IEEE International Conference on Robotics and Automation 2018

DJI RoboMaster AI Challenge

ICRA 2018, Brisbane, Australia

Competition Manual

V1.0

Developed by RoboMaster Organizing Committee

April 2018

Contents

I. RoboMaster Overview

The DJI RoboMaster Program strives to promote education and innovation in the field of robotics. The program hosts several competitions such as the RoboMaster FPV Competition, the RoboMaster Technical Challenge, the ICRA Challenge, and several events at Universities across the country. The RoboMaster Program also facilitates non-competitive events and groups such as building campus clubs, high school robotics courses, summer camps, and the Young Engineer Summit (YES).

Through the RoboMaster Program students from around the world can learn and innovate using today's most cutting-edge technology.

The ICRA 2018 DJI RoboMaster AI Challenge is jointly held by the IEEE International Conference on Robotics and Automation (ICRA) and DJI's RoboMaster Organizing Committee. The ICRA 2018 DJI RoboMaster AI Challenge is a fully autonomous robotics battle. Teams are required to program and build 1-2 autonomous robots. Participating teams must face off against DJI's advanced AI robots on a 5x8m battlefield covered with various obstacles. Teams must target and hit their RMOC opponents on the opposing side of the battlefield. Teams must score higher than the RMOC bots to win a round, and achieve the highest round score out of all competitors to win the challenge.

II. Teams

No.	College/University	Team Name
1	Institute of Automation, Chinese Academy of Sciences	CASIA
2	National Space Science Center, Chinese Academy of Sciences	NSSC
3	Tianjin University	DAJIDALI
4	Wuhan University	DeepWhuRobot
5	Northeastern University	T-DT
6	Harbin Institute of Technology	I Hiter
7	Harbin Institute of Technology	HITCSC
8	Harbin Institute of Technology, Shenzhen	Critical HIT
9	South China University of Technology	South China Tiger
10	East China Normal University	Riva Lion
11	Zhejiang University	ZMART
12	Shenzhen University	Robot Pilots
13	Xi'an Jiaotong University	BattleWolf
14	Northwestern Polytechnical University	Firefly
15	Hong Kong University of Science and Technology	ENTERPRIZE
16	Rose-Hulman Institute of Technology	Rosebotics
17	Johns Hopkins University	Hopkins AI
18	Nanyang Technological University, Singapore	MECAtron
19	University of Alberta	Artificial Imbecile
20	University of Melbourne	Ausdroid
21	Robert College	RCMakers
22	Monash University Malaysia	MyMonash

* In no particular order

III. Challenge Structure and Awards

（I）Challenge Structure

1. Time Slot Assignment

There are a total 22 teams competing in the challenge. The time slot assigned to each team is randomized via a random draw. Team captains will meet to draw a ball out of a box; each ball has a number from 1-22. The number that is drawn correlates to the team's assigned time slot.

2. Challenge Round

Each team plays **FOUR** rounds in total. The final score for the team is the highest among all four rounds. The three teams with the highest number of points will be awarded 1st, 2nd, and 3rd place. All teams will be awarded a certificate for participating.

3. Round Results

A single round ends when:

(1) All of the team's robots or all of RMOC's robots are destroyed.

(2) Round time runs out.

(3) The referee may terminate the challenge when it comes to a sudden situation.

After one Challenge Round, the team score is calculated in the following scheme:

$$Score = \alpha \times X + \beta \times Y - \gamma \times Z$$

Where α, β and γ represent coefficients with the following values:

1. $\alpha = 6.0/(4.0+\text{NUMBER OF ROBOTS})$;
2. $\beta = 75.0/(4.0+\text{NUMBER OF ROBOTS})$;
3. $\gamma = 2.0/(1.0+\text{NUMBER OF ROBOTS})$.

NUMBER OF ROBOTS can be 1 or 2, depending on the number of robots that enter the Challenge Round. RMOC will always present Two Robots no matter how many Team Robots stay in the Field.

And X, Y and Z represent the following:

1. X is the HP reduction of RoboMaster AI robots;
2. Y is the remaining time (in seconds) when both RoboMaster AI robots are destroyed. If the challenge time ends before both AI robots are destroyed, Y is 0;

Z is the HP reduction of Team Robots.

（II） Award

Award	Qty.	Prize
1st Prize	1	Each team member will receive a certificate of participation and one DJI Mavic Pro. The winning team will receive $20,000 USD (before taxes) and one Nvidia Titan XP
2nd Prize	1	Each team member will receive one certificate of participation and one DJI Mavic Air. Winning team will receive $10,000 USD (before taxes) and one Nvidia Titan.
3rd Prize	1	Each team member will receive one certificate of participation and one DJI Spark. The winning team will receive $5,000 USD (before taxes) and one Nvidia Jetson TX2.
Finalist	21	Each team member will receive a certificate of participation. Each team will receive travel sponsorships $1,000 USD (before taxes).

IV. Challenge Timetable

（I） Challenge Timetable

May 21 (Check-in Day & Practice Matches)		
Time	**Content**	**Remarks**
9:00-14:00	Check-in	Check-in – pick up documents and certificates
		Check-in time determines the order teams are scheduled for practice matches
	Mock Inspection	Mock inspection of robot size, weight and modules
		Official inspection and repair
	Team Photos	Pictures of all team members and robots
10:00-14:40	Practice Matches	Each team has the opportunity to compete Practice Matches (20min for each team)
15:00-16:00	Team Captain Meeting/Draw	
May 22 (Challenge Day 1)		
8:30	Pre-match Inspection	Stand-by in the Preparation Area
9:30-12:50	Round 1	Teams compete in the order of drawing results
12:00-13:00	Break	
13:30	Pre-match Inspection	Stand-by in the Preparation Area
14:00-17:00	Round 2	Teams compete in the order of drawing results
May 23 (Challenge Day 2)		
8:30	Pre-match Inspection	Stand-by in the Preparation Area
9:30-10:10	Round 2	Teams compete in the order of drawing results
10:30-12:50	Round 3	Teams compete in the order of drawing results

12:50-14:00	Break	
13:30	Pre-match Inspection	Stand-by in the Preparation Area
14:00~15:30	Round 3	Teams compete in the order of drawing results
15:50-17:00	Round 4	Teams compete in the order of drawing results
May 24 (Challenge Day 3)		
8:30	Pre-match Inspection	Stand-by in the Preparation Area
9:30-11:40	Round 4	Teams compete in the order of drawing results
11:40-14:00	Break	
14:00-15:00	Awards Ceremony	

*** Times may vary on competition day**

（II） Practice Matches Timetable

May 21, 2018 (Check-in Day & Practice Matches)			
Time	**Challenge**	**Red Site**	**Blue Site**
9:30	Start Mock Inspection		
10：00-10：20	1	Team 1	Team 2
10：20-10：40	2	Team 3	Team 4
10：40-11：00	3	Team 5	Team 6
11：00-11：20	4	Team 7	Team 8
11：20-11：40	5	Team 9	Team 10
11：40-12：00	6	Team 11	Team 12
12：00-12：20	7	Team 13	Team 14
12：20-13：20	**Break**		
13：20-13：40	8	Team 15	Team 16
13：40-14：00	9	Team 17	Team 18
14：00-14：20	10	Team 19	Team 20
14：20-14：40	11	Team 21	Team 22
15：00-16：00	Team Captain Meeting/Draw		
16:00	**Closed**		

Note:

1. The specific times may vary the day of the challenge.

2. Team gets 20 minutes for Practice Matches; Teams are allowed to use a small amount of projectiles to simulate the challenge.

3. Teams are scheduled for Practice Matches in chronological order of when they checked-in.

4. Robots must carry PASS cards in order to participate in Practice Matches .

（III） Challenge Timetable

May, 22, 2018 (Challenge Day 1)			
Time	**Challenge**	**Red Site**	**Blue Site**
8:30	Start Pre-match Inspection		
(Round 1)			
9：30-9：40	1	ROMC	1
9：50-10：00	2	ROMC	2
10：00-10：10	3	ROMC	3
10：10-10：20	4	ROMC	4
10：20-10：30	5	ROMC	5
10：30-10：40	6	ROMC	6
10：40-10：50	7	ROMC	7
10：50-11：00	8	ROMC	8
11：00-11：10	9	ROMC	9
11：10-11：20	10	ROMC	10
11：20-11：30	11	ROMC	11
11：30-11：40	12	ROMC	12
11：40-11：50	13	ROMC	13
11：50-12：00	14	ROMC	14
11：30-11：40	15	ROMC	15
11：40-11：50	16	ROMC	16
11：50-12：00	17	ROMC	17
12：00-12：10	18	ROMC	18

12：10-12：20	19	ROMC	19
12：20-12：30	20	ROMC	20
12：30-12：40	21	ROMC	21
12：40-12：50	22	ROMC	22
12：50-14：00	**Break**		
13:30	Start Pre-match Inspection		
Round 2			
14：00-14：10	23	ROMC	1
14：10-14：20	24	ROMC	2
14：20-14：30	25	ROMC	3
14：30-14：40	26	ROMC	4
14：40-14：50	27	ROMC	5
14：50-15：00	28	ROMC	6
14：50-15：00	29	ROMC	7
15：00-15：10	30	ROMC	8
15：10-15：20	31	ROMC	9
15：20-15：30	32	ROMC	10
15：30-15：40	33	ROMC	11
15：40-15：50	34	ROMC	12
15：50-16：00	35	ROMC	13
16：00-16：10	36	ROMC	14
16：10-16：20	37	ROMC	15
16：20-16：30	38	ROMC	16

16：30-16：40	39	ROMC	17
16：40-16：50	40	ROMC	18
16：50-17：00	41	ROMC	19
18:00	**Closed**		

May 23, 2018 (Challenge Day 2)			
Time	**Challenge**	**Red Site**	**Blue Site**
8:30	Start Pre-match Inspection		
Round 2			
9：30-9：40	42	ROMC	20
9：50-10：00	43	ROMC	21
10：00-10：10	44	ROMC	22
Round 3			
10：30-10：40	45	ROMC	1
10：40-10：50	46	ROMC	2
10：50-11：00	47	ROMC	3
11：00-11：10	48	ROMC	4
11：10-11：20	49	ROMC	5
11：20-11：30	50	ROMC	6
11：30-11：40	51	ROMC	7
12：00-12：10	52	ROMC	8
12：10-12：20	53	ROMC	9
12：20-12：30	54	ROMC	10

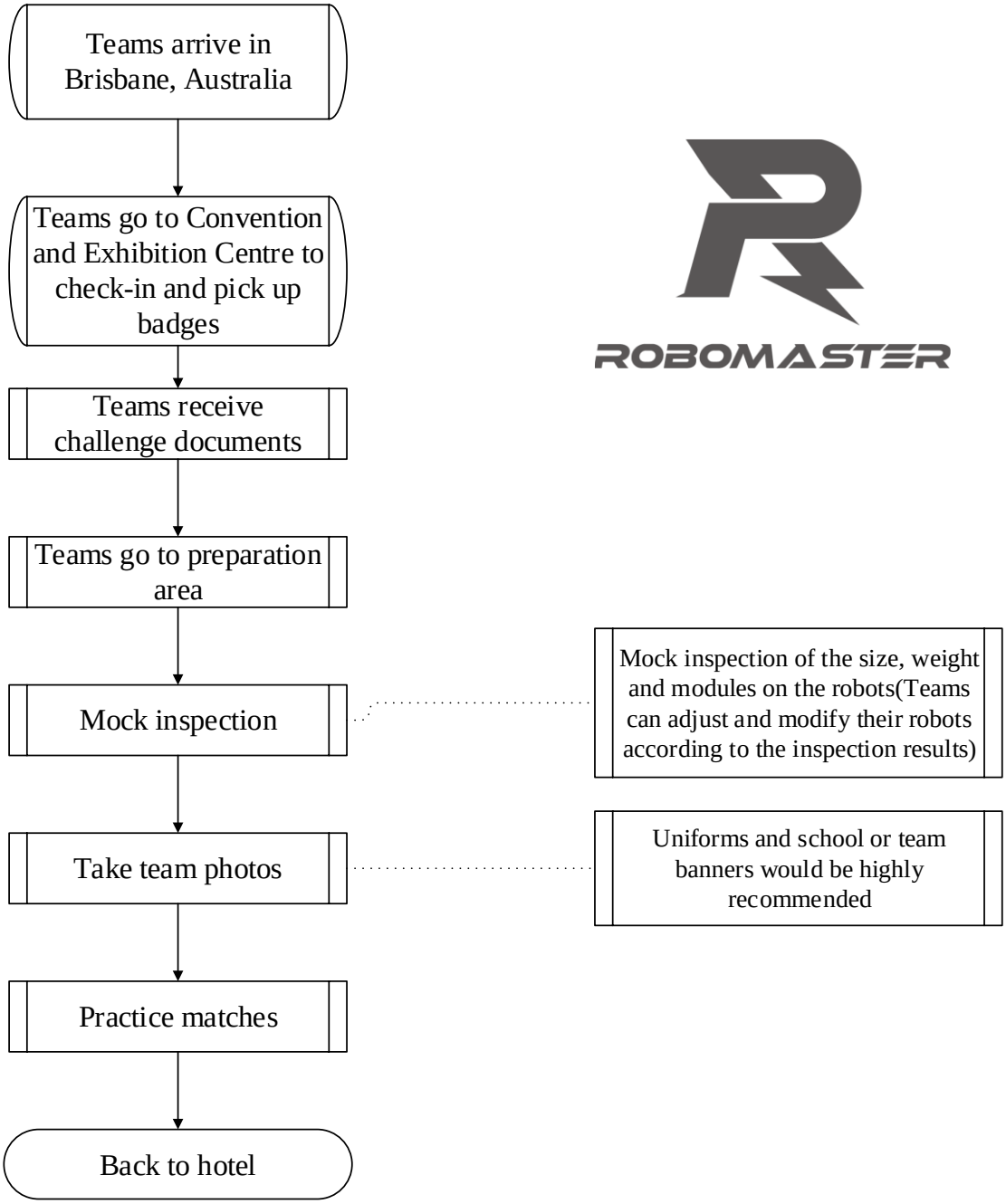
12：30-12：40	55	ROMC	11
12：40-12：50	56	ROMC	12
12：50-14：00	**Break**		
13:30	Start Pre-match Inspection		
14：00-14：10	57	ROMC	13
14：10-14：20	58	ROMC	14
14：20-14：30	59	ROMC	15
14：30-14：40	60	ROMC	16
14：40-14：50	61	ROMC	17
14：50-15：00	62	ROMC	18
14：50-15：00	63	ROMC	19
15：00-15：10	64	ROMC	20
15：10-15：20	65	ROMC	21
15：20-15：30	66	ROMC	22
Round 4			
15：50-16：00	67	ROMC	1
16：00-16：10	68	ROMC	2
16：10-16：20	69	ROMC	3
16：20-16：30	70	ROMC	4
16：30-16：40	71	ROMC	5
16：40-16：50	72	ROMC	6
16：50-17：00	73	ROMC	7
18:00	**Closed**		

May 24, 2018 (Challenge Day 3& Awards Ceremony)			
Time	**Challenge**	**Red Site**	**Blue Site**
8:30	Start Pre-match Inspection		
Round 4			
9：30-9：40	74	ROMC	8
9：50-10：00	75	ROMC	9
10：00-10：10	76	ROMC	10
10：10-10：20	77	ROMC	11
10：20-10：30	78	ROMC	12
10：30-10：40	79	ROMC	13
10：40-10：50	80	ROMC	14
10：50-11：00	81	ROMC	15
11：00-11：10	82	ROMC	16
11：10-11：20	83	ROMC	17
11：20-11：30	84	ROMC	18
11：30-11：40	85	ROMC	19
11：40-11：50	86	ROMC	20
11：50-12：00	87	ROMC	21
11：30-11：40	88	ROMC	22
11：40-14：00	Break		
14：00-15：00	RoboMaster Organizing Committee Awards Ceremony		
15：00-18：00	**Departure**		

* Specific times may vary on the day of the challenge

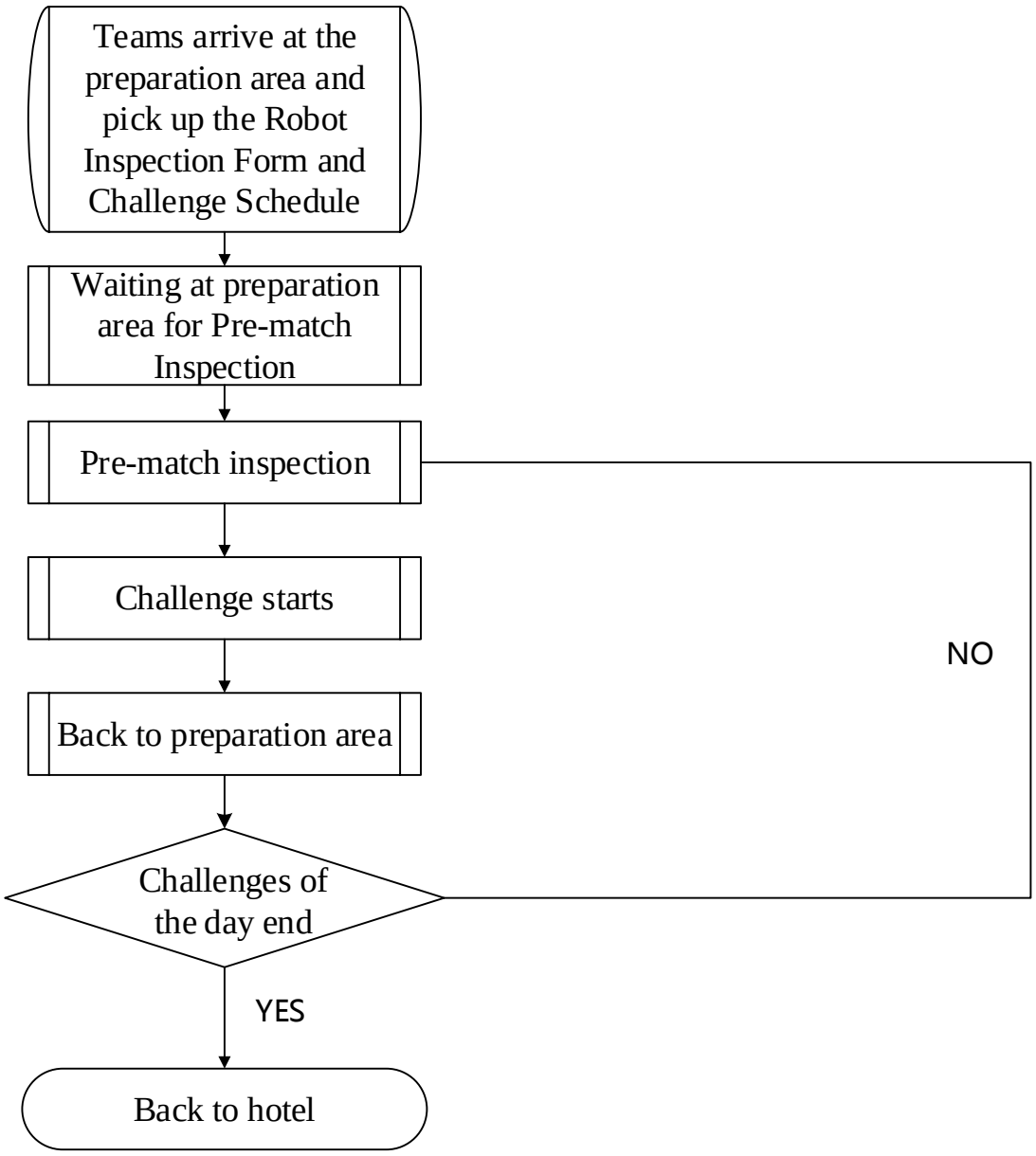
（IV） Check-in Day Flowchart

Check-in Day Flowchart

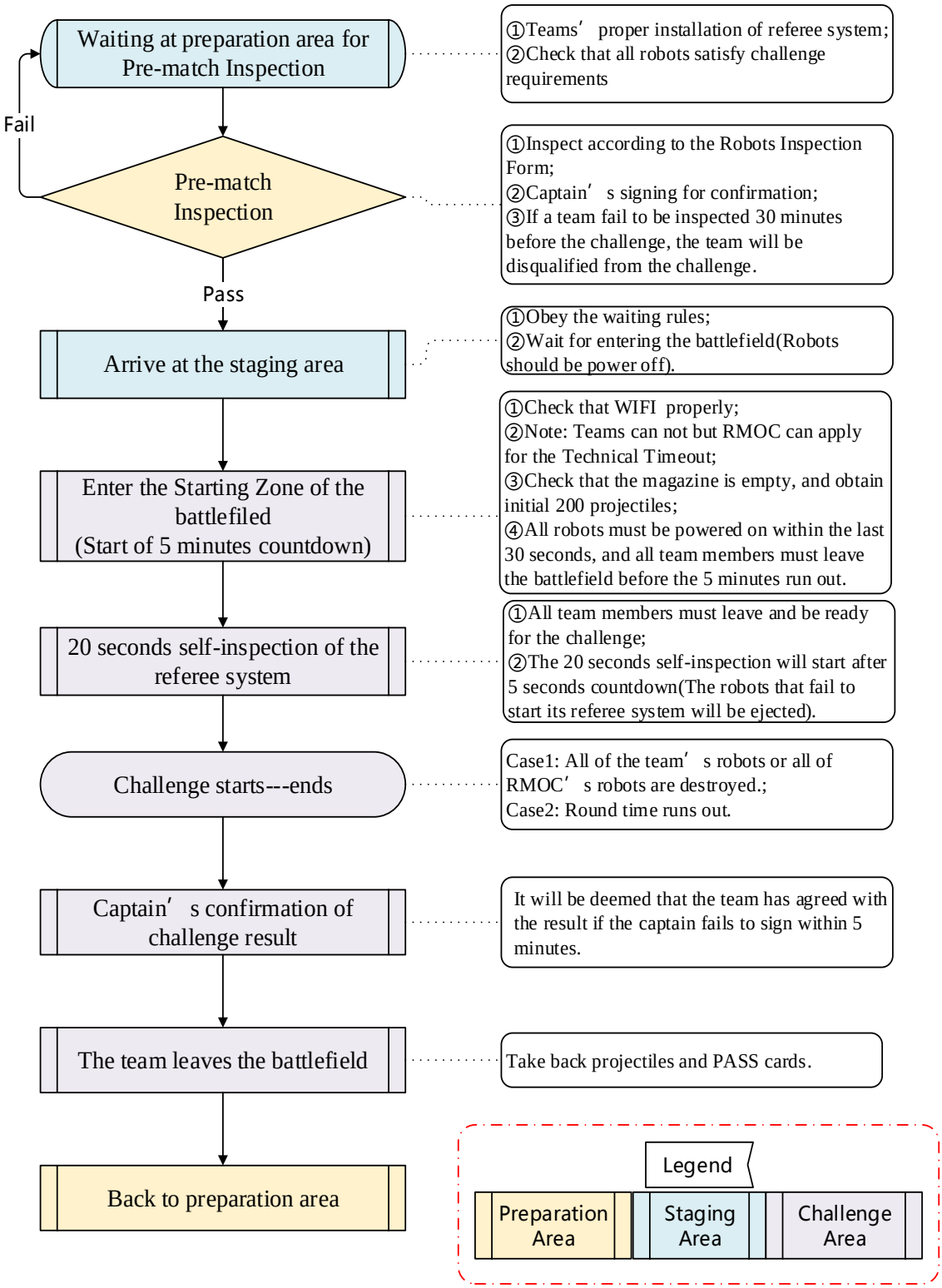


（V） Challenge Day Flowchart

Challenge Day Flowchart



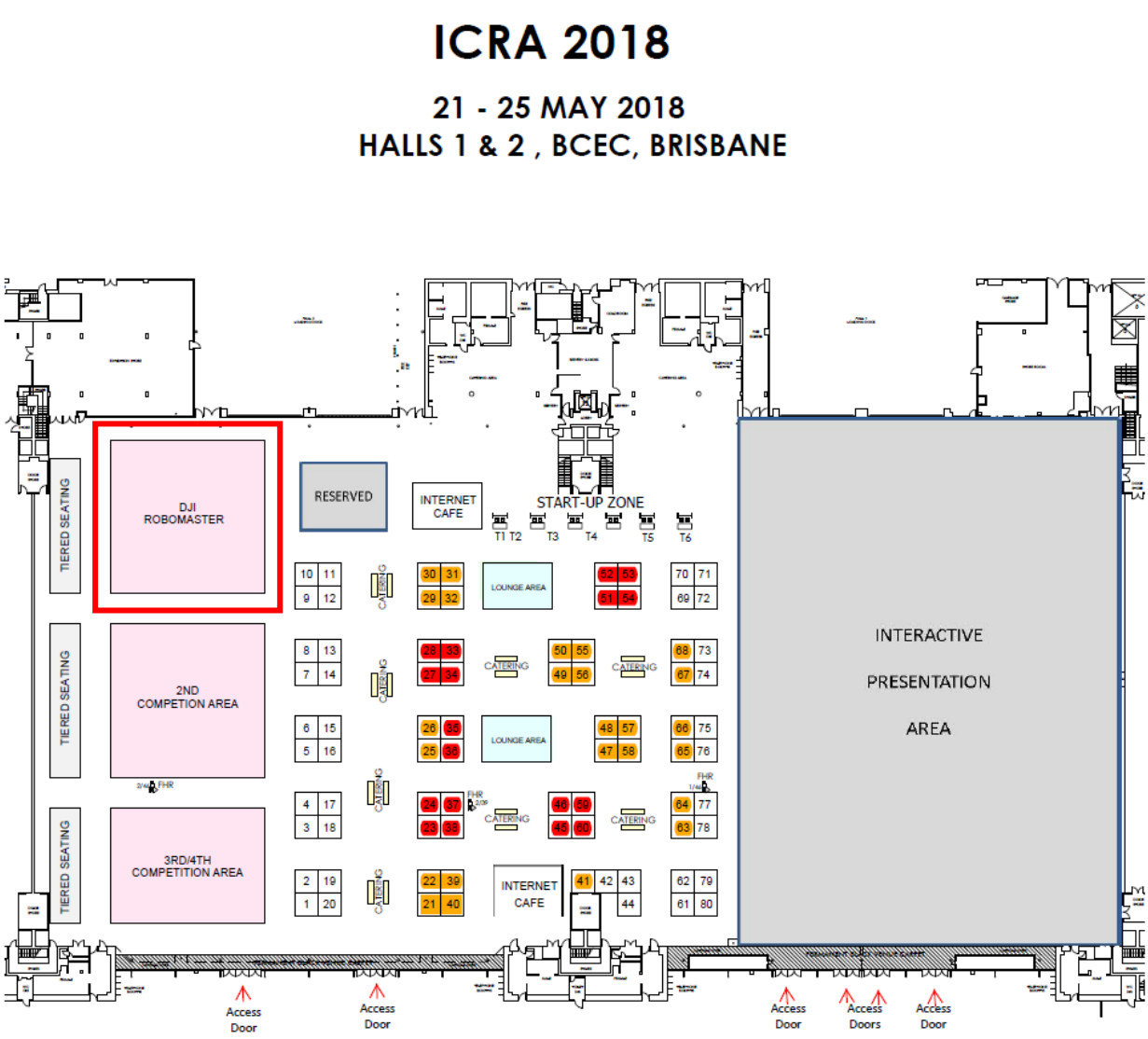
ICRA 2018 Single Round Flowchart



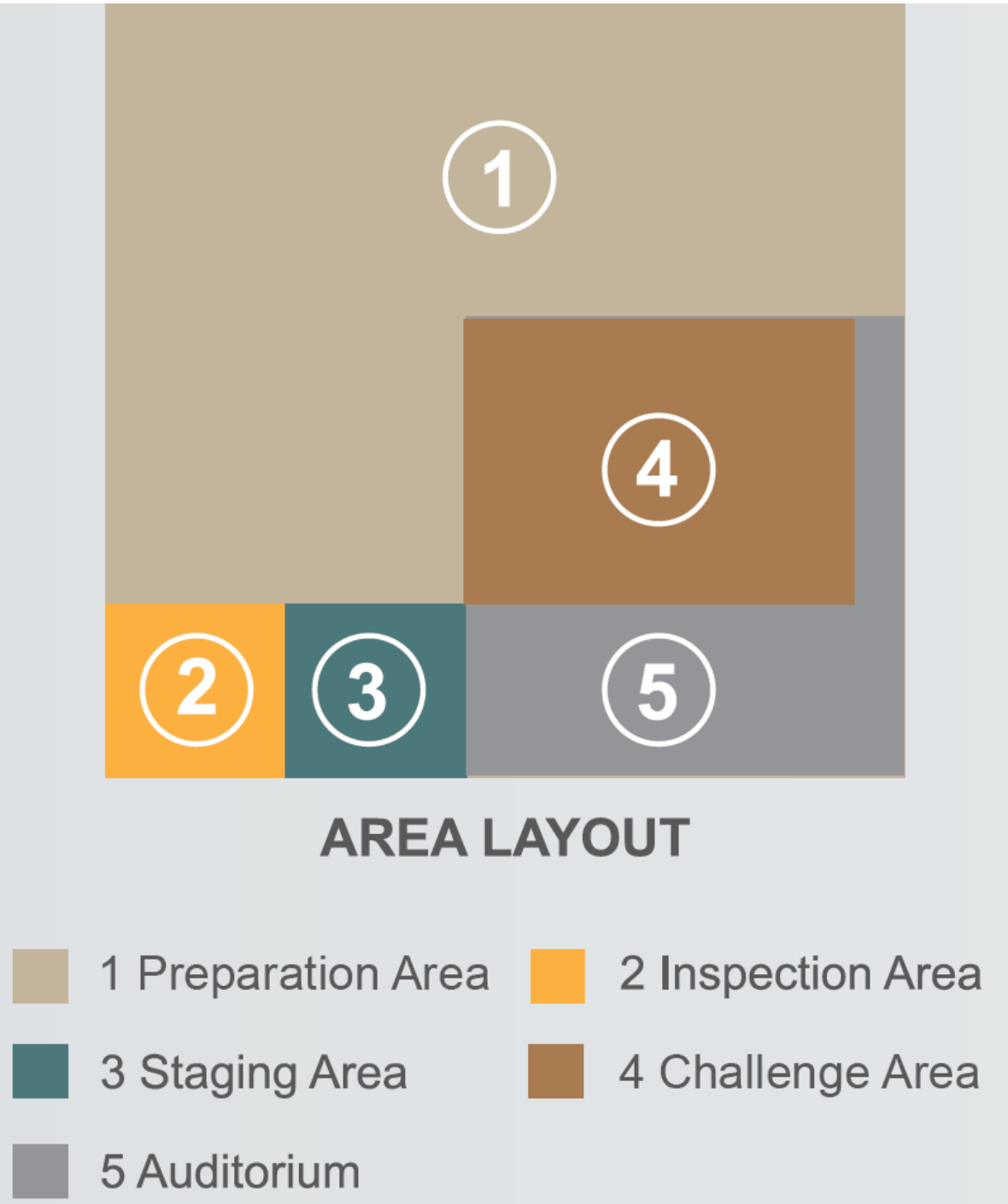
V. Challenge Field Map

Venue： Brisbane Convention & Exhibition Centre, Australia

Cnr Merivale and Glenelg Streets South Bank, Brisbane Queensland Australia



Map of Overall Venue Division



Map of RoboMaster Venue

VI. Safety Statement

1. All team members registering for the *ICRA 2018 DJI RoboMaster AI Challenge* shall have full capacity for civil conduct and shall be capable of independently manufacturing and operating robots. All team members shall, prior to the manufacture of robots with the materials provided by *DJI*, read the documents about *ICRA 2018 DJI RoboMaster AI Challenge* carefully, including but not limited to the registration rules, competition rules, safety guidelines, rules and regulations developed by the RoboMaster Organizing Committee of *ICRA 2018 DJI RoboMaster AI Challenge*.
2. During the challenge, all team members shall ensure that his or her acts in relation to the manufacture, test and use of robots will not bring any injury or damage to his or her teammates, members of opposing teams, referees, staff, viewers, equipment or competition field.
3. The robots competing in *ICRA 2018 DJI RoboMaster AI Challenge* shall not infringe upon the intellectual property rights of any other individuals or organizations. A team shall be held responsible and accountable for any dispute arising therefrom.
4. A team shall ensure that the structural design of their robots competing in *ICRA 2018 DJI RoboMaster AI Challenge* will pass the safety inspection prior to the start of the competition, and shall be subject to the safety inspection of the RoboMaster organizing committee of the event.
5. During any and all periods of R&D and competition, all team members should pay sufficient attention to safety precautions.
6. A team shall ensure the safety of their robots are controlled during the competition. They must check that the bullet and pellet turret are secure, and make sure that the bullets and pellets will never cause direct or indirect injury to operators, referees, staff and audience at any time.
7. A team must take sufficient and necessary safety measures during the R&D, training and competition, including but not limited to: avoiding the dysfunction and malfunction of the controlling system; urge team members to anticipate every operating step prior to the formal operation so as to avoid wrongful operation or collision between team members or between

robots and team members; prohibit team members from working without supervision, and make sure that one or more persons have been appointed to respond to an emergency;

8. A team shall be held responsible and accountable for all and any accidents arising from the breakdown of robots, the loss of control of drones, and other unexpected circumstances. A team shall test the robots for several times before the competition to ensure that they can respond to various emergencies. During the competition, in case of emergencies (such as malfunctions, fire or explosion, etc.), the RoboMaster Organizing Committee of *ICRA 2018 DJI RoboMaster AI Challenge* shall have the right to take the necessary steps to prevent or stop a malfunctioning robot.
9. Materials bought from, or provided by, *DJI* including but not limited to batteries and referee systems, must be properly used in accordance with the information in the user manual attached to the materials aforesaid. *DJI* will not be held responsible and accountable for any injury arising from improper use of the materials. A team shall be held responsible and accountable for injury to its team members or any other persons for damages to properties arising from its manufacture and operation of robots.
10. All team members shall be in strict compliance with the laws and regulations of the People's Republic of China. All team members shall ensure that the robots will be only used for the *ICRA 2018 DJI RoboMaster AI Challenge* and will not be used for refitting or other illegal purpose(s).
11. All team members shall, if he or she has successfully registered with the RoboMaster Organizing Committee of *ICRA 2018 DJI RoboMaster AI Challenge*, agree that he or shall keep all and any technical details and secrets in relation to the referee system provided by *DJI* strictly confidential.
12. The responsible officer of a team shall acknowledge and ensure that all team members have, if he or she has successfully registered with the RMOC, fully understood all content of the safety instructions and all team members have signed and agreed to the safety requirements.

VII. Transportation and Dining Information

（I） Main Transportation Routes

1. **From Brisbane International Airport to Brisbane Convention and Exhibition Center**
   - Taxi: About 20 minutes, about AUD 40
   - Public Transportation (train): About 40 minutes

   Route: Arrive in Brisbane airport train station---take any train line---get off at Southbank Station---exit the station---walk for 650 meters and arrive in Brisbane Convention and Exhibition Center
2. **From South Bank Station to Brisbane Convention and Exhibition Center**
   - Walk: About 10 minutes

（II） Accommodation Information

Hotel	Address	Contact	Average Price/Person (AUD)	Distance
Vine Serviced Apartments	27 Russell Street, South Brisbane, 4101 Brisbane, Australia	(07) 3123 5686	162.5 /per person/day	50m
Novotel Brisbane South Bank	38 Cordelia St, South Brisbane, 4101 Brisbane, Australia	(07) 3237 2524	64.5 / per person/day	200m
Ivy Eve Apartments	22 - 28 Merivale Street, South Brisbane, 4101 Brisbane, Australia	(07) 3844 4555	117 / per person/day	550m
Menso at Southbank	68 Cordellia street	(07) 3844 1355	84/64	600m

	Menso at Southbank, South Brisbane, 4101 Brisbane, Australia		/ per person/day	
Arena Apartments	9 Edmondstone Street, South Brisbane, 4101 Brisbane, Australia	(07) 3844 9985	100 / per person/day	630m

*If the phone number is 0X 1234 5678, its international format is +61X 1234 567 or 0061X 1234 5678.

（III） Dining Information

Restaurant	Address	Contact	Average Price/Person (AUD)	Distance
Bamboo Basket	1003 - 1004/199 Grey St, South Brisbane QLD 4101	(07) 3844 0088	15-20	550m
Jackpot Dining	132 Boundary St, West End QLD 4101	(07) 3255 0668	10-15	850m
Taiwanese Kitchen Restaurant Brisbane	7 Brereton St, South Brisbane QLD 4101	(07) 3255 3003	10-13	1km
PappaRich	Level 1, Shop 104, Wintergarden Shopping Centre, 171-209 Queen Street, Brisbane City QLD 4000	(07) 3211 3585	15-20	1.6km

*If the phone number is 0X 1234 5678, its international format is +61X 1234 567 or 0061X 1234 5678.

VIII. RMOC Announcement

All participants of ICRA 2018 DJI RoboMaster AI Challenge shall comply with the rules and regulations, including ICRA 2018 DJI RoboMaster AI Challenge Rules Manual, ICRA 2018 DJI RoboMaster AI Challenge Referee System Specification Manual, and ICRA 2018 DJI RoboMaster AI Challenge Referee System User Manual (the latest versions released by the RoboMaster Organizing Committee shall prevail)

During the competition, all competition teams shall communicate and cooperate with staff at all posts. All competition staff will wear uniforms and badges for easy identification. Teams shall understand their duties and responsibilities in advance. In case of any questions, the final explanation right is at the Chief Referee.

Title	Duties & responsibilities
General Staff	Run preparation area, waiting area and competition field, and coordinate issues of venue, choreography, logistics services, etc. Only enforce rules and regulations.
Technicians	Check in competing robots, assist participants to repair robots, and take care of competition properties. Only enforce rules and regulations.
Chief Referee	Member of the referee team and arbitration committee. Chair the team-leader meeting and handle arbitral affairs. Can interpret competition rules and regulations.
Head Referee	Leading referee of the referee team who operates the referee system and judge accordingly. Only enforce rules and regulations.
Side Referee	Member of the referee team. Assists the head referee to monitor the challenge. Only enforce rules and regulations.
Volunteers	Guide competing teams, assist with documents, materials and field control, work as referee assistants, etc. Not responsible for the enforcement and explanation of competition rules and regulations.

Note：

1. During the check-in day, teams will take team photos. Uniforms and school or team banners would be highly recommended.
2. During the challenge, all teams shall be subject to the guide of RoboMaster Organizing Committee staffs and comply with the venue order. Please take care of personal life and financial safety. Travel insurance is recommended. In case of any accidents or emergencies due to your own reasons, the RoboMaster Organizing Committee shall assume no responsibility.
3. All the travel expenses for this challenge shall be at the teams themselves. Please arrange for the travel schedule in advance. (Make sure prepare for the passport and visa in advance)
4. That teams take the robots as checked baggage is highly recommended. And please take the invitation with you when entering Australia. Contact RMOC if necessary.
5. According to the Organization Committee of *ICRA 2018 DJI RoboMaster AI Challenge*, all participating competition teams must handle the registration within the required time. The registration link (this link is only accessible to participating team members. Forwarding the link to others is prohibited):

https://icmsaust.eventsair.com/icra2018/competitorregistration/Site/Register

The cost is $395 inc GST.

Competitor Only Registration Fee:

Fee includes the following:

- Name Badge and Lanyard with Competitor Identifying Strip
- Morning and afternoon tea and lunch on Tuesday, Wednesday, Thursday only. If your competition is running Monday or Friday you must make your own meal arrangements.
- Includes access to exhibition and interactive presentation zone within the exhibition hall

Fee Excludes:

- Additional catering outside of main delegate conference days as stated above
- Excludes tickets to social functions (these may be purchased separately via the links on

this form)

- Delegate Bag / Program
- Access to Plenary and Keynotes sessions taking place outside of exhibition hall

If you would like to request Fee Waiver for registration, please refer to《ICRA 2018 DJI RoboMaster AI Challenge Request for Registration Fee Waiver (Form)》.

Note: Both the Travel and Fee Sponsorship would be transferred **after** the challenge.

RoboMaster Organizing Committee

Email: robomaster@dji.com

Official Website: http://www.robomaster.com

Facebook: https://www.facebook.com/RoboMasterDJI/

Twitter: https://twitter.com/RoboMasterDJI

Youtube: https://www.youtube.com/c/RoboMaster

Tel: 0755-86152250

Address：14th Floor, West Wing, Skyworth Semiconductor Design Building, No.18 Gaoxin South 4th Ave, Nanshan District, Shenzhen, China, 518057