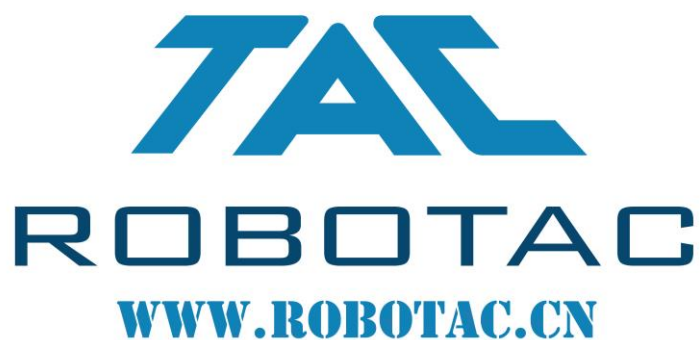


**16th China University Robot
Competition
Robotac 2017**



Game Rules

1.11

January 2017

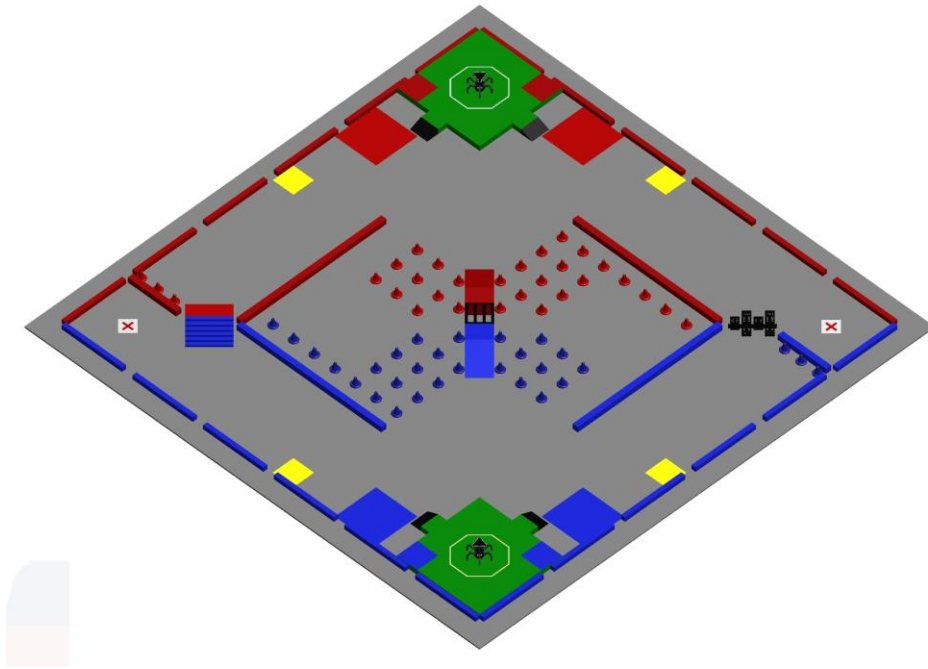


Fig. A Game Field

1 Game Description

1.1 Robotac is a competition between two teams, RED and BLUE. During the game, robots of each team cross obstacles while attacking the opponent robots and fortress. The team that gets the higher score wins the game.

1.2 All robots must carry “Life Post” provided by the organization committee. The Life Post has 3 ranks which indicate the blood volume of the robot. When a robot is attacked, its blood volume will be reduced one rank. The robot “falls in battle” if it loses all ranks and will be automatically powered off.

1.3 Each match lasts 3 minutes.

2 Game Field

2.1 Dimensions and Ground

The game is played on a 12000mm×12000mm foam-mat, surrounded by fence segments of 120mm×120mm×1750mm. Please refer to the Fig. 1 in the Field and Objects Figures. Its Fig. 2 shows an isometric view of the field, and Fig. 3 shows the size of the fence segment in detail.

The game field consists of two uplands and two defense zones for RED and BLUE teams, and the field is covered by foam field tiles with dimension of 600mm×600mm×12mm, as shown in Fig. 4 of the

Field and Objects Figures.

2.2 Upland

Two uplands, measured at 2400mm×2400mm×135mm each, sit on two corners of the game field that share the same diagonal. The upland surface is covered by green foam tiles of 600mm×600mm×12mm. The autonomous robots of each team defend their own upland. Each upland has two autonomous start zones of 600mm×600mm.

Two rubber slopes, weighing 13kg±0.4kg each, of 500mm×320mm×135mm and 2 piers of 500mm×250mm×135mm, as shown in Fig. 5 of the Field and Objects Figures, connect the upland to the game field ground, as shown in Fig.1. Robots may travel up to and down from the upland through the slope and pier. Before the game starts, the pier fills the gap between the slope and the upland. The piers are not fixed onto the field ground, and the defending robots can remove any pier from its original position to prevent the opponent robots from entering the upland. The advancing robots can fill the gap again with pier to enter the upland.

A fortress with six-legs is positioned at the center of the upland. Its maximum diameter and height is measured in 600mm and 300mm respectively, as shown in Fig. 6 of the Field and Objects Figures. The fortress can be attacked by the opponent robots and the team's own robots have to defend it and prevent it from the opponent attacking. The fortress will flash for 10 seconds after being hit to confirm a valid attack. At this time, any other hit will not be counted as a valid attack. In the center of upland, an octagon with an inscribed circle of 1200mm in diameter is marked by white line of 30mm in width.

The fortress equipped with a sensor is provided by the organization committee. The sensor's sensitivity can be considered as "OK" in such a way: when a "shell" falls down from 300mm above the fortress freely and hits it, the sensor will be triggered to confirm the attack, and when the free fall is from 150mm or less, the sensor will not be triggered.

2.3 Defense zone

The diagonal of the field without uplands divides the game field into two parts, called as defense zones for RED and BLUE teams respectively.

In each defense zone, there is a manual robot start zone of 1200mm×1200mm and a shell loading zone of 600mm×600mm.

Two defense zones are connected by four channels through which the robots can travel to the opponent side. Each team can choose anyone of four channels according to their robot characteristics and game strategy.

(1) Seesaw

It is made of painted metal sheet, measured in 600mm×200mm. There are four seesaws spaced in 40 mm. The highest point is 175mm above ground, as shown in Fig.7.

(2) Staircase

It is made of foam PU+PU leatheroid, six steps, measured in 1000mm×600mm×300mm totally, as shown in Fig.8

(3) Broken bridge

It is comprised of slopes and span structure. Two slopes, measured in 1325mm×600mm each, are positioned onto the ground with a gap of 500mm between them. The slopes are made of foam PU and PU leatheroid. The span structure is made of hollow-carved metal sheet with 120mm spacing, and its two ends are attached to the slopes with double faced adhesive tape. Each team can build a whole bridge using a foam tile (600mm×600mm, provided by the team). On both sides of the bridge there are 2 two-way doors, as shown in Fig.9.

(4) Forest

An array arranged by plastic piles, 30 RED and 30 BLUE, with 240mm in diameter, of 230mm in height, and 600mm in center distance, used to simulate the forest. The size of the plastic piles is shown in Fig.10.

(5) Healing Station

In each defense zone, there is a manual robot healing station. The manual robot can only be transfused on its own healing station. For every 10 seconds in the healing zone, it adds one rank of blood volume until the rank reaches to the maximum.

The seesaw and forest, as well as the staircase and forest, are separated by a foam PU+PU leatheroid insulator of 150mm×150mm×1400mm, as shown in Fig.11.

All segments, piles, slopes and staircase are fixed onto the field ground using dual-lock tapes.

3 Game Objects

3.1 Life Post

The life posts provided by the organization are measured in 230mm×65mm×15mm and angled 45 degrees to the horizontal plane. When it is hit in any direction, the blood volume indicator will display that the blood volume is deduced one rank. It uses accelerometers to sense the hitting, whose sensitivity is calibrated by the organization committee. Additional hits within 3 seconds after the initial hit are invalid

and will not be counted. After the robot loses all 3 ranks, the robot is “killed” and will be automatically powered off. Each team will fix the life post to designated location according to the organization committee instruction, and ensure the robot is powered through it. The blood volume indicator connecting to the life post has the same shape as the life post.

Any change and setting to the life posts and blood volume indicators are strictly prohibited. Their installation and performance will be inspected by the organization committee prior to the game.

3.2 Shell

The shell will be provided by the organization committee. It is a rubber ball 54mm in diameter and 44g(±3g) in mass. 25 shells will be provided for each team, and some of them can be preloaded on any manual robot or multiple manual robots before the game starts. The rest will be left in the loading zone for loading in the game. Each team can load the shell after the game starts. The shells are not exclusive for both teams in the game and robots can pick up any shells in the field and shoot them again during the game. For safety, the effective shooting range of the shell must not exceed 10m. Prior to the game, the launch mechanism must be inspected and approved by the organization committee.

4 Robots

Each team can design and build multiple robots according to its own strategy. The organization committee will inspect each robot prior to the game. Any robot that fails to comply with the game rules will be prohibited to the game.

4.1 Autonomous Robots

The number of the team’s autonomous robots is not limited, if the total weight is within the limitation. Before and after the game starts, the dimensions of robots in the autonomous start zone must not exceed 600mm×600mm×300mm and the robots must be in the start zone at the same time. The autonomous robots do not carry any life post or shell launch device. They must carry LED a strip, RED or BLUE, fixed in any location to show the team’s color. They can prevent their own fortress from being attacked, attack the opponent fortress, and remove piers to the upland to prevent the opponent manual robot from entering the upland. But, the mode that they “cuddle” the fortress to protect it is not allowed.

Any communication between autonomous robots and manual robots is prohibited. Before the game, the autonomous robots will be inspected individually. They must perform all actions according to preprogrammed procedures without the manual robots or a remote controller. Their new movement during the game will be considered as result of communication between autonomous and manual robots.

4.2 Manual Robots

The manual robots can be wheeled or tracked vehicles, as well as humanoid/bionic robots. Each team can choose its own remote control method freely and must avoid interference.

4.2.1 Manual Vehicle-type Robot

Each team can have up to 3 manual vehicle-type robots. At any time, the size of each manual vehicle robot must not exceed $600\text{mm} \times 600\text{mm} \times 1200\text{mm}$. The total weight of all manual vehicle-type robots must be less than 27kg. They may be equipped with launch or other attacking mechanisms to strike the opponent robots or fortress. These mechanisms are considered parts of the robot and cannot be separated from the robots.

Prior to the game, each team must designate one manual robot to mount a video transmitter module together with a camera provided by the organization committee for live video transmission. The module weight does not count into the robot total weight.

The transmitter must securely attach to a supporting surface on the robot.

The dimensions of the video transmitter together with camera and battery do not exceed $85\text{mm} \times 70\text{mm} \times 50\text{mm}$, excluding the antenna, as shown in Fig. B.



Fig. B Video transmitter module

A life post provided by the organization committee must be installed on each manual vehicle-type robot in a designated position. The life post uses XT60 plugs, and the following requirements must be satisfied:

(1) Installation

A mounting base of the life post and blood volume indicator provided by the organization committee must rigidly connect to the robot body. Any modification to the base and life post is prohibited.

The base must be mounted at the center of the vehicle-type robot's rear edge, with a height of 60mm~160mm to the ground, as shown in Fig. C.

The blood volume indicator base must be mounted on both sides of the robot, as shown in Fig. D.

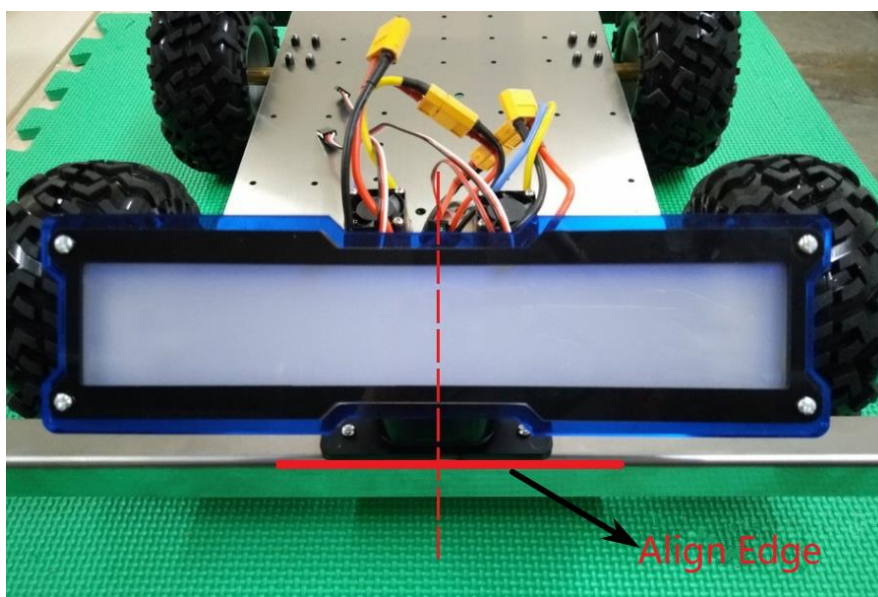


Fig. C Installation position of life post base

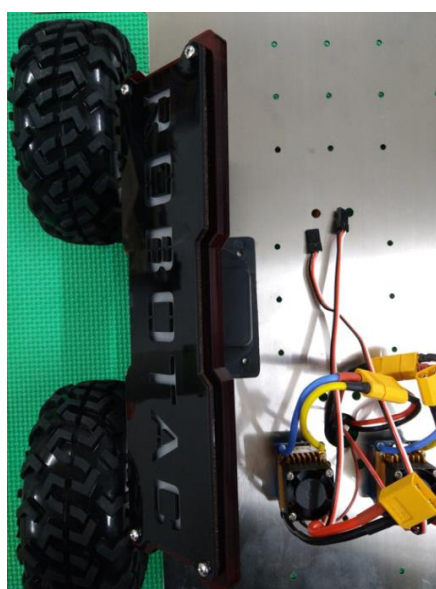


Fig. D Installation position of blood volume indicator

(2) Attack mechanisms and other mechanisms

During the game, the attack and other mechanisms shall not extend within the area of 50mm front the

life post base, as shown in Fig. E, to shelter the life post in any way.

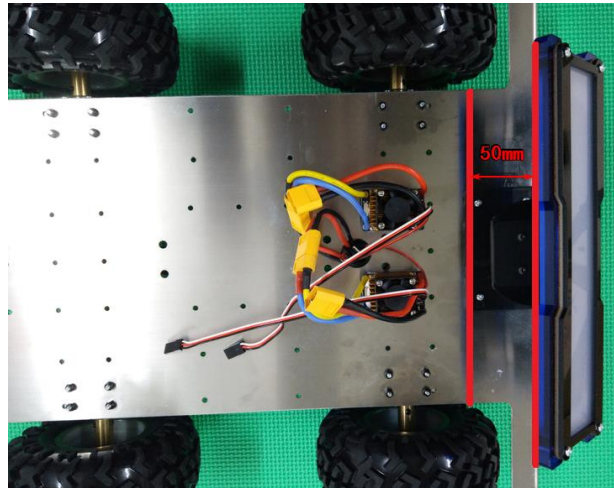


Fig. E Forbidden region front of life post base

4.2.2 Manual Bionic Robots

There is no limitation to the number of manual bionic robots. The manual bionic robots do not carry life post, but must carry a LED strip, RED or BLUE, fixed at any location, to show the team's color. These bionic robots have a size limitation of $600\text{mm} \times 600\text{mm} \times 600\text{mm}$ and a maximum total mass limitation of 13kg. The definition of bionic robots is based on movement mode and speed. A robot will not be considered as bionic robot if it uses continuous circle movement.

The manual bionic robots can be carried by any manual vehicle-type robot to enter the opponent defense zone and attack the opponent robots and fortress.

4.3 Power Source

- (1) Each team must prepare its own power source.
- (2) The power supply voltage must not exceed 12VDC for all manual robots and 24VDC for all autonomous robots.
- (3) The compressed air used as power is allowed. The air pressure must not exceed 0.8MPa, and the volume of air container must not exceed 3L.
- (4) Any hydraulic or other power sources deemed dangerous by the organization committee are prohibited.
- (5) Aerial robots are prohibited.

4.4 Weight

- (1) Total weight of team's robots must not exceed 45kg.
- (2) The total weight includes power source and all parts of robots, not including remote controllers, spare batteries and parts.

5 Team

5.1 All team members must be registered students in the same university/college/polytechnic. There is no restriction for their major. A single student will be designated as the team captain.

5.2 One instructor and 6 students can participate in the game. The instructor cannot operate the robots. Other team members may help carrying the robots to the game field before the game starts.

6 Game

6.1 Game Procedure

6.1.1 Prior to each game both teams are given one minute to set up their robots in the respective zone. The robots may be powered on, but any movement is not allowed.

6.1.2 The chief referee starts the game by blowing a whistle. All autonomous and manual robots can start from their start zones respectively. A robot that beats the whistle will be warned once, but a second false start will cause prohibition in that match.

6.1.3 The team members can operate any manual robots from their own team. If one of their own robots was killed, its operator can control other robots in the game field instead.

6.1.4 All participating team members must stay on their own side, and cannot enter the game field or the opponent side.

6.1.5 Robots that move out of the fence will be sent off in the match. If any part separates from a robot, that robot will be sent off in the match.

6.1.6 Attacking the opponent fortress scores 1 points, killing one opponent manual vehicle-type robot scores 3 points.

6.1.7 The game lasts 3 minutes, and the team with the higher score wins the game. For knockout games, the possible tie can be broken by an extra time of 2 minutes. Each team chooses one robot, and the team that successfully attacks the opponent fortress wins the game. If no attack does not carry out during this 2 minute OT, the team whose robot is closer to the opponent fortress wins the game. If the tie cannot be broken, the team with lightest robot weight wins.

6.2 Retry and Power Off

After the game starts, retry is absolutely prohibited. If a robot is in failure or out of control, it will exit the game automatically. The referee has full right to ask the team power it off and send it out of the game field for safety.

6.3 Violation and Disqualification

6.3.1 The following behaviors will be considered as violation, and the team's score will be deducted 1 point. The penalty can be accumulated.

- (1) Operator enters the game field after the game starts.
- (2) Operators touch their robots after the game starts.
- (3) Team member enters the opponent defense zone or side.

6.3.2 The following behaviors will cause prohibition for the robot. If the prohibited robot does not stop motion according to the referee's instruction, the team's score will be deducted 10 points. The penalty can be accumulated.

- (1) Beating the whistle twice.
- (2) Moving out of the fence.
- (3) Intentionally damaging the game field or objects.

6.3.3 If a team is deemed to have committed following behaviors intentionally, the team shall be disqualified for that match and the opponent team wins.

- (1) Robots not powered through the life post or any change to the life post.
- (2) Dangerous action to the operator, referee, or audience.
- (3) Any act of disobedience against a referee's warning or instruction.
- (4) Any other act against the spirit of fair play.

7 Safety

Safety is the most important issues for the sustainable development of the Robotac competition. Every participant must pay special attention to the safety regulations and take utmost precautions.

7.1 All robots must be designed and built so as to pose danger to anyone, including the teams, referees, staffs, audience, equipment, and game field. If the robot is deemed potentially dangerous, the referee can send it off or end the game at any time.

7.2 In the robot structure design, easy access for safety inspection should be considered.

7.3 Any internal combustion engines, explosives, high pressure air ($>0.8\text{MPa}$), and energetic chemical materials are prohibited.

7.4 Robots equipped with launch or attacking mechanisms are potentially dangerous. The team should ensure that they do not directly or indirectly hit operators, referees, staff and spectators at any time.

7.5 Safety should be the highest priority during all phases of the design and competition. During all phases of development and competition, the teams must pay sufficient attention to the safety issues. The instructors should be responsible for safety guidance and supervision. The venue audience's safety must be taken into account during the competition.

7.6 Safety should be the highest priority during all phases of the design and competition.

8 Others

8.1 Referees have the right to make decision for any action not specified in the rules. The game video may not be valid evidence in the ruling. In the case of a dispute, the chief referee's decision is final.

8.2 The dimensions of the game field and objects described in this Rule Book may have an error margin of plus or minus 5% unless otherwise stated. However, the robot dimensions and weights are the maximum.

8.3 Please pay close attention to our official website <http://www.robotac.cn> for rules updates.

8.4 The organization committee reserves the right for final explanation to the rules.