

**The Sixteenth Robotics Competition for
College Students
RoboMasters 2017**

Competition Rules

(V1.9)

2017.06



The RoboMasters Organizing Committee reserves the right to revise and interpret the rules.

The revised rules will be announced on our official forum. The competitions are subject to the latest version of the rules announced before the event.

Modification

DATE	VERSION	RECORD
2016.10.25	1.0	Release of the first version
2016.10.31	1.1	Make revisions to loopholes discussed, detected and confirmed, originating from posts in the RoboMasters forum, such as format, bullet and pellet refilling operations, and parameters of robots
2016.11.06	1.2 (Preview)	Naming of the manual, size of the competition field, penalty of a foul committed in the base area, and improvements to rules for RoboMasters 2017 Challenge Competitions
2016.11.10	1.2 (Proofread)	Organization structure and competition name altered, rule vulnerabilities fixed
2016.11.18	1.3	Q&A added
2016.11.22	1.3 (Preview)	Annex 1 added
2016.11.23	1.4	Annex 2 added, Annex 1 modified, rules detailed
2016.12.13	1.5	1.Refine the design drawing and the dimensions for the battle field 2.Update the submission method for the "Main Competition Technical Report"
2017.01.17	1.6	1.Refine the descriptions for the technical challenge procedure and competition area 2.Add the judgement details for the lv4 impact warning 3.Add the warning for the gear columns, add the regeneration rune 4.Add the date for sub-contest area and the date for the technical report submission
2017.02.27	1.7	1. obstacle modified 2.add the logical implementation for the regeneration rune 3.update the resource island design and description 4.add the installation description for the armor module 5.modify the numbers of the operators allowed during the game 6.add the requirements for the technical challenge report
2017.4.17	1.8	1.refine the repair speed for the assistant

		<p>robot, delete the judgement for the assistant robots blocking the hero from going up the island</p> <p>2.the drone can install the indicator lights</p> <p>3.delete the description for the competition area and update the area layout</p> <p>4.change judgement for the lv2 warning, move the judgement rules to chap4</p> <p>5.change the delivering way of the initial ammos</p> <p>6.change the outcome judgement for the single game and the ranking rules for the single round group game</p> <p>7.add the damage logic for the base robot</p> <p>8.update the competition schedule</p> <p>9.update the registering table</p> <p>10.determine the judgement module and the color of the armor module for the ground robot technical challenge competition</p>
2017.05.04	Revise V1.8	Update the installation height requirement for the armor module for the base robot
2017.06.06	V1.9	<ol style="list-style-type: none"> 1. Add FAQs for the division competition of RM2017 2. The initial HP value for the soldier change to 2000 3. Update the description for battlefield change 4. Update the judgement rules for main competition and technical challenge 5. Optimize the procedures for the arbitration 6. Add the parameters for the Glowing projectiles 7. Add the buff for the gear column, occupy three gear columns can give the base robot Invincible state for one minute 8. Update the competition filed for the technical challenge, confirm the ground robots will compete in the RED-BLUE starting area.

Organization Structure

Sponsors:

The Communist Youth League of China

The All-China Students' Federation

The Shenzhen Municipal Government

Undertaking organization:

SZ DJI Technology Co., Ltd.

Organizers:

Shenzhen Municipal Committee of the Communist Youth League Shenzhen Municipal Science and Technology Innovation Committee Nanshan District Government, Shenzhen Municipality

Supporting Organization:

The China Youth Development Foundation

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Background

Robotics is currently one of the world's major cutting-edge technologies. It is now entering a new era over 50 years in the making. In the next 3 to 5 years, there will be a massive upsurge in the global robotics industry, and China will become one of its major world markets. With this in mind, a group of science and engineering university students from all over the world participated in the ROBOMASTERS™ program to continue their robotic dreams under the auspices of DJI.

As one of the major “National Robotics Competitions” sponsored by The Communist Youth League of China, RoboMasters 2017 Competition encourages innovation in Robotics automation and intelligent technology with the confrontational practice of the robots at its core.

Participants of RoboMasters 2017 are young engineers and future scientists coming from different universities. The team work spirit and their solid technology background will pave the way for their future success. It also helps cultivate their creativity, expertise and communication abilities.

Like other technological competitions, participants of RoboMasters must abide by its rules and regulations and behave in a responsible manner. The Competition Rules of RoboMasters 2017 are applicable to and must be observed by all team members, advisors, referees, managers, and competition organizers. All participants are required to be fair, just, and honest and present outstanding robotic creations to the audience.

Purpose

Expanding our influence

The event is hosted by the Communist Youth League of China, the All-China Students' Federation, and the Shenzhen Municipal Government. Top tier resources from all parts of society will also be brought in, making the event an amazing showcase of technology. The RoboMasters 2017 Robotics Competition for College Students (hereinafter referred to as "RM2017") draws society's attention to robotics through its intense competition, strict scientific standards, and innovative event scheduling.

Promote the development of practical teaching

The RoboMasters Committee will coordinate with universities to promote the development of practical teaching combined with cutting-edge technology through competitions. This will promote the cultivation and reservation of relevant teaching faculties, build teaching practice centers and laboratories, cultivate a group of outstanding science and technology engineers and promote the transformation of scientific and technological achievements.

Improve social participation

The RoboMasters Committee will carry out various activities during the course of the event, including integrating resources to create an interactive experience that showcases cutting-edge scientific and technological achievements in an intuitive way to engage with the public.

Summarizing academic achievements

In addition to the technological competition, the event will also focus on summarizing academic and technical achievements in the field. Through academic lectures and exchanges, we hope to present the latest accomplishments in robot research and development achieved by the participating teams, and promote in-depth exchanges in related research.

1 Introduction to the Contest

1.1 Overview

The RoboMasters 2017 National Robot Competition for College Students (abbreviated as RM 2017) is a global competition hosted by the Communist Youth League of China, Shenzhen Municipal Government and the Secretariat of the All-China Students' Federation. It is intended to offer a platform for university students to make technological innovations and to promote exchange and dialog among researchers in China and abroad. In the RoboMasters arena, you can experience technological competition, show your charisma and talent, feel the power of teamwork, and sense the seamless connection between man and technology.

Participants should fill in the registration form as a team before the deadline and submit the technical report to the organizing committee in due time. Those whose reports have met the requirements of the committee become eligible for RoboMasters 2017 Regionals or the RoboMasters 2017 Wild Card. Any team that wins in RoboMasters 2017 Regionals or RoboMasters 2017 Wild Card qualify for the RoboMasters 2017 Tournament.

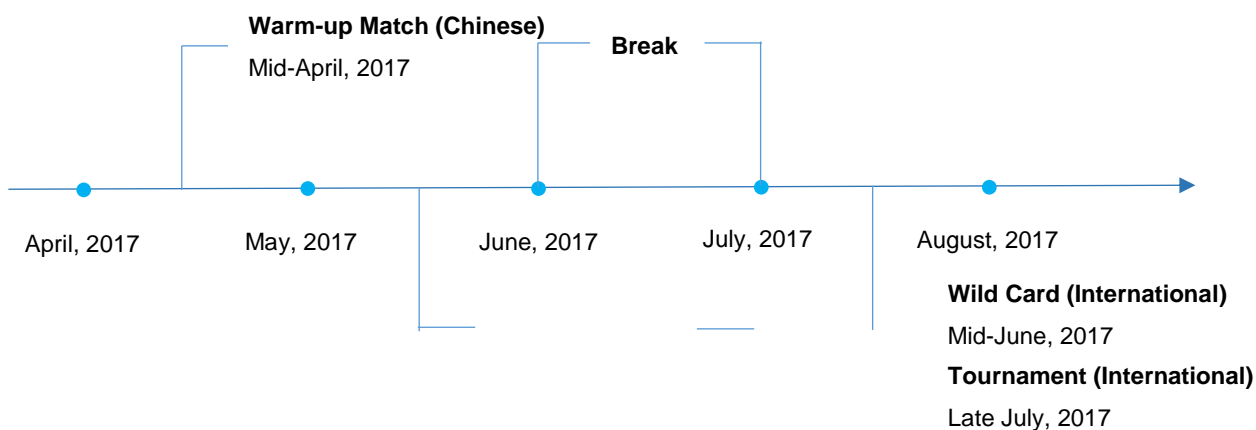
To encourage more young people to take a role in shaping the future of robotics, RM 2017 specially includes the "RoboMasters 2017 Technical Challenge". Held in the same battlefield of the main competition, the Technical Challenge provides independent rules to guide robots to complete certain tasks automatically. Online registration and report submissions are required to enroll in the Technical Challenge, and the teams whose technical report are approved will participate in the Technical Challenge.

Robots used for the Main competition and Technical Challenge must comply with the requirements illustrated in this document.

1.1.1 Schedule

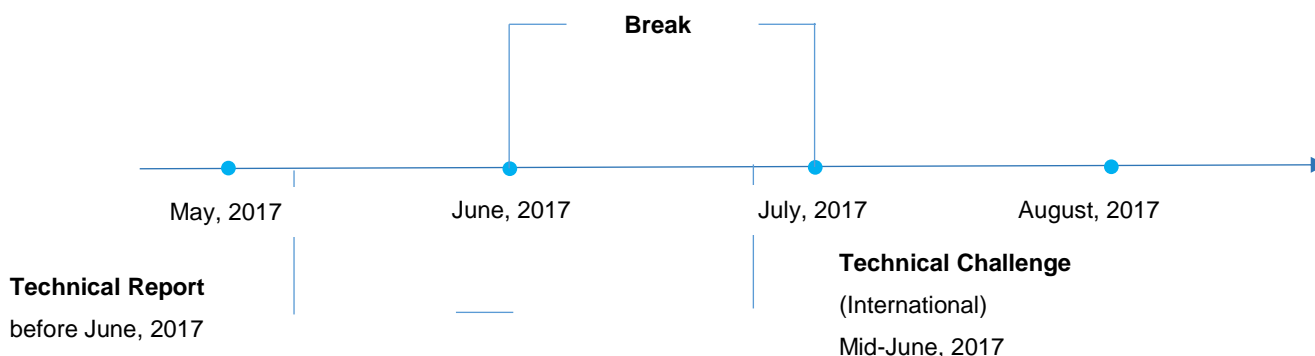
RM 2017 Organizing Committee reserves the rights to change competition schedule and rules. Specific rules and other related items are subject to announcements by the committee on the official forum.

1.1.1.1 Main Competition Schedule



Main Competition Schedule for International Teams			
Contest	Date	Place	Remarks
Qualification Evaluation	2016.11	Online	Guest Team not included
Supplies Endowment	2016.12-2017.01	/	Teams registered and approved.
Technical Report	2017.03.15-2017.03.31	Online	First time to submit the technical report, the teams which pass the verification will be qualified for the divisional competition. They can have the priority to select the division.
Technical Report (2)	2017.4.1-4.15	Online	Second time to submit the technical report, the teams which pass the verification will be qualified for the divisional competition. They can have the priority to select the division (after the first group teams) (1) The details of the divisional competition should refer to the official information (2) Only difference between the two submission time is the priority to choose the division
Referee System Distribution	2017.03-2017.06	/	Technological report meets committee requirements and is approved
Warm-up Match	2017.4	Shenzhen	Only the teams pass the technical verification are allowed, the detail date refer to the official information released
Divisional Competition	2017.5.12-5.21	undecided	The details refer to the official information released later
RM2017 Wild Card	2017.07.29-31	Shenzhen	Compete with Chinese teams that qualify from regionals
RM2017 Tournament	2017.08.01-08.06	Shenzhen	Contest for the Champion of the Year

1.1.1.2 Technical Challenge



RoboMasters2017 Technical Challenge procedures			
Contest	Date	Place	Remarks
Technical Report	2017.4.30-5.15	Online	Submit the report online. The team pass the ground robot challenge verification can get a set of referee system if they do not participate the contest.
Technical challenge	2017.7.28-8.3	Shenzhen	Include preliminaries and the formal match

1.2 Qualifications Eligibility

All participants should meet the following requirements. Any participant or team who is found to not qualify for the competition during pre-competition or formal competition will be stripped of their competition qualification for RM 2017.

1.2.1 Qualifications and Rights

- **Chinese School Teams:** Qualified teams that have been approved by the committee.
 Qualifications: All full-time university students registered in school before August 2016 and participating in a three or four year undergraduate or postgraduate program may take part in the competitions.
 Rights: Eligible for the formal competition and to qualify for the next round; the right to be rewarded as set forth in the reward rules.
- **International Invited Teams:** Accept the invitation from and have been approved by the committee.
 Qualifications: Specially invited teams are primarily from overseas universities. There are no restriction on their educational background due to the differences in education systems.
 Rights: Eligible for the formal competition and to qualify next round; the right to be rewarded as set forth in the reward rules.
- **Wild Card Teams:** Teams that register in the contest in due time but fail to pass the technical assessment, but are invited by the committee as reserved participants.
 Qualifications: All full-time university students registered in school before August 2016 and participating in

a three or four year undergraduate or postgraduate program may take part in the competitions.

Rights: Eligible for the competition but not the formal ones and cannot qualify for the next round. No right to be rewarded as set forth in the reward rules.

1.2.2 Entry Rules

- A single school can only have one team eligible for the competitions. Schools that have different campuses which may lead to students not being able to group together may be allowed to have more than one team. This will be evaluated by the committee.
- Participants must enter the contest in teams. Each participant can join only one team for the contest.
- Each team shall be named “xxx-xxx-xxx-Team” (“-” shall not appear in the actual name). The first XXX stands for the university name of the team, abbreviations are accepted; the second XXX stands for the sponsor name(optional); and the last XXX is the actual team name. The total length of the team name should not exceed 35-characters (each English letter counts for 1-character). The team name should be positive and must comply with regulations and laws.
- Teams with members from two or more schools are allowed; such teams are called consortiums. Consortiums are formed by relevant participants, taking into account their ability to communicate and plan across institutions. Applications for forming a consortium must be submitted to the Organizing Committee, and the consortium is considered to be established upon the Organizing Committee's approval. Once established, consortiums cannot be split and can only participate in the contest as such. In the event that a consortium is split, it shall be considered that the consortium has quit the contest. A consortium's operating and R&D costs, personnel distribution, and any disputes that may arise must be handled by the consortium itself. The Organizing Committee takes no responsibility for any of these issues.
- Each team shall have between five and 35 members, inclusive.
- Each team shall have one Captain, one project manager and one PR manager; The Captain may not take the position of project manager or PR manager, but another team member can act as both project manager and PR manager.
- Each team should have at least one and up to three advisors. Advisors can give assistance to only one team.
- Teams participate in the “Main Competition” by default, but they can choose whether to take part in the “RM 2017 Technical Challenge”. The Technical Challenge can be entered separately. Teams that do not compete in the RM 2017 Regional or Tournament can still enter the Technical Challenge. Two teams from the same university are allowed to enter the Technical Challenge and the Main competition, but competing in the same competition is strictly forbidden. For special cases, refer to

1.2.3 Responsibilities of Team Members

- **Advisor:** As head of a team, the advisor is responsible for building and managing the team. The advisor is responsible for the safety of team members and their property, as well as for directing and managing team expenses during the contest; ensuring that the team leader reports project progress and other issues to the Organizing Committee; instructing the team leader in drafting plans, solving R&D issues, and completing technical reports on time; and helping the team to complete the contest successfully.
- **Captain:** The captain is responsible for the team’s technologies and strategies. The captain is also responsible for the division of work, central planning, and the arrangement and modification of strategies during the contest.
- **Project manager:** The project manager is the manager for the overall project. The project manager controls the project’s overall progress; comprehensively considers R&D costs, work safety and other issues; makes overall management decisions, and makes decisions regarding project targets (including progress, outcome, costs, etc.).
- **PR manager:** The PR manager is responsible for promoting the team's project. The PR manager is responsible for recording information to be used later for internal and external promotion and for the team publicity. The PR manager is also responsible for building and managing a variety of channels to raise the profile of the event and the team.
- **Contacts:** The advisor, team leader, and project manager are the organizers of the team and as such are responsible for communications with the RoboMasters Organizing Committee. Any information that the rest of the team members would like to exchange with the Organizing Committee must go through the organizers.

1.3 Award System

1.3.1 Winners of the RM 2017 Tournament

Award	Ranking	Qty.	Reward
Grand Prize	Champion	1	Championship trophy Championship medals Grand prize certificate Championship certificate RMB 200,000 (pre-tax)
	First Runner-up	1	First runner-up trophy First runner-up medals

			Grand prize certificate First runner-up certificate RMB 100,000 (pre-tax)
	Second Runner-up	1	Second runner-up trophy Second runner-up medals Grand prize certificate Second runner-up certificate RMB 50,000 (pre-tax)
	4th - 8th Place	5	Grand prize certificate Certificate of Honor RMB 20,000 (pre-tax)
2nd Prize	9th - 16th Place	8	2nd prize certificate Certificate of Honor RMB 10,000 (pre-tax)
3rd Prize	17th - 32nd Place	16	3rd prize certificate Certificate of Honor

1.3.2 Divisional competition

Award	Ranking	Qty.	Reward
Grand Prize	Divisional Champion	1 for each division, 4 in total	Divisional Championship trophy Divisional Grand prize certificate Divisional Championship certificate RMB 10,000 (pre-tax)
	First Runner-up	1	Divisional First runner-up trophy Divisional Grand prize certificate Divisional First runner-up certificate RMB 10,000 (pre-tax)
	Second Runner-up	1	Divisional Second runner-up trophy Divisional Grand prize certificate Divisional Second runner-up certificate RMB 10,000 (pre-tax)
	Partial teams from the 4 th to 6 th of each division	12	Grand prize certificate Certificate of Honor RMB 10,000 (pre-tax)
2nd Prize	Partial teams have the relatively high ranking in each division	8	2nd prize certificate Certificate of Honor
3rd Prize	Other teams from each division	/	3rd prize certificate Certificate of Honor

1.3.3 Individual rewards

Award	Qty.	Reward
Outstanding Advisor	8	Certificate of Honor RMB 5,000 (pre-tax)
Outstanding Captain	8	Certificate of Honor RMB 2,000 (pre-tax)
Outstanding Project Manager	8	Certificate of Honor RMB 1,000 (pre-tax)
Outstanding PR Manager	8	Certificate of Honor RMB 1,000 (pre-tax)
Outstanding Judge	5	Certificate of Honor RMB 2,000(pre-tax)
Outstanding Technical Report	10	Certificate of Honor RMB 2,000 (pre-tax)
Most Creative	2	Certificate of Honor RMB 2,000 (pre-tax)

1.3.4 Rewards for Wild Card

Award	Ranking	Qty.	Reward
Qualification Award	The top 1 to 8 teams in the Wild Card	8	Qualification Tickets RMB 10,000 (pre-tax)

1.3.5 Rewards for the Technical Challenge

Award	Ranking	Qty.	Reward
First Prize in Technical Challenge	Champion in the Aerial Robot Challenge	1	Certificate of Honor RMB 30,000 元 (pre-tax)
	First runner-up in the Aerial Robot Challenge	1	Certificate of Honor RMB 20,000 元 (pre-tax)
	Second runner-up in the Aerial Robot Challenge	1	Certificate of Honor RMB 15,000 元 (pre-tax)
	Champion in the Ground Robot Challenge	1	Certificate of Honor RMB 30,000 元 (pre-tax)
	First runner-up in the Ground Robot Challenge	1	Certificate of Honor RMB 20,000 元 (pre-tax)
	Second runner-up in the Ground Robot Challenge	1	Certificate of Honor RMB 15,000 元 (pre-tax)
Second Prize in Technical Challenge	Teams ranking 4 th to 8 th in the Aerial Robot Challenge	5	Certificate of Honor RMB 5,000 元 (pre-tax)
	Teams ranking 4 th to 8 th in the Ground Robot Challenge	5	Certificate of Honor RMB 5,000 元 (pre-tax)
Third Prize in Technical Challenge	Teams ranking 9 th to 16 th in the Aerial Robot Challenge	8	Certificate of Honor Souvenir
	Teams ranking 9 th to 16 th in	8	Certificate of Honor

	the Ground Robot Challenge		Souvenir
Outstanding Performance in Technical Challenge		Some	Certificate of Honor Souvenir

Note: Teams competing in the Technical Challenge must reach the standards regulated in [5.2.2](#) to be eligible for the First Prize awards.

2 Robot Specifications

2.1 Technical Overview

Five types of robots are used in this contest: **Base, Hero, Standard, Aerial** and **Engineering**, and an additional self-made **Refueling Station** is also required. Participating teams can purchase DJI components and modules necessary for robot making from DJI or other producers. All robots must follow the specifications defined in this chapter.

In the contest, two teams will fight against each other in a specified field. Referee systems officially provided by the committee will be mounted on the robots used in the contest. Images taken by the cameras mounted on the robots will be transmitted in real time to the screens in front of the controllers outside the battlefield using HD image transmission modules. By watching the images, the controllers control the robots, moving them around the complex battlefield and attacking the opposing team's robots and base to win the game. Robots that are automated to some degree can be used in the contest to maintain a high technological standard. The referee system will record the hit points (HP) of the robots and damage taken from other robots' attacks; monitor the operation of the shooting mechanism and chassis power; cut off the main power supply when the HP of a robot drops to zero; and transmit the information to respective computers and servers in real time so that **the server can automatically decide which team wins**.

In the Technical Challenge, Aerial robots and Ground robots are required to complete specific tasks. Aerial robots are not required to mount the referee system provided by the committee while Ground robots must be mounted. Both Aerial robots and Ground robots can be decided independently whether to mount the official image transmission or not. Specifications of the Ground robots must be in accord with the Engineering robots. All the robots must be completely automatic to ensure that the result of Technical Challenge is decided by the referees.

The RM2017 Committee has the following advice for teams:

- Read the robot specification carefully, analyze and make a plan beforehand. Build robots to

meet these specifications and improve their structure according to the rules.

- Start the training of robot operator as early as possible to design automatic programs to assist the operator according to the feedback received during training.
- Assess the fund and manpower appropriately and make a budget or a plan to minimize waste at the beginning of the preparation phase.
- Choose products and modules from mature industries to improve the reliability of the robots.
- Pay attention to the manufacturability of components to reduce cost and processing difficulties. Make components modular to fit multiple robots.
- Install and use referee systems correctly to avoid failing the check in.

2.1.1 General Functions of the Robots in Main competition

Robot	Qty.	Function	Remarks
Base Robot	1	Automatic self-defense robot, the key to winning.	A must-have robot. Its chassis power will be temporarily cut off when its upside armor is hit.
Hero Robot	1	Core of the contest, high offensive power and HP.	A must-have robot.
Engineering Robot	0-1	Act as an assistant robot	Supplies ammunition and heals the HP to teammates.
Standard Robot	0-3	Fight flexibly	Main strength of the contest.
Aerial Robot	0-1	Supplies aerial support	Occupy the healing columns to increase whole team's attack ability.
Refueling Station	0-1	Ammunition supply	

2.2 General Technical Requirements and Safety Guidelines

2.2.1 General Technical Requirements

To ensure the games are practical, fair, and safe, robots must be designed and engineered in strict accordance with the technical requirements below

- **Energy requirements:** Robots may only use electric or pneumatic power. **The power supply must consist only of intelligent batteries specified by the host.** The total energy consumption of any single robot may not exceed 200Wh, the voltage may not exceed 30V, and the compressed air pressure may not exceed 0.8MPa. Pneumatic energy sources must be fitted with a barometer at the outlet of the pressure source. **Compressed air storage**

bottles must be protected against cuts. Do not use fuel-powered engines, explosives, hazardous chemical materials, etc. Any robots that do not meet the energy specifications cannot pass check in.

- **Wireless devices:** **The controllers work with the robots must be the product of DJI.** Apart from the robot controllers, HD image transmitters, wireless data links, and other wireless devices provided by the host, **participating teams are allowed to build 2.4G WIFI for communications between robots and robot operators.** Participants can have free frequency hopping in the WIFI band 2.412-2.472GHz, but the bandwidth each team can take up is no more than 40MHz. **All the wireless router should be installed on the robots which are in the battlefield (including refueling station). The committee will not provide the extra external power supply equipment.** The RM 2017 Committee does not guarantee the stability of Wi-Fi built by the participating teams due to unknown Wi-Fi sources in the contest. **Caution:** 1. In the 3-minute preparation time for each game, the team can set up the WIFI network, a mature and rapid solution is recommended to use. 2. The receiving equipment (tablet, laptop) should only be used in the operating room. If the devices are found in the auditorium, this action will be treated as cheat. 3. Only 2.4G WIFI protocol is allowed.
- **Optical approaches:** The use of optical approaches in situations where such approaches are necessary must not harm any controller, referee, member of staff or audience members. Only lasers with a capacity below 50mW or provided by the RM 2017 committee are permitted. The aerial robot with gravitational bombdropping ability can install a laser aiming device. The hero, soldier and base robot can only install the laser aiming device when it has a shooting mechanism. Every shooting device can have only one laser aiming device. Besides the laser aiming device, the ground robot cannot install other devices which can give out obvious lights. This is to avoid the effect on the referee system. The aerial robot can have the indicating lights on it to show the flying status of it, but the indicating light should not affect the order of the game (high power LED lights are forbidden). Otherwise, the aerial robot will not pass the pre-game check in.
- **Visual markings:** The Committee will set obvious marks that can be easily identified in the official referee system for automated parts to identify and aim at. Visual markings and other sensors such as laser radar and cameras may not be mounted if it is covered by armor. No light should be projected to the armor. Any robots that do not meet the visual specifications cannot pass check in.
- **Chassis capacity limits:** There are different limits on the chassis capacity of Standard, Engineering, and Base robots. Chassis: The propulsion system and its accessories are mounted on the chassis, allowing the robots to move horizontally. Chassis capacity: The

capacity of robot propulsion system when it is moving horizontally, and the capacity when the robot is completing specific tasks are excluded. The chassis capacity will be monitored by the referee systems and robot HP will be deducted every time the chassis capacity exceeds its regulated level. Refer to the Referee System Manual for more information.

- **Interaction between robots:** Robots, with the exception of the refueling station, are prohibited from coming into direct contact. Breaches can be considered fouls and a robot may be sent off if at least two armor modules were blocked for more than 5 seconds during the interaction.
- **Interaction between robots and ground properties:** The robot will not pass the pre-game check in if it uses the viscous material like 3M glue to collect the ammo. The moving mechanisms of a robot cannot damage ground properties. When a unit without a firing mechanism moves (an engineering robot or a standard robot without a firing mechanism), it can carry at most two barrier blocks (the robot and the barrier blocks connect through the mounting connection) and at most obstruct armor modules at one side, but it cannot obstruct any armor modules if the robot and the barrier blocks do not come together when pushed. Any robots that do not conform to the barrier block obstruction requirement will be ejected from a game. The obstacles taken by the robots should not block two or more armor modules of the robots for a long time (block the surface of the armor modules in 145 degree for more than 5 seconds). Otherwise, the robot will be ejected from the game.

Numbering the robots: Number the robots During the competition, the committee will number all the robots for both blue and red team. Number 1 will be used to mark the soldier robot, 2 for hero robot, 3 for engineering robot, 4 for second soldier robot and 5 for third soldier robot. **Caution: Do not label the robot with the sticker which is similar with the numbering label the committee will use. Other ornamental should also not contain the obvious number which is similar with the number that committee give to. Otherwise, the robot will not pass the pre-game check in.**

2.2.2 Safety Guidelines

Safety is the basic principle of RM 2017. All participating teams must pay high attention to, and take necessary actions to ensure safety when making robots.

- Ensure robots with bullets cannot directly or indirectly harm controllers, referees, staff and audience members.
- During research and contests, safety should always be regarded as a top priority. Advisors should take responsibility of ensuring that the safety of people involved are taken into consideration.
- Misuse of operators, control systems' loss of control, damage to components all may cause a robot to stop abruptly, accelerate, or spin, which could result in injury or damage to operators

and robots respectively. Bullets may hurt nearby people if the robot is triggered to fire therefore precautions must be taken. Always wear goggles, helmets and other necessary protective equipment.

- The RM 2017 committee has the right to deal with the defective robots in an emergency e.g. fire or explosion.

2.3 Bullets

Caution: during the national competition, some of the game will give out the special glowing bullets.

Bullets used in the games will be provided by the RM2017 Committee. 17mm and 42mm bullets will be used. The referee system will calculate the different impact force from the different sizes and materials of the bullets as different damage values. Any participating teams using non official bullets will be deemed to be cheating.

Type I: 17mm bullet



Material	Diameter	Mass	Damage amount
Plastic (TPE 90)	17 mm (-3% - 0%)	2.6 g (±5%)	50

Type II: 42 mm bullet



Material	Diameter	Mass	Damage amount
Golf ball	42.65 mm (±5%)	45.75 g (±5%)	500

Type III: 17mm glowing bullet

Material	Diameter	Mass	Damage amount
Plastic (TPE 90)	17 mm (-3% - 0%)	3.30 g (±5%)	50

Type IV: 42 mm glowing bullet

42 mm

Material	Diameter	Mass	Damage amount
Plastic (TPE 90)	41.9 mm ($\pm 5\%$)	38.90 g ($\pm 5\%$)	500

2.4 Base Robot

A base must be prepared by each team. One base is allowed in a game, and it must be placed in the base area and move freely in it with referee system mounted. Image transmission and remote controllers are not available. Large-size armor is mounted on the top and around the body. When it is attacked, its HP will drop accordingly. **The chassis power will be cut off for 5 seconds if its upside armor is hit.** One 17mm firing mechanism, for which manual control is not permitted, can be mounted on a base for self-defense. **The controller for the base during the game is forbidden.** During the pre-game check in, it is okay to use the controller to do the test, but after the check in, the receiver of the robot should be removed immediately. Once the controller is used during the game, it will be treated as cheat.

Once the invincible status of the base ends, after the engineering robot occupy three gear columns, the base robot of that side can have one minute invincible status.

Base Robot Specifications			
Item	Limit	Penalty for exceeding limit	Remarks
Effective for	All	-	-
Referee system	Available	-	Large-size armor mounted on the top and around the body. The armor around the body should be 400mm-500mm off the ground. Refer to the Manual for the Referee System for specific mounting requirements
Initial HP	10,000	-	-
Operation mode	Fully automatic	-	-
Bullet type	17mm	-	-
Initial ammo	300	-	Bullets must be emptied before the start of a game
Ammo refilling	Accepted but not rendered	-	Not allowed to bring ammo to other robots.
Ammo firing speed (m/s)	25	Certain amount of HP will be deducted	-
Ammo firing frequency (pc/m)	1200	Certain amount of HP will be deducted	-
Max. weight (kg)	25	-	Referee system excluded

Power of chassis (Wh)	80	Certain amount of HP will be deducted	-
Max. initial size (mm)	800*800*800	A base robot that does not conform to the size requirement specifications will be rejected during the check-in process.	May not exceed 800mm in height, and its orthographic projection on the ground may not exceed an 800 x 800 square.
Size during contest	1000*1000*1000	A base robot that does not conform to the size requirement specifications will be rejected during the check-in process.	It may not exceed 1000mm in height, and its orthographic projection on the ground may not exceed a 1000 x 1000 square.
Range of activity	Base area	-	-
Activation conditions	A base robot may start to move three minutes prior to the commencement of a game, and fire bullets after the formal start of a game	A base robot that fires bullets before the formal start of a game will be considered to in violation of competition rules and will therefore be ejected from the game. The team will be issued a Game Loss penalty.	-

2.5 Hero Robot

A hero robot must be engineered by each team. The hero robot, the main force of a team, must be equipped with the referee system. One image transmitter and one remote controller can be mounted on the robot. One 17mm shooter and one 42mm shooter can also be mounted. Its firing rate and cyclic rate are restricted by the referee system. There is no limit on the power of the chassis.

Hero Robot Specifications			
Item	Limit	Penalty for exceeding limit	Remarks
Effective for	No limits	-	-
Referee system	Available	A hero robot that does not conform to the armor-mounting	Four large-size armor plates are mounted around the body. The ground clearance of the bottom

		requirement will be rejected during the check-in process.	line of any of the four armor plates must be above 400mm. The relevant position between geometric central point of the all four armor plates and the horizontal plane of the central axis of a firing tube when the corresponding firing mechanism is at a horizontal position cannot change during a match. Refer to the Manual for the Referee System for specific mounting requirements
Initial HP	5000	-	-
Operation mode	Manual or automatic	-	-
Bullet type	17mm and 42mm ammo	-	Bullets must be emptied before the start of a game
Initial ammo	0	-	-
Ammo refilling	Accepted and rendered	-	-
Max. weight (kg)	35	-	Referee system is not included
Power of chassis (Wh)	No limits		
Max. initial size (mm)	800*800*800	A hero robot that does not conform to the size requirement specifications will be rejected during the check-in process.	The height is no more than 800, and the orthographic projection on the ground is no larger than the square area of 800*800
Size during contest	1200*1200*1200	A hero robot that does not conform to the size requirement specifications will be rejected during the check-in process.	The height is no more than 1200, and the orthographic projection on the ground is no larger than the square area of 1200*1200
Range of activity	The whole competition area	-	-
Activation conditions Size during contest	A hero robot is allowed to move or fire bullets only after the formal start of a game	A hero robot that moves or fires bullets before the formal start of a game will be considered to in violation of competition rules and therefore will be	-

		ejected from the game	
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Hero robot shooting modes			
Item	Limit		Penalty for exceeding limit
	17mm bullets	42mm bullets	
Max. speed (m/s)	25	15-18	HP will be deducted
Cyclic rate (rounds/min)	120	300	HP will be deducted
Rate control	No more than 2 rounds per second	No more than 5 rounds per second	-

2.6 Standard Robot(Soldier)

A standard robot must be equipped with the referee system. One image transmitter and one remote controller can be mounted on the robot. Only one 17mm shooter can be mounted. Its firing rate and cyclic rate are restricted by the referee system and there is a limit for its chassis capacity.

Standard Robot Specifications			
Item	Limit	Penalty for exceeding limit	Remarks
Effective for	All	-	-
Referee system	Available	-	Four small-size armor plates are mounted around the body. The ground clearance of the bottom line of any of the four armor plates must be 50mm-100mm above the ground. Refer to the Manual for the Referee System for specific mounting requirements
Initial HP	2000	-	-
Operation mode	Free	-	-
Bullet type	17mm	-	-
Initial ammo	0	-	Bullets must be emptied before the start of a game
Ammo refilling	Accepted but not rendered	-	-
Ammo firing speed (m/s)	25	HP will be deducted	-
Ammo firing frequency (pc/m)	300	-	-
Rate control	No more than 5 rounds per second.	HP will be deducted	Only one firing mechanism can be mounted
Max. weight (kg)	15	R	Referee system not included

Power of chassis (Wh)	80	HP will be deducted	-
Max. initial size (mm)	600 x 600 x 500	A standard robot that does not conform to the size requirement specifications will be rejected during the check-in process.	The height is no more than 500, and the orthographic projection on the ground is no larger than the square area of 600*600
Size during contest	700 x 700 x 600	A standard robot that does not conform to the size requirement specifications will be rejected during the check-in process.	The height is no more than 600, and the orthographic projection on the ground is no larger than the square area of 700*700
Range of activity	The whole battlefield	-	-
Activation conditions	A standard robot is allowed to move or fire bullets only after the formal start of a game	A standard robot that moves or fires bullets before the formal start of a game will be considered to be in violation of competition rules and therefore will be ejected from the game.	-

2.7 Aerial Robot

Each team can use with one aerial robot. The referee system will not be installed on any Aerial Robot. It does not have HP, a team may not attack the opposing team's Aerial Robot during a contest. The camera and image transmitter mounted on the aerial robot should be provided by the committee or produced by DJI. The aerial robot offers a bird's-eye view of the whole battlefield to team members by sending image signals back to operating room. It must move only in a specified area, and it can also bomb the base of the opposing team with 42mm bullets. Using the aerial robot to occupy the rune columns specially built for aerial robots, the team's attacking power can be increased. Team members in the control room can send voice commands to the aerial robot controller through the communication device provided by the host, but voices cannot be sent back from the drone controller to the control room. And the aerial robot controller cannot get the image transmitted by the aerial robot.

An aerial robot can only drop ammo using gravity and cannot be equipped with other mechanisms that accelerate the speed of ammo delivery. The aerial robot must be equipped with a fully-

shielded blade protection cover, so that blades are not exposed. The cover must be able to support the weight of the aerial robot and protect the propellers. **When the aerial robot flies to a vertical cylinder of any diameter from any angle and at a certain horizontal speeds, the cover should be able to effectively prevent the blades from coming into contact with the cylinder without suffering any obvious deformation. When the entire body of the aerial robot is supported on the ground by any point of the cover, the cover should be able to bear the static force of the weight of the body and suffer no obvious deformation or damage.**

Anchor lines, slipping rings and safety ropes are available for protecting the aerial robot. Each aerial robot should have a 350mm vertical bar rigidly connected to the top of its body. A steel ring should be mounted at the top of the vertical bar for the connection of the safety rope. When the aerial robot's body is hung via the steel ring, the vertical bar and the ring should be able to bear the static force of the weight of the body of the aerial robot without any obvious deformation or any damage.

If there is a failure with an aerial robot during a game, then it cannot compete in the following matches. However, it will be able to compete in the following games if it successfully passes recheck-in after repairs.

Aerial Robot Specifications			
Item	Limit	Penalty for exceeding limit	Remarks
Type	Multicopter	-	Three or more rotors
Effective for	All	-	-
Referee system	Not available	-	Camera image transmission module provided by the host must be separately installed.
Operation mode	Free	-	-
Bullet type	42mm	-	Firing triggered by gravity only
Initial ammo	10	-	Obtain the ammo from the tarmac. An operator may load ammo to an aerial robot before the start of a game
Ammo refilling	Accepted and rendered	-	An aerial robot may get bullets refilled at the tarmac or at the resource column. It can give ammo to a hero robot or an engineering robot, or get ammo from an engineering robot or a hero robot. However, an aerial robot may not directly resupply an engineering robot or a hero robot within the area of the tarmac. This will

			be considered cheating.
Max. take-off weight (kg)	5	-	Batteries are included, but the bullets or pellets are not
Max. size (mm)	1000*1000*800	An aerial robot that does not conform to the size requirement specifications will be rejected during the check-in process	The height is no more than 800mm, and the orthographic projection on the ground is no larger than the square area of 1000*1000. The limit on the size of an aerial robot shall take into account the size of the connector of a safety rope and the size of blade cover
Max. ammo-carrying quantity	No limits	-	-
Range of activity	Flying space set by the safety rope		
Place of take-off and landing	Tarmac, resource column		
Activation conditions	An aerial robot is allowed to move or drop ammo only after the formal start of a game	An aerial robot that moves or drops ammo before the formal start of a game will be considered to be in violation of competition rules and therefore will be ejected from the game	

2.8 Engineering Robot

Before the game, the RFID module and IC card must be carried by the engineering robot.

Each team can be equipped with one engineering robot. An engineering robot must be equipped with the referee system. One image transmitter and one remote controller can be mounted on the robot but no firing mechanism. Engineering robots are responsible for placing obstacles, assisting the hero robot to land and supplying bullets to other robots. They can also cure hero robots, standard robots and themselves.

Using a specified RFID IC card, engineering robots are able to cure other robots. Therefore, there must be an IC slot on each engineering robot. Each participating team should announce that their engineering robots will take part in the contest before check-in to get their IC card, and the IC card

should be inserted during check-in to see if it works normally. The RM2017 committee is not responsible for damage to the IC card during the game and breakage of the IC card will not affect the game itself. The participating team can apply for a change of the IC card during the game interval if the IC card stops working. It is the team, not the committee's duty to check if the IC card is working normally. **But the committee will help the team to check if the RFID module and IC card work properly before the game.**

Robots from both teams can be cured by reading an RFID IC card placed on the ground. Engineering robots can heal the HP of each robot by 50% at a rate of 2.5% of the total HP per second in one game. They cannot land on the resource island, nor can they prevent the opposing team's robots from landing on the resource island. If found to be doing so, Engineering robots may be warned or expelled from the game.

Engineering Robot Specifications			
Item	Limit	Penalty for exceeding limit	Remarks
Type	Teammates	-	-
Referee system	Yes	-	Two small-sized, central symmetric armor plates mounted around the body. The armor around the body should be 50mm-100mm off the ground. For specifications including the relative distance and geometrical center offset distance of the armor plates, refer to <i>the Manual for the Referee System</i>
Initial HP	1500	-	-
Operation mode	No limit	-	-
Bullet type	N/A	-	-
Initial Ammo	0	-	Bullets must be emptied before the start of a game
Ammo refilling	Accepted and rendered	-	
Max. mass (kg)	25	-	Referee System excluded
Chassis Capacity (W)	120	HP will be deducted.	
Max. initial size (mm)	800*800*800	-	It may not exceed 800mm in height, and its orthographic projection on the ground may not exceed an 800 x 800 square.
Size during contest (mm)	1200*1200*1200	-	It may not exceed 1200mm in

			height, and its orthographic projection on the ground may not exceed a 1200 x 1200 square. Armor should not be covered after transformation, or the robot may be sent off.
Range of activity	The whole battlefield	-	-
Activation conditions	An engineering robot is allowed to move only after the formal start of a game	An engineering robot that moves before the formal start of a game will be considered to be in violation of competition rules and will therefore be ejected from the game.	-

2.9 Refueling Station

The refueling station should be completely automatic and designed by the participating team. It is placed in the refueling area of its own team, providing 17 mm ammo to teammates. There is no limit for its ammo quantity.

Before the start of a game, the refueling station will be emptied. After the game starts, the official refueling mechanism will release 200 17mm ammo. At 2 minutes 30 seconds, another 300 17mm ammo will be released. At 5 minutes, 300 17 mm will be released.

Basic requirements of the Refueling Station: Size not exceeding 1000*1000*1000mm, active movement or firing mechanism are not allowed, and no need referee system required.

The Refueling Station must meet the specifications required by the organizing committee, or it will be rejected during the check-in process.

Participating teams are allowed to add a counterweight to the refueling station, but the object used as a counterweight should not make the size of the refueling station exceed the maximum size, and it must follow all requirements as defined by the rules. The refueling station and its counterweight must be in the refueling area before the game.

The refueling station cannot use the viscous material like the tape to fix it to the ground. **If the refueling station damage the competition area, the team will be given a lose penalty.**

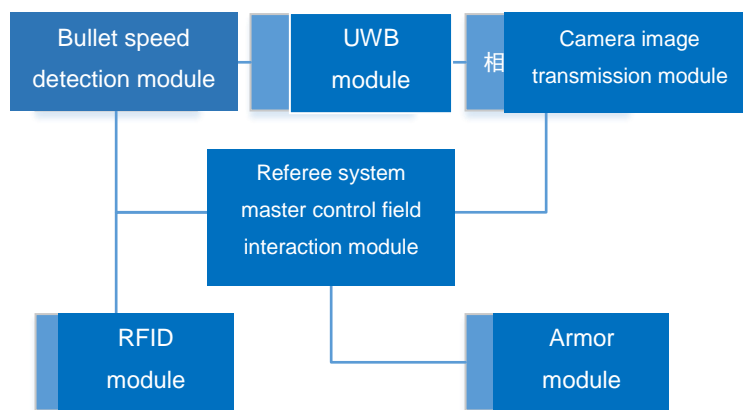
2.10 Referee System

The referee system will be provided by the Organizing Committee. It records attacks from other robots and the HP reduction, monitors the operation of the shooting mechanism and chassis power, and transmits this information to respective computers and servers in real time so that the server can automatically decide which team wins the contest, guaranteeing that the contest is fair.

Participating teams must reserve mechanical and electrical interfaces in the design according to the requirements of each contest type as well as relevant announcements of the Organizing Committee so that the referee system can be easily installed. Any robot that does not conform to the referee system specifications will be rejected during the check-in process. Refer to the Manual for the Referee System for specific mounting requirements.

2.10.1 Components of the referee system

The referee system is composed of the modules below:



- **Camera image transmission module:** Captures real-time camera images, and sends them back to the screen in front of the controllers in the control room.
- **Bullet speed detection module:** Detects the cyclic rate and muzzle velocity of the bullets fired by the robots' firing mechanisms. If the detected rate and velocity are higher than the limit, penalties will be assessed accordingly.
- **Armor module:** Composed of armor sheets and sensors, it protects a robot's internal structure, detects bullet hits on the robot, and deducts HP accordingly.
- **Field interaction module (RFID):** Interacts with functional points in the battlefield by exchanging information with them to perform tasks.
- **UWB module:** Acquires real-time robot locations on the battlefield.
- **Master control module:** Controls the robot's main power supply, checks chassis power, and shows the amount of HP with an indicator column in blue or red. When its power exceeds the limit, a penalty will be assessed. When HP drops to zero, the main power supply will be

automatically cut off. To keep resets to a minimum, when the main power supply is cut off, a limited power supply will be reserved for the robot's automatic control module.

2.10.2 Sizes and interfaces

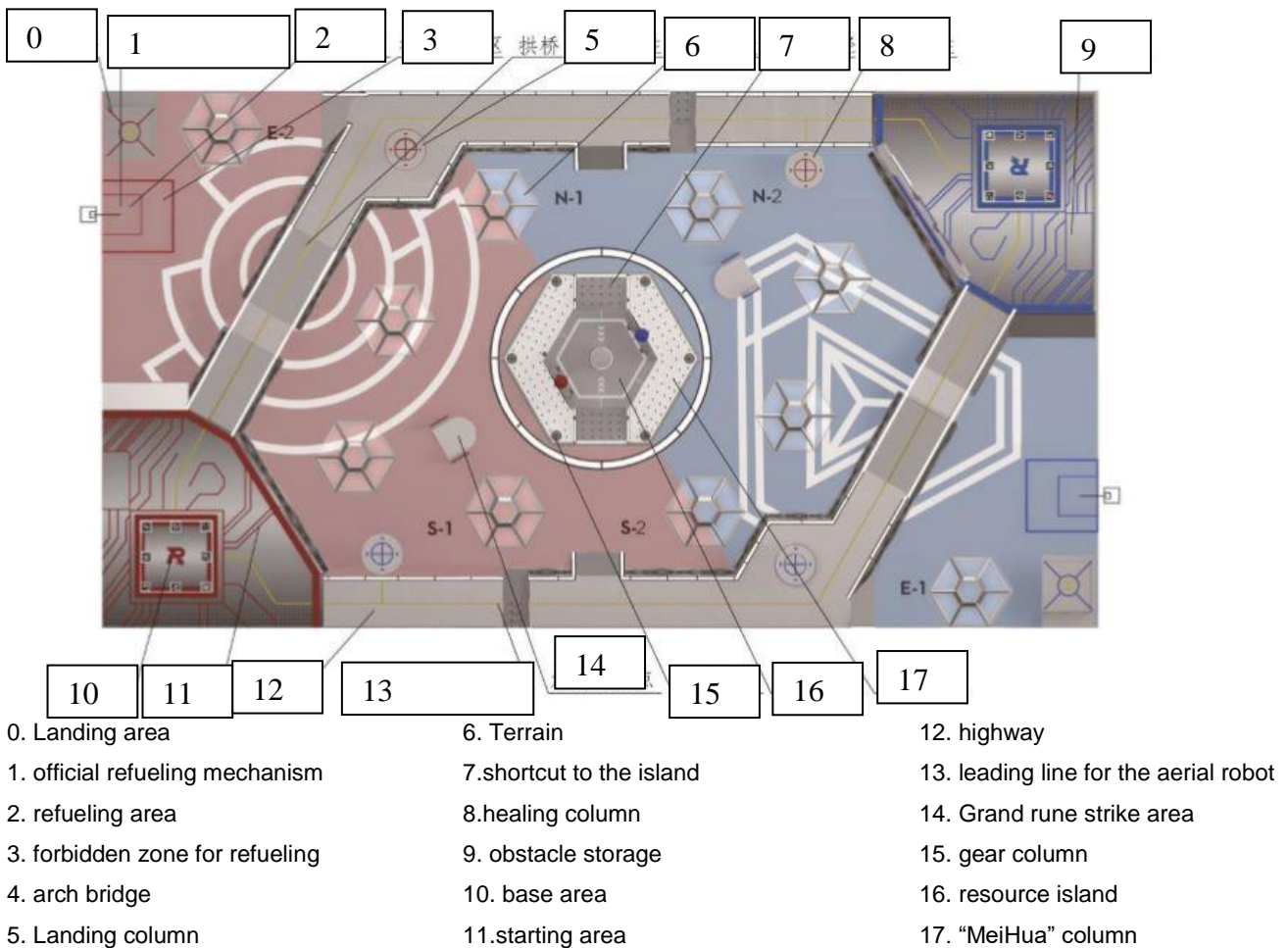
Refer to the Referee System Manual for detailed information on the specific size and interface requirements.

Note: There will be some changes of the size and form of the referee system of RM 2017 compared with RM 2016. The RM 2017 Referee System Manual will be released between February 2017 and March 2017. Participating teams may take the RM 2016 Referee System Manual for reference when making their robot. The organizing committee will try its best to keep the interface the same.

3 Battlefield Description

3.1 Overview of the competition system

The battlefield of RM 2017 is rectangular with its length of 28m and width of 15 m. It is central symmetric. There are six main areas: the starting areas, refueling areas, forbidden refueling areas for both sides. High way area, resource island, barren land, aerial robot area. Outside the battlefield is the referee's table and the control room.



3.1.1 Descriptions

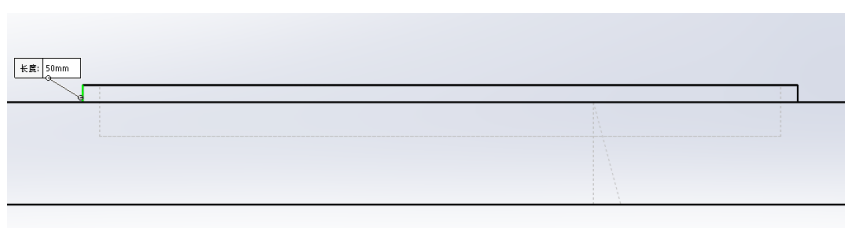
Name	Type	Function	Qty	Remarks
Start area	Land form	Where the ground robots of both teams start when a contest begins.	1x2	One for each team
Base area		Where the base robot can move during a contest	1x2	In each team's start area
Island		With cylindrical container in	1	Surrounded by the

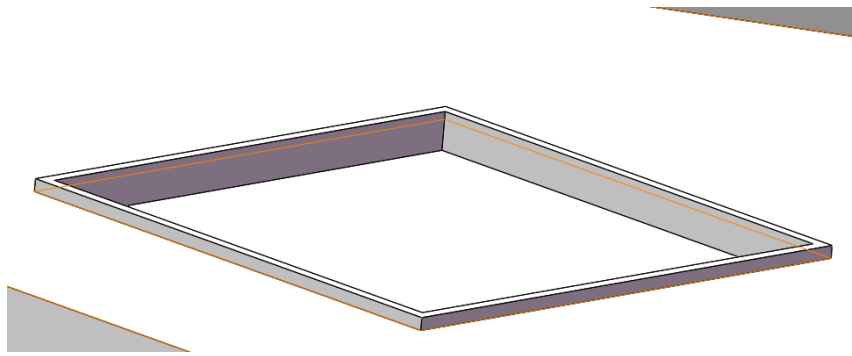
		which bullets are held.		river
Warehouse		Where obstacles are placed and stored.	1x2	In each team's start area, marked by strips on the ground
Landing area		Where drones take off and land.	1x2	
Resource Columns		On the top of the columns, the aerial robot can land and collect ammo	2x2	Due to the restriction of the safety rope, aerial robots from one team can only land on two resource columns.
Grand rune point		Fired on to trigger. All of that team's robots' power will be increased by 200%.	2	Degree of difficulty will be adjusted.
Ammunition depot	Items	Reload ammo regularly.	1x2	A bullet reloading mechanism outside the depot stretches inside. Around the ammunition depot is a 2m*2m forbidden area.
Obstacles		Work as obstacles	Several	Each warehouse has the obstacles of the same quantity.
Rune columns		Close to resource columns. Once occupying the rune columns, that team's robots will heal at a specific HP per second.	2	Attackable armor is placed around the columns. 5 continuous hits in 5 seconds will stop HP healing.

3.2 Battlefield

Start area: This is the area where the ground robots of both teams start when a contest begins. This is also the main area where the ground robots can move in the Technical competition.

Base area: This is the area in which the base can move during a contest. It is a 2000*2000mm square with a 100mm subsidence, separated from the rest of the field with a 5cm fence. The base can move only in this area. Other ground robots cannot enter this area, and obstacles can be placed by each team into this area.



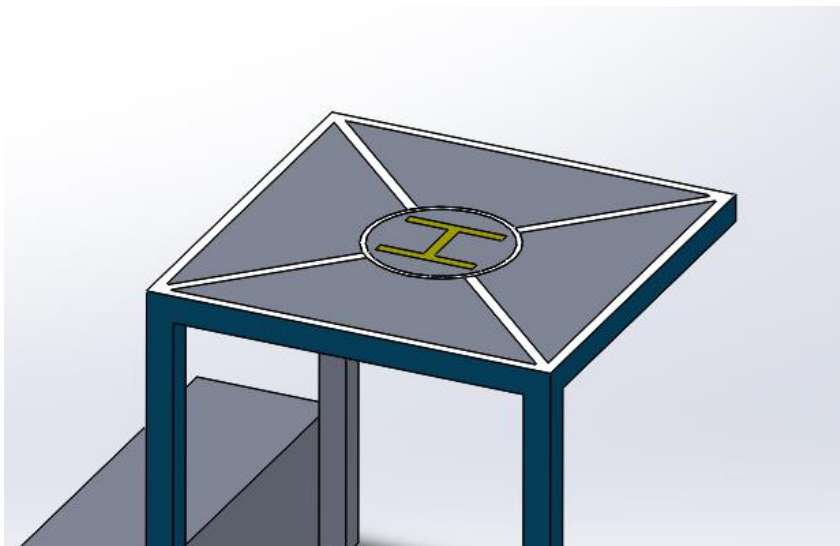


Penalty Criteria in the Base area

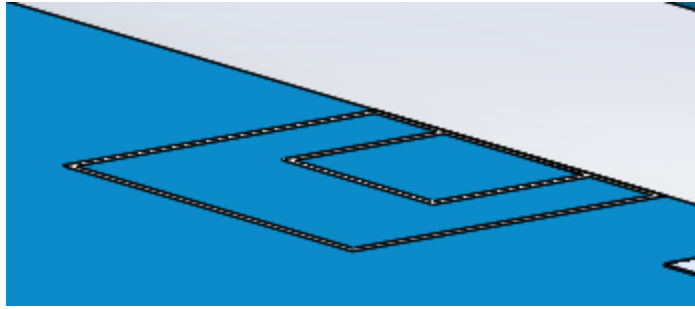
No.	Criteria
1	It will not be regarded as intruding other team's base area if the ground robots from one team (Hero, standard and engineering robots included) stay on the base area of the other team temporarily (within 3 seconds).
2	Robots will be sent off if they stay on an opponent's base area for more than 3 seconds, or if any of one team's robots come into contact with the base robot of the other team.
3	If a robot stays in the base area of the opposing team for more than 10 seconds and causes the base robot to malfunction when it is sent off, the team will be penalized for that contest.

Refer to [4.3.4](#) for detailed information about warning, sent-off and loss.

Landing area: This is the area where aerial robots can take off, land, and reload ammo. Ten 42 mm bullets will be placed in the middle of the landing area before the start.



Ammunition depot: Prepared by each team, these shall be placed in an appointed location in the team's area and use specially designed tubes to supply 17mm bullets every 30-seconds to the team's robots. The end of the tube is right above the center of the ammunition depot, about 1.1m off the ground.



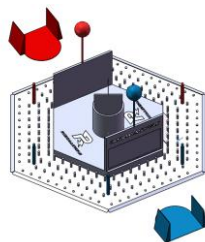
The 2*2 square underneath the tubes, which is outlined in yellow and the space above are a forbidden area. Opponent robots cannot enter this area, and to do so will result in a penalty.

Penalty Criteria in the Ammunition Depot:

No.	Criteria
1	It will not be regarded as intruding other team's ammunition depot if the robots from one team stay on or above the ammunition depot of the other team temporarily (within 2-seconds).
2	If the robot stays on or above the ammunition depot of the other team for 3-seconds or more, that robot will be warned and should immediately leave the ammunition depot. If a robot gets three or more warnings, it will be sent-off.
3	If a robot stays on or above the ammunition depot of the other team for 10 seconds or more, it will be sent-off immediately.
4	If a team's tubes is not able to supply bullets due to damage or the movement of the ammunition depot caused by the other team, the other team will be penalized in this contest.

Refer to [4.3.4](#) for detailed information about warnings, send-offs and losses.

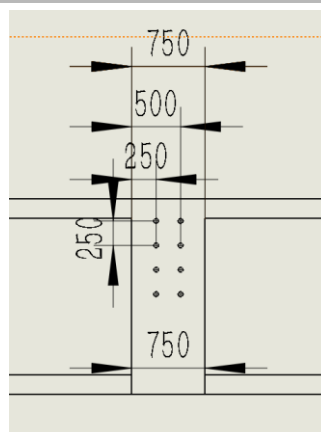
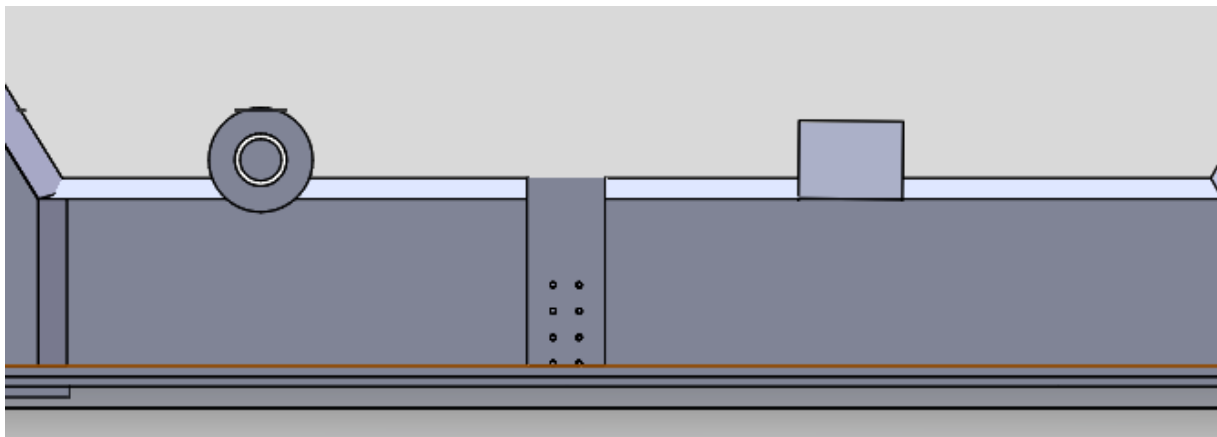
Island: Surrounded by the river (the circular area in the diagram), this is a resource area for both teams at the center of the field. It is prepared by the Organizing Committee. There is a cylindrical container in which bullets are held. A number of 17mm and 42mm bullets are held in the container. The bottom of the container is fixed, and the bullets within the container can to some degree flow from side to side. The island is divided by wood boards in the middle to prevent the teams from interfering with each other. RFID IC cards are placed on the landing sides of the hexagon. Robots landing from both sides can use the RFID module to read the IC card and accelerate their defense power, decreasing the amount of damage by 50% for 20 seconds. By re-reading IC cards, power can be regained. For size, refer to the *Battlefield Manual*.



River: It encircles the island, and works as an obstacle. Six 800 mm columns are placed in the

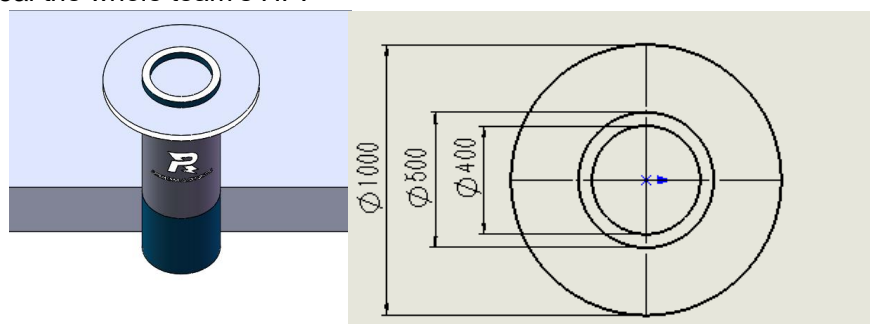
middle of the river. If triggered, these will robots to land on the island more easily. Detailed information will be released by the organizing committee. For size, refer to the *Battlefield Manual*.

Road area: This is a connected area in the field, located slightly above the field. Its surface is flat, and lines are drawn on it. There are slopes of 45-degrees on the sides. See diagrams below. In the middle of the road are ditches, called **ditch areas**.



Resource Columns: On the top of the columns there are around 20 or 40 42mm golf balls. The columns are located in the middle of the battle field. The top of the columns has decorative patterns for visual recognition.

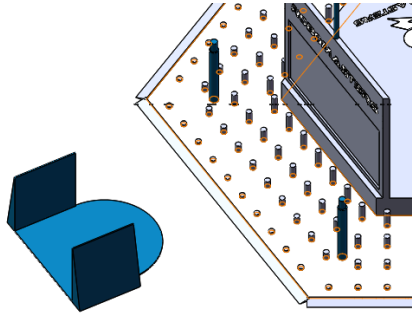
Rune Columns: A special kind of resource column. Aerial robots landing on the remote rune columns will heal the whole team's HP.



Safety Rope: Steel ropes above the battlefield, equipped with slopping rings. Aerial robots are

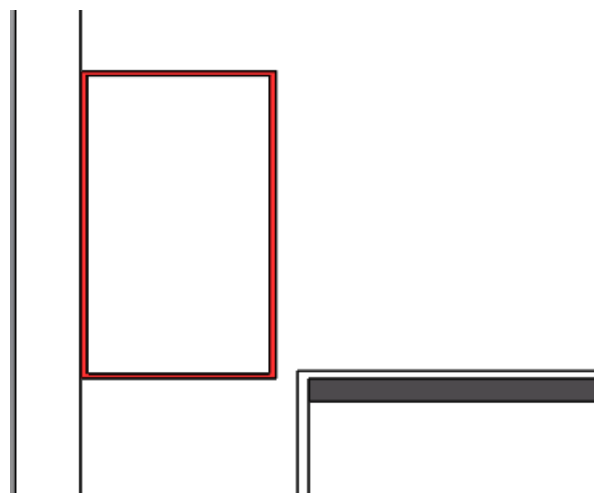
protected by securing the top of the robot to the ropes.

Grand Rune Point: 2m away from the Grand Rune. When the robot reaches the grand rune point, the grand rune will be activated and the images on the large rune will start to change. Successful activation of the grand rune will increase the combat ability for the whole team.



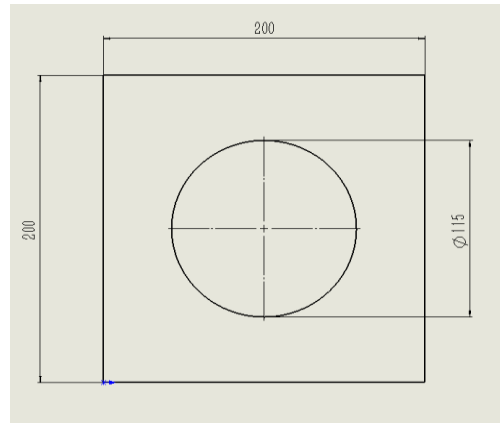
Obstacles and the Warehouse: The place where the obstacles can be stored is called the Warehouse, right at the rim of the start area. Robots can use the obstacles to pave the road, defend against opponents or activate items on the battlefield. The size of the warehouse is 900*2000mm. Obstacles are placed in the warehouse before the game by staff, and participants are allowed to place the obstacles in the warehouse themselves during the 3-minute preparation. Obstacles are not allowed to be placed outside the warehouse. To do so will be deemed a foul the engineering robot will be sent off after the competition starts.

Robots can enter each other's start area and warehouse after the competition starts.

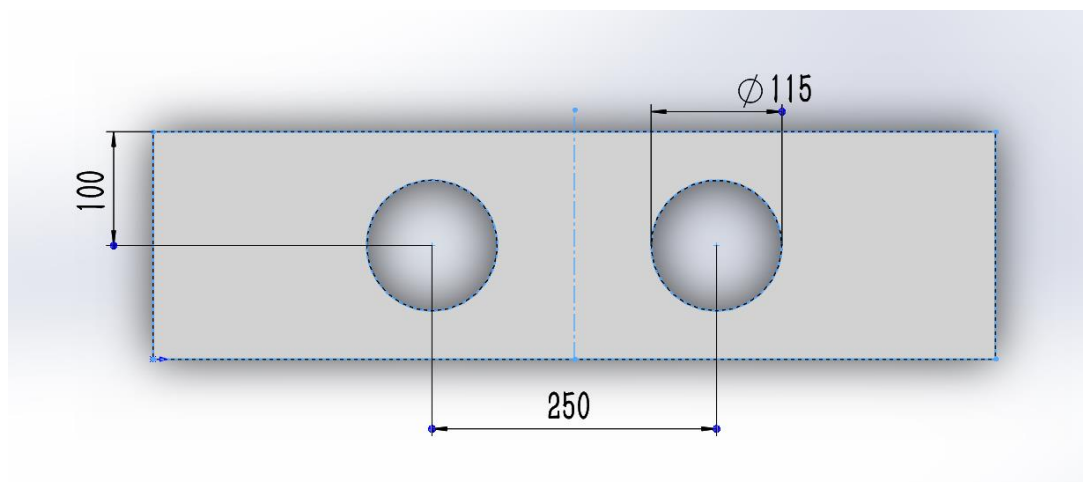


Two types of obstacles: Both made of EVA foam with 45-degree hardness.

A Cube of 200*200*200mm with a hole of a diameter of 115mm and a depth of 100mm.



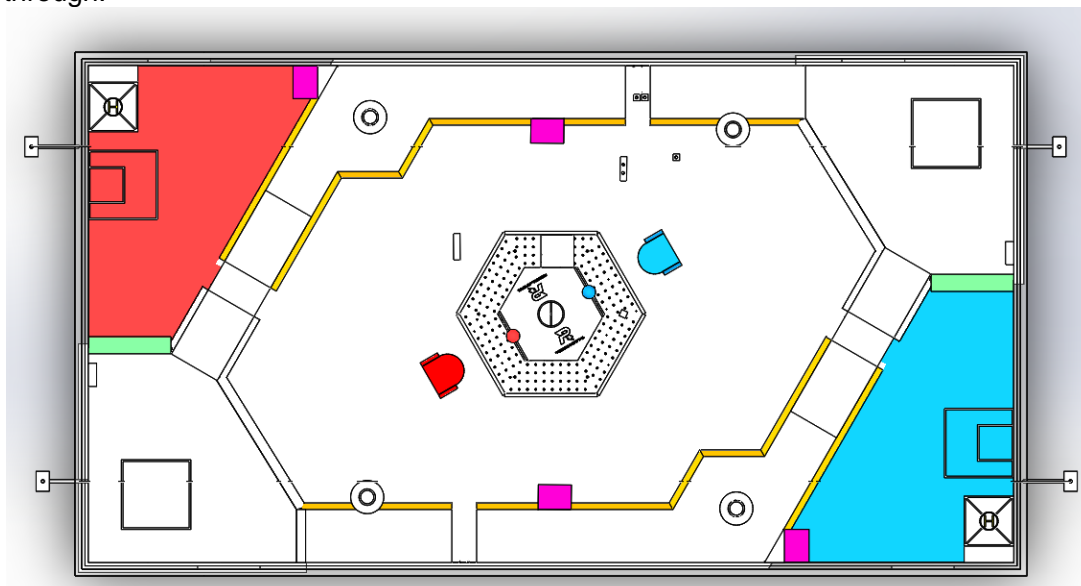
A cuboid of 740*200*200mm with two holes.



3.2.1 Slopes in the battlefield

Different slopes of different degrees can be found in the battlefield. Purple areas have a slope of 15-degrees; green areas have a slope of 30-degrees; and orange areas have a slope of 45-degrees. There may be 5-degree deviation.

Obstacles may be used to link areas with no specific slope that would otherwise be impossible to pass through.

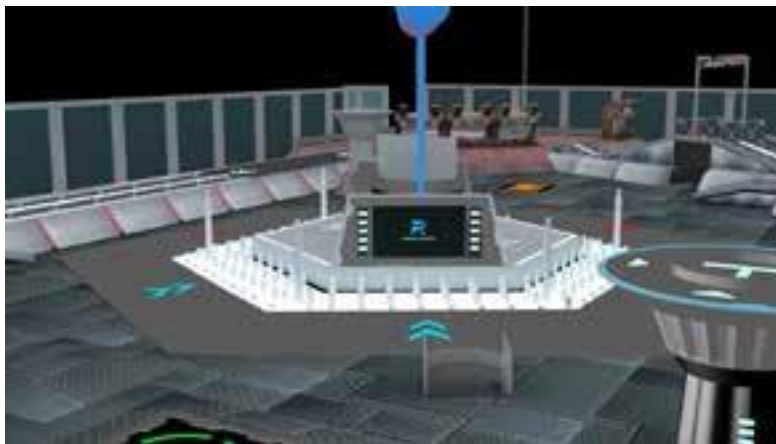


Patterns with colors or contrast images, primarily QR codes will be printed on the landing area, start area, island, road area, columns, obstacles, etc. For details on the patterns and the specific size of the battlefield, refer to the *Manual of Battlefield*.

3.3 Rune system

There are two types of runes: grand runes and aerial runes. Grand runes are more difficult to activate. They can notably enhance a team's combat ability, and play a decisive role in a game. Aerial runes work as supplement and are of strategic importance.

3.3.1 Grand runes



As shown in the Grand rune diagram, there is a 3x3 grid on each side of the island. The target images listed in the target diagram will randomly appear in the 9 blocks with a 5-number code displayed on the top of the diagram. Each array will remain for 1.5-seconds. Then, the next random array will appear. A transparent damage detector/sensor will be installed in front of each block. Robots located in the Grand rune point can fire bullets in accordance with the code illustrated above the 3*3 grid.

- If the robot hit the 1st number correctly in 1.5s, another array will appear with the code unchanged;
- If the robot does not hit the correct number within 1.5s, another array will appear with the code changed;
- If the robot does not hit any number within 1.5s, another array will appear with the code changed;
- If the robot leaves the Grand rune point, the grand rune will return to its initial stage;
- The large rune can be successfully activated once the code has been hit in right sequence.

The large rune is available for hitting after 4 minutes of a game. Only when the robot occupies the large rune point can it hit the large rune. Once the large rune is activated, all the robots from that team's fighting power will be increased by 200% for the following 1-minute. At that time, both teams cannot activate the grand rune. Only one team at the site can own the grand rune tune-up at one time. For the number, the code, the size and more specific information about grand rune, refer to the *Battlefield Manual*.

3.3.2 Aerial runes

Aerial runes are added in the remote resource column of each team. This column consists of a column, sensors and armor. **When an aerial robot lands and stop at the rune column**, the armor around the column will light up, and whole team's HP will be gradually healed. The other team's robots can stop the healing by hitting the armor around the column. If the team wants to regain the healing effect, its aerial robot must take off, leave the column and return.

There will be some changes in the triggering condition, healing capacity and hit quantities based on the whole contest.

4 Main Competition Procedure

& Rules

4.1 Overview

In the RoboMasters 2017 Main Competition, robots from two teams equipped with the official referee system will carry out strategic games. The robot records live images with its camera and transmits them via the video downlink module to the operator's screen in the control room outside the battlefield. With this information, the operator controls the robot's movement and attacks robots from the other team to win. The referee system records the HP and attack information, and monitors shooting mechanism operation and chassis motor power of each robot during the games. The power supply will be disconnected automatically when the HP of a robot reaches 0 in one battle. The server of the referee system will decide the winner automatically via the real-time status of each robot transmitted to the corresponding computer terminal and server.

To take part in RM2017, teams should fill in and submit the application form in the registration system on the official RoboMasters website, then finish the evaluation and submit the technical report before the deadline. Teams with a qualified technical report can take part in RM2017 Regional or RM2017 Wild Card. Teams can only take part in the RM2017 Tournament only if they get excellent results in the RM2017 Regional or as a Wild Card.

4.2 Competition Schedules

The competition procedure is roughly arranged as below, for reference only.

Schedule	Arrangement
Register Pre-check	Teams register and carry out pre-check in the check area. Robots can be adjusted according to the pre-check results.
Field Adaptation	Arrange field adaptation according to the registered order without scoring. Pre-check requirement for the field adaptation is relaxed. Team members can adjust the robots on-site.
Leader Meeting & the Draw	The committee introduces competition details, teams draw for the competition arrangements, advisors and captains raise questions and discuss together with the committee. After the meeting, the committee will publish a FAQ document, which is in line with the rules.
Qualification Match	Formal competition with strict check in.
Quarter-Finals	Adjusted according to the number of the qualifying teams

Semi-Finals, Finals Awards Ceremony	Adjusted according to the actual situation
Youth Engineer Convention	Expected to be the day after the finals

4.3 Competition Procedure

Team members should only move around the Preparation Area, Waiting Area and Competition Area during the competition, follow the arrangements and guides of the organizing committee staff, and abide by the corresponding regional regulations to ensure the competition goes well.

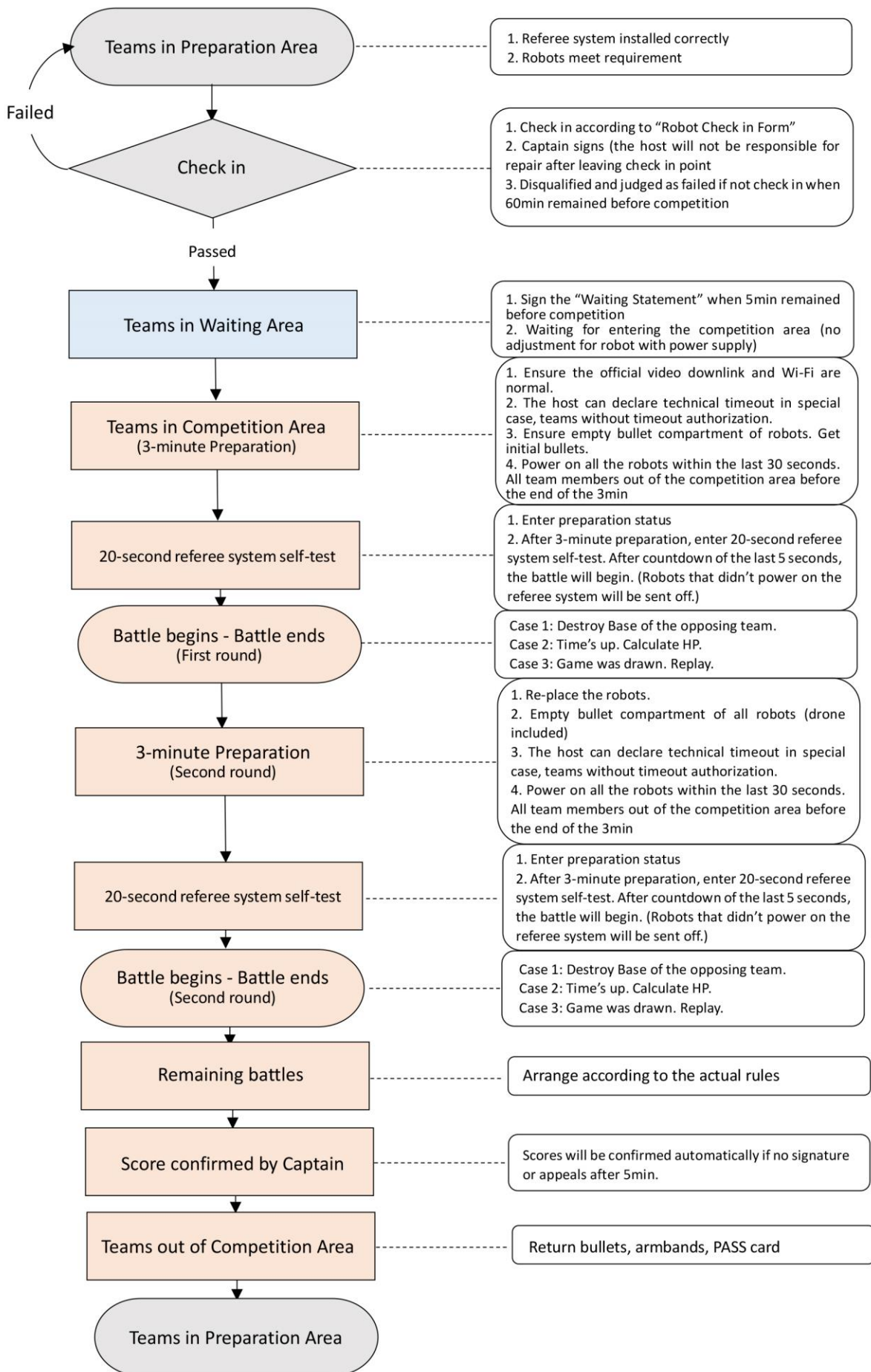
In Regionals and the Tournament, formal competition consists of a qualification match and quarter-finals. In a qualification match, both teams in one battle can get points. However, in quarter-finals, one of the two teams will be knocked out.

All the teams should pass the **check in** before competition to ensure that robots meet the safety standards defined by the RM2017 Organizing Committee so that the referee system can make fair decisions. Team members should enter the competition area when directed by referees and volunteers before competition begins. Team members should clean up the bullets in the robots according to the rules and return them to the defined area after competition ends.

In one competition, two teams will carry out BO2, BO3 or BO5 (varies between Regional and Tournament). Each battle consists of a 3-minute preparation and a 7-minute game.

After starting, team members can enter the battlefield to adjust the robots according to the rules in the 3-minute preparation. After 3 minutes or if both teams are ready to go early, a 20-second referee system self-test period begins. For the last 5 seconds of the period, there will be a countdown sound and display. The battle will begin immediately after 5 seconds. The battle will end after a 7-minute game or if one team wins before the time is up. Preparation for the next battle will then begin. The competition will end when all battles are completed.

4.3.1 Competition Procedure Illustration



4.3.2 Pre-game Rules

4.3.2.1 Register for Check in

Each team must arrive at the check-in area at least 60 minutes before the game begins. To make sure that the robots to be used in the game conform to the competition rules and requirements, the RM2017 Organizing Committee will examine all the robots. Only robots that pass the check will be given an official PASS card to enter the competition site.

No.	Notes
1	A team will be disqualified and the opposing team will win the game if the team does not arrive at the check-in area 60min before the game begins. Be sure to inform the RM2017 Committee if an emergency occurs, and the committee will use its discretion.
2	The team can choose between completing the game with an injured robot or to surrender if a robot error occurs after check in (Base Robot and Hero Robot included) and cannot be repaired before the game.
3	The team cannot be allowed to compete if it only the Base robot (operating automatically) and the Hero robot meet standards. The total number of robots for each team in the Battlefield per game should not exceed 8, and each robot must link to at most one remote controller.

4.3.2.2 Check in

Before and during check in, the RM2017 Organizing Committee will provide teams with a “Robot Check in Form” to help adjust the robots. Robot that don’t pass the examination will not be allowed to enter the competition site until it passes check in following adjustment. The RM2017 Organizing Committee staff will record the check in status in this form.

Failure check in includes the following failures:

No.	Type
1	Power supply does not conform to the rules.
2	Wireless frequency does not conform to the rules.
3	Wired communication or wireless frequency band that does not conform to the rules.
4	Optical approaches do not conform to the rules.
5	Sensor installation does not conform to the rules
6	Referee system installation does not conform to the rules (including non-conformant armor plating or speed detection module mounting, indicator column is covered, etc.)
7	Any size is over the limit.
8	Any mass is over the limit.
9	Drone type does not conform to the rules.
10	Any shooting mechanism is mounted on the drone.
11	Any other robots that the referees determine to be non-conformant.

For the Robot Check in Form, please refer to Annex I.

4.3.2.3 Waiting Area Registration

After check in, participating teams should arrive at the waiting area at least 10min before the game. To make sure that the robots to be used in the game conform to the competition rules and requirements, the RM2017 Organizing Committee will check all the robots' status and team member information.

No.	Notes
1	Each team should have at most 12 members (including advisor and operators) in the waiting area.
2	All the robots in the waiting area should have a PASS card. Robots without a PASS card is will be prevented from entering the competition area.
3	All teams should prepare tools or devices (such cables, remote controllers, etc.) by themselves during the competition. The team is responsible for their tools or devices after entering the competition area.
4	Abide by the safety rules of the waiting area. Avoid accidents or affecting the competition when adjusting or repairing robots. The referee group will give a warning message if robot adjustment has affected the competition. The referee group has the right to give penalties if a serious breach occurs after the first warning.
5	The captain should sign the "Waiting Statement" when 5min remains before game to ensure normal participation. The team will be disqualified and the opposing team will win the game if the captain does not sign at the 5min mark. Be sure to inform the RM2017 Organizing Committee if any emergency occurs, and the committee will use its discretion.

4.3.3 Competition Rules

Team members should stand by out of the battlefield after leaving the waiting area and entering the competition area. The team should abide by the Organizing Committee staff in strict accordance with their arrangement and guidance.

4.3.3.1 3-Minute Preparation

Before the 3-minute preparation, members of both teams should stand by in the boundary of the battlefield. The assistant referee will confirm that members are ready and then inform the referee. After the referee's OK, the team members enter the battlefield and a 3-minute countdown begins.

In the 3-minute preparation, members place the robots in the start area and check robot status and connection. If preparation is completed, press the Ready button in the operation room to put robots into Ready status. The robots should be placed in the starting area and any part of robot should not be in the obstacle storage area.

No.	Notes
1	Team members should empty bullets from their robots and their Refueling Station before each battle. Robots will be sent off if bullets are not cleaned up during the preparation period. The official external refueling device will not supply bullets to the Refueling Station during the battle if bullets are not cleaned up during the preparation period. After are bullets cleaned up, the referee will offer place the initial bullets for the base robot

	and Refueling Station. Hero robots, standard robots and engineering robots cannot accept bullets before the battle begins. Aerial robots do not need to empty their bullets. Only after the referee confirms the initial number of bullets on the landing area can an operator start add bullets into the aerial robot.
2	Each team should have at most 12 members (including advisor and operators) enter the battlefield for arrangement.
3	In the last 30 seconds of the 3-minute preparation, all robots should be powered on.
4	When the 3-minute preparation ends, team members must exit the battlefield immediately. The team will be set to Ready status automatically, even if robot setup is not completed. If any team member stays on the battlefield, the team will lose the game.
5	After the 3-minute preparation, a 20-second referee system self-test will begin. After counting down the last 5-seconds, the battle will begin. Robots that do not power on the referee system will be sent off. If a referee system error occurs during the 20 seconds, only the referee and staff can enter the battlefield to check. All team members should abide by the referee's arrangement and enter the battlefield only if necessary.
6	All robots, except the base robot, cannot take move (including leaving the start area, transferring structure, rotating propellers, etc.) until the battle begins. Robots moving in advance will be sent off.

4.3.3.2 Operator

When the battle begins, there should be at most 5 ground robot operators, one advisor (only strategy command, no operation of any devices) and one aerial robot operator to participate in the battle.

No.	Notes
1	There are 5 computers and one video downlink display screen in the control room. The operator can only operate his/her corresponding computer and should not change his/her position. The advisor can only send strategy commands and should not operate any of the computers or remote controllers, or observe the battlefield situation directly. The aerial robot operator can only operate the drone in the specified control room.
2	Operators in the same control room can communicate with each other. Ground robot operators can send voice commands to the aerial robot operator through the communication device provided by the host, but voice cannot be sent back from the aerial robot operator to the other operators. The referee will warn the aerial robot operator if he/she try to send back any information to other operators. The referee will eject the aerial robot from the game if the operator ignores the warning. A lose penalty will be given out in more serious condition. In the 3-minute preparation, the aerial robot operator should check the communication device with the help of the assistant referee.
3	Referees will monitor all the control rooms. All the operators should not leave their corresponding operating area by themselves without the permission of the referees.
4	The RM2017 Organizing Committee provide mice, keyboards, USB hubs and USB cables for competitors. However, as the performance of these devices reduces over long periods of use, we recommend competitors prepare these devices by themselves, and complete connections and testing before the competition. The RM2017 Organizing Committee assumes no liability for any effect on game results caused by the use of devices provided by the Committee.
5	There is no extra power supply in the operating room, the operator should bring his/her own power source to provide the power to the equipment. Otherwise, it will be treated as damage the field property.
6	The operators should wear the earphone provided by the committee to receive the order from the referee. The

	operators violate this rule will be ejected from the game with his/her robot.
7	The number of operators in the operating room should be same as the number of robots in the battlefield. No more people is allowed in the operating room. Otherwise it will be treated as cheat.

4.3.3.3 Attack and confrontation

After a game starts, robots from different teams may fight for the resources on the field, and attack the robots and base of the opponent through tactical cooperation and by giving full play to battlefield terrain.

No.	Type
1	During a game, a robot cannot strike or damage an opponent's robot (caution: the obstacle on the engineering robot is also counted as part of it). If this occurs, a linesman will raise a bright-colored flag to indicate the impact, and the referee will put an "impact warning" into the referee system.
2	During a game, a robot cannot enter the forbidden zone of their opponent's ammunition depot (caution: the obstacle on the engineering robot is also counted as part of it). If this occurs, a linesman will raise a bright-colored flag to indicate the foul, and the referee will put an "ammunition depo entry warning" through the referee system.
3	During a game, a robot cannot shoot an opponent's aerial robots (caution: the obstacle on the engineering robot is also counted as part of it). If this occurs, the team will be issued a Game Loss penalty.
4	During a game, a robot cannot enter the forbidden zone of their opponent's ammunition depot (caution: the obstacle on the engineering robot is also counted as part of it). If a robot makes the opponent's refueling station unable to receive the ammo from the official refueling mechanism or the robot sent off still block the refueling station of the opponent, there will be a penalty corresponding to the nature of the foul and lead to a penalty to lose.
5	During a game, a robot cannot enter the base area of their opponent. If this occurs, there will be a penalty corresponding to the nature of the foul.

To encourage all teams to improve robotic technology and the stability of robots, the Organization Committee will unveil new and narrow rules on penalties for impact warnings. Only when a robot has a fast front on impact with a robots on the other team will it be judged as a vicious act. Other impacts that do not lead to abnormal or improper operation or functions of a robots (i.e. failing to fire bullets or pellets, unable to drive normally, damage to operation mechanisms, or damage to armor plates of the referee system) will not be taken into account in an appeal.

Impact warnings do not apply to engineering robots. If an engineering robot connects to an opponent robot using through its mechanisms, and this connection hinders the normal operation of the opponent robot, the team will be given a count of three. The team should separate the two robots from each other as soon as possible. If the engineering robot remains connected to the opponent robot of the opponent after count to 3, it will be ejected from the game. If the ejected engineering robot remains to be connected to the robot of the opponent after it is powered off, the team will be issued a Game Loss penalty. Also, there will be more severe penalties for impacts on engineering robots. If an engineering robot comes into contact with or impacts non-armored parts

of an opponent robot, there will be a warning. If an engineering robot hinders the normal operation of an opponent robots (i.e. the engineering robot damages the wires of the opponent robot, causing damage to sensors or the camera lens), the team will be issued a Game Loss penalty.

4.3.3.4 Reload Bullets

During the game, all robots should only use the bullets provided by the host, or the team will be ruled as cheating.

Robots should not reload bullets from their own base robot or use bullets shot by the base robot for purposes other than attacking the opposing team. These activities will be deemed cheating.

Only an Engineering robot can collect bullets on the ground, if other robots do the same thing, this will lead to a game loss penalty.

Before the game, any robot should not shoot bullet, if the shoot cause the hurt to the people, a game loss penalty will be assigned.

After a game begins, the Base robots and Aerial robots can fire immediately without limitation. Hero robots and Standard robots cannot fire until they complete their ammo supply.

Standard Robot reload examples:

No.	Type
1	Reload at least one bullet from the Refueling Station.
2	Reload at least one bullet from the Hero Robot.
3	Reload at least one bullet from the Resource Island.
4	Reload at least one bullet from the Engineering Robot.

Hero Robot reload examples:

No.	Type
1	Reload at least one bullet from the Refueling Station.
2	Reload at least one bullet from the Resource Island.
3	Reload at least one bullet from the Aerial Robot.
4	Reload at least one bullet from the Engineering Robot.

Movements out of the cases above are not considered reloading bullets. Robots firing without reloading bullets will be penalized and the team will lose the game. The team will also lose the game if firing without reloading was not found during the game but is found during appeal.

4.3.3.5 Exception Handling

Referees reserve the right to stop the game in the event that any safety issue occurs. Any

participant may ask a referee on the team's side to stop the game. If the request is reasonable, the chief referee shall decide whether or not the game should be stopped.

The referee group can carry out an official technical suspension if any of the following occurs:

No.	Type
1	Wi-Fi error during the 3-minute preparation of the first battle (if this occurs during the 3-minute preparation of the second or later battle or during the battle, it is ruled as normal fight wear and there will be no suspension.)
2	Image transmission error during the 3-minute preparation of the first battle (if this occurs during the 3-minute preparation of the second or later battle or during the battle, it is ruled as normal fight wear and there will be no suspension.)
3	Referee system connection error during the 20-second referee system self-test.
4	Referee system error on the Base robot.
5	Computer error in the control room.
6	Stage design in the competition area and props outside the battlefield have affected the competition.
7	Drone lanyard error.
8	External bullet reloading mechanism error.
9	Emergency: drone has injured people, batteries are on fire or have exploded, power failure, or personal conflict.

Robots (Base and Hero included) mechanisms, software, Wi-Fi or video downlink errors occurring in the 3-minute preparation after the first battle or during the battle are ruled as normal fight wear and there will be no suspension. A faulty unit can be repaired by team members in the 3-minute preparation. If repairs fail, the robot should take part in the battle with its faulty unit.

Solutions for field props and mechanism errors:

No.	Type
1	If a field prop error occurs, the battle continues as usual. If a rune column/heal column error occurs, the referee system will stop the rune column on both sides to balance the two teams, and the battle can continue. After the battle ends, technical support will repair the props.
2	If an external bullet reloading mechanism error occurs, affecting the team's refueling, the chief referee will inform the competitors through the referee in the control room and "kill" all the robots. The battle will be stopped immediately, and the result will be invalid. The teams can play according to the competition schedule.
3	If a key prop (grand rune or landing shortcuts in the battlefield) error occurs, the referee will try to solve the problem (which may have a 5-20 seconds delay), if the problem cannot be solved. the chief referee will inform the competitors through the referee in the control room and "kill" all the robots. The battle will be stopped immediately, and the result will be invalid. The teams can play according to the competition schedule.

Caution: If there is error occurs on the prop in the field and affect the result of the game, and the referees do not handle the situation properly, either of team can submit the arbitration request. If the committee confirm the situation, a rematch will be issued.

4.3.4 Penalties

Before, during and after games, referees and the RM2017 Organizing Committee will give

penalties to teams that have irregularities and publish these important penalties daily. Irregularities will be divided into cheating and fouls according to severity and corresponding penalties will be given.

There are five types of penalties:

Type	Penalty
Reduce HP	The referee system will automatically reduce the HP of the robot with irregularities.
Warning	Collision and Refueling Station warnings are the most commonly given. For the lvl1 warning, the screen in the control room of the team which is given a warning will become dim for 3s. For the lvl2 warning, the screen will become dim for 5s and other robots besides the base will have a 5% deduction of the HP. If the robot has a HP value less than 5%, the HP value will be deducted to 1. For the lvl3 warning, the specific robot will be sent off from the game. For the lvl4 warning, this will lead to a game loss penalty.
Send off	The robot will be “killed” by the referee system. This penalty will be automatically triggered in specific situations by the referee system or manually by the chief referee via the referee system.
Game Loss	The chief referee or referee system will “kill” the base robot and the battle will stop immediately when there is a game losing penalty. The HP of the losing team’s robots will recorded as 0, while the HP of the opposing team’s will be recorded accurately at the exact amount remaining when the game was ended. If a loss penalty is imposed before the game (3-minute preparation included), the HP of the team receiving the penalty’s robots will be recorded as 0, while the HP of the other team’s robots will be recorded as full. If the loss penalty is imposed after a game because due to an appeal, the HP of the team receiving the penalty will be recorded as 0, while the HP of the other team’s robots will be recorded accurately at the exact amount remaining when the game ended.
Disqualification	Severe cheating and irregularities will result in the disqualification of the whole team from both competitions and prizes of RM 2017. The score of the team will be reserved as a reference for other teams.

4.3.4.1 Cheating

If any of the behaviors listed below are detected during a game, the offending controller will be ruled as cheating, the controller's team will be ruled as losing the competition, and the team will not be able to participate in any part of RM2017

No.	Type
1	Modifying or damaging the official referee system;
2	Performance of any robot during a game does not conforming pre-game examination performance (such as robot size, drone carrying ability, drone firing mechanism, referee system's installation method, etc.);
3	Any team member communicating with anyone outside of the control room during a game;

4	Any operator not being a member of the team, or using a robot not belonging to the team;
5	Anyone that enters the field without going through the check-in procedure;
6	Any team member manually controlling an automated robot;
7	Any bullet other than those provided by the host used;
8	Any unsportsmanlike behavior as defined by the referees.

4.3.4.2 Fouls

The following acts during a game will be deemed fouls. Penalties will be issued according to the specific fouls.

No.	Type
1	If a referee prevents a team from loading its robots with more bullets and pellets than the rules allow, the team will be issued Game Loss penalty if it does not follow the instructions of the referee;
2	If a non-automatic robot moves before the formal start of a game, or a robot fires bullets or pellets before the formal start of a game, the robot will be ejected from the game;
3	If one or more team members do not leave the field after the three-minute preparation ends, the team will be directly issued a Game Loss penalty;
4	If the initial speed of 17 mm bullets or pellets exceeds no more than 10 percent of the limit, 10 percent of the total HP of the robot will be removed. If the speed exceeds more than 10 percent but no more than 20 percent of the limit, 20 percent of the total HP of the robot will be removed. If the speed exceeds more than 20 percent of the limit, 40 percent of the total HP of the robot will be removed; If the initial speed of 42 mm bullets or pellets exceeds no more than 10 percent of the limit, 2 percent of the total HP of the robot will be removed. If the speed exceeds more than 10 percent but no more than 20 percent of the limit, 5 percent of the total HP of the robot will be removed. If the speed exceeds more than 20 percent of the limit, 10 percent of the total HP of the robot will be removed;
5	The firing frequency of bullets or pellets exceeds the limit. 10 percent of the total HP of the robot will be reduced each time the firing frequency of a bullet or pellet exceeds the limit;
6	If the power of chassis exceeds no more than 10 percent of the limit, 10 percent of the total HP of the robot will be removed; if the power exceeds more than 10 percent but no more than 20 percent of the limit, 20 percent of the total HP of the robot will be removed; if the speed exceeds more than 20 percent of the limit, 40 percent of the total HP of the robot will be removed;
7	A warning will be given if a robot deliberately impacts an opponent robot, or enters and stays in the forbidden zone of the ammunition depot, or the opposing team base for a short period of time;
8	If an engineering robot is connected to an opponent robot for an extended period of time, or if a robot enters and stays within the forbidden zone of the opposing team's ammunition depot or base for an extended period of time, the robot will be ejected from the game;
9	If a robot causes abnormal movements or mechanical operations of the opposing team's ammunition depot, or a robot severely hinders the normal operation of opposing robots (an engineering robot damages wires of an opposing robot, causes sensors or a camera lens of the opposing robots be damaged, it remains connected to an opposing robot after it is ejected from a game, the opposing base robot cannot function properly), a Game Loss penalty will be issued;
10	If a referee prevents one or more operators from leaving the designated zone (operation room or aerial robot operation room), the team will be issued Game Loss penalty if its operators do not follow the instructions of the referee;

11	If a robot gets caught in sub-robots or subsystems that are connected with flexible cables, the team will be issued a Game Loss penalty;
12	If one or more team members enter the battlefield without approval, the team will be issued a Game Loss penalty;
13	A team will be issued Game Loss penalty if it does not attend the roll call at the check-in area within the specified time;
14	After a game is over, if one or more team members delay or refuse to leave the competition field and this affects the process of other games, the team will be issued a Game Loss penalty and will be no longer be able to compete in the following events for RoboMasters 2017 or to compete for any awards;
15	If a team member uses prohibited articles, the team will be no longer be able to compete in the following events for RoboMasters 2017 or to compete for any awards. If circumstance are serious, the team member involved will be prosecuted for his liability according to law;
16	If a team member attacks, affects others or endangers their own safety or that of others with the robot, the team will be no longer be able to compete in the following events for RoboMasters 2017 or to compete for any awards; If circumstance are serious, the team member involved will be prosecuted for his liability according to law;
17	If a team member damages the opponent robots, field properties or relevant devices, the team will be no longer be able to compete in the following events for RoboMasters 2017 or to compete for any awards. If circumstance are serious, the team member involved will be prosecuted for his liability according to law;
18	If a team member has a physical altercation with referees, opponents or the audience, the team will be no longer be able to compete in the following events for RoboMasters 2017 or to compete for any awards. If circumstance are serious, the team member involved will be prosecuted for his liability according to law;
19	When the Organization Committee is handling an appeal, if a team does not cooperate with or delays their attendance of Organization Committee inspection, the team will be no longer be able to compete in the following events for RoboMasters 2017 or to compete for any awards;
20	Other acts that severely hinder the process of the competition or violate the spirit of fair competition, will be issued penalties by referees according to the nature and severity of these acts;
21	All team members must, whether at the competition stadium or a dormitory, strictly conform to the Competition Rules of RoboMasters 2017 and the local laws, rules and regulations. If a team member breaks the law, the team will be no longer be able to compete in the following events for RoboMasters 2017 or to compete for any awards;

Note: The chief referee shall have the right to determine the acts not specified in the Competition Rules. The chief referee and members of the arbitration committee shall reserve the right to interpret the competition rules of RoboMasters 2017.

4.3.5 Competition System

4.3.5.1 Victory Conditions

A game may consist of 2, 3 or 5 battles, called BO2, BO3 and BO5. The results of a game are defined as below, according to the different rules of Qualification Matches and Quarter-Finals.

System	Qualification Match	Quarter-Finals
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BO2	2:0, team which wined two battles gets 2 points	N/A
	1:1, both of the team gets 1 point	
	0:2, team which lost two battles gets 0 point	
BO3	N/A	Team which wined two battles wins the game
BO5	N/A	Team which wined three battles wins the game

The conditions for victory of each battle are listed below:

1. A team wins a battle when it destroys the base of the opposing team (i.e. its HP reaches zero).
2. A battle times out. If neither team can destroy the opposing team's base by the end of a battle, the team with the higher total remaining HP of its base and surviving robots wins.
3. If the total remaining HP of all robots on each team are the same, a rematch will be played.

The Net HP of a team is calculated from the total remaining HP of all its own robots minus the total remaining HP of all the opposing team's robots.

4.3.5.2 Round Robin Scored Rules

Rankings are ruled as below with 1 being the highest and 3 being the lowest. The higher priority winner will decide the result.

1. The team with higher total scores ;
2. The team with higher total Net HP;
3. The team with more damage value (HP its opposing team reduced).

If two or more teams are equal using the rules above, the winner will be decided based on the following:

1. Compare the victory and defeat:
2. Compare the total Net HP:
3. Compare the total damage value

If the draw remains after considering these factors, the Committee will arrange another battle for each pair of all the teams.

4.4 Appeal and Arbitration

4.4.1 Confirmation of the Results

Once a game is over, the team leaders shall confirm the score of the game by signing a paper at the bench within 5 minutes. If a team leader does not sign the paper within the allotted time nor makes any appeal, it is deemed that the team has acknowledged the result. After signing, no arbitration should be initiated.

4.4.2 Appeal

During the competition, each participating team may appeal three times, once for Regionals, once for Wild Card, and once for Tournament. These chances cannot be accumulated. Successful appeals are not counted. After three unsuccessful appeals, the RM2017 Organizing Committee will not accept further appeals from the team.

After the rematch from the arbitration, both sides can have the chance to request the arbitration again. The original complaining side will consume one appeal chance no matter the result of arbitration. The continue appeal request after the rematch should be submitted in 5 minutes and signed by the captain and lead teacher. The time limit for submitting the material and evidences will be limited in 30 minutes. If the time exceeds, the committee will not accept the request. After provide the material successfully, the committee will give out the result in one hour.

4.4.2.1 Appeal Procedure

1. **Appeals must be put forward within 5 minutes after the game is over. Appeals put forward outside this period will be deemed invalid.** The team captain should fill in an appeal form to lodge an appeal. An appeal cannot be submitted before or during a game.
2. The chief referee decides whether the appeal is in acceptable.
3. If accepted, the referee group separates the robots of both teams inside the arbitration room for examination and informs both captains. The number of team members at each site should not exceed 3. And the people on the scene can only be captain, manager and important team member. Either captain or manager should be on the scene. After confirm those 3 people, they cannot be replaced by others.
4. When examination is complete, the chief referee will make the final decision.

4.4.2.2 Statute of Limitations for Appeals

1. **Limitation for appeal filed:** Within 5min after the game ended, use the time to write the standard Appeal Form;
2. **Limitation for arrival of both team:** within 30min after appeal filing;

3. **Limitation for evidence / defense data filed:** within 60min after appeal filing.

4.4.2.3 Invalid Appeal Rules

1. Beyond the “limitation for appeal filed”, the Arbitration Committee will not accept the appeal;
2. Within “limitation for arrival of both team”, the absent team or the team with more than 3 members in attendance will be ruled as losing the game;
3. Beyond the “limitation for evidence / defense data filed”, the Arbitration Committee will not accept new data.

4.4.2.4 Appeal Data Requirement

1. **Type:** Only data in U-disk or in the storage of the robot will be accepted.
2. **U-disk requirement:** Place edited videos (the team should prepare the original video data, this will not be provided by the Committee) and appeal text files in the root directory.
3. **Data format:** The duration of each video should not exceed 1min. The file size should not exceed 500MB. The name of the video should display the order and time of the battle.

The video must be able to play in the latest version of Windows Media Player. Picture format should be jpg. Text file format should be txt. Each text file should not contain more than 1000 words.

4. **Data name:** The name of each file should not contain more than 30 characters.
5. **Text file requirement:** One text file should only correspond with one video or picture and the relationship should be written in the text file. The text file must explain the irregularity in the corresponding video or picture.
6. **Robot evidence:** The referee group has the right to separate the robots of both teams for examination. The examination should not continue for more than 3 hours. The deadline to return the robots is the same as the arbitration result.

4.4.3 Arbitration

The RM2017 Organizing Committee will write the arbitration result on the Appeal Form 3 hours after the appeal is filed. **Possible results include “keep the original score”, “the respondent lost the game”, “rematch”.**

Neither party can appeal against any final ruling issued by the Arbitration Committee. If the result

is a “rematch”, the Committee will inform the match schedule at the same time. The appeal will be ruled as invalid and the appeal chance will be eliminated if both teams do not agree to a rematch. The team that refuses to rematch will be ruled as losing the game, if the other team agrees to rematch.

5 Processes and Rules of the

RoboMasters 2017 Challenge

5.1 Overview

To promote the development of intelligent robot technologies, the Organizing Committee will hold a fully automatic Technical Challenge Competition in addition to the regular competition events of RoboMasters 2017. Though the Technical Challenge Competition events are held at the same fields for the RoboMasters 2017 Competition events, it uses a completely different set of rules and only fully automatic robots are eligible for the competition. If a team intends to compete in the Technical Challenge Competition events, it needs to make a formal registration and to submit a technical report. After its technical report is reviewed and accepted, the team will be allowed to compete in Technical Challenge Competition events.

The RoboMasters 2017 Technical Challenge Competition comprises two parts: Aerial Robot Challenge and Ground Robot Challenge. The Aerial Robot Challenge will examine the application and competence of autonomous hovering technology, positioning technology without the application of GPS, target identification technology and automatic take-off and landing technology, and it will also examine the stability of the entire system featuring the combination of these technologies. The Ground Robot Challenge will examine the application and competence of positioning technology, object-grabbing technology, force control technology and target identification technology of ground robots, and it will also examine the stability of the entire system featuring the combination of these technologies. The two competitions are suitable for students who have completed their first-year master degree study to test the stability of autonomous robotic platforms and to develop intelligent navigation technology.

Teams need to choose which robot challenge they wish to compete in, or whether they plan to compete in both, at the time of registration. Through the preliminary contest, teams have several opportunities to separately enter the competition field to take part in the challenge. During a single challenge, a team needs to complete the commissioning of robots and enable them to automatically complete the required tasks within 10 minutes. The scores of a team are calculated on the basis of time required to complete a task and the quality of the accomplished task. The final scores of a team are the highest compiled from the scores of multiple challenges. The scores and prizes for teams competing in the Ground Robot or the Aerial Robot Technical Challenge Competitions are separately calculated and awarded.

Robots that compete in the Aerial Robot Technical Challenge event must conform to the requirement in [Section 2.7 – Aerial Robot](#). Robots that compete in the Ground Robot Technical Challenge event must conform to the requirements in [Section 2.8 – Engineering Robot](#). Robots competing in both Technical Challenge Events must conform to the general requirements under [Section 2.2 - General Technical Requirements and Safety Guidelines](#).

5.2 Competition Processes and Rules

The Technical Challenge Competition events last for several days, as determined by the Organizing Committee. The technical challenge event for aerial robots and the one for ground robots are held in turn. After teams arrive at the competition field, they should first check in and then place their robots and devices in designated areas.

After check-in, teams will have a preliminary contest, and only the winners are eligible to compete in the formal games of the technical challenge event. For the Aerial Robots Challenge, teams that pass the preliminary contest will have 4 challenge opportunities, while for the Ground Robot Challenge, teams will have 3 challenge opportunities.

5.4 Rules for Preliminary Contest

In the preliminary contest, a team must demonstrate that its robots meet the basic requirements for competing in the Technical Challenge Competition, and this can be done through manual operation or automatic operation. Before the start of a preliminary contest, team members and their robots should wait at the entrance of the battlefield. After the team leader shows the referee that his team is ready, the referee will give the instruction to enter the battlefield, and start a 5-minute countdown. Afterwards, the team members can move robots into the battlefield, place them at the designated area, and begin the demonstration. No more than 10 team members are allowed to enter the battlefield to perform these operations. When the demonstration is complete, team members must leave the battlefield. **Only then can robots start to operate (spinning the propellers or moving the wheels).** After the robots start, the referee will begin timekeeping. Robots must complete one of the required tasks specified in the following rules for preliminary contests.

5.4.1 Rules for Aerial Robot Preliminary Contest

An aerial robot needs to take off from the tarmac at the battlefield and land on the column that is the farthest-away from the tarmac. During this process, the flying height of the aerial robot cannot exceed 3 meters.

An aerial robot must complete the landing operation within 2 minutes from the beginning of timekeeping. After landing, it has to stop spinning its propellers and remain steady. Then the team

can pass the preliminary contest.

5.4.2 Rules for the Ground Robot Preliminary Contest

A ground robot starts from the barrier depot at the battlefield and takes out a barrier to put it inside the base.

After a ground robot starts moving, it must complete the placement of a barrier inside the base within 2 minutes from the start of timekeeping. Only if the barrier completely touches the inside of the base can the team pass the preliminary contest.

A preliminary contest lasts for 5 minutes, starting from the time when team members move their robots into the battlefield. After the 5-minute countdown, the preliminary contest is over whether a robot has completed the required task or not. If a robot does not complete the required task within 5 minutes, the team cannot pass the preliminary contest.

If a robot does not complete the required task within 2 minutes after it starts (from the time the referee begins timekeeping), the team will have failed the preliminary contest.

Team members should take every detail into consideration and complete the demonstration of their robots as soon as possible after the preliminary contest starts, so that the robots will have more than 2 minutes to complete the required task.

5.5 Technical Challenge Competition Rules

The winners of the preliminary contest are eligible to compete in the formal games of the Technical Challenge Competition of RoboMasters 2017. Compared with the RoboMasters 2017 Competition events, the Technical Challenge Competition events will have less strict controls over roll call and processes after entry into the battlefield. However, there will be stricter requirements for the competing process. After demonstration, all robots must complete the required tasks fully automatically. Inside and outside the battlefield, teams are not allowed to place equipment and devices that help their robots with positioning. During a technical challenge game, a robot can only be connected to 1 to 3 PCs, laptops or other computing devices outside the battlefield through a wireless connection. Before the start of a challenge game, a team must report to the referee the location of and uses for these devices. The referee will monitor the operating status of these devices during the game. If a team needs to shift the operating mode of its robots from automatic control to manual control, team members must report this to the referee the change of the operating modes, and acknowledge that this will cause their game to be terminated immediately.

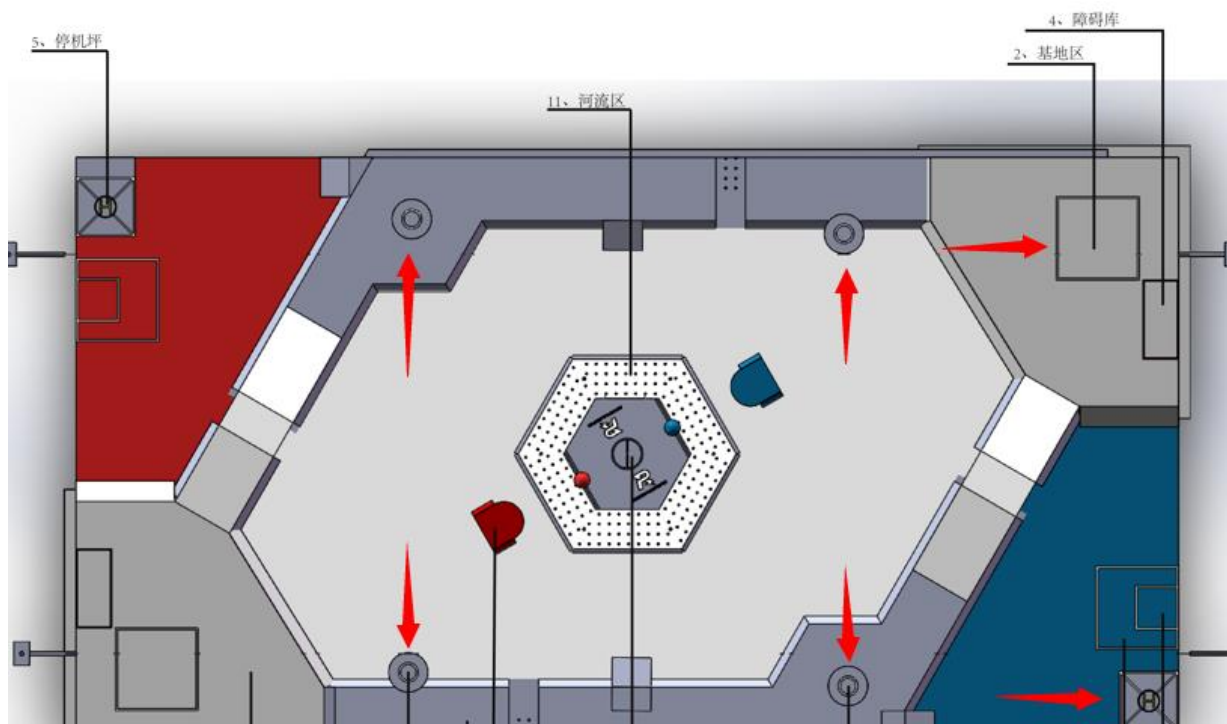
As the lighting and electromagnetic environment of the competition field may be different from the conditions in a laboratory, teams should test their robots in different places, scenarios and lighting

conditions as much as possible, and try to design fully embedded autonomous systems to avoid controlling the robots remotely through a wireless connection.

Before the start of a challenge game, team members and their robots should wait at the entry of a battlefield. After the captain shows to the referee that his team is ready, the referee will give the instruction to enter the battlefield and start the 10-minute countdown. Afterwards, team members can move robots into the battlefield, place them at the designated area, and begin the demonstration. No more than 10 team members are allowed to enter the battlefield to perform these operations. When testing is complete, team members must leave the battlefield. **Only then can robots begin operation (spinning propellers or moving wheels).** The robots must complete the required tasks specified in the following two sections.

5.5.1 Rules for Aerial Robot Technical Challenge Competition

The Aerial Technical Challenge is held at the same battlefield used in the RoboMasters 2017 Competition. In the challenge, other competition props in the battlefield will not be used except the four columns (refer to *Battlefield Specifications* for the size of the columns). On the top of each column, there are five 42-mm ammo units. The color of the ammo units on different columns are different. The locations of key props and areas are indicated by arrows in the following diagram.



An aerial robot can only start from the tarmac. After starting, the aerial robot needs to **take at least one 42-mm ammo unit from each column, and place them in the base camp at the starting zone.** Each time a 42-mm ammo unit is taken away from the top of a column the team scores 30 points; each time a 42-mm ammo unit is placed inside the base camp (the ammo unit

remains inside a 4-sided wooden frame in the base camp), the team scores 100 points. The pickup is only successful when the 42-mm ammo units are successfully placed and remain within 4-sided wooden frame in the base camp.

After an aerial robot successfully picks up four differently colored 42-mm ammo units, the team scores an extra 400 points. After that, the aerial robot must land inside the base camp and stop its propellers. Then task will be considered completed. When the propellers stop spinning, the referee will announce the challenge is over and stop the clock. Remaining seconds will then be used to calculate time reward points.

If a challenge is terminated in advance by the referee (resulting from an unexpected problem with the aerial robot) or upon the request by the team (if an aerial robot loses a 42-mm ammo unit and cannot complete the required task, or there is an unexpected problem with the aerial robot and it has to be controlled manually), then the remaining seconds cannot be used for time reward points.

5.5.1.1 Calculation of points

The points teams score during a challenge is comprised of three parts. First, points scored from taking 42-mm ammo units away from the columns; second, points scored from bringing 42-mm ammo units; third, points scored for remaining time. The more ammo units an aerial robot is able to bring back to base, the higher the score the team will get in the first and the second parts; the less time an aerial robot spends on its task (brining at least 4 42-mm ammo units of different colors back to base, landing and stopping its propellers), the higher its score for the third part. The time reward points are double the number of seconds left before the end of the competition.

For example:

A team's aerial robot brings 4 42-mm ammo units of different colors, lands, and stops spinning its propellers. The referee immediately stops the clock and confirms that the aerial robot used 230 seconds to complete the required task. The final points of the team are: $4 \times 30 + 4 \times 100 + 400 + 2 \times (600 - 230) = 1660$.

An aerial robot takes back 4 42-mm ammo units with different colors. Then it takes five more ammo units from the columns to the base camp, lands and stops spinning its propellers. The referee immediately stops the clock and confirms that the aerial robot used 350 seconds to complete the required task. The final points of the team are: $9 \times 30 + 9 \times 100 + 400 + 2 \times (600 - 350) = 2070$.

If an aerial robot only takes back 3 42-mm ammo units of different colors then drops 5 42-mm ammo units of the last color from the column onto the ground. As the aerial robot cannot pick up the 5 42-mm ammo units from the ground, even if it returns to the base camp, successfully lands

and stops spinning its propellers, the team cannot get time reward scores. The final points of the team will be: $8 \times 30 + 3 \times 100 = 540$.

After an aerial robot takes back four 42-mm ammo units of different colors, it suddenly loses control and keeps flying in one direction and the team shifts to manual control. At this time, the referee will terminate the challenge and confirms that the aerial robot has spent 220 seconds to complete the required task. The final points of the team will be: $4 \times 30 + 4 \times 100 + 400 = 920$.

Tips to score higher points:

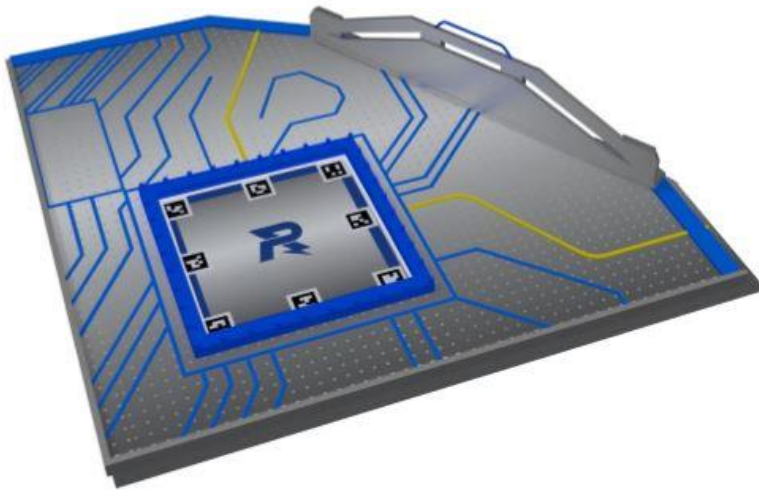
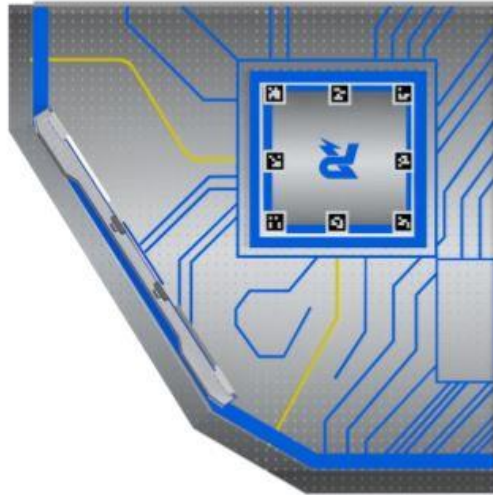
1. Shorten preparation time (the time to complete the required task includes testing time, so less testing time means less time is spent on the required task);
2. Try to take more than one 42-mm ammo unit at a time
3. Take off and land as quickly as possible;
4. Improve the stability of the flying aerial robot through the indoor positioning technology;

A team's highest points scored in across three challenges will be considered its final points. If two teams score the same points, the Organizing Committee will compare the weights of the two aerial robots according to the check-in records, and the lighter one will rank higher.

Note: Only teams that take back at least two 42-mm ammo units are eligible for the top three prizes. If all teams fail to take back at least two 42-mm ammo units, no top prizes will be awarded for the Aerial Robot Technical Challenge. Awards of all teams will begin with second-class prizes.

5.5.2 Rules for the Ground Robot Technical Challenge

The Ground Robot Technical Challenge is held at the starting zone of the battlefield used in the RoboMasters 2017 Competition.



In the competition, there are 16 barriers in the barrier depot. The positions of the barriers in the barrier depot can be freely arranged by teams themselves. However, before a ground robot starts, the barriers and the ground robot must be within the boundaries of the barrier depot.

A ground robot can only begin operation from the barrier depot. After the start, the ground robot must collect barriers on its own and place barriers into the base camp. Each barrier that is

successfully placed into the base camp scores 10 points.

A ground robot cannot carry and move more than 2 barriers within the areas. This will be considered cheating and will lead to the immediate termination of the game.

The ground robot is required to move barriers into the base camp. After the ground robot completes its task, the team scores 300 points. If there is no barrier in the barrier depot, the time when the ground robot returns to the barrier depot and stops moving indicates the end of the game. The referee will announce the end of the challenge and stops the clock. The seconds left when the game stops are used to calculate time reward points. If a challenge is terminated in advance by a referee (if there is an unexpected problem with a ground robot) or upon the request by the team (if a ground robot cannot complete the required task, or there is an unexpected problem with the ground robot and it has to be controlled manually), then the challenge ends and the seconds left cannot be used to calculate the time reward points.

5.5.2.1 Calculation of Points

A team's points scored in a challenge comprise three parts: first, the points scored from putting barriers into the base camp; second, the points scored from the highest height of the structure created by barriers in the base camp; third, the points rewarded on the basis of time left. The less time a ground robot has spent to complete the required task (moving all barriers from the barrier depot into the base camp), the higher the score the teams receive for the third part. The time reward points are twice the number of seconds left.

The highest height of the structure created by barriers in the base camp is the farthest distance between the angular point, line or side of a barrier and the ground of the base camp when all barriers are still. The distance is measured in centimeter (cm) and measurement precision is 5cm. The final value is rounded down. For example, if the height is 88.5cm, it is rounded to 85cm; if the height is 91cm, it is rounded to 90cm. The points scored for height are 20 times the distance number minus 20cm.

For example:

A ground robot puts all 16 barriers into the base camp, returns to the barrier depot and stops. The referee immediately stops the clock and confirms that the ground robot used 100 seconds to complete the task. All barriers are placed horizontally on the bottom surface of the base camp, and the highest height of the structure created by the barriers is 20cm (the barrier is a cube of 20cm). The final points of the team are: $16 \times 10 + 300 + 2 \times (600 - 100) + 20 \times (20 - 20) = 1460$.

A ground robot puts 12 barriers into the base camp, and then arranges the structure of the barriers until time runs out. The referee stops the clock and confirms that the ground robot used 600

seconds to complete the task. Barriers are then placed into a cube column with six layers, and its highest height is 120cm. The final points of the team are: $12 \times 10 + 2 \times (600 - 600) + 20 \times (120 - 20) = 2120$.

A ground robot puts all 16 barriers into the base camp, returns to the barrier depot and stops. The referee immediately stops the timekeeping and confirms that the ground robot used 320 seconds to complete the task. If the highest height of the structure created by the barriers is 90cm. The final points of the team are: $16 \times 10 + 300 + 2 \times (600 - 320) + 20 \times (90 - 20) = 2420$.

A ground robot puts all 16 barriers into the base camp, and it suddenly loses control. It runs towards one side of the battlefield, crosses the barrier depot and bumps against a wall with its wheels spinning. The team shifts the operation mode to manual control. In this situation, the referee will immediately terminate the competition and confirm that the ground robot used 85 seconds to complete the task. All barriers are placed horizontally on the bottom surface of the base camp, and the highest height of the structure created by the barriers is 20cm. The final points of the team are: $16 \times 10 + 300 + 20 \times (20 - 20) = 460$.

Tips to score higher points:

1. Shorten preparation times - the time to complete the task includes the time for , so the less testing time there is, the less time is spent on the task.;
2. Try to place all barriers into the base camp;
3. Improve the stability of gripping, carrying and placing barriers through visual servo and sensor technology;
4. Design a stacking structure for the barriers;
5. Improve the stability of the moving ground robot through wheeled autonomous positioning technology.

A team's highest points scored in the three challenges combined for the final point. If two teams score the same points, the Organizing Committee will compare the weights of the two ground robots according to the check-in records to rank the two teams.

Note: only teams that can place at least 10 barriers in the base camp are eligible for the top three prizes. If all teams fail to place at least 10 barriers in the base camp, there will be no top three prizes for the Ground Robot Technical Challenge. The awards of all teams will begin with second-class prizes.

5.6 Fouls and Penalties

In a Technical Challenge event, a referee will only issue a Game Terminated Penalty. This penalty will be issued if:

No.	Type of fouls
1	A robot is about to malfunction or has malfunctioned (quickly flying out of the battlefield or bumping against the side of the battlefield causing damage to the field)
2	One or more team members enter the field without approval
3	A robot begins operation before the team members leave the field
4	After the timekeeping starts, one or more team members manually control the robot, or change from automatic to manual operation
5	Robots or team members cheat
6	The robot leave the starting area after the game begins.

In addition, the time to the end of a game (propellers of an aerial robot stop spinning or a ground robot returns to the starting zone) shall be subject to the judgment of the referee. The Organizing Committee will record video of the Technical Challenge events to ensure the accuracy of the timekeeping. Teams must abide by decisions made by the referee. Otherwise, the scores of teams in a single challenge will be canceled. [Section 4.3.4 – Fouls and Penalties](#) shall apply to other acts that severely violate the spirit of the Technical Challenge.

6 Update of Rules and FAQ

6.1 Update of Rules

According to the actual situations during RM 2017 preparation and competitions, the rules of the RM2017 competitions will be updated in the following aspects:

1. Improve or add new buffer systems;
2. Minor adjustments to the balancing parameters (bullet numbers, power limits, etc.) in the rules;
3. Modify rules that allow teams to gain an advantage through non-technical means;
4. Additional penalties imposed on actions that cause imbalances in the game.

Note: Referees shall take the latest version of competition rules manual and FAQ as the judging standard.

6.2 General FAQ Platform

RoboMasters official forum : <http://bbs.robomasters.com>

6.2.1 Posting specifications

1. Technical FAQ: “【RM2017 Technical FAQ】 + Post Title”
2. Rules FAQ:“ RM2017 Rules FAQ + Post Title”
3. Other FAQ (Materials, etc.):“ RM2017 Other FAQ + Post Title”

(Note : Post title includes“【】”)

6.2.2 Posting Sections

The Organizing Committee's replies to questions are posted in the sub-section “FAQ” of “Competition Section” on the RoboMasters official forum (bbs.robomasters.com). Please pay attention to updates.

The FAQ will be updated to the rules manual periodically. After updating, the version number of rules manual will also be updated. All updates of the rules manual are posted in the “Competition

Section” on the RoboMasters official forum (bbs.robomasters.com). The latest version will be highlighted on the top.

6.3 Emergency FAQ Channel

Phone: 0755-36383255

RoboMasters Support QQ: 2880600202

RoboMasters 2017 Promotion Manager Group: 234696084

Email: robomasters@dji.com (Subject: “University Name +Team Name+RM2017Questions”)

RoboMasters 2017 Official Competition QQ Group : 234894285

(No more than 5 members of each team should join the official competition QQ group. They should be the team leader, the project manager, the instructor, the promotion manager and other important team members. Remark “University Name +Team Name +Roles in Team + Actual Name” when joining in the QQ group.)

RoboMasters 2017 International Teams QQ Group : 186354902

(All team members can join the international teams QQ group. Remark “University Name +Team Name +Roles in Team + Actual Name” when joining in the QQ group.)

Working Hours of the Organizing Committee: 10:00 a.m.-12:30 a.m., 14:00 p.m.-19:00 p.m. from Monday to Friday.

Annex I

RoboMasters 2017 Robots Check-in Form					
School:			Team:		
Competition Date:			Competition No.:		
Quantity of Robots					
Type	Base Robot	Standard Robot	Hero Robot	Aerial Robot	Engineering Robot
Quantity					
Size & Weight					
No.	Inspection Item	Description			Status
1	Restrictions on Robot Original Size	1. Standard robot: 600x600x500mm 2. Hero robot: 800x800x800mm 3. Base robot: 800x800x800mm 4. Aerial robot: 1000 x 1000 x 800 mm 5. Engineering robot: 800x800x800mm			
2	Restrictions on Robot Extended Size	1. Standard robot: 700x700x600mm 2. Hero robot: 1200x1200x1200mm 3. Base robot: 1000x1000x1000mm 4. Aerial robot: 1000 x 1000 x 800 mm 5. Engineering robot: 1200x1200x1200mm			
3	Robot Weight Restrictions	1. Standard robot: 15kg (The referee system weight-3.5kg is deducted.) 2. Hero robot: 35kg (The referee system weight-4.5kg is deducted.) 3. Base robot: 25kg (The referee system weight-5.5kg is deducted.) 4. Aerial robot: 5kg (if a camera image transmission module provided by the Organizing Committee is installed, the weight of this module-0.2 kg is deducted.) 5. Engineering robot: 25kg (The referee system weight-2.8kg is deducted.)			
Robot Modules					
No.	Module	Description			Status
4	Integrity of the Referee System	No modifications to the referee system (screws, wires).			
5	Armor Module	1. Installed with supporting brackets provided by the Organizing Committee 2. The connecting line of the front and back armor plate is perpendicular to that of the left and right armor plate. The connecting line of the front and back armor plate crosses			

		<p>the geometric central line, while an error of $\pm 50\text{mm}$ is allowed when installing the left and right armor plate.</p> <p>3. The height difference between the highest and the lowest armor plate is no more than 60mm.</p> <p>4. A rigid connection method is used, and all screw holes are tightly fastened and secured to their positions</p> <p>5. The part within the 145° of the outer surface of the armor cannot be shielded</p> <p>6. The bottom of the connector of armor plates is level, and the angle between the stress surface and the vertical plane of armor plates is about 25°</p> <p>7. Armor plates at the top of a base are horizontal, and two armors are coplanar with clearance of no more than 10mm. The top armor plate is higher than the top of armor plates around the body.</p> <p>8. The HP of the referee system is deducted when armor plates are hit</p>	
6	RFID Module	1. The RF card at the bottom is capable of flashing	
7	Speed Detection Module	1. Capable of indicating firing speed and frequency	
8	Image Transmission Module	<p>1. Robots can transmit camera images back normally</p> <p>2. Aerial robots can transmit camera images back normally (No. 1- No. 13 channel)</p>	
9	Ammo-dropping Module of Aerial Robots	1. An aerial robot can only drop ammo using gravity	
10	Safety Module of Aerial Robots	<p>1. The protection rods of an aerial robot is 350mm higher than the plane of the propellers</p> <p>2. The propeller protection cover should be in an enclosed structure, and it is capable of protecting propellers from being exposed from the cover even when it deforms due to the weight of the aerial robot itself</p> <p>3. When an aerial robot is fixed to the ground, a vertically forward force of 30N is applied to the tab on the top of a vertical protection bar without damaging the structure of the bar.</p>	
Others			
No.	Item	Description	Status
11	Power Supply	<p>1. Use products manufactured by SZ DJI Technology Co., Ltd. The total power shall not exceed 200Wh.</p> <p>2. The supply voltage shall not exceed 30V. There is no short-circuit risk in the electrical circuits.</p>	
12	Remote Controller	1. Use products manufactured by SZ DJI Technology Co., Ltd.	
13	Air Pressure	1. The air pressure of embedded equipment cannot exceed	

		0.8MPa.	
14	Laser Device	1. A firing mechanism is not installed with more than one laser sight.	
15	Light Effect of Robots	1. A robot does not have any light effect other than that from the equipment provided by the Organization Committee.	
16	Radio	1. The band is within the bandwidth from 2.412 to 2.472GHz, and the total bandwidth cannot exceed 40MHz.	
17	Others	1. A robot does not contain mechanisms that may damage competition fields.	

Signature:

Annex II

Requirements on Technical Reports for RoboMasters 2017 Main Competition

All teams that compete in the RoboMasters 2017 Main Competition must submit to the Organizing Committee a technical report within the time specified. A team will be entitled to a referee system and eligible to formally compete in the Regional or Wild Card only after its technical report is reviewed and accepted by the Organizing Committee.

I. Requirements for Technical Reports

A technical report is composed of a written report and a video clip.

(I) Video Clip

1. Video Requirements

- Bullets refilling: Pick a robot from supply depots, engineering robots and hero robots, and use it to refill bullets continuously to any two other robots. No less than 50 bullets are refilled to a robot each time.
- Moving ability: any one of the robots completes three circles of movement manually or automatically.
- Firing ability: any one of the robots continuously fires 50 bullets into a frame with a diameter of 30cm that is 3 meters away.
- Power control: a standard robot in the limited power range climbs up to a 15° slope, and does not exceed the power limit during this process.
- Demonstration of completely assembled status: the demonstration of the shapes and structures of the base and hero robot in the same completely assembled status (leaving the referee system installing position and armor fixing mechanism) as they will be in a real competition event.

2. Video Standards

- At the beginning of a video clip, there should be a prompt board. The prompt board should display the name of the school, and the date and place of shooting.

- It is recommended that the video clip is shot with sufficient lighting so that every operation and movement in the video will be clearly observed.
- There should be captions or prompt boards for every process, and explanations should be explicit and accurate so that every process is clearly understood.
- A video clip should contain no or few demonstrations of useless operations or movements. The duration of video clip should be within 5 minutes. Ensure the video clip is concise to reduce the review time of the Organizing Committee.
- Editing and rearrangement of a video clip is allowed, but it is strictly forbidden to fake a video clip through editing and rearrangement.

(II) Written Report

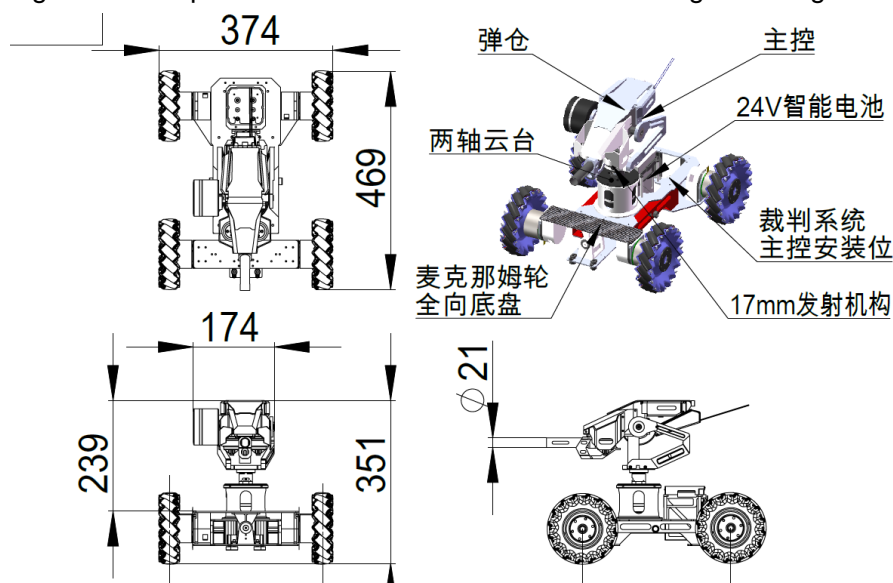
- 1) Robot manufacturing schedule. A robot manufacturing schedule comprises five parts: robot types, number of each type of robots, schedule, cost and man-hours.

For example:

Robot Type	Quantity	Current Cost	Current Man-hours	Estimated Cost	Estimated man-Hours	Design of Scheme	Purchase/Mechanical Processing	Assembly	Commissioning/Improvement
Base Robot	1	5000	50h	10000	100h	January	February	February 10	March 1

- Three-dimension design drawing for each type of robots. The drawing should indicate the basic functional structures and brief introduction to functions.
- Two-dimensional three-view design drawing, including the basic sizes and major mechanisms of a robot.

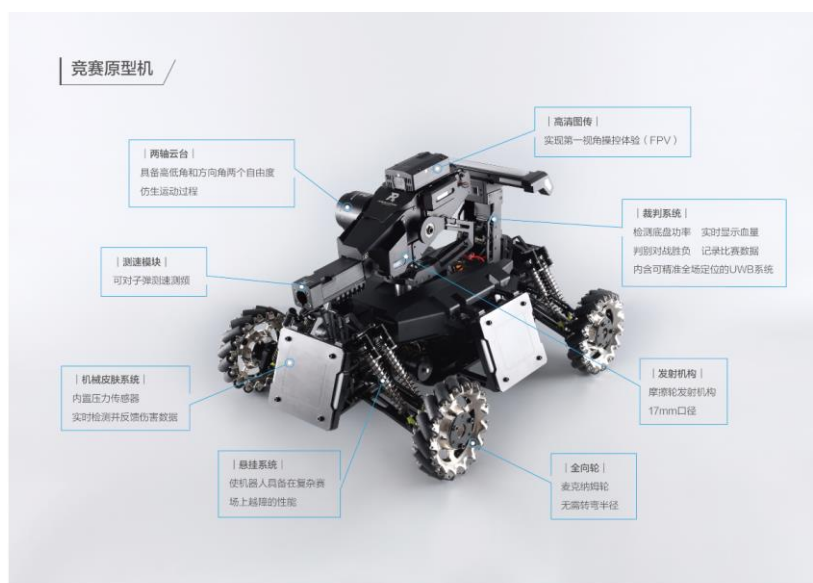
The following is an example of a two-dimensional three-view design drawing:



Explanatory notes: The robot uses XXXX suspension on its chassis, uses a Mecanum wheel (with four-wheel independently driven and omni-directional mobility features), two-axis tripod head, friction-wheeled 17-mm ammo firing mechanism. The battery is placed in the middle rear of the chassis; the master control module is placed under the tripod head. And the chassis follows the tripod head in the control process. With the XXXX Scheme, the robot is capable of automatically identifying and attacking targets. With the XXXX Scheme, the robot has automatic obstacle avoidance, automatic movement or tracking features.

- Photo: the photo of a robot should show the entire figure and appearance of the robot.

For example:



- Group photo of all robots and team members (in the photo, there must be the base and hero robots in the same completely assembled status as they will be in a real competition event).

For example:



Note: the picture is only for reference purposes. The group picture must contain the robots that will compete in the competition (the base and the hero robot), and the robots must be in the completely assembled status (not in parts or components).

II. Submission Method

Each team will have three opportunities to submit its technical report. A team will not be eligible for the formal competition events of RoboMasters 2017 Main Competition if its three submission are all rejected by the Organizing Committee.

1. Pack the video, the written report and pictures into a compressed file (RAR, 7Z or ZIP), upload it to Drobox and set an access password.
2. Submit the link and the access code to the Registration System
3. File Name: School Name + Team name + registration number + technical report.
4. Submission link: <http://signup.robomasters.com/en/>.

III. Time of submission

March 15 - June 1, 2017

Annex III

Terms & Definitions for RoboMasters 2017

Term	Definition
Competition	
RoboMasters 2017	RoboMasters 2017 is a national robot competition jointly hosted by the Communist Youth League of China, the Secretariat of All-China Students' Federation, and the Shenzhen Municipal Government. It is intended to offer a platform for university students to make technological innovations and to promote communication among researchers in China and the rest of the world. RoboMasters 2017 comprises two competition events: RoboMasters 2017 Main Competition and RoboMasters 2017 Technical Challenge.
RoboMasters 2017 Main Competition	This is an event that highlights the shooting and confrontation of robots. While paying great attention to the confrontation and technological competence of robots, it is a robot competition platform specially created for brilliant young engineers in an untraditional way. It comprises three parts: RoboMasters 2017 Regionals, RoboMasters 2017 Wild Card and RoboMasters 2017 Tournament.
RoboMasters 2017 Technical Challenge	This is an event that aims to promote the development of robotic automation and intelligence technologies. It is a fully automatic technical challenge competition in addition to the regular competition events of RoboMasters 2017, and comprises two parts: RoboMasters 2017 Aerial Robot Technical Challenge Competition and RoboMasters 2017 Ground Robot Technical Challenge Competition.
RoboMasters 2017 Regionals	It is a series of regional preliminary contests to be held in a certain number of cities according to the number of teams in different regions across the country. The winners of the preliminary contests will be eligible to compete in RoboMasters 2017 Wild Card and RoboMasters 2017 Tournament.
RoboMasters 2017 Wild Card	It is an event held for teams to compete for the qualification to RoboMasters 2017 Tournament. Winners of RoboMasters 2017 Regionals and specially invited teams will compete in this event.
RoboMasters 2017 Tournament	This is the grand finale of RoboMasters 2017 Competition. Teams that have won the qualifications for the grand finale in RoboMasters 2017 Regionals and RoboMasters 2017 Wild Card will compete in RoboMasters 2017 Tournament.
RoboMasters 2017 Aerial Robot Technical Challenge	The aerial robot technical challenge competition will examine the application and competence of autonomous hovering technology, positioning technology of without the application of GPS, target identification technology and automatic take-off and landing technology, and it will also examine the stability of the entire system featuring the combination of these technologies.
RoboMasters 2017 Ground Robot Technical Challenge	The ground robot challenge technical competition will examine the application and competence of positioning technology, object-grabbing technology, force control technology and target identification technology of moving ground robots and it will also examine the stability of the entire system featuring the combination of these technologies.

Areas

Preparation Area	An area in which teams make preparations for a match. It consists of Check-In Area, Repair and Maintenance Area, and Rest Area.
Waiting Area	An area in which teams and robots eligible to compete in a match wait for the start of a game.
Competition Area	It consists of Battlefield, Referees' Seating, Stage, Ammo Management Zone, Operating Chamber, Game-Watching Zone, Ammo-Returning Zone, and Arbitration Room.
Battlefield	An area on which robots compete, including Starting Area, Base Area, Resource Island, Tarmac, Resource Column, Barrier Depot, Grand Rune, Ammunition Depot (consisting of Official Ammo Refilling Mechanism and Forbidden Zone of Supply Depot), Barrier, Rune Column, etc. Please refer to "Section 3 - Competition Field" in the Competition Rules for details.
Preparation Area	
Check-in Area	An area in which robots will be inspected
Maintenance & Repair Area	The only place in which teams are allowed to power on robots for repair and maintenance in the preparation area
Rest Area	An area in which teams make adjustments and take rests
Competition Area	
Referees' Seating	Chief Referee's Technical Control Center
Ammo Management Zone	An area to screen and classify ammos
Operation Room	An area for one or more team members to operate ground robots and communicate tactics in a match
Aerial Robot Operation Room	An area for one or more team members to operate aerial robots in a match
Game-watching Zone	An area for non-operators in teams to watch games
Ammo-returning Zone	An area for teams to return ammos to the Organizing Committee after a match
Arbitration Room	An area for the representative of the Organizing Committee and director of referees to handle appeals
Entry/Exit passage	A passage for teams to enter or leave a competition field
Entry/Exit	A place from which teams enter or leave a battlefield
Battlefield	
Starting Area	An area from which ground robots of two teams start to operate. In a technical challenge competition, it is a major moving zone for ground robots.
Base Area	An area in which a base robot moves
Landing Area	An area where an aerial robot starts and has bullets or pellets refilled
Ammunition Depot	An area consisting of Official Ammo-refilling Mechanism, Supply Depot Placement Zone, and Forbidden Zone of Supply Depot
Official Ammo-refilling Mechanism	Official ammo-refilling mechanism is located at the upper central position of the Supply Depot area
Forbidden Zone of	Robots are not allowed to enter the forbidden zone of the opponent's supply depot

Ammunition Depot	
Resource Island	A public resource area in the middle of the field. It provides sufficient amount of 17mm and 42mm bullets and pellets to both sides, which will be obtained by hero robots
River	It encircles the Resource Island, and works as an obstacle
Magic Column	They are six 800mm-high columns in the river. Once a magic column is triggered, there will be short-cut to the resource island.
Short-cut to Resource Island	A mechanism in the river that supports the access to the resource island. The Organizing Committee will provide more details during the teams' preparation for the new season.
Road Area	This is the connected area in the field, located slightly above the field. Its surface is flat, and lines are drawn on it. It is surrounded by steep slopes, and there are obstacles resembling the river area in the middle of the road.
Groove	Obstacles resembling the river area in the middle of the road
Resource Column	Twenty or forty 40-mm ammos will be placed on the top of resource columns so that an aerial robot will be able to refill its ammos. In the meantime, each time an aerial robot successfully lands on the top of a resource column, its team will gain certain bonus.
Rune Column	A special resource column. When an aerial robot successfully lands on the top of a rune column, the team will gain certain bonus. Please refer to "Section 3.3.2 – Rune for Aerial Robots" in the Competition Rules for details
Safety Rope of Aerial Robots	Steel cables hanging over the competition field, equipped with sliding rings. It is necessary to secure the protection rope on the sliding ring to the upper part of an aerial robot for limitation and protection
Grand Rune Point	The place where a robot hits the Great Magic Rune
Grand Rune	A team that has successfully gained a great magic rune will have its fighting capacity greatly improved. Please refer to "Section 3.3.1 – Great Rune" for details about the great rune mechanism.
Obstacles	Objects that are placed into the warehouse and serve as barriers. It can be used for tactical defense, road-paving or to trigger specific field props.
Warehouse	A zone to storage barriers
Robots	
Base Robot	The key to the victory of a match, also known as the base. It is capable of automatic defense, and it is an essential force of team in a match.
Hero Robot	The core fighter in a match, also known as hero. It features strong attacking and defense performance, and it is an essential force of team in a match.
Standard Robot	Robots that can combat flexibly and have certain attacking capacity, also known as infantry.
Aerial Robot	Aerial robots can cooperate with other robots in a match as the air-striking force, also known as drone.
Engineering Robot	Robots that can perform different kinds of supporting movements in a match. Please refer to "Section 2.8 – Engineering Robots" in the Competition Rules for details.
Refueling Station	Bullet or pellet supply mechanism independently developed by a team
Systems	
Event Management	It is a supporting system that handles registration of teams, manages team information and

System	ensures the successful participation in competition events. The system is accessible and available to teams.
Competing system	It facilitates teams' learning of competition process and status of different teams. The system will appear on TVs (or computers) specially placed in the preparation area, waiting area and competition field.
Referee system	It monitors the HP of robots in different teams, and determines penalties and results of a match. With its terminal end installed at the referee's seating, it consists of Camera Image Transmission Module, Armor Module, Ammo Speed Detection Module, RFID Module, UWB Module, and Master Control Module. Please refer to the <i>Manual for the Referee System</i> for details.
Field Positioning System (UWB)	The system is installed around the battlefield, and it can show the real-time positions of robots on the battlefield. That is to say, a small map of the battlefield will be shown on an operator's screen
Technical Terms	
Bullet and Pellet	There are two types of bullets and pellets: 17mm and 42mm
Ammo Chamber	A device for holding ammos
Camera Image Transmission Module	It captures camera images in real time, and transmits them back to the screen in front of an operator in the operating room.
Armor Module	It is composed of armor sheets and sensors, protects a robot's internal structure, detects bullet hits on the robot, and deducts HP accordingly.
Ammo Speed Detection Module	It detects the ammo-firing speed and the speed for a bullet or pellet flying out of the firing chamber. When it exceeds the limit, a penalty will be given.
RFID Module	It can conduct information interaction with function points and performs corresponding functions by reading RFID IC card in the field
UWB Module	It can obtain the information about a robot's position in the battlefield
Master Control Module of Referee System	It controls the robot's main power supply, checks chassis power, and shows the amount of HP with an indicator column. When its power exceeds the limit, a penalty will be assessed. When HP drops to zero, the main power supply will be automatically cut off
Firing Mechanism	Bullet and pellet firing mechanism of a robot
Laser Sight	It is under the bullet firing mechanism of a robot and helps with targeting
Sensor	It is a kind of detection device, capable of detecting information, transforming such information into electronic signal or other forms for transmission, handling, storage, displaying, recording, control, etc. A sensor may refer to laser radar, ultrasonic sensor, infrared sensor, etc.
Firing Frequency	Ammo-firing frequency (pc/m)
Firing Speed	Ammo-firing speed (m/s)
Chassis	A chassis is the mechanism supporting and equipped with the power system and its components. It enables a robot to move horizontally.
Power of Chassis	It is the power of the power system that is required to make a robot move, and it does not include the power that is required to perform special operations.
Omni wheel	Wheel system featuring Omni-directional movement of chassis

Competition Affairs

College or University Team	A team that is established by domestic college or university students (not-on-the-job doctoral students, postgraduate students and full-time undergraduate students and students from three or two-year colleges, who have their academic status officially registered before August 2017). It passes registration and technical report assessments within the time specified, and conforms to the participation requirements.
International Teams	A team that is established by foreign college or university students (no limit on academic degrees). It passes registration and technical report assessments within the time specified, and conforms to the participation requirements.
Wild Card Teams	A team that is established by domestic college or university students (not-on-the-job doctoral students, postgraduate students and full-time undergraduate students and students from three or two-year colleges, who have their academic status officially registered before August 2017), passes registration examination and review but fails in the technical report assessment, and then receives a special invitation from the Organizing Committee for the competition events
Qualification for the Competition	Teams are able to spend time and money on research and development of robots, and are eligible for some materials provided by the Organizing Committee free of charge.
Competition Preparation Qualification Assessment	The assessment is delivered in the way of answering questions online. The assessment contents are mainly about the competition rules of the new season. The full mark is 100 points, and the passing mark is 60 points. A team that has scored 60 points or more will be eligible for preparing for the competition.
Technical Report	A report in which a team needs to state its research progress of robots and competence of robotic technology. The report may contain video clips, pictures and photos, texts, etc.
Warm-up Match	Before the formal start of RoboMasters 2017 Regionals, teams that have passed the check-in of robots are able to play warm-up matches within a given time, at the competition field provided by the Organizing Committee according to their warm-up match registration orders. The results of warm-up matches will not be used for ranking or prize-awarding purposes. A team may decide whether to participate in warm-up matches or not on its own.
Check-in	A process to examine and determine whether a robot conforms to relevant requirements and has the qualification to compete in a match
Pre-check	At the date to check in for competition, teams will have their robots checked according to the order of arrival and commissioned according to the check-in results
PASS Card	A card given to a team that has successfully passed the check-in
Field Adaptation	Before the start of a competition event of RoboMasters 2017, teams that have successfully passed the check-in may have adaptive training on formal competition fields according to the order of check-in. During an adaptive training, a team may power on their robots for commissioning
Qualification Match	Group round robin. A team will compete with other teams in the same group successively. Teams in a group will be ranked according to the points and HP of these teams. Winners of a group round robin will progress to the next round
Quarter-Finals	Single elimination. Once a team loses in a match, it will be eliminated
BO2	In a group round robin, each match will be played according to the BO2 system: each match comprises two sets of games, and a team will score three points if it wins in both two games,

	1 point if the match is ended in a tie, and will not score any point if it loses.
BO3/BO5	In a single eliminate competition, a team has two wins out of three games or three wins out of five games
Net HP	The difference between the remaining HP of a team's robots and that of its opponent when a game is over
Total Net HP	The sum of net winning HP of a team in a group round robin
Damage	The difference between the initial HP and the residual HP of an opponent when a game is over
Total Damages	The sum of damages caused by a team in a group round robin
3-Minute Preparation	When competing teams enter the battlefield, the 3-minute countdown starts. Within the 3-minutes, teams should place their robots inside the starting zone, inspect the equipment provided by the Organizing Committee, check that their robots function properly, so as to ensure that they are ready for the start of the game.
20-Second Self-checking of the Referee System	After the 3-minute countdown, the referee system will spend 20 seconds to check its communication links and devices.
5-Seconds Countdown	The last 5 seconds of the 20 seconds for the referee system to check its communication links and devices.
Readiness	The competing teams are ready, and the game can start any time
Foul	A team violates the competition rules
Penalty	Penalties are given to a team that violates the competition rules, including warning, sent-off, game loss or cancel the qualification to compete further games.
Sent-off	A team violates the competition rules. During a game, the ground robot that violates the competition rules will be fouled out by the referee system and cannot compete further in the game; the aerial robot that violates the competition rules will not take off any more after landing on the tarmac.
Warning against Impact	Warning against a robot's viciously impact or damage of the opponent's robots
Warning against Supply Depot	Warning against a robot's entering the forbidden zone of the opponent's supply depot
Technical Timeout	Malfunction or maintenance of equipment provided by the Organizing Committee
Cleaning Battlefield	Staff in the competition field clear the bullets and reset props in the competition field
Appeal	A team may file for an arbitration application by following certain procedures if it opposes a match result
Arbitration	The representative of the Organizing Committee and the director of referees handle appeals and give final decisions
Time Limit for Filing an Appeal	Within 5 minutes after a game is over. When an appeal is filed, the time on the appeal form shall prevail. The Arbitration Committee will not accept an appeal when it exceeds the limited time.
Time Limit for Both Sides to Be Present	Within 30-minutes after the appeal is filed. Within the limited time, a team that is not present will be determined to lose the game; a team that has more than 3-representatives present will be deemed to be absent and then determined to lose the game

Time Limit for Submitting Evidences/Defending Documents	Within 60 minutes after the appeal is filed. The Arbitration Committee will reject documents after the time limit for submitting evidences/defending documents.
Position	
Advisor	Chief person-in-charge of a team, responsible for the management of the team
Captain	A person in charge of the technological and tactical affairs of a team
Project Manager	A person who takes overall charge of the projects, controlling the progresses, outcomes and costs
Public Relations Manager	A person in charge of the promotion of robot teams and RoboMasters 2017 events
Ground Robot Operator	A team member who operates a ground robot
Aerial Robot Operator	A team member who operates an aerial robot
Referee	Referees supervising a match, including Operating Chamber Referee, Aerial Robot Operating Chamber Referee and Linesman
Assistant Referee	An assistant referee assists a chief referee in focusing on the situations on a battlefield and recording competition results
Chief Referee	The chief judging official of a match
Director of Referee	Top officer of the referee team
Technical Support Staff	Working staff that maintain and repair equipment provided by the Organizing Committee



RoboMasters大赛组委会

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