team report, and the rest of the time is for evaluation and consultation. The presentation will be evaluated according to the contents of the "Robot Mechanism and Strategy Explanation" and the "Project Proposal".
- B. The project proposal includes "Scoring Strategy", "Team Communication" and "Mechanical Design" and is limited to a total of four pages (excluding the cover page and table of contents).
 1. Scoring Strategy:
 - 1.1. Specify the scoring method used in the exploration period (autonomous phase), the corresponding functions between the hardware and the program code, such as which sensor (lens) is used to track or sense the target object, and a screenshot of the program can be attached.
 - 1.2. Please explain the joystick button function configuration during the snatching and occupation period (remote control phase).
 - 1.3. Please explain the scoring strategies for the three periods in a single round, and analyze what accidents may happen to the car during the process and how to deal with it?
 2. Team Communication: Describe how your team will be divided up (offensive and defensive responsibilities) within your team for a game.
 3. Mechanical Design: What robot designs have you developed for the robot in

relation to the rules and tasks outlined in this competition?

- Attempt to address various aspects such as the chassis framework, arms, grippers, cargo container, counterweights, sensors, and lenses. Visual aids such as pictures and photos can be utilized for presentations.

C. MATRIX Opinion Leader (MOL) Submission:

- This project is the basis for the independent award selection of the alliance group enterprise awards. It is not included in the preliminary scoring content. Teams are free to choose whether to participate.
- Teams interested in participating please share in the MATRIX Robo Community (FB community) Posts that are beneficial to the development and promotion of this robot competition, STEAM or AI education (with photos or videos), use your influence to let more people know about this competition and robot education.
- The content is not limited to the robots participating in the team, it can also be other MATRIX works created by your team, production experience sharing, innovative ideas or gameplay.
- The selection method will be based on the number of likes of a single post. Teams can submit multiple posts and continue to submit and vote until the day before the physical finals.

[Competition Rules]

A. Competition Structure Explanation

1. This is an alliance competition. The schedule will be established and disclosed by the organizers on the tournament day. After check-in, participating teams will draw lots to determine their team numbers, partners, and opponents for the alliance points competition.
2. If a team is temporarily absent on the day, the schedule may be temporarily changed before the game or the team number vacancies in the lottery may be backfilled starting from the team with the last number in the lottery. If there are still insufficient spots after backfilling, the team to be added to the substitute match will be designated by lottery.
3. The Alliance system will be divided into two kinds of matches, Qualification Match and Elimination Match. In both the Qualification Match and Elimination Match, teams will ally with each other to engage in competition. They will contend for tasks involving robot movement and vie for space energy cubes by devising mechanisms for offensive and defensive maneuvers. The robots will be controlled autonomously through programming or remotely via remote control.
4. The alliance achieving the highest score in a single round of the Qualification Match is declared the winner and is awarded 3 points. In the event of a tie, where both alliances have the same score, each team receives 1 point, while the losing team obtains 0 points. (see section 3 for more details on alliance scoring).
5. Each team must play at least 4 Alliance Qualification Matches. If a team must participate in more than 4 Alliance Qualification Matches due to the competition system, the team can choose the best 4 matches from the participated matches for the total points.
6. The team captains will be selected based on the overall alliance point standings, and the team captains will select their teammates to participate in the alliance playoffs. The top 50% of the teams in the alliance points ranking will be eligible to participate in the alliance selection. In case of a tie in total points, rankings will be determined by the total number of scores earned in each alliance qualification matches. If a tie persists, the team with the lower average robot weight will be ranked higher.
7. The Alliance Elimination Round consists of three matches, the first Alliance to win two matches win the round. In the event of a tie after the three matches, additional matches will be played until one Alliance is the first to win two

matches.

8. If the total number of teams does not reach 24, the two teams with the highest ranking in alliance qualification matches will be the Team Captains. They have the privilege of selecting one team from the top 50% of the alliance qualification ranking to advance to the Grand Final.
9. If the total number of teams reaches 24 or more, the four teams with the highest ranking in the alliance qualification matches will assume the role of Alliance Captains for the Alliance Semi-Finals. Each Alliance will consist of three teams, and rotations will be observed during the matches. In each match, the Blue Alliance must determine the robot to compete first and position it on the field unless the Red Alliance decides to go first.
 - The priority sequence for alliance captains in selecting allies, based on points ranking, is as follows: 1st round: 1 -> 2 -> 3 -> 4; 2nd round: 4 -> 3 -> 2 -> 1. The matchups are: 1st alliance vs. 4th alliance (with the winning alliance becoming the red alliance in the final), 2nd alliance vs. 3rd alliance (with the winning alliance becoming the blue alliance in the final).
 - In the final round, the blue alliance will choose to deploy the robot first and position it. The ultimate round will take place between the two victorious alliances.
10. The alliance captain can choose a team whose points ranking is lower than his own. If the selected team rejects the alliance invitation, it cannot be selected by other teams. If the team that refuses the alliance invitation is not the alliance captain or does not have a replacement alliance captain, it will be withdrawn from the alliance candidate list. Teams that are not selected for any league will not be able to enter the subsequent league finals.

B. Competition Rules

1. The playing field consists of a mat with squares for the Red and Blue Alliances, placed on opposite ends along one of the diagonals of the field (see Figures 1-1, 1-2 and 6).
2. The other white square boxed area at either end of the diagonals of the field is the landing zone, and the two landing zones are connected by a white center field line (see Figure 1-1, 1-2).
3. There are nine mining towers in the field (see Figure 4), which serve as platforms for space energy cubes (see Figure 5).
4. The three mining towers in the alliance half of Group A and the alliance base are connected by a set of white cross tracks as tracking auxiliary lines (see Figure 1-1, 3-1)
5. Field Set Up: All mining towers set one energy cubes (see Figure 3-1, 3-2)
6. The backs of the two alliance bases will be marked with the corresponding color of the alliance area, and players must operate their joysticks within the alliance area, and may not leave the area during the competition, except if permitted by the competition rules.
7. Two teams will form an alliance, so each alliance will have two robots to compete.
8. Before the start of the timer, each alliance's robot must not be extended beyond the specified size and must partially touch its own alliance base.
9. A single match lasts 2.5 minutes and divided into 3 phases: the first 30 seconds is the exploration period, followed by a 2-minute scramble period, and the last 30 seconds of the scramble period is the occupation period.
10. Competition Format: Both groups will engage in autonomous robot mode during the exploration period. The team joystick needs to be placed on the ground in your own alliance area. At the start of the competition, teams are required to press the green triangle button on the joystick. Once activated with a single touch, the robot cannot be manipulated with the joystick until the ready period beeps. Control over the robot can only resume when the competition period beeps.
11. The projection of robot in the exploration period may not touch the white center line of the field, the landing zone, the mining tower on the center line, or the energy cube above it, otherwise alliance get penalty.
12. Teams need to clip energy cube in the field and place it on own alliance base within the time limit, while avoiding being pushed out of the square mats by their opponents and try to occupy the landing zone as possible.
13. Each robot can only move one Energy Cube at a time. Alliance get penalty if

two Energy Cubes are in your possession at the same time.

14. Energy Cubes that are complete in the opponent's base cannot be seized again.
15. Each robot has a Reset Card, which allows an existing robot to reenter the field from the nearest landing zone.
16. If the robot is pushed out or falls out of the square mat, the field is incapacitated, and the team has the option of either not moving the robot and putting down the remote control or presenting a reset card and moving the robot to the nearest landing zone by the team itself for re-entry.
17. When a robot is placed in the landing zone for reset, there will be a 3-second buffer time to be free from interference from other robots, opponent robots that touching the resetting robot or pushing it out of the field during the readout period get penalty (except in the case of a forced situation).
18. Reset Cards cannot be used during the Exploration Period and Occupation Period.
19. The reset card that has been submitted to the referee will not be returned regardless of whether the robot is successfully reset.
20. If an Energy Cube falls out of the field, it will be placed on the nearest Landing Zone box line with the assistance of the Referee, with no pause in time.
21. Upon complete entry of the Cube into the base:
 - If your team unintentionally pushes the Cube out of the base and out of the field, it should be positioned on the nearest landing zone frame line.
 - If the opposing team accidentally pushes the Cube out of the base, the referee will return it to the base.
22. During the scramble period, robots can continue to collect cubes to the base or try to push their opponents out of the field, or they can begin to take over the landing zone.
23. If there is no further scoring or point changes, time ends early.

C. Score/Penalty & Game result

[Score]

1. When the end of the exploration period, each cube successfully placed in the base earn 200 points.
2. When the end of the match, each cube successfully placed in the base earn 100 points. Scores of sections 1 and 2 are calculated independently. For example, if a cube is successfully placed during the exploration period, and the cube is still on the base at the end of the match, the team will get $200+100=300$ points for this cube).
3. Robots that fall over or are pushed out of the square mats will result in the opposing alliance receiving 50 points.
4. At the end of the occupation period, when the bell rings, the robots project at least part of their contact onto the landing zone, and each robot is awarded 100 points.
5. After the occupation period ends, if your team's robots are in both landing zones, you get 100 extra points.
6. Each reset card used is worth 50 points to the opponent's alliance.

[Penalty]

1. If you hold more than two cubes at a time and score points in that situation, you will incur a total deduction of 250 points—100 points for each extra cube and an additional 150 points for each square scored in violation of the rules.
2. 100 points will be deducted if the robot is projected to touch the center line or the tower on the center line but does not touch any object in the team's half of the field during the scouting period.
3. 300 points will be deducted if a robot is projected to touch the center line or a tower on the center line and touches an object in the team's half of the field (cube, opponent's robot) during the exploration period.
4. Touch an opponent's robot that is resetting, and the reset robot doesn't fall out of the field, 100 points will be deducted.
5. Contacting an opponent's robot that is resetting causes it to fall out of the field, deducting 300 points.

[Game result]

1. At the end of the 2:30 period, the team with the highest alliance score wins, or if both teams have the same alliance score, the game is tie.
2. If time expires and neither team has scored and both teams have lost the ability to move, the game is considered a tie.

D. Playfield and Props Size

1. Site Configuration:

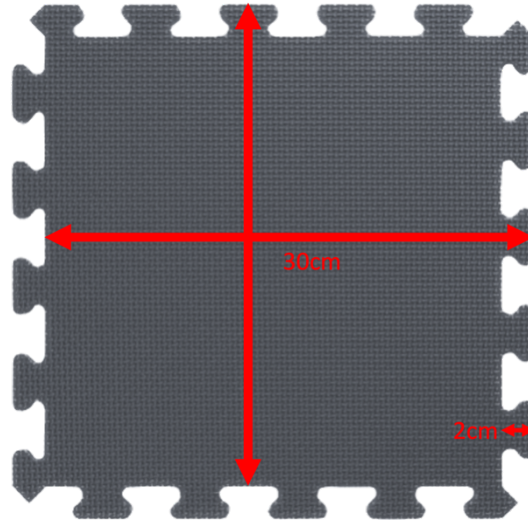


Figure 2. Single EVA mat

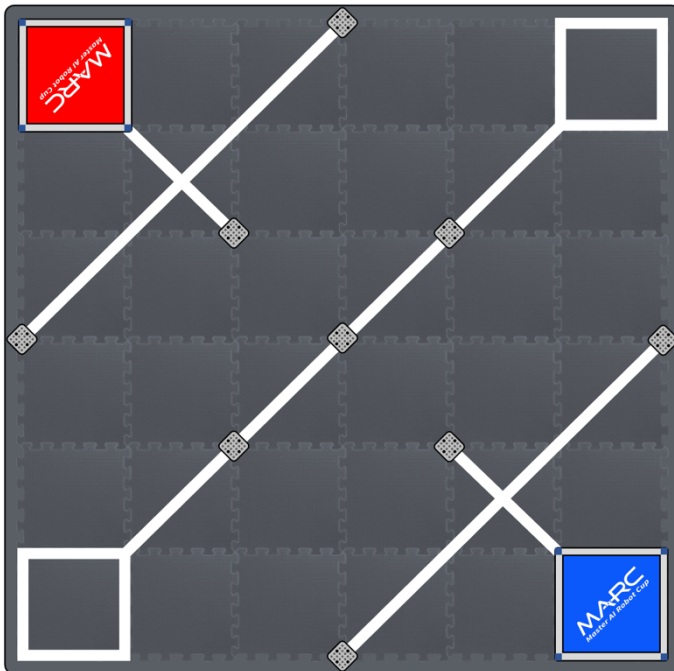


Figure 3-1. Initial Configuration of the Group A.

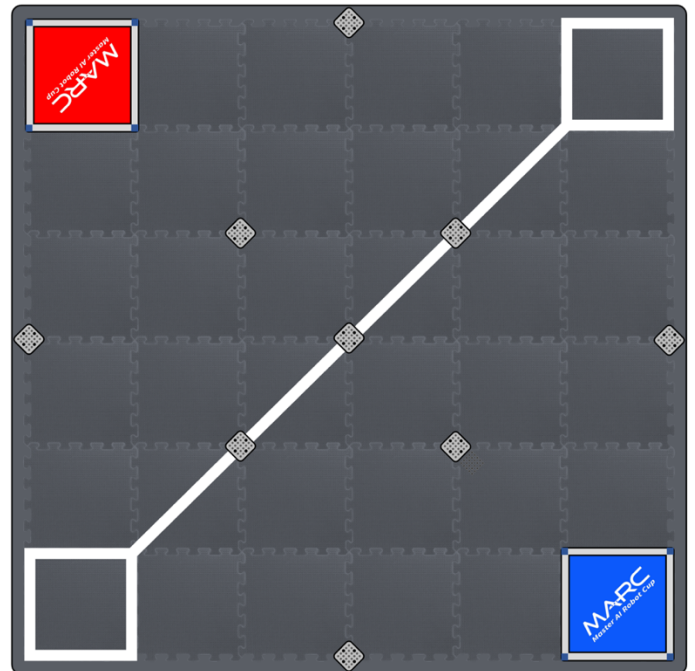


Figure 3-2. Initial Configuration of the Group B.

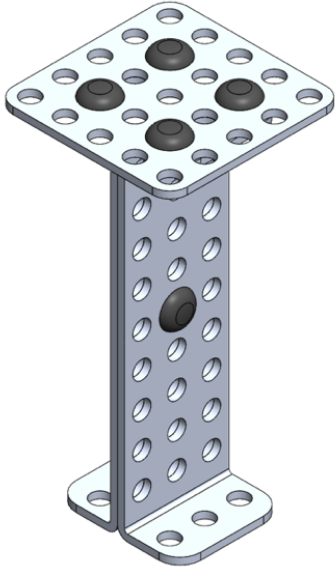


Fig. 4. Mining platform

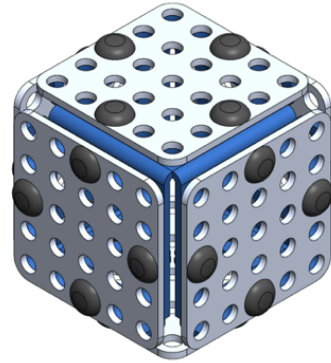


Fig. 5. Space energy cube

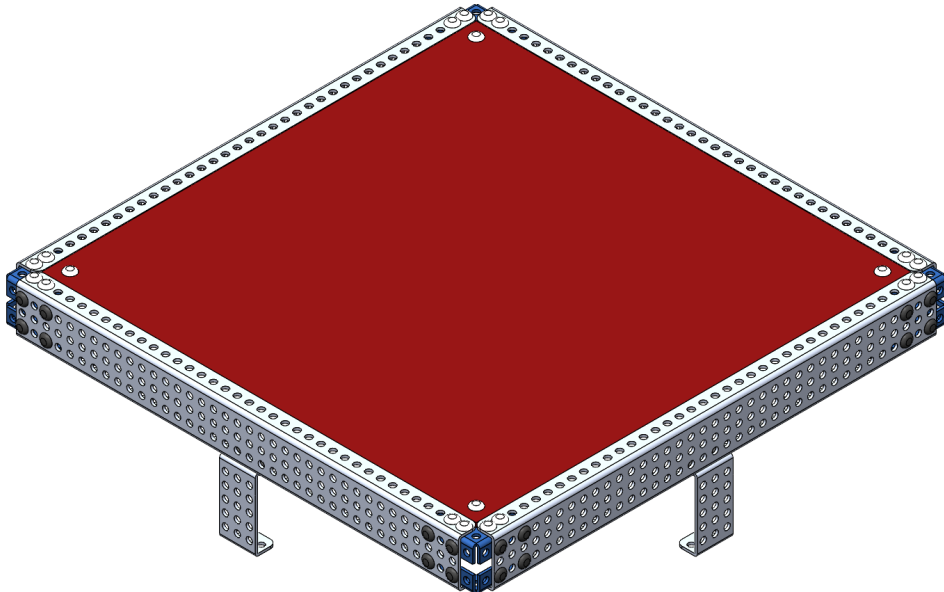


Figure 6. Alliance Base (Red)

2. The playfield measures 188 cm long x 188 cm wide and is made of black EVA mats with a length of 30 cm, a thickness of 3 cm, a density of 30 D and an embossed surface, arranged with homogeneous edging strips.
3. Alliance Base: made of MATRIX parts and acrylic panels, 32 cm long and wide, 5 cm high above the field.
4. Landing zone: 32 cm square in length and width, with 3.6 cm wide white ground sticker tape.
5. Center line: connect the two landing zones with 3.6 cm wide white ground tape.
6. Tracking line (only used by Group A): Cross-connect the mining tower and alliance base in the half field, using 3.6 cm wide white ground tape.
7. Mining tower: made of MATRIX parts, square plane at the top measuring 4.2 x 4.2 cm and 5 cm above the field.
8. Energy cube: made of MATRIX parts, 4.8 x 4.8 x 4.8 cm (5.2 x 5.2 x 5.2 cm with pin bumps).

E. Robot Restrictions

1. Length, Width, Height/Weight: Initial state length 32cm, width 32cm, height unlimited, upper limit 1800g.
2. The controller is limited to one MATRIX Mini V2.4 or one MATRIX R4 V1.0. The use of the expansion hub/controller is prohibited.
3. All power sources for the robot can only be supplied by one battery pack of 12V or less.
4. The battery pack powering the controller must be properly secured.
5. Except for the dedicated battery pack for controller power supply, other batteries cannot be used on the robot (including counterweights or other purposes).
6. Power motors for robot moving are limited to two motors (MATRIX TT motor or MATRIX TT encoder motor) / operating voltage is limited to 5V.
7. The servo motor limits the maximum torque to 25 kg-cm (5V). (This is the tolerated configuration of a single servo motor and a single micro servo motor on the competition study example machine. If you need to configure multiple servo motors, please evaluate whether the relevant equipment specifications and quantity exceed the controller's operating limit).
8. The number of sensors, cameras, TT motors, servos and their specifications must comply with the upper limit of the controller.
9. The joystick is limited to one set of MATRIX MJ2.
10. The use of metal parts for the main structure of the chassis and frame is

restricted, and the use of one-piece molded frames is not permitted.

11. The rest of the jaws, motor mounts, and housings can be made by 3D printing and laser cutting. (Does not include commercially available modular plastic building brick parts)
12. The use of water, fire, gas, and the installation of sharp objects (e.g. hammers, razor blades, etc.) are prohibited.
13. Only one robot can be used. Spare robots are not allowed and must be presented in bulk.

F. Team Awards

1. Winning Alliance: 2 teams (3 teams awarded when the total number of teams reaches 24 or more)
2. Finalist Alliance: 2 teams (3 teams awarded if total number of teams is 24 or more)
3. Honorable mention: 6 teams +
4. MATRIX Award: Selection will be based on MOL submissions. The quota will be increased or vacant based on the actual participation.

G. The Board of Directors reserves the right to amend the Rules and Regulations, and the actual situation will be subject to on-site announcement.