

ABU
ASIA-PACIFIC ROBOT CONTEST 2009
TOKYO



THEME & RULES

TRAVEL TOGETHER
FOR THE VICTORY DRUMS

September 1st 2008

ABU ASIA-PACIFIC ROBOT CONTEST 2009 TOKYO
HOST ORGANISING COMMITTEE

Contents

Towards the Cooperative Society of People and Robots	2
Kago, the Core Item of the Contest Theme	2
The importance of Safety	3
Domestic Contests in Each Country and/or Region	3
Rules	5
1. Outline of the Contest	6
2. Field: Structure and Specifications	7
3. Specifications for the Kago	9
4. Game Procedure	10
5. Competition Tasks	11
6. Retries for Robots	15
7. Deciding the Winner	16
8. Conditions and Points to Watch Out for in Designing and Manufacturing Robots	17
9. Violations	20
10. Disqualification	21
11. On the Safety of the Robots	21
12. Teams	22
13. Others	22
Appendix	23

THE CONTEST THEME

TRAVEL TOGETHER FOR THE VICTORY DRUMS

Towards the Cooperative Society of People and Robots

Cooperation between people and robots is the theme of the ABU Asia-Pacific Robot Contest 2009 Tokyo.

In industry, the use of robots is already common practice. The development of new types of robot has now become necessary in such fields as care for the elderly and the physically disabled, and rescue work in times of emergency. New types of robots are required that are capable of being a part of our daily life and providing us with care. They must share such human qualities as kindness and cooperation above and beyond the speed, power and precision demanded of conventional robots. Robots designed from this new perspective are expected to meet rising demand in the years to come.

The ABU ROBOCON 2009 Tokyo has been conceived of as a step towards the goal of close cooperation between manual (or directly human-controlled) and automatic robots. That is not an easy challenge but it is one of truly great worth.

Kago, the Core Item of the Contest Theme

The core item of this year's contest is the Kago, the traditional Japanese palanquin or litter of the pre-modern era. People were often carried in Kago to distant places. The Kago was a basket suspended from a wooden pole, called here the Shoulder Pole, as shown in the photo. It was carried by two men, one in front and the other behind.

Travel in olden times was far from smooth. There were mountains, steep slopes, and sharply winding roads to traverse. The bearers who carried the Kago had to cooperate very closely to reduce the sway and complete the journey safely.



Kago,
the traditional Japanese palanquin

Photo: The Mainichi Newspapers

The Importance of Safety

Safety is one of the most important elements in the sustainable development of the ABU ROBOCON.

The safety of the robots themselves is the first and foremost issue for the safe holding of the contest. The participating teams, as the robot designers, are responsible for the safety of their robots.

The teams must work and cooperate closely with the organisers to ensure the utmost safety of the contest.

Safety must always be the top priority and it must be considered for all people involved in the contest as officials, participants or spectators in all circumstances.

Teams are required to pay sufficient attention to the safety of their robots on this basis before applying to take part in the contest.

Domestic Contests in Each Country and/or Region

All domestic contests in each country and/or region related to participation in the ABU ROBOCON 2009 Tokyo should conform to the rules. It is understood, however, that materials may not be available in some places. Organisers are advised to use the best possible materials and adhere as closely as possible to the specifications laid down for the final contest.

Rules

1. Outline of the Contest

Travel Together for the Victory Drums is a game based on an imaginary journey of olden days using the *Kago* palanquin.

An *Automatic Carrier Robot* in the front and a *Manual Carrier Robot* in the rear shall cooperate to carry an automatic *Traveller Robot* in a *Kago* to the goal with the aim of completing the journey before the other team. Various tasks stand in the way, including a *Mountain Pass* and *Woods*. The *Kago* and *Traveller Robot* must not be dropped.

The *Traveller Robot* must beat the three *Victory Drums* when it reaches the *Goal Zone*. The three traditional Japanese drums are arranged vertically on a platform. The team that beats all three drums first is the winner.

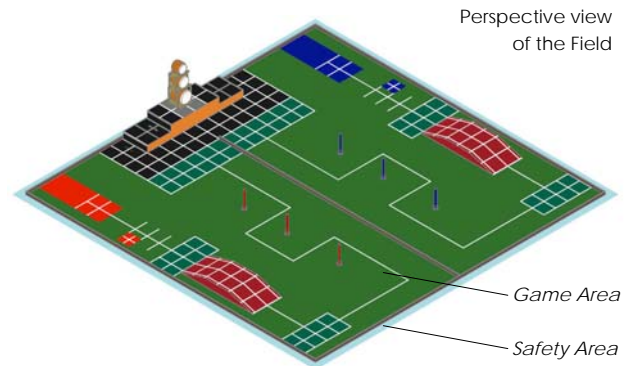
Each match is contested by red and blue teams. A match lasts three minutes.

2. *Field*: Structure and Specifications See Figure 1 to 7

2.1. The *Field* consists of the *Game Area* and *Safety Area*.

2.2. The *Game Area* measures 12,000 mm x 12,000 mm. It is surrounded by a wooden fence 100 mm high and 30 mm wide.

2.3. White lines are drawn on the floor of the *Game Area*, as shown in Figure 1. Each white line is 30 mm wide.



2.4. The *Game Area* consists of a *Kago* (=Palanquin) Zone and a *Goal Zone*.

2.5. *Kago Zone*

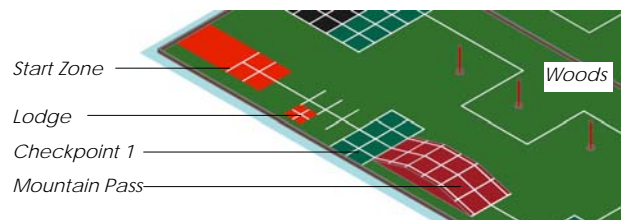
2.5.1. The *Kago Zone* is divided into two exclusive sections, one for the red and the other for the blue team, separated by a wooden fence that is 100 mm tall and 30 mm wide.

2.5.2. The *Kago Zone* contains a *Start Zone*, a *Lodge*, *Checkpoints*, a *Mountain Pass* and *Woods*.

2.5.3. *Start Zone*

2.5.3.1. The *Start Zone* measures 1,000 mm x 2,500 mm.

2.5.3.2. The floor surface is red for the red team and blue for the blue team.



2.5.4. *Lodge*

2.5.4.1. Each *Lodge* is 500 mm x 500 mm in area and 12 mm tall.

2.5.4.2. The floor surface is red for the red team and blue for the blue team.

2.5.5. *Checkpoints*

2.5.5.1. There are three *Checkpoints* each within the *Kago Zone* for the red and blue teams.

2.5.5.2. *Checkpoints 1* and *2* are 2,000 mm x 1,000 mm and *Checkpoint 3* is 3,000 mm x 1,000 mm large.

2.5.6. *Mountain Pass*

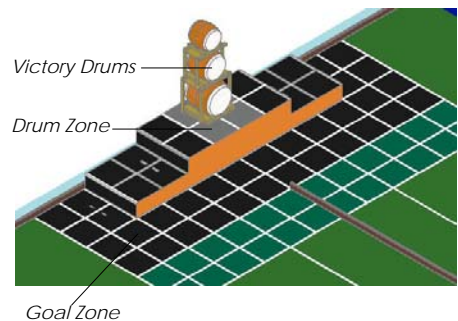
- 2.5.6.1. *Mountain Pass* is 1,200 mm x 3,000 mm in area.
- 2.5.6.2. Viewed from above, the slope climbs across a horizontal distance of 1,000 mm from each side. The flat top has an elevation of 300 mm.
- 2.5.6.3. The flat section at the top of the pass has an area of 1,200 mm x 1,000 mm.

2.5.7. *Woods*

- 2.5.7.1. The *Woods* consist of three poles.
- 2.5.7.2. Each pole is cylindrical with a diameter of 76.3 mm and rise to a height of 1,600 mm from the floor. Each pole stands on a pedestal 176.3mm in diameter installed on the floor of the Field.
- 2.5.7.3. The edges of the pedestals of poles 1 and 2 are 2,000 mm apart and edges of the pedestals of poles 2 and 3 are 1,600 mm apart.
- 2.5.7.4. The poles and pedestals of the red team are painted red and those of the blue team are painted blue.

2.6. *Goal Zone*

- 2.6.1. The *Goal Zone* is 6,000 mm x 2,000 mm.
- 2.6.2. Part of the *Goal Zone* is stepped.
The stepped area is 1,000mm x 4,000mm large.
- 2.6.3. There are two steps, each 250 mm high.
- 2.6.4. The first steps each have an area of 1,000mm x 1,000mm. The top step is 1,000mm x 2,000mm.
- 2.6.5. There is a *Drum Zone* in the middle of the top step. This measures 1,000mm x 1,000mm.
- 2.6.6. The *Victory Drums* are placed in the *Drum Zone*. Three drums are arranged vertically with the largest one at the bottom and smallest on top. The *Victory Drums* consist of the three drums and the drum stand to hold them.
- 2.6.7. The drums are hand-made in the traditional Japanese style with the body made of wood and faced with leather. The diameters of the circular faces of the drums that must be hit are approximately 420 mm for the large drum, 360 mm for the middle drum, and 300 mm for the small drum.



2.7. *Safety Area*

- 2.7.1. The *Safety Area* is 300mm wide, including the fence surrounding the *Game Area*.

3. Specifications for the *Kago* See Figure 8

3.1. The *Kago* used in the contest shall be provided by the organisers.

3.2. Each *Kago* consists of a *Shoulder Pole*, *Cross Bars* and a *Seat* on which the *Traveller Robot* sits and *Ropes* that attach the *Seat* to the *Cross Bars*.

3.3. The *Kago* weighs approximately 3 kg.

3.4. *Shoulder Pole*

3.4.1. The *Shoulder Pole* is a rectangular wooden rod measuring 2,000mm (long) x 40mm (wide) x 30mm (thick).

3.4.2. The *Shoulder Pole* is marked with a 10 mm wide painted white lines to a distance of 730 mm from each end of the pole at intervals of 50mm.

3.4.3. *Cross Bars* are installed 750 mm from each end of the *Shoulder Pole*. Each *Cross Bar* is a rectangular wooden rod measuring 500 mm (long) x 40mm (wide) x 30mm (thick).

3.5. *Seat*

3.5.1. The *Seat* is made of plywood and measures 500 mm x 500 mm x 12 mm (thick).

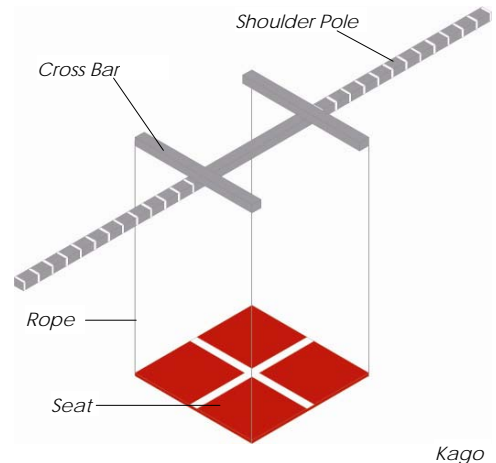
3.5.2. The red team's *Seat* is painted red and the blue team's *Seat* is painted blue. Each is marked by a white cross in lines that are 30mm wide.

3.6. Connection of the *Shoulder Pole* and the *Seat*

3.6.1. The *Seat* is attached to the *Cross Bars* by four *Ropes*.

3.6.2. The *Ropes* are made of 1.5 mm thick stainless steel wire.

3.6.3. The bottom of the *Shoulder Pole* shall be 800 mm from the top of the *Seat*.



4. Game Procedure

4.1. Length of a match

4.1.1. Each match lasts three minutes.

4.1.2. In the following cases, a match ends even before the passage of 3 minutes.

4.1.2.1. When the *Goal* is achieved.

4.1.2.2. In the event of disqualification.

4.1.2.3. When the referees judge that continuation of the match is impossible.

4.2. Setting of robots

4.2.1. One minute is provided for setting of robots before the start of each match.

4.2.1.1. Three members of each team may engage in setting of robots.

4.2.1.2. Any team that fails to complete setting of robots in one minute shall be able to resume the setting work once the match has begun.

4.3. Deployment of the robots and team members at the start of the match

4.3.1. The *Automatic and Manual Carrier Robots* shall be placed in the *Start Zone* carrying the *Kago*. The *Automatic Carrier Robot* shall be in front of the *Kago* in the direction of travel and the *Manual Carrier Robot* behind it. The *Kago* shall not be touching the floor.

4.3.2. The *Traveller Robot* shall be placed at the *Lodge*.

4.3.3. Team members responsible for starting the *Automatic Carrier Robot* and the *Traveller Robot* shall wait near their respective robot. They are allowed to start inside the *Game Area*.

4.3.4. The operator of the *Manual Carrier Robot* shall wait within the *Game Area* with a controller in the hands.

4.4. Starting an *Automatic Carrier Robot*

4.4.1. A team member shall start an *Automatic Carrier Robot* by single switch operation.

4.4.2. After switching the robot on, the team member who performs the starting operation shall immediately leave the *Field*.

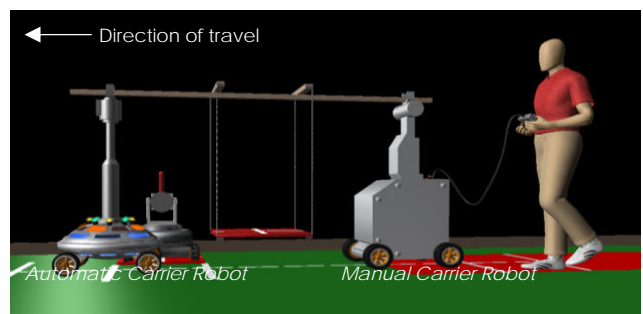
5. Competition Tasks

5.1. Once the match has begun, each team shall complete the tasks in the following order:

- 5.1.1. The task of the *Traveller Robot* boarding the *Kago* (The *Task of Boarding*).
- 5.1.2. The task of crossing the *Mountain Pass* (The *Task of Crossing*).
- 5.1.3. The task of passing through the *Woods* (The *Task of Passing*).
- 5.1.4. The task of the *Traveller Robot* alighting from the *Kago* (The *Task of Alighting*).
- 5.1.5. The task of the *Traveller Robot* beating each drum (The *Task of Beating*).

5.2. Each team must always observe the following during the match:

- 5.2.1. From the start of the match to the completion of the *Task of Alighting*, the *Kago* shall always be carried by one *Automatic* and one *Manual Carrier Robot* by means of the *Shoulder Pole*.



- 5.2.2. The *Automatic Carrier Robot* shall always be in front of the *Kago* in the direction of travel (Failure to do so is a violation under 9.1.3).
The direction of travel means the direction in which the *Kago* is moving on the *Field* while completing the tasks one by one.
- 5.2.3. The *Manual Carrier Robot* shall not move the *Automatic Carrier Robot* directly with the *Shoulder Pole* (This causes disqualification under 10.1.1).
- 5.2.4. The *Carrier Robots* may not touch any part of the *Kago* other than the *Shoulder Pole* (This is a violation under 9.1.4).
- 5.2.5. No part of the *Automatic* or *Manual Carrier Robots* may enter onto the *Goal Zone* or into the space above it (This is a violation under 9.1.6).
- 5.2.6. The *Kago* may not touch the floor of the *Field* (This is a violation under 9.1.7).
This rule shall not apply, however, when the *Traveller Robot* is boarding or alighting from the *Kago*, or when part of the *Automatic Carrier Robot* is touching or above a *Checkpoint*.
- 5.2.7. Neither the *Kago* nor the *Traveller Robot* may touch either the poles or the pedestals (This is a violation under 9.1.8).

- 5.2.8. Neither the *Traveller Robot* nor the *Drumstick(s)* shall touch the floor surface of the *Field* (This is a violation under 9.1.11. As to the *Drumsticks*, see 8.7.6-11). The floor surface of the *Lodge* is, however, excluded from this rule. This rule shall cease to apply from the time of the *task of alighting*.
- 5.2.9. The *Traveller Robot* shall not touch any part of the *Kago* other than the *Seat* (This is a violation under 9.1.9).
- 5.2.10. Neither the *Traveller Robot* nor the *Drumstick(s)* shall touch the *Automatic or Manual Carrier Robots* (This is a violation under 9.1.10), except in the cases mentioned in 5.6.4 and 5.8.1.
- 5.2.11. Team members shall not touch the robots except in the cases of starting operations and *Retries*.

5.3. *Task of Boarding*

- 5.3.1. The *Traveller Robot* shall board the *Kago* when the *Kago* arrives at the *Lodge*.
- 5.3.2. The *Kago* may touch the floor of the *Kago Zone* for the purpose of boarding.
- 5.3.3. Boarding the *Kago* means the *Traveller Robot* mounting onto the *Seat* and having no remaining contact with the floor of the *Lodge*.
- 5.3.4. A team member shall start the *Traveller Robot* for boarding onto the *Kago* by a single switch operation.
- 5.3.5. Once the *Traveller Robot* has been started, the team member shall immediately leave the *Field*.
- 5.3.6. The *Task of Boarding* shall be completed once the *Traveller Robot* has boarded the *Kago* and any part of the *Automatic Carrier Robot* in front has entered onto the *Checkpoint 1* or into the space above it.



Task of Boarding

5.4. *Task of Crossing*

- 5.4.1. The *Automatic and Manual Carrier Robots* shall cross the *Mountain Pass* while carrying the *Kago* with the *Traveller Robot* on the *Seat*.
- 5.4.2. To cross the *Mountain Pass* means to ascend the slope from the *Checkpoint 1*, continue across the flat ground at the top of the *Mountain Pass* and descend the slope on the other side to the *Checkpoint 2*.
- 5.4.3. The *Task of Crossing* shall be completed once the *Manual Carrier Robot* (excluding the controller) has left the area of and above the *Mountain Pass* and any part of the *Automatic Carrier Robot* has entered onto the *Checkpoint 2* or into the space above it.



Task of Crossing

5.5. *Task of Passing*

5.5.1. The *Automatic and Manual Carrier Robots* shall pass through the *Woods* while carrying the *Kago* with the *Traveller Robot* on the *Seat*.

5.5.2. The robots shall first pass between the poles 1 and 2 and then between the poles 2 and 3.

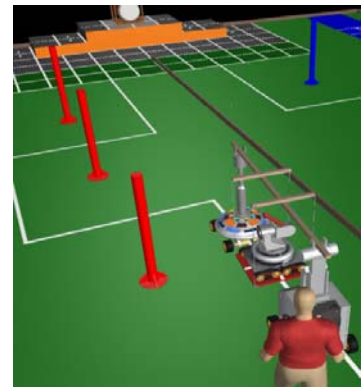
5.5.3. At the start of the *Woods*, the robots may pass either side of the pole 1.

5.5.4. The passage between poles 1 and 2 is complete once the entire body of the *Manual Carrier Robot* (excluding the controller) has crossed the virtual straight line connecting the centres of poles 1 and 2.

The passage between poles 2 and 3 is complete once the entire body of the *Manual Carrier Robot* (excluding the controller) has crossed the virtual straight line connecting the centres of poles 2 and 3.

5.5.5. The *Task of Passing* is complete once the passage between poles 2 and 3 has been completed and any part of the *Automatic Carrier Robot* has entered onto the *Checkpoint 3* or into the space above it.

5.5.6. Neither the *Kago* nor the *Traveller Robot* may come in contact with either the poles or their pedestals.



Task of Passing

5.6. *Task of Alighting*

5.6.1. A team may let its *Traveller Robot* alight from the *Kago* once the *Task of Passing* has been completed.

5.6.2. The *Traveller Robot* may alight from the *Kago* anywhere in the respective *Kago Zone* and *Goal Zone* (As to the *Automatic and Manual Carrier Robots*, see 5.2.5).

5.6.3. The *Kago* may touch the floor of the *Kago Zone* when the *Traveller Robot* alights from the *Kago*.

5.6.4. The *Manual Carrier Robot* may touch the *Traveller Robot* when the *Traveller Robot* alights from the *Kago*.

5.6.5. The *Task of Alighting* is complete once the *Traveller Robot* has left the *Seat* completely.

5.6.6. Once the *Task of Alighting* is completed, the operator of the *Manual Carrier Robot* shall leave the *Field* immediately.

5.6.7. Once the *Task of Alighting* is completed, a team member shall switch off the *Automatic Carrier Robot* with the referees' permission.



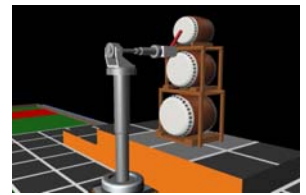
Task of Alighting

5.7. How to achieve the *Goal*

- 5.7.1. Only the *Traveller Robot* may enter the *Goal Zone*.
- 5.7.2. Only the *Traveller Robot* of the red team may enter onto the steps or into the space above them on the red side, and only the *Traveller Robot* of the blue team may enter onto the steps or into the space above them on the blue side, of the *Drum Zone*.
- 5.7.3. The *Traveller Robots* of both teams can enter onto the *Drum Zone* or into the space above it.
- 5.7.4. The *Goal* is achieved once a team's *Traveller Robot* has beaten each of the three drums in the *Goal Zone* with the *Drumstick(s)* (As to the *Drumsticks*, see 8.7.6-11). The referees shall judge whether the drums have been beaten by listening to the sound.
- 5.7.5. The *Traveller Robot* must remain in contact with the *Drumsticks* while the drums are being beaten.
- 5.7.6. The drums do not have to be beaten in any particular order.
- 5.7.7. The *Traveller Robot* may beat the drums from any position on either the respective steps or the floor of the *Field*.
- 5.7.8. Only the drum faces oriented towards the centre of the *Field* shall be beaten (Failure to do so is a violation under 9.1.15).
- 5.7.9. Neither the *Traveller Robot* nor the *Drumsticks* may touch any part of the *Victory Drums* other than the faces to be beaten (Failure to observe this rule is a violation under 9.1.15).
- 5.7.10. No part of either the *Traveller Robot* or the *Drumsticks* may enter onto the *Drum Zone* or into the space above it for the purpose of obstructing the opposing team (This is a violation under 9.1.14).



Traveller robot on the steps



Traveller Robot on the floor

5.8 At the Checkpoints

- 5.8.1. The *Kago* may be placed on the *Field* once any part of the *Automatic Carrier Robot* has entered onto a *Checkpoint* or into the space above it. The *Manual Carrier Robot* may touch the *Traveller Robot* at this time.

6. Retries for Robots

- 6.1. In the case of a violation, the referees shall instruct the team to start again (*Retry*).
- 6.2. In the case of faulty robot movements, it is possible to start again (*Retry*) with the referees' permission.
- 6.3. Team members are permitted to touch the robots while preparing for a *Retry*.
- 6.4. The place of the *Retry* shall depend on how far the tasks have been completed
- 6.5. In the case of failure to complete the *Task of Boarding*, the *Retry* shall be made from the *Start Zone*.
- 6.6. A *Retry* from the *Start Zone* shall be performed in accordance with the procedure described in 4.3.
- 6.7. When a *Retry* is made after completing the *Task of Boarding*, the *Automatic Carrier Robot* shall be placed at the *Checkpoint 1*.
When a *Retry* is made after completing the *Task of Crossing*, the *Automatic Carrier Robot* shall be placed at the *Checkpoint 2*.
When a *Retry* is made after completing the *Task of Passing*, the *Automatic Carrier Robot* shall be placed at the *Checkpoint 3*.
To be placed at a *Checkpoint* means that at least a part of the *Automatic Carrier Robot* shall be inside or above the *Checkpoint*.
- 6.8. To make a *Retry* at a *Checkpoint*, the *Automatic and Manual Carrier Robots* shall carry the *Kago* with the *Traveller Robot* on the *Seat*. The *Kago* shall not be touching the floor.
- 6.9. A *Retry* after completing the *Task of Alighting* shall be made by placing the *Traveller Robot* anywhere within *Checkpoint 3*.
- 6.10. At the time of the *Retry*, team members shall switch the robot on to start it. After switching the robot on, the team member who performs the starting operation shall immediately leave the *Field*.
- 6.11. Only a single switch operation is permitted for each robot.
- 6.12. *Retries* can be made as many times as necessary.
- 6.13. Strategies premised on the use of *Retries* are banned.

7. Deciding the Winner

- 7.1. The team whose *Traveller Robot* has beaten the three drums first shall achieve the *Goal* and be the winner. This ends the match.
- 7.2. If neither team has achieved the *Goal* at the end of the 3-minute match, the winner shall be decided in the following order of priority:
 - 7.2.1. The team that has beaten the greater number of drums is the winner.
 - 7.2.2. If the number of drums beaten is the same, the team that has beaten the higher drum is the winner.
 - 7.2.3. If the teams are level in terms of drums beaten, the team that was first to beat a drum in the case in which both teams have beaten only one drum, or the team that was first to beat a second drum in the case in which both teams have beaten only two drums, is the winner.
 - 7.2.4. The team that has completed greater number of tasks is the winner.
 - 7.2.5. If the same number of tasks has been completed, the team whose *Traveller Robot* is closest to the drums is the winner.
 - 7.2.6. If the winner has not been settled by any of the above, the match shall be replayed or the winner shall be chosen by the judges.

8. Conditions and Points to Watch out for in Designing and Manufacturing Robots

- 8.1. Each team shall use three robots: One *Automatic Carrier Robot* that carries the *Shoulder Pole* in front of the *Kago*; one *Manual Carrier Robot* that carries the *Shoulder Pole* in the rear; and one automatic *Traveller Robot* that rides in the *Kago*.
- 8.2. The robots may not divide into sub-units.
- 8.3. No communication between the robots is allowed.
- 8.4. The robots used in the contest must be handmade by students of the university to which the team belongs.
- 8.5. The *Automatic Carrier Robot*
 - 8.5.1. The *Automatic Carrier Robot* shall move automatically once it has been started by a team member.
 - 8.5.2. The *Automatic Carrier Robot* shall be started by a single switch operation.
 - 8.5.3. The dimensions of the *Automatic Carrier Robot* shall not exceed 1,000 mm (long) x 1,000 mm(wide) x 1,500 mm(tall).
- 8.6. The *Manual Carrier Robot*
 - 8.6.1. The *Manual Carrier Robot* can be operated by means of a cable connection or by remote control using infrared, visible rays or sound waves. Wireless radio control is not permitted. The operator is not permitted to ride on the manual robot.
 - 8.6.2. In the case of cable operation, the cable connecting the *Manual Carrier Robot* and the controller shall be at least 1,000 mm and not more than 3,000 mm long. The cable shall be connected to the robot at a height of not less than 1,000 mm above the floor surface of the Field.
 - 8.6.3. The dimensions of the *Manual Carrier Robot* shall not exceed 1,000 mm(long) x 1,000 mm(wide) x 1,500 mm(tall). In the cases stated in 5.6.4 and 5.8.1, however, the robot shall be capable of stretching its arms and other parts within the range delimited by a circle that is 2,000mm in diameter as viewed from above.

8.7. The *Traveller Robot*

- 8.7.1. The *Traveller Robot* must be able to move about automatically once it has been started by one of the team members, except in the cases stated in 5.6.4 and 5.8.1.
- 8.7.2. The *Traveller Robot* shall be started by a single switch operation.
- 8.7.3. The size of the *Traveller Robot* shall be within the range delimited by a circle that is 2,000mm in diameter as viewed from above.
- 8.7.4. The *Traveller Robot* shall not touch any part of the *Kago* other than the *Seat*.
- 8.7.5. The *Traveller Robot* may not be attached to the *Seat*. The *Traveller Robot* must slide or fall if the *Seat* is inclined by 20 degrees in either the longitudinal or the transverse direction to the direction of travel.
- 8.7.6. The *Traveller Robot* shall carry *Drumstick(s)* to beat the drums. It can carry no more than three *Drumsticks*.
- 8.7.7. The *Traveller Robot* shall be capable of beating the drums with the *Drumstick(s)*.
- 8.7.8. At least one *Drumstick* must remain in its entirety at least 300mm above the surface of the *Seat* while the *Traveller Robot* is riding in the *Kago*.
- 8.7.9. The *Drumsticks* shall be prepared by each team.
- 8.7.10. Each *Drumstick* shall be cylindrical and at least 300 mm long x 20 mm in diameter.
- 8.7.11. *Drumsticks* painted red all over and blue all over shall be prepared.

8.8. Weight of the robots

- 8.8.1. The combined weight of all of a team's robots and other devices to be used in the entire contest, including the power source, cables, controllers, *Drumsticks* and other equipment, shall not exceed 50 kg. The weight of back-up batteries of the same type, weight and voltage as the primary batteries is, however, exempted from this rule.

8.9. Power sources for the robots

- 8.9.1. Each team must prepare the power sources for the robots.
- 8.9.2. The voltage of the power source used by each robot shall not exceed DC24V.
- 8.9.3. Any power source deemed dangerous or inappropriate by the organiser may not be used.

8.10 Detailed rules on safety

- 8.10.1. The use of explosives, fire and dangerous chemicals is prohibited.

8.10.2. If a laser is used, it shall be of Class 2 or less. In designing and preparing the laser, full care must be taken to protect all persons at the venue from harm during all procedures. In particular, the beams must be so oriented that they cannot shine into the eyes of the spectators.

8.11. Examination of the robots

8.11.1. Participating robots shall be examined prior to the test run on the day before the contest and again on the day of the contest before it begins. A team that fails an examination shall not be allowed to participate in the test run or contest.

8.11.2. Details of what will be examined and how will be provided at a later date.

9. Violations

- 9.1. If a violation occurs, a *Retry* shall be made by bringing the robot back to the *Start Zone* or the *Checkpoints*. The place and method of the *Retry* is laid down in "6. Retries for Robots". The following cases are violations:
- 9.1.1. Any part of either robot or its operator or the *Kago* enters onto the *Safety Area* or into the space above it.
 - 9.1.2. Any part of either robot or its operator or the *Kago* enters onto the *Kago Zone* of the opposing team or into the space above it.
 - 9.1.3. When carrying the *Kago*, the *Manual Carrier Robot* is in front in the direction of travel.
 - 9.1.4. Either the *Automatic* or the *Manual Carrier Robot* touches any part of the *Kago* other than the *Shoulder Pole*.
 - 9.1.5. Either the *Automatic* or the *Manual Carrier Robot* touches the *Traveller Robot*, except in the cases described in 5.6.4 and 5.8.1.
 - 9.1.6. Any part of either the *Automatic* or the *Manual Carrier Robot* enters onto the *Goal Zone* or into the space above it.
 - 9.1.7. The *Kago* touches the floor of the *Field*, excluding the cases stated in 5.3.2, 5.6.3 and 5.8.1.
 - 9.1.8. Either the *Kago* or *Traveller Robot* touches the poles or their pedestals in the *Woods*. The *Automatic* and *Manual Carrier Robots* are permitted to touch the poles or their pedestals.
 - 9.1.9. The *Traveller Robot* touches any part of the *Kago* other than the *Seat*.
 - 9.1.10. Either the *Traveller Robot* or the *Drumstick(s)* touches the *Automatic* or the *Manual Carrier Robot*, except in the cases described in 5.6.4 and 5.8.1.
 - 9.1.11. Either the *Traveller Robot* or the *Drumstick(s)* touches the floor of the *Field*. The *Lodge* is, however, excluded from this rule, and this rule ceases to apply from the time of the *Task of Alighting*.
 - 9.1.12. The *Traveller Robot* drops all of the *Drumsticks*.
 - 9.1.13. Any part of either the *Traveller Robot* or *Drumsticks* enters onto the opposing team's steps or into the space above it, not including the *Drum Zone*.
 - 9.1.14. Any part of either the *Traveller Robot* or *Drumsticks* enters onto the *Drum Zone* or into the space above it for the purpose of causing obstruction.
 - 9.1.15. Either the *Traveller Robot* or *Drumstick(s)* touches any part of the *Victory Drums* other than the faces to be beaten.
 - 9.1.16. Other actions that infringe on the rules without producing disqualification.

10. Disqualification

- 10.1. A team shall be disqualified if it commits any of the following during the match:
 - 10.1.1. The team's *Manual Carrier Robot* moves the *Automatic Carrier Robot* directly using the *Shoulder Pole*.
 - 10.1.2. The team damages or tries to damage the *Field* and/or facilities and equipment or opponent's robots.
 - 10.1.3. Either the team's robot or operator or *Kago* crosses the outer boundary of the *Safety Area* either on the ground or in the air.
 - 10.1.4. The team's robot that has entered onto the *Kago Zone* of the opposing team or into the space above it comes in contact with an opposing robot.
 - 10.1.5. The team has made a false start twice in the same match.
 - 10.1.6. The team performs any act that is not in the spirit of fair play.
 - 10.1.7. The team fails to obey instructions and/or warnings issued by the referees.

11. On the Safety of the Robots

- 11.1. All robots shall be so designed and manufactured as to pose no danger of any kind to any person in the venue.
- 11.2. All robots shall be so designed and manufactured as to cause no damage to any robot of an opposing team or the *Field*.

12. Teams

- 12.1. Each participating country or region in the contest can be represented by one team only. Japan, as host country, may be represented by two teams.
- 12.2. A team consists of three students and one instructor who all belong to the same university. The three students of the team are entitled to participate in the match itself.
- 12.3. In addition, a three-member pit crew can adjust the robots in the pit room and help to carry the robots to the Field, but cannot participate in the match itself. The members of the pit crew must be students of the same university as the team.
- 12.4. Participation by post-graduate students (graduate school students) is not permitted.

13. Others

- 13.1. The legitimacy of any action not provided for in this rule book shall be subject to discretion of the referees.
- 13.2. The dimensions, weights etc. of the *Field* and other facilities and equipment described in this rule book have a margin of error of plus or minus 5% unless otherwise stated.
- 13.3. All questions should be addressed to the official website of the ABU Asia-Pacific Robot Contest 2009 Tokyo (<http://www.aburobocon2009/>). An Q&A section will be provided on the site.
- 13.4. Notification of any addition and/or correction to this rule book shall be made on the official web site.
- 13.5. The referees may demand additional explanations on safety issues when the safety of a robot is deemed to be in question.
- 13.6. No contact by means of a radio communication device and/or loudspeaker is permitted between team members and/or team members and any third party during a match.

Appendix

1. Colours and Materials of the Floor Surface

Items	Colours		Materials
Game Area	Light green	Pantone 364 U	Vinyl sheet
Checkpoints	Green	Pantone 342 U	
Mountain Pass	Brown	Pantone 1807 U	
Goal Zone	Gray	Pantone 426 U	
Drum Zone	Light gray	Pantone 424 U	
Safety Area	Light blue	Pantone 2975 U	
Start Zone & Lodge	Red	Pantone 1807 C	PVC film
Start Zone & Lodge	Blue	Pantone 287 C	
White Lines	White		

2. On the Distribution of Samples of Contest-Related Articles

Samples of the *Kago* (1 red team *Kago* and 1 blue team *Kago*) to be used at the ABU Asia-Pacific Robot Contest 2009 Tokyo will be sent to the broadcasters of participating countries and regions.

Samples of floor materials etc. will also be sent in due course. Details will be informed to the participating broadcasters by e-mail.

3. Transporting the Robots

- 3.1. The organisers shall transport the robots of the ABU Asia-Pacific Robot Contest 2009 Tokyo according to a fixed procedure. The details of this procedure will be announced.
- 3.2. The robots must be able to fit inside a single box with dimensions of 1,500 x 1,500 x 1,500 mm for transport. Only one box may be used.